

Microwave Digital Archive

IEEE Microwave Theory and Techniques Society

1953-1961

Welcome

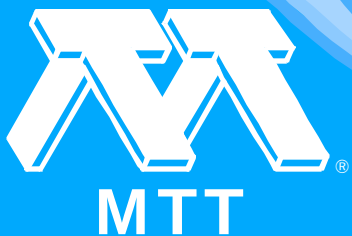
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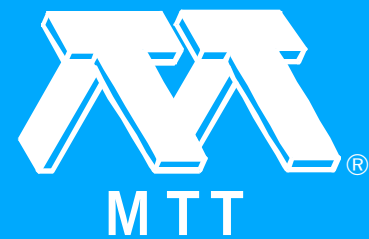
The Microwave Theory and Techniques Society of the IEEE has finished a complete archive of all reviewed and published material since 1953. Yearly updates of the published material will be compiled in the future. As digital media changes over the years, it will be necessary to update the format of the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

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

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

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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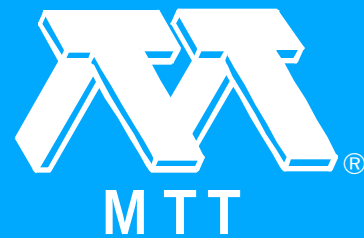
ACKNOWLEDGMENTS

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.

REFERENCES

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

ISBN: 0-7803-9906-4



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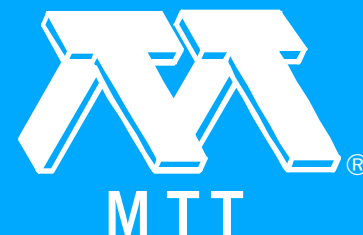
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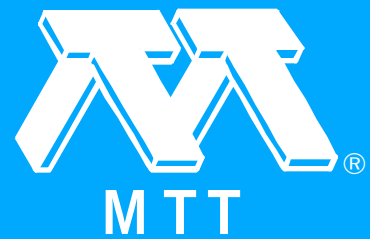
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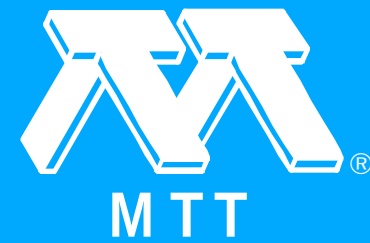
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INTRODUCTION

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

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

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

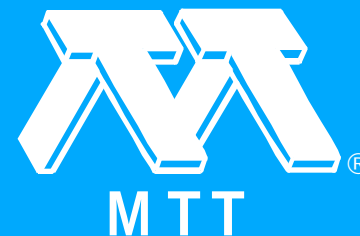


ACROBAT PREFERENCES

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



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

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

Search icon  will be present on the Acrobat Toolbar if the function is properly installed. Specifics of the Search function are described later in this section.

EXITING AN ARTICLE

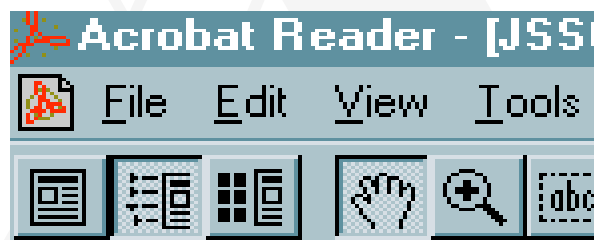
To exit an article after viewing, and return to the electronic guide, select File > Close from the menu bar. To switch between the article and the electronic guide or any other PDF file that is open, select “Window” and pick the open file you wish to return to.



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USING BOOKMARKS

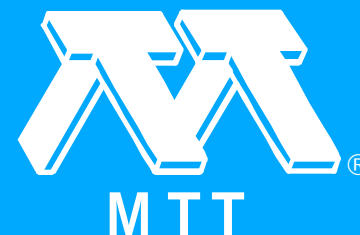
In addition to links, you can navigate through the Electronic Guide using Bookmarks. If they are not already visible, choose View > Bookmarks and Page from the menu bar or press the “Display Page and Bookmarks” button on the tool bar. A panel opens on the left side of the screen displaying Bookmarks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



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

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



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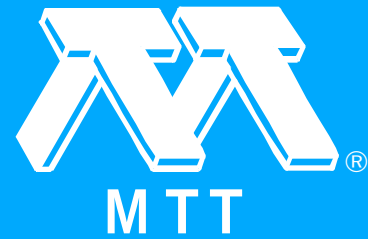
Articles may have text outside normal print-area defaults. We recommend selecting “Shrink to Fit” in the print menu (File > Print) to capture the complete image for your printout. This setting will become your new default.

SELECTING GRAPHICS

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

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

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



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NAVIGATION BUTTONS

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

Section Map

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

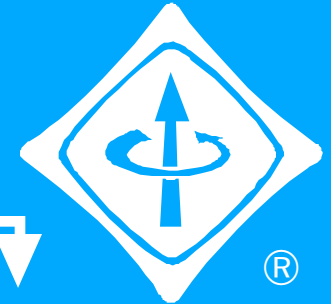
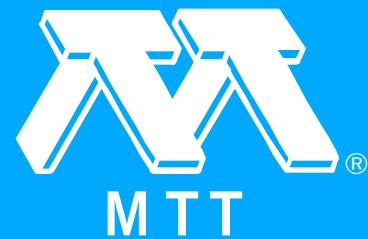
Next Page button

Click to advance to the next page in the section.

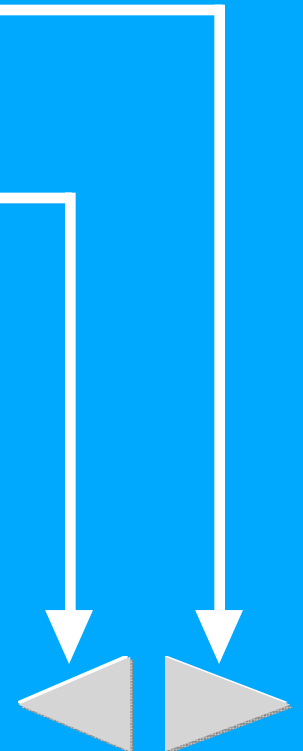
Previous Page button

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

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

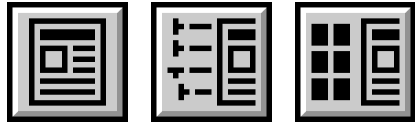


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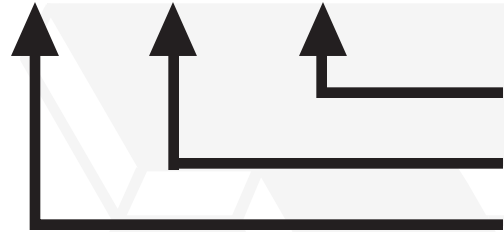


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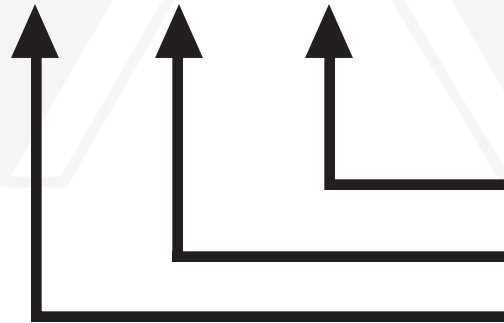
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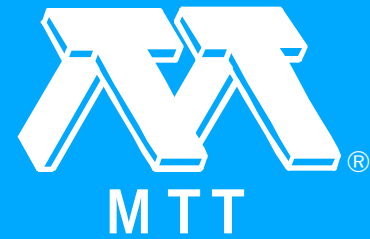
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Display Page



Zoom/Selection



Select Text
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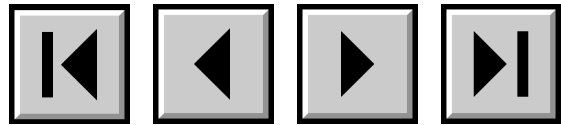
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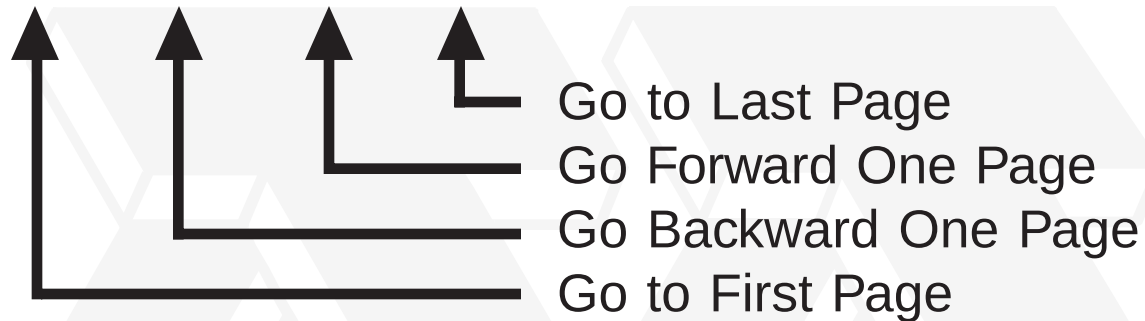


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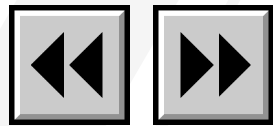


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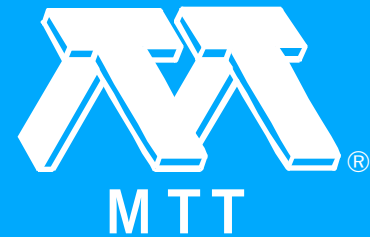


History



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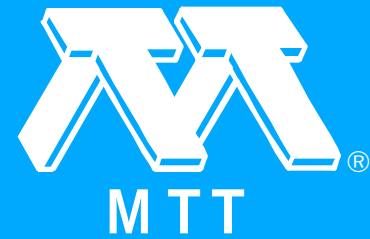


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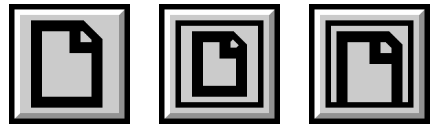
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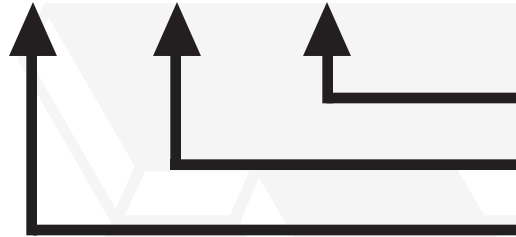
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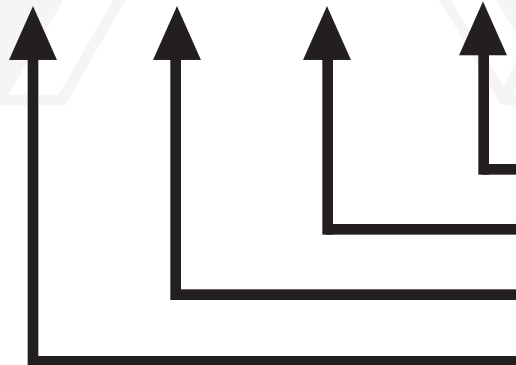
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Fit Page
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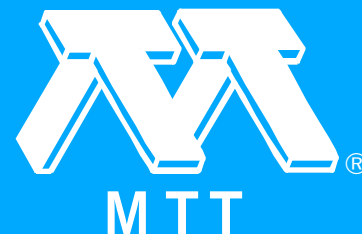
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SEARCHING

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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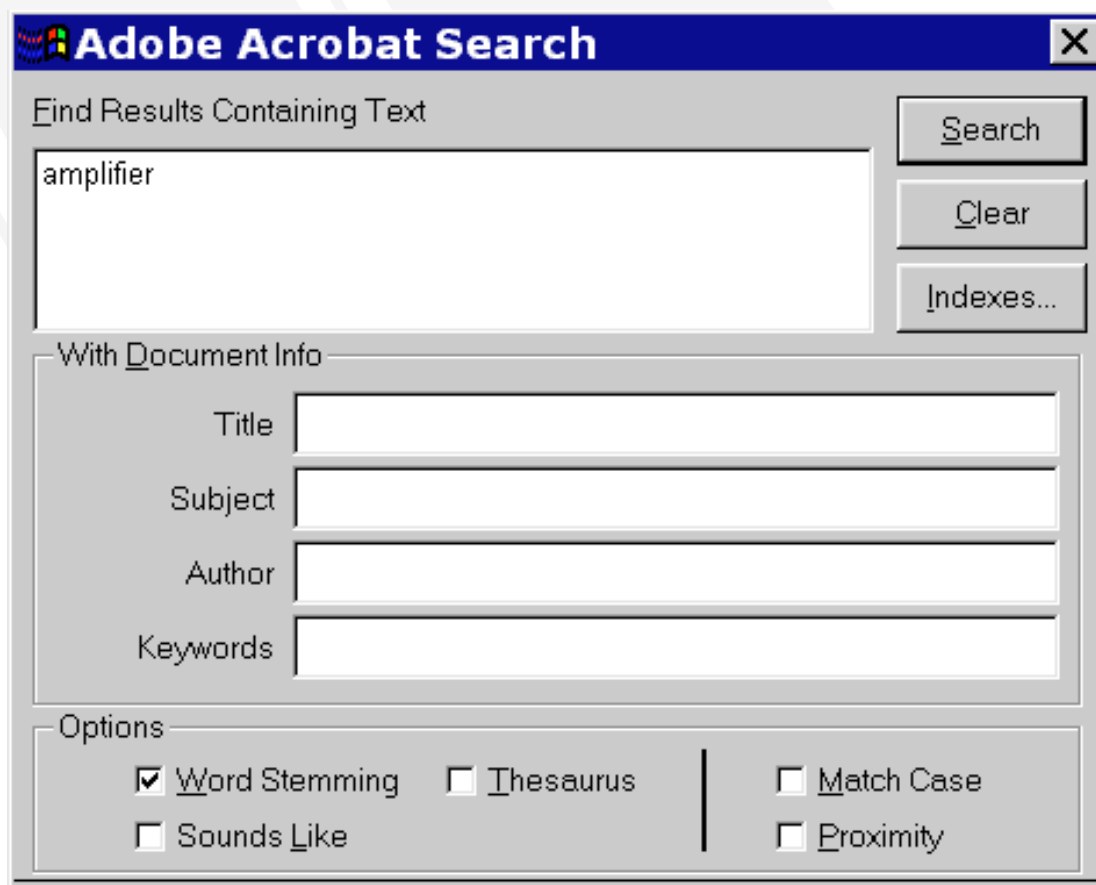
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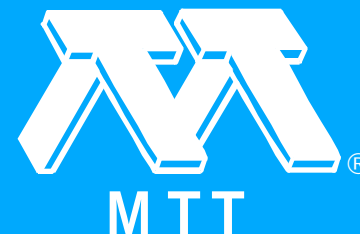
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If you are not finding files you think should show in the results list, Acrobat may not be attached to the correct index file. To check, press the “Indexes...” button for a list of available indexes. If this title is not listed, press the “Add...” 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 this is a section titled 'With Document Info' containing four labeled text input fields: 'Title', 'Subject', 'Author', and 'Keywords'. At the bottom is an 'Options' section with four checkboxes: 'Word Stemming' (checked), 'Thesaurus' (unchecked), 'Match Case' (unchecked), and 'Sounds Like' (unchecked). The 'Proximity' checkbox is also present but is partially obscured by the bottom edge of the dialog.

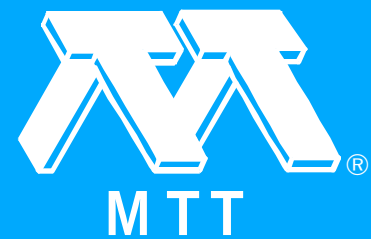


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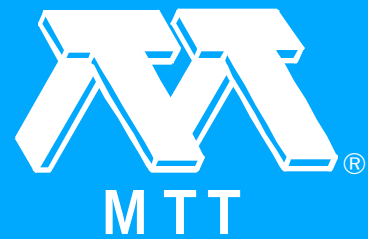
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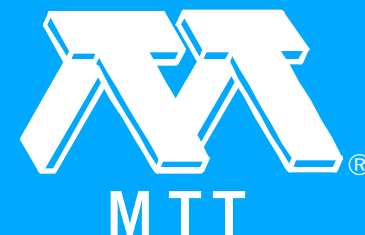
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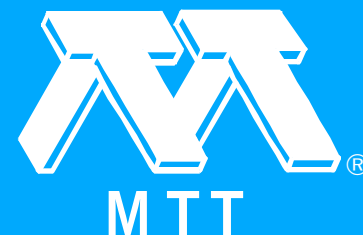
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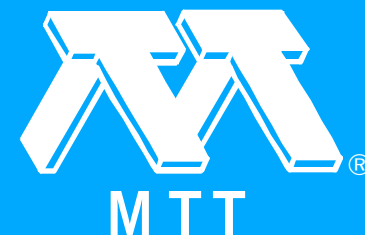
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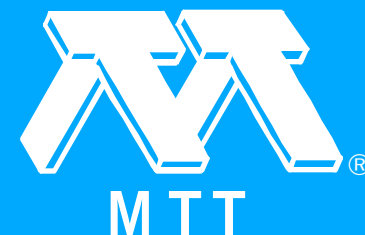
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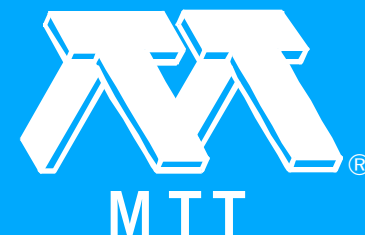
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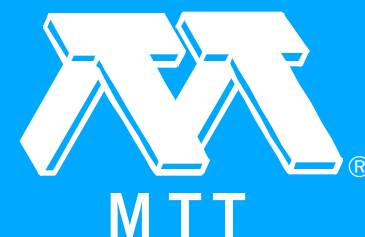
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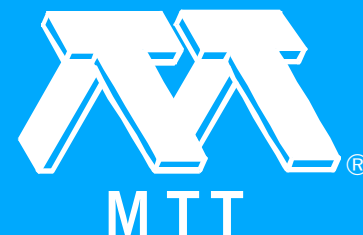
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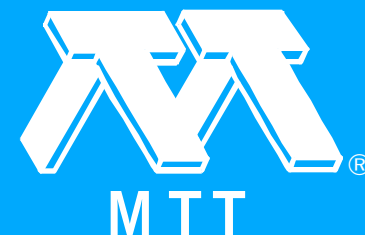
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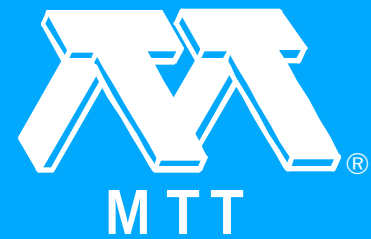
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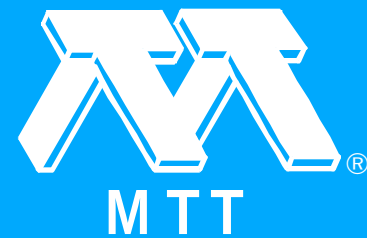
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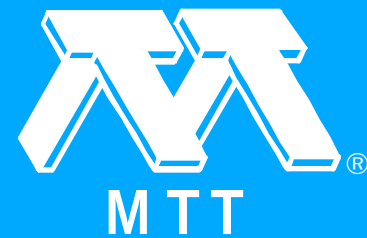
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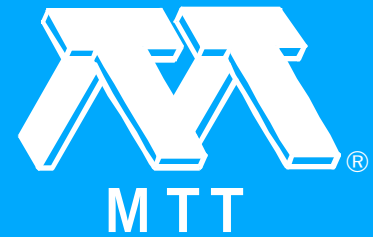
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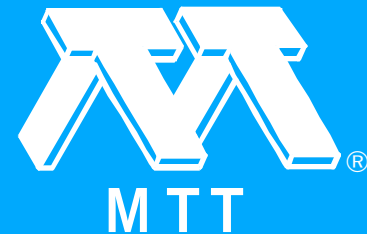
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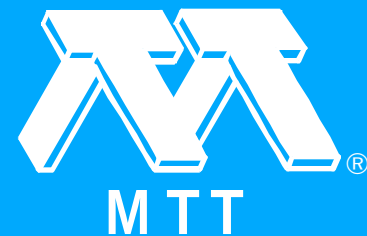
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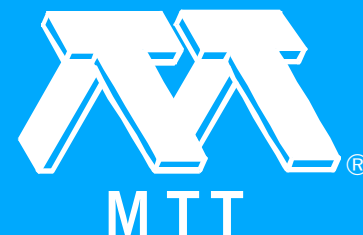
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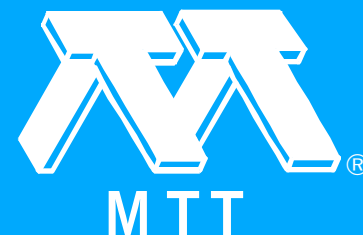
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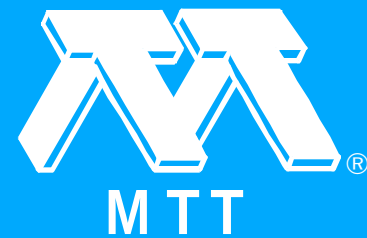
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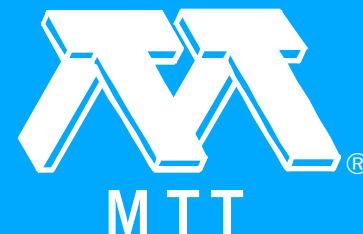
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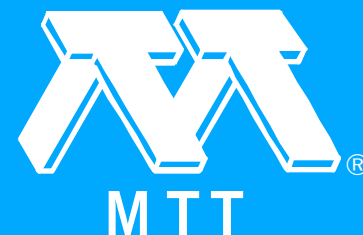
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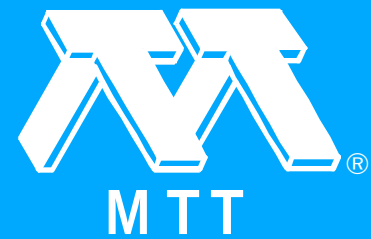
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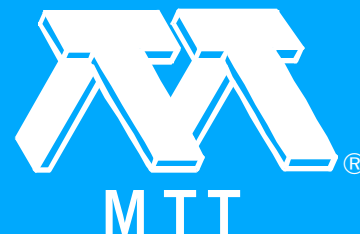


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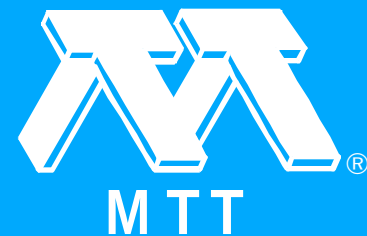
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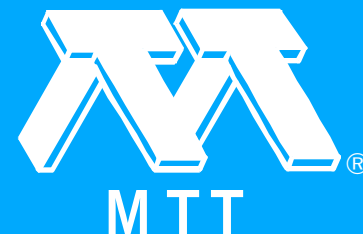


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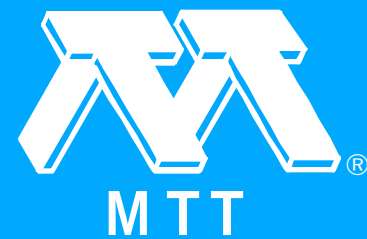
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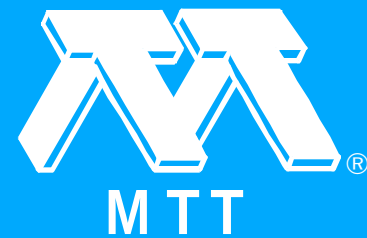
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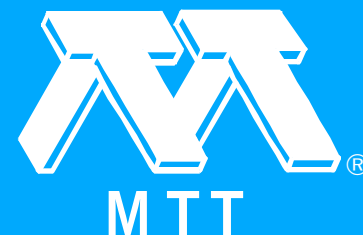
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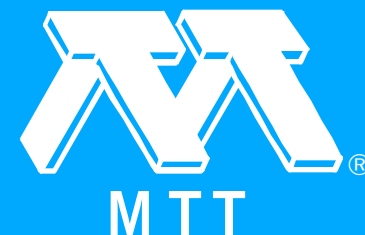
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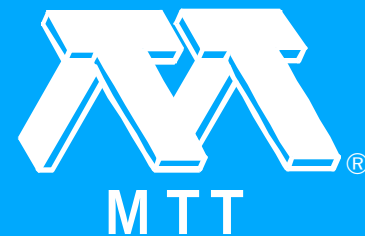
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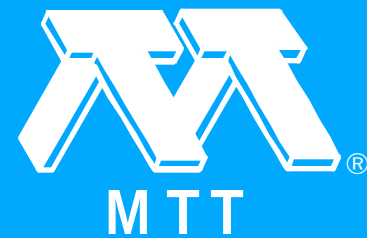
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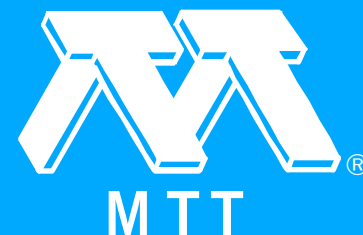
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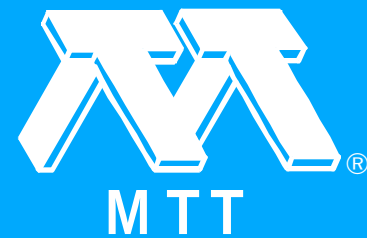
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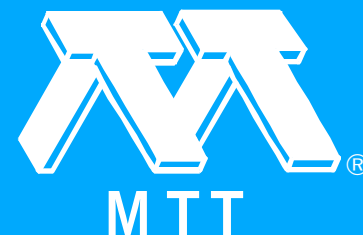
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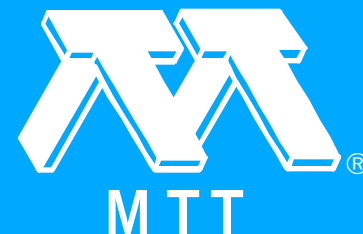
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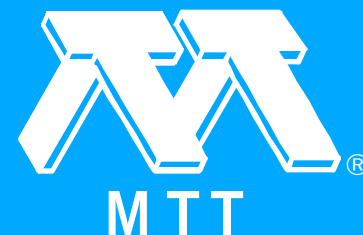


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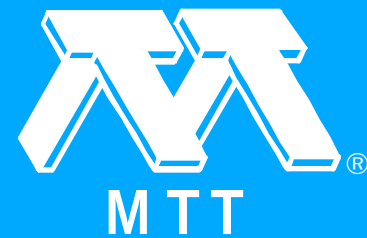
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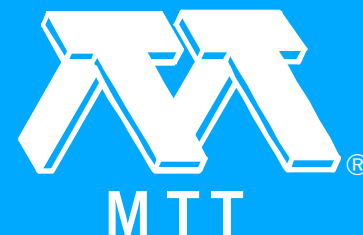
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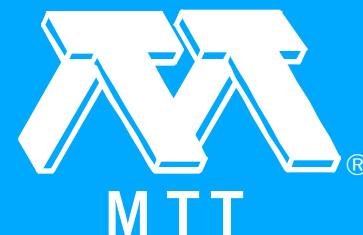
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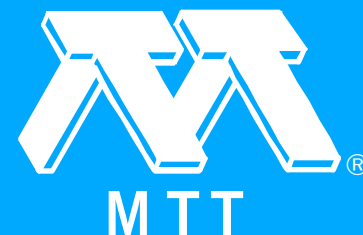
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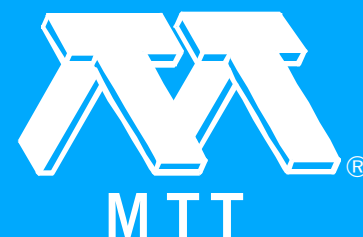
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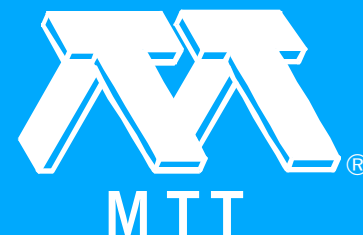


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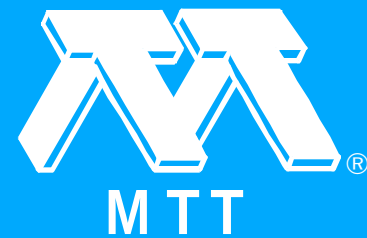
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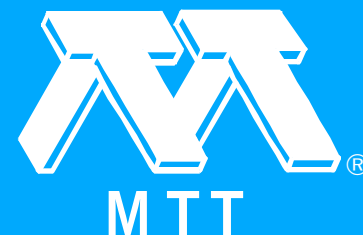
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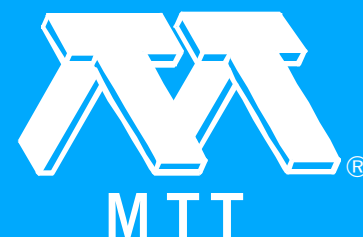
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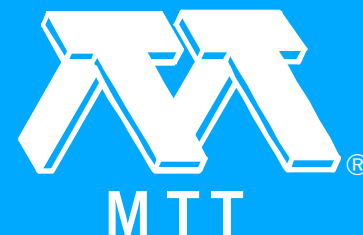
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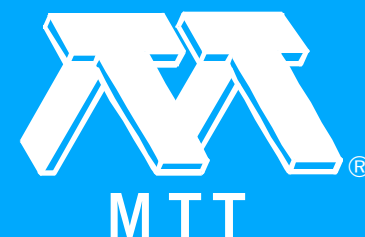
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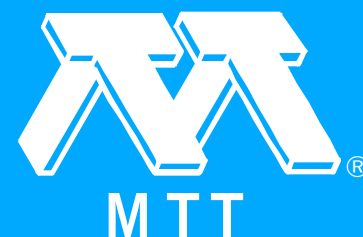
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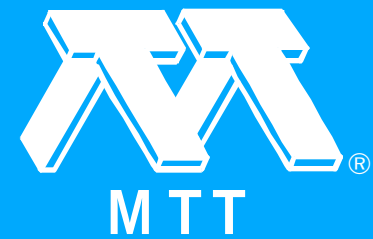
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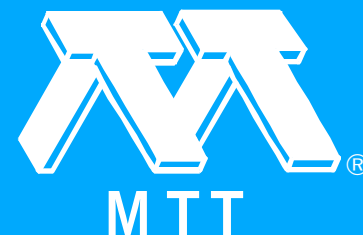
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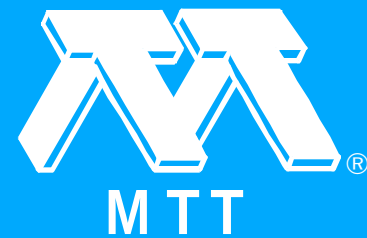
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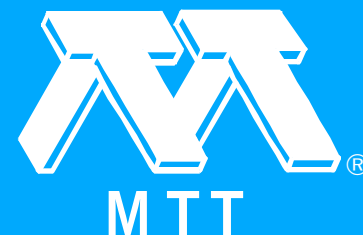
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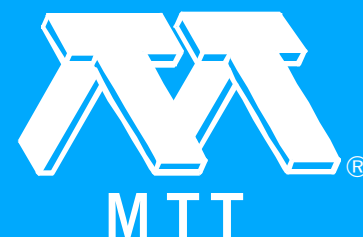
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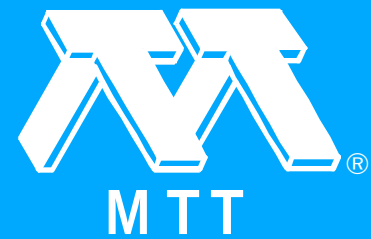
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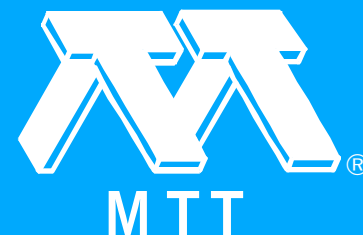
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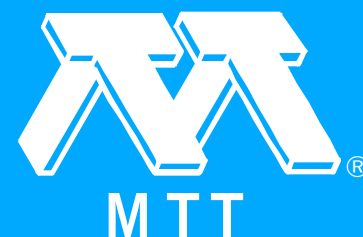
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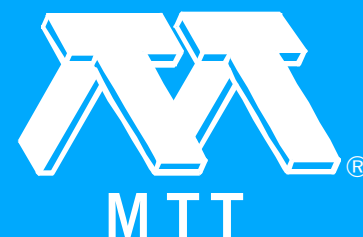
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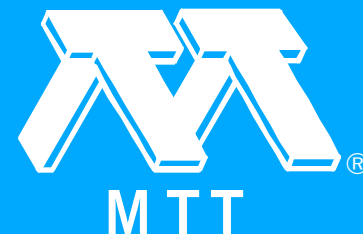


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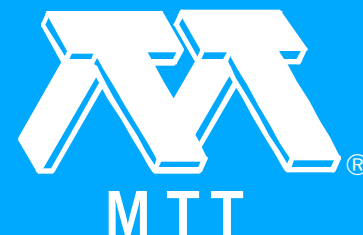
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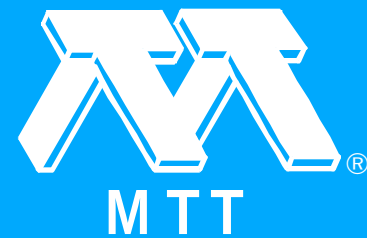
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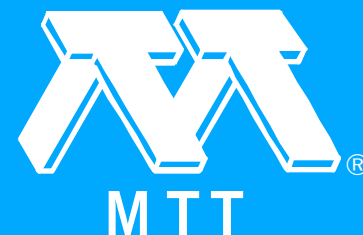
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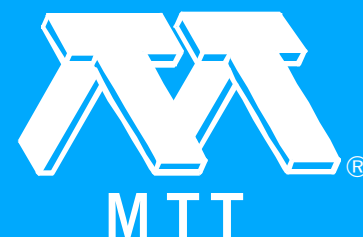
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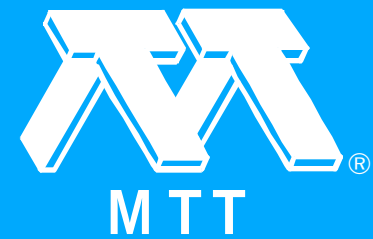
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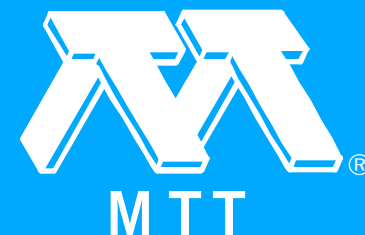
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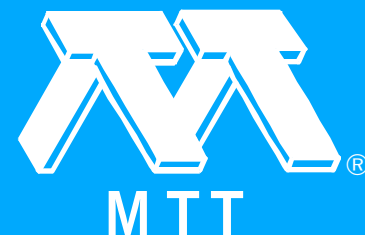
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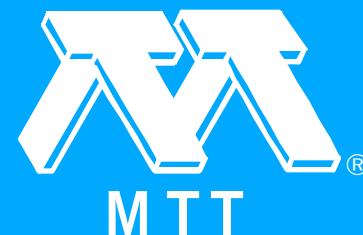
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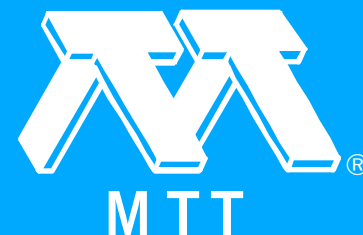


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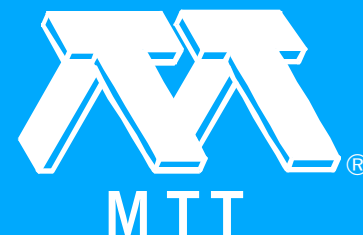
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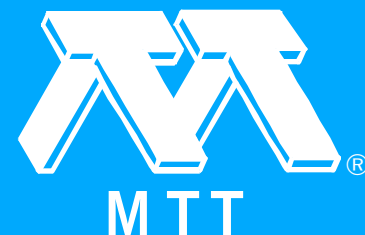
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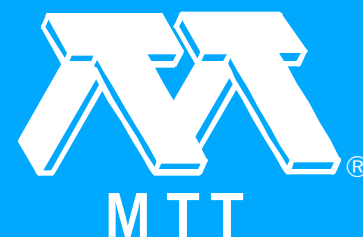
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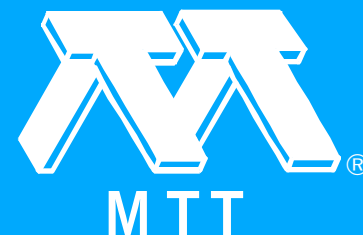
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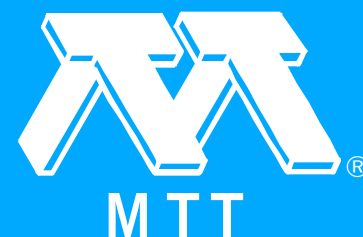
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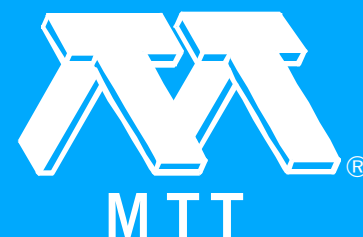
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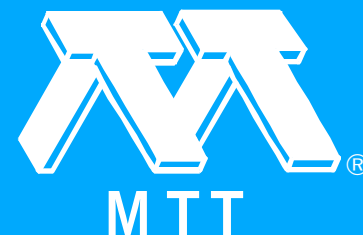
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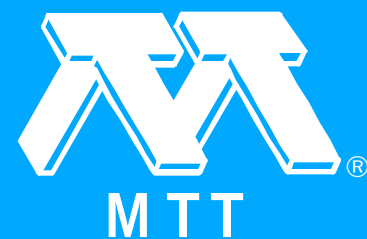
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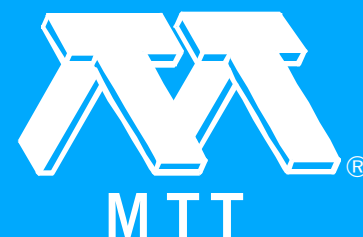
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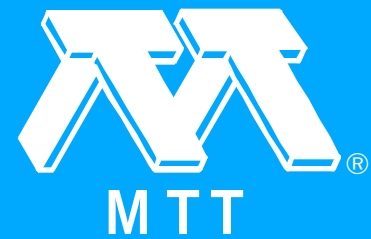
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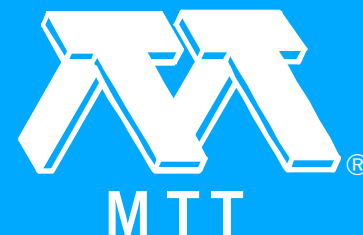
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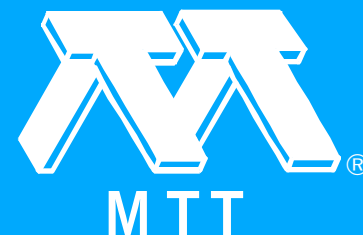
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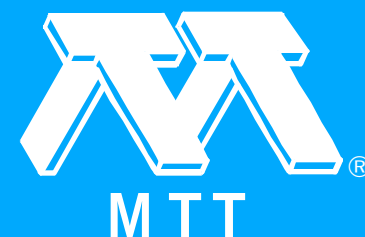
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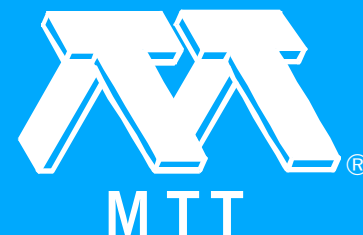
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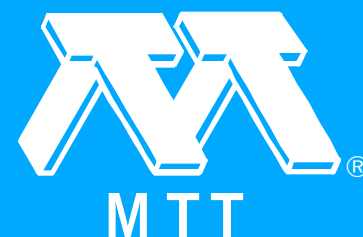
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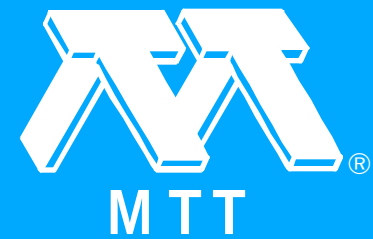
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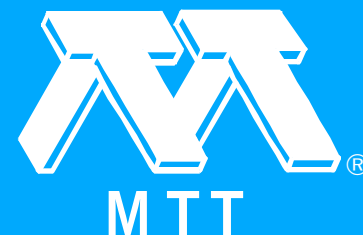
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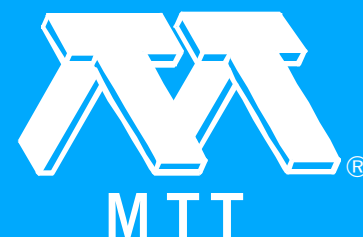
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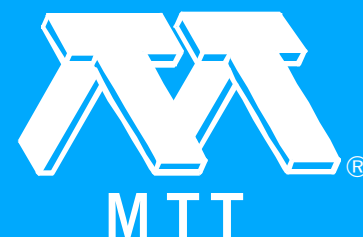
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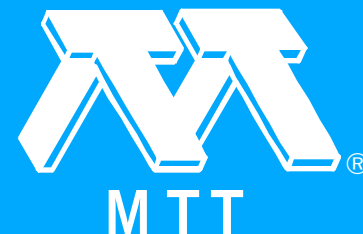
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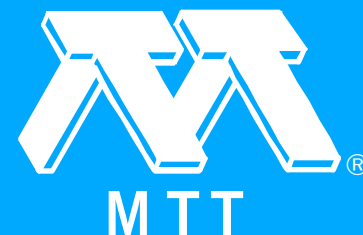
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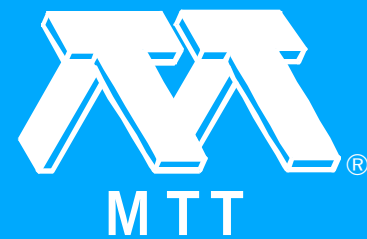
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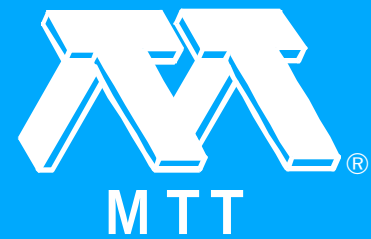
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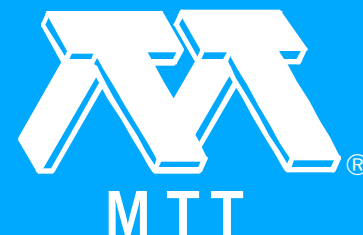
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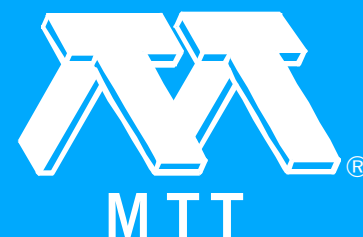
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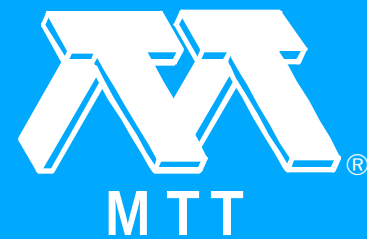
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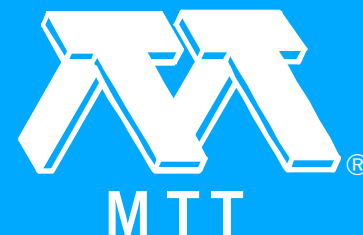
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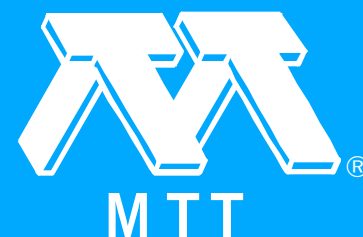
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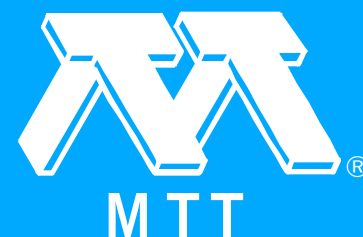
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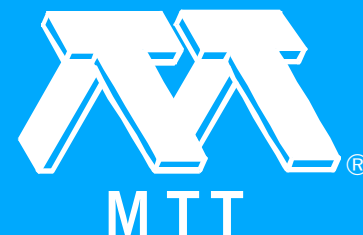
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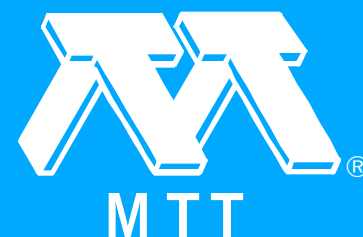
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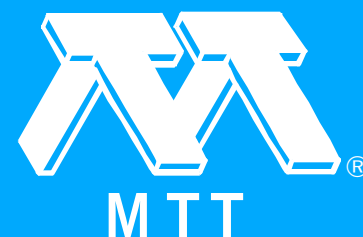
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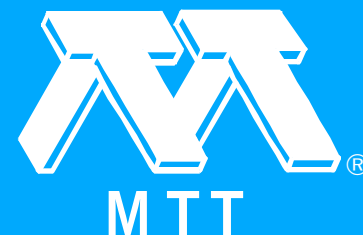
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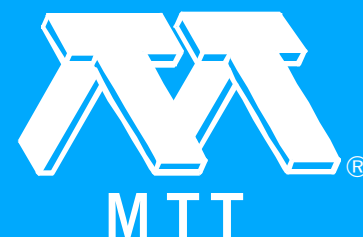
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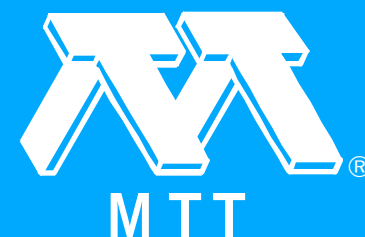
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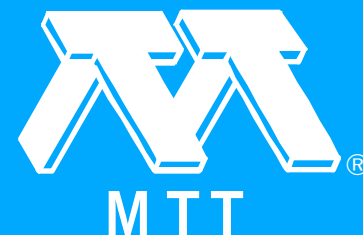


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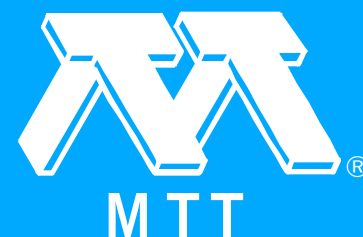
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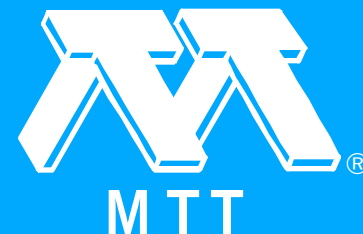
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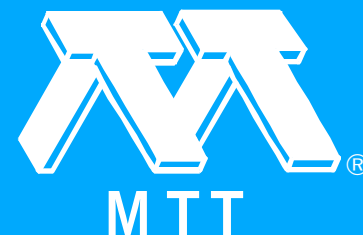
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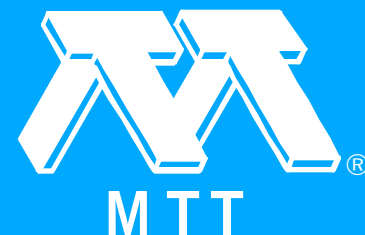
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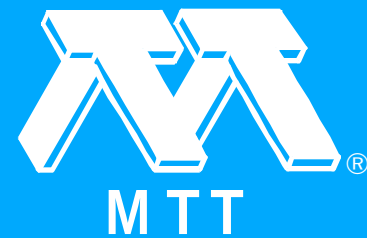
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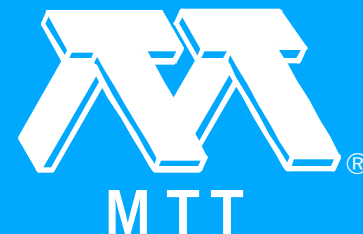
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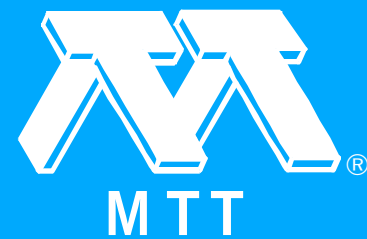
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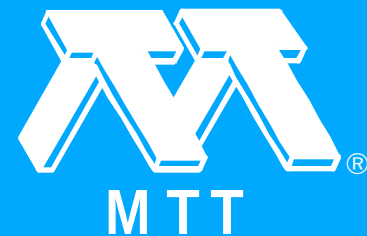
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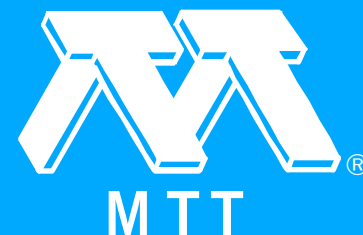
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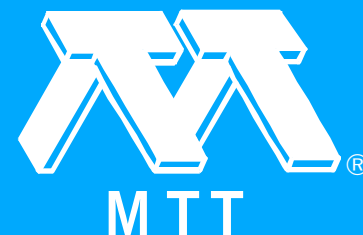
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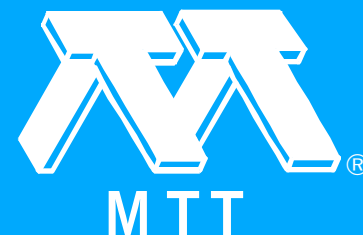
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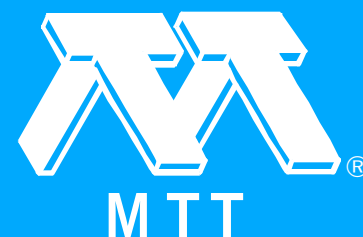
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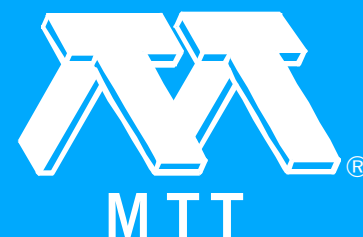
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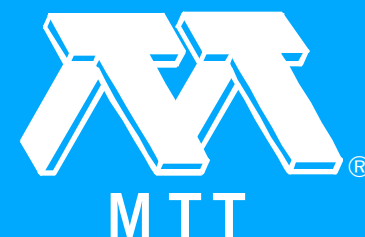
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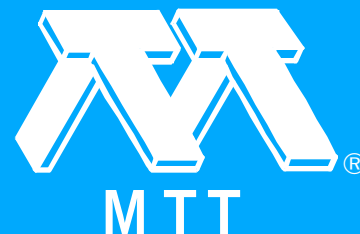


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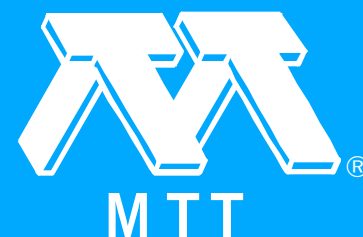
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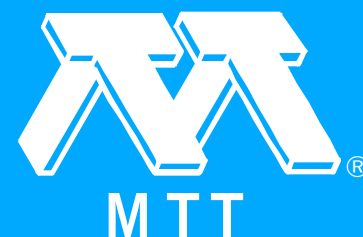
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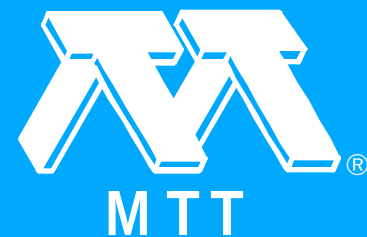
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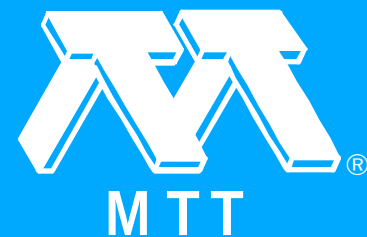
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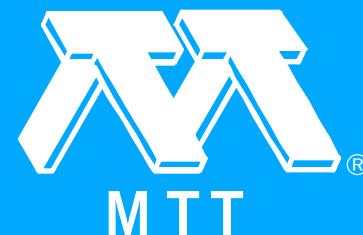
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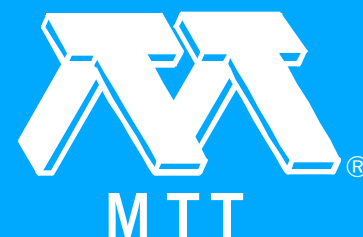
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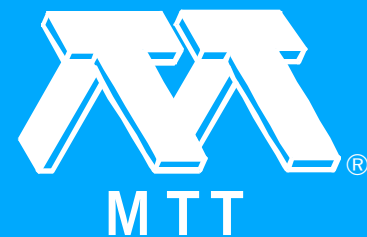
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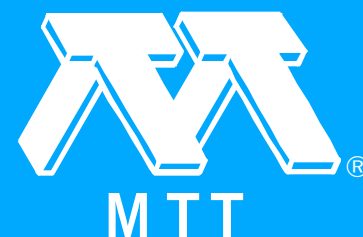
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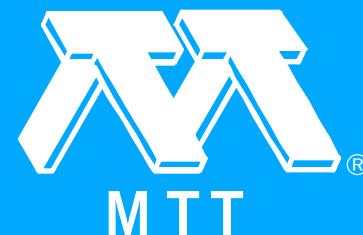
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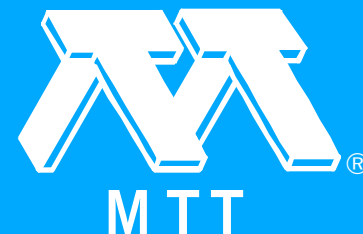
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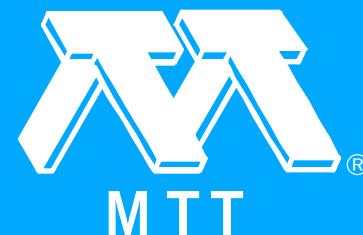
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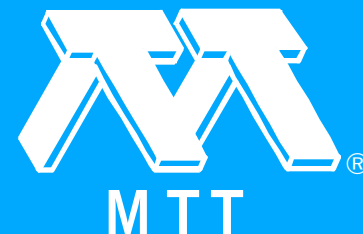
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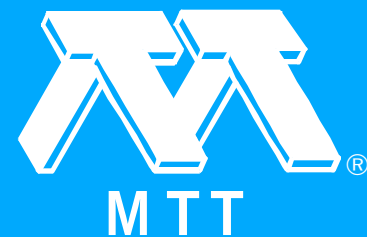
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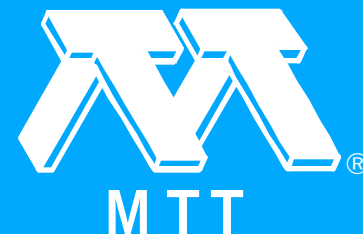
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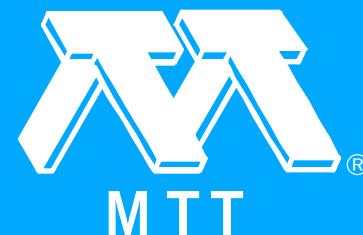
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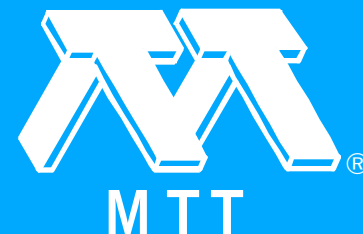
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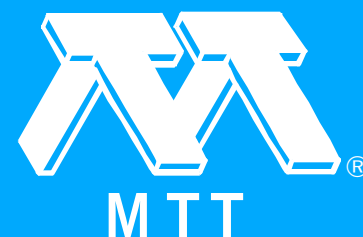
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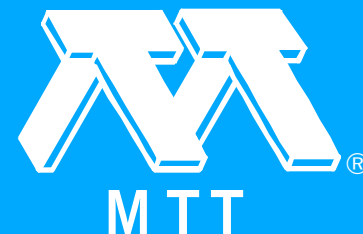
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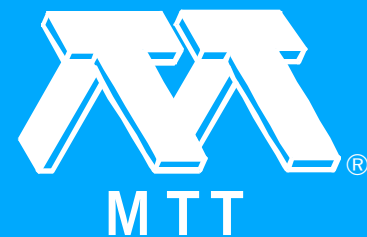
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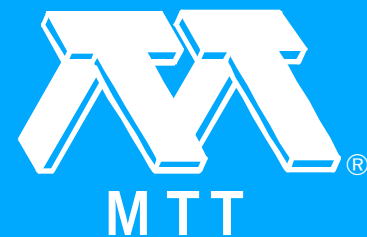
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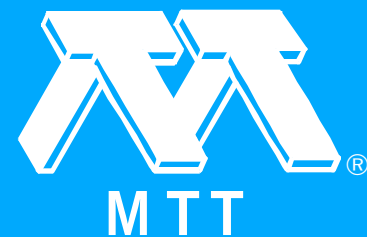
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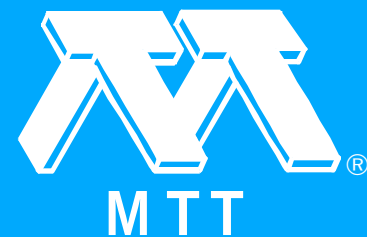
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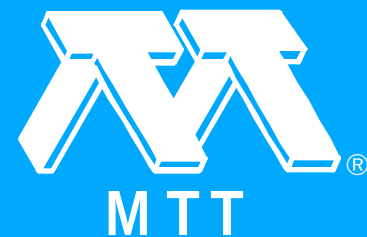
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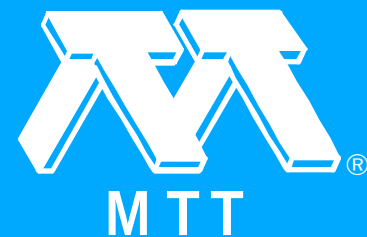
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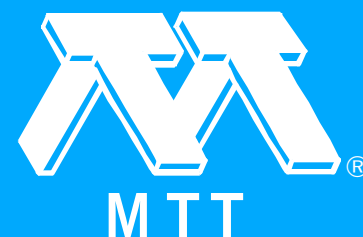
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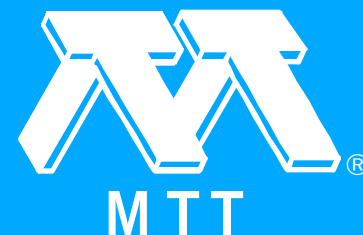


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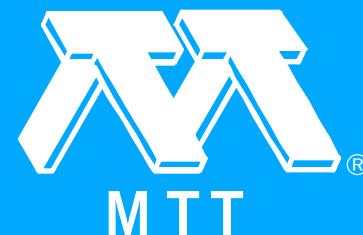
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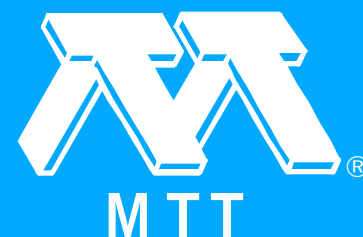
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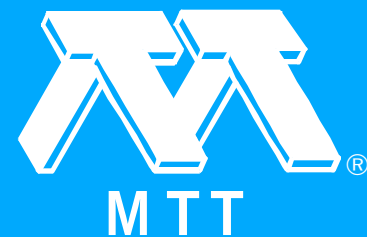
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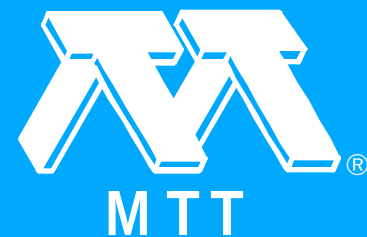
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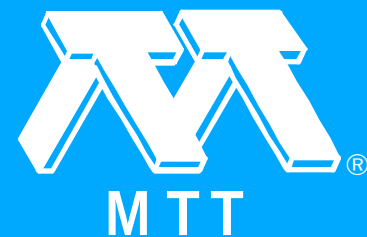
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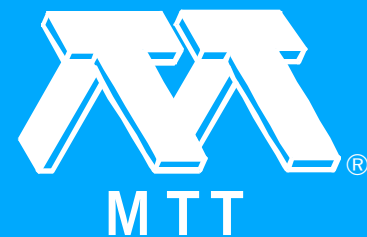
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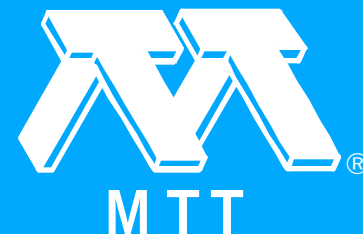
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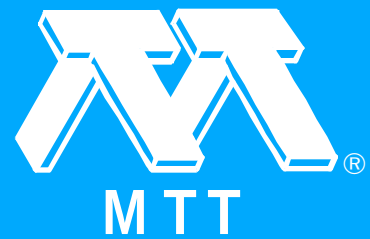
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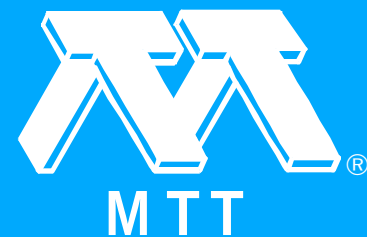
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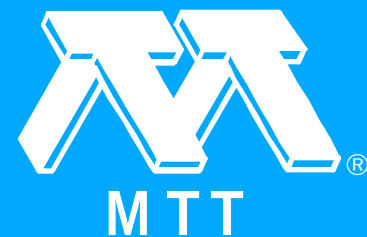
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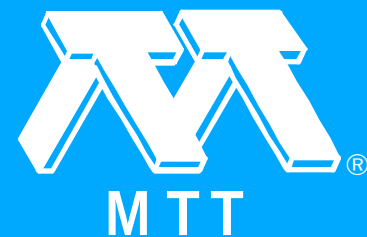
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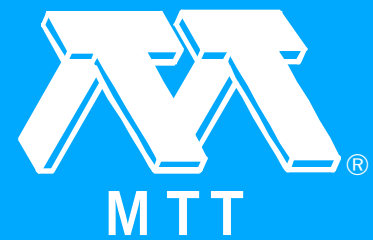
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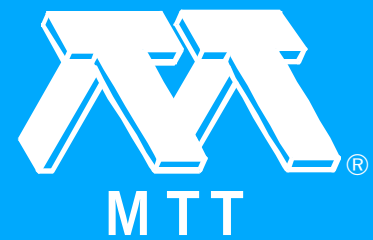
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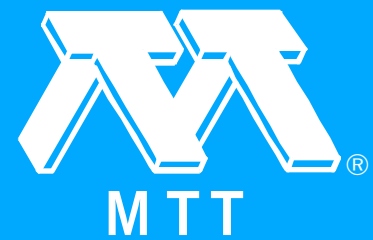
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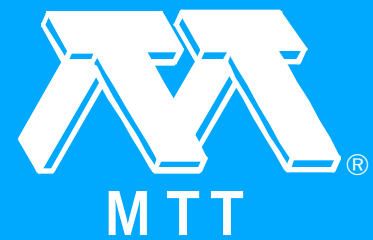
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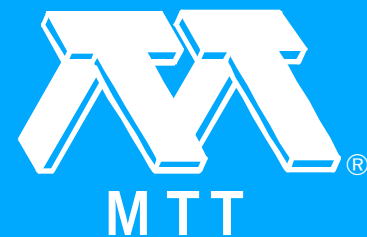
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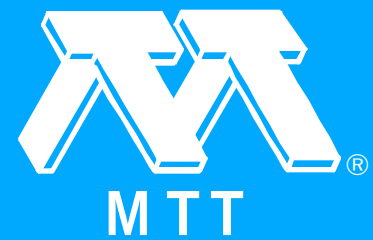
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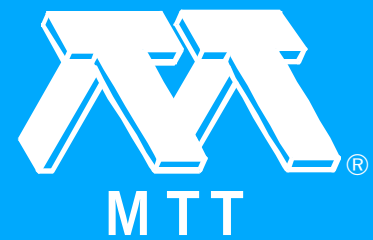
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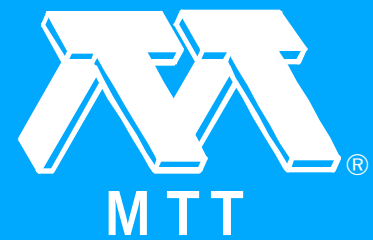
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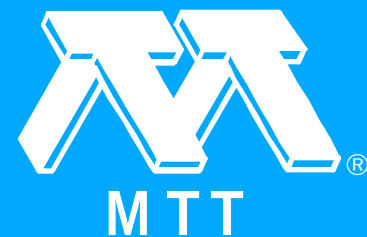
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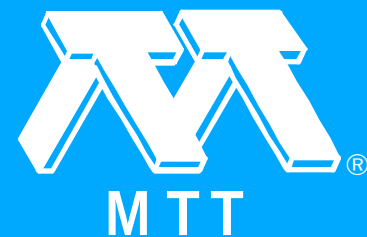
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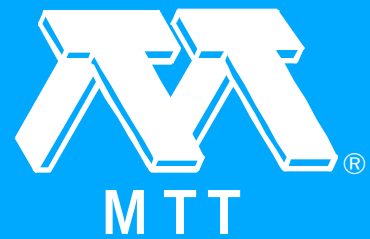
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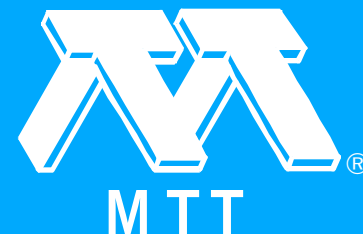
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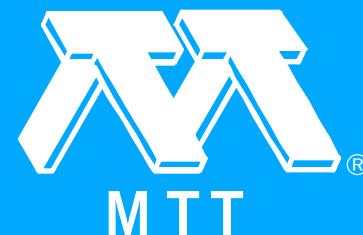
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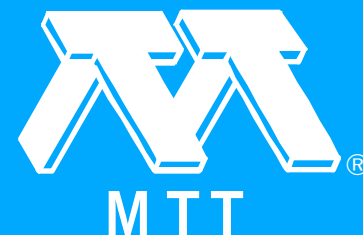


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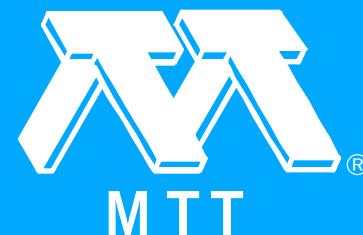
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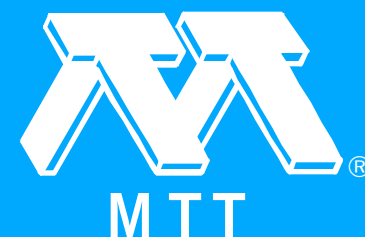
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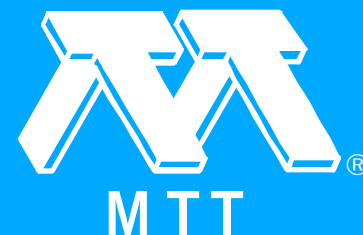
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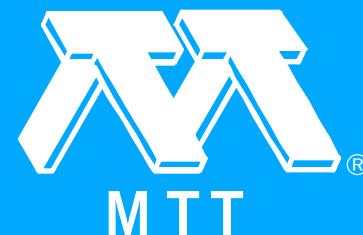
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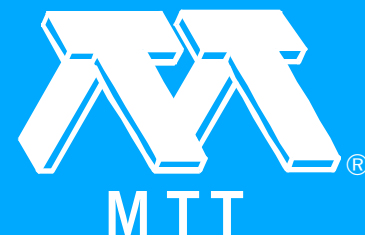
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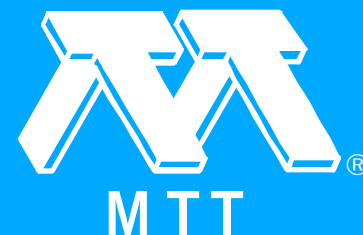
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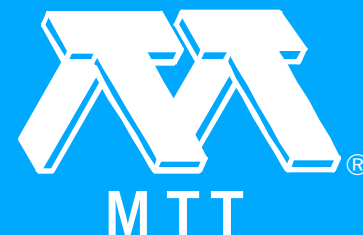
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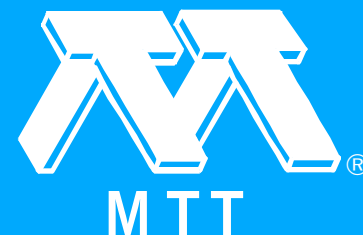
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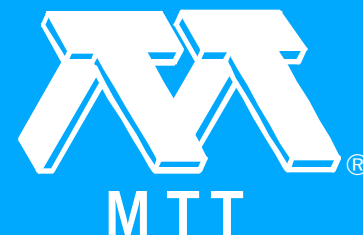
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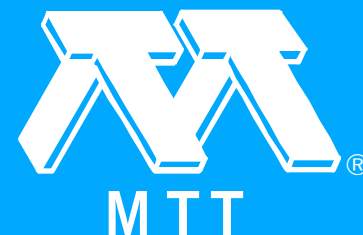
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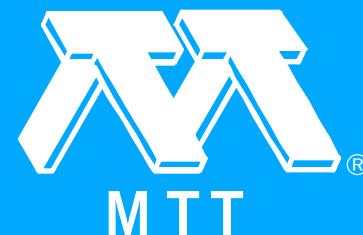
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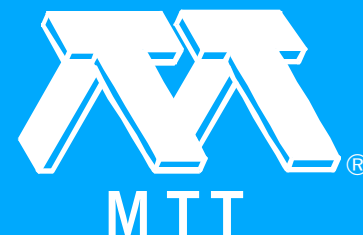


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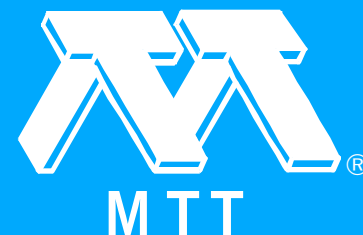
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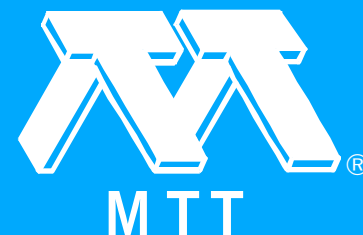
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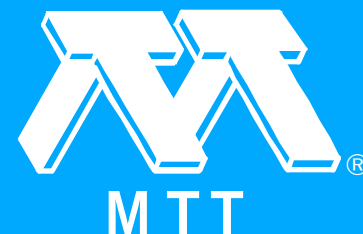
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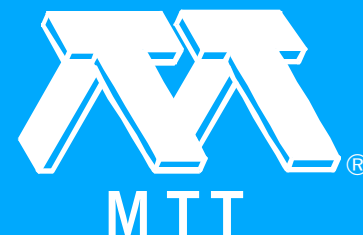
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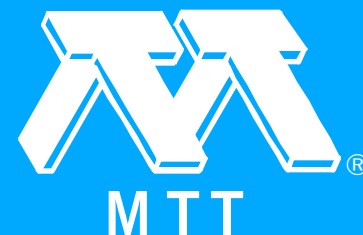
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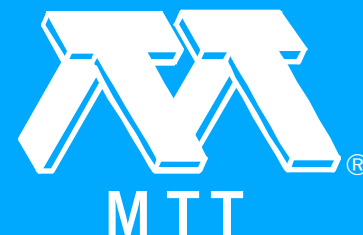
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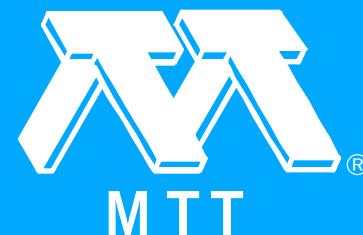
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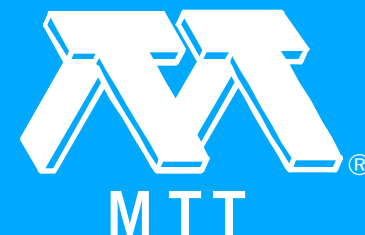
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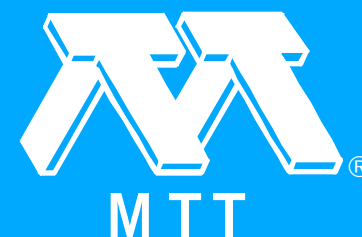
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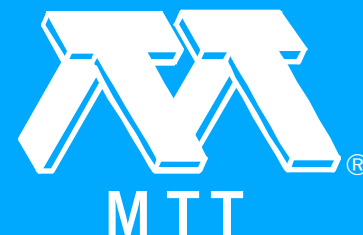
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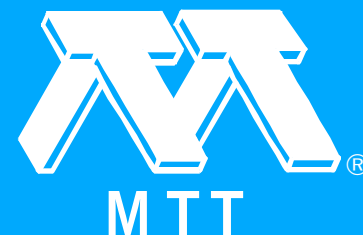
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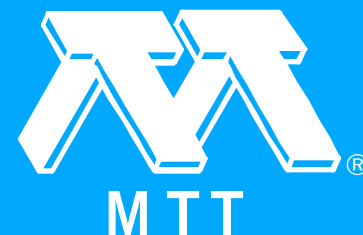
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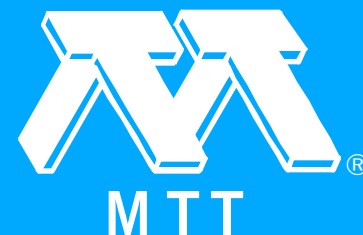
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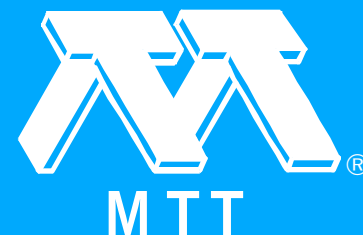
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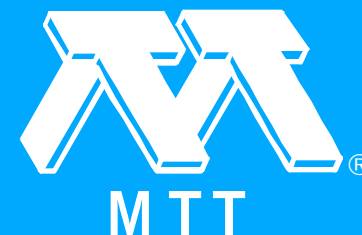
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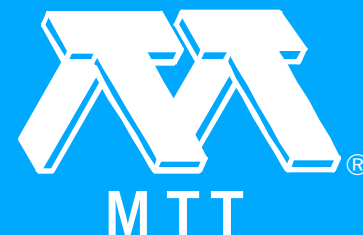
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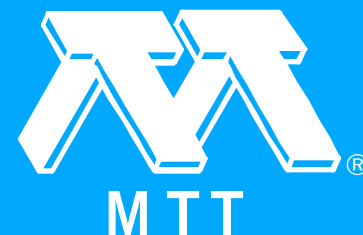
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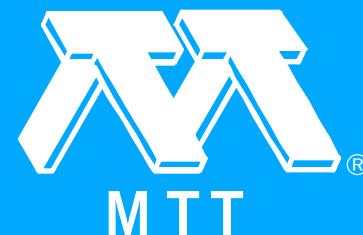
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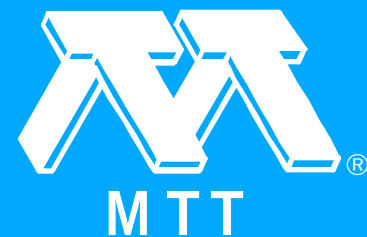
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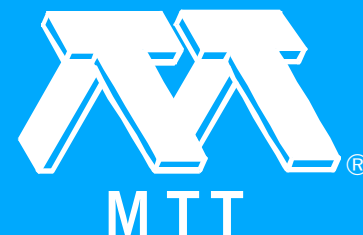
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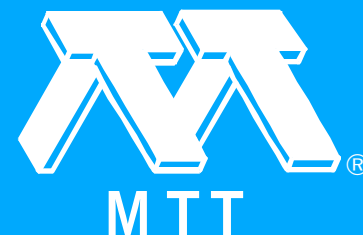
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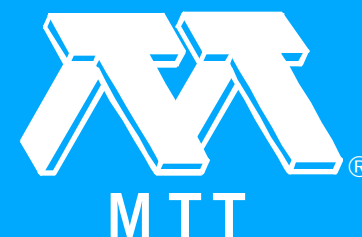
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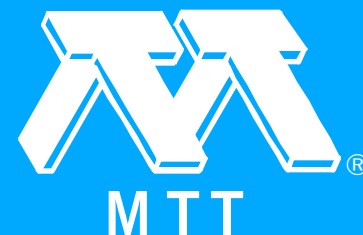
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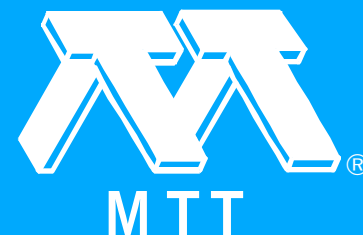
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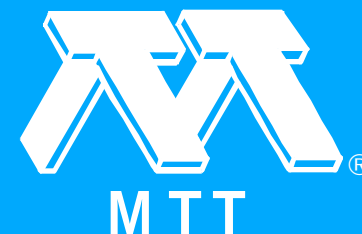
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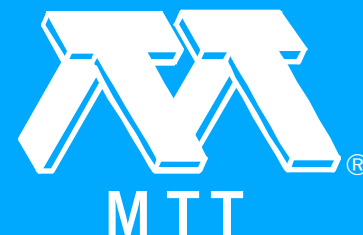
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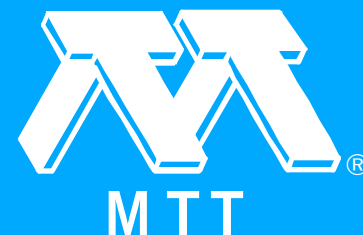
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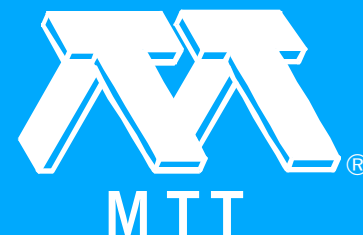
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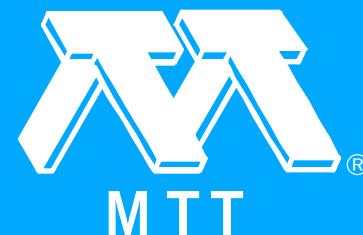
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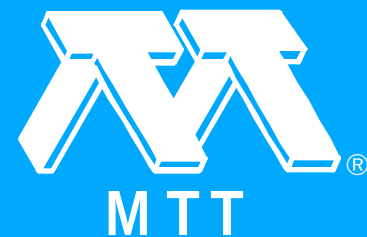
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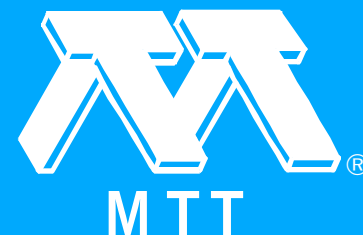
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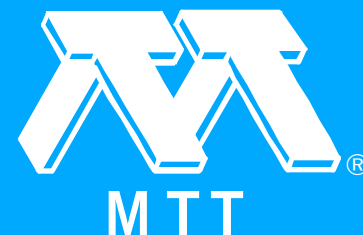
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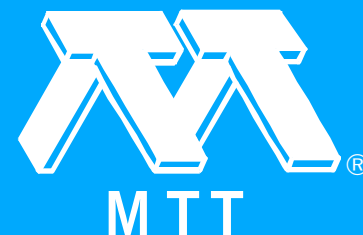
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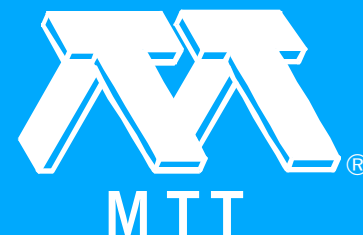


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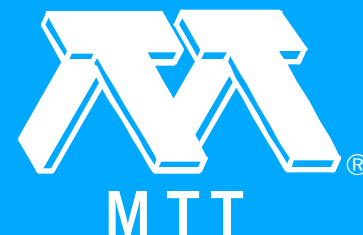
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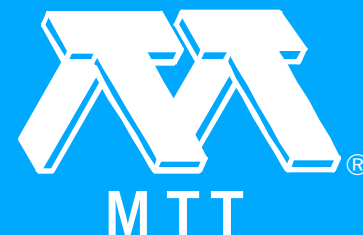
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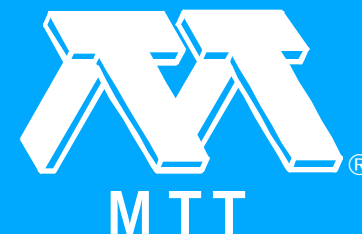
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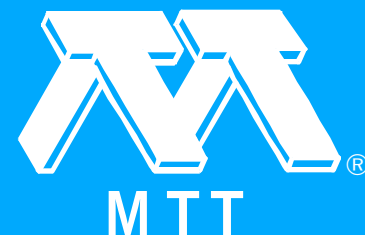
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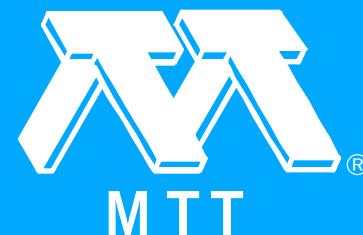
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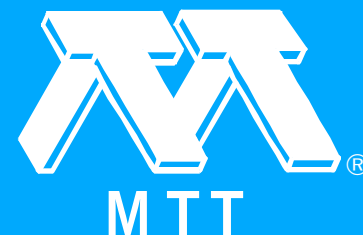
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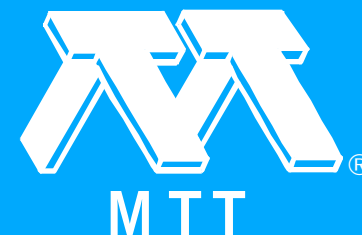
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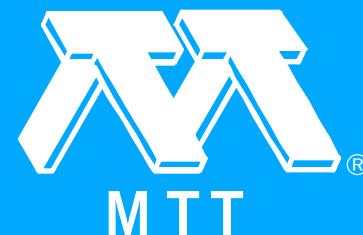
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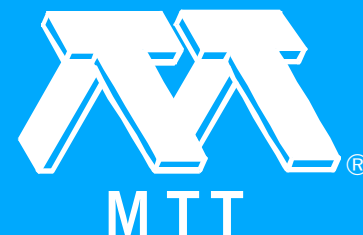
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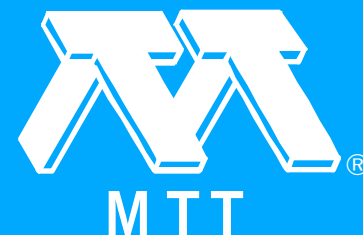


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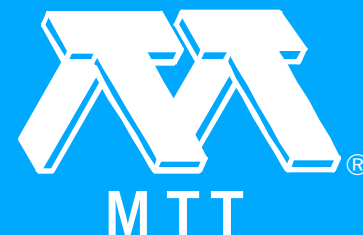
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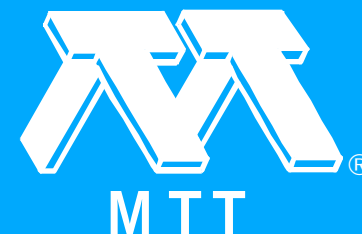
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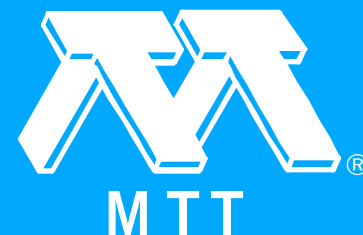
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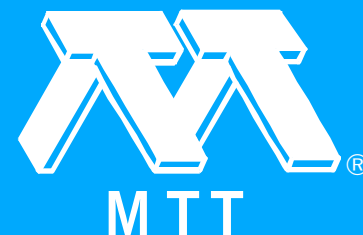
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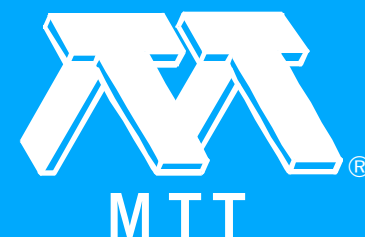
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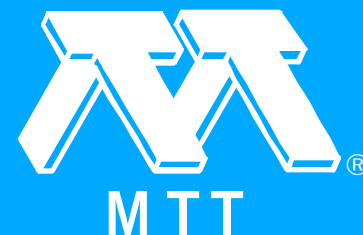
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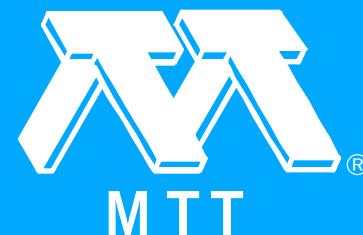
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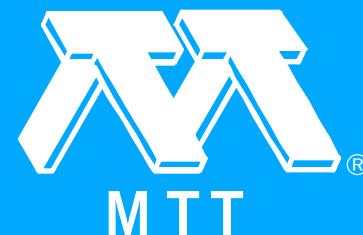
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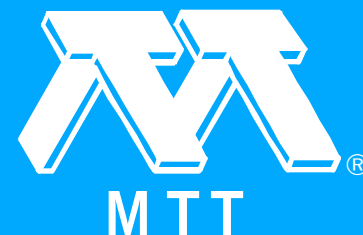


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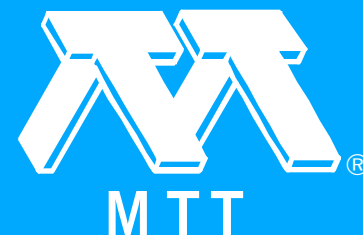
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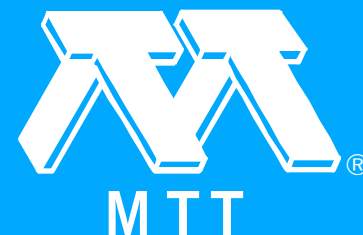
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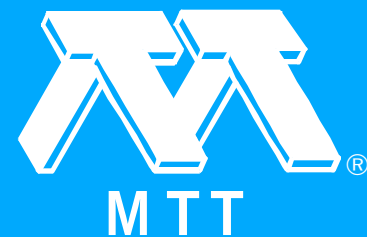
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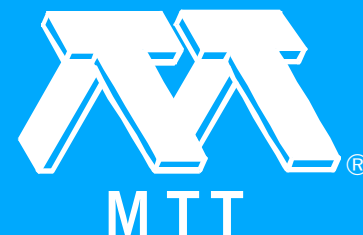
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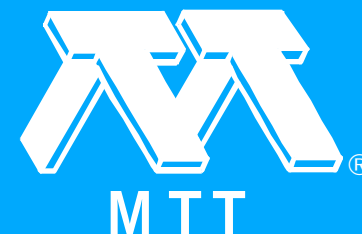
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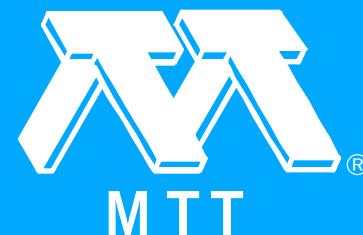
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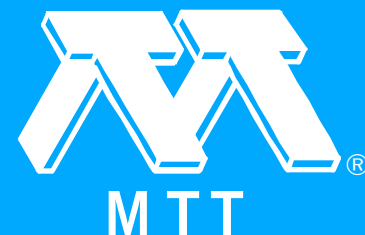
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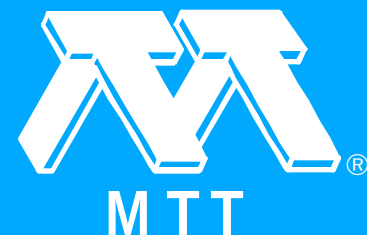
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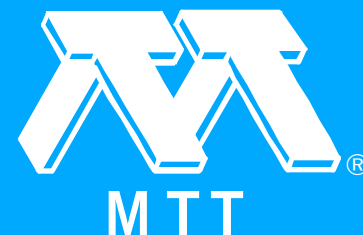
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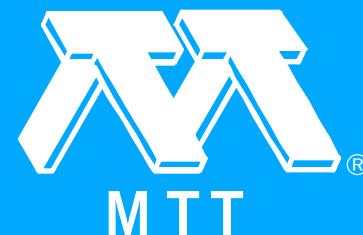
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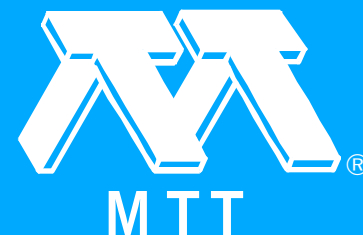
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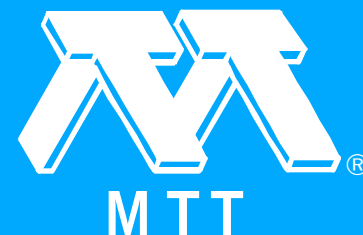


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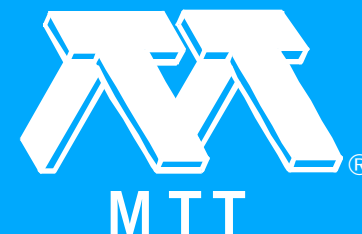
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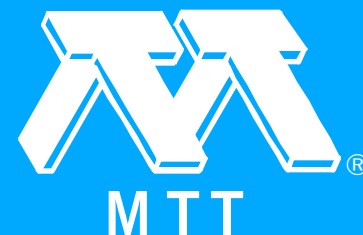
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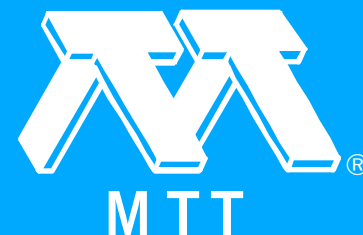


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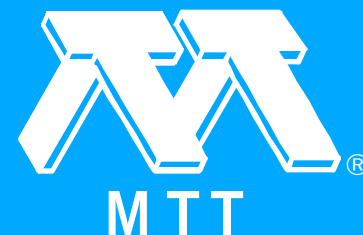


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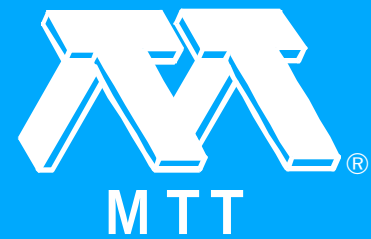
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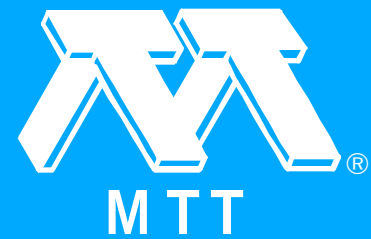
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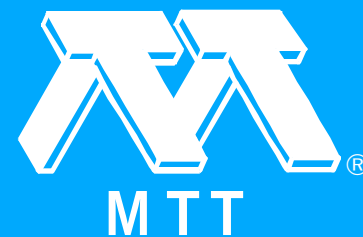


Abstracts

Foreword (Mar. 1953 [T-MTT])

B. Warriner. "Foreword (Mar. 1953 [T-MTT])." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 3-4.

This is the first issue of the Transactions of the IRE Professional Group on Microwave Theory and Techniques. The Group's publication policy is explained in the News and Notes Section of this issue. Future issues of the Transactions will publish papers submitted to the Group for publication and papers given at symposia. The Transactions will be devoted exclusively to the microwave field and will strive to completely cover the fields of interest of the PGMTT.



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A New Chart for the Solution of Transmission Line and Polarization Problems

G. Deschamps. "A New Chart for the Solution of Transmission Line and Polarization Problems." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 5-13.

The chart presented in this paper has been described in Ref. 1 where it appeared as an orthographic map of the Poincare sphere. Its application to transmission lines is believed to be new and since in this respect important properties derive from projective geometry rather than from the relation to the sphere it is proposed to call it the projective chart.

Click on title for a complete paper.

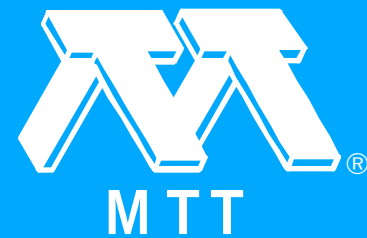


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Some Coupled-Wave Theory and Application to Waveguides (Abstract)

S.E. Miller. "Some Coupled-Wave Theory and Application to Waveguides (Abstract)." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 14-14.

Coupled transmission lines have been employed as transducers for selectively coupling between a single-mode waveguide and one mode of a multi-mode waveguide. Theoretical relations describing the characteristics of such devices and some results of experiments are to be presented.



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Audio Modulation Substitution System for Microwave Attenuation Measurements

J. Korewick. "Audio Modulation Substitution System for Microwave Attenuation Measurements." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 14-21.

This paper describes an Audio Modulation Substitution System for high accuracy microwave attenuation measurements. In order to utilize the full advantages of a high-gain, narrow-band audio amplifier, problems of noise, hum, and instability had to be overcome. The techniques used to overcome these difficulties are discussed. The system is used over the frequency range of 240-40,000 mc and can measure up to 40 db.



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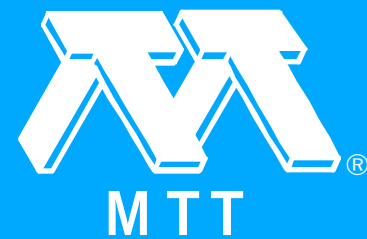


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The Microwave Interferometer for Measuring the Time Displacement of a Projectile Within the Barrel of a Gun (Abstract)

H.C. Hanks, Jr.. "The Microwave Interferometer for Measuring the Time Displacement of a Projectile Within the Barrel of a Gun (Abstract)." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 22-22.

This paper discusses the design and tests of a Microwave Interferometer, an instrument capable of measuring the time-displacement of a projectile within the barrel of a gun. A continuous record of the projectile time-displacement is obtained by using a CW-Doppler radar technique at K-band. A discussion is made of the effect of higher order modes within the gun barrel and of the effect of the leakage of the propellant gases ahead of the projectile.



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Performance of Ferrites in the Microwave Range (Abstract)

A.G. Fox. "Performance of Ferrites in the Microwave Range (Abstract)." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 22-22.

The discovery of microwave Faraday rotation in ferrites has opened up a whole new field of investigation and applications. An elementary explanation of the cause of Faraday rotation will be given with the aid of a model of a spinning electron, which can demonstrate ferromagnetic resonance and negative permeability. Some of the applications of ferrites to microwave circulators, modulators and phase changers will be discussed.

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Microstrip - A New Microwave Transmission Technique (Abstract)

H.F. Engelmann. "Microstrip - A New Microwave Transmission Technique (Abstract)." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 22-22.

A new use is made of the classical two-wire transmission line in its application to microwave transmission. By the introduction of a ground plane, the familiar two-wire line is reduced to a planar configuration which permits important advantages to be obtained compared to present microwave techniques. These advantages include good electrical characteristics, reduction in size and weight, with corresponding reduction in manufacturing costs since printed circuit techniques become applicable. The general characteristics of this system are presented together with application information with respect to components, etc.

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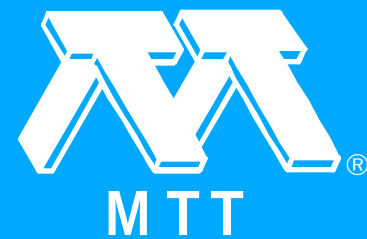


Abstracts

X-Band Rotary Joint

H.J. Riblet and R.L. Williston. "X-Band Rotary Joint." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 23-24.

In view of the important part played by rotary joints in many radar systems, it is surprising that little or nothing has been published on this subject since the appearance of the discussion by Niemann, Ehlers and Worrell, in which they give the war time status of this component. In spite of the excellent work already done on this project, however, there remained a need for a high power rotary joint with a lower V.S.W.R. over a 11% frequency band.



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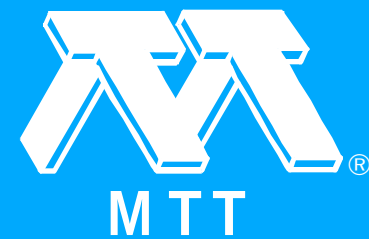


Abstracts

Doubly Compensated Tunable Cavity

T.S. Saad. "Doubly Compensated Tunable Cavity." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 25-28.

The problem of temperature compensation of microwave cavities is one that has received considerable attention. This paper will attempt to describe a method of compensation which has been used by the Microwave Development Laboratories with some degree of success. It is well to point out at this time that all the cavities described here will be assumed to be filled with a dry inert gas and hermetically sealed. This will eliminate for the purposes of this paper the question of humidity effects.



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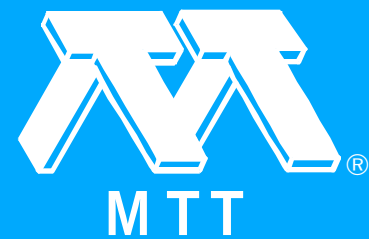
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Compact Top-Wall Hybrid Junction

E. Hadge. "Compact Top-Wall Hybrid Junction." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 29-30.

Very often in working with a waveguide transmission systems, it is necessary or desirable to couple off from the system a specified amount of the energy for various purposes. A common and practical method of accomplishing this is through the use of directional couplers and waveguide hybrid junctions. The hybrid junction, as used in this discussion, refers to a specialized waveguide directional coupler having the characteristic that when power enters one of its terminals this power divides equally between the two forward output terminals. the object of this paper is to describe briefly a compact, broad-band hybrid junction whose high performance and geometry are noteworthy.

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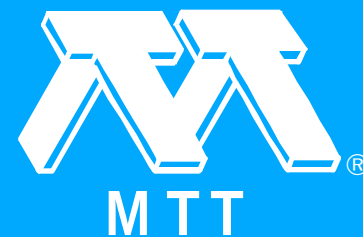


Abstracts

Duplexing Filter Design at 2000 MC

D.R. Crosby. "Duplexing Filter Design at 2000 MC." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 31-38.

This talk concerns the design of the duplexing filters for the commercial RCA microwave communication equipment operating in the 1700 to 2000 mc region. Such equipment is extensively used by pipe line companies and electric power companies. This equipment is sold competitively both against other suppliers of microwave equipment and against suppliers of wire line facilities. Thus it must be of acceptable commercial quality, while production costs must be an ever present design consideration.



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A Standard Waveguide Spark Gap

D. Dettinger and R.D. Wengenroth. "A Standard Waveguide Spark Gap." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 39-47.

Accurately rating the power handling capacity of a microwave component is a frequent and difficult task. In a study of this problem for the Bureau of Ships, a simple waveguide spark gap has been found to be a valuable tool and its adoption by microwave engineers as a universal standard is recommended.



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A Rotary Joint for Two Microwave Transmission Channels of the Same Frequency Band (Abstract)

H.P. Raabe. "A Rotary Joint for Two Microwave Transmission Channels of the Same Frequency Band (Abstract)." 1953 Transactions on Microwave Theory and Techniques 1.1 (Mar. 1953 [T-MTT]): 48-48.

This dual-channel rotary joint consists of two pairs of rectangular waveguide terminals, a circular waveguide which transmits both channels and coupling elements between the rectangular waveguide terminals and the circular waveguide which convert the rectangular H/sub 10/ mode into the circular H/sub 01/ and E/sub 01/ modes. If pure H/sub 01/ and E/sub 01/ modes can be excited, perfect separation of the channels as well as constant amplitudes and phases can be obtained when the joint rotates. While the conversion into the circular E/sub 01/ mode is performed by a conventional method, a new method had to be developed for the conversion of the rectangular H/sub 10/ mode into the circular H/sub 01/ mode.

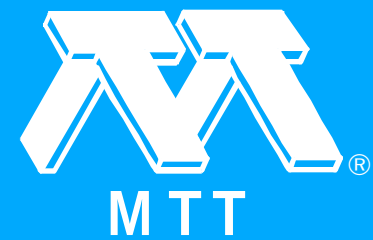
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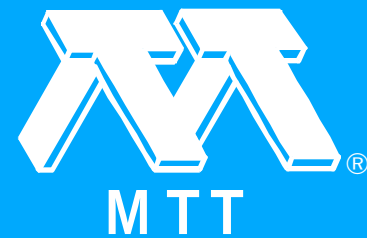


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Foreword (Nov. 1953 [T-MTT])

A.G. Clavier. "Foreword (Nov. 1953 [T-MTT])." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 1-2.

The Transactions of the PGMTT is the organized technical publication of its membership. The technical papers which are presented in this publication are given the same careful attention as papers published in the Proceedings of the Institute of Radio Engineers, and, with the cooperation of the members of this professional group and the support of the Institute, we are certain that the Transactions will become one of the most important publications in the field of Microwave Theory and Techniques.



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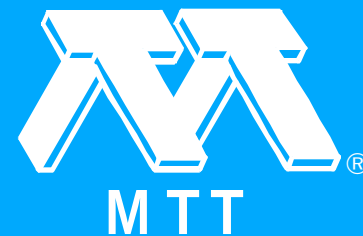


Abstracts

Instrumentation of Microwave Electron Resonance in Magnetic Fields

W.D. Hershberger and R.C. Mackey. "Instrumentation of Microwave Electron Resonance in Magnetic Fields." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 3-10.

The title of this paper is long and descriptive, but the phenomena studied are known as paramagnetic resonance or ferromagnetic resonance, as the case may be. The device which is used to perform these studies is known as a paramagnetic spectroscope, and is described in the following pages.



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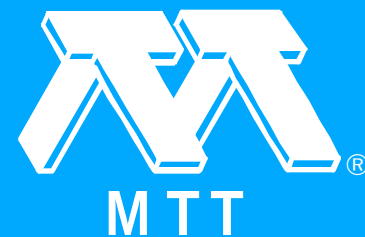


Abstracts

Properties of Ferrites in Waveguides

N.G. Sakiotis and H.N. Chait. "Properties of Ferrites in Waveguides." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 11-16.

In the past few years research with ferrites has shown that these materials possess unusual properties of considerable importance to microwave engineers. These properties result from the fact that at microwave frequencies and in the presence of a static magnetizing field, these non-conducting ferromagnetic media are characterized by an asymmetric tensor permeability whose components are functions of the static magnetizing field. Because of this one can, by means of a variable magneto-static field, vary the propagation characteristics e. g., the phase, polarization, and transmission loss of a wave-propagating in waveguide-containing ferrite materials. Since the static magnetizing field can be varied by purely electrical means, it is possible with the use of these materials to construct microwave components which will very rapidly vary either phase or polarization electrically.



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A Coaxial Magic-T

T. Morita and L.S. Sheingold. "A Coaxial Magic-T." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 17-23.

A coaxial hybrid junction is described whose performance is analogous to a waveguide magic-T. The design of three different types of coaxial magic-T is discussed. Standing-wave characteristics of an experimental model of each type are given. Experimental results indicate that standing-wave ratios less than 2 looking into any arm can be obtained easily over a frequency band of about 10 per cent. Owing to the structural symmetry of the device, the decoupling between shunt and series arm is of the order of 40 db. An application of the coaxial magic-T to phase measurements is described. This method of phase measurement is independent of the amplitude of the unknown signal.



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Broad-Banding Circular Polarizing Transducers

D.L. Margerum. "Broad-Banding Circular Polarizing Transducers." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 24-29.

A problem frequently encountered in microwave and antenna work is that of obtaining elliptically polarized waves of low axial ratio over extremely broad frequency bands. In an effort to reach a more satisfactory solution to this problem than is possible with present techniques a theoretical study was conducted on several elliptically polarizing transducer configurations in circular waveguide. The results of this study indicated that the bandwidth obtainable with dielectric slab type transducers could be broadened considerably by using shielded dielectric rod type transducers.

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



Abstracts

Two Types of Waveguide Switches

A. Pratt. "Two Types of Waveguide Switches." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 30-32.

In the design of Century Electronics' multiple function test set, the problem of waveguide switching between the various functions arose. The problem could have been solved by using sheer force, but space, weight, and economic requirements ruled out this approach. A study was accordingly made to see if new techniques could be used, and from this study two useful types of switches evolved.



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Abstracts

Attenuation and Power-Handling Capability of Helical Radio-Frequency Lines

J.H. Bryant and E.J. White. "Attenuation and Power-Handling Capability of Helical Radio-Frequency Lines." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 33-38.

A method is described for computing cold insertion loss as well as power-handling capabilities of a helical radio-frequency line. The helically-conducting-cylinder model in free space is considered first. Computations are then extended to account for the presence of an outer, coaxial, uniformly conducting cylinder.



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Annular Resonant Slots in Dielectric-Filled Circular Waveguide

M. Cohn. "Annular Resonant Slots in Dielectric-Filled Circular Waveguide." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 39-43.

Measurements were made to determine the properties of thin annular resonant slots in polystyrene-filled circular waveguide, in which the TE/sub 11/ mode is propagating. Data on the variation of susceptance of these slots as a function of frequency through the X-band region is presented in graphic form. Quantitative information relating the resonant frequency and Q of these slots to their geometry is presented. An empirical expression was found relating the Q of these slots to their gap size.

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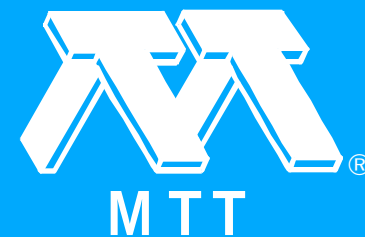


Abstracts

Errata (Nov. 1953 [T-MTT])

"Errata (Nov. 1953 [T-MTT])." 1953 Transactions on Microwave Theory and Techniques 1.2 (Nov. 1953 [T-MTT]): 44-44.

We should like to call attention to the following corrections to be made in connection with the last issue of the Transactions of the Professional Group on Microwave Theory and Techniques, vol. 1, no. 1: 1. The reflection chart in Figure 3 on page 11, showing circles of constant phase of the impedance should be labeled "Carter Chart." 2. Figure 5 on page 12 should be interchanged with Figure 4 on page 21.



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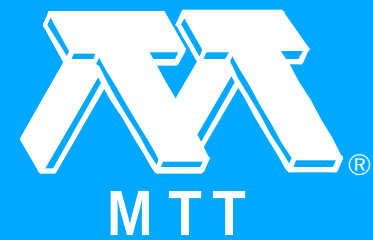
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Abstracts

Front Cover and Table of Contents (Apr. 1954 [T-MTT])

"Front Cover and Table of Contents (Apr. 1954 [T-MTT])." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): f1-f2.



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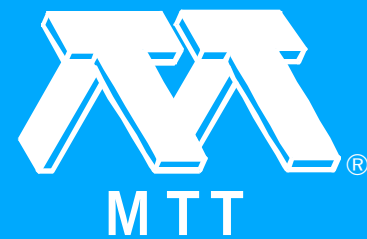


Abstracts

The Microwave System of the Michigan-Wisconsin Pipeline Company

W.P. Maginnis and H. Place. "The Microwave System of the Michigan-Wisconsin Pipeline Company." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 1-8.

It is perhaps unnecessary to point out to the reader that in the design of a communication network, such as the Michigan-Wisconsin Pipeline microwave-VHF system, which includes 60 microwave stations, the incorporation of the desired operating features into the system is often a more complex and demanding engineering task than the design of the basic circuit elements. The provision of maximum flexibility and utility as desired by the customer, introduces engineering problems which are not easily solved by laboratory methods and which must, therefore, be anticipated and solved by analysis, and proven only in the final installation. The microwave -VHF communication system described in this paper required, before its completion, the solution of many complex system problems. The description of the system facilities will, therefore, occupy most of this paper and only a brief description of the apparatus used will be included.



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Microwave Site Selection in Undeveloped Country

R.D. Pynn. "Microwave Site Selection in Undeveloped Country." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 9-15.

This article discusses a method by which microwave systems are laid out in rugged undeveloped country, where maps alone cannot be used to indicate path clearance. The first step is to gather all available information and, by careful study of the topography, to lay out several possible microwave routes. The next step is to conduct a methodical low level aerial survey by means of inexpensive light aircraft, making descriptive notes of the proposed relay sites and measuring the height of all hills on or close to the propagation line. If the first plan fails the height data obtained contribute to a more enlightened second plan and the process is repeated until an attractive system develops. A third step is necessary in order to establish tower heights and assure that sites picked out from the air are practical from an installation viewpoint. Field parties carrying simple equipment visit the sites and conduct additional tests, on the basis of which tower heights are computed and construction parties are able to move in.

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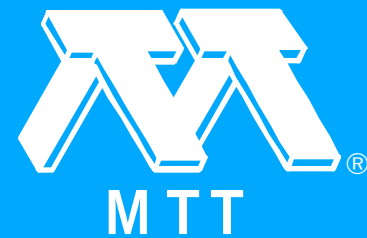


Abstracts

Microwave Repeater Site Planning and Development

R.M. Chapman. "Microwave Repeater Site Planning and Development." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 16-31.

In the overall planning of a microwave system the propagation experts must work in conjunction with the site development engineers. The site development group will require the services of civil and mechanical engineering consultants. These people should operate together in choosing each and every site so that propagation versus site development economics can be compared at every step. For the purpose of this symposium the two problems will be discussed separately.



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Abstracts

Remote Control of Standby Engine Generator Sets Over a Microwave System

R.L. Halvorson. "Remote Control of Standby Engine Generator Sets Over a Microwave System." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 32-35.

Experience in actual operation of microwave relay systems throughout the country has shown that involuntary outages have been caused principally by failure of the input power to the microwave equipment. Where substantially continuous service is required of the microwave system the common practice is to have emergency standby power available. This emergency power is supplied by an emergency generator set at the microwave station site. Failure of the normal input power supply initiates starting the engine generator set to supply a particular microwave station with power. This paper describes the units used to improve reliability of engine generators in microwave applications.



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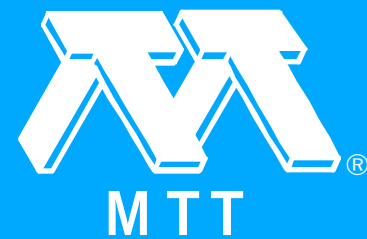


Abstracts

Application of Compandors to FM Radio Systems with Frequency Division Multiplexing

M.G. Harp, M.H. Kebby and E.J. Rudisuhle. "Application of Compandors to FM Radio Systems with Frequency Division Multiplexing." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 36-40.

Compandors are used to improve the intelligibility of speech transmission circuits by increasing the signal-to-noise ratio. Originally developed in the early 1930's for use with transoceanic radio circuits, they have since been applied to some extent on long distance telephone circuits, usually of the carrier-derived type. Within the past few years new telephone carrier systems have been developed which include a compandor as an integral part of the equipment for each speech channel.



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Abstracts

A Double Side-Band Amplitude-Modulated Multiplex System for Use over Microwave Radio

N.B. Tharp. "A Double Side-Band Amplitude-Modulated Multiplex System for Use over Microwave Radio." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 41-49.

Microwave communications is one of today's most rapidly expanding fields in the radio art. Its inherent characteristics fit well into the communication needs of expanding industry. One of its important advantages over conventional communication means is the capability of handling numerous voice frequency channels over a single radio frequency carrier. This capability is made possible by the wide bandwidth which is available and can be transmitted at ultra high frequencies.



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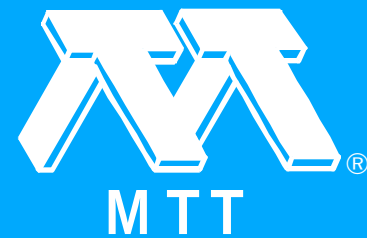


Abstracts

A Microwave System for Trunk Service

J.J. Lenehan. "A Microwave System for Trunk Service." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 50-59.

The system described in this paper was designed to provide trunk facilities for telegraph purposes. The accumulated experience of the Telegraph Company's New York-Washington-Pittsburgh radio relay triangle was of value in the early stages of planning. This commercial service, which was installed in the latter part of 1946 and placed in operation early in 1948, highlighted many of the problems that are encountered with this transmission medium.



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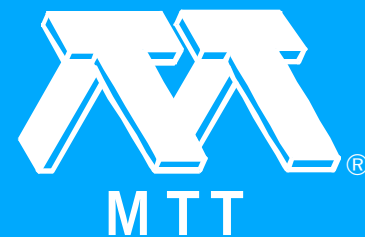


Abstracts

A Microwave Radio System for Pipeline Use

E. Dyke. "A Microwave Radio System for Pipeline Use." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 60-62.

In the Texas-Illinois pipeline installation of a microwave relay, the reliability problem was emphasized by the distribution of some 2000 vacuum tubes and associated other components over more than a thousand miles of pipeline right-of-way. The general solution to the reliability problem was threefold, including the design of inherently reliable equipment, provision of full automatic switchover to standby in case of component failure, and special test facilities for rapid isolation of any degraded component.



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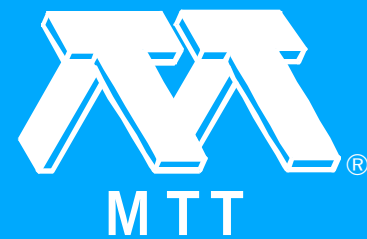


Abstracts

Microwave & VHF Radio Installation for the Union Electric System

G.W. Fox. "Microwave & VHF Radio Installation for the Union Electric System." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 63-83.

The prime function of any electric utility is that of reliable and uninterrupted power flow to its customers. The direct relation between the growth of a utility and the expansion of its communication facilities often times do not parallel. This results in the communications facilities becoming so overburdened that they almost become ineffective. Figure 1 shows Union Electric's growth over the past few years.



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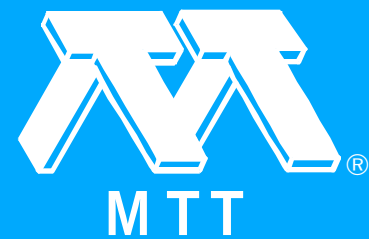
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Microwave Radio Relay Link for Military Use

S. Metzger. "Microwave Radio Relay Link for Military Use." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 84-88.

Radio set AN/TRC-29 is the nomenclature for a frequency-modulated microwave radio link equipment designed for military use. It transmits in the band from 1700 to 2400 megacycles and will accept input signals between 30 cycles and 4.5 megacycles. In most cases, It will probably be used in conjunction with Multiplexer Set AN/TCC-13. This latter unit, which will also be described, is a pulse-position-multiplex equipment providing 23 voice channels. Facilities are included so that two multiplexer sets can be combined to provide 46 voice channels for transmission over one radio set. In place of 46 voice channels, the radio set can be used for transmission of radar signals. It can also carry television signals, but direct-current reinsertion amplifiers would be necessary in approximately every third station. Various other types of signals whose bandwidth lies within the 30-cycle-to-4.5-megacycle range can also be carried.

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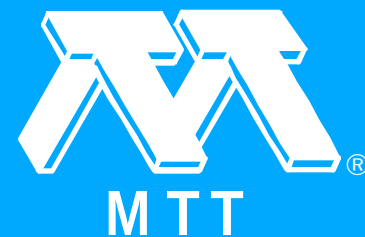


Abstracts

Transco Microwave System

H.A. Rhodes. "Transco Microwave System." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 89-92.

The Transco system is approximately 1,780 miles in length and has roughly 9,350 circuit miles in use, all of which are for voice conversation. Our main system consists of 59 stations placed at intervals of 30.7 miles, with the shortest hop 10 miles and the longest 50 miles. Tower heights range from 50 to 350 feet, generally supporting two 6' dishes. The backbone equipment was manufactured by General Electric Company and operates in the 2,000 Mc band. As installed, this equipment is designed to accommodate 12 pulse channels of 3 Kc bandwidths. At 4 intermediate points all circuits or channels are demodulated and terminated or wired through to modulate a new pulse train. Leg circuits operating in the 950 Mc band are used to tie the main system to operational points located at short distances from the pipe line. This system was installed for the purpose of providing communication essential in the maintenance and operation of a 30' high pressure pipe line which runs from southwest Texas to New York.



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Abstracts

Microwave Testing with Millimicrosecond Pulses

A.C. Beck. "Microwave Testing with Millimicrosecond Pulses." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 93-99.

Pulse testing techniques have been used for many purposes for a long time. In studies of waveguides as radio and radar components and for possible communications systems use, we have employed various types of pulse testing. The need for greater resolution through the use of very short pulses has always been apparent. For this reason, equipment has recently been built to generate and display 9,000 megacycle pulses having a length of about 6 millimicroseconds. In a pulse of this length there are less than 100 cycles of radio frequency energy, and the pulse occupies less than 10 feet of path length in the transmission medium. The r-f bandwidth required is about 500 megacycles.



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Theoretical Aspects of Microstrip Waveguides

G.A. Deschamps. "Theoretical Aspects of Microstrip Waveguides." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 100-102.

The Microstrip is a modification of the wire-above-ground system of transmission - the wire is replaced by a narrow strip printed on a dielectric sheet which is backed by a conductor. An exact theory for such a structure is difficult because the cross section is not homogeneous and has a geometry which does not lead to separation of variables. Furthermore it is an "open" structure where the energy is not confined to a finite region as it would be in conventional or "closed" waveguides.

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Considerations in Klystron Design for Microwave Relay Systems

R.W. Olthuis. "Considerations in Klystron Design for Microwave Relay Systems." 1954 Transactions on Microwave Theory and Techniques 2.1 (Apr. 1954 [T-MTT]): 103-107.

When a new relay system is being considered, there are many decisions to be made about the type of system and the tube to generate the power. A system which employs a klystron power mixer has many advantages. One of them being that all video amplifiers are eliminated except one at each of the terminals. Furthermore there are no modulation processes that cause amplitude non-linearity in any of the repeaters. Also, experience has demonstrated that klystrons for this service can be very long lived giving tens of thousands of hours life.

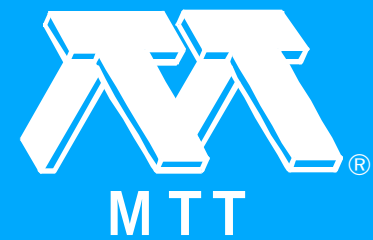
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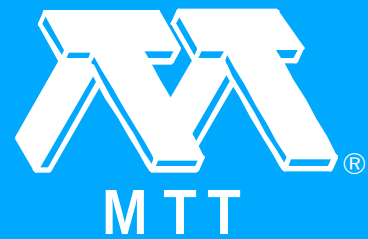


Abstracts

Symposium on Modern Advances in Microwave Techniques (Announcement) (Jul. 1954 [T-MTT])

"Symposium on Modern Advances in Microwave Techniques (Announcement) (Jul. 1954 [T-MTT])." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 1-1.

The Microwave Research Institute of the Polytechnic Institute of Brooklyn, in cooperation with the Professional Group on Microwave Theory and Techniques of the Institute of Radio Engineers presents a comprehensive symposium on Modern Advances in Microwave Techniques. This symposium will be held on November 8, 9, and 10, in the auditorium of the Engineering Societies Building, 33 West 39th Street, New York City, and will form apart of the centennial celebration of the Polytechnic which was incorporated in 1854. As on past occasions, the symposium will very likely be co-sponsored by the Office of Naval Research, the Office of Scientific Research of the Air Force and the Signal Corps of the Army.



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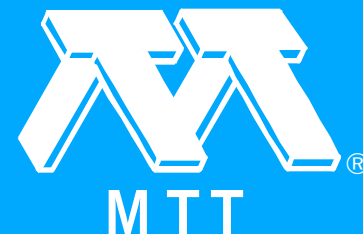


Abstracts

Frequency Curves

W.W. Mumford. "Frequency Curves." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 1-1.

A set of curves showing wavelength in waveguide versus frequency for the commonly used rectangular waveguides in the frequency range from 2600 to 11,650 mc can be obtained upon request from Frequency Standards, P.O. Box 504, Asbury Park, New Jersey.



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Abstracts

A Traveling-Wave Electron Deflection System

R.C. Honey. "A Traveling-Wave Electron Deflection System." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 2-9.

Several types of traveling-wave electron deflection structures that can be used in microwave oscillographs are described and compared. An interaction structure consisting of a folded wire over a plane is considered in detail, both theoretically and experimentally. A general analysis of the interaction of electrons with sinusoidally varying transverse electric fields is presented and is applied to traveling-wave deflection systems. This analysis gives quantitative information about the interdependence of deflection and drift space lengths, beam velocities, frequencies and phase velocities along the structure. Limitations on the design and performance of traveling-wave deflection systems can be determined from this analysis.



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Crystal Checker for Balanced Mixers

P.D. Strum. "Crystal Checker for Balanced Mixers." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 10-15.

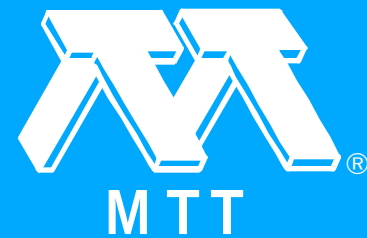
To achieve optimum performance from a microwave receiver that uses a balanced crystal mixer, matched pairs of crystals should be used. However depending on the reason for choosing the balanced mixer for a particular receiver, the crystal characteristics that should be matched and the degree of balance that is required vary considerably. The three principal reasons for using balanced mixers are: 1. To minimize noise figure by suppressing local-oscillator noise. 2. To suppress local-oscillator power radiation. 3. To reduce receiver sensitivity to certain spurious responses. For radar receivers, the first reason is the only important one, and fortunately it places the least stringent requirement on the degree of balance.

Abstracts

A Technique for Stabilizing Microwave Oscillators

J.L. Altman. "A Technique for Stabilizing Microwave Oscillators." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 16-25.

The stabilization of microwave oscillators whose short term deviations in frequency are in the order of one part in 10^8 is discussed in this article. The control system, which consists of a dual mode reference cavity and feedback amplifier, is applied to a reflex klystron oscillator. Circuit analysis and practical design considerations are presented. A practical method of measuring the actual frequency stability is given.



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Abstracts

Use of Crystals in Balanced Mixers

J. Taub and P.J. Giordano. "Use of Crystals in Balanced Mixers." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 26-38.

The crystal parameters to be considered for obtaining accurate information about local oscillator noise suppression in a balanced mixer are theoretically presented. The interrelationship between available local oscillator noise suppression and the important design characteristics of microwave receivers are discussed and curves are plotted. A method of accurately measuring local oscillator noise suppression is given and experimental data is correlated with theoretical results.



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Abstracts

A Coaxial Line Filled with Two Non-Concentric Dielectrics

D.J. Angelakos. "A Coaxial Line Filled with Two Non-Concentric Dielectrics." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 39-44.

An analysis has been made of a coaxial transmission line composed of two coaxial cylindrical conductors. Two dielectrics fill different angular portions of the volume between the conductors. The propagation constants (primarily the guide wavelength) are determined by a resonant condition applied to the plane transverse to the direction of propagation. Experimental verification is given for near unity values of the ratio of the outer to the inner radius. In addition, an experimental investigation has been made of the properties of the guide wavelength as a function of frequency and larger ratios of the radii.



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H/sub o1/ Mode Circular Waveguide Components

D.A. Lanciani. "H/sub o1/ Mode Circular Waveguide Components." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 45-51.

A convenient method of launching the H/sub o1/ mode in round waveguide is described. Four resonant slots are employed in a compact end-feed transition design. Construction details and performance curves are given. Also described is a developmental bend which avoids the H/sub o1/-E/sub 11/ mode degeneracy problem by employing a superimposed pair of "E" and "H" plane rectangular waveguide bends. A mode absorber is described which is capable of reducing the mode impurities inherent in the transition design to a level of less than 0.1% of the emerging H/sub o1/ mode power. Other possible applications of the H/sub o1/ wave to problems other than low loss microwave transmission are briefly considered.

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Characteristic Impedance of the Shielded-Strip Transmission Line

S.B. Cohn. "Characteristic Impedance of the Shielded-Strip Transmission Line." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 52-57.

Simple formulas are given for the characteristic impedance of a transmission line consisting of a conducting strip of rectangular cross section centered between parallel conducting plates at ground potential. The formulas agree to within 1.2 per cent with an exact formula for a zero thickness strip. In the case of finite thickness up to a quarter of the plate spacing, the formulas are expected to be at least that accurate. A family of characteristic impedance curves given in this paper should prove useful to the design engineer.

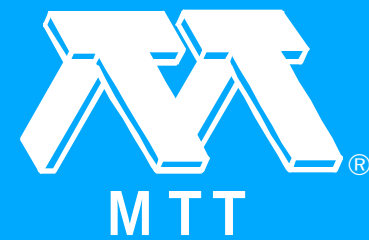
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R.F. Schwartz. "Bibliography on Directional Couplers, 1935-1953." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 58-63.



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"Addenda (Jul. 1954 [T-MTT])." 1954 Transactions on Microwave Theory and Techniques 2.2 (Jul. 1954 [T-MTT]): 64-68.

1. G. A. Deschamps, "New Chart for the Solution of Transmission-Line and Polarization Problems," Trans. IRE Professional Group on Microwave Theory and Techniques, vol. 1, no. 1, pp. 5-13; March, 1953: In his article, "Die Anwendung der Riemannschen Zahlenkugel und ihrer Projectionen in der Wechselstromtechnik," (Radiowelt, vol. 1, pp. 23-26; October, 1946), F. Steiner obtained the representation of impedances by points on a sphere by the use of stereographic projection of the complex numbers plane. He then considered the orthogonal projection of this sphere on an equatorial plane which gives, in effect, the projective chart. An application of that chart to the determination of impedance by the 3-probes method, anticipating part of the results in the section titled, "Problems on Power," is also described.

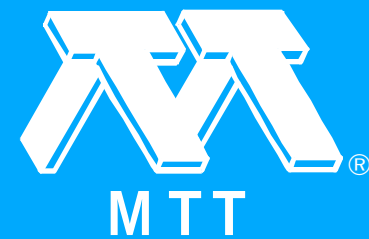
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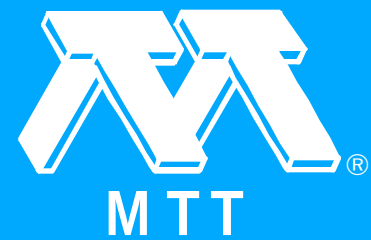
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Optical Methods for the Measurement of Complex Dielectric and Magnetic Constants at Centimeter and Millimeter Wavelengths

T.E. Talpey. "Optical Methods for the Measurement of Complex Dielectric and Magnetic Constants at Centimeter and Millimeter Wavelengths." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 1-12.

A method is described which permits the determination of the complex dielectric constant, $\epsilon^* = \epsilon_0/k_{\text{sub } e}/(1-j \tan \delta_{\text{sub } e})$, and the complex permeability, $\mu^* = \mu_0/k_{\text{sub } m}/(1-j \tan \delta_{\text{sub } m})$, using free space transmission and reflection from a plane sheet of the sample dielectric. The procedure represents an extension of that used at optical frequencies. Differences arise however, due to the fact that the assumptions of $k_{\text{sub } m} = 1$ and $\tan \delta_{\text{sub } m} = 0$, which are made in the optical theory, are not always valid at millimeter wavelengths.

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Millimeter Wave Spectroscopic Components

W.C. King. "Millimeter Wave Spectroscopic Components." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 13-16.

The very rapid development of the field of microwave electronics from the late 1930's to the present has opened up the region of the electromagnetic spectrum lying between the "radio" region and the infrared region. It is not generally realized, however, that these recent developments were by no means the earliest work in the field of centimeter and millimeter waves --- for example, Heinrich Hertz published in 1889 a description of the apparatus with which he generated and detected radiation of approximately 50 cm wavelength. In 1893-94 the Italian scientist, Righi, conducted experiments at even shorter wavelengths, and in 1923 the Americans, Nichols and Tear, published results of experiments covering the entire region from 50 mm to 0.22 mm --- from 5 kMc to 1300 kMc! Using small tungsten spark gaps, paraffin lenses, an eschelle grating, and a thermal-type detector they were able to prove experimentally the complete equivalence of "radio" and "infrared" radiation, thus closing the gap which had existed between the two.

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Harmonics at Millimeter Wavelengths

A.H. Nethercot, Jr.. "Harmonics at Millimeter Wavelengths." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 17-20.

Two techniques for obtaining millimeter waves with sufficient power to make physical measurements have been investigated at the Columbia Radiation Laboratory. The first in point of time was to use the harmonics of the fundamental frequency directly emitted by a magnetron when it is in oscillation. Harmonics up to wavelengths of 1.25 mm have been observed. The only advantage of the magnetron is in the ease of adjustment. An operator of moderate experience should be able to produce 1.5 mm radiation within a few hours using this technique. The other method in use is to frequency multiply the power emitted by a klystron by means of a silicon-tungsten contact used as a non-linear device. This method has produced 1.5mm wavelength radiation at Columbia and wavelengths up to 0.77 mm at Duke University. It has the advantages that the radiation is stable in power and frequency, is monochromatic, and also is tuneable. The price paid is in a considerably greater time of adjustment and alignment, a few weeks being not at all uncommon.

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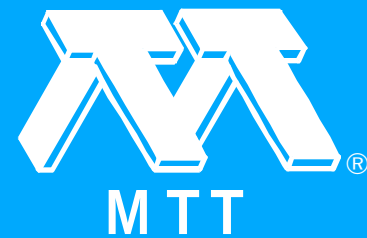


Abstracts

Millimeter Wave Generation by Cerenkov Radiation

M. Danos and H. Lashinsky. "Millimeter Wave Generation by Cerenkov Radiation." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 21-22.

As a part of the Columbia University Radiation Laboratory program for the generation of millimeter waves the Cerenkov effect is being used to produce microwave radiation. The frequency range of interest in this project is in the submillimeter region in as much as the longer wavelengths can be generated by conventional methods. I shall first describe briefly the properties of Cerenkov radiation and then report on results obtained to date and on the program planned for the immediate future.



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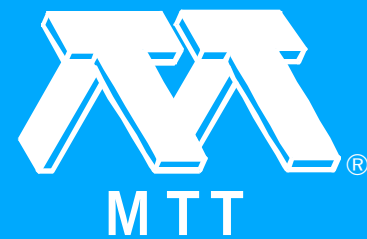


Abstracts

Stabilization of Reflex Klystrons by High-Q External Cavities

S.J. Rabinowitz. "Stabilization of Reflex Klystrons by High-Q External Cavities." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 23-26.

The frequency stability of the local oscillator is often the most important factor in determining the IF bandwidth of superheterodyne receivers. The inherent frequency stability of the local oscillator, which in the case of millimeter reflex klystrons is quite poor, can be improved by electronic means with the use of some forms of microwave discriminator. An alternate method is to increase the effective Q of the oscillator, since the frequency stability of a free-running oscillator is proportional to the Q of the resonant circuit. The latter method has the advantages of simplicity and of ease of alignment and tuning. The frequency stability which results, while not as great as can be obtained electronically, is sufficient for some purposes.



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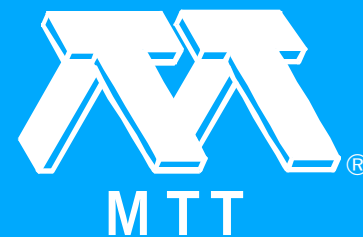


Abstracts

Superheterodyne Receiver for the 100 to 150 kMc Region

C.M. Johnson. "Superheterodyne Receiver for the 100 to 150 kMc Region." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 27-32.

In our work in the region from 100 to 300 kMc we are continually searching for more sensitive receiving systems and have recently been investigating superheterodyne detection in this region.



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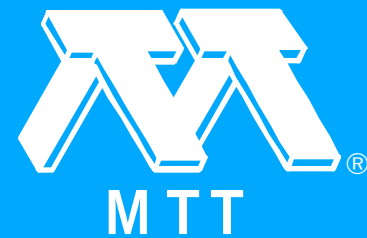


Abstracts

Magnetron Research at Columbia Radiation Laboratory

M.J. Bernstein and N.M. Kroll. "Magnetron Research at Columbia Radiation Laboratory." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 33-37.

Current magnetron research and development at Columbia Radiation Laboratory is principally directed towards the production of the shortest wavelengths in the millimeter region; the development of high power in the millimeter region; the development of wide range tunable tubes; and the investigation of low field magnetron operation.



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Low Loss Dielectric Waveguides

M.T. Weiss and E.M. Gyorgy. "Low Loss Dielectric Waveguides." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 38-47.

The history of dielectric waveguides begins back in 1910 with the publication of a theoretical paper by Hondros and Debye, who gave a mathematical treatment of transverse magnetic mode propagation in lossless dielectric guide. In the 1930's Southworth began experimental work on these modes while Carson, Mead, and Schelkunoff developed a general theory which showed the existence of TE, TM, and hybrid HE modes. During World War II, dielectric rod antennas came into use. However, dielectric waveguides as transmission lines were considered impractical at that time when the shortest wavelengths in use were several centimeters long. The size of dielectric required at these long wavelengths, and the problems of support, radiation, and crosstalk, appeared to be serious drawbacks to the practical utilization of these guides. Furthermore, there was no great need for dielectric guides, since dominant-mode metallic guides had sufficiently low loss while flexibility could readily be obtained by corrugated guides or by coaxial lines.

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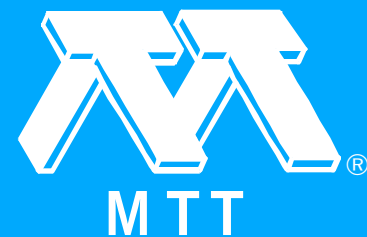


Abstracts

A Calorimeter for Power Measurements at Millimeter Wavelengths

W.M. Sharpless. "A Calorimeter for Power Measurements at Millimeter Wavelengths." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 45-47.

A calorimeter for measuring low-level power at millimeter wavelengths is described. This is a broadband device capable of measuring power levels of the order of one milliwatt with an estimated accuracy of plus or minus 1/4 db. The calorimeter utilizes the substitution principle by matching the temperature rises of two identical power absorbers, in one of which is dissipated the unknown high frequency power while the other is heated by a measured amount of direct current power.



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An Experimental Broad-Band Helix Traveling-Wave Amplifier for Millimeter Wavelengths

S.D. Robertson. "An Experimental Broad-Band Helix Traveling-Wave Amplifier for Millimeter Wavelengths." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 48-53.

This paper considers a number of problems which have been encountered and solved in the design and construction of an experimental millimeter-wave amplifier using a microscopic helix only 0.015" in diameter. Amplifications of as much as 19 db have been obtained at a wavelength of 6 millimeters, and amplifications of 9 db have been measured at wavelengths as short as 5.2 millimeters.



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The Use of Flat Waveguide in the Millimeter Range

S. Hopfer. "The Use of Flat Waveguide in the Millimeter Range." 1954 Transactions on Microwave Theory and Techniques 2.3 (Sep. 1954 [T-MTT]): 54-54.

The use of flat waveguide in the millimeter range has the advantage of increased power handling ability and lower attenuation as compared to the ordinary single mode guide. These advantages are gained at the expense of possible multi-mode propagation. Various flat guide components are described which are designed to operate over a 4:1 frequency band with minimum higher mode excitation. In addition, the measurement of the equivalent coupling parameters of waveguide discontinuities when two modes are propagating, is discussed. These measurements are facilitated through the use of a novel standing wave indicator which allows the standing wave of each mode to be measured separately. The experimental values of the coupling parameters are in good agreement with those predicted by theory.

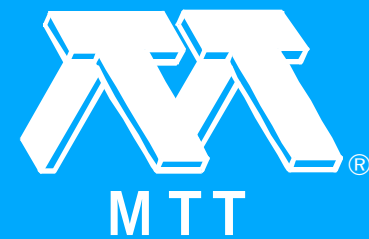
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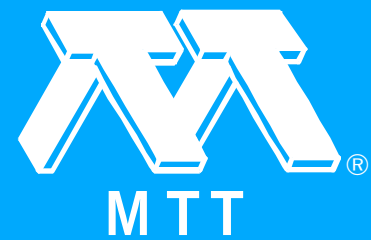
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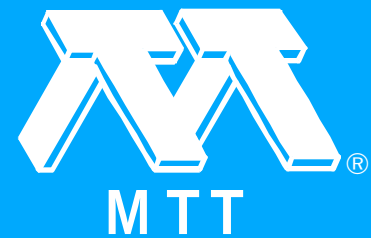


Abstracts

Publication Plans of the PGMTT

T. Saad. "Publication Plans of the PGMTT." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 1-1.

With this issue, the PGMTT embarks on a new publication policy. For our regular issues, which will be published in January, April, July and October, we will use the same style type and format used in the Proceedings. Periodically, we will publish such special issues as appear necessary to keep us well informed. The first of these will be the Special Issue on the Microwave Strip Circuits Symposium held at Tufts College, October 11-12, 1954.



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Biography - George Clark Southworth

"Biography - George Clark Southworth." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 2-2.

Born at Little Cooley, Pennsylvania, on August 24, 1890, Dr. Southworth did undergraduate work at Grove City College and graduate work at Columbia and Yale. Then for ten years he was a teacher and for many more years a research worker on the various frequency frontiers of radio. Beginning with experimental work at Grove City College prior to World War I and continuing with research work at the Bureau of Standards and Yale University during World War I, he has been with the Bell System since 1923. He is the author of a score or more of scientific papers on such diversified subjects as ultrashort waves, the dielectric properties of water at ultrahigh frequencies, radio wave propagation, antenna arrays, earth currents, and radio astronomy, as well as that for which he is best known, waveguides. His work culminated in 1950 in a 675-page textbook on microwave techniques, " Principles and Applications of Waveguide Transmission."

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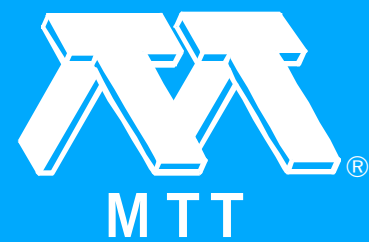
The Challenge

G.C. Southworth. "The Challenge." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 3-3.

There are still many people who remember well when radio was used solely for telegraph purposes. At that time there was no broadcasting, no transoceanic telephony and, of course, no television or radar. Nor were there any of the countless other services now rendered by radio, such as telephone communications with airplanes and with motor vehicles. Beginning back in the early days of radio with the first appreciation that each single radio service required a separate band of frequencies, additional services meant inevitably a growth toward higher and higher frequencies. This growth passed rather swiftly with the years, first from tens of kilocycles, where commercial radio first started, to megacycles, and thence to tens, hundreds and thousands, and now more recently to tens of thousands of megacycles. With our best laboratory techniques, we are now at a rather indefinite and probably temporary frontier around a hundred thousand megacycles. This briefly is the half-century path that has led to the work of this particular Professional Group.

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A Method of Forming a Broad-Band Microwave Frequency Spectrum

R.E. Wall, Jr. and A.E. Harrison. "A Method of Forming a Broad-Band Microwave Frequency Spectrum." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 4-9.

A method of generating a wide spectrum of evenly spaced sidebands in the microwave region, suitable for use as a frequency standard, is presented and discussed. The frequency spectrum is produced by modulating the beam acceleration voltage of a klystron with two high-frequency voltages. The frequency of one of these modulation voltages is an integral multiple of the frequency of the other voltage, so that certain sidebands of the lower frequency coincide with the sidebands of the higher frequency. The output of the klystron then consists of a frequency spectrum about the microwave carrier frequency with the spacing between sidebands equal to the lowest of the two modulating frequencies. The method is examined analytically and experimentally. The operation of a klystron is ordinarily expressed with time as the variable. An analysis making use of the Laplace transform to convert the function of time into a function of frequency has been found convenient. The result gives the magnitude of the sidebands as a function of the operating parameters of the klystron.

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A Turnstile Polarizer for Rain Cancellation

P.A. Crandell. "A Turnstile Polarizer for Rain Cancellation." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 10-15.

This paper describes a rain canceller using a turnstile junction to provide the necessary polarization of the fields. It discusses the system from the point of view of adapting an existing radar feed system to one that will permit the reduction of rain return. The turnstile junction is described, and it is shown to have properties that meet the requirements for obtaining circular or elliptical polarizations. Along with this description, the theory behind the effect of elliptical and circular polarization on rain return is discussed in detail as well as the practical limits such a theory can be put to. Other considerations such as aspect ratio of antennas and screening for the antenna surfaces are touched upon.

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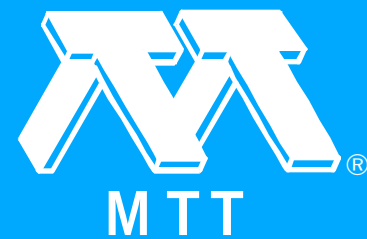


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Graphical Filter Analysis

H.N. Dawirs. "Graphical Filter Analysis." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 15-21.

Some well known principles of filters and transmission lines are recalled and used to develop graphical methods of analyzing lossless transmission line filters consisting of a series of symmetrical and identical sections. The results of this development are used to construct a special filter analysis chart by means of which a filter may be completely analyzed from a Smith Chart plot of the input impedance characteristics.



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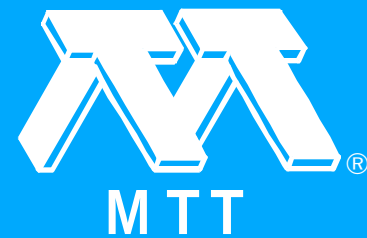


Abstracts

Crystal Checker for Balanced Mixers (Correction)

P.D. Strum. "Crystal Checker for Balanced Mixers (Correction)." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 21-21.

P. D. Strum, author of "Crystal Checker for Balanced Mixers," which appeared on pages 10-15 of the July, 1954 issue of the Transactions, PGMTT, has brought the following correction to the attention of the editors: In the last paragraph under Matching Procedure, " . . .62-25 . . . " should read " . . . 65-25"



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A Waveguide Impedance Meter for the Automatic Display of Complex Reflection Coefficient

H.L. Bachman. "A Waveguide Impedance Meter for the Automatic Display of Complex Reflection Coefficient." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 22-30.

A waveguide impedance meter has been developed, comprising some specially designed components and some components previously designed for other applications. When this circuit is used in conjunction with the X-band rapid sweep oscillator and suitable display and control circuits, the impedance focus of a waveguide component is automatically and rapidly measured and oscillographically displayed in the reflection coefficient plane. A waveguide component having a 1¼-inch X 5/8-inch (large X-band) waveguide input port can be continuously measured throughout the frequency range extending from 8.5 to 9.6 kmc (12 per cent X-band). The bandwidth of the system is limited by the design bandwidth of the waveguide components. The plane of the impedance measurement may be referred to a plane internal to or external to the input port of the component under test. An expanded portion of the reflection coefficient plane may be displayed on the crt when small reflections are measured. The measurements of several representative impedances by the waveguide circuit were compared with slotted line measurements of these same components. For measurements of large reflections, standard /spl infin/ db swr full scale display, the maximum observed errors of the magnitude and phase of the reflection coefficient as measured by the waveguide circuit were 10 per cent and 5 degrees respectively. These maximum errors occurred for measurements performed at the ends of the 12 per cent frequency band. The average errors of the magnitude and phase of the reflection coefficient were 2.5 per cent and 2 degrees respectively. For measurements of small reflections, with the crt display of the reflection coefficient plane expanded to 6 db swr full scale, the maximum observed deviation of the waveguide circuit measurements from slotted line measurements was 0.5 db swr, and the average deviation was 0.2 db swr. The maximum errors again occurred at the ends of the 12 per cent frequency band.

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Abstracts

A Method of Measuring Dissipative Four-Poles Based on a Modified Wheeler Network

H.M. Altschuler. "A Method of Measuring Dissipative Four-Poles Based on a Modified Wheeler Network." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 30-36.

A method of abstracting the parameters of dissipative four-poles from measured data is presented here. This semi-precision method is applicable to symmetric four-poles and results directly in a conveniently symmetric network representation. It is based on the modified Wheeler representation, a new and completely general network, which is introduced in this paper. In addition to the derivation of the network and of the analysis, the relationship that the network bears to its dual, to the impedance Tee, and to the admittance Ri is presented.



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Notes on a Crystal Mixer Performance

W.L. Pritchard. "Notes on a Crystal Mixer Performance." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 37-39.

A simple relation between optimum rf source impedance for minimum noise figure and the nominal conversion loss of a mixer is derived. This impedance is related to the input mismatch and its dependence on the type of IF amplifier input circuit is discussed. Relations between the crystal noise temperature and mixer noise temperature as a function of conversion loss are derived for different load conditions at the image frequency terminals.



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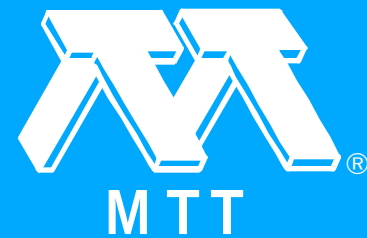


Abstracts

Intrinsic Insertion Loss of a Mismatched Microwave Network

K. Tomiyasu. "Intrinsic Insertion Loss of a Mismatched Microwave Network." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 40-45.

A brief review is presented of the absolute minimum loss of a two-port, mismatched lossy microwave network. This minimum loss, called the "intrinsic insertion loss" can be attained by adding suitable susceptances at the ports that will yield simultaneous bilateral network match. A measurement procedure is described and convenient graphs are presented.



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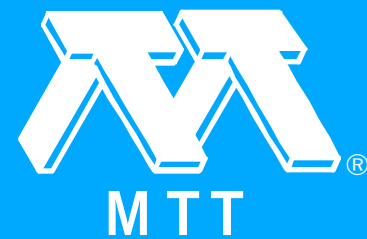


Abstracts

Klystron Noise (Correspondence)

P.D. Strum. "Klystron Noise (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 45-45.

In my paper "Crystal Checker for Balanced Mixers" I gave data on the excess noise of typical klystrons. Since that paper was prepared, further data has been obtained that permits an expansion of Fig. 6.



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A Practical Method of Locating Waveguide Discontinuities (Correspondence)

O.T. Neau. "A Practical Method of Locating Waveguide Discontinuities (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 45-46.

In the maintenance of ultra-high frequency equipments utilizing waveguide, one of the more difficult troubles to diagnose and correct is that of the high standing wave ratio. The question always arises as to whether the antenna or the waveguide is at fault. Sometimes a visual inspection of the transmission system will disclose the difficulty. Too often, however, the physical layout of the system makes a close inspection impractical. The construction of many antennas, also, does not permit an examination of the radio frequency components without a complex mechanical disassembly, costly in terms of man-hours.

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Contributors (Jan. 1955 [T-MTT])

H.M. Altschuler, H.L. Bachman, P.A. Crandell, H.N. Dawirs, M. Riekienbach, W.L. Pritchard, K. Tomiyasu and R.E. Wall, Jr.. "Contributors (Jan. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.1 (Jan. 1955 [T-MTT]): 178-182.



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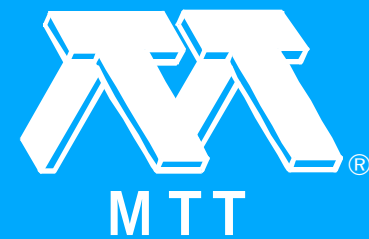
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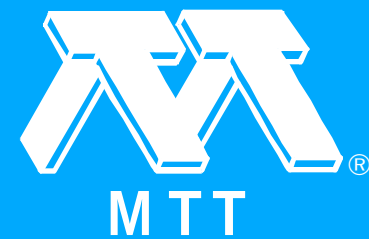
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"Front Cover (Mar. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): f1-f2.



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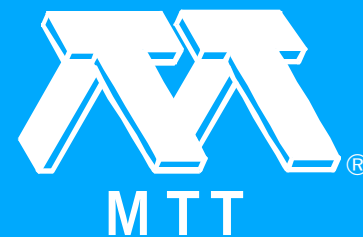


Abstracts

Foreword (Mar. 1955 [T-MTT])

"Foreword (Mar. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): i-i.

The interest and activity in Microwave Strip Circuits (Stripline, Microstrip, Triplate, Microwave Printed Circuits, etc.) has increased immensely since World War II. As a result, microwave strip circuits are being utilized in transmission line and antenna problems which were considered almost impossible of solution. This increased activity has also had the effect of introducing many more people into the field and so has increased the need for disclosing and disseminating information on MSC techniques.



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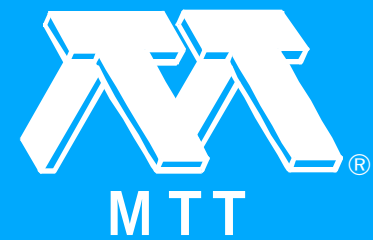
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Table of Contents (Mar. 1955 [T-MTT])

"Table of Contents (Mar. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): ii-ii.



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Abstracts

Microwave Printed Circuits - A Historical Survey

R.M. Barrett. "Microwave Printed Circuits - A Historical Survey." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 1-9.

The microwave printed circuit, as described in this paper, is an extension of the well-known technique which is of such importance in the lower frequency regions, where lumped element circuits are practical. This new circuit possesses all of the virtues of other printed circuits, such as light weight, cheapness, ease of manufacture, miniaturization, etc., along with the ability to be used at frequencies as high as 10,000 mc. The basis of the new technique is the planar or "flat strip" coaxial transmission system which was developed during World War II but which has remained unpublished and relatively unknown in the postwar period; and for which an adequate theoretical analysis had not been available.



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Abstracts

Microwave Strip Circuit Research at Tufts College

A.D. Frost and C.R. Mingins. "Microwave Strip Circuit Research at Tufts College." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 10-12.

Research into some of the basic aspects of the electrical and mechanical characteristics of microwave strip line components was initiated at the Research Laboratory of Physical Electronics at Tufts College in November 1952, under the sponsorship of the Antenna Laboratory of the Electronics Research Directorate, Air Force Cambridge Research Center. The work was planned at that time as a continuation and development of the original investigations carried out by Mr. Robert M. Barrett of the Antenna Laboratory.



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Abstracts

Characteristics and Some Applications of Stripline Components

W.E. Fromm. "Characteristics and Some Applications of Stripline Components." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 13-20.

Basic characteristics of Stripline in various frequency bands from 1000 to 16,000 mc are summarized. Various components such as transitions to coaxial line, attenuators, hybrid rings, directional couplers, and filters are shown. Some applications of these components in practical high performance microwave circuits and equipment in the frequency range of 2500-10,000 mc are also described.



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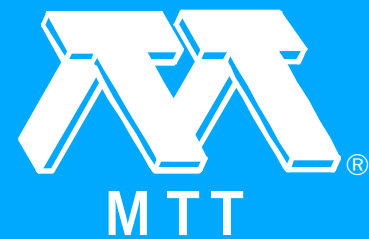
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Photoetched Microwave Transmission Lines

N.R. Wild. "Photoetched Microwave Transmission Lines." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 21-30.

Microwave transmission line and components of unusual light weight and compact construction can be made employing photoetching techniques to produce strip type transmission line. This report will be a general description of work done at Sanders Associates, Inc., to develop techniques for the design and manufacture of photoetched microwave transmission lines. Discussion will include measurements of attenuation and radiation leakage on parallel plate strip lines, as well as shielded type Tri-plate lines, the problem of mode purity and its relation to electrical parameters, various schemes of making transitions from standard waveguide to photoetched strip line. The basic design and performance of various components, as well as items of test equipment, such as slotted lines, matched loads, fixed attenuators, variable attenuators, directional couplers, crystal holders, phase shifters, hybrid rings, coax to Tri-plate transistors, etc., will also be treated. In addition, data will be presented showing impedance and susceptance values of simple discontinuities and impedance matching transformers. A simple technique for constructing gyrators and resonators will be presented, and the design and fabrication of an S-band signal generator employing photoetched microwave Tri-plate line will be shown, illustrating that practical microwave systems can be constructed far more economically than would be possible utilizing conventional waveguide techniques.

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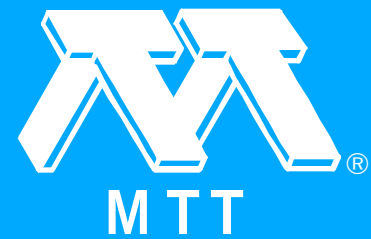


Abstracts

Characteristics and Applications of Microstrip for Microwave Wiring

M. Arditi. "Characteristics and Applications of Microstrip for Microwave Wiring." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 31-56.

Microstrip has been developed as a substitute for waveguides or coaxial lines, especially for the development of microwave components and Microwave circuitry.



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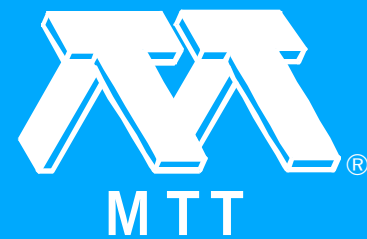


Abstracts

Miniature Strip Transmission Line for Microwave Applications

E.N. Torgow and J.W.E. Griemsmann. "Miniature Strip Transmission Line for Microwave Applications." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 57-64.

The construction of a strip line whose physical size is kept as small as possible consistent with reasonable electrical performance is presented. This line is fabricated by relatively simple techniques and can be shaped to fit line components into relatively confined spaces. The line has good power handling capacity and moderately low attenuation. Various components have been developed in this line including a broadband 3/8" coaxial line to strip line adapter, a broadband matched load, attenuators, and high and low pass filters.



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Strip Type Components for 2000 Megacycle Receiver Head-End

K.E. Zublin. "Strip Type Components for 2000 Megacycle Receiver Head-End." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 65-74.

Recent experimental work has evolved some components using air-spaced strip type transmission line that have been used successfully in connection with a variable attenuator, cavity and crystal mixer. Bandwidth, VSWR, and NF measurements are comparable with a commercial receiver head-end presently in use. The asymmetric air-spaced strip-above-ground transmission line used results in a simple configuration for coupling the line to the cavity. It also facilitates the application of a variable attenuator using a ferrite slab of high attenuation per unit length and having good VSWR properties.

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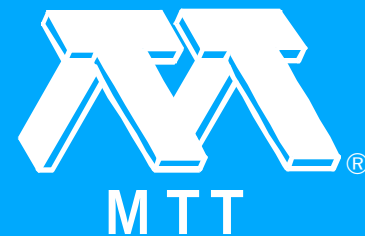


Abstracts

Properties of Dielectric Image Lines

D.D. King. "Properties of Dielectric Image Lines." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 75-81.

The properties of a dielectric rod on an image surface are reviewed, and experimental results on straight sections, various bends, and a twist are presented. Techniques for measuring insertion parameters and field distributions are described.



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Abstracts

Practical Dielectric Filled Waveguide

T.N. Anderson. "Practical Dielectric Filled Waveguide." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 82-86.

This paper describes the development of a laminated teflon-filled dielectric waveguide using techniques similar to what has been done in the flexible coaxial line. It describes the development of dielectric waveguide giving the theoretical design of the teflon-filled dielectric waveguide from both a mechanical and electrical point of view.



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Measurements of Attenuation and Phase Velocity of Various Laminate Materials at L-Band

H.W. Cooper and M.E. Ringenbach. "Measurements of Attenuation and Phase Velocity of Various Laminate Materials at L-Band." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 87-92.

Measured data are plotted for the characteristic impedance, velocity of propagation, and attenuation of dielectric sheet supported strip transmission lines for four dielectric materials: teflon bonded glass cloth, epoxy bonded glass cloth, polyester bonded glass mat, and XXXP paper base phenolic. At 1000 megacycles the teflon material is excellent and the epoxy and polyester materials satisfactory for low Q applications, such as microwave transmission lines.

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



Abstracts

Rigorous Determination of the Parameters of Microstrip Transmission Lines

K.G. Black and T.J. Higgins. "Rigorous Determination of the Parameters of Microstrip Transmission Lines." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 93-113.

Statement of Problem--The purpose of this paper is to determine explicit expressions enabling calculation of the performance of the recently-introduced open-strip UHF transmission line, now rapidly coming into extensive use.



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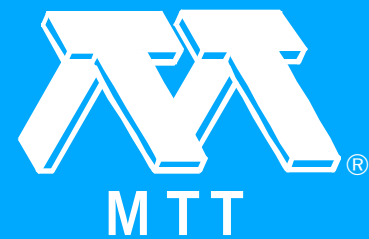
The Mutual and Input Impedance of Strips Between Parallel Planes

W.H. Hayt, Jr.. "The Mutual and Input Impedance of Strips Between Parallel Planes." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 114-118.

The input impedance of a thick dipole antenna between parallel planes, or the mutual impedance between two such elements, each carrying an assumed sinusoidal current distribution, is obtained by first considering filamentary dipoles. The longitudinal or tangential field intensity about a single dipole of length L between parallel planes, as indicated in Fig. 1, is therefore obtained by considering the infinite series of images in the two planes, from which the longitudinal field is simply written as an infinite summation of the fields due to the individual dipole elements. This series converges too slowly to be of any practical use, however, and a transformation of series must be applied, which results in the infinite series of exponential terms with imaginary arguments becoming a series of modified Bessel functions of zero order of the second kind. The final expression is given as Eq. (1) below and converges rapidly in most cases.

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Problems in Strip Transmission Lines

S.B. Cohn. "Problems in Strip Transmission Lines." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 119-126.

A review is given of characteristic-impedance formulas for shielded-strip transmission lines. From these formulas a set of approximate relationships for the attenuation and Q of a dielectric-filled shielded-strip transmission line is derived. The method makes the standard assumption that the current distribution is that of a lossless line and the surface resistivity that of an infinite-plane conductor. Although this method applies accurately to most other types of lines, in this case an error of the order of 10% is believed to occur due to the failure of the assumptions at the corners of the strip. However, the error is in a direction that makes the computed values conservative, and the accuracy should be sufficient for most practical purposes. The derivation of a correction term is now being attempted. In addition to the discussion of attenuation attention is given in this paper to the design considerations involved in a shielded-strip-line impedance meter, and to some preliminary data obtained with this device. Also the future topics for investigation under this research and development program are mentioned.

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Capacity and Characteristic Impedance of Strip Transmission Lines with Rectangular Inner Conductors

N.A. Begovich. "Capacity and Characteristic Impedance of Strip Transmission Lines with Rectangular Inner Conductors." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 127-133.

An example of the rigorous solution of a complex region boundary value problem is presented. The particular problem, the electrostatic capacity and characteristic impedance of a strip transmission line, is solved exactly and numerical results are given for a particular geometrical configuration.

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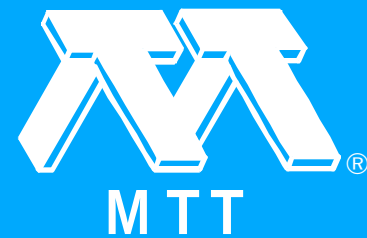


Abstracts

Equivalent Circuits for Discontinuities in Balanced Strip Transmission Line

A.A. Oliner. "Equivalent Circuits for Discontinuities in Balanced Strip Transmission Line." 1955 *Transactions on Microwave Theory and Techniques* 3.2 (Mar. 1955 [T-MTT]): 134-143.

Theoretical formulas are derived for the equivalent circuit parameters of a variety of discontinuities in balanced strip transmission line. These formulas are simple in form and are obtained by employing a small aperture procedure or a Babinet equivalence procedure in conjunction with an approximate model of the line. The results for a number of discontinuities are presented and comparison is made with the available measured data.



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A Universal Approximate Formula for Characteristic Impedance of Strip Transmission Lines with Rectangular Inner Conductors

R.L. Pease and C.R. Mingins. "A Universal Approximate Formula for Characteristic Impedance of Strip Transmission Lines with Rectangular Inner Conductors." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 144-148.

An explicit expression is developed for the characteristic impedance of a microwave strip transmission line with rectangular inner conductor of arbitrary dimensions. The expression is exact for zero thickness and arbitrary width, exact for zero width and arbitrary thickness, and quite accurate (within 3% for the extreme cases of a square inner conductor of dimensions about 0.01 of plate separation, but in most cases of practical interest within 0.1%) throughout the entire range of thickness and width.



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Abstracts

Stripline Radiators

E.G. Fubini. "Stripline Radiators." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 149-156.

Progress on the use of strip conductors as microwave antennas indicates that the technique is flexible and economical. Broadside curtains can be fabricated with sufficient accuracy. Several types of balanced Stripline feed have been considered, and twists have been successfully built. A variety of baluns have been evaluated and used to feed colinear Franklin arrays through binary splits. Whereas in these structures the design is such as to minimize the field within the supporting dielectric, we have deliberately directed the field into the dielectric in various applications of surface waves. By etching configurations on the foil face of the dielectric, the surface index of refraction or surface reactance is controlled.



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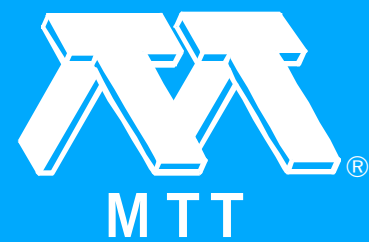
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Slot Array Employing Photoetched Tri-Plate Transmission Lines

D.J. Sommers. "Slot Array Employing Photoetched Tri-Plate Transmission Lines." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 157-162.

Microwave printed circuit techniques are readily adapted to the construction of compact antennas ideal for flush mounting on high speed aircraft. This paper describes the development of a two-dimensional X-band array consisting of 16 slots fed by photoetched Tri-plate transmission line. The design of a unity coupled series slot and the resulting mode purity problems are discussed. Several power divider configurations are illustrated and data (on the performance of some of these devices is presented. The construction of a 4 slot E-plane, a 4 slot H-plane and the combination 4x4 E-, H-plane array utilizing these power dividers is shown. Radiation patterns of each of these arrays were measured and a comparison of the individual and combination array patterns is made.

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Bandpass Filters Using Strip Line Techniques

E.H. Bradley and D.R.J. White. "Bandpass Filters Using Strip Line Techniques." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 163-169.

Strip lines provide a convenient transmission medium for the realization of microwave filters. Since bandpass filters designed in waveguide and coaxial lines would be large at ultra-high frequencies, strip lines afford a practical means of realizing filters which are simply fabricated, are readily reproduced, and, in most cases, represent an appreciable savings in size and weight. Of the different types of strip transmission lines currently in use, the so-called "sandwich" structure has been employed at Melpar for two reasons: (1) very broad-band coax-to-strip-line transitions are easily realized; and (2) the electromagnetic field is essentially confined between the two ground planes, thus reducing problems in packaging.

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





Resonator and Preselector in Balanced Strip Line

M. Michelson and J.F. Moore. "Resonator and Preselector in Balanced Strip Line." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 170-174.

One of Raytheon's commercial applications involves microwave circuitry in balanced strip line, with a 3/8" spacing between ground planes. Though the less critical parts of the unit are etched in copper-clad Teflon-Fibreglas, two of the components are of higher Q than can reliably be obtained in the presence of plastic. They are: 1. a resonator, for use as a frequency stabilizing reference element in an AFC circuit; and 2. a four-stage maximally flat preselector filter. These units are made of separate strips of metal, and do not depend on the plastic sheet for their support.

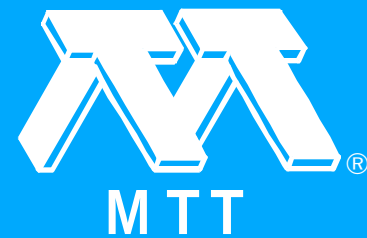


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A Broadband Microstrip Crystal Mixer with Integral DC Return

E. Carlson. "A Broadband Microstrip Crystal Mixer with Integral DC Return." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 175-177.

The recent introduction of practical oscillators, such as carcinotrons and backward wave traveling wave tubes, has resulted in a need for broadband mixers. The combination of the broadband mixer and local oscillator results in the realization of a microwave receiver, capable of covering a two to one frequency range. Tuning can be accomplished in microseconds by changing the voltage applied to one of the electrodes of the oscillator. This broadband mixer and local oscillator combination has a number of practical uses in novel airborne electronic systems, remote tuning receivers, spectrum analyzers, and automatic antenna pattern receivers.



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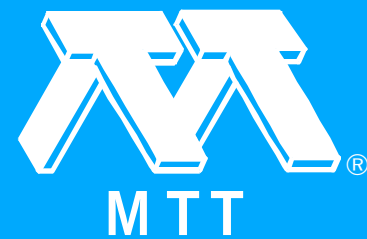
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Contributors (Mar. 1955 [T-MTT])

T.N. Anderson, M. Arditì, R.M. Barrett, N.A. Begovich, K.G. Black, E.H. Bradley, E.C. Carlson, S.B. Cohn, H.W. Cooper, W.E. Fromm, A.D. Frost, E.G. Fubini, J.W.E. Griemsmann, W.H. Hayt, Jr., T.J. Higgins, D.D. King, M. Michelson, C.R. Mingins, J.F. Moore, A.A. Oliner, R.L. Pease, M. Ringenbach, D.J. Sommers, E.N. Torgow, D.R. White, N.R. Wild and K.E. Zublin. "Contributors (Mar. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.2 (Mar. 1955 [T-MTT]): 178-182.



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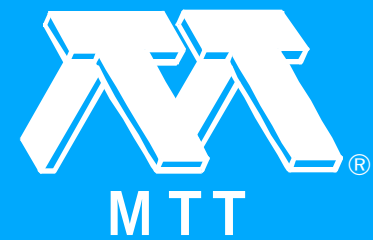
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Message from the Editor (Apr. 1955 [T-MTT])

T.S. Saad. "Message from the Editor (Apr. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 1-1.

This issue represents our second regular Transaction using the new for-mat and printing. Comments to date on the January issue have been very favorable. We proudly present as our distinguished Microwave personality of this issue, W. W. Mumford. Mr. Mumford, in addition to being a well-known figure in the field, is one of the most active members of the Professional Group on Microwave Theory and Techniques and has been National Chairman of the Group for the past year. Two other special articles have been included in this month's publication. Both of them are invited papers. The first paper, by D. D. King, is the annual summary of work in the Microwave field entitled "Advances in Microwave Theory and Techniques." The other paper is a tutorial paper by E. W. Matthews, Jr., on "The Use of Scattering Matrices in Microwave Circuits."



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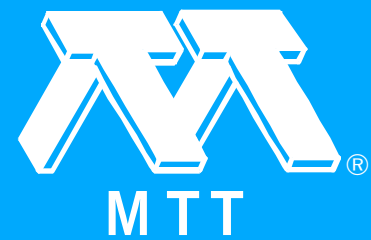


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Biography - William Walden Mumford

"Biography - William Walden Mumford." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 2-2.

Born at Vancouver, Washington, on June 17, 1905. Mr. Mumford majored in physics and mathematics at Willamette University, Salem, Oregon, receiving the A.B. degree in 1930. He at once joined the Technical Staff of the Bell Telephone Laboratories with the Radio Research Department at Holmdel, N. J. He has worked on ultra short-wave propagation and microwave components for radio relay systems and radars. Mr. Mumford's contributions in the microwave field include the directional coupler, wideband coaxial to waveguide transducers, helix to waveguide transitions as used in the traveling-wave tube and the gas-discharge noise generator. These are covered in fifteen published papers and nine patents.



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Keep Abreast of the Microwave Art

W.W. Mumford. "Keep Abreast of the Microwave Art." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 3-3.

Microwaves are playing an ever-increasing role in the communications field. Over 30,000 route miles are already being used in the United States by communication companies, industrial and transportation concerns and the military agencies. Bell System microwave facilities alone provide more than 6,500,000 miles of telephone circuits and 48,000 miles of television channels. Thousands of miles of additional microwave facilities are either under construction or in the planning state. In addition to voice and television transmission, microwave systems are being used for services such as teletype, telemetering and remote control. The military agencies are installing an increasing amount of microwave equipment for national defense. With such expansion in the uses of microwave, those of us who are responsible for the design and installation of these systems must keep abreast of the art, in order that new systems may contain the latest advances, resulting in improved quality, greater dependability and lower cost.

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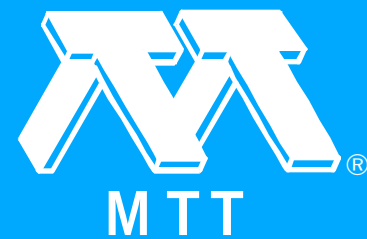


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Report of Advances in Microwave Theory and Techniques-1954

D.D. King. "Report of Advances in Microwave Theory and Techniques-1954." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 4-7.

The field of interest indicated by the title includes the transmission, control, measurement, and generation of microwaves. We shall consider transmission only in the form of guided waves, leaving antenna and propagation problems as a subject deserving of a review in its own right. Similarly, we shall take note of the circuit aspects of microwave amplifiers and generators. Space charge, focusing, and noise problems associated with microwave oscillators are probably best considered separately, since they often require very different theoretical approaches and experimental techniques. With these boundaries to our review established, we must proceed to subdivide the area of interest for detailed discussion. We follow here a somewhat arbitrary set of headings which aim to clarify and codify the material without duplication.



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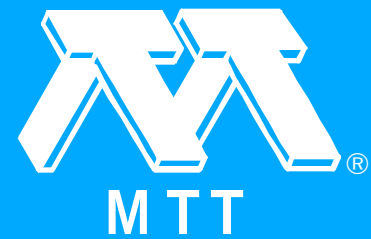


Abstracts

Planar Transmission Lines

D. Park. "Planar Transmission Lines." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 8-12.

This paper derives formulas for the transmission properties--characteristic impedance and attenuation--in the principal mode of a transmission line consisting of one or two long strips of metal foil embedded in a dielectric material between two long metal strips considerably wider than the central ones. The width and spacing of the central strips is arbitrary, and it is also necessary to take account of their thickness in computing the attenuation. A graphical method is given for evaluating the characteristic impedance in general, and analytic approximations are given for a number of special cases. Finally the question of the leakage of power from between the outer strips is considered briefly.



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Measurement of Time-Quadrature Components of Microwave Signals

J.H. Richmond. "Measurement of Time-Quadrature Components of Microwave Signals." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 13-15.

A phase-sensitive coherent detector used for microwave laboratory measurements is described. The receiver measures the real ($|E| \cos \alpha$) and imaginary ($|E| \sin \alpha$) components of a signal E with equipment which is less elaborate than that required for measuring the amplitude $|E|$ and phase α . Furthermore, many calculations are more convenient if E is presented in rectangular rather than polar form. Measurements made with the receiver on known fields in waveguides are included to demonstrate its accuracy. The receiver has a sensitivity of -125 dbw at 9,375 mc.

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Optimum Design of Stepped Transmission-Line Transformers

S.B. Cohn. "Optimum Design of Stepped Transmission-Line Transformers." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 16-20.

This paper describes the optimum stepped-transmission-line transformer structure for matching two unequal characteristic impedances. For any specified bandwidth, the steps are designed to yield a Tchebycheff-type (or equal-ripple) reflection-coefficient response. Over this band, the maximum vswr is less than that obtainable with any other stepped-transformer having the same number of steps. Design method and technique for eliminating discontinuity-capacitance effects are given. The measured results for a coaxial and a waveguide model are presented and found to verify the method.

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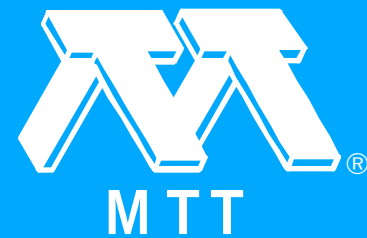


Abstracts

The Use of Scattering Matrices in Microwave Circuits

E.W. Matthews, Jr.. "The Use of Scattering Matrices in Microwave Circuits." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 21-26.

Difficulties arising from the use of the impedance concept in microwave circuitry have led to the introduction of the scattering representation for work at these frequencies. This paper presents a development of the scattering approach in terms of fundamental transmission-line phenomena. The physical meaning of the quantities involved is brought out wherever possible and the relationships among the various elements of the scattering matrix are given. Several examples of the application of scattering techniques to analysis of the properties of microwave junctions are presented, and methods for measuring scattering parameters of such junctions are outlined.



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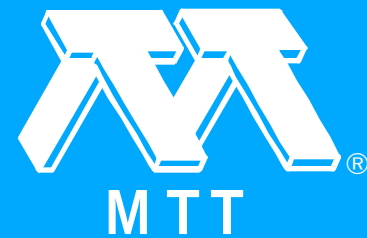


Abstracts

Some Applications and Characteristics of Ferrite at Wavelengths of 0.87 Cm and 1.9 Cms

C. Stewart. "Some Applications and Characteristics of Ferrite at Wavelengths of 0.87 Cm and 1.9 Cms." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 27-31.

This paper describes the use of ferrites in waveguide to produce Faraday rotations at 0.87 cm and 1.9 cms wavelengths. The Dicke radiometric receiver is briefly reviewed and its improvement by the use of ferrite waveguide components is described. Experimental equipment for securing data on the behavior of ferrites is discussed. Details are given for the construction of a unidirectional waveguide transmission line for 0.87 cm wavelength.



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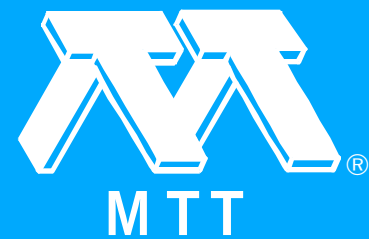
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Probes for Microwave Near-Field Measurements

J.H. Richmond and T.E. Tice. "Probes for Microwave Near-Field Measurements." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 32-34.

To be satisfactory for microwave near-field measurements, a probe must have desirable polarization characteristics, must have an aperture small enough to indicate the field at a point, must deliver sufficient signal voltage to permit accurate measurement, and yet must not seriously distort the fields. The design of a probe may be simplified if the fields to be measured are known to be almost linearly polarized or to consist only of a traveling wave. Comparison of measurements made with various probes has led to the development of a small open-ended waveguide probe which is simple to construct and has given excellent results.

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



Abstracts

Measurement Techniques for Multimode Waveguides

A.C. Beck. "Measurement Techniques for Multimode Waveguides." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 35-41.

This paper surveys some of the techniques that have been worked out for multimode waveguide measurements. Equipment has been developed for measuring one mode at a time by taking advantage of the differences between the modes. Illustrations of its use are given.



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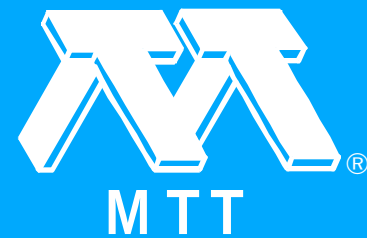


Abstracts

Reports of International Organizations (Correspondence)

L.G. Cumming and W.W. Mumford. "Reports of International Organizations (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 42-42.

In the interest of improving co-ordination of the activities of the IRE with those of in-ternational organizations (such as CCIR, URSI and IEC), the Office of the Technical Secretary will distribute from time to time lists of the material received from these organizations. We are enclosing the first set of such lists herewith.



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Bibliography on Directional Couplers (Addenda)

R.G. Medhurst and R.F. Schwartz. "Bibliography on Directional Couplers (Addenda)." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 42-43.



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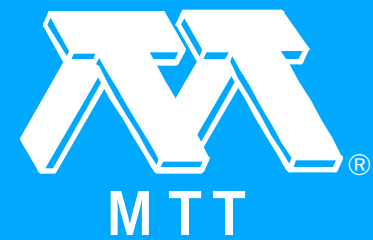
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Abstracts

Contributors (Apr. 1955 [T-MTT])

A.C. Beck, S.B. Cohn, D.D. King, E.W. Matthews, Jr., D. Park, J.H. Richmond, C. Stewart and T.E. Tice. "Contributors (Apr. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.3 (Apr. 1955 [T-MTT]): 44-44.



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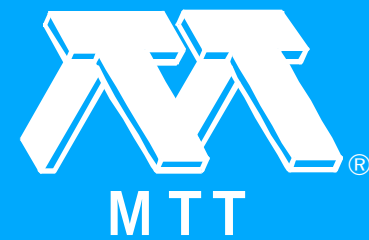
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"Front Cover and Table of Contents (Jul. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): f1-f2.



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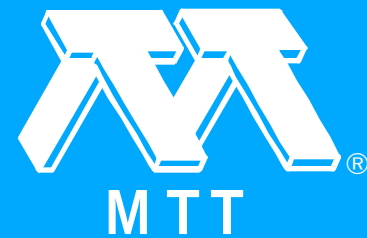


Abstracts

Message from the Editor (Jul. 1955 [T-MTT])

T.S. Saad. "Message from the Editor (Jul. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 1-1.

The omission from this issue of our distinguished microwave personality is regrettable. This feature has evoked much favorable comment and it is planned to continue it in all regular issues. The October issue will present Professor Ernst Weber of the Polytechnic Institute of Brooklyn.



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Double-Ridge Waveguide for Commercial Airlines Weather Radar Installation

T.N. Anderson. "Double-Ridge Waveguide for Commercial Airlines Weather Radar Installation." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 2-9.

This paper describes the design and development of a double-ridge waveguide designed to propagate both C-band and X-band (5,400 and 9,300 mc) so as to allow for a common waveguide installation in commercial airliners which could use either a C-band or an X-band weather penetration radar. This double-ridge waveguide is capable of propagating over the desired frequency range with single mode operation only; it yields attenuation at C-band which is only slightly higher than that of normal C-band waveguide and has somewhat reduced attenuation at X-band compared to standard $1 \times \frac{1}{2}$ rectangular waveguide. This double-ridge guide has been adopted by Aeronautical Radio, Inc. and is specified in their Characteristic No. 529 entitled "5.7 Cm Weather Penetration Airborne Radar." This paper also gives an analysis of the calculated guide wavelength in this double-ridge guide, attenuation, and peak power-handling capabilities; and compares the results of these calculations with measured data. Peak power-handling capability for this double-ridge guide is well within the requirements of this application. The testing procedures used for high-power breakdown measurements are described. This paper also covers the development of double-ridge waveguide flanges, elbows, bends, twists, transitions, and flexible waveguide for use over this extremely broad band.

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Simplified Calculation of Antenna Patterns, with Application to Radome Problems

J.H. Richmond. "Simplified Calculation of Antenna Patterns, with Application to Radome Problems." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 9-12.

Generally, the calculation of antenna far-field patterns from known near-field distributions is tedious and may require the use of a large computer. The calculations are simplified for certain types of antennas having separable near fields. This simplifying assumption is found to yield satisfactory results with pyramidal horns and parabolic reflector antennas. Calculations are further simplified by approximating a complex line integral with two real summations. Measured and calculated far-field patterns are included to indicate the accuracy of the calculations. Results are presented for horns and parabolic antennas and for a horn covered with a hollow dielectric wedge. The method is applicable to both E-plane and H-plane pattern calculations. The main lobe of a far-field pattern is calculated in less than one hour on a desk calculating machine by the simplified method. In radome work an important feature is that it permits rapid evaluation of the far-field distortion associated with any given near-field distortion in any given small region in the near field.

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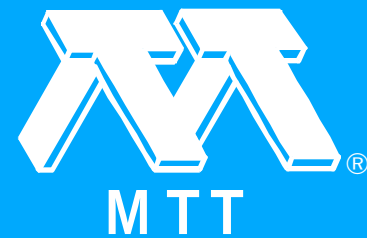


Abstracts

A Modulated Scattering Technique for Measurement of Field Distributions

J.H. Richmond. "A Modulated Scattering Technique for Measurement of Field Distributions." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 13-15.

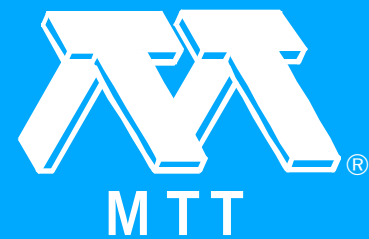
Electric field distributions can be measured accurately by passing a short metal dipole through the field and recording the wave scattered by the dipole. Ordinarily the method is difficult to use since the scattered signal is small, critical tuning adjustments are required, and careful attention to stability is necessary. However, by placing a nonlinear impedance at the center of the dipole and applying an audio voltage through slightly conducting threads, the scattered wave can be modulated. This makes it possible to relax the tuning and stability requirements and at the same time to increase the sensitivity of the measurements.



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Potential Solution of a Homogeneous Strip-Line of Finite Width

W.H. Hayt, Jr.. "Potential Solution of a Homogeneous Strip-Line of Finite Width." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 16-18.

The exact potential solution for a zero-thickness strip centered between two ground planes of finite width is outlined. For unit separation of the ground planes, the solution is applied to obtain curves of capacitance per unit length for several representative ground plane widths as a function of strip width. The results are valid for all strip widths, including the case in which the strip is wider than the ground planes. The validity of assuming infinite ground plane width is investigated and it is found that such an assumption leads to little error providing the ratio of ground plane width to separation is at least 2.5, and also providing the difference between ground plane and strip width is at least one-half of the ground plane separation.

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Resonant Frequencies of Higher-Order Modes in Radial Resonators

D.C. Stinson. "Resonant Frequencies of Higher-Order Modes in Radial Resonators." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 18-23.

A summary of the relevant work on radial line discontinuities and radial line resonators is presented. A step-type discontinuity is analyzed using an integral equation formulation and the results are applied to the calculation of the resonant frequencies of a radial resonator. This method is verified by experiment and compared with the foreshortened-line approximation and with the methods of Marcuvitz and Goddard, whose work is satisfactory for the order TM mode. However, the present method is the only one which is equally applicable to the calculation of the resonant frequencies of TM modes possessing higher-order radial variations.

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Abstracts

A Shunt Technique for Microwave Measurements

H.M. Altschuler and A.A. Oliner. "A Shunt Technique for Microwave Measurements." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 24-30.

A new method of measuring low-loss quantities at microwave frequencies, which employs a lossy shunt structure, is described. The additional loss introduced thereby reduces the excessively high VSWR's to values lying in the measurable range. The relevant information is abstracted from the data in a precision manner independent of the parameters of the shunt structure itself. Applications are made to the measurement of low-loss dielectric constants, structures with shunt representations such as certain bolometer elements, attenuation constants, and VSWR's of slightly lossy variable short circuits. Physical realizations of such shunt structures are discussed.



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A Rotary Joint for Two Microwave Transmission Channels of the Same Frequency Band

H.P. Raabe. "A Rotary Joint for Two Microwave Transmission Channels of the Same Frequency Band." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 30-41.

This paper describes a rotary joint for two microwave transmission channels of the same frequency band. It consists of two pairs of rectangular waveguide terminals, a circular waveguide which transmits both channels, and coupling elements between the rectangular waveguide terminals and the circular waveguide which convert the rectangular H_{10} mode into the circular H_{01} and E_{01} modes. If pure H_{01} and E_{01} modes can be excited, perfect separation of the channels as well as constant amplitudes and phases can be obtained when the joint rotates. While the conversion into the circular E_{01} mode is performed by a conventional method, a new method had to be developed for the conversion of the rectangular H_{10} into the circular H_{01} mode.

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Transverse Electric Resonances in a Coaxial Line Containing Two Cylinders of Different Dielectric Constant

J.W. Carr. "Transverse Electric Resonances in a Coaxial Line Containing Two Cylinders of Different Dielectric Constant." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 41-44.

A coaxial line containing a medium of propagation consisting of two coaxial cylindrical cylinders of different dielectric constant is considered for the special case of TE/sub nm/ resonances, and numerical calculations are carried out for a few cases of the TE/sub 11/ type resonance. A reference paper called to the attention of the author by the reviewer treats the general condition of propagation in such a line. The numerical solutions to the cases of interest in this application were not performed, however, presumably since the interest was in propagating modes and since the general characteristic equation is quite complicated. It is shown here that consideration of transverse boundary conditions only leads to an equation which is much less complicated and which is equivalent to the reduction of the general characteristic equation (of the reference paper) when cutoff is approached.

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The Operation of Bolometers Under Pulsed Power Conditions

M. Sucher and H.J. Carlin. "The Operation of Bolometers Under Pulsed Power Conditions." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 45-52.

The dynamic behavior of Wollaston (thin platinum) wire bolometers under pulsed power conditions is examined and shown to be responsible for certain errors in the measurement of microwave power. These errors, in order of importance, arise from the nonlinearity of bridge null arm current as a function of bolometer resistance, from the nonlinear cooling of the bolometer in the interval between pulses, from the time variation of VSWR of the bolometer and from the time variation of bias power in the bolometer. The total error is found to be proportional to the bolometer resistance excursion during a pulse; the resistance excursion, in turn, is proportional to the pulse energy. All of these errors, with the exception of that due to nonlinear cooling, are amenable to calculation. The latter error was evaluated by subtracting the sum of the computed errors from the experimentally determined total error. The total error is about 14 to 15 per cent per 100 ohms resistance excursion for two widely used bolometer types under typical conditions. More than half of the above error may be eliminated by suitable design of the bridge circuitry.

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Abstracts

Proceedings or Transactions? (Correspondence)

J.R. Pierce. "Proceedings or Transactions? (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 52-53.

Questions frequently arise in Editorial Board discussions and among the reviewers of Proceedings papers as to what should be published in the Proceedings of the IRE and what should be published in the various Transactions. This statement will not settle the matter, but it does clarify the present situation and speculate about future possibilities.



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Impedance Matching (Correspondence)

N. Balabanian. "Impedance Matching (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 53-54.

Matching an impedance to a transmission line by the use of a cascaded section of line is a well-known process. However, the range of terminating impedance that can be matched by this method, I believe, is not so well-known. Consider a lossless line of characteristic impedance R_0 to which is to be matched an arbitrary impedance $Z = R + jX$ by means of another lossless line of length d and characteristic impedance R_1 cascaded between the first line and the load as shown schematically in Fig. 1. The problem is to determine for what range of values of Z a match can be thus obtained for any values of R_1 , and d .

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Abstracts

Contributors (Jul. 1955 [T-MTT])

H.M. Altschuler, T.N. Anderson, H.J. Carlin, J.W. Carr, W.H. Hayt, Jr., A.A. Oliner, H.P. Raabe, J.H. Richmond, D.C. Stinson and M. Sucher. "Contributors (Jul. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.4 (Jul. 1955 [T-MTT]): 54-54.



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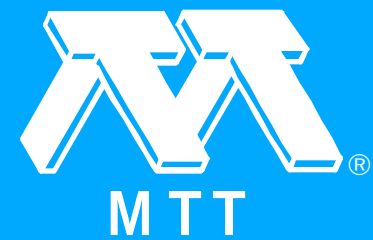
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"Front Cover and Table of Contents (Oct. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): f1-f2.



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Message from the Editor (Oct. 1955 [T-MTT])

T.S. Saad. "Message from the Editor (Oct. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 1-1.

This issue completes our first year using our new type and format. In the past year we have published four regular issues of the Transactions and the special issue on Microwave Strip Circuits. Our success is best measured by the quality and number of papers submitted for publication. The year's end marks a new policy. We will be able to prepare future manuscripts sufficiently far in advance to allow for mailing in the early part of the publication month. In the future, all papers accepted for publication must be sent to the editor complete with proper illustrations, photograph, and biography at least two months prior to the publication date.



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Biography - Ernst Weber

"Biography - Ernst Weber." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 2-2.

Dr. Weber was born in Vienna, Austria, on September 6, 1901, and received all his education there. He was graduated with the diploma of Electrical Engineer from the Technical University in Vienna in 1924, and joined the Austrian Siemens-Schuckert Company as research engineer. On the basis of several papers on field theory applied to machinery, he received the degree of Sc.D. from the Technical University in Vienna in 1927.

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Microwaves--Science and Art

E. Weber. "Microwaves--Science and Art." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 3-3.

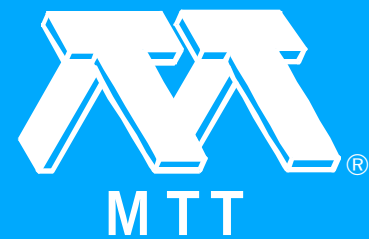
Engineering endeavor is generally recognized to be the utilization of man's knowledge with ingenuity for human welfare. Man's knowledge is science in all its branches; ingenuity, art, inventiveness, creative application. With the increased scope of scientific exploration and discovery, engineering at the advanced stages has naturally become "scientific engineering." Perhaps no field has experienced this development so strongly as "Microwave Theory and Techniques," as the area of our professional group is so aptly called.



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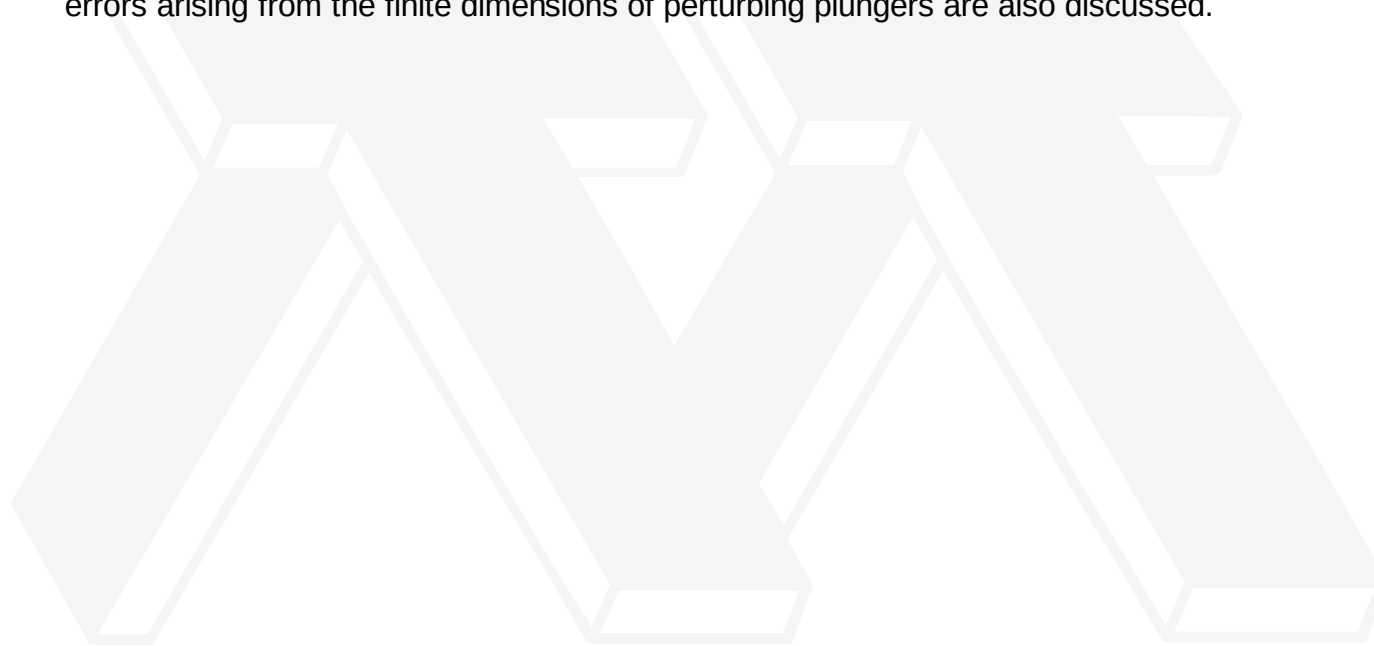
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Shunt Impedance of Klystron Cavities

E.L. Ginzton and E.J. Nalos. "Shunt Impedance of Klystron Cavities." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 4-7.

Values of R/Q_f or re-entrant resonators are given for configurations for which neither the coaxial-field nor the radial-field approximations are valid. The values are calculated by net point methods, and agree well with experimental values obtained by perturbation methods. Some errors arising from the finite dimensions of perturbing plungers are also discussed.



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Abstracts

Planar Transmission Lines--II

D. Park. "Planar Transmission Lines--II." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 7-11.

An expression is found for the characteristic impedance of a transmission line consisting of two parallel strips of foil placed between, and perpendicular to, two wide plates.



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A High-Speed Broadband Microwave Waveguide Switch

W.L. Teeter. "A High-Speed Broadband Microwave Waveguide Switch." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 11-14.

A switch which switches microwave energy to any of several separate waveguide loads is described. The switch has the bandwidth and power-carrying capability which is essentially that of the input and output waveguides. Data is given for a switch which operates over the frequency range of 8,600 to 10,000 mc with a vswr of less than 1.15 during transmission and less than 1.5 during switching. The switching speed is limited only by the practical limit for rotating the metal shorting vane. A typical example is given of a 5-output switch with a switching rate of 1,800 per second (vane rotation of 3,600 rpm) and a dead time during switching of 14 per cent of total time. Dead time is a function of switch diameter and vane rotation rate and could be reduced by increasing the vane diameter or rotation rate.

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Effect of Ellipticity on Dominant-Mode Axial Ratio in Nominally Circular Waveguides

P.I. Sandsmark. "Effect of Ellipticity on Dominant-Mode Axial Ratio in Nominally Circular Waveguides." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 15-20.

An investigation is made of the effect of ellipticity on the dominant-mode axial ratio (AR) in nominally circular waveguides. Equations for calculating the AR are derived for the case where the difference between the major and minor axes of the guide cross section is small and the waveguide is not too long. Values of AR obtained by calculations are compared with measured values, and a method for improving the AR performance of a waveguide run is demonstrated.

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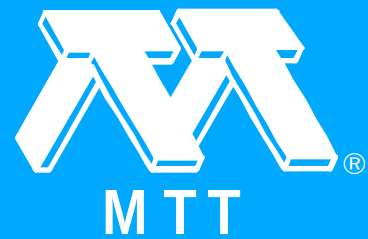


Abstracts

The Design of Ridged Waveguides

S. Hopfer. "The Design of Ridged Waveguides." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 20-29.

As far as we are aware, the only published design information on ridged guide transmission lines is found in a paper by S. B. Cohn and to some extent in the Waveguide Handbook. Recent applications, however, have indicated a need for additional and, in some cases, more accurate design information. The present paper is largely written with this in mind.



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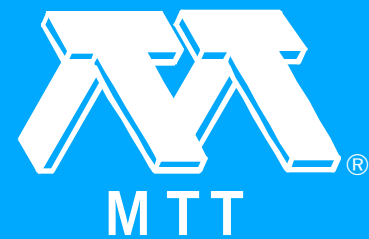
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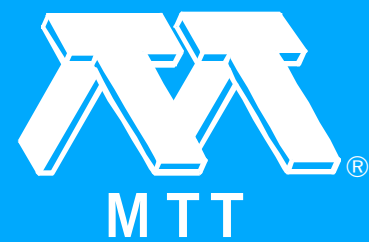
Shielded Coupled-Strip Transmission Line

S.B. Cohn. "Shielded Coupled-Strip Transmission Line." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 29-38.

An analysis is made of the odd and even TEM modes on a pair of parallel co-planar strips midway between ground planes. Rigorous formulas are presented for the case of zero-thickness strips, while approximate formulas are given for strips of finite thickness and for strips printed on opposite sides of a thin dielectric sheet supported in air between ground planes (AIL construction). The characteristic impedances and the phase velocities of the two modes are necessary and sufficient information for the design of directional couplers, coupled-line filters, and other components utilizing the coupling between parallel-strip lines. In order to facilitate design work, nomograms are included in the paper which give the dimensions of the coupled-strip cross section in terms of the odd- and even-mode characteristic impedances. The characteristic-impedance scales of these nomograms may be read to an accuracy of better than one per cent over a wide range of values that is sufficient for most purposes.

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High-Power Ferrite Load Isolators

A. Clavin. "High-Power Ferrite Load Isolators." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 38-43.

The principles of ferromagnetic resonance have been well described in literature. It is the purpose of this paper to point out the application of these principles to the design of practical microwave components, especially for high power. The various types of ferrite microwave circuits that can be used in the design of a load isolator are presented. The advantages and disadvantages of each of these circuits are discussed in regard to the electrical, mechanical, thermal, and magnetic field requirements. Experimental data are given for the optimum design of nonreciprocal ferrite absorbers for rectangular guide. Finally, practical design information for a power circulator in rectangular waveguide is presented which has been modified for use as a load isolator. This device has extremely high isolations (50 db) and low insertion loss (.5 db), and has maintained an isolation in excess of 30 db over a 25 per cent bandwidth with a permanent magnet field. Power handling ability of 250 kw peak with a .001 duty cycle is easily accomplished without external cooling. This isolator requires quite small magnetic fields for proper operations and hence packaged isolator is quite lightweight. Use of this power circulator for high-power modulators and duplexers is discussed.

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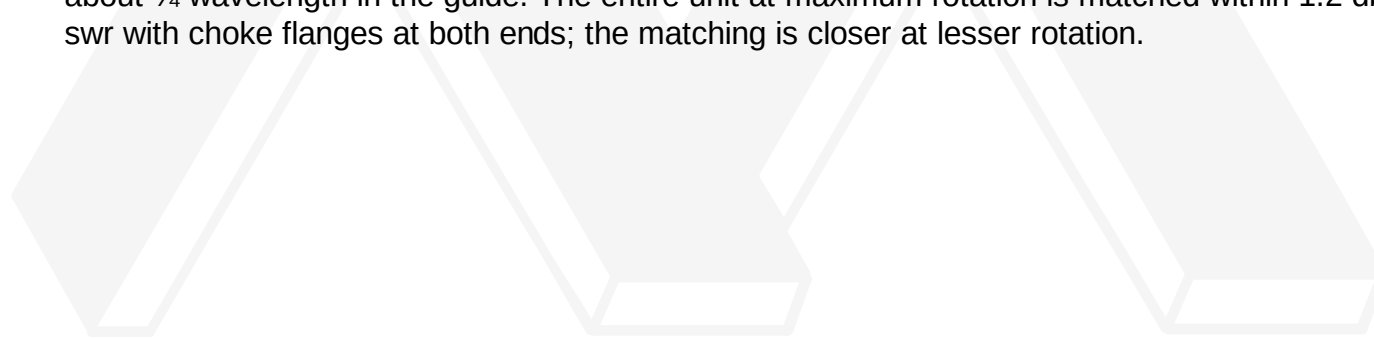
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Step-Twist Waveguide Components

H.A. Wheeler and H. Schwiebert. "Step-Twist Waveguide Components." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 44-52.

The step twist is a number of adjoining sections of straight rectangular waveguide, twisted about their common axis at their junction faces. The technique of designing the step twist resides in the proportioning of the section dimensions and the angles at the twist faces. The resulting design is much shorter than the usual twisted waveguide; it offers further advantages in ease of specifying shape and dimensions, and in their reproducibility in construction. A series of fixed 90-degree step twists has been designed for the rated 40 per cent frequency bandwidths in the standard waveguide sizes for 1 to 40 kmc. The total angle is divided equally among seven faces spaced about $1/8$ wavelength in the guide. Each step twist is matched within 0.3 db swr with plain flanges or 0.5 db swr with choke flanges at both ends. Rotary step twists for operation at all angles out to ± 90 degrees have been designed for the same bandwidths. The total angle is divided unequally among four faces (choke flanges) spaced about $1/4$ wavelength in the guide. The entire unit at maximum rotation is matched within 1.2 db swr with choke flanges at both ends; the matching is closer at lesser rotation.



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Abstracts

A Double-Ground-Plane Strip-Line System for Microwaves

B.A. Dahlman. "A Double-Ground-Plane Strip-Line System for Microwaves." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 52-57.

The double-ground-plane strip line consists of two parallel conducting planes with a conducting strip imbedded in a homogeneous dielectric between them. Transmission characteristics for this system are calculated, and design formula are given. Practical viewpoints on design and application of strip lines are discussed. System can be used as an inexpensive base for microwave circuits and is well adapted to laboratory experiments and mass production.



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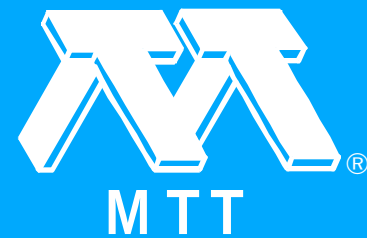


Abstracts

Transmission Characteristics of Sandwiches (Correspondence)

H.F. Mathis. "Transmission Characteristics of Sandwiches (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 57-58.

The radome design equations which are in common use are based on the transmission characteristics of sandwiches. Transmission line techniques provide a convenient method for determining these characteristics. The transmission line analogy of wave propagation has been discussed by Ramo and Whinnery. A restricted application of this analogy is given in a report by Snow. In this note, a more general application will be discussed.



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Measurement of Reflection Coefficients through a Lossless Network (Correspondence)

H.F. Mathis. "Measurement of Reflection Coefficients through a Lossless Network (Correspondence)." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 58-58.

Often it is not convenient to measure a reflection coefficient directly. In some such cases, the following procedure may be used. The arrangement of components shown in Fig. 1 will be considered. It will be assumed that lines Nos. 1 and 2 are lossless. These lines may be transmission lines, waveguides, or one of each.

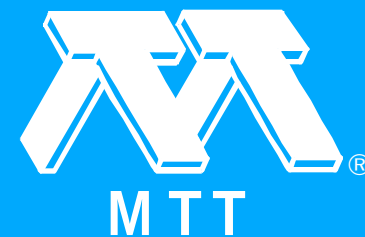
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Contributors (Oct. 1955 [T-MTT])

A. Clavin, S.B. Cohn, B.A. Dahlman, E.L. Ginzton, S. Hopfer, E.J. Nalos, D. Park, P.I. Sandsmark, H. Schwiebert, W.L. Teeter and H.A. Wheeler. "Contributors (Oct. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.5 (Oct. 1955 [T-MTT]): 58-59.



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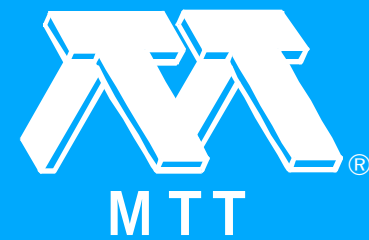
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"Front Cover and Table of Contents (Dec. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): f1-f2.



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Foreword (Dec. 1955 [T-MTT])

H. Engelmann. "Foreword (Dec. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 1-1.

To keep our membership abreast of the latest developments in the microwave art, this volume of Transactions is devoted exclusively to the publication of the PGM-TT-sponsored papers presented at the Annual 1955 URSI-IRE meeting held in Washington, D. C. The two sessions at which the papers were read were organized by the Group in cooperation with Commission 6 of URSI. The IRE Professional Group on Microwave Theory and Techniques wish to extend their thanks to Dr. E. C. Jordan, Chairman of Commission 6 of the U. S. A. National Committee of URSI and to Dr. W. E. Gordan, Secretary-Treasurer of the National Commission URSI, for their help and advice in the organization of these microwave sessions.



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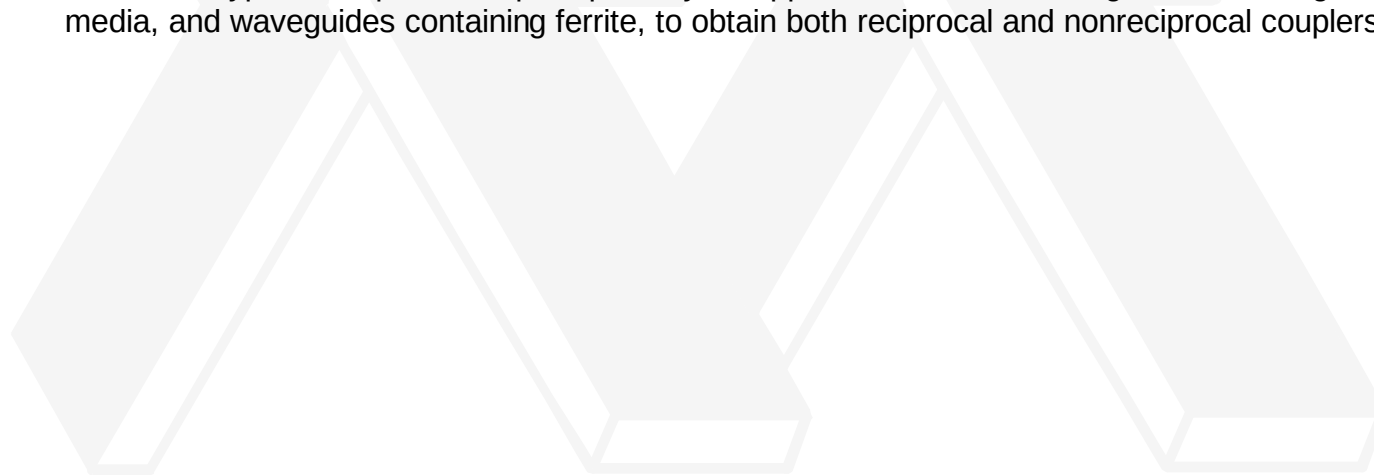
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Wave Coupling by Warped Normal Modes

A.G. Fox. "Wave Coupling by Warped Normal Modes." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 2-6.

It has been shown by J.S. Cook that wave power may be transferred from one to another of two coupled waveguides through a variation of their phase constants. It is now clear that this is but one example of a new principle of coupling which is here called "normal mode warping." Wave power inserted at one end of a coupled waveguide system may be made to appear at the other end with any desired power distribution by gradual warping of the normal mode field patterns along the coupler. In general, both variation of the coupling coefficient and phase constants are required. Much wider bands are theoretically possible than with any other distributed type of coupler. This principle may be applied to dielectric waveguides, birefringent media, and waveguides containing ferrite, to obtain both reciprocal and nonreciprocal couplers.



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Abstracts

Investigation of VHF Nonoptical Propagation between Sardinia and Minorca

J.M. Clara and A. Antinori. "Investigation of VHF Nonoptical Propagation between Sardinia and Minorca." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 7-12.

Announcements that VHF and UHF transmission had been found possible over distances considerably greater than classical diffraction theory had predicted, aroused considerable interest in Europe. It was felt that if such transmission proved to be reliable, there would be numerous cases where it could provide circuits more conveniently and, perhaps, more economically, than could conventional transmission systems.



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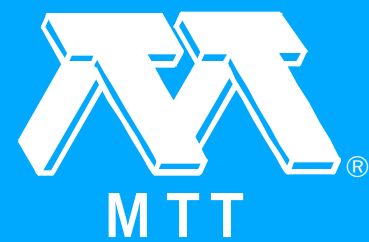
Data on the Temperature Dependence of X-Band Fluorescent Lamp Noise Sources

W.W. Mumford and R.L. Schafersman. "Data on the Temperature Dependence of X-Band Fluorescent Lamp Noise Sources." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 12-17.

This paper is concerned primarily with the performance of fluorescent lamps as microwave noise sources at 9,000 mc. In particular, it deals with the temperature dependence of the excess noise ratio of an 8-watt lamp running at a lamp current of 150 ma in a 10° E-plane holder. It was found that 1) the bulb temperature is much higher than that with a lamp current of 75 ma encountered in the 90° H-plane circuit investigated previously at 4,000 mc, hence the temperature coefficient of excess noise versus waveguide temperature obtained in the 4,000 mc circuit does not apply, 2) anomalous and unreproducible inversions in the temperature coefficient at these higher bulb temperatures have been observed, 3) these anomalies can be avoided by operating the bulb at lower temperatures, 40°C to 50°C, where the lamps appear to be just as uniform and stable and probably just as noisy as they are at 4,000 mc.

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Phase Shift by Periodic Loading of Waveguide and Its Application to Broad-Band Circular Polarization

A.J. Simmons. "Phase Shift by Periodic Loading of Waveguide and Its Application to Broad-Band Circular Polarization." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 18-21.

A rectangular or square waveguide may be loaded periodically by thin capacitive or inductive irises in order to produce phase delay or phase advance, respectively. The amount of phase shift may be calculated with accuracy by making use of available theoretical values of iris susceptance and of transmission line theory. The phase shifting sections may be designed for low voltage standing-wave ratio (vswr) over a considerable bandwidth. When a square waveguide capable of supporting two fundamental modes is loaded periodically, the irises act inductively for one mode and capacitively for the other, thus introducing a differential phase shift. This differential phase shift may be made equal to 90° , in order to convert linear to circular polarization. Furthermore such a device may be made, by proper choice of parameters, to yield near-circular polarization over a bandwidth of 1.65:1, because the variation in phase delay for one mode and phase advance for the other tend to compensate each other as the frequency is varied. Several of these circular polarizers have been built and tested at X band and the measured results of ellipticity and vswr, as well as broad-band performance check with theoretical values quite closely.

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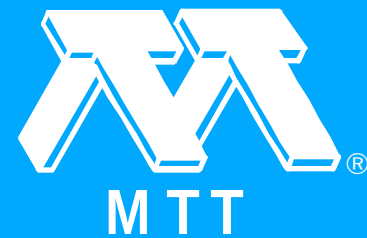


Abstracts

900-mc PTM Over-the-Horizon Radio Link

F.J. Altman, R.E. Gray, A.G. Kandoian and W. Sichak. "900-mc PTM Over-the-Horizon Radio Link." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 22-26.

An experimental over-the-horizon radio link has been installed and tested for several months by the Federal Telecommunication Laboratories. Its chief purpose has not been to study propagation, although several interesting results may appear, nor to establish a commercially usable communication facility, but rather to study the application of this relatively unexploited type of propagation to multi-channel transmission, particularly that using ptm, pulse-time modulation.



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A Method for the Accurate Measurement of the Noise Temperature Ratio of Microwave Mixer Crystals

R.E. Davis and R.C. Dearle. "A Method for the Accurate Measurement of the Noise Temperature Ratio of Microwave Mixer Crystals." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 27-35.

For the precise measurement of noise temperature ratio of a microwave mixer crystal it is common practice to employ a Roberts coupling network in order to make the Y factor independent of crystal conductance. It is shown here that a number of errors are introduced in this method, the chief of which is failure to consider the effect of transit time loading. It is also shown that the use of cathode lead inductance leads to a much improved measurement of noise temperature ratio.

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Circuit Components in Dielectric Image Lines

D.D. King. "Circuit Components in Dielectric Image Lines." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 35-39.

Symmetry of dipole mode in a dielectric rod permits use of an image system. By replacing lower half of dielectric and its surrounding field with an image surface, support problem is eliminated. Resulting image provides structural convenience and also has very low loss, provided wave is allowed to occupy a cross section many wavelengths square. In millimeter region this is readily achieved. Possibilities of new types of circuit elements in this image system are explored. Combination of optical and waveguide techniques is a characteristic of resulting components. Properties of several transducers between image line and either rectangular waveguide or coaxial line are described. Attenuators, standing-wave detector, and various directional coupler types for image lines are also discussed.

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Abstracts

Applications of the Turnstile Junction

M.A. Meyer and H.B. Goldberg. "Applications of the Turnstile Junction." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 40-45.

The Turnstile Junction is a six-terminal pair microwave network, consisting of four coplanar rectangular arms and a circular arm, orthogonal to the rectangular arms, which is excited in two orthogonal TE $1, 1$, modes. The characteristics of the network are such that they lend themselves to some very important and unique applications in the microwave field. Making use of the symmetry conditions and the field division properties of the Junction, this paper describes the operation of the Junction under various conditions, with particular emphasis on the applications to which these characteristics lend themselves.



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The Ultra-Bandwidth Finline Coupler

S.D. Robertson. "The Ultra-Bandwidth Finline Coupler." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 45-48.

The "finline coupler" is a recently developed microwave circuit element with which it has been possible to assemble hybrid junctions, directional couplers, and polarization-selective couplers capable of operating over bandwidths of at least three-to-one in frequency. Constructional details and experimental results are given.



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Microwave Traveling-Wave Tube Millimicrosecond Pulse Generators

A.C. Beck and G.D. Mandeville. "Microwave Traveling-Wave Tube Millimicrosecond Pulse Generators." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 48-51.

For some time, short pulse techniques have played a useful part in the microwave art. In order to obtain better resolution, equipment for generating and viewing microwave pulses about six millimicroseconds long was developed and described previously. The regenerative pulse generator in that equipment was rather complex and difficult to build and adjust. A much simpler generator of pulses with about the same time duration is now being used. It produces short pulses by properly gating a conventional microwave signal source with a traveling-wave amplifier having suitable transient voltages applied to both its helix and its beam-forming electrode. It is easier to construct and operate, requires fewer components, and gives a more stable output. It can be used at any frequency where a signal source and a traveling-wave amplifier are available. The pulse frequency can be set anywhere within the amplifier bandwidth. Both generators are described and compared. Equipment for receiving, displaying, and measuring the pulses is also briefly discussed. Pulse shapes and resolutions are shown on oscilloscope photos.

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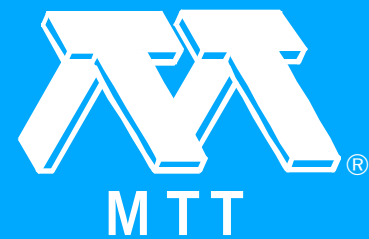
E-Plane Forked Hybrid-T Junction

W.K. Kahn. "E-Plane Forked Hybrid-T Junction." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 52-58.

A novel rearrangement of the waveguides of a microwave hybrid-T junction has been investigated. This junction is formed by the intersection of four rectangular waveguides, two of which (conventionally E and H arms) are mutually perpendicular, cross-polarized, and have their centerlines in one symmetry plane of the junction; the remaining two waveguide arms are formed by symmetric E-plane bifurcation of the E-arm waveguide extended. This hybrid T possesses special advantages with regard to match and pulse power capacity. A special test fixture was constructed of 1.122- X 0.497-inch rectangular waveguide. Experimental design work was carried out over a 12 per cent range of frequencies from 8.5 to 9.6 kmc. The H-arm reflection was reduced to 2.6-db standing-wave ratio (swr) by simple shaping of the bifurcating element. Addition of conventional matching elements resulted in maximum reflections, within the above band, of 0.8 and 0.6 db swr in the H and E arms, respectively. The ultimate limitation on the E-arm power capacity, as fixed by the intensified electric field at the leading (rounded) edge of the center partition, was computed to be 2 db below uniform waveguide. Experimental corroboration has been obtained.

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A Switch-Detector Circuit

F.S. Coale. "A Switch-Detector Circuit." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 59-62.

Crystal circuit is used wherein switching is accomplished by varying dc voltage across a crystal. Impedance of crystal plus its mount varies from low inductive to high capacitive value. Maximum attenuation frequency of high-pass, series m-derived filter varies with change of parallel inductance or capacitance. If crystal is placed across parallel capacitance, and its bias varied, input impedance of filter is changed. As a result, attenuation vs frequency characteristics are varied. Operating parameters of switch are: frequency, 500-1,000 mc; bandwidth, 20 mc; switching, >55 db; average insertion loss, 2 db; switching time, $< \frac{1}{2}$ μ sec; bias voltage, between -0.6 and +0.6 volts. This unit finds application in radar jamming problems, as well as a low power modulator for rf signals.

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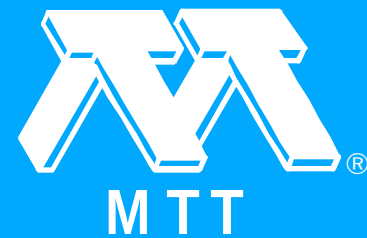


Abstracts

The Regeneration of Binary Microwave Pulses (Abstract)

O.E. DeLange. "The Regeneration of Binary Microwave Pulses (Abstract)." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 62-62.

The chief advantage of binary pulse systems resides in the possibility of regenerating such pulses at intervals along the transmission route to prevent the accumulation of distortions due to noise, bandwidth limitations, and other disturbing effects. A very important part of any such transmission system is the regenerative repeater employed. This paper reports the results of experiments performed to determine the possibilities of such a repeater operating in the microwave frequency range.



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Noise Measurements in the UHF Range (Abstract)

E. Maxwell and B.J. Leon. "Noise Measurements in the UHF Range (Abstract)." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 62-62.

Comparative noise figure measurements in the 400 mc frequency range have been made using commercial noise diode sources, thermal noise sources, and fluorescent lamps as noise generators. The thermal sources were of two kinds, a high temperature source at about 1,000°K and a low temperature source at 4°K. Measurements made with noise diodes yielded results about 1.0 db higher than those made with the thermal noise sources, from which it is inferred that the diodes are not satisfactory primary standards of noise in this frequency range. The effective noise temperature of a standard 6 w fluorescent tube (coupled to a helical line) was determined to be approximately 12,000°K by comparing its noise output with that of the hot thermal source. This is consistent with the figure of 11,400°K reported by Mumford at 4,000 mc.

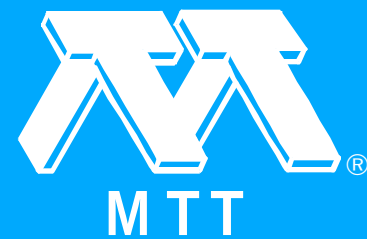
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Contributors (Dec. 1955 [T-MTT])

F.J. Altman, A. Antinori, A.C. Beck, J.M. Clara, F.S. Coale, R.E. Davis, R.C. Dearle, A.G. Fox, H.B. Goldberg, R.E. Gray, W.K. Kahn, A.G. Kandoian, D.D. King, G.D. Mandeville, M.A. Meyer, W.W. Mumford, S.D. Robertson, R.L. Schafersman, W. Sichak and A.J. Simmons.
"Contributors (Dec. 1955 [T-MTT])." 1955 Transactions on Microwave Theory and Techniques 3.6 (Dec. 1955 [T-MTT]): 62-64.



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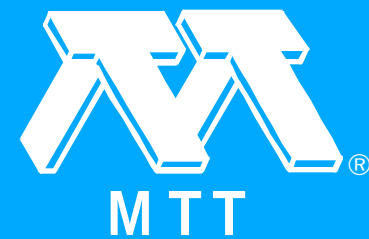
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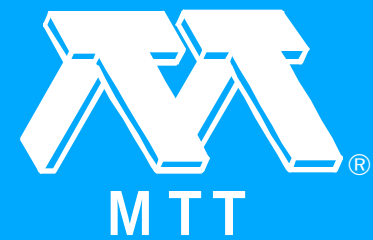
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Message from the Editor (Jan. 1956 [T-MTT])

"Message from the Editor (Jan. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 1-1.

This month we are pleased to feature Mr. André G. Clavier as our eminent microwave personality. His many contributions are well known to most members. His editorial speaks for itself. Included in this issue is a list of the members of the professional group. We hope that this will be an annual feature of the January issue.



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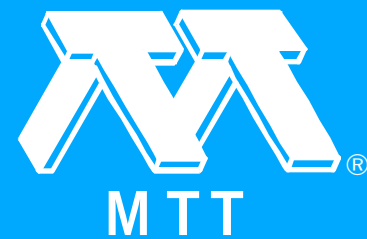


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Biography - A. G. Clavier

"Biography - A. G. Clavier." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 2-2.

A. G. Clavier was born in France in 1894. He graduated at the Sorbonne as "Licencie en Sciences Physiques et Mathématiques" and received the diploma of Electrical Engineer from the École Supérieure d' Électricité (Paris) in 1920. He started his career of radio research as the head of one of the Laboratories of the French Signal Corps, in charge of military developments in the higher part of the radio-frequency spectrum. He was a member of the French jury supervising the famous amateur contest in 1923 for short-wave transatlantic communication. He was Secretary of the Redaction of "Onde Électrique" during its first years of existence (1922-1925).



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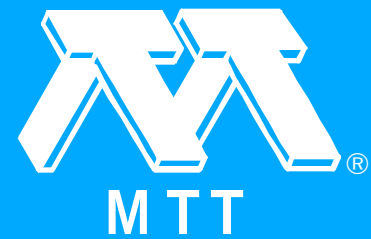


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Wire vs Wireless Communication

A.G. Clavier. "Wire vs Wireless Communication." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 3-3.

Though the integration of all modes of electrical communication is a practical fait accompli under the progress and aegis of the information theory, the fact remains that there is an undeniable and healthy competition between wire and wireless means in almost all communication fields. I would like to devote this editorial to some aspects of this technical feud, and to be allowed to present some personal technical souvenirs at this occasion.



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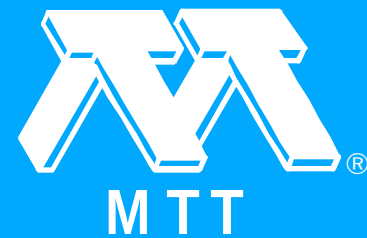


Abstracts

The Characteristic Impedance of a Slotted Coaxial Line

R.E. Collin. "The Characteristic Impedance of a Slotted Coaxial Line." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 4-8.

The propagation of a second type of TEM mode in a slotted coaxial line is analyzed. The characteristic impedance of the slotted line is evaluated by means of variational expressions giving upper and lower bounds to the true value. A two term approximation to the charge distribution and a one term approximation to potential distribution give results accurate to within ± 2 per cent. Curves of characteristic impedance against angular slot width are presented.



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Broadband Ferrite Microwave Isolator

P.H. Vartanian, J.L. Melchor and W.P. Ayres. "Broadband Ferrite Microwave Isolator." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 8-13.

A new type broadband unidirectional transmission line has been built utilizing the difference in energy distribution between two counter-rotating circularly polarized waves in a circular waveguide containing a ferrite. This principle of isolation is different from those which have been used previously. A large difference is observed in the energy distribution of two counter-rotating TE/sub 11/ modes in a ferrite loaded circular waveguide. A ferrite rod magnetized along its axis presents an effective rf permeability of approximately two for the mode rotating in a negative screw sense with respect to the direction of magnetization. For the positive sense of rotation the effective rf permeability becomes very small and negligible energy is transmitted through the ferrite rod.

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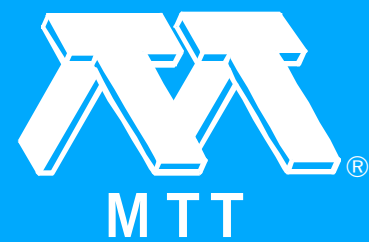
An Approximate Analysis of Coaxial Line with a Helical Dielectric Support

J.W.E. Griensmann. "An Approximate Analysis of Coaxial Line with a Helical Dielectric Support." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 13-23.

Shown in Fig. 1 is a cutaway section of coaxial cable with a helical dielectric support. The particular cable depicted bears the trade name of Styroflex derived from the fact that the dielectric helix is built up in a winding operation from nonplasticized polystyrene tapes giving to the final assembly a tight grip on the center conductor and a good degree of allowable bending capability. The outer conductor in the original design of the cable consists of an aluminum sheath extruded over the dielectric. Other forms of cable with helical dielectric support are also available.

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Improved Microwave Noise Measurements Using Ferrites

C.H. Mayer. "Improved Microwave Noise Measurements Using Ferrites." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 24-28.

The ferrite isolator and the ferrite circulator have been applied separately to improve the accuracy of measuring small microwave noise powers or small power differences. Either the isolator or the circulator effectively isolated the input circuit of a microwave receiver from the impedance of the source. As a result, the measurement errors introduced by mismatched source impedances were reduced by as much as 98 per cent. The added input circuit losses of the ferrite components reduced the receiver sensitivity by only about 10 per cent. Since the accuracy of measuring small noise power differences was limited principally by impedance errors, the addition of ferrite isolation to the receiver input circuit increased the sensitivity of measurement to near the theoretical limit. The ferrite isolator was used as a passive transmission element in these experiments. The ferrite circulator, however, was used as an electrically-operated, microwave switch. This switch was used to replace the mechanical chopper in a Dicke-type radiometer. In addition to impedance isolation, the ferrite switch makes possible rapid comparison measurements of the microwave noise powers from any two sources, or of the noise powers from the same source in two different polarizations.

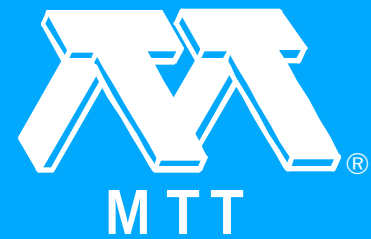


Abstracts

The Characteristic Impedance of the Shielded Slab Line

R.H.T. Bates. "The Characteristic Impedance of the Shielded Slab Line." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 28-33.

The characteristic impedance of the shielded slab line is worked out exactly in terms of elliptic functions. A design graph is given to cover most practical applications.



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Abstracts

Characteristics of a New Serrated Choke

K. Tomiyasu and J.J. Bolus. "Characteristics of a New Serrated Choke." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 33-36.

A new type of serrated choke will permit cuts or gaps anywhere on the walls of a rectangular waveguide. The low gap impedance is provided essentially by closely spaced, quarter-wave-length, open-ended, two-wire-line stubs. Low power and high power characteristics of many designs are presented.



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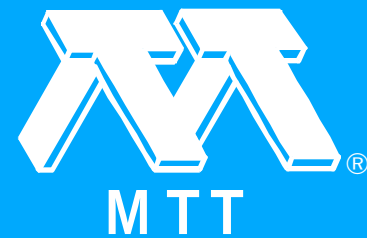


Abstracts

Microwave Filters Utilizing the Cutoff Effect

P.A. Rizzi. "Microwave Filters Utilizing the Cutoff Effect." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 36-40.

Two band-rejection microwave filters employing the waveguide cutoff effect are discussed. One type utilizes the cutoff property in the series arm of an E plane tee to improve the filter's characteristics, while the other utilizes this property in the E and H arms of a magic tee. Experimental data for both single and multistage filters are presented. Methods of obtaining low standing wave ratios over a broad pass-band are also presented.



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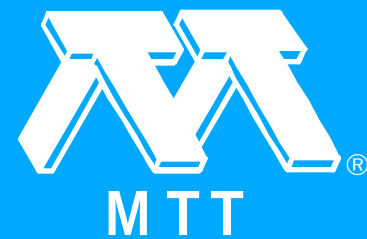


Abstracts

Technique of Pulsing Low Power Reflex Klystrons

J.I. Davis. "Technique of Pulsing Low Power Reflex Klystrons." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 40-47.

Very little published information is available on pulsing low power reflex klystrons. Since low power reflex klystrons have been generally designed for cw operation as local oscillators, a minimum of effort has been directed toward the development of specific low power pulse reflex klystrons. This paper summarizes an effort that has been directed toward pulsing typical low power reflex klystron with a description of the techniques evolved and a summary of the limitations and merits of each technique. Included also is a description of a pulse klystron "priming" technique that minimizes the effects of pulse shortening and leading edge jitter associated with typical pulse operation.



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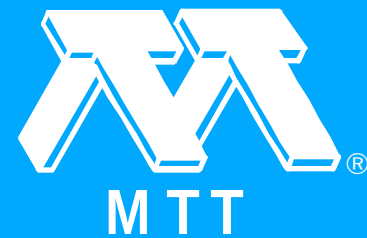


Abstracts

Some Properties of Image Circles

H.F. Mathis. "Some Properties of Image Circles." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 48-50.

Some properties of image circles for four-terminal networks are discussed. A procedure for correcting an image circle, obtained with a lossy short, is presented. Indirect methods for determining the open and short circuit impedances of a symmetrical four-terminal network are discussed.



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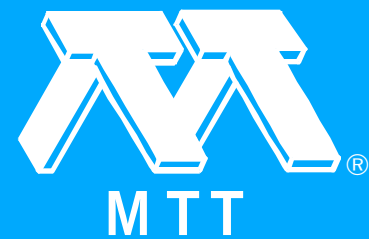
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Determination of the Parameters of Cavities Terminating Transmission Lines

R.A. Lebowitz. "Determination of the Parameters of Cavities Terminating Transmission Lines." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 51-53.

Past methods available for measuring parameters of cavities terminating transmission lines are often considered too involved for production line testing. One common method requires many individual standing wave ratio measurements at frequencies slightly lower and higher than the resonant frequency of the cavity. These measurements take not only an excessive length of time but also require an accurately controlled variable frequency oscillator for precision measurements. A second method in which an oscillographic display of reflected power is used, while much faster, requires more complicated equipment and calls for use of unconventional measurement procedures. The method presented herein was devised to meet time and accuracy requirements on the production line. Its speedy results can be obtained from equipment and calculations with which production line personnel are familiar. Use is made of the same common sweep frequency method utilized in testing transmission and absorption cavities. This paper presents a derivation of the theory of the method, a description of the apparatus used, and a comparison of the results obtained with this and the point by point method.

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Double-Ridge Waveguide (Correspondence)

T.N. Anderson. "Double-Ridge Waveguide (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 54-54.

Dr. Seymour Cohn has pointed out that the equation for attenuation as shown on page four of the article "Double-Ridge Waveguide for Commercial Airlines Weather Radar Installation" by the undersigned should be corrected to read as follows: Using a value for K of 1.2 which seems reasonable for this geometry, Dr. Cohn has computed the attenuation for the double ridge guide and obtained numbers of 0.0407 decibel per foot at 9375 mc, which agrees rather well with measured data.

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Abstracts

On a Variable Impedance Termination for Testing High Power Components (Correspondence)

R.J. Stegen and A. Clavin. "On a Variable Impedance Termination for Testing High Power Components (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 54-54.

In testing microwave components for electrical breakdown under high power it is generally desirable to simulate conditions encountered in a system. For proper evaluation it is necessary, therefore, to employ a termination, the reflection coefficient of which is variable and which will handle high powers. Our attempt to manufacture a variable mismatch device similar to those described in the literature were unsuccessful, since we could not obtain sufficiently high insertion vswr without electrical breakdown of the tuner.



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Roster of PGMTT Members (Jan. 1956 [T-MTT])

"Roster of PGMTT Members (Jan. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.1 (Jan. 1956 [T-MTT]): 55-61.



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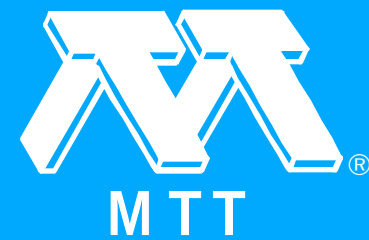
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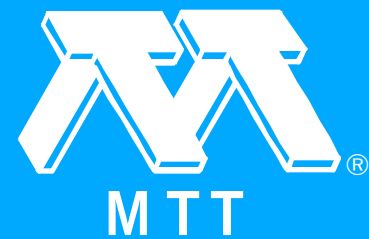
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Biography - H. A. Wheeler

"Biography - H. A. Wheeler." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 65-65.

H. A. Wheeler was born in St. Paul, Minn., on May 10, 1903. In 1925, he received the degree of B.S. in Physics from George Washington University, and from 1925 to 1928 engaged in post-graduate study in the Physics Department of Johns Hopkins University. After summer work with Professor Alan Hazeltine, Mr. Wheeler joined Hazeltine Corporation at its beginning in 1924, where he worked on the design of radio receivers. In 1926, he originated the diode detector and avc that came into common use in broadcast receivers. Later he specialized in fm and TV receivers; the latter work was awarded the Morris Liebmann Prize by the IRE in 1940. In 1939, he was appointed Vice-President and Chief Consulting Engineer of Hazeltine Electronics Corporation. During World War II, he worked on iff radar, for which he received the Navy Certificate of Commendation. Also he was active in the microwave developments that were later adopted in the dme sets now used for air navigation. He has more than 150 U. S. patents and many foreign patents.

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Microwave Engineering--Is it Specialization or Diversification?

H.A. Wheeler. "Microwave Engineering--Is it Specialization or Diversification?." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 66-67.

When a college graduate is considering employment in the field of microwaves, he often asks us, "Wouldn't it be a mistake to specialize so early in my career?" Before World War 1, when I was a boy, I decided to "specialize" in "wireless". I don't know why. No one conceived that wireless would blossom out into the tremendous field that today is embraced in the Institute of Radio Engineers. By the time I graduated from engineering school in 1925, radio broadcasting had already got out of hand and was being brought under control. But all frequencies above 1.5 megacycles were relegated to the amateurs because "they had no practical value."

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Abstracts

Report of Advances in Microwave Theory and Techniques-1955

D.D. King. "Report of Advances in Microwave Theory and Techniques-1955." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 68-74.

The theory and techniques we wish to review comprise the transmission, control, measurement, and generation of microwaves. Excluded are antenna and propagation problems, as well as the specifically electronic aspects of microwave amplifiers and generators. To order the subjects being considered we have established the following broad headings: I. Waveguides; II. Gyromagnetic Media; III. Measurements; IV. Detection; V. Sources. Within each of these, more specific subdivisions help to classify the large number of papers which have appeared. The large quantity of papers, and the attendant number of subdivisions needed to order them, are proof of the broad activity in the microwave field. However, what was once considered a small area has thereby been subdivided into even smaller parts. In this review, we have provided many subcategories in order to show more clearly the different directions of effort in the microwave field. We hope this does not lend support to the superspecialist, interested only in say TE/sub 01n/ mode reaction wavemeter design in the P-band. To the reader with such limited interests we must address a warning: our discussion is not cross-referenced, and waveguide measurements on gyromagnetic media might be listed under I, II, or III depending on relative emphasis.



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Coupled-Strip-Transmission-Line Filters and Directional Couplers

E.M.T. Jones and J.T. Bolljahn. "Coupled-Strip-Transmission-Line Filters and Directional Couplers." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 75-81.

This paper describes the theory of operation of coupled strip line filters and directional couplers, and presents information from which these components may be easily designed. Low-pass, band-pass, all-pass, and all-stop filter characteristics are obtained from these coupled lines either by placing open or short circuits at two of the four available terminal pairs, or by interconnecting two of the terminal pairs. Directional couplers having perfect directivity and constant input impedance at all frequencies, and for all degrees of coupling, are obtained by placing equal resistive loads at each of the four terminal pairs.

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Abstracts

Absolute Measurement of Receiver Noise Figures at UHF

E. Maxwell and B.J. Leon. "Absolute Measurement of Receiver Noise Figures at UHF." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 81-85.

Absolute measurements of noise-figures in the UHF range are described, using hot and cold thermal sources as standards. It was found that the noise temperature of the T-5 6 watt fluorescent tube is 16.1 ± 0.6 db above $kT_{\Delta v}$. Noise diodes were found to be in error at these frequencies by approximately 1 db.



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Design and Development of Strip-Line Filters

E.H. Bradley. "Design and Development of Strip-Line Filters." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 86-93.

Strip transmission lines offer an alternate medium in which microwave filters can be realized. Since bandpass filters designed in waveguide or coaxial lines would necessarily be large at ultra-high frequencies, strip lines provide a practical means of realizing filters which are simply fabricated and which represent an appreciable saving in size and weight.



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Measurement of Crystal Impedances at Low Levels

H.N. Dawirs and E.K. Damon. "Measurement of Crystal Impedances at Low Levels." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 94-96.

It is very important to know the impedances of crystal diodes when constructing circuits such as mixers and detectors in which the crystals are used. It is always difficult to measure these impedances due to the nonlinear characteristics of the crystals but it is most difficult to make the measurements at minimum levels at which the crystals operate, since with such methods as the slotted line, the detector must operate at a still lower level to obtain the required probe decoupling. Thus, since the load whose impedance is being measured is itself a crystal operating at its minimum level, it is practically impossible to obtain a detector with sufficient sensitivity to make the measurement. Crystal impedances at these minimum levels are of utmost importance as it is here that optimum matching is essential for maximum sensitivity.

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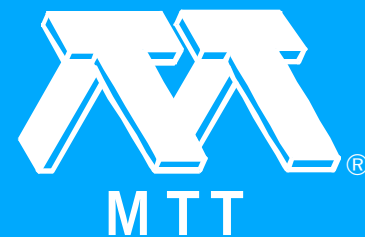


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Long-Line Effect and Pulsed Magnetrons

W.L. Pritchard. "Long-Line Effect and Pulsed Magnetrons." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 97-110.

A simplified theory of long-line effect is developed leading to expressions for maximum tolerable line length and vswr. The theory is verified experimentally and photographic evidence of the deleterious effect of long-line behavior is presented. The prevention of long-line effect by various methods, including decoupling the magnetron, attenuation, phase shifter, and ferrite isolators, is discussed.



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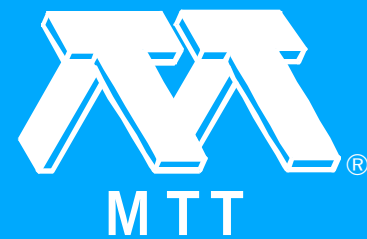


Abstracts

The Use of Non-Euclidean Geometry in Measurements of Periodically Loaded Transmission Lines

R.L. Kyhl. "The Use of Non-Euclidean Geometry in Measurements of Periodically Loaded Transmission Lines." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 111-115.

The propagation characteristics of periodically loaded transmission lines can be deduced from impedance measurements taken with a series of different terminating configurations in a manner analogous to the "nodal shift" method of measuring microwave junction characteristics. The non-Euclidean properties of impedance transformations form a particularly simple approach for analyzing measurements in the case of the loaded line.



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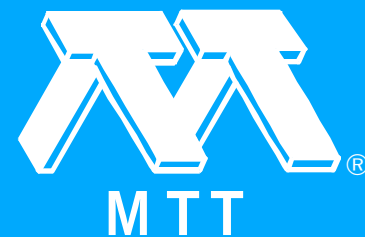


Abstracts

A New Microwave Frequency Standard by Quenching Oscillator Control

N. Sawazaki and T. Honma. "A New Microwave Frequency Standard by Quenching Oscillator Control." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 116-121.

This paper shows that in this new frequency standard system the multiplication is made by synchronizing oscillation, which is achieved by quenching a microwave oscillator with a standard quartz-crystal oscillator. The output frequency spectrum of this synchronizing oscillator includes only integral multiple frequencies of a quartz-crystal oscillator. Each spectrum can be utilized as standard frequencies. Theoretical calculations and experimental results are also described here. And to avoid the influence of noise voltage on the build-up of the quenching control microwave oscillator, the double modulation system is used, which is controlled and intermitted simultaneously by both $f_{\text{sub } 1}$ voltage (output of the low frequency standard) and $n_{\text{sub } 1} f_{\text{sub } 1}$ voltage ($n_{\text{sub } 1}$ is an integer).



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Determining Attenuation of Waveguide from Electrical Measurements on Short Samples

A.F. Pomeroy and E.M. Suarez. "Determining Attenuation of Waveguide from Electrical Measurements on Short Samples." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 122-129.

An improved method for accurately determining the attenuation of waveguide from measurements on very short samples is presented. First, two samples are measured separately and then in tandem. When the measurements are properly made, the sum of the attenuations when the samples are measured separately agrees with the attenuation when measured in tandem at each frequency of measurement. Second, the average effective resistivity is found over a band of frequencies. Using the average effective resistivity, the attenuation at any frequency in the band can be determined. Results for WR159 copper waveguide are shown.

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Planar Transmission Lines--III (Correspondence)

D. Park. "Planar Transmission Lines--III (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 130-130.

The general theory of planar transmission lines developed earlier allows one to show that there is only a certain range of dimensions within which the line will be mechanically stable and reproducible. Within this range, very simple approximate formulas for the attenuation and characteristic impedance can be given. The optimal line, with respect to both stability and attenuation, has its central conductors in the form of very narrow strips.

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Abstracts

Phase Shift and Attenuation in a Transmission Line (Correspondence)

H.F. Mathis. "Phase Shift and Attenuation in a Transmission Line (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 130-131.

Circular transmission line charts, i.e. Carter (Z-0) and Smith (R-X) charts, can be used to determine the phase shift and attenuation in a uniform transmission line, or waveguide, which may be lossy and which is not terminated in a matched load. The procedure discussed here is based on the simple properties of these charts. The procedure can be extended to symmetrical four-terminal networks.



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A Novel Technique for Making Precision Waveguide Twists (Correspondence)

E.M.T. Jones and R.C. Honey. "A Novel Technique for Making Precision Waveguide Twists (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 131-132.

In a recent issue of the IRE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, Wheeler and Schwiebert described step-twist waveguide components having good performance over a full waveguide band. These step-twist components are composed of a few short sections of straight rectangular waveguide, twisted about their common axis at their junction faces. Typically the length of each short section of the step-twist is the order of $1/8$ to $1/4$ of a guide wavelength, while the twist angle between sections may be as much as 30 degrees.



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On Symmetrical Matching (Correspondence)

H.F. Mathis. "On Symmetrical Matching (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 132-132.

It is sometimes desirable to use symmetrical matching for a symmetrical lossless discontinuity in a transmission line or waveguide. A convenient form of such matching is two equal shunt susceptances placed across the transmission line, or waveguide, at positions which are symmetrical with respect to the discontinuity. The following procedure can be used to determine the positions and value of the shunt susceptances. 1) The position P and the value B of the shunt susceptance for one-sided matching is determined. (The susceptance may be inductive or capacitive; therefore, there are two possible pairs of P and B . Either of these pairs may be used.) 2) A shunt susceptance whose value is $B/2$ is placed at the position P . 3) The second shunt susceptance is placed on the other side of the discontinuity so that symmetry is restored.



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Abstracts

Contributors (Apr. 1956 [T-MTT])

J.T. Bolljahn, E.H. Bradley, E.K. Damon, H.N. Dawirs, T. Honma, E.M.T. Jones, D.D. King, R.L. Kyhl, B.J. Leon, E. Maxwell, A.F. Pomeroy, W.L. Pritchard, N. Sawazaki and E.M. Suarez. "Contributors (Apr. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.2 (Apr. 1956 [T-MTT]): 133-134.



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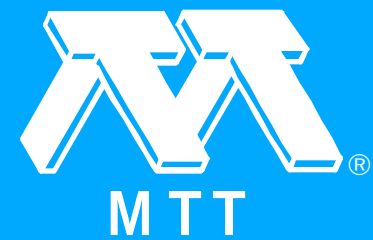
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"Front Cover and Table of Contents (Jul. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): f1-f2.



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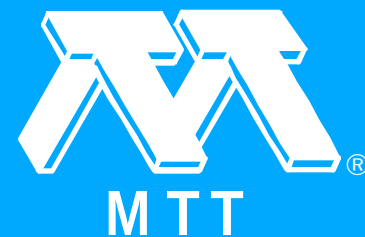


Abstracts

Biography - E. L. Ginzton

"Biography - E. L. Ginzton." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 135-135.

Born in Russia in 1915, in Ekaterinoslav, now Dnepropetrovsk, Edward L. Ginzton came to the United States when he was 13. He attended the University of California, receiving the B.S. and M.S. degrees in electrical engineering. With the encouragement and assistance of Dr. F. E. Terman, he transferred to Stanford University for graduate work in radio engineering, receiving the E.E. degree in 1938 and the Ph.D. degree in 1940, after specializing in the study of negative feedback and the theory and application of stabilized negative impedances.



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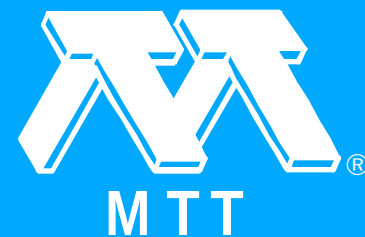


Abstracts

Microwaves--Present and Future

E.L. Ginzton. "Microwaves--Present and Future." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 136-136.

Many of us are so immersed in the ever-narrowing branches of electrical engineering that it is difficult to take stock of the accomplishments in the field as a whole or to visualize the possibilities and limitations of future developments. For those of us engaged in teaching and research, and who expect to remain in the field, such an assessment is necessary if we are to guide our students properly and anticipate the probable roles of our own specialties. I will review briefly present-day microwave applications indicating some of the spectacular developments during the past twenty years and try to make an appraisal of potential limitations in microwave research per se, and point to a possible profitable avenue of research for the future.



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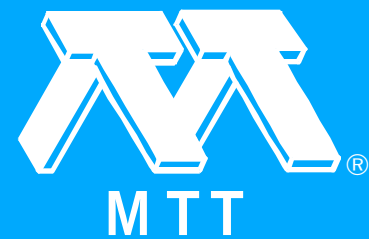
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Rapid Measurement of Dielectric Constant and Loss Tangent

D.M. Bowie and K.S. Kelleher. "Rapid Measurement of Dielectric Constant and Loss Tangent." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 137-140.

The problem of evaluating dielectric constant and loss tangent by the short-circuited-waveguide technique has been encountered continually in recent years in the study of artificial dielectric media and radome materials. In general, practical measurements have involved materials with low loss and dielectric constants less than 10. The analytical method normally applied to data on such materials requires laborious computation. The available graphical methods have not completely eliminated computation and have provided answers of unsatisfactory accuracy. The present paper describes rapid graphical techniques for evaluating dielectric constant and loss tangent from the quantities normally measured with the slotted line, using samples of arbitrarily chosen length. It begins with equations previously derived for the case of low-loss media. By use of a new parameter, the relationship between dielectric constant and the measured shift in standing-wave minimum is plotted in such a way that all possible values of dielectric constant within any predetermined range are read directly from the graph with no computation whatsoever. A graph can be readily prepared to apply over a full range of frequency to all sizes of rectangular waveguide.

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



Abstracts

Propagation in Ferrite-Filled Transversely Magnetized Waveguide

P.H. Vartanian and E.T. Jaynes. "Propagation in Ferrite-Filled Transversely Magnetized Waveguide." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 140-143.

A solution to the problem of propagation of higher modes in a transversely magnetized ferrite-filled rectangular waveguide has been found. The solutions to the problem are expressed in the form of four rigorous nonlinear algebraic equations which characterize the problem and are ready for numerical solution. The dependence of the fields in the direction of magnetization is the same as for the classical modes.



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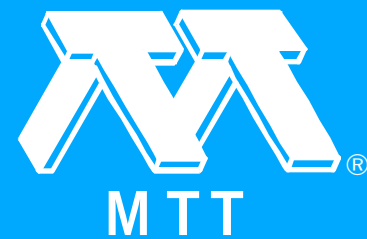


Abstracts

Currents Excited on a Conducting Surface of Large Radius of Curvature

J.R. Wait. "Currents Excited on a Conducting Surface of Large Radius of Curvature." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 143-145.

The nature of the electromagnetic field of an antenna in the vicinity of a surface of large radius of curvature is discussed. Assuming a spherical surface, the solution for a dipole source in the form of the Watson residue series is transformed to a more rapidly converging series which is preferable at short distances. Using this result, numerical data is presented in graphical form for the currents induced on the spherical surface. The curves are applicable to both a stub and slot antenna mounted on the conducting surface.



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A Note on Noise Temperature

P.D. Strum. "A Note on Noise Temperature." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 145-151.

The effective noise temperature of the output impedance of a lossy passive network at an arbitrary noise temperature connected to one or more resistive loads at arbitrary noise temperature lies between the highest and the lowest of these noise temperatures, as determined by the losses between the output terminals and the loads. The determination of the effective noise temperature of a gas-discharge noise generator over a wide frequency range is simplified by the substitution of a loss measurement for the more difficult noise temperature measurement. For minimum-noise radar applications care must be used in considering the excess noise of crystal mixers and gas-discharge duplexers. The influence of galactic radiation on a receiving system is such that there is an optimum frequency in the region of 200 to 600 mc for minimum "operating noise figure." Typical examples of radio-astronomy measurements are amenable to analysis of the type given. Finally, several corrections to measured noise figure are analyzed.

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Compact Microwave Single-Sideband Modulator Using Ferrites

J.C. Cacheris and H.A. Dropkin. "Compact Microwave Single-Sideband Modulator Using Ferrites." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 152-155.

This paper describes a single-sideband modulator for shifting the frequency of an x-band signal by means of a rotating magnetic field transverse to a ferrite differential half-wave section. The device is one of the first practical applications of the double-refraction properties of ferrites. Improvements over an earlier model include reduction in size and continuous operation without drift. An efficient and compact magnetic structure has been designed for producing the rotating magnetic field. Excessive heating of the ferrite and voltage breakdown of the coils is eliminated by a forced-air cooling system. The modulator shifts the microwave-carrier frequency of 9375 mc by plus or minus 20 kc. With a rotating field of approximately 200 oersteds the microwave insertion loss is 1.0 db. The undesired sideband suppression is above 40 db while the carrier suppression is 23 db. For a frequency bandwidth of 500 mc, the insertion loss remains below 5 db.

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A Semi-Infinite Array of Parallel Metallic Plates of Finite Thickness for Microwave Systems

R.I. Primich. "A Semi-Infinite Array of Parallel Metallic Plates of Finite Thickness for Microwave Systems." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 156-166.

An array of parallel metallic plates of finite thickness are useful in microwave lenses. The effect of finite thickness in the idealized situation of a semi-infinite array of perfect conductivity, is treated theoretically and experimentally for normal incidence of a uniform plane wave on the plane interface separating the medium from free space. The theoretical discussion involves the approximate variational method and a procedure is given for estimating the order of magnitude of the error in the final result. It is shown that it can be advantageous to use plates of finite thickness since the reflection from the interface can be reduced from that existing for infinitely thin plates.

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The Characteristic Impedance of Trough and Slab Lines

R.M. Chisholm. "The Characteristic Impedance of Trough and Slab Lines." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 166-172.

A variational method is used to develop an expression for the characteristic impedance of a "trough line" consisting of a circular cylinder mounted inside and parallel to the walls of a semi-infinite rectangular trough. The "slab line" consisting of a circular cylinder between infinite, parallel plates is treated as a special case of the trough line in which the bottom of the trough is taken to be infinitely remote from the circular cylinder. The solution has not been restricted to cylinders that are mounted exactly half way between the parallel walls of the trough; a simple formula is presented for calculating the tolerances which must be placed on the "centering" of the center conductor for a given allowable error in the characteristic impedance. The expression for the characteristic impedance is presented as the sum of three terms. The first is a "zero order" logarithmic term, the second a "second order" correction term which vanishes as the center conductor becomes infinitely small, and the third is an "off-center" correction term which arises when the cylinder is not exactly half way between the parallel walls of the trough. The second order correction term amounts to about 0.3 ohms when the characteristic impedance is of the order of 50 ohms. A fourth order approximation using the same method changes this by about 0.001 ohm.

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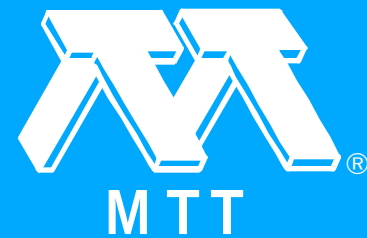


Abstracts

A Simplified Calibration of Two-Port Transmission Line Devices

F.L. Wentworth and D.R. Barthel. "A Simplified Calibration of Two-Port Transmission Line Devices." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 173-175.

During the evaluation measurements of several two-port junction devices over a wide band of frequencies the authors found that the method of shorts as described in three previous papers was too laborious to be practical. By reinterpreting and combining the ideas of earlier authors, a valuable simplification was obtained. Since this paper is based upon the previous articles, no fundamental proofs will be given except to show the necessary extensions involved.



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Impedance and Polarization-Ratio Transformations by a Graphical Method Using the Isometric Circles

E.F. Bolinder. "Impedance and Polarization-Ratio Transformations by a Graphical Method Using the Isometric Circles." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 176-180.

The isometric circles for the direct and inverse linear fractional transformations can be used for transformations of impedances and polarization ratios. In the loxodromic case an inversion is performed in the isometric circle of the direct transformation, followed by a reflection in the symmetry line of the two circles, and a rotation around the origin of the isometric circle of the inverse transformation. In the nonloxodromic case only the first two operations have to be applied. Three illustrative examples are given: the first shows the transformation of the right half of the complex impedance plane into the unit circle (Smith Chart); the second gives a circular proof of the Weissfloch transformer theorem; the third shows an example of cascading, lossless, two terminal-pair networks.

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A Broad-Band Dual-Mode Circular Waveguide Transducer

R.D. Tompkins. "A Broad-Band Dual-Mode Circular Waveguide Transducer." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 181-183.

This paper describes a broad-band dual-mode waveguide transducer designed to couple two orthogonal TE/sub 11/ circular waveguide modes in separate rectangular waveguide ports. A compact, rugged, and economical junction has been developed to operate from 8600 mc to 9600 mc with a vswr of less than 1.15 at the rectangular port and a mode isolation of 50 db or greater. Developmental models are described to indicate the evolution from theory to the final model. Some problems encountered in attaining a small physical size are discussed in detail. The new junction has application to mode multiflexing, circular waveguide ferrite devices, circular polarization, and as a circular wave guide magic-T.

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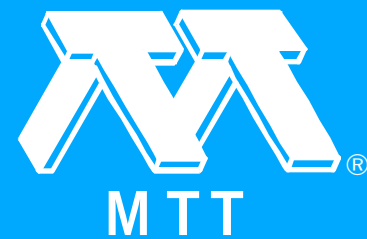


Abstracts

A Switch Detector Circuit (Correction)

F.S. Coale. "A Switch Detector Circuit (Correction)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 183-183.

Franklin S. Coale, author of the paper "A Switch Detector Circuit", which appeared on pages 59-61 of the December, 1955 issue of Transactions on Microwave Theory and Techniques, has requested that the following information, omitted in his manuscript, be published by the editors. The work for the paper was accomplished while Mr. Coale was a member of the Sperry Gyroscope Company under an Air Force Contract. P.J. Sferrazza, of Sperry, developed a band-pass crystal switch at 3300 mc which gave a dynamic switching of greater than 44 db over a 10 mc bandwidth.



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Planar Transmission Lines--II (Correspondence and Rebuttal)

A.J. Giger and D. Park. "Planar Transmission Lines--II (Correspondence and Rebuttal)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 184-184.

I would like to call your attention to a certain mistake in the above paper. Park's transmission line, consisting of two parallel strips between two wide plates [Fig. 1(a)], has to be changed to the line geometry indicated in Fig. 1(b) in order to maintain the results of the mentioned paper.

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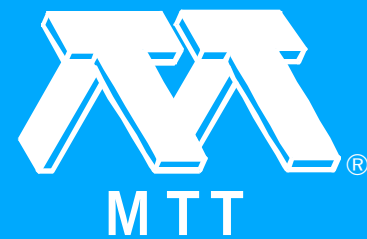


Abstracts

Determination of the Parameters of Cavities Terminating Transmission Lines (Correspondence)

M.W. St. Clair. "Determination of the Parameters of Cavities Terminating Transmission Lines (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 184-184.

The method of measuring cavity parameters outlined in the above paper has been used successfully for some time by our laboratory for measuring parameters of cavities at X band having Q's as high as 150,000. For improved accuracy in these measurements, an additional refinement has been made in the method which makes all measurements independent of the law of the crystal detectors used.



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A Low VSWR Matching Technique (Correspondence)

A.J. Giger. "A Low VSWR Matching Technique (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 184-187.

A variation on the method described by Feller and Weidner for obtaining low standing wave ratios over a frequency band has proven to be very useful in the design of low vswr microwave components. If curve A in Fig. 1 represents the input admittance of the device to be matched, the method described by Feller proceeds as follows: 1) Insert a value of susceptance which causes the curve to lie along a constant vswr circle (curve B). 2) Move toward the generator until the frequency sensitivity of the line length causes the curve to reduce to a point (point C). 3) Move to the nearest intersection with the $g=1$ circle (curve D). 4) Insert a value of susceptance which transforms the admittance plot to the center of the chart; i.e., a matched condition (curve E).

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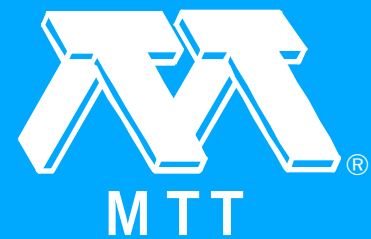


Abstracts

Microwave Equipment for College Laboratories (Correspondence)

R.T. Reich. "Microwave Equipment for College Laboratories (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 187-187.

I should like to take advantage of this correspondence column to discuss briefly a problem which we at Clarkson College may have in common with many other private colleges. We believe that our undergraduate curriculum should include a course in microwaves and that this course to be effective must include some laboratory work. The problem is that it is very difficult to equip a microwave laboratory on the sort of budget existing in a small college. Commercial equipment is, in general, much too expensive and is really much higher quality than is required for simple student laboratory work. We have been able to meet our needs in part by constructing our own waveguide components and in part through the generosity of several concerns which have given us used or rejected equipment or made it available to us at very low cost. We have been given a variety of microwave tubes plus some oscillators and a number of waveguide and coaxial components which make it possible for us to operate our laboratory.



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Abstracts

Russian Edition of "Principles and Applications of Waveguide Transmission" (Correspondence)

G.C. Southworth. "Russian Edition of "Principles and Applications of Waveguide Transmission" (Correspondence)." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 187-187.

This book was written by the well-known American specialist in the uhf field who was one of the pioneers of waveguide techniques. As the author mentions in his preface, the book does not pretend to encompass fully the subject; however, in addition to a description of the fundamentals of the theory of waveguide transmission it contains extensive material devoted to the design and operation of various waveguide components and assemblies and also of electron apparatus applied in conjunction with waveguide apparatus. A part of this material was published earlier in periodicals but is being published row for the first time in book form.



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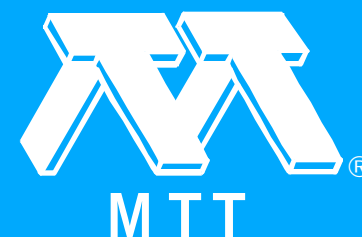
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Abstracts

Contributors (Jul. 1956 [T-MTT])

D.R. Barthel, E.F. Bolinder, D.M. Bowie, J.C. Cacheris, R.M. Chisholm, H. Dropkin, E.T. Jaynes, K.S. Kelleher, R.I. Primich, P.D. Strum, R.D. Tompkins, P.H. Vartanian, J.R. Wait and F.L. Wentworth. "Contributors (Jul. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.3 (Jul. 1956 [T-MTT]): 187-189.



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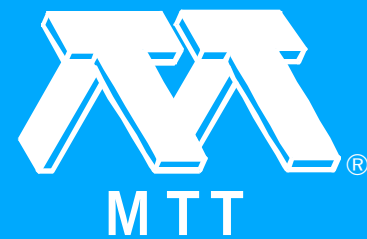


Abstracts

Foreword (Oct. 1956 [T-MTT])

R.F. Schwartz. "Foreword (Oct. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 192-192.

In the spring of 1955 the Administrative Committee of PGMTT was looking for a new place to hold the yearly technical meeting of the group. The writer was present at the meeting where possible places were discussed, and he was asked whether he thought a meeting in Philadelphia could be arranged. The idea of holding a local meeting devoted to microwave relays had already been discussed by him with others of the Philadelphia area, and accordingly it seemed as though the situation demanded that the national and local meetings be combined. Presentation of the idea to the Executive Committee of the Philadelphia Section resulted in their approval and agreement to participate as a co-sponsor. Later, the PGAP also agreed to co-sponsor the meeting.



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Nonuniform, Inhomogeneous, and Anisotropic Waveguides

R.W. Klopfenstein. "Nonuniform, Inhomogeneous, and Anisotropic Waveguides." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 193-196.

This paper discusses in a general way some of the properties of nonuniform, inhomogeneous, and anisotropic waveguides and transmission lines. No attempt is made to discuss in detail the behavior of any particular type of waveguide except for the purposes of example. Most of the points discussed are well known separately, but an attempt has been made to bring some of general properties of special types of waveguide together in order to unify them, and, thus, it is hoped, to contribute to the over-all understanding of guided wave phenomena.



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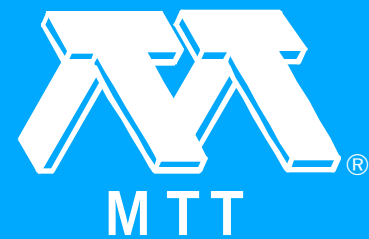
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Open Wire Lines

G. Goubau. "Open Wire Lines." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 197-200.

The properties of two-wire lines and single wire lines (surface wave transmission lines) are discussed on a comparative basis. The two-wire line is actually a system of two coupled single wire lines and thus requires a high degree of symmetry to maintain the desired wave mode. While the single wire line is more affected by bends it has the advantages that it is simpler in construction and is less susceptible to weather conditions. The main domain of the two-wire lines lies in the frequency range below 100 mc and that of the single wire line in the range above 100 mc.

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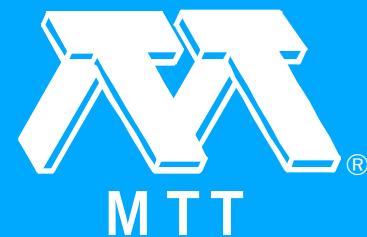


Abstracts

Rectangular and Ridge Waveguide

T.N. Anderson. "Rectangular and Ridge Waveguide." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 201-209.

This paper describes the present state of the art with respect to rectangular ridge waveguide giving tables and data from standard waveguide sizes and constructional techniques for both rigid and flexible waveguide. The problems inherent in waveguide connectors are discussed along with the various methods for producing waveguide assemblies. The problems inherent with present-day waveguide standardization are also discussed. It is essential that a series of standard waveguide for high pressure operation and for extremely broadband operation (ridgeguide) be standardized. The latest RETMA miniature standard flanges are shown along with present-day thinking on a series of pressurized contact flanges.



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Abstracts

A Broad-Band Microwave Circulator

E.A. Ohm. "A Broad-Band Microwave Circulator." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 210-217.

The discovery of a simple, low loss way to hold Faraday rotation constant over a broad-band (coupled with the development of wide-band, high return loss, circular-to-rectangular waveguide transformers, and polarization couplers) has made it possible to design and build a high quality circulator for use in the 10.7 kmc to 11.7 kmc band. The essential characteristics of the described unit include a more than 30-db return loss at each terminal, an isolation of 30 db or greater between "isolated" terminals, and a 0.35-db insertion loss between transmission terminals.



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Abstracts

The Excitation of Surface Waveguides and Radiating Slots by Strip-Circuit Transmission Lines

A.D. Frost, C.R. McGeoch and C.R. Mings. "The Excitation of Surface Waveguides and Radiating Slots by Strip-Circuit Transmission Lines." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 218-222.

A variety of methods for coupling between a shielded strip-circuit transmission line, operating in the TEM coaxial mode, and a surface waveguide have been investigated. The arrangements include phased dipole arrays, series ground-plane slots and longitudinal slot excited probes. Impedance and matching conditions for each are discussed together with their relative efficiency and bandwidth. In the case of a single radiating slot, measurements on the effective equivalent circuit have been made as a function of the orientation angle of the slot with respect to the axis of the strip-line guide. Slots used ranged in length from 0.3 to 0.6 $\lambda_{\text{sub } g}$, having length/width ratios from 5 to 16.



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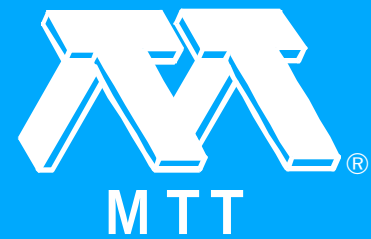


Abstracts

The Turnstile Circulator

P.J. Allen. "The Turnstile Circulator." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 223-227.

Theory and performance of a narrow band circulator employing but a single junction and a 45-degree Faraday rotator are discussed. Factors affecting bandwidth are considered and pertinent curves are plotted. Isolation bandwidth curves permit prediction of performance. This compact circulator, although frequency sensitive, is tunable and provides high reverse and cross isolations making it especially suited to duplexing, isolating and switching applications.



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Nonreciprocal Two-Ports Represented by Modified Wheeler Networks

H.M. Altschuler and W.K. Kahn. "Nonreciprocal Two-Ports Represented by Modified Wheeler Networks." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 228-233.

The extension of the (reciprocal) modified Wheeler network to include the more general nonreciprocal two-port is given. This representation is derived via a known decomposition of the general nonreciprocal network into two portions, one reciprocal, the other nonreciprocal. The reciprocal portion is then taken as the modified Wheeler network. Recombination of the elements results in the desired representation which is constituted of a minimum number, i.e., of eight, passive elements. Each of these is a natural idealization of a physical microwave component. Since six of the elements belong to the class of "bilaterally matched" networks, some of the properties of this class are discussed. Two of the bilaterally matched elements embody the nonreciprocal properties of the network: a one-way attenuator and a one-way phase-shifter. Many of the characteristics of the (reciprocal) modified Wheeler network carry over directly to this nonreciprocal representation. The microwave measurement of the network parameters is also indicated.

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Criteria for the Design of Loop-Type Directional Couplers for the L Band

P.P. Lombardini, R.F. Schwartz and P.J. Kelly. "Criteria for the Design of Loop-Type Directional Couplers for the L Band." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 234-239.

For many years the design of loop type directional couplers has relied heavily on experiment. One of the most common varieties has been the loop coupler much shorter than a wavelength and having a built-in termination (vestigial arm). In this paper the criteria for the design of loop couplers of any length are considered, and their application to either coaxial line or waveguide are discussed. The theoretical basis for design is established by first considering the theory of coupled transmission lines. Several designs which utilize a quarter-wavelength or shorter loops and which have very desirable features with regard to coupling, directivity, and band-width are illustrated. Typical performance of couplers having couplings of 20-40 db and directivities of over 30 db are presented.

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Improved Rectangular Waveguide Resonance Isolators

M.T. Weiss. "Improved Rectangular Waveguide Resonance Isolators." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 240-243.

The early resonance isolators, using nearly full waveguide height ferrite slabs, gave a high reverse loss per unit length but a disappointingly low reverse-to-forward loss ratio. By substantially reducing the height of the ferrite slabs, the reverse-to-forward loss ratio can be increased at the expense of reverse loss per unit length. More recently, it has been found that the addition of certain dielectric loading in rectangular waveguide resonance isolators results in generally improved performance. Thus, the reverse-to-forward loss ratio of these isolators is high (150 to 1 at X band) and the reverse loss per unit length is also high (20 db/inch at X band). The broad-banding problem will also be briefly discussed.

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



Abstracts

An Automatic Gain Control System for Microwaves

J.P. Vinding. "An Automatic Gain Control System for Microwaves." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 244-245.

This paper describes a system which can keep the power level in a microwave set-up constant with good accuracy in spite of variations of the input power level. The system uses a variable attenuator based on the Faraday rotation in magnetized ferrite and thereby achieves a frequency response up to about 500 cps with the present equipment and much better potential response. Variations in input power are reduced by a factor varying from 10 to 400 depending on available power and on the detector used to detect the output power.



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A Method of Analysis of Symmetrical Four-Port Networks

J. Reed and G.J. Wheeler. "A Method of Analysis of Symmetrical Four-Port Networks." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 246-252.

An analysis of four-arm symmetrical networks such as a branched directional double stub coupler or the hybrid ring (rat race) is presented. The input wave is broken into an even and an odd mode and the vector amplitude out the various arms is computed from the sums or differences of the reflection or transmission coefficients for the two modes. A zero decibel directional coupler is described and its possible use as a duplexer is proposed. The design of multiple stub directional couplers for any degree of coupling is discussed. A method of computing the bandwidth of all these couplers is outlined, and the bandwidth curves, the power out the various arms with respect to frequency of the zero decibel coupler, are computed. A tabulation is made for six different 3 db couplers (even-power split) and their standing wave ratio, evenness of power split and isolation of the fourth arm as a function of frequency assuming perfect performance at the band center.

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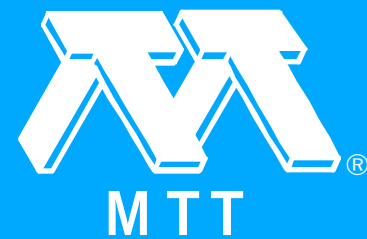


Abstracts

Broad-Band Waveguide Series T for Switching

J.W.E. Griemsmann and G.S. Kasai. "Broad-Band Waveguide Series T for Switching." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 252-255.

By use of properly proportioned half-wavelength transformer-sections in the arms of a waveguide series T broad-band performance can be obtained for switching applications. Over the frequency band 8200 to 9765 megacycles per second, corresponding to a bandwidth of 17.4 per cent, an experimental model showed an insertion vswr of less than 1.15 for transmission through the aligned arms and 1.30 for transmission around the bend. Further bandwidth improvement is possible with the use of a special arrangement of quarter-wave transformer sections but at the expense of further impairment of power-carrying capacity.



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A Traveling-Wave Directional Filter

F.S. Coale. "A Traveling-Wave Directional Filter." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 256-260.

A new type of microwave filter is presented in which resonance occurs in the form of a traveling wave rather than in the conventional form of a standing wave. This device is a constant-resistance circuit, and therefore presents a very low input vswr. Formulas for loaded Q and insertion loss are given. Experimental results verify the theoretical approach. This filter, which is constructed of a transmission-line loop and two directional couplers, finds application in multiplexing filters as well as in matched band-pass and band-rejection filters.



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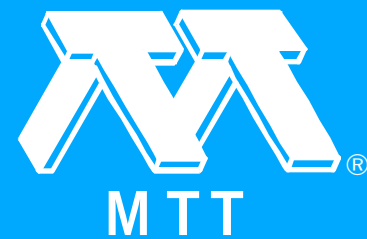


Abstracts

Miniaturization of Microwave Assemblies

L. Lewin. "Miniaturization of Microwave Assemblies." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 261-262.

A method of construction is described in which waveguides are arranged in a single plane with adjacent walls common. An assembly is made from a top and bottom plate between which partition walls are arranged to constitute the transmission region. A hybrid-T is made from a 3 db coupler, and a microwave repeater is described consisting of five band-pass filters, two hybrid-T's, an isolator, and several other component aspects. Setting up in situ is achieved by the use of a Bethe hole coupler to monitor the reflection or transmission at a number of specially located check ports. No electric coupling can be measured across a soldered fabricated waveguide wall.



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Recent Advances in Finline Circuits

S.D. Robertson. "Recent Advances in Finline Circuits." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 263-267.

Detailed studies of transmission properties of the finline coupler have revealed existence of certain phenomena which adversely affect the transmission characteristics. A discussion of the origin and successful elimination of such effects is described. New applications for the finline coupler have been found in the design of hybrid junctions, twists and bends in multimode waveguide, and other polarization selective devices. The paper concludes with a presentation of theoretical and experimental results in the application of finline techniques to low-pass microwave filters.

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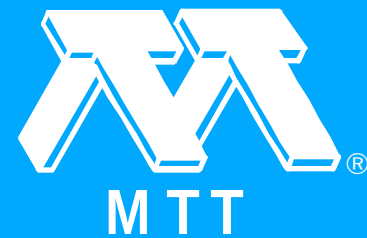


Abstracts

Recent Advances in Waveguide Hybrid Junctions

P.A. Loth. "Recent Advances in Waveguide Hybrid Junctions." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 268-271.

Design techniques for waveguide hybrid tee junctions, resulting in convenient structures and simple internal matching elements for increased bandwidth and power-handling capacity are described, and experimental data are given.



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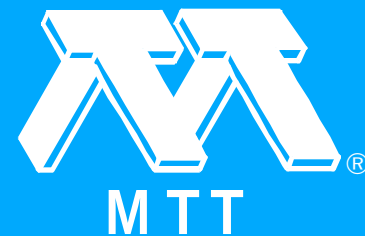
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Contributors (Oct. 1956 [T-MTT])

P.J. Allen, H.M. Altschuler, T.N. Anderson, F.S. Coale, A.D. Frost, G. Goubau, J.W.E. Griemsmann, W.K. Kahn, G.S. Kasai, P.J. Kelly, R.W. Klopfenstein, P.P. Lombardini, P.A. Loth, C.R. McGeoch, C.R. Mingins, E.A. Ohm, J. Reed, S.D. Robertson, R.F. Schwartz, J.P. Vinding, M.T. Weiss and G.J. Wheeler. "Contributors (Oct. 1956 [T-MTT])." 1956 Transactions on Microwave Theory and Techniques 4.4 (Oct. 1956 [T-MTT]): 271-274.



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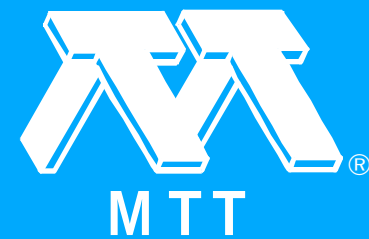
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Biography - J. R. Whinnery

"Biography - J. R. Whinnery." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 2-2.

John R. Whinnery was born on July 26, 1916 in Read, Colo. He received the B.S. degree in electrical engineering from the University of California in 1937, and immediately went to work for the General Electric Company in Schenectady, N.Y. At the General Electric Company, Mr. Whinnery entered the three-year Advanced Engineering Program, and following that, supervised the high-frequency part of that program for two years. He then worked in the Electronics Laboratory and the Research Laboratory on problems in velocity-modulation tubes, traveling-wave tubes, and disk-seal triodes. In 1945-1946 he was also part-time lecturer in Union College.

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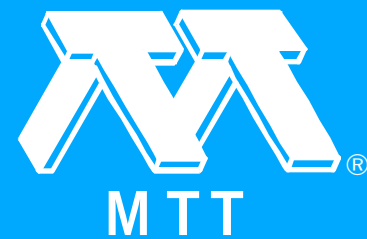


Abstracts

The Next Problem in Engineering Education

J.R. Whinnery. "The Next Problem in Engineering Education." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 3-3.

We have read very much in the past few years of the need for more engineers, so I shall not repeat the arguments here. Many of you have taken part in the very excellent programs designed to acquaint high school students with the opportunities in an engineering career, and I should first like to point out how successful these programs have been. This fact, I believe, is not generally realized. To use our own school as an example, enrollments during the past two years for the university as a whole have risen about 14 per cent, using the same standards of admitting only those among the upper 15 per cent of high school graduates. This rise reflects very nearly the increased birth rate at the end of the depression and the population growth of this area. During this same period, enrollment in engineering has increased about 50 per cent, and in electrical engineering 80 per cent. Although we do not break down the fields of interest further in the early undergraduate years, I believe the proportion of those interested in the microwave field is remaining nearly constant in spite of the competition from several newer fields.



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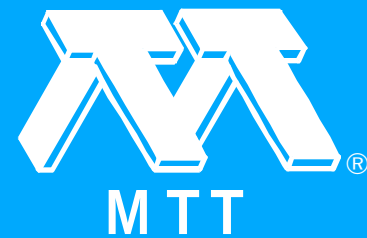


Abstracts

Broad-Band Balanced Duplexers

C.W. Jones. "Broad-Band Balanced Duplexers." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 4-12.

Balanced duplexer circuits are described and a comparison is made between the two principal configurations employing gaseous switching devices. The balanced tr duplexer is limited in power-handling ability, while the balanced atr duplexer has slightly greater received-signal insertion loss. An analysis is made of the reflecting properties of an atr array, and the practical upper limit of the number of array elements is determined.



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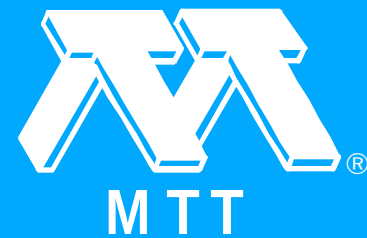


Abstracts

Calculation of the Parameters of Ridge Waveguides

T.-S. Chen. "Calculation of the Parameters of Ridge Waveguides." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 12-17.

In this paper an algebraic expression which constitutes an approximation to Cohn's transcendental equation is given for the determination of the dominant-mode cutoff wavelength of ridge waveguides. A modified derivation of Mihran's equation for calculating the characteristic impedance of ridge waveguides is discussed. Based upon these formulas, nomography are constructed to permit the determination of these parameters with sufficient accuracy when the waveguide and the ridge dimensions vary. Experimental verification of the calculated cutoff wavelength is included.



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Excitation of Higher Order Modes in Spherical Cavities

R.N. Ghose. "Excitation of Higher Order Modes in Spherical Cavities." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 18-22.

An analysis for determining approximately the optimum position of the exciting source inside a spherical cavity for exciting any TE or TM mode is presented. For any TE or TM mode the orientation of the exciting probe or loop is determined by maximizing the surface integral of $|\bar{H}|$ or line integral of $|\bar{A}|$ which is proportional to the excitation coefficient for the corresponding mode. Specific examples of mode discrimination by proper orientation of the exciting source are also included in the paper. Besides, graphs of the surface integral of $|\bar{H}|$ and the line integral of $|\bar{A}|$ for various modes are presented to indicate the variation of mutual inductance for any mode, for different positions of the exciting source.

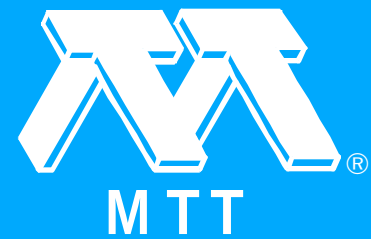


Abstracts

Strip Line Hybrid Junction

H.G. Pascalar. "Strip Line Hybrid Junction." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 23-30.

The equivalent circuit of a strip line network is shown to display the properties of a hybrid junction. An application is illustrated by design of a balanced mixer and the presentation of the resultant measured data.



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Losses in Dielectric Image Lines

D.D. King and S.P. Schlesinger. "Losses in Dielectric Image Lines." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 31-35.

The dipole mode in a dielectric rod permits an image system in which half the dielectric and its surrounding field are replaced by a metal sheet. If the field is allowed to extend many wavelengths outside the rod, the resulting line has very low losses. The contribution of the image surface to line loss is calculated, and shown to be generally less than the dielectric loss. Radiation from obstacles along the line is also discussed. Such obstacles in closed single-mode waveguides are useful for matching purposes. Although matching elements are easily constructed for the image line, radiation loss proves difficult to control.



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General Synthesis of Quarter-Wave Impedance Transformers

H.J. Riblet. "General Synthesis of Quarter-Wave Impedance Transformers." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 36-43.

This paper presents the general synthesis of a radio frequency impedance transformer of n quarter-wave steps, given an "insertion loss function" of permissible form. This procedure parallels that of Darlington for lumped constant filters by providing the connection between Collin's canonical form for the insertion loss function and Richards' demonstration that a reactance function may always be realized as a cascade of equal length impedance transformers terminated in either a short or open circuit. In particular, it is shown that insertion loss functions of the form selected by Collin are always realizable with positive characteristic impedances, and that the synthesis procedure, for maximally flat and Tchebycheff performance, involves the solution, at most, of quadratic equations. In addition, this procedure permits the proof of Collin's conjecture that, for his insertion loss function, the resulting reflection coefficients are symmetrical. Finally, closed expressions are given for the coefficients of the input impedance of a given n section transformer in terms of the n characteristic impedances and vice versa.

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An Analysis of the Diode Mixer Consisting of Nonlinear Capacitance and Conductance and Ohmic Spreading Resistance

A.C. Macpherson. "An Analysis of the Diode Mixer Consisting of Nonlinear Capacitance and Conductance and Ohmic Spreading Resistance." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 43-51.

A method is presented for calculating the mixer admittance matrix Y' which results when an ohmic impedance is connected in series with a diode mixer described by an admittance matrix Y . There are no restrictions on the frequency dependence of the ohmic impedance nor on the number of harmonic sidebands considered. The equations are worked out in detail for the "low Q " case in which signal, image, and intermediate frequencies are considered, and it is shown that Y' in this case is "nearly low Q ." As a result of this analysis the usual criterion for good high-frequency mixing, i.e., that the product of the spreading resistance and the barrier capacitance be small compared with unity, is criticized and a new figure of merit is proposed. Explicit formulas have been derived for calculating the elements of Y' when Y represents the parallel combination of a nonlinear conductance and capacitance. In general, these formulas are cumbersome, but three special cases have been considered in detail.

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Resonance Properties of Ring Circuits

F.J. Tischer. "Resonance Properties of Ring Circuits." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 51-56.

The ring guide or ring circuit, a microwave device consisting of a waveguide having the ends connected to form an annular ring, has properties similar to those of ordinary resonant cavities. Wave propagation within the ring guide, its interaction with a waveguide to which it is coupled, and its resonant circuit properties are investigated in this report. The properties of a prototype circuit consisting of a ring guide of rectangular cross section were found to agree with theory.

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Frequency Stabilization of a Microwave Oscillator with an External Cavity

I. Goldstein. "Frequency Stabilization of a Microwave Oscillator with an External Cavity." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 57-62.

This paper describes a procedure by which a cavity stabilizer may be designed for a microwave oscillator. Formulas are derived for the following essential design parameters: 1) stabilization factor; 2) stabilization range; 3) vswr of the stabilizer circuit with cavity tuned; 4) vswr of the stabilizer circuit with the cavity detuned; and 5) insertion loss of the cavity assembly. The validity of designing with the derived relations has been experimentally confirmed.

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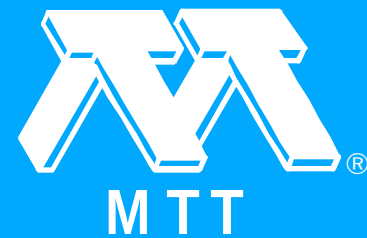


Abstracts

Cooling of Microwave Crystal Mixers and Antennas

G.C. Messenger. "Cooling of Microwave Crystal Mixers and Antennas." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 62-63.

The development of low-noise mixer crystals has reached the point where the noise figure is approaching fundamental, theoretical limits. The desire for still greater sensitivity has led to the consideration of other possible means for noise reduction. This paper will discuss two possibilities: physically cooling the mixer crystal, and using an antenna directed toward background noise which is lower than room temperature. The improvement which can be realized increases rapidly as the room-temperature noise figure is reduced.



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Measurement and Control of Microwave Frequencies by Lower Radio Frequencies

R.C. Mackey and W.D. Hershberger. "Measurement and Control of Microwave Frequencies by Lower Radio Frequencies." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 64-68.

From the fields of nuclear and paramagnetic resonance comes a relation between precession frequency and magnetic field strength for nuclei and unpaired electrons. The relation is such that $f_{\text{n}}/K_{\text{n}} = f_{\text{e}}/K_{\text{e}}$ for nuclei and $f_{\text{e}}/K_{\text{e}} = f_{\text{n}}/K_{\text{n}}$ for electrons. Thus if the frequency of one oscillator is set for f_{n} and the frequency of another oscillator is adjusted so that simultaneous nuclear and electronic resonance occurs in the same magnetic field, the frequency ratio of the oscillators is given by the ratio of K_{e} to K_{n} . Values of K_{e} and K_{n} have been tabulated for many substances and therefore allow frequency comparisons to be made. For example, protons in mineral oil and electrons in hydrogen have a precession frequency ratio of 658.228; hence for an f_{e} in x band, f_{n} is about 14 mc when the magnetic field is 3300 Gauss. Changing the value of H causes the frequencies to move up or down the frequency scale but their ratio is always constant. By this method microwave frequencies may be measured with equipment of a much lower frequency range. The precision of measurement is limited by the widths of the nuclear and electronic resonance curves and runs between one part in 10^4 to 10^5 . This frequency measurement method may be made the basis of automatic control of microwave frequencies by quartz crystals or very stable lower frequency oscillators. An experimental model of such a system has been constructed and operated.





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Discontinuities in a Rectangular Waveguide Partially Filled with Dielectric

C.M. Angulo. "Discontinuities in a Rectangular Waveguide Partially Filled with Dielectric." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 68-74.

The modal spectrum for a rectangular waveguide with a dielectric slab at the bottom of the guide is obtained following the Characteristic Green's Function method developed by Marcuvitz. Then a four-terminal network is found as equivalent to the junction of the partially filled waveguide and an empty rectangular waveguide. An integral equation is written for the electric field at the plane of the junction and variational expressions are derived for the parameters of the four-terminal network connecting the transmission line equivalent to the partially filled waveguide to the transmission line equivalent to the empty guide. A reasonable guess for the electric field at the discontinuity gives approximate values for the parameters of the four-terminal network. These values agree with experiment. The parameters of the network are plotted vs frequency and thickness of the slab.

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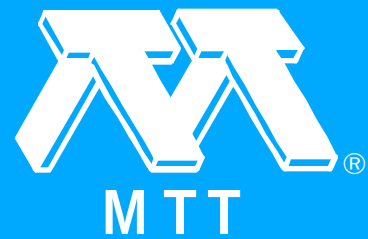


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Optimum Bandwidth for Waveguide-to-Coaxial Transducers (Correspondence)

D.S. Friedman. "Optimum Bandwidth for Waveguide-to-Coaxial Transducers (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 75-77.

Mumford has determined a method for optimizing the bandwidth of waveguide-to-coaxial transducers.



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Planar Transmission Lines--I (Addendum)

D. Park. "Planar Transmission Lines--I (Addendum)." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 75-75.

If it is desired to use fine wires of diameter a instead of these flat strips, an elementary argument shows that the characteristic impedance is given.



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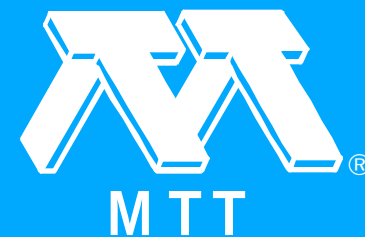
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C.M. Angulo, T.-S. Chen, R.N. Ghose, I. Goldstein, W.D. Hershberger, C.W. Jones, D.D. King, R.C. Mackey, A.C. Macpherson, G.C. Messenger, H.G. Pascalar, H.J. Riblet, S.P. Schlesinger and F.J. Tischer. "Contributors (Jan. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.1 (Jan. 1957 [T-MTT]): 75-77.



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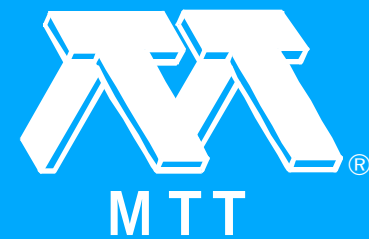
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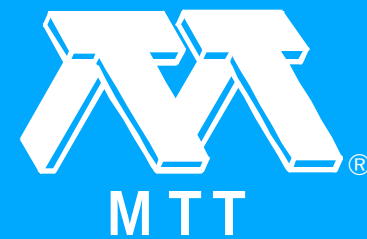
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Table of Contents (Apr. 1957 [T-MTT])

"Table of Contents (Apr. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 79-79.



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Abstracts

Message from the Editor (Apr. 1957 [T-MTT])

T.S. Saad. "Message from the Editor (Apr. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 80-80.

Beginning with the next issue of these Transactions, Kiyo Tomiyasu will be the Editor. The last two years have seen these Transactions grow both in size and quality of contents. The growth has been a healthy one, and there appears to be every reason to believe that it will continue. In closing my term of office, I would like to thank the various people who have helped to make these Transactions possible. These people include the members of the editorial board whose names are listed below, the Administrative Committee of the Professional Group, the editorial staff at IRE Headquarters, and the many fine authors without whom these Transactions would not exist.



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Biography - Alfred C. Beck

"Biography - Alfred C. Beck." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 81-81.

Alfred C. Beck was born in Granville, N. Y., on July 26, 1905. He received the E.E. degree from Rensselaer Polytechnic Institute in 1927. During the summers of 1926 and 1927 he worked in the Test Department of the New York Edison Company on various electric power projects, and through the academic year, 1927-1928, he was an instructor in mathematics at Rensselaer Polytechnic Institute. Graduate courses in communications during that year, and experience as a radio amateur (W2AGG), convinced him that his interests were along the lines of radio communication.

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Communication Superhighways

A.C. Beck. "Communication Superhighways." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 82-82.

Because of advances in communication, it has been said that more progress has been made in science and general living conditions in the last fifty years than in all the thousands of years preceding. Part of this is due to transportation improvements in all divisions--land, water, and air. Today, auto trips from New York to Chicago in about fifteen hours demonstrate strikingly what a big advance turnpikes make in surface travel. Such thoroughfares are important for the trucking industry, too, and government is pushing superhighway construction all over the country. On these highways traffic has exceeded all estimates, thus proving their value. The telephone is one of the important parts of the communication art which has contributed so much to our way of living. In its early days, amplification became a necessity for extending the talking distances, and fifty years ago the birth of the electron tube made this practical, as well as ushering in the electronic art which gave us our profession. And this tube, by the process of modulation, led to carrier systems, stacking up many individual channels on single transmission lines that became highways of communication. This was a big advance, greatly reducing the cost and increasing the amount of long distance traffic.

Click on title for a complete paper.

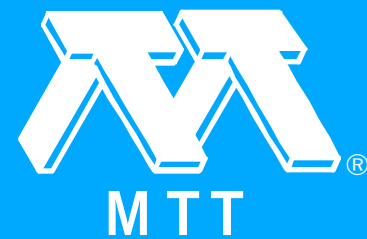


Abstracts

Report of Advances in Microwave Theory and Techniques-1956

D.D. King. "Report of Advances in Microwave Theory and Techniques-1956." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 83-91.

Microwave theory and techniques include the transmission, control, and measurement of waves of centimeter or millimeter length. The methods applicable in this region differ sufficiently from those at lower frequency to constitute a rather well-defined discipline. This area is the subject of our review. Several subjects contiguous to the microwave domain are excluded. Thus, antenna and propagation problems do not exhibit so clearcut a change with wavelength, and are mentioned only indirectly. The electronic aspects of microwave generators are also omitted, although much work on the circuits for these generators is necessarily included.



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Coupled Strip Transmission Lines with Rectangular Inner Conductors

J.D. Horgan. "Coupled Strip Transmission Lines with Rectangular Inner Conductors." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 92-99.

A method is presented for determining the capacitance of electrostatic fields which have hitherto proved intractable because their solutions required the evaluation of hyperelliptic integrals. The method is illustrated by applying it to the determination of the characteristic impedance of a strip transmission line. The results compare favorably with the results of existing solutions. The method is then used to determine the characteristic impedance of coupled strip transmission lines with inner conductors of rectangular shape. Curves are included which permit the determination of this impedance over a wide range of line proportions.

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

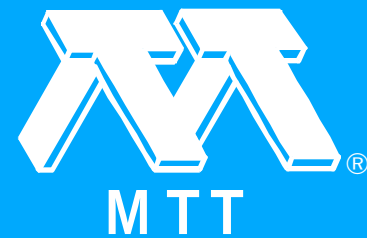


Abstracts

The Impedance of a Wire Grid Parallel to a Dielectric Interface

J.R. Wait. "The Impedance of a Wire Grid Parallel to a Dielectric Interface." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 99-102.

Analysis is given for the problem of reflection of a plane wave at oblique incidence on a wire grid which is parallel to a plane interface between two homogeneous dielectrics. It is assumed that the wire grid is a periodic structure and consists of thin cylindrical wires of homogeneous material. The equivalent circuit is derived where it is shown that the space on either side of the interface can be by a transmission line, and the grid itself is represented by a pure shunt element across one of the lines.



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Semicircular Ridges in Rectangular Waveguides

J.G. Van Bladel and O. Von Rohr, Jr.. "Semicircular Ridges in Rectangular Waveguides." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 103-106.

The two-dimensional Helmholtz equation is solved in a rectangle having two semicircular projections in the center of its broad faces. More particularly, the lowest two eigenvalues are determined for Neumann's boundary condition, and the lowest eigenvalue for Dirichlet's boundary condition. The results are of interest in various fields of physics, such as vibrations of a membrane, but are of particular importance in the study of waveguide propagation. The latter application is stressed in the article, in accordance with the practical importance of ridged waveguides.

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

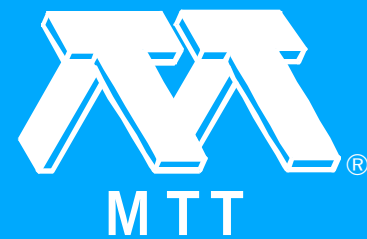


Abstracts

Synthesis of a Class of Microwave Filters

H. Seidel. "Synthesis of a Class of Microwave Filters." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 107-114.

This paper deals with the development of a new model for a class of microwave filters. With this model one can reproduce and systematize from a general viewpoint results now in the literature. Its most prominent feature, however, is that the use of the model permits the development of a synthesis procedure for the wide-band filter. From this single model a wide variety of structural realizations are readily obtained. Designs employing this model, and the appropriate synthesis, show significant improvement of desired characteristics over conventional designs. The general multiple quarter wave matching transformer problem is also discussed.



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Single Slab Arbitrary Polarization Surface Wave Structure

R.C. Hansen. "Single Slab Arbitrary Polarization Surface Wave Structure." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 115-120.

A single grounded dielectric slab can support either TM or TE modes, but cannot propagate both with the same velocity. This paper concerns a modification of the single slab which enables either polarization to propagate with the same velocity. Such a structure could transmit a circularly polarized wave, and would be useful in transmission, feeder, and antenna applications. The structure consists of a grounded dielectric slab with parallel metal plates imbedded in the dielectric, normal to and in contact with the ground plane. The plates do not reach the top of the slab. Propagation is along the plates, whereas corrugated surfaces propagate across the vanes. For small plate thickness, the TE field is undisturbed; hence, the entire slab thickness controls the velocity. The TM field, however, has an electric field component parallel to the plates, which is shorted out by the plates; thus, only the thickness of slab above the plates controls this mode, and the two modes can be independently controlled.

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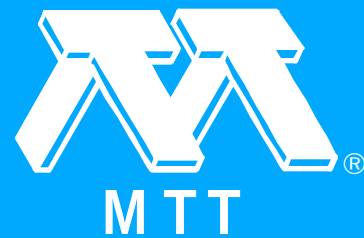


Abstracts

The Effects of Reflections from Randomly Spaced Discontinuities in Transmission Lines

R.K. Moore. "The Effects of Reflections from Randomly Spaced Discontinuities in Transmission Lines." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 121-126.

Reflections from randomly spaced transmission line discontinuities can cause serious attenuation and distortion of pulses in the lines, and the presence of reflections at the sending end may be undesirable. The effect of these discontinuities may be described in terms of the mathematics for combining outputs from oscillators with random frequencies. The location of the discontinuity corresponds to the frequency of an oscillator. The phase constant of the transmission line is analogous to time for the oscillators. Use of spectrum and filter analogies permits approximate determination of discontinuity locations from measurements. Use of known space and size distributions permits statistical prediction of attenuation and of size of reflected wave at the sending end.



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The Statistical Prediction of Voltage Standing-Wave Ratio

J.A. Mullen and W.L. Pritchard. "The Statistical Prediction of Voltage Standing-Wave Ratio." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 127-130.

The problem of predicting the probability distribution of vswr for many randomly spaced discontinuities is solved using the "central limit theorem." Assuming that reflection factors add in the complex plane and using the "central limit theorem" the result is shown to be a Rayleigh distribution in terms of the reflection factor. The probability of the vswr over a band of frequencies is calculated using the concept that this band of frequencies can be considered as a number of statistically independent samples.

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Performance of Three-Millimeter Harmonic Generators and Crystal Detectors

J.M. Richardson and R.B. Riley. "Performance of Three-Millimeter Harmonic Generators and Crystal Detectors." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 131-135.

Because of growing applications of millimeter wave measurements, a fairly thorough investigation of what could be expected from sources and detectors in the 3 mm region was made. The sources consisted of fourth-harmonic generators from a 1.25 cm fundamental. A type of crystal holder for both harmonic generators and detectors in which a small crystal wafer is positioned in the broad wall of the millimeter waveguide, being contacted by a whisker passing across the waveguide (the open-guide type) was found to be superior in general to units using crystal cartridges or modifications thereof. Factors affecting the performance of these units have been investigated statistically. It was found that the short-circuit current sensitivity in microamperes per microwatt of a good crystal detector of the type described above is not greatly less than the value for crystals at lower microwave frequencies, so that the minimum detectable signal is about the same. As an additional result, evidence for an important effect in which the harmonic generation process degrades the signal-to-noise ratio of the source is presented and discussed.

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Circularly Polarized Microwave Cavity Filters

C.E. Nelson. "Circularly Polarized Microwave Cavity Filters." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 136-147.

A new group of circularly polarized microwave cavity filters is described. With a single circularly polarized cavity, a reflectionless filter is achieved that couples nearly 100 per cent of the energy from the main waveguide at the cavity resonant frequency. Two degenerate cavity modes may be excited, to produce a circularly polarized field, by coupling to the transverse and longitudinal waveguide magnetic fields or to the transverse electric and magnetic waveguide fields. A theoretical analysis is presented as well as experimental results. The loss between the band-pass terminals of the reflectionless circularly polarized filter is identical with the loss in a conventional reflectiontype band-pass filter with the same bandwidth and cavity-wall losses. The null at resonance between the band-elimination terminals of the reflectionless circularly polarized filter is limited only by the asymmetries of the cavity and not by the cavity-wall losses. Design equations and curves are given for eight of the lower order, circularly cylindrical, degenerate cavity modes that are coupled to a rectangular waveguide at the point of circularly polarized waveguide magnetic fields.

Click on title for a complete paper.

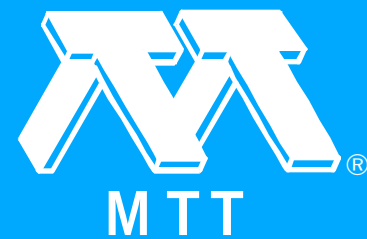


Abstracts

Reference Cavity Design Considerations

W.A. Gerard. "Reference Cavity Design Considerations." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 148-152.

The design problems in a reference cavity include coupling, cavity Q, temperature compensation, stability, and hysteresis. Temperature compensation is shown to be a problem in second order compensation theory and is solved by material changes. Stability is achieved by novel mechanical design and by elimination of hysteresis producing members.



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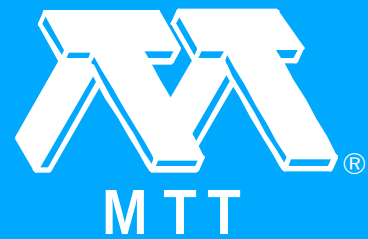


Abstracts

The Relationship of Physical Applications of Fourier Transforms in Various Fields of Wave Theory and Circuitry

E.F. Bolinder. "The Relationship of Physical Applications of Fourier Transforms in Various Fields of Wave Theory and Circuitry." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 153-158.

A procedure is presented for connecting some known physical applications of Fourier transform pairs in different branches of the theory of waves and circuitry. After an investigation of the cases of diffraction, reflection, and coupling of waves, deflection of particles (which includes the cathode-ray-tube case and so-called gap effect) and the closely related scanning problem are examined. Finally, extension to random functions is discussed briefly.



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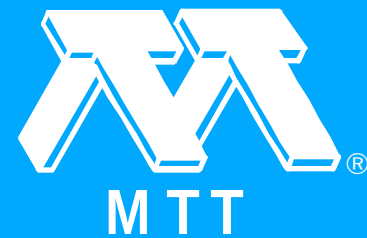


Abstracts

A Variant in the Measurement of Two-Port Junctions

G. Deschamps. "A Variant in the Measurement of Two-Port Junctions." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 159-161.

Projective constructions are described for deducing the iconocenter of a two-port junction from input reflection coefficient measurements taken with a short circuit placed in various positions in the output waveguide. The wavelength in the output line is deduced from a four-point measurement. If this wavelength is known in advance, a three-point measurement gives all the information needed to construct the iconocenter.



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Abstracts

WESCON Papers' Deadline Set for May 1 (Correspondence)

"WESCON Papers' Deadline Set for May 1 (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 161-161.

Authors wishing to present papers at the 1957 WESCON Convention to be held in San Francisco, Calif., on August 20-23 should send 100-200 word abstracts, together with complete texts or additional detailed summaries, to the Technical Program Chairman, D. A. Watkins, Stanford Electronics Laboratories, Stanford University, Stanford, Calif., for consideration by the Technical Program Committee. Authors will be notified whether or not their papers have been accepted by June 1.



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Abstracts

The IRE "Affiliate" Plan--A New Venture in Engineering Society Structure and Service (Correspondence)

W.R.G. Baker. "The IRE "Affiliate" Plan--A New Venture in Engineering Society Structure and Service (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 161-161.

On January 4, 1957, the IRE Board of Directors arrived at a decision which may in time prove to be one of the most far-reaching in its 45-year history. On that date the Board adopted a plan which will enable non-IRE members whose main professional interests lie outside the sphere of IRE activities to become affiliated with certain of the IRE Professional Groups without first having to join the IRE itself.



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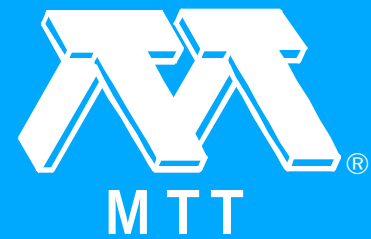


Abstracts

Matching the Sides of a Parallel-Plate Region (Correspondence)

A.C. Hudson. "Matching the Sides of a Parallel-Plate Region (Correspondence)." 1957 *Transactions on Microwave Theory and Techniques* 5.2 (Apr. 1957 [T-MTT]): 161-162.

One of the simplest forms of electromagnetic wave is a TEM wave propagating between parallel conducting planes which extend laterally to infinity.



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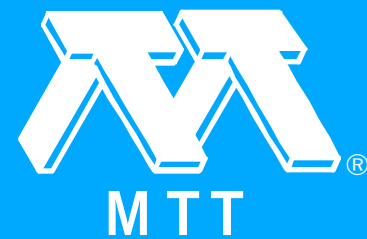


Abstracts

A Method of Analysis of Symmetrical Four-Port Networks (Correspondence)

J. Reed. "A Method of Analysis of Symmetrical Four-Port Networks (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 162-163.

The following errors appeared in the above article. On page 248 the C term in the matrix for Fig. 11 should be $j(-a^2c^2+2ac+a^2-1)$. Also, on page 249 the term for T+- for the rat race ring should be $T_{+-} = -j/\sqrt{2}$.



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Miniature Waveguide Flanges Unpressurized Contact Type (Correspondence)

T.N. Anderson. "Miniature Waveguide Flanges Unpressurized Contact Type (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 162-162.

I would like to call attention to the fact that RETMA Standard RS-166 with the above title and dated October, 1956, has been released. Copies of the Standard can be obtained through the Engineering Department of the RETMA, 11 West 42nd Street, New York 36, N. Y.

Click on title for a complete paper.

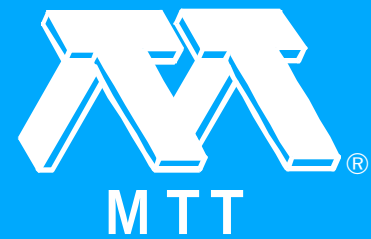


Abstracts

Criteria for the Design of Loop-Type Directional Couplers for the L Band (Correspondence)

R.F. Schwartz. "Criteria for the Design of Loop-Type Directional Couplers for the L Band (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 162-162.

We have noted several errors in the above articles and the corrections are as follows:



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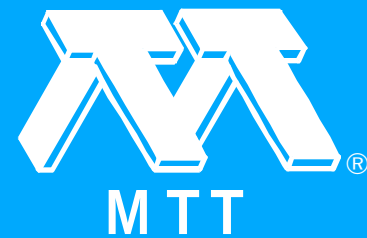


Abstracts

Planar Transmission Lines--Part III (Correspondence and Author's Reply)

K.S. Packard, Jr. and D. Park. "Planar Transmission Lines--Part III (Correspondence and Author's Reply)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 163-163.

The following area few comments on the above. This paper purports to derive criteria for the optimum line from the standpoint of stability and attenuation. The conclusions arrived at, however, are erroneous.



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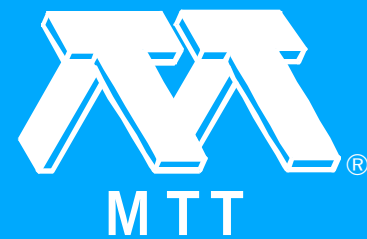


Abstracts

A Low VSWR Matching Technique (Correspondence and Authors' Reply)

L. Goldstone and P.A. Rizzi. "A Low VSWR Matching Technique (Correspondence and Authors' Reply)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 163-163.

I would like to call your attention to a certain error in the above correspondence. The admittance function plotted by the author on the Smith chart winds counter-clockwise. This is contrary to the laws of nature for passive linear networks. These laws prescribed that the plot of the admittance function wind clockwise from the low to the high frequency.



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A Broad-Band Microwave Circulator (Correspondence and Authors' Reply)

A. Clavin and E.A. Ohm. "A Broad-Band Microwave Circulator (Correspondence and Authors' Reply)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 164-165.

Edward A. Ohm has recently shown some applications of microwave circulators, first suggested by A. G. Fox, S. E. Miller, and W. W. Mumford of the Bell Telephone Laboratories. One in particular, a circulator microwave modulator, I believe, needs some further discussion. This device is shown in Fig. 1. As shown, the energy from the oscillator travels to the port containing the modulator, where it is modulated, reflected from the short circuit, passed back through the modulator and to the output arm of the circulator. Let us consider what occurs if the modulator is a typical ferrite type modulator, like those commercially available. This modulator is shown in Fig. 2.

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On Symmetrical Matching (Correspondence and Author's Replies)

J. Reed and H.F. Mathis. "On Symmetrical Matching (Correspondence and Author's Replies)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 165-167.

Mr. Mathis' note is correct in that a match is achieved with the three shunt susceptances, but he is wrong in his assertion that no other positioning is possible for match. His method of matching is outlined in Fig. 1.

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Abstracts

The Available Power of a Matched Generator from the Measured Load Power in the Presence of Small Dissipation and Mismatch of the Connecting Network (Correspondence)

L.O. Sweet and M. Sucher. "The Available Power of a Matched Generator from the Measured Load Power in the Presence of Small Dissipation and Mismatch of the Connecting Network (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 167-168.

It is sometimes necessary to determine the available power of a matched generator in terms of the power dissipated in a load when the load is connected to the generator by means of a slightly mismatched 4-pole having small loss. (A piece of waveguide or short length of coaxial line could exemplify such a 4-pole; the discontinuities at flanges or at connectors and supporting beads could give rise to the slight mismatch.)



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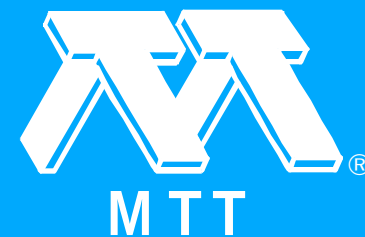
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Abstracts

Contributors (Apr. 1957 [T-MTT])

E.F. Bolinder, G. Deschamps, W.A. Gerard, R.C. Hansen, J.D. Horgan, D.D. King, R.K. Moore, J.A. Mullen, C.E. Nelson, W.L. Pritchard, J.M. Richardson, R.B. Riley, H. Seidel, J.G. Van Bladel, O.E. von Rohr, Jr. and J.R. Wait. "Contributors (Apr. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): 169-170.



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"Back Cover (Apr. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.2 (Apr. 1957 [T-MTT]): b1-b2.



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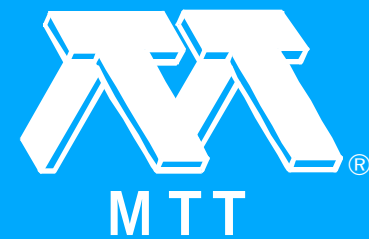
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"Front Cover (Jul. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): f1-f2.



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Abstracts

Biography - Sergei Alexander Schelkunoff

"Biography - Sergei Alexander Schelkunoff." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 172-172.

Sergei Alexander Schelkunoff was born in Russia in 1897. In the early years of his primary and secondary education he was interested in almost everything except mathematics which he would not have passed at all if it were not for the kindness of his teachers.



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Microwaves and Mathematics

S.A. Schelkunoff. "Microwaves and Mathematics." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 173-173.

Mathematics and mathematicians play an essential role in the development of science and engineering. This is particularly conspicuous in the case of electromagnetic theory and microwave engineering. In the preface to his famous treatise, Maxwell refers to Gauss as the man who " . . . brought his powerful intellect to bear on the theory of magnetism, and on the methods of observing it, and [who] not only added greatly to our knowledge of the theory of attractions, but reconstructed the whole of magnetic science as regards the instruments used, the methods of observation, and the calculation of the results. . . ." Maxwell also adds: "The great success which these eminent men [Gauss, Weber, Riemann, J. & C. Neumann, Lorentz, etc.] attained in the application of mathematics to electrical phenomena, gives, as is natural, additional weight to their theoretical speculations. . ." But a note of dissatisfaction is sounded in "There is also a considerable mass of mathematical memoirs which are of great importance in electrical science, but . . . they are for the most part beyond the comprehension of any but professed mathematicians."

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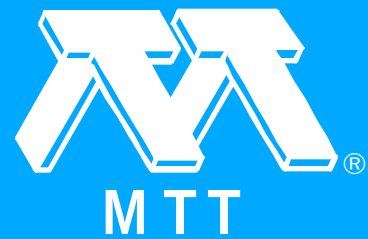


Abstracts

Well Done, Ted

H.F. Engelmann. "Well Done, Ted." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 174-174.

We are all indebted to Ted Saad for his three years of tireless work as editor of our magazine. It does not take more than a brief glance through these pages to see what an exhausting time-consuming job it must be to both edit and coordinate the material for such a highly technical and valuable publication.



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Abstracts

A Modified Equal-Element Band-Pass Filter

R. Bawer and G. Kefalas. "A Modified Equal-Element Band-Pass Filter." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 175-176.

A method is presented whereby considerable improvement in the frequency response of a five-stage, equal-element waveguide filter can be realized while preserving nearly all the structural simplicity of this realization. It is shown that by increasing the loaded Q of the center resonant element of a five-stage, equal-element filter, the pass band ripple can be appreciably reduced and the skirt selectivity improved. The modified design also provides a simple means of bandwidth adjustment.



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Application of Rayleigh-Ritz Method to Dielectric Steps in Waveguides

R.E. Collin and R.M. Vaillancourt. "Application of Rayleigh-Ritz Method to Dielectric Steps in Waveguides." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 177-184.

The Rayleigh-Ritz method is applied to obtain approximations to the first N eigenfunctions and corresponding eigenvalues in an inhomogeneously filled rectangular waveguide. These approximate eigenfunctions are then used to obtain a solution for the reflection and transmission coefficients at the junction of an empty and partially filled waveguide. Theoretical and experimental results are given for a dielectric slab which extends completely across the broad dimension of the guide, but only partially across the narrow dimension. The experimental values are within the experimental error of the computed values obtained by considering the dominant mode and only two evanescent modes.

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



Abstracts

Coupling through an Aperture Containing an Anisotropic Ferrite

D.C. Stinson. "Coupling through an Aperture Containing an Anisotropic Ferrite." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 184-191.

Coupling through an aperture containing anisotropic ferrites is investigated theoretically by a simple extension of Bethe's hole coupling theory to include the dipole moment of the body in the aperture. The magnetic dipole moment of the ferrite body is ordinarily a vector but becomes a tensor upon the application of a field. This new theory is applicable to any situation where Bethe's small-hole coupling theory is valid. Experimental verification was quite satisfactory and was obtained on two Bethehole couplers: one with the waveguides parallel, and the other with the waveguides perpendicular.



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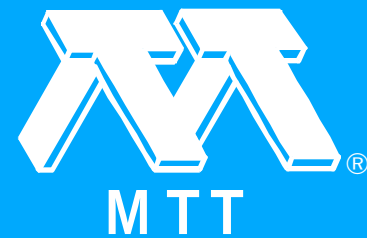


Abstracts

An Adjustable Sliding Termination for Rectangular Waveguide

R.W. Beatty. "An Adjustable Sliding Termination for Rectangular Waveguide." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 192-194.

A new adjustable sliding termination for rectangular waveguide has been developed. The termination is of simple design and can easily be adjusted to have reflection coefficients from zero to nearly unity in magnitude and any desired phase. In addition to the usual applications of adjustable sliding terminations for rectangular waveguide, it provides a suitable design for an adjustable transferor secondary standard of impedance for rectangular waveguide systems.



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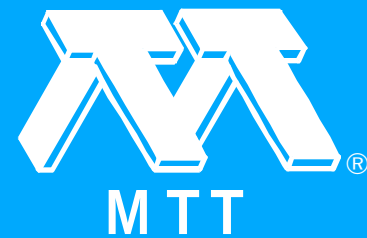


Abstracts

Field Displacement Isolators at 4,6,11, and 24 KMC

S. Weisbaum and H. Boyet. "Field Displacement Isolators at 4,6,11, and 24 KMC." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 194-198.

Performance of ferrite field displacement isolators at various frequency bands is described. Single and double-slab isolators have been constructed in rectangular waveguide. Four single-slab isolators are reported in the following frequency bands: 3700-4200 mc; 5925-6425 mc; 10,700-11,700 mc and 23,500-24,470 mc; one double-slab isolator is described in the frequency range 10,700-11,700 mc.



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A Method of Producing Broad-Band Circular Polarization Employing an Anisotropic Dielectric

H.S. Kirschbaum and S. Chen. "A Method of Producing Broad-Band Circular Polarization Employing an Anisotropic Dielectric." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 199-203.

A procedure is described whereby it is possible to design circular polarizers for both waveguides and in window form to be used over a broad band of frequencies. The difference in phase constants for two mutually orthogonal E fields while propagating in an anisotropic dielectric is combined with the effect due to guide wall spacing to obtain a reasonably constant differential phase constant for the two fields over a broad frequency band. By properly choosing the length of the anisotropic dielectric in the direction of propagation, and orienting this dielectric properly with respect to an incident linearly-polarized wave, the transmitted wave is circularly polarized over a correspondingly broad band of frequencies.

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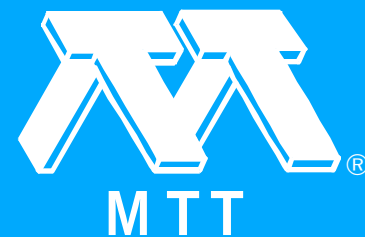


Abstracts

Errors in a Magic-Tee Phase Changer

R.M. Vaillancourt. "Errors in a Magic-Tee Phase Changer." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 204-207.

This paper recalls the basic properties of a magic-tee and how it can be used as a linear phase changer. An analysis of the symmetrical magic-tee phase changer is made, which shows that nonlinearities of the phase shift and amplitude modulation are second and higher order effects caused by small mismatches of the structure. Also, some qualitative comments are made on the errors of an asymmetrical phase changer. Measurements on a phase changer assembled from ordinary laboratory equipment show that the phase shift is linear to better than 1° .



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Excess Noise in Microwave Crystal Diodes Used As Rectifiers and Harmonic Generators

J.M. Richardson and J.J. Faris. "Excess Noise in Microwave Crystal Diodes Used As Rectifiers and Harmonic Generators." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 208-212.

Excess noise produced by microwave excitation of silicon crystal diodes was studied for operation of the crystal as a detector and as a microwave harmonic generator. The noise appears at the detector terminals and also as noise sidebands of the microwave harmonic, thus degrading the spectral purity of the harmonic relative to that of the fundamental. Possible models of the processes involved are presented. Difficulties and technique of measurement are discussed. Observations for 1N26 crystals, used as detectors, doublers, and triplers, and excited by X-band power in the range 8 to 100 mw are presented, showing limitations on spectral purity set by the process of noise production during harmonic generation.

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Exponential Transmission Lines as Resonators and Transformers

R.N. Ghose. "Exponential Transmission Lines as Resonators and Transformers." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 213-217.

An attempt has been made to analyze the theory of an exponential transmission line from its complex reflection coefficient's standpoint and to indicate how the characteristics of an exponential line can be completely represented for any frequency with the help of the Smith Chart. It is shown that the optimum design parameters of an exponential transmission line which maybe used as a transformer, with a frequency-sensitive load at one end, can be determined with the help of the Smith Chart and some derived equations. This paper also includes a study of the coaxial type exponential line which can be used as a series or parallel resonator. Theoretical expressions for the attenuation constant, stored energy, and Q for such types of resonator have been derived. Also indicated in this paper is the possibility of replacing the uniform-line coaxial-type resonators in many microwave and uhf wave filters by the exponential-line resonators, particularly when a large power-handling capacity is warranted.

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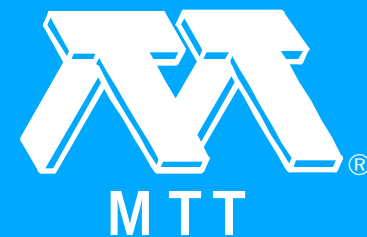


Abstracts

Rectangular and Ridge Waveguide (Correction)

T.N. Anderson. "Rectangular and Ridge Waveguide (Correction)." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 217-217.

Tore N. Anderson, author of the paper "Rectangular and Ridge Waveguide," which appeared on pages 201-209 of the October, 1956 issue of these Transactions, regrets the omission of the following reference.



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Abstracts

The Advantages of Expressing Standing-Wave Ratio in Decibels (Correspondence)

D. Dettinger. "The Advantages of Expressing Standing-Wave Ratio in Decibels (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 218-218.

It has been the practice at Wheeler Laboratories for the past ten years to express standing-wave ratio in decibels as opposed to a numerical ratio. So far as we are aware, this practice first evolved in the Bell Telephone Laboratories.



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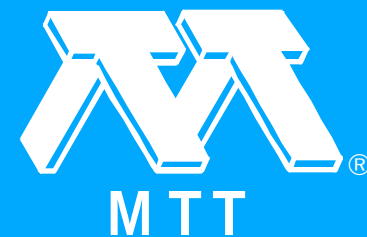


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Contributors (Jul. 1957 [T-MTT])

R. Bawer, R.W. Beatty, H. Boyet, S. Chen, R.E. Collin, J.J. Faris, R.N. Ghose, G.P. Kefalas, H. Kirschbaum, J.M. Richardson, D.C. Stinson, R.M. Vaillancourt and S. Weisbaum.

"Contributors (Jul. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): 219-220.



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"Back Cover (Jul. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.3 (Jul. 1957 [T-MTT]): b1-b2.



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"Front Cover (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): f1-f2.



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Table of Contents (Oct. 1957 [T-MTT])

"Table of Contents (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 221-221.



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Abstracts

Message from the Editor (Oct. 1957 [T-MTT])

K. Tomiyasu. "Message from the Editor (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 222-222.

In the preceding issue Herbert F. Engelmann, past Chairman of the PGMTT, expressed indebtedness to and congratulated Theodore S. Saad who for three years as editor devoted tireless efforts in building up the IRE Transactions on Microwave Theory and Techniques to a highly-technical and valuable publication. I wish to take this opportunity to endorse heartily this congratulation and to express hope that the high publication standard can be maintained.



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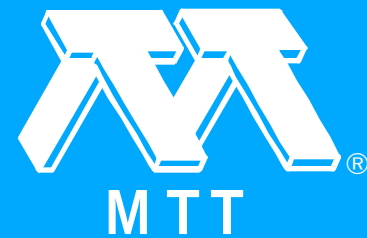


Abstracts

Biography - Wilmer L. Barrow

"Biography - Wilmer L. Barrow." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 223-223.

Wilmer L. Barrow is Vice-President for Research and Development of the Sperry Gyroscope Company, following previous appointments as Sperry's Chief Engineer in 1947 and as Vice-President in 1952. Formerly, he was on the faculty of Massachusetts Institute of Technology under wartime emergency as Director of Fire Control in 1943, and Director of Armament Engineering in 1945.



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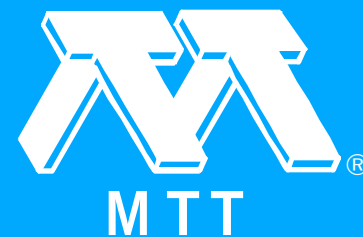


Abstracts

Yesteryear--Tomorrow

W.L. Barrow. "Yesteryear--Tomorrow." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 224-225.

It is an exciting experience for an individual to participate in the birth of a new technological discovery and then to live to see it develop from infancy into a mature and important factor in the world. Such an experience comes unexpectedly to only a few lucky individuals and then usually once in a lifetime. I have always considered myself fortunate to have shared this kind of experience with a few other fortunate persons in the opening up and growth of the modern microwave industry.



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Abstracts

Microwave Prize (Oct. 1957 [T-MTT])

W.L. Pritchard. "Microwave Prize (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 226-226.

The Professional Group on Microwave Theory and Techniques has established the Microwave Prize to recognize annually a significant paper which appeared in the IRE Transactions on Microwave Theory and Techniques. In selecting the paper, consideration is given primarily to the subject of the contribution and secondarily to its presentation. The award consists of a certificate, a monetary sum of \$100, and a feature publication in these Transactions. If the paper has more than one author, the monetary sum is to be divided equally among the authors.



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A Variable-Ratio Microwave Power Divider and Multiplexer

W.L. Teeter and K.R. Bushore. "A Variable-Ratio Microwave Power Divider and Multiplexer." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 227-229.

A microwave circuit is presented which provides continuous variation of microwave power between two outputs in any desired ratio. A typical device utilizing the circuit is described, and other uses of the circuit are discussed. An X-band power divider was constructed which had a vswr of less than 1.2 at all times over the frequency range of 8.6 to 9.6 kmc, divided the total input energy between the outputs in any ratio from 1/10,000 to 1, and had less than 0.4-db total insertion loss. No other losses were present. Adjustment could be made under maximum power levels of the waveguide. Another use of the circuit is to couple two high-power transmitters into one output, thus providing a dual frequency antenna coupler or diplexer. By cascading diplexers, multiplexing can be accomplished.

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High-Power Ferrite Circulators

P.A. Rizzi. "High-Power Ferrite Circulators." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 230-237.

The Faraday rotation and insertion loss of various ferrite-loaded waveguide structures have been studied in order to determine their power-handling capacities. A method of measuring insertion loss to within ± 0.05 db is described. Two figures of merit containing this information are defined for the various configurations. The first, defined as the rotation per attenuation, indicates for a given value of rotation the efficiency of power transmission through the device, while the second, defined as the dissipative area per power loss, indicates the power handling capacity of the structure. By utilizing this information, the author has described an X-band ferrite circulator which is capable of handling an average power of 1000 watts. In addition, the design of a 2000-watt gyrator type circulator is indicated.

Click on title for a complete paper.



Abstracts

Spectral Distribution of Thermal Noise in a Gas Discharge

S.M. Bergmann. "Spectral Distribution of Thermal Noise in a Gas Discharge." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 237-238.

By means of thermodynamic considerations it is shown under which conditions microwave noise power generated by a gas discharge can be considered thermal. A critical analysis of Mumford's hypothesis is made.



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Design of Aperture-Coupled Filters

F. Shnurer. "Design of Aperture-Coupled Filters." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 238-243.

A procedure for the design of aperture-coupled Filters is presented, based on the theory of conventional coupled circuits. This design procedure accounts for the relatively low insertion loss of aperture-coupled filters as compared with other known designs of microwave filters. The factors which contribute to this low value of insertion loss are the following: 1) Use of a high Q-mode configuration such as a cylindrical cavity in the TE/sub 011/ mode. 2) Aperture coupling of elements eliminating the losses of impedance transforming sections of transmission line. 3) A mechanical design which eliminates joints at critical points and also provides control over interior surface finishes.

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Optimum Impedance and Dimensions for Strip Transmission Line

K.S. Packard, Jr.. "Optimum Impedance and Dimensions for Strip Transmission Line." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 244-247.

This paper makes use of the higher mode limitations on the dimensions of symmetrical strip transmission line to derive the permissible dimensions at any given frequency and characteristic impedance. In conjunction with Cohn's results for the attenuation in strip transmission line these are used to obtain the maximum achievable Q at any frequency and the optimum characteristic impedance; that is, the impedance providing the lowest attenuation. This provides the basis for selecting the characteristic impedance for resonant elements in strip line filters and other applications wherein the lowest possible attenuation is desired. Conclusions are also reached regarding the best form factor (ratio of strip thickness to ground-plane spacing) for a given characteristic impedance.

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Deflection of Waveguide Subjected to Internal Pressure

L.G. Virgile. "Deflection of Waveguide Subjected to Internal Pressure." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 247-250.

The pressure carrying capacity of a large range of standard waveguide sizes can be readily determined by the use of formulas presented in this paper. The derivation of these formulas is obtained by a contiguous beam analogy and comparable test results are shown which substantiate the validity of the theoretical analysis. Where high pressure conditions prevent the use of standard waveguide, these same formulas are utilized in the development of special high-strength lightweight guide. Techniques for designing such waveguide, including the use of a honeycomb sandwich construction, are discussed.

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The Calibration of Microwave Attenuators by an Absolute Method

E. Laverick. "The Calibration of Microwave Attenuators by an Absolute Method." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 250-254.

A bridge method by means of which microwave attenuators can be calibrated absolutely is described, with a consideration of the main possible sources of error. A bridge was set up at $\lambda/2 = 3.2$ cm to test the principle of the method. It was shown that, using nonspecialized equipment, a high degree of accuracy was obtainable. An attenuator was calibrated over a range of 20 db, with an accuracy of the order of ± 0.02 db. This accuracy is within the accuracy of other methods of calibration in current use, and there seems no reason why, with suitable precautions, the order of accuracy should not be improved still further, if required.

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Pulse Waveform Degradation Due to Dispersion in Waveguide

R.S. Elliott. "Pulse Waveform Degradation Due to Dispersion in Waveguide." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 254-257.

Phase velocity in a waveguide is a nonlinear function of frequency and thus causes dispersion of the spectral components in a pulse waveform. For most practical cases, it is a good assumption to consider the phase constant to be a quadratic function of frequency. An expression can then be derived for the exit waveform shape as a function of guide length, dispersion, and width of the input rectangular pulse. The derived expression is given in terms of tabulated error functions and Fresnel integrals. It is universal in form and applicable to a wide range of practical problems. A family of degraded shapes has been computed from this expression and is presented graphically. The results apply for any mode in a straight waveguide of arbitrary but constant cross section.

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Broad-Band Quarter-Wave Plates

W.P. Ayres. "Broad-Band Quarter-Wave Plates." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 258-261.

Analytical expressions are given for the propagation constant for the two orthogonal dominant modes in a square waveguide loaded with a centered slab of dielectric. These are combined to find the differential phase shift in a loaded section. Solutions of these equations are given for polystyrene which enables one to design broad-band quarter wave plates. The problem of transforming from unloaded to loaded guide is discussed and two solutions are given and another suggested. Experimental results are given and it is found that the work in square guide carries over to circular guide almost intact. It is shown that quarter-wave plates may easily be designed to cover a normal waveguide bandwidth.

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Coherent Spontaneous Microwave Emission by Pulsed Resonance Excitation

L.E. Norton. "Coherent Spontaneous Microwave Emission by Pulsed Resonance Excitation." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 262-265.

This paper describes an investigation of the coherent microwave emission from pulse-excited ammonia molecules. Coherent and periodic pulses of near resonance frequency and 1-μsec duration excited the gas from its initial thermal equilibrium condition. Self-induced coherent emission (molecular ringing) continued after the excitation field was removed. This radiation was observed during a period of 10 μsec. In an actual experiment performed, a new Doppler bandwidth reduction method was used in the gas cell. The observed spectral width of the ammonia 7,7 line was about 5 kc. The emission was used to stabilize the excitation signal source to a short-term frequency stability of 2×10^{-10} .

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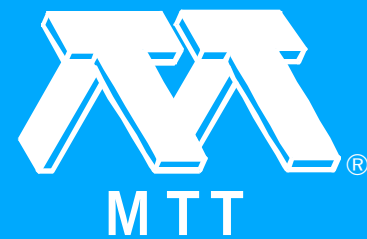


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Planar Transmission Lines--Part III (Correction)

K.S. Packard, Jr.. "Planar Transmission Lines--Part III (Correction)." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 265-265.

Karle S. Packard, author of "Planar Transmission Lines-Part III," a correspondence which appeared on page 163 of the April, 1957 issue of these Transactions, wishes to make the following correction to his paper.



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Abstracts

The Available Power of a Matched Generator from the Measured Load Power in the Presence of Small Dissipation and Mismatch of the Connecting Network (Correction)

L. Sweet and M. Sucher. "The Available Power of a Matched Generator from the Measured Load Power in the Presence of Small Dissipation and Mismatch of the Connecting Network (Correction)." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 265-265.

Leonard Sweet, co-author with M. Sucher of the correspondence, "The Available Power of a Matched Generator from the Measured Load Power in the Presence of Small Dissipation and Mismatch of the Connecting Network," which appeared on pages 167-168 of the April, 1957 issue of these Transactions, has brought the following correction to the attention of the editors.



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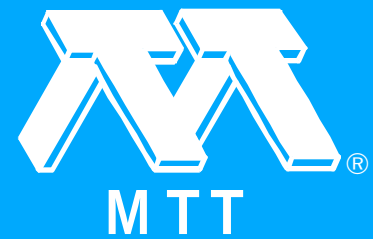
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Determination of Equivalent Circuit Parameters (Correspondence)

R.E. Collin. "Determination of Equivalent Circuit Parameters (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 266-267.

At a given frequency, a lossless discontinuity on a transmission line may be represented by an equivalent circuit consisting of an ideal transformer and two lengths of transmission line.

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Effect of a Mismatched Ring in a Traveling-Wave Resonant Circuit (Correspondence)

K. Tomiyasu. "Effect of a Mismatched Ring in a Traveling-Wave Resonant Circuit (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 267-268.

In traveling-wave resonant ring circuits wave amplitude "amplification" has been predicted and shown experimentally. In the present note, the input reflection coefficient (input vswr) and wave amplification are considered when the resonant ring circuit contains a mismatch. Qualitatively a small mismatch (low vswr) can produce under resonant conditions a greatly "magnified" input vswr and reduces the maximum attainable amplification in the ring.

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Abstracts

Application of Rayleigh-Ritz Method to Dielectric Steps in Waveguides (Correspondence)

C.M. Angulo. "Application of Rayleigh-Ritz Method to Dielectric Steps in Waveguides (Correspondence)." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 268-268.

Collin and Vaillancourt write that in a previous paper of mine: "the coupling of the LSE modes by the step when a LSM mode is incident is neglected."



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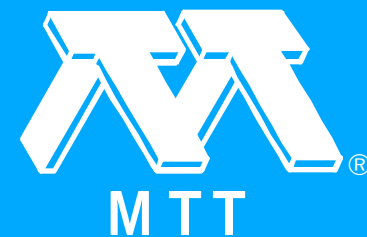
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Abstracts

Contributors (Oct. 1957 [T-MTT])

W.P. Ayres, S.M. Bergmann, K.R. Bushore, R.S. Elliott, E. Laverick, L.E. Norton, K.S. Packard, Jr., P.A. Rizzi, F. Shnurer, W.L. Teeter and L.G. Virgile. "Contributors (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): 268-269.



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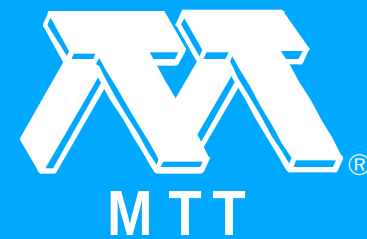
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Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-5, 1957

"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-5, 1957." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): i-iii.



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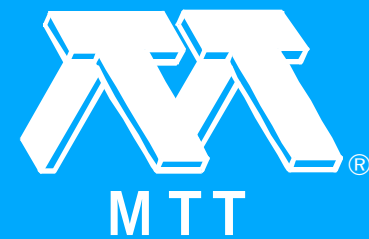
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Back Cover (Oct. 1957 [T-MTT])

"Back Cover (Oct. 1957 [T-MTT])." 1957 Transactions on Microwave Theory and Techniques 5.4 (Oct. 1957 [T-MTT]): b1-b2.



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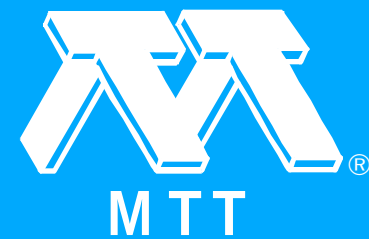
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Front Cover (Jan. 1958 [T-MTT])

"Front Cover (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): f1-f2.



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Table of Contents (Jan. 1958 [T-MTT])

"Table of Contents (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 1-1.



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Biography - Clarence Lester Hogan

"Biography - Clarence Lester Hogan." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 2-2.

Clarence Lester Hogan was born on February 8, 1920, in Great Falls, Mont. He received the B.S. degree in chemical engineering from Montana State College in 1942. While an undergraduate he was elected to Phi Kappa Phi and Tau Beta Pi and received two awards: the American Chemical Society Award, based on an election by the faculty and student body, and given to a junior student showing great promise for professional development, and the Montana Society of Engineers Gold Medal, given to the most outstanding senior in the College of Engineering. Among his extra curricular activities were the offices of editor-in-chief of the college publication, The Maztana Engineer, and vice-president of Kappa Sigma.

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The Pace of Modern Technology

C.L. Hogan. "The Pace of Modern Technology." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 3-3.

In 1946, J. H. E. Griffiths published in Nature the first account of an experimental observation of the phenomenon of ferromagnetic resonance. Naturally enough this paper elicited little interest from electrical engineers, nor did the theoretical work of C. Kittel and D. Polder published during the next three years which gave a quantitative explanation of Griffith's experiment. Now, however, approximately eight years after Polder's rather complete theoretical paper on ferromagnetic resonance this issue of an engineering journal is devoted exclusively to the practical ramifications of this first experimental observation. Many of the devices referred to in this issue are beyond the development stage and are already in widespread use in microwave systems. Although the delay between research and development and between development and production usually seems interminably long to those most actively associated with the development of engineering devices, it appears, in retrospect at least, that in this case the progress has been almost astounding. In fact, it is illuminating to go back to the beginning of the electronic era and look at the basic experiments which led to the development of the vacuum tube in order to see how our technological timetable has been greatly compressed during the last fifty years.

Click on title for a complete paper.



Abstracts

Foreword (Jan. 1958 [T-MTT])

T.N. Anderson. "Foreword (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 4-4.

With the tremendous advances being made in the microwave ferrite field and solid-state microwave devices, and with the success of the Harvard Symposium in April, 1956, it was felt that further symposia were desired on the subject especially at the radio engineers' level. Hence, it was proposed that the Long Island, New York, and Northern New Jersey Chapters of the PGMTT hold a jointly sponsored meeting on the subject during the 1956-1957 season.



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Abstracts

The Status of Microwave Applications of Ferrites and Semiconductors

B. Lax. "The Status of Microwave Applications of Ferrites and Semiconductors." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 5-18.

The recent developments in the field of ferrite devices are reviewed. Emphasis is placed on the extension of nonreciprocal devices to lower microwave frequencies. and high powers. The design considerations and achievements of broad banding also are covered. Fundamental principles leading to the applications of non-linear properties of ferrites are described briefly. Preliminary experimental accomplishments in the construction of frequency doublers, mixers, and ferromagnetic resonance amplifiers are summarized. The possible role of the new ferromagnetic garnet material is indicated. Although no significant new semiconductor devices have been developed at microwave frequencies, possibilities are considered for doing this with use of cyclotron resonance and spin resonance phenomena and their related properties in semiconductors.



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Nonreciprocal Electromagnetic Wave Propagation in Ionized Gaseous Media

L. Goldstein. "Nonreciprocal Electromagnetic Wave Propagation in Ionized Gaseous Media." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 19-29.

The nonreciprocal propagation of electromagnetic waves in ionized gaseous media is discussed, and experimental observations are reported in this paper. The classical Faraday experiment in the optics of anisotropic media has suggested an analogous phenomenon at microwave frequencies. The anisotropic behavior of the free electron gas which is immersed in a magnetic field and subjected to an incident electromagnetic wave is determined. Guided microwave experiments were performed which confirm the theoretical predictions of nonreciprocal wave propagation in such ionized gases.

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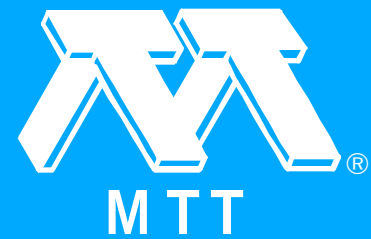


Abstracts

The Three-Level Solid-State Maser

H.E.D. Scovil. "The Three-Level Solid-State Maser." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 29-38.

This article gives an introduction to amplification by solid-state maser techniques. Emphasis is placed on the three-level solid-state maser. The relevant physical properties of paramagnetic salts are discussed. The basis of the three-level excitation method is reviewed. Some design considerations are given. The design and performance characteristics of a particular device are mentioned.



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Nonmechanical Beam Steering by Scattering from Ferrites

M.S. Wheeler. "Nonmechanical Beam Steering by Scattering from Ferrites." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 38-42.

A small aperture radiating circularly polarized energy is loaded with a spherical ferrite to produce an electronic beam directing system. The ferrite is immersed in a static magnetic field which is in general at an oblique angle with the unreflected direction of radiation. It is shown that radiation is principally in the direction of the magnetic field when the polarization is in the negative sense. From symmetry this allows beam deflection with two degrees of freedom. To consider an application for such a device, it is proposed that this deflection system be used in conical scan. A mechanization is shown, which solves the problem in principle, but it is not competitive with present mechanical scanners from the point of view of side lobes, etc.

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Abstracts

A Ferrite Boundary-Value Problem in a Rectangular Waveguide

C.B. Sharpe and D.S. Heim. "A Ferrite Boundary-Value Problem in a Rectangular Waveguide." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 42-46.

A solution is obtained for the electric field at the air-ferrite interface ($z=0$) in a rectangular waveguide filled with ferrite in the semi-infinite half ($z>0$) and magnetized in the direction of the electric field. The field is expressed in terms of a Neumann series obtained by iteration of a singular integral equation which satisfies the boundary conditions at the interface. The equivalent circuit for the junction is also presented.



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Abstracts

Some Techniques of Microwave Generation and Amplification Using Electron Spin States in Solids

D.I. Bolef and P.F. Chester. "Some Techniques of Microwave Generation and Amplification Using Electron Spin States in Solids." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 47-52.

Possible modes of operation of two-level solid state masers utilizing the techniques of population inversion used in nuclear magnetic resonance are described. Methods of continuous operation of two-level masers and their usefulness as microwave generators are discussed.



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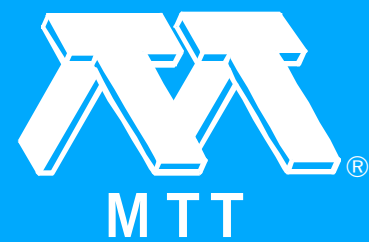
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A Microwave Ferrite Frequency Separator

H. Rapaport. "A Microwave Ferrite Frequency Separator." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 53-58.

When multiple filter groups are interconnected for operation out of a single source, interaction effects between filters can occur. Frequently, unless special precautions are taken, the filters may interact to such an extent that severe deterioration in performance may result.

Introduction of the gyrator by Tellegen and the subsequent microwave realization of the circulator by Hogan, Rowen, and others provide new possibilities for design of channel-branching circuits and frequency-spectrum partition arrays. The nature of the frequency separation problem is reviewed, and the application of the ferrite circulator to effect channel branching is considered in detail. Several specific multichannel systems comprising various circulator filter and one-way line filter arrays are presented and their relative merits examined. A 4-port (3-channel) experimental prototype separator system consisting of a Faraday rotation type of circulator and maximally flat band-pass waveguide filters is described. A quantitative theory of operation of the prototype is developed. Experimental data and performance curves are given. These data show close agreement with results predicted by the theory.

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Ferrite-Loaded, Circularly Polarized Microwave Cavity Filters

W.L. Whirry and C.E. Nelson. "Ferrite-Loaded, Circularly Polarized Microwave Cavity Filters." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 59-65.

Circularly polarized cavities have made possible a group of compact, high-Q, microwave waveguide filters having useful directional properties. When these cavity filters are ferrite loaded, frequency sensitive circulators result and magnetic tuning becomes possible. This paper presents several new three- and four-port ferrite-loaded filters, some with 3-db waveguide couplers, which can be used as tunable band-pass filters, tunable band-rejection filters, or as passive, selective duplexers. As duplexers, they can be operated at a fixed frequency or can be magnetically tuned over a one to five per cent frequency range at X band depending upon the allowable loss. Experimental loss, bandwidth, isolation, and tuning data are presented. Temperature stability and power handling capacity are also discussed.

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Resonant Properties of Nonreciprocal Ring Circuits

F.J. Tischer. "Resonant Properties of Nonreciprocal Ring Circuits." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 66-71.

The ring circuit investigated consists of a resonant ring guide coupled to a main guide. The properties can be described by the equations for the waves in the ring guide resulting from excitation in the main guide. The influence of nonreciprocity on the properties is investigated under conditions of varying coupling. The representation of the ring waves by the poles and zeros is chosen to permit interpretation of the results under the large variety of operational conditions with respect to coupling and nonreciprocity. The application for measuring the material constants of ferrites is discussed.

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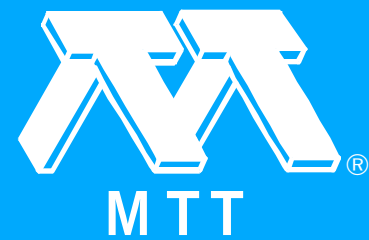


Abstracts

Exact Solution for a Gyromagnetic Sample and Measurements on a Ferrite

H.E. Bussey and L.A. Steinert. "Exact Solution for a Gyromagnetic Sample and Measurements on a Ferrite." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 72-76.

An outline of an exact solution for a gyromagnetic rod centered in a right circular cylindrical cavity resonator is given. This solution is applied in evaluating dielectric and tensor-magnetic measurements on a well-known ferrite. Complex frequencies and constitutive parameters are introduced and the solution is expanded in series to obtain a convenient calculational scheme. Comparisons are made of exact and perturbation calculations of results from a small and a large sample. The effect of insufficient symmetry of the cavity is discussed and the condition for sufficient symmetry is given. The g value of electrons was 2.02.



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Resonance Measurements on Nickel-Cobalt Ferrites as a Function of Temperature and on Nickel Ferrite-Aluminates

J.E. Pippin and C.L. Hogan. "Resonance Measurements on Nickel-Cobalt Ferrites as a Function of Temperature and on Nickel Ferrite-Aluminates." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 77-82.

The variation of line width (ΔH) and effective g factor (g_{eff}) with cobalt content and with temperature is studied in a series of ferrites of composition $\text{Ni}_{1-\alpha}\text{Co}_{\alpha}\text{Mn}_{0.02}\text{Fe}_{1.9}\text{O}_{4\pm}$. Here α lies between 0 and 0.09; temperatures range from 20° to 340° C. A minimum in ΔH is observed at $\alpha=0.027$; g_{eff} decreases with increasing α . The temperature dependence of each is qualitatively that which would be expected on the basis of the temperature dependence of the anisotropy of the mixed ferrite. Above room temperature ΔH and g_{eff} increase or decrease, depending on the cobalt content. It is also shown that the shape of the resonance line is determined by the sign of the anisotropy constant. For negative K_1 the line is steeper on the low-field side of resonance--for positive K_1 it is steeper on the high-field side.

Resonance data are presented on several nickel-cobalt ferrite-aluminates, of composition $\text{Ni}_{1-\alpha}\text{Co}_{\alpha}\text{Mn}_{0.02}\text{Fe}_{2-t}\text{Al}_t\text{O}_{4\pm}$, with α varying from 0 to 0.025 for $t=0.3, 0.4, 0.5$, and 0.6 . The reduction of ΔH and g_{eff} expected from anisotropy considerations is observed.



Ferromagnetic Resonance in Some Polycrystalline Rare Earth Garnets

G.P. Rodrigue, J.E. Pippin, W.P. Wolf and C.L. Hogan. "Ferromagnetic Resonance in Some Polycrystalline Rare Earth Garnets." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 83-91.

Ferromagnetic resonance measurements have been carried out on a series of polycrystalline garnets of composition $5\text{Fe}/\text{sub } 2/\text{O}/\text{sub } 3/ \cdot 3\text{M}/\text{sub } 2/\text{O}/\text{sub } 3/$ with $\text{M}=\text{Y}, \text{Sm}, \text{Gd}, \text{Dy}, \text{Ho}, \text{Er},$ and Yb . These measurements were made over a temperature range from 20°C to the Curie points (approximately 280°C). The variations of line widths and effective g values over this temperature range are reported. $\text{Y}, \text{Yb},$ and Sm garnets have g values of approximately 2.0 at room temperature while those of $\text{Dy}, \text{Ho},$ and Er are appreciably less than 2.0. High-density yttrium garnet has a line width of approximately 50 oersteds at room temperature; line widths of other members of this series were found to vary from 400 to greater than 3000 oersteds. The effective g value and line width of the gadolinium garnet tend to very high values as its compensation point (17°C) is approached. The narrow line width of the yttrium garnet is found to depend strongly on the density of the sample. When the density decreases from 96 per cent to approximately 92 per cent of the theoretical value, the line width increases from 50 to about 150 oersteds. Several technical applications in which these materials might be particularly advantageous are discussed briefly.





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Reciprocal Ferrite Devices in TEM Mode Transmission Lines

D. Fleri and B.J. Duncan. "Reciprocal Ferrite Devices in TEM Mode Transmission Lines." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 91-96.

Several new reciprocal ferrite devices have been designed in TEM mode transmission lines to operate over both narrow and extremely broad bandwidths in the low-microwave frequency region. These include variable attenuators, an amplitude modulator, and a traveling-wave tube equalizer. Each component utilizes the attenuation associated with gyromagnetic resonance in low saturation magnetization ferrites. The techniques used to overcome the matching problems inherent in TEM mode transmission lines when ferrite loaded, and the design considerations pertinent to each component, are treated in detail. The parameters affecting the characteristics of each device are discussed and both final design and operating characteristics of the components are presented.

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Abstracts

Measurement of Ferrite Isolation at 1300 MC

G.S. Heller and G.W. Catuna. "Measurement of Ferrite Isolation at 1300 MC." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 97-100.

Optimum geometry for ferrite isolators at low microwave frequencies in rectangular waveguide is discussed and measurements are presented which show the feasibility of constructing a practical isolator at 1300 mc using commercially available ferrites. Further data for a narrower line-width ferrite are presented. The high-reverse to forward-loss ratios obtained are in accord with predictions from perturbation theory.



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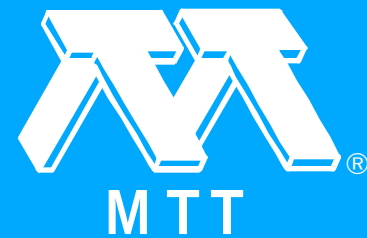


Abstracts

An Electronic Scan Using a Ferrite Aperture Luneberg Lens System

D.B. Medved. "An Electronic Scan Using a Ferrite Aperture Luneberg Lens System." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 101-103.

Beam displacements up to $\pm 30^\circ$ have been observed in the radiation patterns from various ferrite-loaded waveguide apertures in transverse magnetic fields. The apertures are used as feeds for Luneberg lenses, and electrical lobing of narrow pencil beams is accomplished. The proposed use of a square waveguide ferrite-filled feed for a sequential lobing system is described.



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Round Table Discussion on Design Limitations of Microwave Ferrite Devices

C.L. Hogan, B. Lax, P.H. Vartanian, J.O. Artman, G.S. Heller, H. Scharfman, T.N. Anderson, B.J. Duncan, E. Wantuch, H. Seidel, R.C. LeCraw, H.J. Carlin, R.F. Soohoo, P. Johnson, L. Swern, J.H. Rowen, J.C. Cacheris, D.L. Fresh, A.L. Aden, E. Schlomann, H.E.D. Scovil and R.W. Damon. "Round Table Discussion on Design Limitations of Microwave Ferrite Devices." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 104-111.

The 1957 Annual PGMTT Meeting concluded on May 10 with a round table discussion on Design Limitations of Microwave Ferrite Devices. This discussion was moderated by Professor C. L. Hogan of Harvard University, and the panel members were Drs. J. O. Artman, H. J. Carlin, D. L. Fresh, G. S. Heller, R. C. LeCraw, H. Seidel, and P. H. Vartanian. The topics considered appropriate for discussion were: 1) high-power effects (nonlinearity), 2) low-frequency limits, 3) high-frequency limits, 4) anomalous propagation in ferrite loaded waveguides, 5) below-saturation behavior of ferrites, 6) "fast" ferrite devices (depending on relaxation time), 7) bandwidth problems, 8) materials and losses, and 9) high-speed magnetic field problems. An edited version of the recorded discussion is published on the following pages.

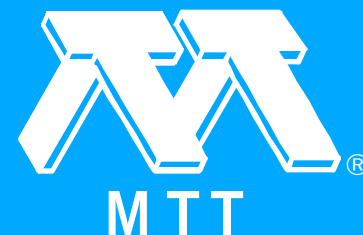


Abstracts

Note on Impedance Transformations by the Isometric Circle Method (Correspondence)

E.F. Bolinder. "Note on Impedance Transformations by the Isometric Circle Method (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 111-112.

The isometric circle method is a graphical method of transforming a complex quantity by the linear fractional transformation. It has recently been applied to impedance transformations through bilateral two-port networks. The purpose of this note is to show the connection between the isometric circle method and another graphical method called the "triangular" method, and also to present a useful formula for reflection-coefficient transformations through bilateral, lossless two-port networks.



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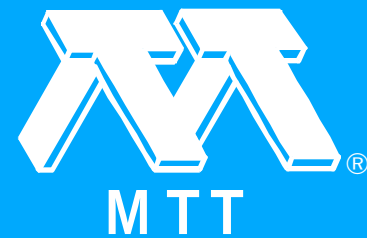


Abstracts

On the Pressure Dependence of Microwave Crystal Rectifiers (Correspondence)

W.G. Matthei. "On the Pressure Dependence of Microwave Crystal Rectifiers (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 112-112.

During the past couple of years, as a result of government interest, silicon microwave crystal rectifiers have not only decreased their noise figures but also have increased their resistance to adverse environments; i.e., high burnout, high temperature, excessive humidity.



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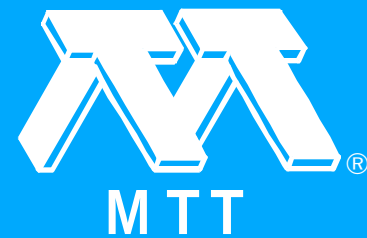


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PGMTT News (Jan. 1958 [T-MTT])

"PGMTT News (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 113-113.

The Annual PGMTT Meeting was held May 9-10 in New York, N. Y., at the Western Union Auditorium. Three hundred and six attended the outstanding program. Twenty-three technical papers were given, three of which had been invited.



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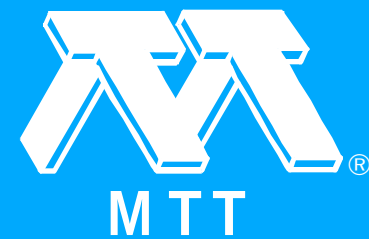
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Call for Papers - 1958 PGMTT National Symposium (Jan. 1958 [T-MTT])

"Call for Papers - 1958 PGMTT National Symposium (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 114-114.



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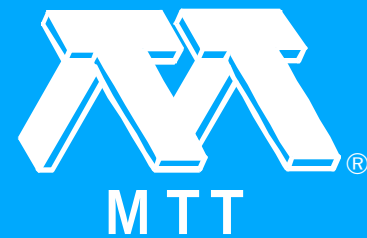
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Contributors (Jan. 1958 [T-MTT])

D.I. Bolef, H.E. Bussey, G.W. Catuna, P.F. Chester, B.J. Duncan, D.A. Fleri, L. Goldstein, D.S. Heim, G.S. Heller, C.L. Hogan, B. Lax, D.B. Medved, C.E. Nelson, J.E. Pippin, H. Rapaport, G.P. Rodrigue, H.E.D. Scovil, C.B. Sharpe, L.A. Steinert, F.J. Tischer, M.S. Wheeler, W.L. Whirry and W.P. Wolf. "Contributors (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 115-118.



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Membership Roster, as of November 5, 1957

"Membership Roster, as of November 5, 1957." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): 120-120.



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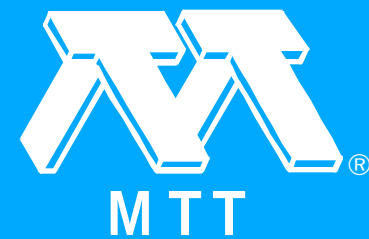
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"Back Cover (Jan. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.1 (Jan. 1958 [T-MTT]): b1-b2.



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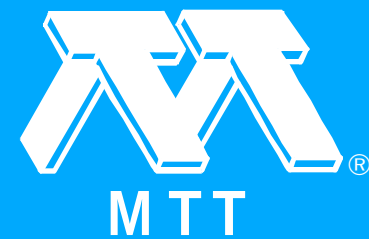
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Biography - Nathan Marcuvitz

"Biography - Nathan Marcuvitz." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 130-130.

Nathan Marcuvitz was born on December 29, 1913, in New York, N. Y. In 1935 he received the Bachelor's degree in electrical engineering from the Polytechnic Institute of Brooklyn, where he remained as a graduate fellow until 1936. At this time, he joined the RCA Laboratories as a student engineer and subsequently did advanced development work on electron tubes, iconoscopes, and orthicons for television applications. He returned to the Polytechnic Institute of Brooklyn in 1940, where he received the Master's degree in 1941.

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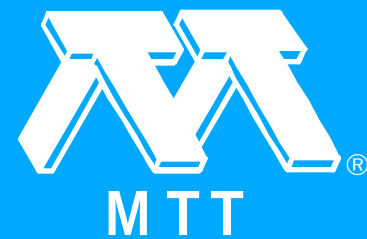


Abstracts

Academic Research Institutes in the Microwave Field

N. Marcuvitz. "Academic Research Institutes in the Microwave Field." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 131-132.

Since World War II, large research institutes have burgeoned forth on the campuses of many colleges and universities throughout the United States. Fulfilling at their inception a national need in time of crisis, they have continued in these less critical times to contribute importantly to the national research program. Their impact on academic curricula has been varied but no less important. The effective increase in faculty provided by academic research institutes is permitting the expansion of graduate course programs into ever widening areas of science and engineering in a manner responsive to contemporary scientific and technical developments. Expanded curricula and research facilities make it possible for students in increasing numbers to enter into research programs that attempt to prepare them realistically for the demands our technological society imposes upon them. Despite these evident advantages, research institutes have yet to find a truly permanent place in the academic structure. Financial difficulties, together with related problems of securing balance between research and academic obligations, characterize this paradoxical situation. Since these points bear strongly on the question of the proper utilization of our national scientific and engineering potential, let us examine the role academic research institutes can play on the educational scene with particular stress, by example, on those in the microwave field.



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A Wide-Band Double-Vane Torque-Operated Wattmeter for 3-CM Microwaves

A.L. Cullen, B. Rogal and S. Okamura. "A Wide-Band Double-Vane Torque-Operated Wattmeter for 3-CM Microwaves." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 133-136.

This paper describes a torque-operated wattmeter for waveguide, capable of measuring power in the range of 10 to 200 watts in the wavelength range 3.05-3.45 cm, with an accuracy of about 2 per cent over most of the wave band. The instrument is an absolute standard since its calibration depends only on measurements of mass, length, and time. Negligible power is absorbed, and the instrument is insensitive to mismatch.

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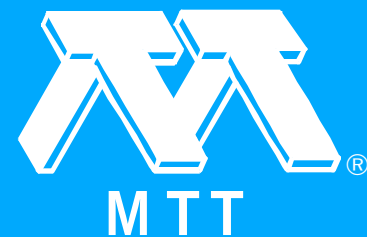


Abstracts

Traveling-Wave Resonators

L.J. Milosevic and R. Vautey. "Traveling-Wave Resonators." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 136-143.

In the first part of the paper, the principles are given which have led to the conception of the traveling-wave resonator, and the calculations enabling its operation to be understood are presented. The second part describes the apparatus in detail and examines it, bearing in mind its use as high-power testing equipment.



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Reflection Coefficient of E-Plane Tapered Waveguides

K. Matsumaru. "Reflection Coefficient of E-Plane Tapered Waveguides." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 143-149.

This paper treats the reflection of linearly and sinusoidally tapered waveguides. In the first part, reflection coefficients of linearly tapered waveguides for dominant modes are calculated. Graphs of the vswr of tapers for different impedance ratios are plotted showing that the vswr does not go to unity at multiples of a half wavelength. In the second part, reflection coefficients of sinusoidally tapered waveguides are calculated. Experimental data verify the theory for both kinds of tapers of various lengths at 4 kmc band. Linear tapers perform almost as well as exponential tapers, and better than shorter hyperbolic tapers. The reflection coefficients of sinusoidal tapers can be about half as small as that of the linear tapers, and these tapers compare favorably with the Dolph-Tchebycheff and the Willis taper of improved design.



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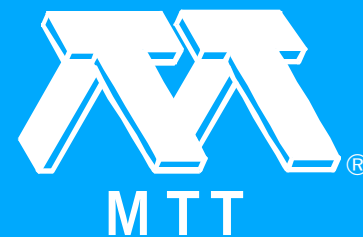


Abstracts

Propagation in Ferrite-Filled Microstrip

M.E. Brodwin. "Propagation in Ferrite-Filled Microstrip." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 150-155.

The propagation constant of a ferrite-filled microstrip is measured as a function of the longitudinal static magnetic field. The results agree with the analysis by Van Trier of the infinite parallel plane waveguide filled with gyromagnetic media. The analysis is extended to anisotropies greater than 0.5. A simple relationship between propagation constant and anisotropy for the quasi-TEM mode with small spacing ($X \ll \lambda/g$) is noted. Cutoff spacings for higher modes are calculated. An apparatus for the measurement of propagation constant independently of interface reflections is described.



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An Improved Method for the Determination of Q of Cavity Resonators

A. Singh. "An Improved Method for the Determination of Q of Cavity Resonators." 1958 *Transactions on Microwave Theory and Techniques* 6.2 (Apr. 1958 [T-MTT]): 155-160.

The various Q factors and circuit efficiency of a cavity resonator can be evaluated from standing-wave measurements on a transmission line or waveguide coupled to the resonator. In the usual method, measurement errors near the half-power points have an unduly large influence on the result. This paper describes a method in which this type of error is avoided. In the new method, v_{swr} and position of minimum at various frequencies are plotted on a Smith chart and a circle is drawn through the points. This circle is suitably rotated around the center of the chart and a value of equivalent susceptance is read off for each frequency. The graph of susceptance vs frequency is a straight line, whose slope the Q factors are evaluated. The underlying theory of the above method is discussed and typical experimental results are presented. Charts of parameters required in the calculations are given.

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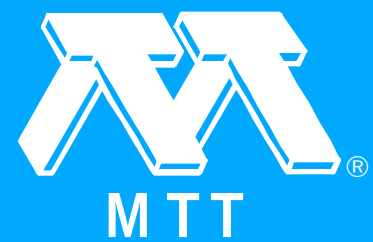
Characteristic Impedances of the Slotted Coaxial Line

J. Smolarska. "Characteristic Impedances of the Slotted Coaxial Line." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 161-166.

The characteristic impedance for the two possible TEM modes is calculated for a slotted coaxial line whose outer walls have a zero thickness. Conformal mapping is used in the calculations. The characteristic impedance for a slotted coaxial line is calculated in an approximate way for outer wall thickness different from zero.

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Velocity Modulation of Electromagnetic Waves

F.R. Morgenthaler. "Velocity Modulation of Electromagnetic Waves." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 167-172.

This paper deals with electromagnetic wave propagation through dielectric media whose propagation constants vary as a function of time. If the parameters of the medium cannot respond to changes in the electric and magnetic fields of the propagating wave, the fields within such media will be linear. Maxwell's equations are solved for cases in which the scalar permittivity and permeability vary independently with time. When the impedance is constant, an exact solution is obtained. When the impedance varies, a closed form approximation is found since an exact solution is not always possible. The field energy and electromagnetic momentum are derived for a velocity transient and it is seen that, in general, the energy changes and the momentum remains constant. The frequency deviation that results when a monochromatic wave is passed through a section of dielectric with nonconstant velocity of propagation is discussed in detail. An approximate solution is obtained for the case in which the electrical length of such a section is small; it is found that essentially linear phase modulation occurs. The general solution is found for the case in which the electrical length of section is long and the permittivity of the medium sinusoidally modulated. The optimum length found to give the greatest frequency deviation is shown to be generally impracticable. It appears that ferroelectric or ferrimagnetic velocity-modulated dielectrics are feasible, at least for low-power modulators.

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Heat Loss of Circular Electric Waves in Helix Waveguides

J.A. Morrison. "Heat Loss of Circular Electric Waves in Helix Waveguides." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 173-177.

This paper presents a theoretical calculation of the eddy current losses of circular electric waves in a closely-wound helix waveguide. The wire diameter is assumed large compared to the skin depth, but small compared to the guide diameter and the operating wavelength, so that the fields near the wire are quasistatic and may be determined by conformal mapping. When the wires are in contact, the waveguide wall is effectively a metal surface with grooves of semicircular cross section, the current flow being parallel to the direction of the grooves. The power loss for this case is computed to be about 8.5 per cent higher than in a waveguide with smooth metal walls. When the wires are not in contact, the wall is treated as a grating of parallel, round wires. The increase in power loss over a smooth surface is approximately 22.5 per cent when the wires are separated by a distance equal to their diameter.

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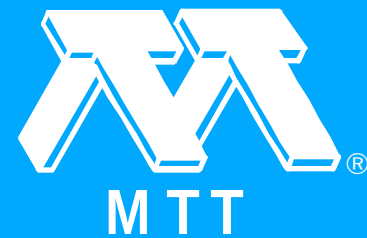


Abstracts

The Expansions of Electromagnetic Fields in Cavities

K. Kurokawa. "The Expansions of Electromagnetic Fields in Cavities." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 178-187.

In the theory of cavity resonators, the assumptions are frequently made that every irrotational function can be represented as the gradient of a scalar and that every divergenceless function can be represented as the rotation of a vector. These are, however, not necessarily correct. This paper corrects these misleading assumptions and describes "the theory of cavity resonators" which supplement the classical theory of Slater.



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Broad-Band Calorimeters for the Measurement of Low and Medium Level Microwave Power I. Analysis and Design

M. Sucher and H.J. Carlin. "Broad-Band Calorimeters for the Measurement of Low and Medium Level Microwave Power I. Analysis and Design." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 188-194.

Design considerations for a group of broad-band calorimetric power meters, capable of accurately measuring low (zero to one milliwatt) and medium (zero to 100 milliwatts) power levels over a frequency range from zero to 75,000 mc, are presented. The power meters are of the nonadiabatic, twin, dry-load type and utilize the substitution of dc power. The conflicting requirements imposed upon the design by the need to realize broad-band performance, adequate sensitivity, reasonably short response time, negligibly small rf-dc equivalence error, freedom from "zero" drift and from other types of error are discussed. An analysis is given of the known sources of error which enables the accuracy of the individual instruments to be reliably estimated.



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Broad-Band Calorimeters for the Measurement of Low and Medium Level Microwave Power II. Construction and Performance

A.V. James and L.O. Sweet. "Broad-Band Calorimeters for the Measurement of Low and Medium Level Microwave Power II. Construction and Performance." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 195-202.

The construction and performance of a series of rugged, broad-band twin-Joule calorimeters, using dry loads, are described. These calorimeters operate over the frequency range of 0 to 75,000mc. The over-all measurement error, computed as the rms value of the maximum individual errors from known independent sources, is shown to lie between 1 and 2½ per cent for power levels between 1 and 100mw. Power measuring techniques are discussed and a method using the heating and cooling cycle of the calorimeter is described in detail. Power comparison measurements between the calorimeters and several bolometer mounts illustrate the increasing inefficiency of bolometer mounts with increasing frequency.



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Amplitude Stabilization of a Microwave Signal Source

G.F. Engen. "Amplitude Stabilization of a Microwave Signal Source." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 202-206.

Recent developments in the microwave field have provided new tools for use in regulating the output amplitude of a microwave signal source. An amplitude or power stabilizer has been constructed at the National Bureau of Standards Boulder Laboratories, using the recently developed self-balancing dc bolometer bridge and a commercially available, electrically controlled, ferrite attenuator which achieves power stabilities of a few parts in 10^4 per hour. Use of a high directivity directional coupler permits stabilization of the forward traveling component of the signal, thus providing the equivalent of a matched, stable generator. In practice, a broad-band source match of V_{SWR} less than 1.05 is achieved, and this figure may be further improved, at a given frequency, by suitable tuning. In addition, the device has applications as a precision broad-band attenuator, since known changes in power level may be achieved by switching certain of the associated dc components.

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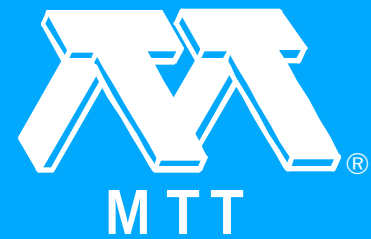


Abstracts

A Simple Artificial Anisotropic Dielectric Medium

R.E. Collin. "A Simple Artificial Anisotropic Dielectric Medium." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 206-209.

The anisotropic properties of an infinite stack of thin dielectric sheets separated by another set of thin sheets with a different dielectric constant is investigated. It is shown that the anisotropic properties are brought about because of the two distinct modes of propagation which can exist in such a stacked array of sheets. The limiting forms of the wave solutions and second-order results for the equivalent dielectric constants are given.



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Calculation and Measurement of the Noise Figure of a Maser Amplifier

J.C. Helmer and M.W. Muller. "Calculation and Measurement of the Noise Figure of a Maser Amplifier." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 210-214.

The noise performance of regenerative amplifiers is reviewed and equations are obtained which serve to interpret a measurement of noise from an ammonia molecular beam maser amplifier. The measurement is accomplished by means of a double heterodyne system in which a detuned maser oscillator serves as second local oscillator. The measured noise figure is 3.5 ± 0.5 db, as predicted by theory for the slightly undercoupled circuit used. Although no beam noise is observed, the experimental uncertainty places an upper limit of 40° K on the spontaneous emission noise temperature of the ammonia beam.

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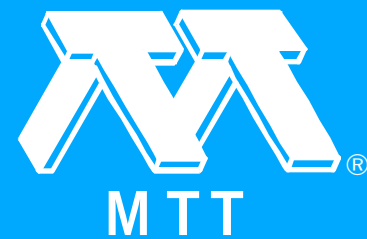


Abstracts

Propagation in Dielectric Slab Loaded Rectangular Waveguide

P.H. Vartanian, W.P. Ayres and A.L. Helgesson. "Propagation in Dielectric Slab Loaded Rectangular Waveguide." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 215-222.

Propagation in dielectric loaded rectangular waveguide is investigated theoretically for varying slab thickness and dielectric constant. The slabs are placed across the center of the waveguide in the E plane. This geometry is found to offer bandwidths in excess of double that of rectangular waveguide for dielectrics having dielectric constants of approximately 18. Power handling capacities which are double or triple that of standard waveguide are achievable using the dielectric loaded waveguide. In addition to the theory, design curves of bandwidth, guide wavelength, cutoff wavelength, impedance, power handling capacity, wall losses, and dielectric losses are presented and compared to experiment where possible.



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Parallel-Coupled Transmission-Line-Resonator Filters

S.B. Cohn. "Parallel-Coupled Transmission-Line-Resonator Filters." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 223-231.

This paper describes the synthesis of band-pass transmission-line filters consisting of series of half-wavelength resonant conductors such as strips. The design differs from the usual end-coupled strip configuration in that successive strips are parallel coupled along a distance of a quarter-wavelength. The resulting coupling between resonators is partly electric and partly magnetic. Several important advantages are gained by this arrangement: 1) the length of the filter is approximately half that of the end-coupled type; 2) the gaps are larger and therefore less critical; and 3) the insertion-loss curve is symmetrical on a frequency scale with the first spurious response occurring at three times the center frequency of the pass band. Formulas are derived for the parallel-coupled-resonator transmission-line filter that permit accurate design for Tchebycheff, maximally flat, or any other physically realizable response. The formulas are theoretically exact in the limit of zero bandwidth, but frequency-response calculations show them to give good results for band widths up to about 30 per cent. An experimental strip-line filter of this type has been constructed, and the data given in this paper show that excellent performance has been obtained.

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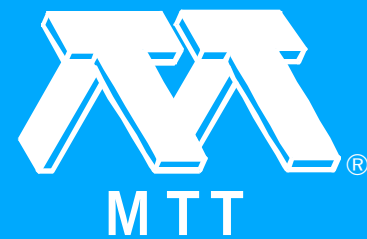


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A New Class of Broad-Band Microwave 90-Degree Phase Shifters

B.M. Schiffman. "A New Class of Broad-Band Microwave 90-Degree Phase Shifters." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 232-237.

In the type of circuits considered here, the input power is divided equally between two channels whose outputs are caused to have a very nearly 90° phase difference over a broad frequency range. Networks suitable for application at low frequencies which perform the above function have been widely investigated. This report describes a new type of 90° differential phase shifter which has a constant resistance input, and which is useful over bandwidths as large as 5:1 in the microwave region.



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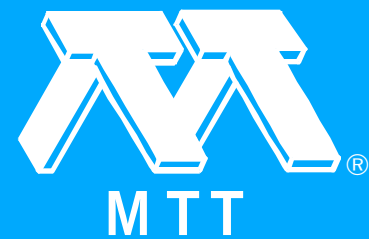
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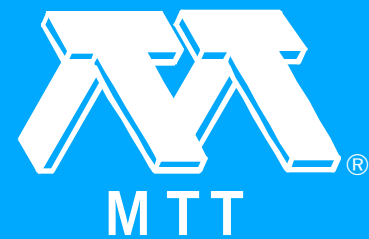
Fourier Transforms and Directional Couplers (Correspondence)

S. Sensiper. "Fourier Transforms and Directional Couplers (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 238-238.

The excellent review of Bolinder on the applications of Fourier transforms in wave theory, particularly the section on "Coupling of Waves," suggested that the readers of these Transactions might also be interested in some related work performed by this writer some time ago. A report on this work contains a section on the use of Fourier integral and series methods for directional coupler design. In connection with directional couplers, this letter also can be considered as noting a further addition to the useful bibliography of Schwartz. Although not widely distributed, the aforementioned report has been available since late 1947 in the Document Room of the Research Laboratory of Electronics at the Massachusetts Institute of Technology as No. SPE-239. It should be emphasized that this letter is not intended to start a controversy as to who did what first, but rather to bring to the readers' attention a report of possible interest.

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Analysis of the Variable-Ratio Microwave Power Divider (Correspondence)

R.M. Vaillancourt. "Analysis of the Variable-Ratio Microwave Power Divider (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 238-239.

It has been shown experimentally that a variable-ratio microwave power divider is easily assembled from two identical 3-db directional couplers and a phase changer. The scattering matrix of this structure is readily obtained from the flow graph showing the interconnections between the couplers. The following shows that the whole structure is still a directional coupler, derives the conditions to optimize the power transfer, and finally, gives the phase angles of the scattering coefficients.

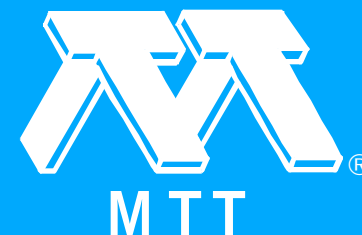
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Call for Papers - 1958 WESCON Convention (Apr. 1958 [T-MTT])

"Call for Papers - 1958 WESCON Convention (Apr. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 239-239.



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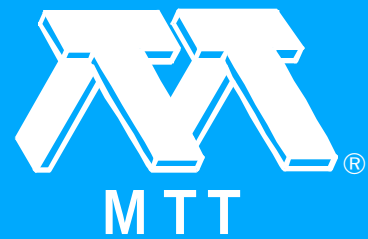


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1958 PGMTT National Symposium (Announcement) (Apr. 1958 [T-MTT])

"1958 PGMTT National Symposium (Announcement) (Apr. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 240-241.

The 1958 PGMTT National Symposium, sponsored by the IRE Professional Group on Microwave Theory and Techniques and hosted by the IRE San Francisco Section, will be held at Cubberley Auditorium, Stanford University, Stanford, Calif. May 5-7.



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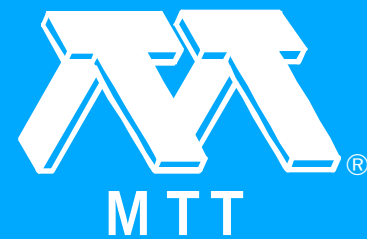
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Contributors (Apr. 1958 [T-MTT])

W.P. Ayres, M.E. Brodwin, H.J. Carlin, S.B. Cohn, R.E. Collin, A.L. Cullen, G.F. Engen, A.L. Helgesson, J.C. Helmer, A.V. James, K. Kurokawa, K. Matsumaru, L. Milosevic, F.R. Morgenthaler, J.A. Morrison, M.W. Muller, S. Okamura, B. Rogal, B.M. Schiffman, A. Singh, J. Smolarska, M. Sucher, L.O. Sweet, P.H. Vartanian and R. Vautey. "Contributors (Apr. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.2 (Apr. 1958 [T-MTT]): 242-245.



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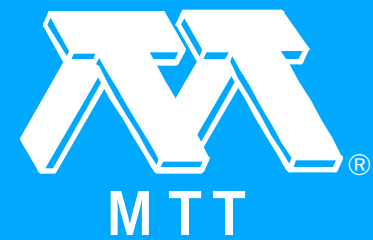
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"Table of Contents (Jul. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 247-247.



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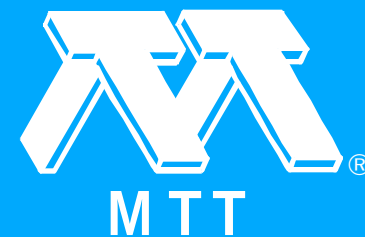


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Message from the Editor (Jul. 1958 [T-MTT])

K. Tomiyasu. "Message from the Editor (Jul. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 248-248.

Beginning with this issue, the members of the Editorial Board of the IRE Transactions on Microwave Theory and Techniques will be listed on the Table of Contents page.



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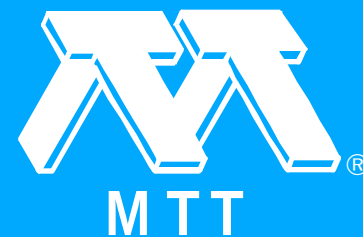


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Biography - Lan Jen Chu

"Biography - Lan Jen Chu." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 249-249.

Lan Jen Chu was Hweiying, Kiangsu, born on August 24, 1913 in China. He graduated from Chiao Tung University, Shanghai, China with the B.S. degree in electrical power in 1934. He received the S.M. degree in 1935 and the SC. D. in electrical engineering from M.I.T. in 1938.



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Education for Electrical Engineering

L.J. Chu. "Education for Electrical Engineering." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 250-250.

Thirty years ago an undergraduate program in electrical engineering consisted chiefly of studying the design and operation of the electrical devices--then relatively few--that were in use at the time. The program included subjects on generators, motors, transmission systems, telephone and telegraph systems, radio, and electric batteries. An average graduate was considered to be adequately equipped to serve society in the entire electrical field. Whenever a new invention was reduced to practical use another subject was merely added to the curriculum. When the curriculum became too crowded for a student to finish it in four years, the concept of options was introduced. Under that concept the undergraduate specialized in one branch of electrical engineering. At graduation he was equipped to serve society in his own field, but was usually not well informed in other fields. He had a tendency to shy away from the other branches of electrical engineering. In more recent years there have been proposals to subdivide undergraduate options into even finer structures in an attempt to supply the needs of vastly diversified electrical industries.

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Report of Advances in Microwave Theory and Techniques-1957

R.E. Beam. "Report of Advances in Microwave Theory and Techniques-1957." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 251-263.

This report is devoted to advances in theory, experiment, and application of microwave sources, amplifiers, circuits and circuit elements, transmission lines, and detectors. The radiation, propagation, and reception of microwaves are mentioned only indirectly. An attempt is made to provide coverage of foreign as well as domestic advances.



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A New Form of High-Power Microwave Duplexer

P.D. Lomer and R.M. O'Brien. "A New Form of High-Power Microwave Duplexer." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 264-267.

A new form of microwave duplexer, capable of handling twice as much power as an equivalent balanced duplexer is described. It consists of a microwave bridge circuit and a power-sensitive half-wavelength phase shifter. A simple gas-discharge tube is used in the phase shifter, which changes the length in one arm of the bridge circuit by a half-wavelength for high-power and low-power microwave pulses, respectively. The performance of one form of phase-shift duplexer has been measured over a frequency range from 8500 mc to 10,000 mc. The vswr is less than 1:2 and the receiver isolation is greater than 30 db over most of the waveband. This is comparable to the performance of a balanced duplexer using the same components. The power handling capacity of the phase-shift duplexer is intrinsically twice as great as that of the balanced duplexer. For example, at a wavelength of 3 cm the phase-shift duplexer will operate unpressurized at a peak power level of 200 kw with a 2:1 safety factor on breakdown, whereas performance of a balanced duplexer at this power level is marginal.

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Radiation from a Rectangular Waveguide Filled with Ferrite

G. Tyras and G. Held. "Radiation from a Rectangular Waveguide Filled with Ferrite." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 268-277.

This paper presents an approximate analytical solution to the problem of radiation from a ferrite-filled rectangular waveguide. The field distribution at the mouth of the guide is assumed to be unaffected by the termination of the guide. The vector Huygens' principle is applied to find the far-zone radiation field from the determined aperture field. The solution to the problem is found in this manner for the cases of longitudinal and transverse magnetization of the ferrite. The transverse magnetization case is supplemented with a discussion of a specific numerical example which includes plots of the aperture field distribution and the phase angle as well as plots of the far-zone radiation field. The experimentally known phenomenon of the effect of the applied magnetic field upon the shift of the main lobe is demonstrated and verified analytically.

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Launching Efficiency of Wires and Slots for a Dielectric Rod Waveguide

R.H. DuHamel and J.W. Duncan. "Launching Efficiency of Wires and Slots for a Dielectric Rod Waveguide." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 277-284.

This paper describes an experimental investigation of surface wave launching efficiency. Wires, rings, and slots are considered as exciters of the HE/sub 11/ mode on a dielectric rod image line. A formula is derived which relates the efficiency of a launcher to its impedance as a scatterer on the surface waveguide. Efficiency is obtained by using this formula and also by applying Deschamps' method for determining the scattering matrix coefficients of a port junction. Graphs are presented which illustrate the variation of efficiency with the dimensions of the launchers and with the parameter $\lambda/g/\lambda$, the ratio of the guide wavelength to the free space wavelength.

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Microwave Switching by Crystal Diodes

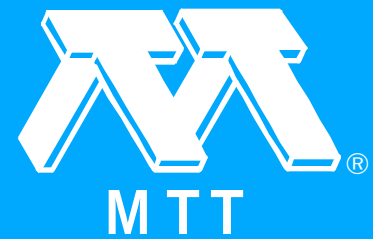
M.R. Millet. "Microwave Switching by Crystal Diodes." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 284-290.

This paper gives the results of an investigation of the use of a microwave crystal as an RF switching element. Variation of a dc bias applied to the crystal will change its impedance, thereby providing an electronic control of microwave power. Empirical data are correlated with the physical structure of the crystal and its equivalent circuit to establish the frequency and power limitations of the switch. A comparison is also made of the switching properties of germanium and silicon crystals. Curves are given for predicting the switching capacity of any diode once its impedance has been normalized with respect to the characteristic impedance of the waveguide. Some methods are suggested for improving the bandwidth and power capacity of the crystal switch.

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Dielectric Image Lines

S.P. Schlesinger and D.D. King. "Dielectric Image Lines." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 291-299.

Some further studies on the dielectric image line are presented. Following a verification of field purity for the conventional image system, the effects of dielectric constant and dielectric geometry on loss, dispersion, and field extent are examined. Results are also discussed for an asymmetric line, i.e., the case of dielectric binding medium partially submerged in an image surface.

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A Fast Ferrite Switch for Use at 70 KMC

E.H. Turner. "A Fast Ferrite Switch for Use at 70 KMC." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 300-303.

A normally open (attenuating) switch using ferrites has been built to operate in the 70-kmc region. It can be operated in 0.5 μ sec and can be used with high duty cycles. The attenuation is about one db in the closed position and about 60 db in the open position. Construction and performance of the switch are discussed.



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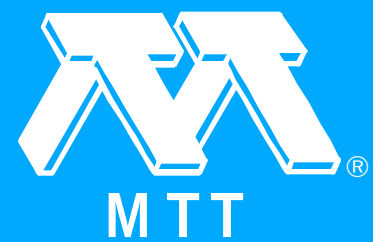
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Theoretical Analysis of the Operation of the Field-Displacement Ferrite Isolator

K.J. Button. "Theoretical Analysis of the Operation of the Field-Displacement Ferrite Isolator." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 303-308.

A theoretical analysis of the resistance-sheet isolator is carried out, and numerical solutions are obtained for the forward and reverse propagation constants of the distorted dominant mode in a rectangular waveguide containing a transversely magnetized thick ferrite slab displaced slightly from the side wall. The microwave electric field patterns within the waveguide are plotted for several values of the physical design parameters of the isolator for which experimental performance data have been reported. Field patterns are used to describe the principles of the isolator and to select the optimum values of slab thickness, internal dc magnetic field, ferrite magnetization, and location of the slab in the waveguide for the idealized isolator. Evidence is presented to show that it is necessary to use a comparatively thick ferrite slab located in a very small usable range of distances from the side wall. The appropriate value of internal dc magnetic field is simply related to the magnetization of the ferrite and to the frequency. It has not been necessary to take into account the perturbing effects of the resistance card or matching techniques in order to explain the basic design principles.

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Reciprocity Relationships for Gyrotropic Media

R.F. Harrington and A.T. Villeneuve. "Reciprocity Relationships for Gyrotropic Media." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 308-310.

Reversal of the dc magnetic field in gyrotropic media transposes the tensor permeability and permittivity. It is shown that this also transposes the impedance, admittance, and scattering matrices any device. It follows from this that the usual reciprocity statements for isotropic media apply to gyrotropic media if one reverses the dc magnetic field whenever an interchange of source and is made.

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Broad-Band Stepped Transformers from Rectangular to Double-Ridged Waveguide

E.S. Hensperger. "Broad-Band Stepped Transformers from Rectangular to Double-Ridged Waveguide." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 311-314.

The design of a series of broad-band Tchebycheff-type stepped waveguide transformers from various sizes of standard rectangular waveguides to a double ridged waveguide covering the frequency range of 4750 to 11,000 mc is described. Four separate transformers employing RG-67/U (WR-90), RG-68/U (WR-112), RG-106/U (WR-137), and WR-159 to Airtron ARA-133 double-ridged waveguide have been designed using this technique and cast in aluminum. The complete frequency range is covered by several pairs depending on which sizes of mating rectangular waveguides are desired. The RG-106/U design covers a frequency range of 53 per cent with a maximum VSWR of 1.08, while the other three designs each cover a slightly smaller frequency band with a VSWR not exceeding 1.05. Along with the experimental results obtained, an outline of the design method is given which can be used to design similar transformers between any compatible rectangular and double ridged waveguides.

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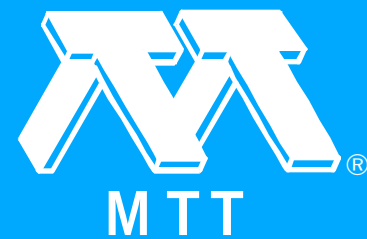


Abstracts

A Wide-Band Balun

J.W. McLaughlin, D.A. Dunn and R.W. Grow. "A Wide-Band Balun." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 314-316.

Experimental results are given for a transformer from an unbalanced 50-ohm coaxial line to a balanced pair of 50-ohm coaxial lines. The design is one proposed by Marchand. The balance, standing wave ratio, and insertion loss are nearly constant over a 13 to 1 frequency range from 650 mc to 8500 mc. The standing wave ratio is less than 2.1 to one and the insertion loss is about 0.5 db over this band of frequencies.



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Power-Flow Relations in Lossless Nonlinear Media

H.A. Haus. "Power-Flow Relations in Lossless Nonlinear Media." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 317-324.

The Manley-Rowe relations, originally derived for nonlinear lumped circuit elements, are generalized to include the power flow in the fields produced in the presence of lossless, nonlinear media. The generalization is carried out first for nonlinear anisotropic media with single-valued relations between the instantaneous $\bar{E}$ and $\bar{P}$, and $\bar{H}$ and $\bar{M}$. The proof is extended to include gyromagnetic media under small-signal excitation at the signal frequency (but large excitation at the pump frequency). The relations are applied to show under what conditions power gain can be achieved with a three-frequency and a four-frequency excitation of a ferrite. The form of the coupling coefficients in the electromagnetic operation of a ferrite amplifier is shown to be a consequence of the generalized Manley-Rowe relations.

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One Aspect of Minimum Noise Figure Microwave Mixer Design

S.M. Bergmann. "One Aspect of Minimum Noise Figure Microwave Mixer Design." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 324-326.

A theory is derived which enables a direct measurement of the optimum RF impedance for minimum noise figure. This is achieved by an extension of Pound's method for loss measurements. Also, an analysis is made of the relation between minimum noise figure and maximum gain of the mixer represented as a two-port network. The procedure consists of first matching the RF signal input terminals with short-circuited IF terminals. Next open-circuited IF terminal conditions are obtained by a circuit used by Pound. Then a reference plane is determined coinciding by preference with the plane of a maximum in the standing wave pattern of $VSWR = r$. A discontinuity is finally introduced that would have a VSWR of $p = \sqrt{r}$ and have its maximum or minimum at the plane of reference.

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A Broad-Band High-Power Vacuum Window for X Band

H.J. Shaw and L.M. Winslow. "A Broad-Band High-Power Vacuum Window for X Band." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 326-330.

Recent developments in high-power tubes for the 3-cm wavelength region have created a need for waveguide output windows which are capable of transmitting peak power in excess of 1 megw and average power in the neighborhood of 1 kw, and which have frequency bandwidths of about 15 per cent. This paper describes a structure which is designed to meet these electrical requirements, and which also has desirable physical and fabrication properties. A dielectric plug, which forms the vacuum seal, is used as one element of a three-element filter. The design procedure and experimental results are discussed.

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A 5-MM Resonance Isolator (Correspondence)

M.T. Weiss and F.A. Dunn. "A 5-MM Resonance Isolator (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 331-331.

The rectangular waveguide resonance isolator operating at frequencies from 3000 to 24,000 mc is a simple and compact device since the dc magnetic field requirements are relatively low. In the 5-mm range, however, resonance isolators are not practical if conventional ferrites are used because very high magnetic fields of about 20,000 oersteds are required to obtain resonance at these high frequencies. By using highly oriented Ferroxdure, resonance isolators in the millimeter range become feasible because of the high internal anisotropy field of 17,000 oersteds exhibited by this material. Thus, with Ferroxdure a magnetic field of a few thousand oersteds is sufficient for resonance in the 5-mm region.

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Abstracts

On Riblet's Theorem (Correspondence)

H. Ozaki. "On Riblet's Theorem (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 331-332.

Riblet presented the following theorem which is concerned with the synthesis of a quarter-wave impedance transformer.



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Ferrite Directional Couplers with Off-Center Apertures (Correspondence)

D.C. Stinson. "Ferrite Directional Couplers with Off-Center Apertures (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 332-333.

A recent study of Bethe's small-hole coupling theory has led to an extension of his work to include the case where the coupling aperture is filled with an anisotropic ferrite. This new theory is applicable to any situation where Bethe's coupling theory is useful and is hindered chiefly by inadequate expressions for the magnetic dipole moments of the ferrite.



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A Modulator for Microwave Mixers (Correspondence)

G.E. Schafer. "A Modulator for Microwave Mixers (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 333-334.

A method is described for producing an amplitude modulated wave at an intermediate frequency from the mixing of two cw signals in a coaxial or waveguide system. The method is adaptable to any frequency range in which crystal mixers are used. At least 82 per cent modulation is produced by this method, and the envelope is a square wave. The repetition rate is 0 to 20 kc with presently available commercial components.



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Reciprocal Ferrite Phase Shifters in Rectangular Waveguide (Correspondence)

A. Clavin. "Reciprocal Ferrite Phase Shifters in Rectangular Waveguide (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 334-334.

A recent article by Reggia and Spencer describes a reciprocal ferrite phase shifter for rectangular waveguide. This phase shifter consists of a pencil of ferrite suspended along the central axis of the waveguide by means of a dielectric. The phase is controlled by an applied longitudinal magnetic field. This geometry is shown in Fig. 1. Large amounts of phase shift are produced by this geometry with low insertion loss, and application to antenna beam scanning appears likely, as suggested by Reggia and Spencer.

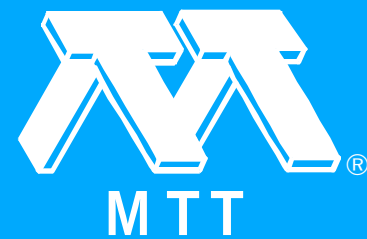
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Contributors (Jul. 1958 [T-MTT])

R.E. Beam, S.M. Bergmann, K.J. Button, R.H. DuHamel, J.W. Duncan, D.A. Dunn, R.W. Grow, R.F. Harrington, H.A. Haus, G. Held, E.S. Hensperger, D.D. King, P.D. Lomer, J.W. McLaughlin, M.R. Millet, R.M. O'Brien, S.P. Schlesinger, H.J. Shaw, E.H. Turner, G. Tyras, A.T. Villeneuve and L.M. Winslow. "Contributors (Jul. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.3 (Jul. 1958 [T-MTT]): 335-337.



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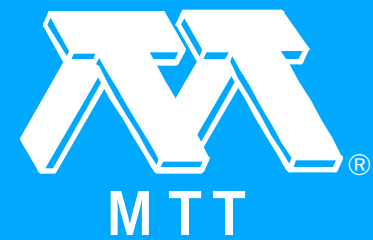
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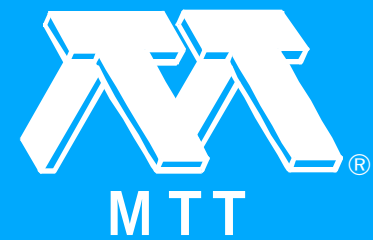
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"Table of Contents (Oct. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 339-339.



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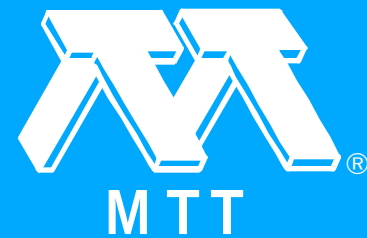


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Biography - Eugene G. Fubini

"Biography - Eugene G. Fubini." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 340-340.

Eugene G. Fubini (A'36-SM'46-F'54) was born on April 19, 1913 in Turin, Italy. He received the Ph.D. degree from the University of Rome, Italy, in 1933. Associated with the National Electric Institute of Italy from 1936 to 1938, he also worked prior to World War I, in the Short-Wave Division, General Engineering Department, of the Columbia Broadcasting System.



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A Plea for Simplification

E.G. Fubini. "A Plea for Simplification." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 341-342.

Handbook engineering is becoming more and more common in our laboratories and the distance is increasing between the engineer faced with the practical problem and the professional theoretical man. The widening of the practice-theory gap seems to be universal throughout our industry: our efficiency is reduced and progress made more difficult. The people who are compelled to the steady use of hand-book formulas regret this fact and have an intense thirst for knowledge.



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Microwave Prize (Oct. 1958 [T-MTT])

W.L. Pritchard. "Microwave Prize (Oct. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 343-343.

The Professional Group on Microwave Theory and Techniques has established the microwave Prize to recognize annually a significant paper which appeared in the IRE Transactions on Microwave Theory and Techniques. In selecting the paper, consideration is given primarily to the subject of the contribution and secondarily to its presentation. All members and affiliates of PGMTT are eligible for the award. The award consists of a certificate, a monetary sum of \$100, and a feature publication in these Transactions. If the paper has more than one author, the monetary sum is divided equally among the authors.



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General Treatment of Klystron Resonant Cavities

K. Fujisawa. "General Treatment of Klystron Resonant Cavities." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 344-358.

Klystron resonant cavities are treated for general cases and their equivalent circuits are theoretically determined, which allows a fairly accurate estimate of resonant properties. It is shown that a reentrant cavity is expressed as a low-frequency series LCR/sub se/ circuit or a shunt LCR/sub sh/ circuit, taking L as the inductance of a toroidal coil with one turn and with a cross section the same as the cavity, C as the gap capacitance plus the equivalent capacitance of the cavity, and R /sub se/ or R /sub sh/ as the equivalent series or shunt resistance of the cavity at resonance. The introduction of the equivalent cavity capacitance has proved to be very effective. The formulas derived here enable one to calculate the resonant frequency within an error of a few per cent and the shunt resistance and the Q within an error of several tenths of a per cent in most cases, and thus should prove to be very useful to the designer of microwave circuits.

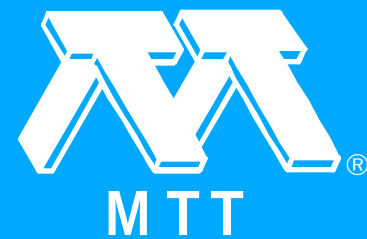


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A Unified Discussion of High-Q Waveguide Filter Design Theory

H.J. Riblet. "A Unified Discussion of High-Q Waveguide Filter Design Theory." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 359-368.

For the general design of conventional, high-Q, direct-coupled waveguide filters to be based on the frequency behavior of a classical ladder network prototype, it is necessary and sufficient that the reflecting elements of the filter be replaceable by admittance inverters and that the lengths of transmission line be replaceable by resonant elements. The error due to the latter assumption is of the order of twice the square of the percentage bandwidth measured in guide wavelengths, and the classical synthesis problem is a limiting case of a solvable transmission line problem. In this limit, an exact equivalence is established between the design of a direct-coupled filter and the design of a quarter-wave-coupled filter based on the same ladder network prototype. Design formulas for equal ripple and maximally flat performance are given for the VSWR's of the reflecting elements in terms of dimensionless quantities. Detailed comparison of previous formulas is made.



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An Analysis of a Broad-Band Coaxial Hybrid Ring

V.J. Albanese and W.P. Peyser. "An Analysis of a Broad-Band Coaxial Hybrid Ring." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 369-373.

This paper describes a broad-band coaxial hybrid ring which has excellent isolation and balance characteristics. The ring differs from the conventional hybrid in that the fourth arm has a series-type balun feed and is positioned so that a plane of symmetry exists through two of the arms. Isolation between these arms and balance between the output arms are theoretically independent of frequency. The admittance and VSWR of the input arms are computed by bisecting the ring about the plane of symmetry and employing standard Smith Chart techniques. Corresponding experimental data are included. A comparison is made with the conventional coaxial hybrid ring.

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Some Notes on the Optimum Design of Stepped Transmission-Line Transformers

L. Solymar. "Some Notes on the Optimum Design of Stepped Transmission-Line Transformers." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 374-378.

This paper describes an optimum design of monotonic stepped transmission-line transformers when the reflection coefficient and the bandwidth ratio are prescribed. For the analysis, discontinuity capacitances and reflection interactions are neglected and the validity of the conclusions is therefore restricted to small steps. The analysis is applicable to a multistep transmission line of which the quarter-wave transformer is a special case. In particular, it is shown that if the number of steps is increased from three to five a larger bandwidth may be obtained, but it is not possible to reduce the over-all length in this manner. For a given bandwidth, the shortest taper is always a stepped transmission line and never a continuous one.



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Microwave Semiconductor Switching Techniques

R.V. Garver, E.G. Spencer and M.A. Harper. "Microwave Semiconductor Switching Techniques." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 378-383.

This paper describes new microwave techniques employing the properties of N-type germanium diode switches. For applications requiring very high isolations, multiple switches are added in tandem. With proper spacing, they form antiresonant cavity circuits. In this case the isolations and insertion losses in db are directly additive. A switch is described which is normally ON and is pulsed OFF. Finally, details are given of a switch in a hybrid-tee configuration in which switching isolations of 50 db are obtained with an insertion loss of 0.7 db.



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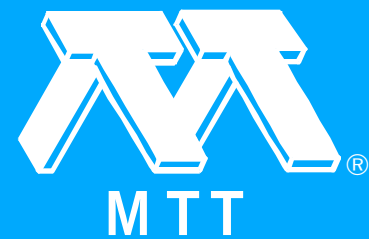
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Microwave Q Measurements in the Presence of Coupling Losses

E.L. Ginzton. "Microwave Q Measurements in the Presence of Coupling Losses." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 383-389.

In the use of the impedance (Q-circle) method of measuring the cavity Q values, the presence of losses in the coupling network (between the cavity and the available external terminals) is usually neglected. If appreciable losses are present this simplification is not justified, and its use can lead to significant errors. The losses in any coupling network can be described by means of an equivalent canonical circuit containing a series and a shunt resistor. The losses due to the series element are immediately apparent from the character of the impedance locus when plotted on a Smith Chart and can be corrected for an "apparent" Q value. However, unless the shunt loss can be determined by a separate calibration of the coupling network, the apparent Q value will be ambiguous because the shunt losses occurring in the coupling network are not distinguishable from those in the cavity proper. Methods for using the impedance data for determining the Q values are given on the assumption that the coupling network parameters can be found. It is also pointed out that due to the presence of coupling losses the loaded and external Q values are no longer uniquely defined, but their meaning depends upon the application of interest. Formulas relating these to the coupling network parameters are given.

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The Excitation of a Dielectric Rod by a Cylindrical Waveguide

C.M. Angulo and W.S.C. Chang. "The Excitation of a Dielectric Rod by a Cylindrical Waveguide." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 389-393.

This paper is a theoretical analysis of the excitation of the lowest circular symmetric TM surface wave along an infinite circular dielectric rod by a metallic cylindrical waveguide coaxial with the rod. The asymptotic expressions for all the fields are obtained by means of the Wiener-Hopf method. The expressions for the total average power transmitted to the surface wave, the total average power reflected, and the total power radiated, per unit incident power, are derived and computed for $\epsilon=2.49$ for various radii of the dielectric rod.

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An Investigation of the Properties of Germanium Mixer Crystals at Low Temperatures

L.K. Anderson and A. Hendry. "An Investigation of the Properties of Germanium Mixer Crystals at Low Temperatures." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 393-398.

Experimental determinations of the noise temperature ratio, IF resistance, and conversion loss of 1N263 germanium mixer diodes operated in an X-band receiver are presented as a function of mixer temperature for the range -196°C to 27°C . No improvement in receiver noise factor was obtained by cooling the mixer to -196°C ; however an improvement of 0.3 to 0.6 db was observed by cooling to a temperature in the region -100°C to -50°C . The exact value of the improvement and the optimum temperature depends on the individual crystal, as well as on dc bias and local oscillator drive.

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



Abstracts

The Multiple Branch Waveguide Coupler

J. Reed. "The Multiple Branch Waveguide Coupler." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 398-403.

A multiple branch directional coupler is discussed for rectangular waveguide applications for series junctions. A design method is developed which is valid for any coupling ratio and any number of branch lines with perfect match and directivity. The frequency response of this type coupler is calculated with the aid of a digital computer.



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Coupled-Transmission-Line Directional Couplers

J.K. Shimizu and E.M.T. Jones. "Coupled-Transmission-Line Directional Couplers." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 403-410.

Formulas are presented for the design of coupled-transmission-line directional couplers that are rigorous for any value of coupling. Two basic types are treated in detail; the simplest is one-quarter wavelength long at the center of its frequency band, while the other is three-quarter wavelength long. The quarter-wavelength type can be used over an octave of frequencies with approximately constant coupling, while the three-quarter-wavelength type can be used equally well over more than two octaves. For example, a -3-db coupler of the first type has a variation of ± 0.3 db over a 2:1 band, while the second type has the same variation over a 4.5:1 band. Theoretically both types should have infinite directivity at all frequencies. The experimental results for models of these directional couplers have been found to conform very closely to the theoretical coupling functions, while the directivity, although usually good, is limited by discontinuity effects and constructional tolerances.

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Design of a Full Waveguide Bandwidth High-Power Isolator

B.J. Duncan and B. Vafiades. "Design of a Full Waveguide Bandwidth High-Power Isolator." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 411-414.

An analysis of the microwave fields in rectangular waveguide indicates that circular polarization of the H-vector components exists at two planes only and the location of these planes is frequency dependent. Also, an examination of Kittel's theory reveals that resonance in ferrites can be made to occur at different frequencies for a constant value of dc magnetic biasing field provided the ferrites are characterized by different values of saturation magnetization. These two effects have been used concurrently in the design of an X-band waveguide isolator for operation over a 45 per cent bandwidth, and at high power levels. The theory underlying the design of this isolator is presented. Included is a treatment of the parameters which affect the isolator design. Finally, an operative isolator is described and its experimental characteristics are reported.

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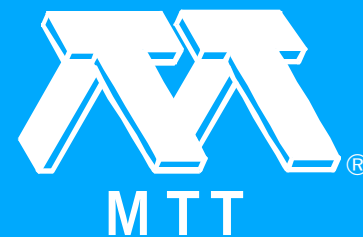


Abstracts

A Simple Artificial Anisotropic Dielectric Medium (Correction)

R.E. Collin. "A Simple Artificial Anisotropic Dielectric Medium (Correction)." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 414-414.

Robert E. Collin, author of "A Simple Artificial Anisotropic Dielectric Medium", which appeared on pages 206-209 of the April, 1958 issue of these Transactions, wishes to make the following correction to his paper.



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Wide-Band Microwave Transmission Measuring System

J.B. Linker, Jr. and H.H. Grimm. "Wide-Band Microwave Transmission Measuring System." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 415-418.

A relatively broad-band balanced microwave measurement system has been built using a traveling-wave tube amplifier which permits automatic phase and amplitude transmission measurements to be made simultaneously as a function of frequency over the frequency range 8.7 kmc-9.6 kmc. A phase accuracy of ± 1 degree can be achieved for a change of attenuation in the unknown of 24 db. Loss measurements can be made with an accuracy of ± 2 per cent. The bridge is built largely of commercially available components and can be easily duplicated. The basic technique is compatible with additional broad-banding efforts as improved components become available, and it will eventually be applicable to all microwave frequencies.

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



Abstracts

Method for Measuring the Directivity of Directional Couplers

G.E. Schafer and R.W. Beatty. "Method for Measuring the Directivity of Directional Couplers." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 419-422.

This method of measuring directivity requires the measurement of the ratio of powers delivered to the side arm when the normal input arm is connected alternately to an adjustable sliding termination and a sliding short circuit. The short circuit is phased to yield maximum and minimum responses and the amplitudes are averaged. Two techniques of adjusting the termination may be used, One procedure requires zero reflection from the termination. The other procedure requires adjustment for a null at the detector and then measurement of the maximum response due to changing the phase of the termination. The inherent errors of the method are analyzed and found to be within the limits--0.01 to 0.00 db in a specific example.



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Abstracts

Development of a High-Power L-Band Resonance Isolator

E.O. Schulz-DuBois, G.J. Wheeler and M.H. Sirvetz. "Development of a High-Power L-Band Resonance Isolator." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 423-428.

Waveguide resonance absorption isolators have been developed for use under high peak and average power conditions at L band. Two ferrite materials, one a nickel aluminate ferrite, the other a nickel cobalt ferrite, were developed for this purpose. The characteristics of isolators using these two materials are described.



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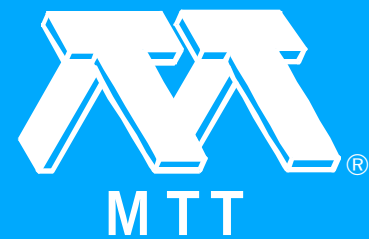
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High-Power Microwave Filters

J.H. Vogelman. "High-Power Microwave Filters." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 429-439.

In order to obtain filters capable of handling very high power, the use of radial lines and uniform line discontinuities was investigated as the most promising approach. In this connection, it was necessary to consider the equivalent circuit and interaction for H-type radial line mated at each end to uniform TE/sub 10/ waveguide for taper angles of 45°. It was found that the equivalent circuit was valid for taper angles of 45°, and that for engineering design purposes the interaction could be neglected. The author utilized the 45° tapers and the uniform lines to design a high-power microwave filter capable of handling 700 kw at 10 pounds pressure in 0.900 by 0.400 ID waveguide. The design procedure for a multielement filter is described utilizing a partly graphical approach.



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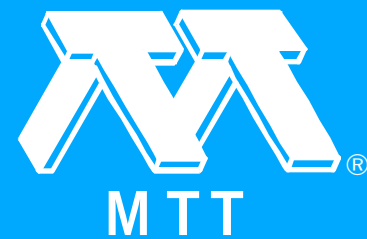


Abstracts

A Method of Calculating the Characteristic Impedance of a Strip Transmission Line to a Given Degree of Accuracy

R.G. de Buda. "A Method of Calculating the Characteristic Impedance of a Strip Transmission Line to a Given Degree of Accuracy." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 440-446.

The calculation of the characteristic impedance of the strip transmission line TEM-mode can be reduced to the solution of a two-dimensional potential equation with the strip cross section determining the boundary conditions. Usually this potential equation is solved by conformal mapping, but only the most simple shapes permit exact mapping. Approximations may require considerable work and their accuracy is uncertain. This paper describes an alternative numerical method which is particularly suitable for boundaries consisting of any number of straight lines and right angles. It is based on relaxation methods, but by using also variational principles it derives an approximate value for the impedance, and an upper and lower bound with a difference as small as desirable.



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Ferrite Line Width Measurements in a Cross-Guide Coupler

D.C. Stinson. "Ferrite Line Width Measurements in a Cross-Guide Coupler." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 446-450.

Theoretical and experimental results are presented to show that the line width and the g factor of a spherical ferrite sample can be measured in a cross-guide coupler. The method is much easier to instrument than the usual cavity method and the measurements are much easier to perform. Experimental verification with a cavity perturbation system indicates that the measured quantities are sufficiently accurate for most purposes.

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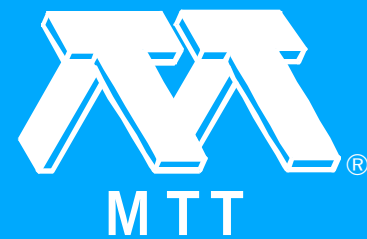


Abstracts

Applications of Directional Filters for Multiplexing Systems

F.S. Coale. "Applications of Directional Filters for Multiplexing Systems." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 450-453.

The design of microwave multiplexing systems for frequency channelization of a broad-band microwave spectrum is complicated by problems such as off-resonance mismatch and mutual interaction between adjacent filters. By employing directional filters as basic building blocks, it is possible to construct multiplexing filters with a perfect input match since the input VSWR of a directional filter is theoretically unity both at resonance and off-resonance. Less insertion loss of a manifold may be obtained by the use of directional filters than with conventional band-pass filters. Curves giving the predicted response of a manifold containing n elements are presented for single-tuned and double-tuned directional filters. An asymmetrical response shape is obtained which has a midband insertion loss related to the separation of adjacent channels. An experimental model consisting of a five-channel multiplexer has been constructed utilizing double-tuned-circular-waveguide directional filters.



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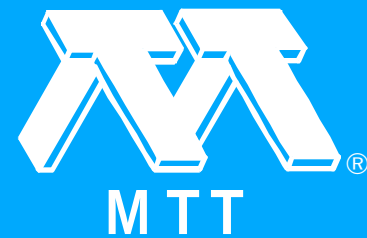


Abstracts

Coaxial Isolator Utilizing Yttrium-Iron Garnet (Correspondence)

L. Freiberg. "Coaxial Isolator Utilizing Yttrium-Iron Garnet (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 454-454.

The inherently narrow ferromagnetic resonance line width attainable with yttrium-iron garnet (YIG) material permits building isolators with greatly improved characteristics at the lower microwave frequencies. An isolator utilizing YIG designed for operation in the UHF range has been reported. This letter describes a coaxial isolator designed to operate at 2250 ± 50 mc employing yttrium-iron garnet.



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A Broad-Band Microwave Coaxial Connector with Capacitive RF Coupling and Isolated DC Returns (Correspondence)

C.M. Lin and R.W. Grow. "A Broad-Band Microwave Coaxial Connector with Capacitive RF Coupling and Isolated DC Returns (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 454-454.

A modified type N connector for passing RF while grounding the center conductor of the coaxial line has been reported by McLaughlin and Dunn. This device is useful for many applications but in microwave measurements it is sometimes necessary to have a high pass filter with a different dc voltage connected to each side of the filter. One such situation occurs in the connection of the input terminal of a microwave tube at one dc potential to a signal generator at essentially ground potential. Such a filter has been made with a type N connector having a series capacitance in the center conductor and a high resistance wire connected to one side of the split center conductor and passing through a small hole in the outer conductor.

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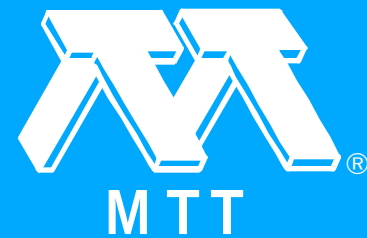


Abstracts

The Cutoff Wavelength of Trough Waveguide (Correspondence)

K.S. Packard. "The Cutoff Wavelength of Trough Waveguide (Correspondence)." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 455-456.

The trough waveguide, although in use for several years, is not widely known and has received only little attention in the literature. This waveguide was suggested by E. G. Fubini, and its fundamental mode may be compared to that of a TE mode in symmetrical strip transmission line.



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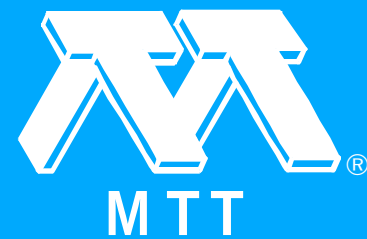
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Contributors (Oct. 1958 [T-MTT])

V.J. Albanese, L.K. Anderson, C.M. Angulo, R.W. Beatty, W.S.C. Chang, F.S. Coale, R.G. de Buda, B.J. Duncan, K. Fujisawa, R.V. Garver, E.L. Ginzton, H.H. Grimm, M.A. Harper, A. Hendry, E.M.T. Jones, J.B. Linker, Jr., W.P. Peyser, J. Reed, H.J. Riblet, G.E. Schafer, E.O. Schulz-DuBois, J.K. Shimizu, M.H. Sirvetz, L. Solymar, E.G. Spencer, D.C. Stinson, B.C. Vafiades, J.H. Vogelman and G.J. Wheeler. "Contributors (Oct. 1958 [T-MTT])." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): 457-460.



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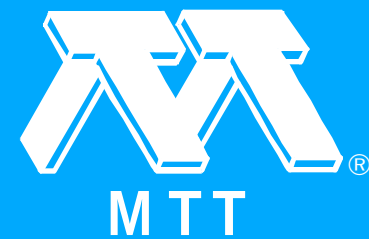
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Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-6, 1958

"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-6, 1958." 1958 Transactions on Microwave Theory and Techniques 6.4 (Oct. 1958 [T-MTT]): i-v.



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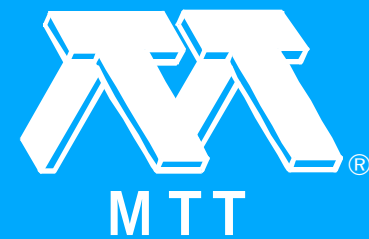
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Front Cover (Jan. 1959 [T-MTT])

"Front Cover (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): f1-f2.



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"Table of Contents (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 1-1.



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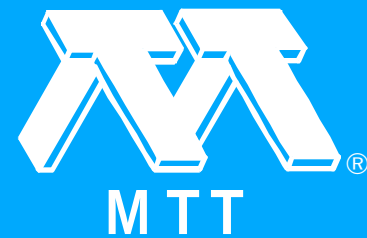


Abstracts

Message from the Chairman (Jan. 1959 [T-MTT])

T.S. Saad. "Message from the Chairman (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 2-2.

A major portion of the operation of the PGMTT rests each year upon several editors, committee chairmen and other individuals. While it has not been customary to honor them with any special recognition, we wish to take this opportunity to identify them to express appreciation for their generous contribution of time and effort.



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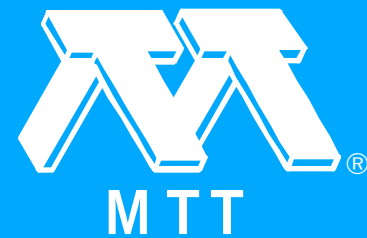


Abstracts

Biography - Wilbur L. Pritchard

"Biography - Wilbur L. Pritchard." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 3-3.

Wilbur L. Pritchard (A'45-M'48-SM'52) was born in New York, N.Y., on May 31, 1923. He received the B.E.E. degree in 1943 from the College of the City of New York. From 1948 to 1951 he was gaged in part-time graduate study at the Massachusetts Institute of Technology.



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Abstracts

Education and Science in a Mature Society

W.L. Pritchard. "Education and Science in a Mature Society." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 4-4.

During recent years self-examination by many thinking Americans has evolved extensive criticism of our educational system. On the one hand, just after the war the criticism was engendered largely by the apparent political naivete of some engineers and scientists. This unawareness on their part contributed to several unfortunate incidents and made the public sensitive to the need for political and cultural sophistication on the part of scientists. Our professional schools were criticized freely for providing curricula so narrowly technical that they did not produce wholly educated people. This criticism was just. No one disputes the need for broad education in scientific and engineering schools.



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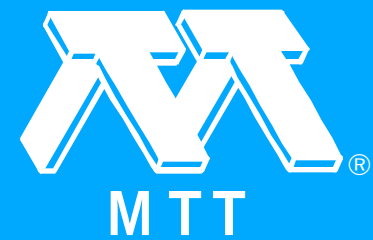


Abstracts

Foreword (Jan. 1959 [T-MTT])

A.L. Aden. "Foreword (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 5-5.

Plans for the 1958 PGMTT National Symposium started during August, 1957 with a decision by the San Francisco Chapter of the PGMTT to try to hold the Symposium on the West Coast.



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Microwave Radiation from Ferrimagnetically Coupled Electrons in Transient Magnetic Fields

F.R. Morgenthaler. "Microwave Radiation from Ferrimagnetically Coupled Electrons in Transient Magnetic Fields." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 6-11.

Under certain restrictive conditions it appears that ferrimagnetically coupled electron spins are capable of coupling energy from a transient magnetic field and giving it up in the form of microwave radiation. This paper analyzes the behavior of the uniform precession of motion in ferromagnetic insulators under the influence of transient magnetic fields of changing amplitude and direction. The expected radiation power and efficiency are calculated for such an oscillator employing yttrium iron garnet.

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Ferrite High-Power Effects in Waveguides

E. Stern and R.S. Mangiaracina. "Ferrite High-Power Effects in Waveguides." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 11-15.

Deterioration of ferrite devices caused by both high power thermal and nonlinear effects are discussed. It is shown that thermal effects can be described, at least qualitatively, by a simple exponential equation. A theoretical maximum power capacity is derived in terms of ferrite configuration parameters. The results of experiments with high peak powers at both S-band and X-band frequencies are compared with predictions of Suhl's theory on nonlinear, high power effects in ferrites. Steady-state and transient effects are considered. It is shown that high power effects may be eliminated in ferrite devices by properly choosing ferrite properties and geometry.

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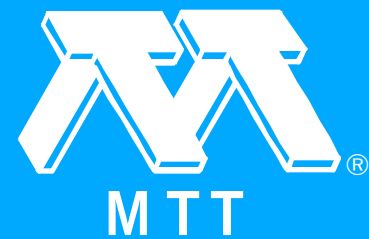
Temperature Effects in Microwave Ferrite Devices

J.L. Melchor and P.H. Vartanian. "Temperature Effects in Microwave Ferrite Devices." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 15-18.

With proper choice of shape, it is possible to minimize the frequency shift of ferromagnetic resonance in microwave ferrite components operating over a wide range of ambient temperatures. Calculations have been made for minimum resonance frequency shift change in saturation moment. Curves relating the resonance frequency shift as a function of saturation magnetization are plotted for several ferrite geometries. Design curves are presented for reducing dependence of resonance frequency on temperature.

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Characteristics of Ferrite Microwave Limiters

G.S. Uebele. "Characteristics of Ferrite Microwave Limiters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 18-23.

Microwave ferrites that exhibit a nonlinear RF absorption as a function of RF power level can be utilized in the construction of a passive microwave device which will allow small RF signals to be transmitted with very little attenuation but which will attenuate large RF signals considerably. Such a device tends to "limit" the amplitude of the microwave energy passing through the device and is therefore called a ferrite microwave limiter. One application of the ferrite limiter is in the protection of crystal detectors in pulsed radar sets. However, when a rectangular pulse of X-band RF energy is transmitted through the limiter, the output waveform is no longer rectangular but consists of a leading edge spike of 0.1- μ sec duration followed by a plateau of highly attenuated RF energy. At the present time the leading edge spike is the major obstacle in the successful use of the ferrite microwave limiter as a TR cell in the protection of crystal detectors. Experimental techniques used to improve the performance of the limiter are presented, and the performance characteristics of an X-band ferrite microwave limiter are shown.

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Nonreciprocity in Dielectric Loaded TEM Mode Transmission Lines

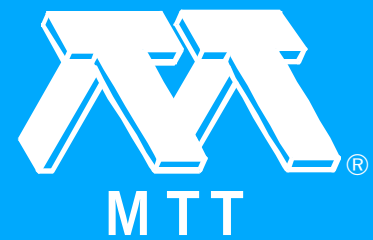
D. Fleri and G. Hanley. "Nonreciprocity in Dielectric Loaded TEM Mode Transmission Lines." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 23-27.

An analysis is presented of partially dielectric loaded strip transmission line from the point of view of ferrite applications. It is shown that the microwave magnetic field is elliptically polarized both at the dielectric surface and within the dielectric. The degree of elliptical polarization is expressed analytically as a function of the dielectric constant, the degree of dielectric loading, and the frequency. For specific values of dielectric constant and loading, a high degree of circularity may be made to exist at the dielectric surface over extremely broad frequency bands. Experimental data are presented which are in accord with the theoretical predictions.

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Ferrite Phase Shifter for the UHF Region

C.M. Johnson. "Ferrite Phase Shifter for the UHF Region." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 27-31.

An extremely compact, low-loss, ferrite phase shifter has been developed for the 200 to 800-mc region. It consists of a folded stripline structure approximately 6½ inches long and less than 1 inch square in cross section. The device requires a longitudinal magnetic field of sufficient intensity to place the operating region above resonance. For field swings of about 900 oersteds (from 430 to 1250 oersteds at 400 mc), 360° change in phase shift can be obtained with about 1 db of loss. The phase shifter is reciprocal and shows identical low-power and high-power characteristics up to at least 10-kw peak. Some additional data are included on the operation of the phase shifter down to 10 mc and up to 2000 mc.

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A Ferrite Serrodyne for Microwave Frequency Translation

F.J. O'Hara and H. Scharfman. "A Ferrite Serrodyne for Microwave Frequency Translation." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 32-37.

A ferrite serrodyne has been developed to produce a frequency translation of X-band microwave signals over ranges from zero to 50 kc. The device consists of an efficient longitudinal field ferrite phase shifter and an associated electronic driver for generating the modulating sawtooth. Transmission or reflection operation is possible. A conversion loss of 1 to 2 db is obtained. Suppression of spurious output spectral components is 33 db or more for a 10-kc translation and 21 db for a 50-kc translation.

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Broad-Band Ferrite Rotators Using Quadruply-Ridged Circular Waveguide

H.N. Chait and N.G. Sakiotis. "Broad-Band Ferrite Rotators Using Quadruply-Ridged Circular Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 38-41.

It has been shown that the rotation of the plane of polarization of a wave propagating in a magnetized unbounded ferrite medium should be independent of frequency. However this is not the case when a ferrite rod of small diameter is placed within a waveguide. For example, if a ferrite rod one-quarter inch in diameter in a fifteen-sixteenth inch diameter circular waveguide is used, the rotation will change by a factor of four to one over the frequency band from 8000 to 10,000 mc. This variation in rotation is substantially due to the waveguide characteristics, and can be minimized by lowering the cutoff frequency of the waveguide. Various methods of lowering the cutoff of circular waveguide are compared. Data on the broadbanding of the rotation by dielectric loading and also by the use of quadruply-ridged circular waveguide is shown. An experimental study showing the effect of the ridge width and height on the cutoff of the circular waveguide and the frequency dependence of the rotation is discussed.

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



Abstracts

Present State of the Millimeter Wave Generation and Technique Art--1958

P.D. Coleman and R.C. Becker. "Present State of the Millimeter Wave Generation and Technique Art--1958." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 42-61.

Two of the few fruitful approaches to the low millimeter and submillimeter wave generation problem appear to be frequency multiplication by means of nonlinear phenomena and frequency conversion by parametric systems. Current work on frequency multiplication using relativistic megavolt beams, crystal diodes, field emitters, ferrites, etc., is reviewed. A brief account of present efforts to extend conventional tubes below wavelengths of 3 mm is presented. Waveguide components used at 1 to 2 mm are described.



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Millimeter-Wave Generation Experiment Utilizing Ferrites

W.P. Ayres. "Millimeter-Wave Generation Experiment Utilizing Ferrites." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 62-65.

It is estimated that at least 50 watts of peak power at 2-mm wavelength has been generated from 4-mm excitation by harmonic generation in ferrites. This experiment is similar to the frequency doubling previously reported from 9 to 18 kmc, except for some differences in optimum geometry and material. A wide range of ferrites has been used, as well as garnets and permanent magnet type materials. In carrying out this experiment it has been necessary to develop components such as a 4-mm high-power isolator, a calorimeter for measurement of the 4-mm and 2-mm power, and numerous 2-mm waveguide components.

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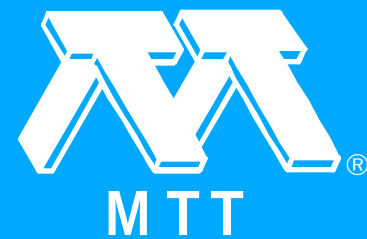


Abstracts

Some Characteristics of Dielectric Image Lines at Millimeter Wavelengths

J.C. Wiltse. "Some Characteristics of Dielectric Image Lines at Millimeter Wavelengths." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 65-69.

The attenuation characteristics of several dielectric image lines have been calculated for the frequency range extending from 24 to 100 kmc and have been checked experimentally at 35 and 70 kmc. To obtain low attenuation at these high frequencies, dielectric materials with little loss and small size of cross section are required, while low values of the dielectric constant are also desirable. The effects of the size and shape of the dielectric cross section and of low dielectric constant are treated separately. To find proper materials with low dielectric constants several new foam plastics were investigated. Three types were found suitable for image line use, and in fact, these plastics have such good electrical and physical properties that they should be useful in many microwave applications. A qualitative measure of field extent is given for several image lines at 35 or 70 kmc, and various image lines and associated components are discussed. A new type of image line, called the tape line, is described.



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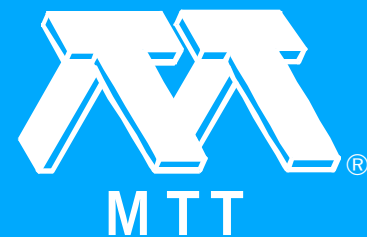


Abstracts

The Interaction of Microwaves with Gas-Discharge Plasmas

S.C. Brown. "The Interaction of Microwaves with Gas-Discharge Plasmas." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 69-72.

The interaction of microwaves with gas-discharge plasmas provides a valuable tool for studying the fundamentals of gas-discharge phenomena and methods of controlling and switching microwave power. A summary of our present state of knowledge in this field is presented by using as particular examples the interaction of high density and low density gas-discharge plasmas in S-band resonant cavities, both in the presence and absence of dc magnetic fields.



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High Power, Magnetic Field Controlled Microwave Gas Discharge Switches

S.J. Tetenbaum and R.M. Hill. "High Power, Magnetic Field Controlled Microwave Gas Discharge Switches." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 73-82.

A new type of gas discharge switch is described. It is electronically controllable, broadband, and capable of rapidly switching high power pulsed microwaves from either of two waveguide input ports to a single waveguide output port, or from one waveguide input port to either of two waveguide output ports. The electronic control is achieved by turning on or off a magnetic field set for cyclotron resonance. An approximate analysis is given of the operation of the active element of the switch and the results are compared with experiment. An analysis of the effects of frequency scaling indicates that, with the exception of the magnetic flux density which increases with increasing frequency, the switch parameters either improve or remain unchanged in going to higher frequencies. Two different switch configurations are investigated, one a Y-junction switch for operation at S band and the other a balanced top-wall hybrid coupler switch for operation at K/sub u/ band. Their electrical characteristics are described.

Click on title for a complete paper.



Abstracts

Solid-State Microwave Amplifiers

H. Heffner. "Solid-State Microwave Amplifiers." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 83-91.

The maser and the parametric amplifier form a new class of microwave amplifiers which can exploit the properties of bound electrons in a solid. These amplifiers have several common characteristics, among them being their very low-noise performance. This paper reviews the method of operation of these amplifiers, discusses the performance achieved and achievable by the various versions, and points up some of the difficulties involved in effectively utilizing the extremely low-noise figures obtainable. A bibliography is included in which an attempt has been made to include all published papers on masers and parametric amplifiers.



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Abstracts

A UHF Solid-State Maser

R.H. Kingston. "A UHF Solid-State Maser." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 92-94.

Chromium doped potassium cobalticyanide has been utilized in the design and construction of a solid-state maser operating in the frequency range of 300 to 500 mc. The pumping frequency is fixed at 5400 mc and the magnetic field required is in the vicinity of 80 gauss. The design utilizes a cavity mode at the pumping frequency and a tuned loop at the operating frequency, thus avoiding the design complications associated with the large size of UHF cavities. System measurements using a directional coupler for isolation yield noise temperatures of approximately 70 degrees Kelvin at bandwidths in the 50 kc range.



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A Microwave Frequency Standard Employing Optically Pumped Sodium Vapor

W.E. Bell, A. Bloom and R. Williams. "A Microwave Frequency Standard Employing Optically Pumped Sodium Vapor." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 95-98.

An instrument in which a simple microwave triode oscillator is stabilized by reference to a natural atomic resonance---the field-independent hyperfine resonance of sodium---is described. Light from a sodium lamp is transmitted through an absorption cell containing sodium vapor and argon, which is placed in a resonant cavity. This light produces population differences between the two quantum levels which are involved in the desired atomic resonance and provides a means of detecting resonance. The cavity is excited by an external microwave triode oscillator which is frequency modulated to a small degree at 60 cycles. When the exciting oscillator frequency coincides with the center of the atomic resonance line, the signal observed by a photocell will be a modulation of the transmitted light at 120 cycles and higher even-order harmonics. Any deviation from line center will introduce a 60-cycle component whose phase and magnitude may be detected to produce an error signal to retune the oscillator in the usual servo loop manner. Theory predicts that an accuracy of possibly one part in 10^{10} can be achieved by systems using sodium and suitable local oscillators. It is evident also that such systems can be engineered into quite small packages, making possible many new applications of microwave oscillators stabilized to high order.



Abstracts

Microwave Filter Design Using an Electronic Digital Computer

L. Young. "Microwave Filter Design Using an Electronic Digital Computer." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 99-101.

It is shown how a transmission-line circuit can be analyzed by a digital computer. Transformation matrices are used and broken down into equations which are applicable to a computer. "Synthesis by computer" involves feeding in an approximate design and programming the computer to search for better parameters until the performance matches the specification. Examples are given to indicate time and cost of both analysis and synthesis procedures on an IBM Type 650 digital computer. The synthesis of a stagger-tuned three-cavity filter is described.



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Measurement of Two-Mode Discontinuities in a Multimode Waveguide by a Resonance Technique

L.B. Felsen, W.K. Kahn and L. Levey. "Measurement of Two-Mode Discontinuities in a Multimode Waveguide by a Resonance Technique." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 102-110.

The deliberate use of two or more propagating modes in a multimode waveguide, and a knowledge of associated control elements, has assumed renewed importance, particularly for millimeter wavelength applications. This paper presents a resonance measurement technique for the precise evaluation of the equivalent network for a lossless shunt discontinuity coupling two nondegenerate modes in a multimode waveguide. The discontinuity structure is placed into a cavity closed by adjustable plungers, and the data consists of those plunger positions which render the cavity resonant in the two modes of interest. This multipoint data is then transformed to permit an analysis of the two-port network in the discontinuity plane by conventional techniques. Computations and experimental results obtained at S band illustrative of the procedure are presented for shunt discontinuities coupling the E_{01} and H_{01} modes in circular waveguide. The accuracy achieved is comparable to that obtained in single mode precision measurements.

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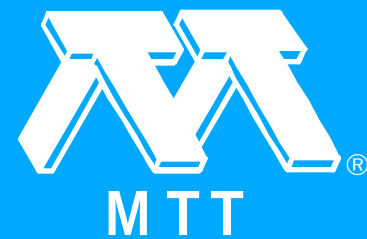


Abstracts

Mode Couplers and Multimode Measurement Techniques

D.J. Lewis. "Mode Couplers and Multimode Measurement Techniques." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 110-116.

The measurement of harmonic and spurious signals in waveguide systems is complicated by the fact that one must usually deal with a multimodal measurement. Since the energy may propagate in any mode consistent with the frequency and waveguide geometry, the measurement system used must discriminate between these different modes. A simple and direct approach to this problem is through the use of "mode couplers" which couple selectively to any desired mode. Theoretical and practical details for mode couplers for the first five modes in rectangular waveguide are presented, as well as the application and limitations of this measurement technique.



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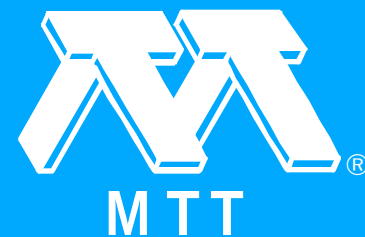


Abstracts

Measurement of Harmonic Power Generated by Microwave Transmitters

V.G. Price. "Measurement of Harmonic Power Generated by Microwave Transmitters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 116-120.

A measurement technique is described that can be used to determine quantitatively the power levels of the higher order modes propagating in a straight, lossless, rectangular waveguide. The technique employs a number of small calibrated electric probes which are fixed on the broad and narrow walls of the waveguide measurement section to sample the electric fields within. The method used to calibrate these probes is briefly discussed, and information on accuracy and limitations of the probe technique is presented. Some measurement results on the power levels in the modes of the second and third harmonic frequencies in the outputs of high power S-band magnetrons and klystrons are presented. The multiple-probe technique has reduced the time required to take measurements at a given frequency to about one-half hour. An automatic computer has been programmed to perform all of the required mathematical operations and has reduced the computation time to less than one-half hour for each measurement frequency.



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Tunable Passive Multicouplers Employing Minimum-Loss Filters

J.F. Cline and B.M. Schiffman. "Tunable Passive Multicouplers Employing Minimum-Loss Filters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 121-127.

Several multicoupler techniques are described for operating twenty or more UHF transmitters and receivers simultaneously with a single localized antenna system. The types of multicouplers considered include the simple parallel-connected filter type and several distributed-line types, in which the individual branches are separately tuned. The filters used are of the symmetrical, narrow-band, direct-coupled resonator type, designed to obtain minimum center-frequency insertion loss for a given insertion loss in the adjacent channels. Design formulas are given for these filters, and characteristic response shapes are presented. The extra-channel susceptance, which is the principal factor limiting the number of channels obtainable in a single multicoupler, is discussed in terms of the input coupling coefficient, the resonator parameters, and the lengths of the connecting lines.

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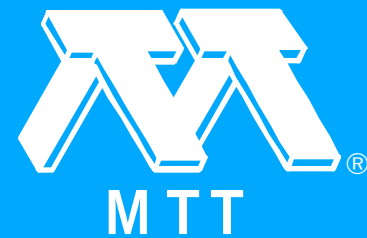


Abstracts

A Wide-Band Strip-Line Balun

E.M.T. Jones and J.K. Shimizu. "A Wide-Band Strip-Line Balun." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 128-134.

A new wide-band strip-line balun that uses a pair of dual coupled-strip-line band-pass filters is described. It can operate over bandwidths up to about 8:1 in the frequency range of about 100 to 10,000 mc. Design data and theoretical performance curves for typical wide-band baluns of this type are presented. The measured performance of an experimental balun operating over a 3:1 frequency range centered at 3000 mc is compared with the theoretical performance, and the effects of discontinuities and dissymmetries in the experimental balun are discussed.



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Periodic Structures in Trough Waveguide

A.A. Oliner and W. Rotman. "Periodic Structures in Trough Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 134-142.

The center fin in trough waveguide can be modified in a periodic fashion to alter the propagation characteristics of the guide. Two such periodic modifications, one an array of circular holes and the second a periodic array of teeth, have been measured fairly extensively and analyzed theoretically. These configurations are useful in connection with antenna scanning or waveguide filter applications. The array of holes produces only a mild slowing of the propagating wave, but the toothed structure, which may alternatively be described as a series of flat strips extending beyond the edge of the tin, can cause the propagating wave to vary from a very slow to a very fast wave. The periodic structures are theoretically treated by two methods, a transverse resonance procedure and a periodic cell approach. These theoretical results agree very well with each other and with the measured data.



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A Study of a Serrated Ridge Waveguide

H.S. Kirschbaum and R. Tsu. "A Study of a Serrated Ridge Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 142-148.

The serrated, or periodically slotted ridge produces a periodic loading which retards the phase velocity of the wave in a waveguide. Such structures may be used to provide a variable index of refraction for microwave lenses and as elements in microwave filters. Two approaches are presented in this paper giving the frequency dependence of the index of refraction. One is based on equivalent circuit representations which are qualitatively valid for the effect of the loading. Circuit parameters which determine the shape of the index of refraction curve are calculated from the experimental data. The other approach providing a purely analytic expression of the index of refraction is derived by a field matching method. Calculations show good agreement with test data.

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Design Considerations for High-Power Microwave Filters

S.B. Cohn. "Design Considerations for High-Power Microwave Filters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 149-153.

The need for high-power filters is reviewed briefly, and various design approaches are discussed. The major portion of the paper treats the power-handling capacity of multiple-resonator filters using inductive windows or posts as coupling elements. A formula is derived that gives the relative power capacity of a waveguide filter of this type in terms of the bandwidth and cavity dimensions, and the element values of the low-pass prototype filter. By means of this formula it is shown quantitatively how high-power ratings may be achieved through the use of enlarged cavities. Methods for eliminating spurious filter responses and of reducing the reflected energy are discussed.

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Evacuated Waveguide Filter for Suppressing Spurious Transmission from High-Power S-Band Radar

H.A. Wheeler and H.L. Bachman. "Evacuated Waveguide Filter for Suppressing Spurious Transmission from High-Power S-Band Radar." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 154-162.

A one-megawatt magnetron, used in a search radar, tunes over the S band of 3.1 to 3.5 kmc, and simultaneously causes interference in the band of 3.7 to 4.0 kmc by occasional oscillation in spurious modes. For insertion in the antenna line of this radar, a band-pass filter has been designed to provide over 120 db attenuation in the interference band. It is a wave filter with M-derived terminations for impedance matching and with three sections including traps resonant in the stop band, for high attenuation, all made of nine resonant irises spaced $\frac{1}{4}$ wavelength in a waveguide. Each filter is sealed by pressure windows and evacuated to handle the high-power pulses. Two such filters are connected in parallel between 3-db directional couplers to make a nonreflecting assembly.

Click on title for a complete paper.



Hybrid Junction--Cutoff Waveguide Filters

E.N. Torgow. "Hybrid Junction--Cutoff Waveguide Filters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 163-167.

Low-pass and band-pass filter characteristics can be obtained in waveguide by the use of an arrangement of a waveguide hybrid junction and lengths of cutoff waveguide. Low-pass filters are obtained by terminating a conjugate pair of ports of the hybrid in identical cutoff waveguide sections through short lengths of phase correcting lines. Band-pass characteristics can be realized by introducing a third cutoff waveguide having a lower cutoff frequency at the input port of the hybrid. These filters have a matched input at all frequencies above the lower end of the pass band and are characterized by low-pass band insertion loss, steep skirt selectivity, and moderate rejection band attenuation. The power handling capabilities of the structure exceed those possible with conventional microwave filter circuits, and the design is particularly well suited for use at frequencies above 10 kmc. Simple techniques are available for constructing filters of this type having variable cutoff frequencies and variable bandwidths.



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Practical Design of Strip-Transmission-Line Half-Wavelength Resonator Directional Filters

R.D. Wanselow and L.P. Tuttle, Jr.. "Practical Design of Strip-Transmission-Line Half-Wavelength Resonator Directional Filters." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 168-173.

Strip-transmission-line directional filters have been found extremely useful since they serve as a combination multiplexer and filter assembly. A step by step procedure has been developed for the quarter-wave coupled filter design having a prescribed band-width, skirt selectivity, and passband ripple tolerance for narrow band multiplexing applications. An experimental study of the strip-transmission-line resonator as an integral part of the directional filter utilizing direct and quarter-wave coupling between the half-wave resonants has been carried out; and an efficient method of tuning a filter is described. This study has included not only problems of insertion loss caused by dissipation but also effects on filter characteristics caused by variations in environmental temperature.

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A High Average Power Broad-Band Ferrite Load Isolator for S Band (Correspondence)

E.N. Skomal. "A High Average Power Broad-Band Ferrite Load Isolator for S Band (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 174-175.

A broad-band high average power S-band load isolator has been developed by using a dielectric loaded waveguide and a composite ferrite.

Click on title for a complete paper.



Abstracts

Reflection Coefficient of E-Plane Tapered Waveguides (Correspondence)

R.F.H. Yang and K. Matsumaru. "Reflection Coefficient of E-Plane Tapered Waveguides (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 175-176.

In a paper by Matsumaru formulas of the input reflection coefficients of the linearly and sinusoidally E-plane tapered waveguides are given. Excellent agreements between the theoretical and experimental results have been found in both cases. In this note we wish to add some analytical remarks.



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The Permeability Matrix for a Ferrite Medium Magnetized at an Arbitrary Direction and its Eigenvalues (Correspondence)

G. Tyras. "The Permeability Matrix for a Ferrite Medium Magnetized at an Arbitrary Direction and its Eigenvalues (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 176-177.

In analysis of propagation through magnetized ferrites it is usually assumed that the applied magnetostatic field is along one of the axes of the microwave carrier. It may be of interest to analyze the more general case; one in which the applied magnetostatic field is at an angle arbitrary to the axes of the microwave carrier.

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Abstracts

Resistive-Film Calorimeters for Microwave Power Measurement (Correspondence)

J.A. Lane. "Resistive-Film Calorimeters for Microwave Power Measurement (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 177-177.

Two papers published recently in these Transactions have described calorimetric techniques for the measurement of microwave power at the milliwatt level which are free from the limitations inherent in existing methods using resistance-type milliwatt-meters.



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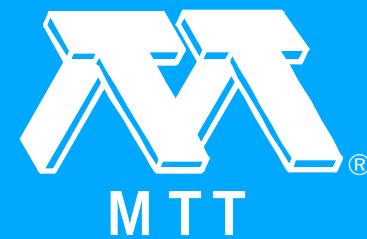


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PGMTT News (Jan. 1959 [T-MTT])

"PGMTT News (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 178-179.

Stanford University was the location of the 1958 PGMTT National Symposium, held on May 5-7. Four hundred and thirty-seven registrants attended the six technical sessions held in Cubberley Auditorium.



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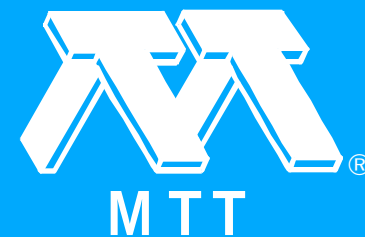
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Call for Papers - 1959 PGMTT National Symposium (Jan. 1959 [T-MTT])

"Call for Papers - 1959 PGMTT National Symposium (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 180-180.



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W.P. Ayres, H.L. Bachman, R.C. Becker, W.E. Bell, A. Bloom, S.C. Brown, H.N. Chait, J.F. Cline, S.B. Cohn, P.D. Coleman, L.B. Felsen, D.A. Fleri, G.L. Hanley, H. Heffner, R.M. Hill, C.M. Johnson, E.M.T. Jones, W.K. Kahn, R.H. Kingston, H. Kirschbaum, L. Levey, D.J. Lewis, R.S. Mangiaracina, J.L. Melchor, F.R. Morgenthaler, F.J. O'Hara, A.A. Oliner, V.G. Price, W. Rotman, N.G. Sakiotis, H. Scharfman, B.M. Schiffman, J.K. Shimizu, E. Stern, S.J. Tetenbaum, E.N. Torgow, R. Tsu, L.P. Tuttle, Jr., G.S. Uebele, P.H. Vartanian, Jr., R.D. Wanselow, H.A. Wheeler, R.G. Williams, J.C. Wiltse and L. Young. "Contributors (Jan. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.1 (Jan. 1959 [T-MTT]): 181-186.



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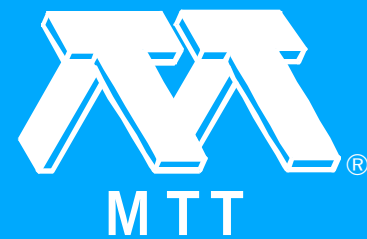
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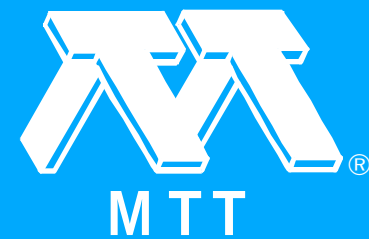
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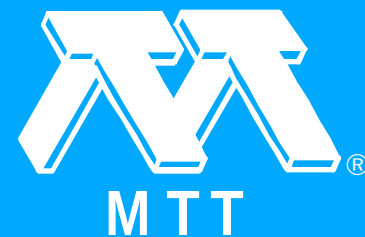


Abstracts

Message from the Editor (Apr. 1959 [T-MTT])

K. Tomiyasu. "Message from the Editor (Apr. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 188-188.

Since the editorship of Transactions is a group responsibility which should be rotated among its members, I have asked to be replaced after serving for two years. I deeply appreciate having had this opportunity for it has been interesting, enjoyable, and rewarding. This issue of Transactions is the last one under my editorship and the next following issue, July, 1959, will be the first one under the new editor, Dr. Donald D. King.



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Biography - Seymour B. Cohn

"Biography - Seymour B. Cohn." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 189-189.

Seymour B. Cohn (S'41-A'44-M'46-SM'51-F'59) was born in Stamford, Conn., on October 21, 1920. After receiving the B. E. degree in electrical engineering from Yale University, New Haven, Conn., in 1942, he worked for the Radio Research Laboratory of Harvard University, Cambridge, Mass., specializing in UHF and microwave receivers, circuits, and filters. In 1944 he represented the Radio Research Laboratory as a technical observer with the U. S. Air Force in the Mediterranean Theater of Operations. Following the disbanding of the Radio Research Laboratory at the end of 1945, he enrolled as a graduate student at Harvard University and was awarded the M.S. degree in communication engineering in 1946, and the Ph.D. degree in engineering science and applied physics in 1948.

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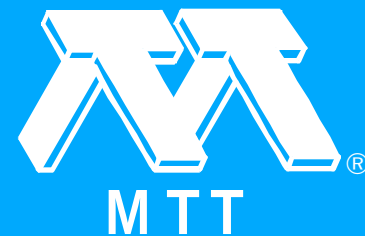


Abstracts

Breaking through the Mental Barrier

S.B. Cohn. "Breaking through the Mental Barrier." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 190-191.

Any of us whose work requires thinking will realize that the brain was not really meant for scientific effort. As to whether it is better suited to its more basic functions of guiding the individual is another fascinating subject that I will not consider here. Instead, I choose to pinpoint and attack a major inadequacy of the mind that interferes with our professional labors, and hope thereby, in some degree, to assist progress in our field.



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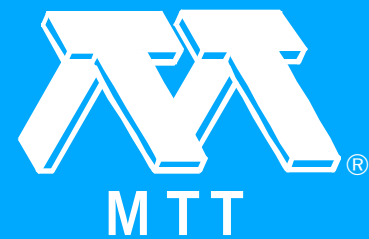
Reflection of a Pyramidally Tapered Rectangular Waveguide

K. Matsumaru. "Reflection of a Pyramidally Tapered Rectangular Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 192-196.

The reflection coefficient Γ of a pyramidally tapered rectangular waveguide is derived by assuming that the taper impedance is proportional to the height and guide wavelength and inversely proportional to the width of the taper cross section. It is shown that the loci of Γ , plotted in the K plane as a function of taper length for some conventional tapers, do not pass through the center of the chart at multiples of a half-guide wavelength as for an exponential line, but instead they converge almost concentrically. The frequency characteristic of the pyramidally tapered waveguide is compared with other types of tapers. Typical 7-kmc experimental results for several tapers differing in length are presented.

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Cascade Directional Filter

O. Wing. "Cascade Directional Filter." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 197-201.

A directional filter is a completely matched four-port which exhibits a directional and a filter-like frequency characteristic. This paper explores the properties of N-directional filters connected in cascade through sections of transmission lines. Analysis shows that if a directional filter admits the equivalent circuit representation offered here, its transfer functions are functions of only one parameter, a susceptance function. When the directional filters are cascaded in a certain way, the overall transfer functions have the same form as before except that the susceptance function is now the sum of the susceptance functions of the component filters. The last property is an important one. Given a transfer function expressed in terms of a susceptance function, the network designer can expand the susceptance in partial fraction and realize the transfer function using directional filters in cascade, each being characterized by a much simpler susceptance.

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



Propagation in a Dielectric-Loaded Parallel Plane Waveguide

M. Cohn. "Propagation in a Dielectric-Loaded Parallel Plane Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 202-208.

A theoretical analysis of wave propagation in a parallel plane waveguide partially filled with a dielectric is performed. This transmission line is a symmetrical three-region structure consisting of two infinite parallel conducting planes with a dielectric slab of rectangular cross section between and contacting each of the planes. It has been found that TEM and TM modes cannot propagate on this structure. This investigation is concerned with TE modes, although hybrid modes can also propagate on this line. The lowest order TE mode, which is the dominant mode, has no cutoff and hence is inherently suited to extremely wide bandwidth operation. Equations have been presented for the field components, guide wavelength, cutoff criteria, power handling capabilities, wall losses, and dielectric losses as a function of the operating wavelength, waveguide dimensions, and material constants. In the case of the dominant mode, design curves covering a large range of wavelengths, dimensions, and dielectric constants are presented. For a loosely bound wave, the losses are comparable or less than those of conventional rectangular waveguide and the power handling capacity is an order of magnitude greater.





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Electromagnetic Backscattering Measurements by a Time-Separation Method

C.C.H. Tang. "Electromagnetic Backscattering Measurements by a Time-Separation Method." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 209-213.

The object of this research is to investigate the feasibility of adapting the conventional pulsed radar technique for closerange back-scattering measurements for obstacles of arbitrary shape and small scattering cross sections. The time-separation or microwave-pulse method described in this paper differs essentially from all previously used laboratory methods in that the scattered field does not mix with the incident field at the detector and is separated from it in time. The essential experimental arrangement of this method is similar to that of the CW magic-T method except that a source generating very short pulses is used instead of CW. Preliminary experimental data for thin circular metallic disks show that the pulse method is a feasible one, since the measured results are in close agreement with the theoretical values. Accurate back-scattering measurements for obstacles of arbitrary shape and small scattering cross sections should be obtainable by this method provided a short microwave pulse of high power level is available.

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On Network Representations of Certain Obstacles in Waveguide Regions

H.M. Altschuler and L.O. Goldstone. "On Network Representations of Certain Obstacles in Waveguide Regions." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 213-221.

Network representations for a class of obstacles in waveguide regions when the diffraction problem is of a vector type can be obtained by the use of E- and H-type modes. The special properties of these modes are discussed and highlighted by an example involving the network representation of a periodic strip grating in free space for oblique incidence. Transformations relating the different networks based on various modal representations in rectangular coordinate systems are also discussed.

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



Reflectors for a Microwave Fabry-Perot Interferometer

W. Culshaw. "Reflectors for a Microwave Fabry-Perot Interferometer." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 221-228.

The advantages of microwave interferometers for wavelength and other measurements at millimeter wavelengths are indicated, and a microwave Fabry-Perot interferometer discussed in detail. Analogous to the cavity resonator, this requires reflectors of high reflectivity, small absorption, and adequate size. Stacked dielectric plates, and stacked planar or rod gratings are shown to be suitable forms of reflectors, and equations for the reflectivity, optimum spacing, and bandwidth of such structures are derived. A series of stacked metal plates with regularly spaced holes represents a good design of reflector for very small wavelengths. Fringes and wave-length measurements at 8-mm wavelength are given for one design of interferometer, these being accurate to 1 in 10/sup 4/ without any diffraction correction. For larger apertures and reflectors in terms of the wavelength, errors due to diffraction will decrease.



Abstracts

Precise Control of Ferrite Phase Shifters

D.D. King, C.M. Barrack and C.M. Johnson. "Precise Control of Ferrite Phase Shifters." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 229-233.

Hysteresis and thermal drifts can prevent accurate calibration of ferrite phase shifters. To provide a precise setting of phase in response to a control signal a servo system has been developed. This system utilizes a control frequency to determine uniquely the phase shift in a ferrite element. The desired phase shift is then a function only of control frequency and line length. Performance data are given for various operating conditions of the control system.



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Abstracts

Tables for Cascaded Homogeneous Quarter-Wave Transformers

L. Young. "Tables for Cascaded Homogeneous Quarter-Wave Transformers." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 233-237.

Quarter-wave transformers are frequently required in microwave and UHF systems. An exact design procedure is known but involves lengthy calculations. Faced with the design of many such transformers, the calculations were programmed on an IBM 704 digital computer. The speed of computation is such that several hundred designs for 2, 3, and 4 section transformers were systematically computed in a few minutes. The results are reproduced here in tables, which should permit the calculation of most cases of practical interest by interpolation.



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The Synthesis of Symmetrical Waveguide Circulators

B.A. Auld. "The Synthesis of Symmetrical Waveguide Circulators." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 238-246.

A method for synthesizing symmetrical waveguide circulators by adjusting the eigenvalues of the scattering matrix is described. This procedure is particularly useful for the design of very compact circulators in the form of waveguide junctions containing ferrite obstacles. Permissible structural symmetries for a circulator are listed, and a standard form for the scattering matrix of a symmetrical circulator is defined. The synthesis procedure is then described in detail, stating the conditions to be imposed on the scattering matrix eigenvalues, and an expression is obtained for the changes in the eigenvalues due to the placing of anisotropic material within the junction. By applying the theory to Allen's 4-port turnstile circulator, it is shown that the use of a matched turnstile junction and a reflectionless Faraday rotator is not essential. The theory is also applied to the design of novel 3- and 4-port circulators, and two 6-port circulators, one of which may be used as a 5-position waveguide switch, are described. Some experimental results are presented for a compact 3-port circulator in the form of an H-plane Y junction, in 1 inch by ½ inch waveguide, containing a ferrite post obstacle. This circulator, which operates with a bias field of approximately 25 oersted, has a useful bandwidth of 3 per cent. Greater bandwidths would be expected in a Stripline or a fin-line version of this device.

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Delay Distortion in Crystal Mixers

T. Kawahashi and T. Uchida. "Delay Distortion in Crystal Mixers." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 247-256.

Delay distortion is one of the most important characteristics in the frequency-modulated supermultichannel microwave repeater. With regard to receiving crystal mixers, the cause, shape, vanishing condition, etc., of delay distortion are analyzed, and the experiments show good agreement with the results of this analysis. To eliminate this delay distortion, the electrical length between the crystal and the image suppression filter must be determined so that the image frequency impedance may not be infinite in a desired frequency band, or the intermediate frequency load impedance must be fixed at a certain definite value.

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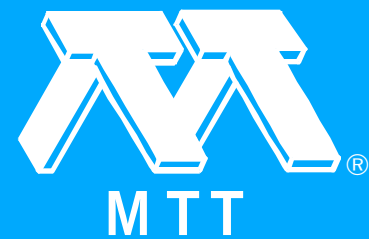
The Efficiency of Excitation of a Surface Wave on a Dielectric Cylinder

J.W. Duncan. "The Efficiency of Excitation of a Surface Wave on a Dielectric Cylinder." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 257-268.

This paper presents a theoretical and experimental study of the excitation of the lowest order TM surface wave on an infinite dielectric cylinder. The source is a circular filament of magnetic current within the dielectric rod. The integral solution for the field is evaluated as a contour integral by applying Cauchy's theorem. The far zone radiation field is obtained by means of a saddle point integration. Curves are presented which show excitation efficiency as a function of $k_0 a$, the normalized circumferential length of the filament. A filament 0.83 wavelength in diameter will launch the TM mode with an efficiency of 95 per cent. A narrow annular slot in a large metal sheet was used to approximate the magnetic current filament and efficiency was measured using Deschamps' method for a two-port junction. The experimental measurements verify the theoretical analysis. In addition, it was found that the slot launching efficiency was essentially independent of the ground plane dimensions.

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Proposal for a Tunable Millimeter Wave Molecular Oscillator and Amplifier

J.R. Singer. "Proposal for a Tunable Millimeter Wave Molecular Oscillator and Amplifier." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 268-272.

An atomic beam apparatus suitable for a millimeter wave generator is theoretically discussed. The beam consists of atoms having a net magnetic moment. The upper and lower Zeeman levels of the atomic beam in a magnetic field are spatially separated by an inhomogeneous magnetic field. The upper state atoms enter a cavity where transitions occur at a frequency determined by a static magnetic field. The resonant frequency of the cavity is set at the transition frequency. The positive feedback of the cavity allows operation as an oscillator. Some of the more important parameters for oscillator operation are evaluated. The upper frequency limit is determined primarily by the resonant structure design.

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



Abstracts

High-Speed Microwave Switching of Semiconductors--II

R.V. Garver. "High-Speed Microwave Switching of Semiconductors--II." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 272-276.

A relationship between low-power isolation and small-signal, low-frequency diode resistance is reported. A study of ambient heating indicates that with increasing temperature the diode characteristics tend to approach the line characteristic of the above relationship. Observed switching speeds of 1.5 to 3.0 μs are reported. A theory is presented which agrees with the switching time data and predicts microwave switching times as low as 0.2 to 0.3 μs . High speed switching is discussed with reference to significant parameters, e.g., hole storage, internal heating, and pulse reverse diode characteristics.



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Abstracts

A Logarithmic Transmission Line Chart

A.C. Hudson. "A Logarithmic Transmission Line Chart." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 277-281.

A chart is presented which relates the real and imaginary components of the impedance at any position along a transmission line to the magnitude and location of the standing wave. In the present chart the ordinate is R/Z_0 plotted logarithmically and the abscissa is a function of X/R . Thus a change in the reference impedance becomes a simple vertical translation of any point. An auxiliary chart permits the direct determination of the length and impedance of transmission line required to match a given impedance.



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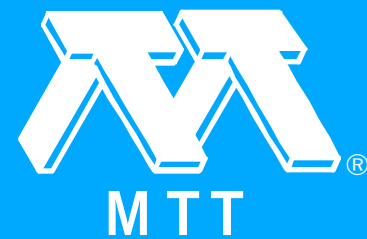


Abstracts

The Far Fields Excited by a Point Source in a Passive Dissipationless Anisotropic Uniform Waveguide

A.D. Bresler. "The Far Fields Excited by a Point Source in a Passive Dissipationless Anisotropic Uniform Waveguide." 1959 *Transactions on Microwave Theory and Techniques* 7.2 (Apr. 1959 [T-MTT]): 282-287.

The direction of the net power flow associated with a propagating mode of an arbitrary passive dissipationless anisotropic uniform waveguide may be opposite to its direction of (phase) propagation. It is shown that when a point source is introduced into a waveguide in which this is the case, such propagating modes contribute to the fields excited by this source only in that direction for which their power flow is directed away from the source. In addition it is shown that the nonpropagating modes contribute to the total field only in that direction in which they decay with increasing distance away from the source so that the far fields are given by a superposition of propagating modes only. The proof given makes use of the known properties of the frequency dependence of the physical parameters of any linear passive system in which the causality restriction is satisfied.



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Analysis of a Negative Conductance Amplifier Operated with a Nonideal Circulator

E.W. Sard. "Analysis of a Negative Conductance Amplifier Operated with a Nonideal Circulator." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 288-293.

Negative conductance amplifiers are usually operated with a circulator in order to achieve greater gain-bandwidth products and stable operation. Typical circulators differ from ideal circulators in that the forward loss between ports is not zero, and the reverse isolation between ports is not infinite. The main effects of noninfinite isolation are shown to be a modified gain-bandwidth product and a assumed to exist between ports 3 and 2. No other dechange in output admittance of the circulator output port. These effects result principally from the finite isolation between the output and amplifier ports. The main effect of incidental dissipation has previously been shown to be an increase in system noise figure. This paper considers only the effects caused by noninfinite isolation. A model of a lossless three-port circulator with noninfinite isolation is set up, and a negative conductance amplifier is considered to be limited to ensure a positive output conductance at the output port of the circulator (that is, the combination of negative conductance amplifier and nonideal circulator is assumed to be open-circuit stable). Subject to this assumption, the combination of negative conductance amplifier and nonideal circulator is then analyzed for its output admittance, available power gain, and effective input noise temperature.

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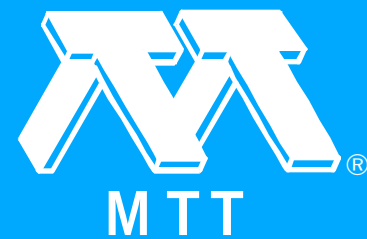


Abstracts

Propagation Constants in Rectangular Waveguide Partially Filled with Dielectric (Correspondence)

W.L. Weeks. "Propagation Constants in Rectangular Waveguide Partially Filled with Dielectric (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 294-294.

There is considerable current interest in the production of guided electromagnetic waves having phase velocities equal to or less than the speed of light in free space (for example, in the design of traveling-wave slot antennas and of devices involving electron traveling-wave interactions). Such phase velocities can be obtained conveniently by partially loading a rectangular waveguide with dielectric material. In antenna work particularly, because of the field configurations, it is usually desirable to place the dielectric interface so that it is parallel to the broad face of the waveguide, as indicated in Fig. 1. The calculation of phase velocities in such a waveguide has been considered in the literature, and there is published information on some of the cutoff frequencies, but (since in this case there is no convenient relationship between the cutoff frequencies and the propagation constants) there has been little detailed information available concerning the phase velocities as a function of waveguide proportions and dielectric material. Thus a compilation has been made of such information for the dominant (hybrid) mode.



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A Short Rugged Ferrite Half-Wave Plate for a Single-Sideband Modulator (Correspondence)

H.I. Glass. "A Short Rugged Ferrite Half-Wave Plate for a Single-Sideband Modulator (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 295-295.

One type of microwave phase shifter consists of two quarter-wave plates between which is placed a half-wave plate whose principal axis is rotatable. The phase shift introduced is directly proportional to the angular displacement of the principal axis of the half-wave plate. Continuous rotation of the principal axis causes continuous advancement or retardation of the phase of the signal traversing the phase shifter. This causes a frequency shift of the signal and the device can thus be used as a single-sideband modulator.

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Abstracts

A Technique for Minimizing Hysteresis in a 35-DB Ferrite Variable Attenuator (Correspondence)

H.I. Glass. "A Technique for Minimizing Hysteresis in a 35-DB Ferrite Variable Attenuator (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 295-296.

A requirement arose for a low-power microwave transmitter, the output power of which could be controlled over 40 db with a reset accuracy of 0.5 db for single frequency operation.



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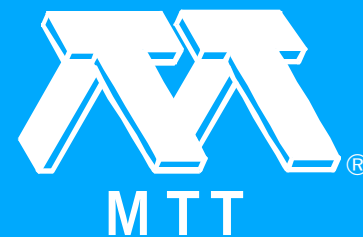


Abstracts

Quarter-Wave Compensation of Resonant Discontinuities (Correspondence)

C.E. Muehe, Jr.. "Quarter-Wave Compensation of Resonant Discontinuities (Correspondence)." 1959 *Transactions on Microwave Theory and Techniques* 7.2 (Apr. 1959 [T-MTT]): 296-297.

In designing RF transmission line components it is often necessary to place a short-circuited quarter-wavelength stub in parallel with the line or an open-circuited quarter-wavelength stub in series with the line. The stub can be broadbanded by merely changing the characteristic impedance of the line on either side of the stub for a distance of one quarter wavelength.



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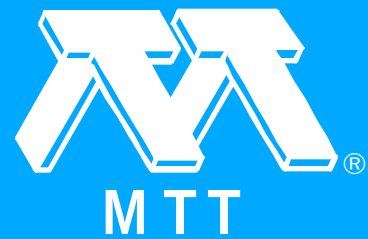


Abstracts

Ozaki's Comments (Comments)

H.J. Riblet. "Ozaki's Comments (Comments)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 297-298.

Ozaki's comments have drawn my attention to the fact that there is a significant difference between "The Synthesis Theorem" given in my paper and the restatement of it that is given and proven in the Appendix.



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Vector Formulations for the Field Equations in Anisotropic Waveguides (Correspondence)

A.D. Bresler. "Vector Formulations for the Field Equations in Anisotropic Waveguides (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 298-298.

In the following we will exhibit vector formulations for the equations determining the different components of the electromagnetic field in a source-free uniform waveguide. All results will be stated without proof. The derivations are given elsewhere. The vector formulations given below are applicable to uniform waveguides containing anisotropic media restricted only by the requirement that the permittivity (epsilon) and permeability (μ) dyadics be independent of the axial coordinate z . For uniform waveguides (with the indicated restriction on μ and epsilon) we consider solutions to the Maxwell equations which display characteristic time and z dependence of the form $\exp i(k_z z - \omega t)$.

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Abstracts

An Extension of the Reflection Coefficient Chart to Include Active Networks (Correspondence)

L.J. Kaplan and D.J.R. Stock. "An Extension of the Reflection Coefficient Chart to Include Active Networks (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 298-299.

At a single frequency, a two-port can be represented by the scattering matrix.



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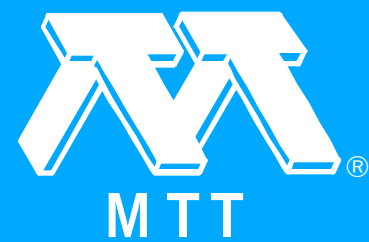
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Characteristics of a Ferrite-Loaded Rectangular Waveguide Twist (Correspondence)

A.E. Barrington. "Characteristics of a Ferrite-Loaded Rectangular Waveguide Twist (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 299-300.

The Faraday effect in a straight rectangular waveguide, a section of which is completely filled with a ferrite material subjected to an axial magnetic field, has been described by Du Pré, who states that, owing to the presence of a medium of dielectric constant and permeability greater than those of air, modes other than the usual TE/sub 10/ mode may be propagated in the ferrite-filled section. In particular, the TE/sub 01/ mode whose electric vector is perpendicular to the narrow dimension of the guide may be supported. If, owing to Faraday rotation, the TE/sub 10/ mode is converted to the TE/sub 01/, mode, propagation cannot take place beyond the ferrite-filled section. Experimentally this was confirmed by Du Pré who observed minimum of transmitted power for 90 degree rotation. Similar results were obtained in this laboratory with a straight rectangular guide loaded with a cylindrical ferrite specimen the ends of which were tapered for matching purposes as shown in Fig. 1(a). For a given axial magnetic field the reduction of transmitted power was largest with the specimen in the center of the guide, but, as might have been expected, no nonreciprocal effects were observed. A twisted rectangular waveguide section, however, loaded with the same specimen, exhibited nonreciprocal characteristics. In the experiment the sample was mounted centrally midway between the flanges of a 90 degree commercial 0.4x 0.9 inch twist and an axial magnetic field was applied as shown in Fig. 1(b).

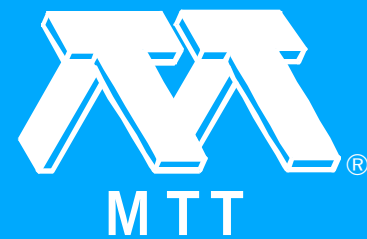
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Abstracts

Contributors (Apr. 1959 [T-MTT])

H.M. Altschuler, B.A. Auld, C.M. Barrack, A.D. Bresler, M. Cohn, W. Culshaw, J.W. Duncan, L.O. Goldstone, A.C. Hudson, C.M. Johnson, T. Kawahashi, D.D. King, K. Matsumaru, E.W. Sard, J.R. Singer, C.C.H. Tang, T. Uchida, O. Wing and L. Young. "Contributors (Apr. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 300-302.



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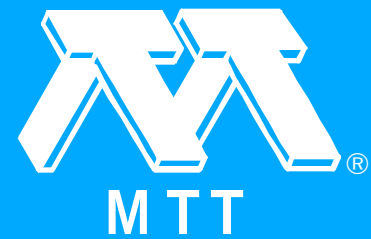


Abstracts

1959 PGMTT National Symposium (Announcement) (Apr. 1959 [T-MTT])

"1959 PGMTT National Symposium (Announcement) (Apr. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): 303-304.

The 1959 PGMTT National Symposium sponsored by the IRE Professional Group on Microwave Theory and Techniques, in cooperation with the Division of Applied Physics, Harvard University, will be held at Paine Hall, Harvard University, Cambridge, Mass., June 1-3, 1959.



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"Back Cover (Apr. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.2 (Apr. 1959 [T-MTT]): b1-b2.



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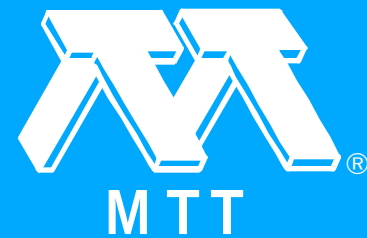


Abstracts

Biography - Henry J. Riblet

"Biography - Henry J. Riblet." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 306-306.

Henry J. Riblet (A'45-M'55-F'58) was born on July 21, 1913, in Calgary, Can. He graduated from Yale University, New Haven, Conn., with the B.S. degree in mathematics in 1935. He received the M.A. and the Ph.D. degrees in mathematics from Yale in 1937 and 1939, respectively.



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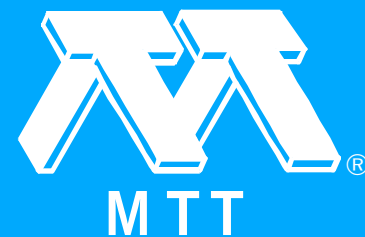


Abstracts

Pure or Applied?

H.J. Riblet. "Pure or Applied?." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 307-307.

It seems that in the general desire to acknowledge and recognize the contributions of science to our present society, there is a tendency to glamorize the basic sciences at the expense of their engineering counterparts. It is almost as if a descending hierarchy has been established between theory at one end and practice at the other. Perhaps this is not the case, but articles on the danger of neglecting pure research in the interest of its applications and lamenting the distribution of research and development funds are a familiar sight, while it is seldom noted that only rarely can pure research proceed faster than the engineering technology on which it rests. Such articles foster the idea that research is reserved to pure science while the design engineer is relegated to the role of skillful computer.



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Abstracts

Report of Advances in Microwave Theory and Techniques in U.S.A.-1958

R.E. Beam and M.E. Brodwin. "Report of Advances in Microwave Theory and Techniques in U.S.A.-1958." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 308-325.

This report on advances in microwave theory and techniques is based on papers appearing in American journals. Advances in the realm of sources and detectors, transmission lines, circuits and circuit elements, components, and measurements are reported. No attempt is made to cover advances in the realm of antennas and wave propagation.



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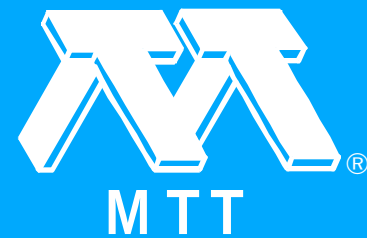


Abstracts

Report of Advances in Microwave Theory and Techniques in Great Britain-1958

J. Brown. "Report of Advances in Microwave Theory and Techniques in Great Britain-1958." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 325-327.

The characteristic impedances of a coaxial type line in which the inner conductor is a flat strip and of a triplate strip line have been calculated.



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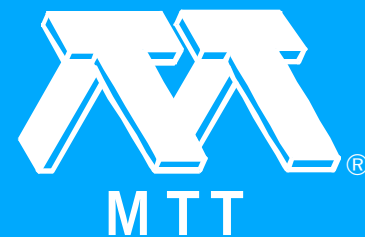


Abstracts

Report of Advances in Microwave Theory and Techniques in Western Europe-1958

G. Goudet. "Report of Advances in Microwave Theory and Techniques in Western Europe-1958." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 327-330.

A member of Philips Research Laboratory, Eindhoven, Holland, has used a new method to calculate the radiation impedance of a linear antenna in a waveguide of rectangular cross-section, viz., Schwingers' variational principle. This new application, even when based on only a two-term Fourier expansion of the current distribution, gives better results than a sinusoidal current distribution.



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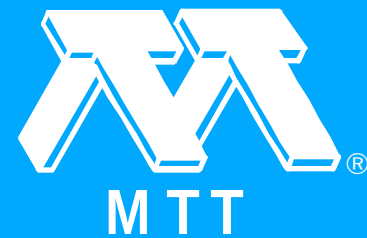


Abstracts

Report of Advances in Microwave Theory and Techniques in Japan-1958

I. Someya. "Report of Advances in Microwave Theory and Techniques in Japan-1958." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 331-331.

A number of papers were presented in the fields of microwave art from companies and universities. In this article, short abstracts of some selected papers will be mentioned.



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A Ferrite Cutoff Switch

R.F. Soohoo. "A Ferrite Cutoff Switch." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 332-336.

The theory and operating characteristics of a new type of high performance reflective switch is given. It utilizes the cut-off phenomenon in transversely-magnetized ferrites. The insertion loss of the device is 0.4 db and over 60 db within the 8.8 to 9.5 kmc band when the ferrite is demagnetized and magnetized respectively. The reflection coefficient of the switch in the "off" state is more than 90 per cent over this same band. In contrast to most other ferrite devices, it is of the reflective rather than the absorptive type. Furthermore, it has the unique property that its operating bandwidth is determined mainly by the magnitude of the applied field. Possible applications of the device in antenna switching and as a tunable cutoff filter will be discussed.

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Propagation Constants of Circular Cylindrical Waveguides Containing Ferrites

H.K.F. Severin. "Propagation Constants of Circular Cylindrical Waveguides Containing Ferrites." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 337-346.

The paper describes some results of a theoretical and experimental investigation of the propagation behavior of circular cylindrical wave guides containing longitudinally magnetized ferrite rods. As long as no concentration of the RF-magnetic field in the ferrite occurs, theoretical expressions for the propagation constants can be given by applying first-order perturbation method. Faraday rotation measurements have been made between 5000 and 7600-mcs using commercially available ferrites. Reasonable agreement between theoretical and experimental results has been found for a thin axial ferrite rod in an air-filled guide in both cases of saturated and nonsaturated ferrites. Energy concentration in the ferrite determines the propagation behavior in the partially filled waveguide. This effect can be enhanced by surrounding the ferrite rod with a dielectric tube. For a given rod diameter and permittivity of the tube there is an optimum outer diameter of the tube for which the Faraday rotation becomes maximum.

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



Abstracts

Magnified and Squared VSWR Responses for Microwave Reflection Coefficient Measurements

R.W. Beatty. "Magnified and Squared VSWR Responses for Microwave Reflection Coefficient Measurements." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 346-350.

In conventional microwave impedance measuring the measured ratio of maximum to minimum detector signal level is ideally equal to the voltage standing-wave ratio (VSWR) of the termination. In this paper, it is shown how radically types of response are obtainable in which the observed ratio may approximately equal the square of the VSWR or may be magnified any desired amount. Theory is given enabling accurate measurements by interesting techniques. Accuracies of 0.1 per cent in VSWR to 2.0 have been achieved using magnified response techniques.



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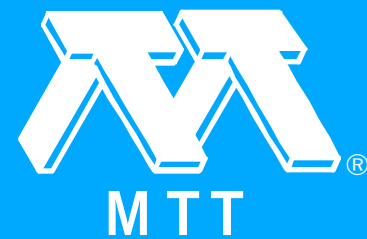


Abstracts

Microwave Reflectometer Techniques

G.F. Engen and R.W. Beatty. "Microwave Reflectometer Techniques." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 351-355.

A rigorous analysis of the microwave reflectometer is presented for what is believed to be the first time. By means of this analysis, the correct adjustment of auxiliary tuners is described, and the errors resulting from incorrect adjustments are treated in a quantitative manner. It is shown how the reflectometer technique may be further simplified while preserving the accuracy of measurement. A convenient method of adjusting the auxiliary tuners is described, sources of error are discussed, and an example is given of the calculation of error limits.



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Application of a Backward-Wave Amplifier to Microwave Autodyne Reception

J.K. Pulfer. "Application of a Backward-Wave Amplifier to Microwave Autodyne Reception." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 356-359.

A microwave receiver using a single-circuit backward-wave amplifier as a combination radio-frequency amplifier and homodyne local oscillator is described. The amplifier tube is operated at a value of beam current just above that required to maintain oscillation. It is shown that in this way, the high gain and narrow bandwidth of the single-circuit backward-wave amplifier may be utilized in an electronically tunable microwave receiver. The resultant sensitivity is 10 to 15 db worse than that obtainable from a good superheterodyne. The loss in sensitivity is due entirely to the high noise figure of the backward-wave amplifier, which can theoretically be reduced to a value comparable with that of a superheterodyne. The advantages of the receiver are its simplicity and its lack of image difficulties. Rejection of off-frequency signals is such that they are attenuated by at least 50 db.

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



Mode Theory of Lossless Periodically Distributed Parametric Amplifiers

K. Kurokawa and J. Hamasaki. "Mode Theory of Lossless Periodically Distributed Parametric Amplifiers." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 360-365.

In this paper, an operator T_0 is introduced for the analysis of the periodically distributed parametric amplifier. The operator is the product of a diagonal matrix expressing the pumping phase relation and the T matrix of the basic section of the amplifier. The eigenvectors of T_0 are called the "modes" of the amplifier. The orthogonality properties of the modes are proved in a similar way as for the conventional mode theory. Finally, an expression is derived for the power gain of the amplifier as an application of the theory.

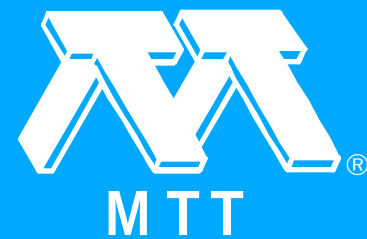


Abstracts

O-Guide and X-Guide: An Advanced Surface Wave Transmission Concept

M. Sugi and T. Nakahara. "O-Guide and X-Guide: An Advanced Surface Wave Transmission Concept." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 366-369.

This paper describes the O-guide and X-guide which are proposed by the authors and are the advanced surface waveguides composed of thin dielectric sheets. The results of an analysis of the TE fundamental mode in the O-guide are described, and the theoretical characteristics as a transmission line are discussed. The practical guides are suitable especially for the SHF region and guides can be obtained which have lower attenuation constants than coaxial lines, G-lines, and rectangular waveguides.



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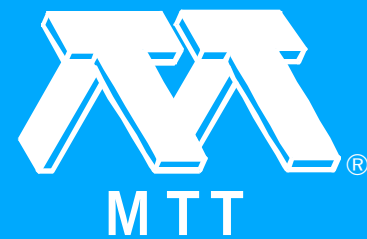


Abstracts

Evacuated Waveguide Filter for Suppressing Spurious Transmission from High-Power S-Band Radar (Correction)

H.A. Wheeler and H.L. Bachman. "Evacuated Waveguide Filter for Suppressing Spurious Transmission from High-Power S-Band Radar (Correction)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 369-369.

H. A. Wheeler and H. L. Bachman, authors of "Evacuated Waveguide Filter for Suppressing Spurious Transmission from High-Power S-Band Radar," which appeared on pages 154-162 of the January, 1959 issue of these Transactions, have submitted the following correction.



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Abstracts

Tunable Passive Multicouplers Employing Minimum-Loss Filters (Correction)

J.F. Cline and B.M. Schiffman. "Tunable Passive Multicouplers Employing Minimum-Loss Filters (Correction)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 369-369.

J. F. Cline and B. M. Schiffman wish to call attention to a typographic error in an equation in their article "Tunable Passive Multicouplers Employing Minimum-Loss Filters," which appeared on pages 121-127 of the January, 1959 issue of these Transactions. The error occurs in (11) on page 125. The radical sign should terminate at the end of the binomial and before the final - 1.



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The Transmission of TE/sub 01/ Wave in Helix Waveguides

T. Hosono and S. Kohno. "The Transmission of TE/sub 01/ Wave in Helix Waveguides." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 370-373.

Relations are investigated between the transmission characteristics of a helix waveguide and its surface impedance in regions where any simple approximate formulas are not available because of the magnitude of the surface impedance. The numerical calculations show that, for any given value of the surface impedance and the angular mode index, there exist an infinite number of different modes which are distinguishable from each other by different values of the radial propagation content. Selecting a mode with minimum attenuation for each given surface impedance, we can draw the equiattenuation lines, connecting these points of equal attenuation on the complex surface impedance plane. At some point on the complex surface impedance plane, a maximum value of the minimum attenuation is found. For the TM/sub 0/ mode supported by a helix waveguide 50 mm in diameter, used at a frequency of 50 kmc, this minimax value of the attenuation constant is about 8 neper per meter, and the corresponding value of the surface impedance is about 57.6-j28.8 ohms. The attenuation constants of all the TM/sub 0/ modes corresponding to this optimum value of the surface impedance cannot be smaller than this minimax value. The same kind of calculations are also performed for the two lowest hybrid modes. Physical structures giving the best value of the surface impedance are also suggested.





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Design of Linear Double Tapers in Rectangular Waveguides

R.C. Johnson. "Design of Linear Double Tapers in Rectangular Waveguides." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 374-378.

This paper considers the problem of a taper connecting two uniform waveguides of arbitrary dimensions and propagating a single mode; an approximate expression for the reflection coefficient is derived. The special case of a linear double taper in rectangular waveguide is examined in detail for propagation in the TE/sub 10/ mode. Approximate expressions for the reflection coefficient and voltage standing wave ratio as functions of the taper dimensions and free space wavelength are derived and experimentally verified.

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



Spurious Mode Generation in Nonuniform Waveguide

L. Solymar. "Spurious Mode Generation in Nonuniform Waveguide." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 379-383.

This paper deals with the problem of a nonuniform waveguide joining two uniform ones and the spurious modes generated by it when a pure mode is incident in one of the uniform waveguides. The generalised telegraphist's equations are stated and transformed into a set of differential equations for the amplitudes of the forward and backward traveling waves. The expressions for the coupling coefficients between the various modes are given and analysed.



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A High Power Diplexing Filter

L. Young and J.Q. Owen. "A High Power Diplexing Filter." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 384-387.

An L-band diplexing filter has been constructed with an estimated power-carrying capacity of 5 megw at atmospheric pressure (for a power safety factor of nearly four to one) and an insertion loss of less than 0.1 db. The filter consists of two hybrid junctions and two high pass waveguide sections, which are arranged as in a balanced duplexer, with the "TR-tubes" replaced by the high-pass sections. In the upper frequency band, the input VSWR is better than 1.10 over a seven and one-half per cent bandwidth, but deteriorates only slightly over a larger bandwidth. In the lower frequency band, the input VSWR is better than 1.32 over a 13 per cent bandwidth. The separation interval between these two bands is approximately 10 per cent between their nearest frequencies.

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End Plate Modification of X-Band TE/sub O11/, Cavity Resonators (Correspondence)

M.C. Thompson, Jr., F.E. Freethey and D.M. Waters. "End Plate Modification of X-Band TE/sub O11/, Cavity Resonators (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 388-389.

In the application of microwave refractometers, the sampling cavity consists of a right circular cylinder whose parallel faces are partially opened to permit air flow. The ambient air is aspirated through the cavity, and the instrument measures a weighted average of the index of the air contained at any time within the cavity.

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Design of Open-Ended Microwave Resonant Cavities (Correspondence)

D.C. Thorn and A.W. Straiton. "Design of Open-Ended Microwave Resonant Cavities (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 389-390.

This paper summarizes a Ph.D. dissertation on the design and analysis of open-ended microwave cavities. The study was motivated by the need for a cavity with a high measure of quality, Q , through which an unobstructed flow of gases or particulate matter could be obtained. Used in collection with the Crain refractometer, instantaneous measurements of the refractive index of the material in the cavity can be made. Measurements utilizing his technique but with other types of cavities have previously been made in order to study the dielectric properties of smoke and other aerosols.

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Transverse Electric Field Distributions in Ferrite Loaded Waveguides (Correspondence)

D.J. Angelakos. "Transverse Electric Field Distributions in Ferrite Loaded Waveguides (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 390-391.

The transverse electric field distribution in dielectric and ferrite loaded waveguides has been measured by several investigators. Knowledge of the actual field distribution within the waveguide is needed in the design of field displacement isolators, phase-shifters, and similar microwave devices. In making such measurements, care must be taken to choose lengths of samples of ferrites or dielectrics sufficiently long enough so that the distribution in one transverse plane will be the same (except for an attenuation effect) as in another transverse plane.

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Abstracts

Feeding RF Power from a Self-Excited, Pulsed Source into a High-Q Resonant Load (Correspondence)

H.A. Spuhler, R.J. Kenyon and P.D. Coleman. "Feeding RF Power from a Self-Excited, Pulsed Source into a High-Q Resonant Load (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 391-391.

A problem frequently arising in microwave electronics is the feeding of pulsed power from a self-excited source into a high-Q resonant load. A typical example is the one of feeding power from a pulsed magnetron into a high-Q microwave cavity such as that used in a linear accelerator. In the past, it has been customary to use a stabilizing load in a series tee system which results in approximately half the magnetron power being fed into the high-Q cavity.



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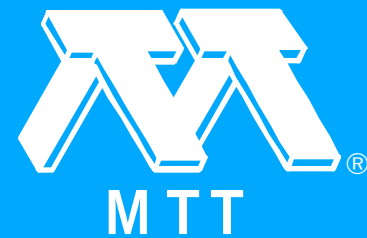


Abstracts

An Image Line Coupler (Correspondence)

D.J. Angelakos. "An Image Line Coupler (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 391-392.

For many microwave transmission systems, it is possible to make use of highconductivity "image planes" as ground planes or as shields. Strip transmission lines, image plane lines, and dielectric image lines are examples of such systems.



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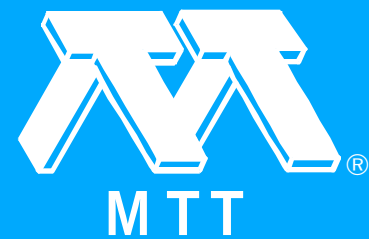
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An Extension of the Concept of Stop and Pass Bands of a Zobel Type Filter to a General Reciprocal Two Port Network Which has a Non-loxodromic Transformation (Correspondence)

D.J.R. Stock and L.J. Kaplan. "An Extension of the Concept of Stop and Pass Bands of a Zobel Type Filter to a General Reciprocal Two Port Network Which has a Non-loxodromic Transformation (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 392-393.

The conventional treatment of the Zobel filter starts with symmetrical T or pi sections of pure reactance and then develops the iterative measures of the network; the fixed points and the propagation constant. It is shown that the propagation constant is either pure real (stop band) or pure imaginary (pass band). These iterative measures can be worked out for the general T section. Fig. 1 shows the nomenclature used for the symmetrical T section and the general two port.





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Characteristic Impedance of Split Coaxial Line (Correspondence)

H. Kogo. "Characteristic Impedance of Split Coaxial Line (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 393-394.

A few years ago, the balun was studied at our laboratory and it is important to know the characteristic impedances of the line. There are several papers concerning this characteristic impedance. The cross section of the transmission lines is shown in Fig. 1 and the characteristic impedances are calculated in these papers. Last year, a paper was published in the IRE Trans. on Microwave Thoery and Technique on this problem, using similar methods described below. I wish to describe my approach and show a disparity.

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



A Method for Enhancing the Performance of Nonreciprocal Microwave Devices (Correspondence)

B. Ancker-Johnson. "A Method for Enhancing the Performance of Nonreciprocal Microwave Devices (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 394-395.

The performances of nonreciprocal microwave devices are as temperature dependent as the ferromagnetic materials used to produce them. Hence, the operating characteristics vary markedly with incident power level and ambient temperature. In order to compensate for these temperature changes, special cooling techniques are frequently utilized. Since those are often inconvenient, devices are more usually designed to operate at a much broader frequency range than the specifications demand resulting in deterioration of performance in the specified band. In some cases, ferrites may be especially prepared to have a nearly constant saturation magnetization for range of temperature, as illustrated in Fig. 1. Whereas both of these ferrites have the same saturation magnetization at room temperature, changing the temperature to 100°C causes a 25 per cent change in the $4\mu\text{M}/\text{sub s/}$ of the commercially available ferrite, but only a 7 per cent variation in the especially designed one. Tailoring ferrites to the application is much too difficult to represent a solution to the problem.



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Characteristics of Argon Noise Source Tubes at S-Band (Correspondence)

W.J. Medd. "Characteristics of Argon Noise Source Tubes at S-Band (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 395-395.

During the design of equipment for applications in radio astronomy, various tests were performed on argon plasma noise source discharge tubes, with emphasis on the Bendix 6358/TD-12 which is Model A148 of Johnson and DeRemer. In view of the wide use of these tubes as secondary standards of microwave noise power, a brief summary of the results obtained will be given. A description of the test equipment and experimental procedures used would be repetitive of much that has been reported by Sees and Hughes, but is available from the writer if desired.

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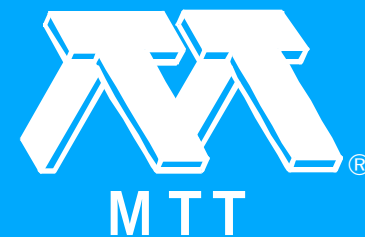


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PGMTT News (Jul. 1959 [T-MTT])

"PGMTT News (Jul. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 396-396.

Photograph picturing those attending the PGMTT Administrative Committee luncheon meeting, held on March 23 at the Essex House, New York, N.Y.



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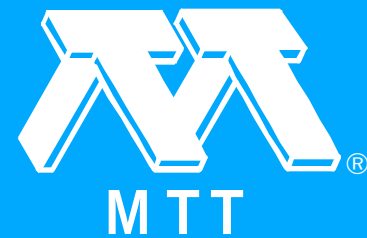
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R.E. Beam, R.W. Beatty, M.E. Brodwin, J. Brown, G.F. Engen, G. Goudet, J. Hamasaki, T. Hosono, R.C. Johnson, S. Kohno, K. Kurokawa, T. Nakahara, J.Q. Owen, J.K. Pulfer, H. Severin, I. Someya, L. Solymar, R.F. Soohoo, M. Sugi and L. Young. "Contributors (Jul. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.3 (Jul. 1959 [T-MTT]): 396-398.



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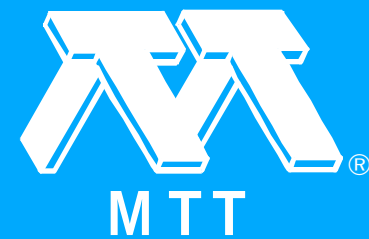
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Front Cover (Oct. 1959 [T-MTT])

"Front Cover (Oct. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): f1-f2.



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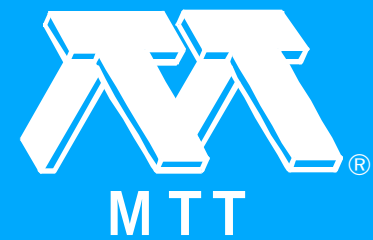
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"Table of Contents (Oct. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 399-399.



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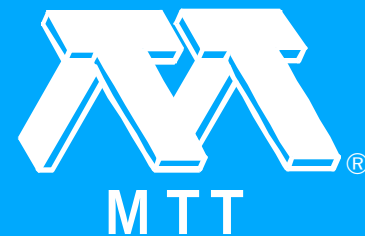


Abstracts

Biography - A. Gardner Fox

"Biography - A. Gardner Fox." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 400-400.

A. Gardner Fox (A'40-SM'45-F'56) was born in Syracuse, N. Y. on November 22, 1912. He received the B.S. and M.S. degrees in electrical engineering from the Massachusetts Institute of Technology, Cambridge, in 1935.



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Abstracts

The Communications Frontier Between Classical and Quantum Physics

A.G. Fox. "The Communications Frontier Between Classical and Quantum Physics." 1959 *Transactions on Microwave Theory and Techniques* 7.4 (Oct. 1959 [T-MTT]): 401-401.

Man's sophisticated art of communications has been built upon his ability to generate and detect coherent electromagnetic waves. This art has been pushed to higher and ever higher frequencies, until now important experimental work is being carried on in the neighborhood of one millimeter wavelength.



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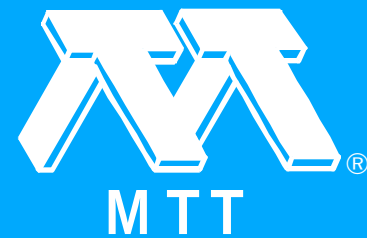


Abstracts

Mechanical Design and Manufacture of Microwave Structures

A.F. Harvey. "Mechanical Design and Manufacture of Microwave Structures." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 402-422.

The paper gives an account of the various aspects of the design and manufacture of microwave structures. The presentation of design information such as dimensions and tolerances is first discussed. Machining and other fabrication processes are then examined. Several methods of metal casting and associated techniques are described and the electrodeposition of waveguide components studied. Such final stages as inspection procedure, protective finishing and packaging are considered. The survey concludes with a bibliography.



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The Dependence of Reflection on Incidence Angle

R. Redheffer. "The Dependence of Reflection on Incidence Angle." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 423-429.

A lossy dielectric sheet has complex dielectric constant $\epsilon = \epsilon(x)$ and complex permeability $\mu = \mu(x)$, where x is the distance to one interface. This sheet is backed by a conducting surface and used as an absorber. If $|\epsilon(x)\mu(x)| \gg \epsilon_0/\mu_0$, so that $(\epsilon/\epsilon_0)(\mu/\mu_0) - \sin^2 \theta$ is nearly independent of the incidence angle θ , then the amplitude reflection $R(\theta)$ is wholly determined by $R(0)$. Typical results: When $R(\theta_0) = 0$ at one polarization, then at $\theta = \theta_0$ the reflection for the other polarization corresponds to a voltage standing-wave ratio $\text{SWR} = \sec^2 \theta_0$. At perpendicular polarization max $|R(\theta)|$ on (θ_1, θ_2) is least, for given $|R(0)|$, if $R(0)$ is real and positive; and then $R(\theta) = 0$ at $\tan^2 \theta/2 = R(0)$. But for parallel polarization $R(0)$ must be real and negative to get optimum performance. When the absorber functions at both polarizations the best obtainable result is $|R(\theta)| = \tan^2 \theta/2$, no matter what interval (θ_1, θ_2) is specified. The error in the approximation is investigated theoretically and experimentally. A complete set of graphs is included, suitable for design of those absorbers to which the theory applies. The analysis also yields an exact expression for the limiting behavior of the reflection at grazing incidence. This can be used in problems such as computation of the field due to a dipole over a plane earth. Finally, the theory of the Salisbury screen is re-examined as an aid in checking the other developments.

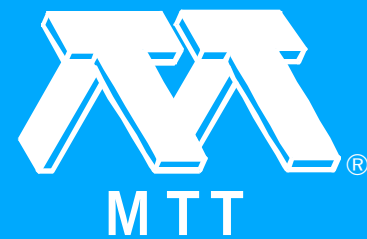


Abstracts

Analytical Asymmetry Parameters for Symmetrical Waveguide Junctions

M. Cohen and W.K. Kahn. "Analytical Asymmetry Parameters for Symmetrical Waveguide Junctions." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 430-441.

This paper presents a systematic approach to the evaluation of (waveguide) junctions from the standpoint of their conformance to certain symmetries. Preferred sets of asymmetry parameters are found which are complete, minimal in number, which go to zero when the junction represented is symmetrical, and which may often be identified with a corresponding structural symmetry defect. The asymmetry parameters are first introduced for general linear junctions, but special attention is given to reciprocal and lossless junctions. The derivation of these preferred sets is based on the theory of group representations hitherto employed in the analysis of ideally symmetric junctions. One of the applications of these preferred parameters yields first-order relations among the defects of a nearly perfect hybrid-T junction which are believed to be new.



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Orthogonality Relationships for Waveguides and Cavities with Inhomogeneous Anisotropic Media

A.T. Villeneuve. "Orthogonality Relationships for Waveguides and Cavities with Inhomogeneous Anisotropic Media." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 441-446.

A modified reciprocity theorem forms the basis of development of orthogonality relationships for modes in waveguides and in cavities containing inhomogeneous, anisotropic media. In the lossless case certain of these may be interpreted in terms of power flow and energy storage. The special case of magnetized gyrotropic media is discussed for longitudinal and transverse magnetization.

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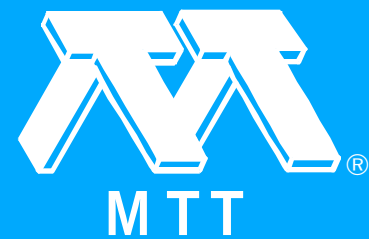


Mismatch Errors in Cascade-Connected Variable Attenuators

G.E. Schafer and A.Y. Rumfelt. "Mismatch Errors in Cascade-Connected Variable Attenuators." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 447-453.

The treatment of mismatch errors is extended to cover variable attenuators cascade-connected in a system which is not free from reflections. The method of analysis is applicable to any number of cascaded attenuators, but only the analysis of two and three variable attenuators in cascade is presented. Graphs are given to aid in estimating the limits of mismatch error. In an example, which is considered representative of rigid rectangular waveguide systems, the limits of error are: for two attenuators in cascade, 0.19 db in a 3-db measurement, and 0.17 db in a 40-db measurement; and for three attenuators in cascade, 0.25 db in a 40-db measurement, and 0.23 db in a 75-db measurement.





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A Nonreciprocal, TEM-Mode Structure for Wide-Band Gyrator and Isolator Applications

E.M.T. Jones, G.L. Matthaei and S.B. Cohn. "A Nonreciprocal, TEM-Mode Structure for Wide-Band Gyrator and Isolator Applications." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 453-460.

The theoretical and experimental operation of a novel form of TEM transmission-line network capable of operation over octave bandwidths is described. This network consists, basically, of a parallel arrangement of two conductors and a ferrite rod within a grounded outer shield. The conductors maybe connected in a two-port configuration which provides, in the absence of the ferrite rod, complete isolation from zero frequency to the cut-off frequency of the first higher mode. With an unmagnetized ferrite rod properly inserted, the broad-band isolation is virtually unaffected. When the rod is magnetized by an axial magnetic field, coupling occurs between the two ports by a process analogous to Faraday rotation. The device may be used as a broad-band gyrator, switch, or modulator, and with the addition of a resistance load, as an isolator. The bandwidth of these components is inherently limited only by the bandwidth capability of the ferrite material itself.

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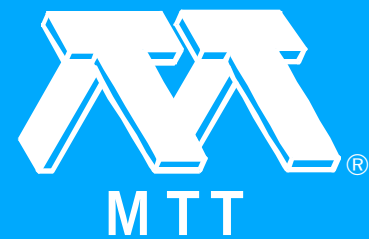
High-Power Microwave Rejection Filters Using Higher-Order Modes

J.H. Vogelman. "High-Power Microwave Rejection Filters Using Higher-Order Modes." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 461-465.

In order to obtain filters capable of handling very high power, the use of radial lines and uniform line discontinuities was investigated. Forty-five-degree tapers and uniform lines were used to design a high-power microwave filter capable of handling 700 kw at 15 pounds pressure in a 0.900 by 0.400 ID waveguide. In addition to the filtering which results from the discontinuities in the TE/sub 10/ mode in the waveguide, high insertion loss elements are effected when the enlarged uniform line section is larger than the TE/sub 10/ mode waveguide wavelength and when the length of the enlarged section is approximately $(2n - 1)\lambda_{\text{sub } 10} / 4$. Extremely large insertion losses are possible by the cascading of these elements. Tuning, in the standard-size waveguide, has no effect on the insertion loss of the higher-mode enlarged waveguide at its resonant frequency. Empirical design formulas are evolved and the design procedure for band-rejection filters is given, using these high insertion loss elements.

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A Method for Accurate Design of a Broad-Band Multibranch Waveguide Coupler

K.G. Patterson. "A Method for Accurate Design of a Broad-Band Multibranch Waveguide Coupler." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 466-473.

A new approach is made to the problem of tapering the branch impedances for broad-band performance. A taper is proposed, which, for a 3-db branch coupler, is shown to give much better results in theory and practice than the currently used binomial taper. Also, simple expressions are developed which enable the effects of waveguide junction discontinuities to be adequately corrected, thus allowing a greater accuracy in design to be achieved than was hitherto possible.

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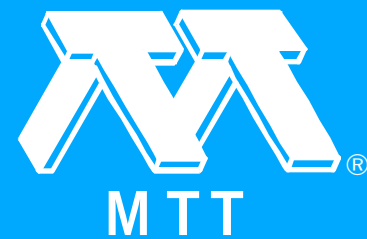


Abstracts

The Analogy Between the Weiss-floch Transformer and the Ideal Attenuator (Reflection Coefficient Transformer) and an Extension to Include the General Lossy Two-Port (Correspondence)

D.J.R. Stock and L.J. Kaplan. "The Analogy Between the Weiss-floch Transformer and the Ideal Attenuator (Reflection Coefficient Transformer) and an Extension to Include the General Lossy Two-Port (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 473-474.

Weissfloch's transformer theorem states that at certain pairs of reference planes a lossless two-port can be represented by an ideal transformer. There are many proofs of this important theorem. One of the most interesting is due to Bolinder, who uses properties of the bilinear transformation. For lossless two-ports, the transformations will belong to the Fuchsian group.



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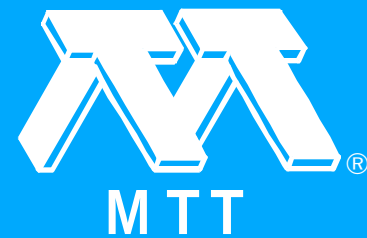


Abstracts

Some Notes on Strip Transmission Line and Waveguide Multiplexers (Comments)

R.M. Kurzrok. "Some Notes on Strip Transmission Line and Waveguide Multiplexers (Comments)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 475-475.

Use of two tuning screws through the ground planes of a strip-line cavity resonator can excite the parallel plane TEM mode unless both screws are equidistant from the center conductor, rendering this method of tuning quite unattractive. A single tuning screw parallel to and midway between the ground planes is the better way of tuning a stripline cavity resonator.



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The Representation of Impedances with Negative Real Parts in the Projective Chart (Correspondence)

D.J.R. Stock and L.J. Kaplan. "The Representation of Impedances with Negative Real Parts in the Projective Chart (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 475-475.

In a previous note, the authors considered the representation of active networks in the reflection coefficient chart. The projective chart is obtained from a stereographic projection onto a unit sphere and then from an orthographic projection from the sphere. It is immediately obvious that reflectances whose magnitude is greater than unity will lie within the unit circle of the projective chart. Therefore, each will coincide with another reflectance whose magnitude is less than unity.

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Design Calculations for UHF Ferrite Circulators (Correspondence)

H. Boyet, S. Weisbaum and I. Gerst. "Design Calculations for UHF Ferrite Circulators (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 475-476.

The recent advances in low-noise amplifier work for communications systems has created an additional demand for circulators; in this case, to prevent receiver noise from returning to the low-noise amplifier. In the range of frequencies greater than 2000 mc, ferrite circulators have been developed in circular and rectangular waveguides. However, in the UHF region, which is a range of frequencies of increasing interest and importance in communications, ferrite circulators present a problem in the sense that ordinary waveguides needed in this range are prohibitively large for practical use. Button of Lincoln Laboratory and Seidel of Bell Telephone Laboratories have pointed a way around this difficulty by considering a TEM structure (a coax) loaded antisymmetrically with dielectric material and ferrite. This configuration provides for the longitudinal component of RF magnetic field necessary for nonreciprocity in the phase constant. The essentially TEM nature of the device allows use of reasonably small, practical cross-sectional areas. The parallel-plate analog analysis presented in Button's paper leads to a transcendental equation for the phase constant which we present below for convenience, together with an example of the structure.

Click on title for a complete paper.



Abstracts

Discussion on Optimum Bead Spacing (Correspondence and Author's Reply)

J. Reed and D. Dettinger. "Discussion on Optimum Bead Spacing (Correspondence and Author's Reply)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 477-477.

Mr. Dettinger's article on the optimum spacing of bead supports in coaxial transmission lines is too sanguine as to the performance which will result. He states that an array of M beads arranged according to his theory will result in a total reflection coefficient of no more than $\sqrt{1/M}$ where Γ_0 is the reflection of one bead. In his Fig. 5 he shows a chart of the reflection of four beads equally spaced and the reduced reflection which he hopes will result from application of his rule. The case where there are four beads will result for equal spacing in a maximum value of $4\Gamma_0$, and from his theory for progressive spacing it should be possible to arrange the beads so that the maximum possible reflection is only $2\Gamma_0$.



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Abstracts

Concerning Riblet's Theorem (Correspondence)

L. Young. "Concerning Riblet's Theorem (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 477-478.

I would like to add yet another comment concerning Riblet's theorem.



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Broad-Band Stub Design (Correspondence)

L. Young. "Broad-Band Stub Design (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 478-478.

Mr. Muehe's results for broad-band stubs, while going beyond that of previous investigators, are similar to my design curves published earlier without detailed derivation. The main difference is that my curves were based on a formula involving the bandwidth as defined by the lowest and highest frequencies of zero reflection. Mr. Muehe's analysis is therefore superior to my simpler approach: my design curves erred on the safe side in predicting a slightly smaller bandwidth.

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Abstracts

Attenuation of the HE/sub 11/ Mode in the H-Guide (Correspondence and Author's Reply)

M. Cohn and F.J. Tischer. "Attenuation of the HE/sub 11/ Mode in the H-Guide (Correspondence and Author's Reply)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 478-480.

The properties of the lowest order hybrid mode of the H-guide line have been analyzed by Tischer in a number of papers. This type of transmission line has also been under investigation at this laboratory for some time and a number of discrepancies exist between our analysis and those of Tischer.



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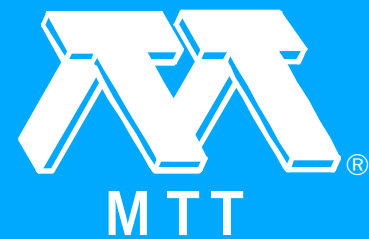
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Experimental Determination of Wavelength in Dielectric-Filled Periodic Structures (Correspondence)

E. Weissberg. "Experimental Determination of Wavelength in Dielectric-Filled Periodic Structures (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 480-481.

Let it be required to determine the guided wavelength in a dielectric-filled periodic structure, such as a corrugated wall or serrated waveguide. The accepted traveling probe technique requires a slot in the broad wall of the guide and a groove in the dielectric material. Even if the errors introduced by these modifications could be tolerated, other effects render this technique unsuitable. One of these is a surface-wave effect which results in a measured wavelength higher than the one in the guide and lower than the free-space value. If the structure is dissipative, such as a serrated guide, more difficulties arise.

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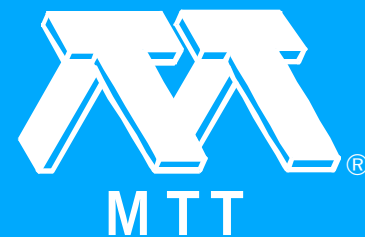


Abstracts

An Automatic Microwave Dielectrometer (Correspondence)

W.F. Gabriel. "An Automatic Microwave Dielectrometer (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 481-481.

The dielectric constant of low-loss dielectric materials can be measured accurately, rapidly, and automatically by proper utilization of an automatic microwave impedance instrument of the type which presents its output in Smith Chart form; i.e., the magnitude and phase of the reflection coefficient. The method employed is essentially a modification of the slotted line technique which was originally described by Roberts and Von Hippel, the difference being that the slotted line is replaced by an automatic impedance instrument with a direct reading scale.



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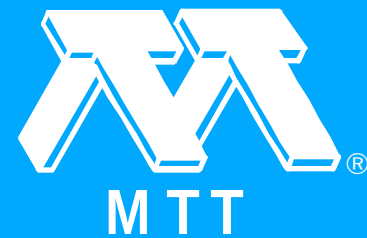


Abstracts

Design Note on a Serrated Choke (Correspondence)

W.F. Gabriel. "Design Note on a Serrated Choke (Correspondence)." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 482-482.

The serrated choke described by Dr. Kiyo Tomiyasu and J. J. Bolus is a very effective device to employ whenever long cuts or gaps are present on the walls of rectangular waveguide. This communication is concerned with the application of a serrated choke to an X-band waveguide ring switch, wherein the waveguide was split longitudinally at opposite corners to form a rotor section and a stator section.



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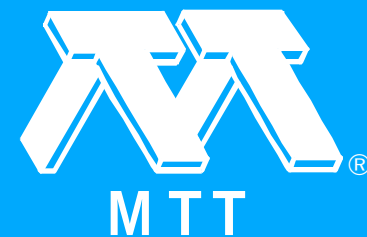
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Abstracts

Contributors (Oct. 1959 [T-MTT])

M. Cohen, S.B. Cohn, A.F. Harvey, E.M.T. Jones, W.K. Kahn, G.L. Matthaei, K.G. Patterson, R. Redheffer, A.Y. Rumfelt, G.E. Schafer, A.T. Villeneuve and J.H. Vogelmann. "Contributors (Oct. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 482-484.



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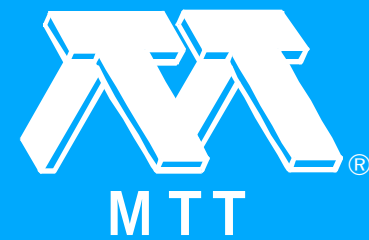
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Call for Papers - 1960 PGMTT Symposium (Oct. 1959 [T-MTT])

"Call for Papers - 1960 PGMTT Symposium (Oct. 1959 [T-MTT])." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): 485-485.



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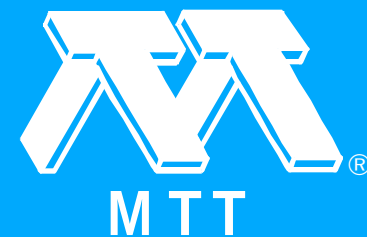
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Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-7, 1959

"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-7, 1959." 1959 Transactions on Microwave Theory and Techniques 7.4 (Oct. 1959 [T-MTT]): i-v.



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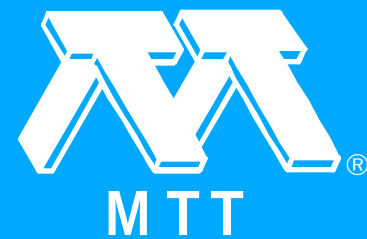


Abstracts

Message from the Editor (Jan. 1960 [T-MTT])

D.D. King. "Message from the Editor (Jan. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 2-2.

With this issue of the IRE Transactions on Microwave Theory and Techniques, we begin a new publication schedule of six issues per year appearing on alternate months. The principal reason for adopting this more frequent schedule is to reduce the interval between the receipt and publication of a paper. The rate of progress in microwaves is now so rapid that publication delays are a significant factor to both authors and readers. Thanks to our competent and conscientious editorial board, papers are reviewed promptly. However, with our previous quarterly publication cycle, papers received in the wrong phase were inevitably held up for several extra months. This factor will now be much reduced.



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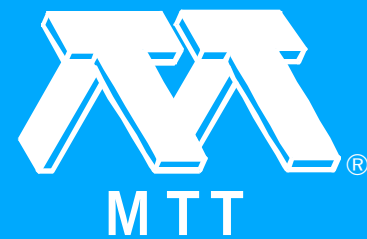


Abstracts

Microwave Prize (Jan. 1960 [T-MTT])

T.S. Saad. "Microwave Prize (Jan. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 3-3.

The Professional Group on Microwave Theory and Techniques has established the Microwave Prize to recognize annually a significant paper which appeared in the IRE Transactions on Microwave Theory and Techniques. In selecting the paper, consideration is given primarily to the subject of the contribution and secondarily to its presentation. All members and affiliates of PGMTT are eligible. The award consists of a certificate, a monetary sum of \$100, and a feature publication in these Transactions. If the paper has more than one author, the monetary sum is divided equally among the authors.



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Theoretical Limitations to Ferromagnetic Parametric Amplifier Performance

R.W. Damon and J.R. Eshbach. "Theoretical Limitations to Ferromagnetic Parametric Amplifier Performance." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 4-9.

It has been commonly expected that improved operation of the ferrite parametric amplifier could be obtained by use of materials of narrower resonance linewidth, ΔH . This parameter is critical in determining the pumping power (P_{p}) required for operation of the device. Also of importance, however, is the limitation of device properties determined by the dependence on ΔH of the instability threshold of the spin-wave system. Considering this limitation, the maximum voltage gain-fractional bandwidth product ($g/v/\Delta\omega/\omega_1$) has been determined as a function of other device parameters, and typical values calculated for several modes of operation. In the electromagnetic mode, for example, there is an optimum ΔH which yields maximum $g/v/\Delta\omega/\omega_1$ at a given pumping power. It is also shown that a minimum filling factor, also a function of ΔH for some types of operation, is required to reach the oscillation threshold even in the unloaded device.

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An Extension of the Mode Theory to Periodically Distributed Parametric Amplifiers with Losses

K. Kurokawa and J. Hamasaki. "An Extension of the Mode Theory to Periodically Distributed Parametric Amplifiers with Losses." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 10-18.

For the extension of the mode theory of the lossless periodically distributed parametric amplifier to the lossy case, a "conjugate circuit" is introduced in this paper. The conjugate circuit is an imaginary circuit which is obtained in the pass band by replacing each resistance in the original circuit with the negative resistance of the same magnitude. The orthogonality properties between the modes of the original circuit and those of the conjugate circuit are derived. The power gain and the noise figure of the amplifier are calculated, showing the usefulness of this mode theory in accounting for the spreading resistance of the semiconductor diode.

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Action of a Progressive Disturbance on a Guided Electromagnetic Wave

J.-C. Simon. "Action of a Progressive Disturbance on a Guided Electromagnetic Wave." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 18-29.

A problem often encountered in wave physics concerns the interaction of various types of waves, and the energy transfer from one wave to another. In the particular case of waves of the same nature, "modes" can be distinguished in such a way that a wave can be represented as a sum of these modes. Their essential character is that the energy associated with each does not vary with time. It is also said that these modes are not "coupled." This, for instance, is the case of waves guided in an electric waveguide, of mechanical vibration in a bar, and of energy levels in quantum physics.

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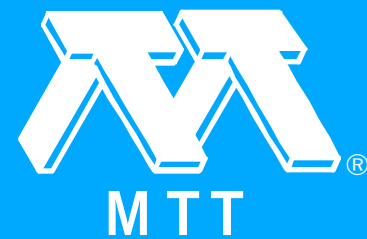


Abstracts

Periodic and Guiding Structures at Microwave Frequencies

A.F. Harvey. "Periodic and Guiding Structures at Microwave Frequencies." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 30-61.

The paper reviews the properties of periodic and guiding structures which now play an important part in the operation of components, antennas, electron tubes and low-noise amplifiers. An account is first given of dispersive propagation in periodic-loaded lines, showing how the frequency characteristic breaks into pass and stop bands. The formation of forward- and backward-space harmonics and the effect of systematic modification of loading are examined. A description is then given of the various types of surface-wave structures including dielectric rods, dielectric-clad metals, and corrugated surfaces, as well as surface wave instruments and circuits. Practical slow-wave structures such as ladder lines, coupled cavities and helices are finally treated. The survey concludes with a bibliography.



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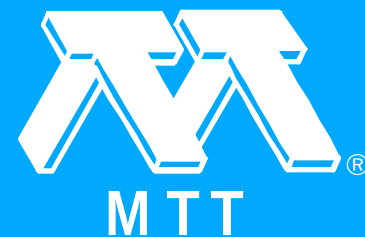


Abstracts

Design of Mode Transducers

L. Solymar and C.C. Eaglesfield. "Design of Mode Transducers." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 61-65.

The propagation of the electromagnetic wave in a gradual transducer is discussed. It is shown that the incident mode and the geometry of the transducer determine the outgoing mode. Inverting this theorem, a method is suggested for the design of the transducer's surface for cases in which the desired modes in the uniform waveguides are given. The application of the method is illustrated in three examples.



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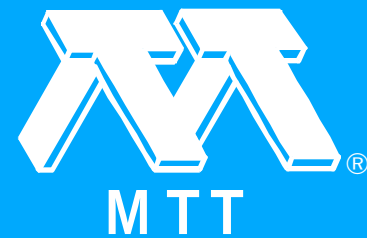


Abstracts

UHF Resonator with Linear Tuning

B.H. Wadia and R.L. Sarda. "UHF Resonator with Linear Tuning." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 66-72.

A novel method of tuning a transmission-line type resonator is described. The first-order theory of such a resonator is derived and presented in the form of design curves which indicate an extremely good tuning linearity. Experiments with a resonator designed on this principle agree with theory.



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Equivalent Circuits for Small Symmetrical Longitudinal Apertures and Obstacles

A.A. Oliner. "Equivalent Circuits for Small Symmetrical Longitudinal Apertures and Obstacles." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 72-80.

Formulas based on small aperture and small obstacle theory are presented for the determination of equivalent circuits for symmetrical longitudinal apertures and obstacles. These formulas are then applied to several examples of practical interest, including aperture discontinuities in trough waveguide and an obstacle array of interest to anisotropic radomes.



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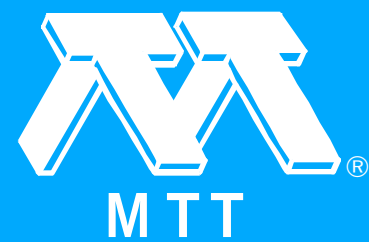
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On the TE/sub n0/ Modes of a Ferrite Slab Loaded Rectangular Waveguide and the Associated Thermodynamic Paradox

A.D. Bresler. "On the TE/sub n0/ Modes of a Ferrite Slab Loaded Rectangular Waveguide and the Associated Thermodynamic Paradox." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 81-95.

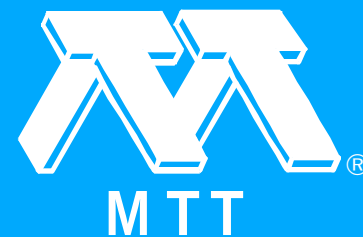
It has been known for some time that the secular equation for the TE/sub n0/ modes of a perfectly conducting rectangular waveguide loaded with a transversely magnetized dissipationless full height ferrite slab located against one of the narrow walls of the waveguide admits the possibility of the existence of only a single propagating mode (transporting energy in one direction only). In this paper, it is established that if we admit the existence of a passive dissipationless uniform waveguide supporting only a single propagating mode we are led inescapably to a thermodynamic paradox. A uniqueness theorem is cited to establish that, for the waveguide described above, the paradox is associated with the TE/sub n0/ mode set alone. This conclusion motivates a thorough study of the secular equation for the TE/sub n0/ modes of this waveguide. This study is initiated by an investigation into the properties of the TE/sub n0/ surface waves guided along a plane interface separating a transversely magnetized dissipationless ferrite from free space. It is shown that two oppositely directed surface waves are guided along this interface. These two surface waves are admitted in different finite ranges of the parameter values which never coincide and which may or may not overlap. Each of the two surface waves has both a high- and a low-frequency cutoff and, in general, both a high and a low dc magnetic field cutoff. The propagation constant of one of the surface waves becomes infinite at the low field (high-frequency) cutoff. The next step in the analysis consists of an examination of the behavior of these surface waves on finite thickness ferrite slabs located in different environments. It is shown that when one of the two interfaces bounding the slab approaches a short circuit the infinite propagation constant noted above behaves in a peculiar discontinuous fashion. Next, the TE/sub n0/ mode secular equation of the slab loaded rectangular waveguide is analyzed and information is developed leading to a description of the behavior of the propagation constants of all the propagating TE/sub n0/ modes. This analysis reveals that the possibility of the existence of only a single propagating

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mode is associated only with the surface wave mode of this waveguide. A resolution for the thermodynamic paradox is proposed based on the discontinuous behavior of one of the infinite propagation constants associated with this surface wave mode. It is shown that with a properly chosen secular equation for the waveguide under consideration there are always an even number of TE_{n0} propagating modes, half of which transport energy in one direction, half in the other. This demonstration is based, in part, on an analysis leading to relations between the direction of the power flow associated with a propagating mode and the derivative of its propagation constant with respect to the dc magnetic field.



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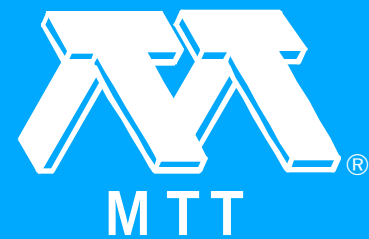
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L-Band Ferromagnetic Resonance Experiments at High Peak Power Levels

E. Schlomann, J.H. Saunders and M.H. Sirvetz. "L-Band Ferromagnetic Resonance Experiments at High Peak Power Levels." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 96-100.

Ferromagnetic resonance absorption at high peak power levels has been observed at 1300 mc in yttrium-gadolinium garnets and in a nickel ferrite-aluminate. In agreement with theoretical predictions, the critical field characterizing the onset of nonlinear effects, in a series of yttrium-gadolinium garnet disks of a given shape, was found to be very sensitively dependent on the gadolinium content. Similarly, for samples of a given composition, the critical field strength was sensitively dependent on the shape of the sample in agreement with theoretical predictions. At moderate power levels the susceptibility varies linearly with the square of the RF magnetic field strength over an appreciable range. This result can be understood in terms of an extension of Suhl's theory. The results can be used to predict the high power performance of these materials when used in isolators.

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High Power Ferromagnetic Resonance at X-Band in Polycrystalline Garnets and Ferrites

J.J. Green and E. Schlomann. "High Power Ferromagnetic Resonance at X-Band in Polycrystalline Garnets and Ferrites." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 100-103.

Resonance experiments have been performed at X-band on spherical samples of polycrystalline yttrium garnet, yttrium-gadolinium garnet, yttrium-holmium garnet and nickel-cobalt ferrite. The RF field strength extended up to 60 Oersted. In the case of yttrium garnet the samples differed considerably in density and hence in linewidth. At fairly low power levels the susceptibility at resonance varies linearly with the square of the RF magnetic field strength. At high power levels the susceptibility is inversely proportional to the amplitude of the microwave magnetic field. The "spin-wave linewidth" $\Delta H/k$ is inferred by extrapolation from the behavior at very high powers. It is found that $\Delta H/k$ is, to a large extent, independent of the linewidth ΔH observed by the usual low power experiments. In particular $\Delta H/k$ was found to be essentially the same (approximately 4 Oe) for all yttrium iron garnets (single crystals and polycrystals with linewidth varying between 1.8 Oe and 450 Oe). On the other hand, $\Delta H/k$ increases very rapidly if the yttrium is partially substituted by holmium ($\Delta H/k \sim 11$ Oe for 1 per cent substitution.)



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Microwave Diode Cartridge Impedance

R.V. Garver and J.A. Rosado. "Microwave Diode Cartridge Impedance." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 104-107.

In any application of a semiconductor microwave diode, the impedance of the diode cartridge plays a very important role. Two commonly made assumptions, which are quite erroneous, are that 1) the impedance of the diode cartridge consists simply of a shunt capacitance and whisker inductance, and 2) the metal-to-semiconductor junction at microwave frequencies behaves approximately as it does at 10 mc. In this paper it is shown that the impedance of the diode cartridge at microwave frequencies can be measured accurately by substituting a carbon die for the semiconductor.

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Abstracts

Theory of the Germanium Diode Microwave Switch

R.V. Garver, J.A. Rosado and E.F. Turner, Jr.. "Theory of the Germanium Diode Microwave Switch." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 108-111.

The application of a generally neglected theory of microwave detection to the poorly understood problem of metal-to-semiconductor junction behavior at microwave frequencies is discussed. Experimental results are disclosed which support the theory and appear to be the first experimental verification of it. It is shown how the theory predicts that germanium microwave diodes should exercise direct switching action upon microwaves while silicon microwave diodes should not, as had been observed in the past but with no explanation.



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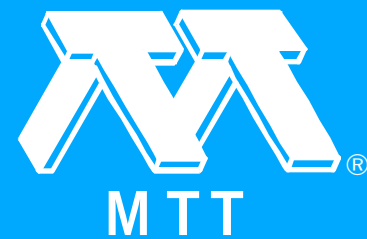


Abstracts

Improvement in the Square Law Operation of 1N23B Crystals from 2 to 11 kmc

A. Staniforth and J.H. Craven. "Improvement in the Square Law Operation of 1N23B Crystals from 2 to 11 kmc." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 111-115.

Crystal rectifiers have been used for many years as video detectors in microwave measurements. In most of the applications the detection characteristic at low level is assumed to be square law. It is well known that, in general, this assumption is not justified, particularly if reasonable accuracy is desired. The conditions required to increase the dynamic range over which square law response may be achieved have been investigated experimentally. Results obtained in this laboratory have indicated that a forward bias current of 100 microamperes or more with a low video load resistance made the operation of the crystal closer to the ideal square law over a larger dynamic range.



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An N-Way Hybrid Power Divider

E.J. Wilkinson. "An N-Way Hybrid Power Divider." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 116-118.

A circularly symmetric power divider is described which splits a signal into n equiphase equiamplitude parts where n can be odd or even. The power divider provides isolation between output terminals and approximately matched terminal impedances over about a 20 per cent band. A theory of operation is given which yields the necessary design parameters, and an experimental model is described which has a minimum isolation of -27 db between output terminals, an output VSWR of 1.6, and an input VSWR of 1.2.

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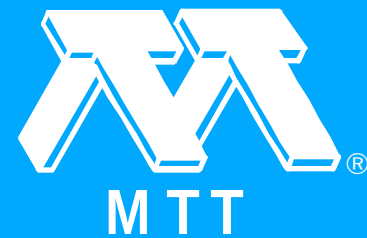


Abstracts

Higher Order Modes in Coupled Helices (Correspondence)

R.E. Hayes. "Higher Order Modes in Coupled Helices (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 119-120.

The problem of electromagnetic wave propagation in a system consisting of the two infinitely long concentric sheath helices free space, shown in Fig. 1, may be approached as a boundary value problem. This has been done before for the case of the lowest mode, but the determinantal equation which gives the propagation constants the higher order modes has not been given before. This note describes the analysis which gives the propagation constants for all modes of propagation.



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The Tetrahedral Junction as a Waveguide Switch (Correspondence)

J.A. Weiss. "The Tetrahedral Junction as a Waveguide Switch (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 120-121.

A junction of two rectangular waveguides which are mutually cross-polarized becomes a magnetically controlled reactive switch when properly loaded by a ferrite rod magnetized longitudinally. It is a special case of a novel type of structure for which we propose the name tetrahedral junction. As a switch, it possesses: 1) very high insertion loss in the reflecting state, ~60 db; 2) loss in the transmitting state which is lower in principle than that attainable in any similar ferrite-waveguide device, <0.1 db; 3) high switching speed-1 mu sec is attainable with conventional circuits and convenient currents; 4) large bandwidth, ~10 per cent; 5) little sensitivity to variations in applied field and saturation magnetization; and 6) small phase and small phase-variations with frequency and applied field in the transmitting-state.





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Some Measurements of Traveling-Wave Tube Attenuators at 2000 MC (Correspondence)

C.H. Dix. "Some Measurements of Traveling-Wave Tube Attenuators at 2000 MC (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 121-122.

Saturation in traveling-wave tube amplifiers, that is, the failure of the output to continue to rise as the input power is increased, can occur in several ways. The limit may arise through heating of the RF circuit, or if the circuit can be so made that this does not occur, the ultimate limit is provided by the amount of power that can be carried on the beam; large signal calculations of the behavior under these conditions have been made by several investigators. It has also been observed, however, that the saturation limit is a function of the amount and distribution of loss in the attenuator, and recent calculations, for example by Rowe, include the study of the limiting power output for various values of the loss parameter d .

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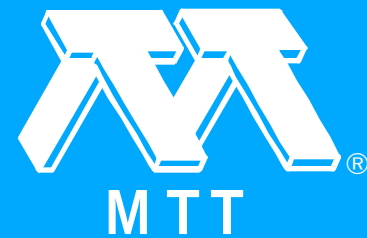


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PGMTT News (Jan. 1960 [T-MTT])

"PGMTT News (Jan. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 123-124.

During the spring of 1958, a joint decision was reached by the Boston Chapter of the Institute of Radio Engineers and the Administrative Committee of the Professional Group on Microwave Theory and Techniques to hold the 1959 annual meeting in the Boston area.



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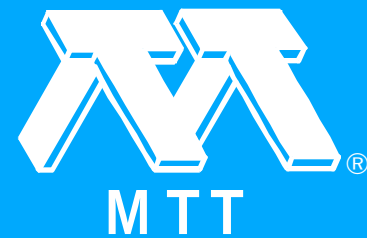
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Contributors (Jan. 1960 [T-MTT])

A.D. Bresler, J.H. Craven, R.W. Damon, C.C. Eaglesfield, J.R. Eshbach, R.V. Garver, J.J. Green, J. Hamasaki, A.F. Harvey, K. Kurokawa, A.A. Oliner, J.A. Rosado, R.L. Sarda, J.H. Saunders, E. Schlomann, J.-C. Simon, M.H. Sirvetz, L. Solymar, A. Staniforth, E.F. Turner, Jr., B.H. Wadia and E.J. Wilkinson. "Contributors (Jan. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.1 (Jan. 1960 [T-MTT]): 125-127.



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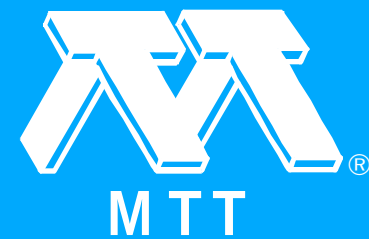
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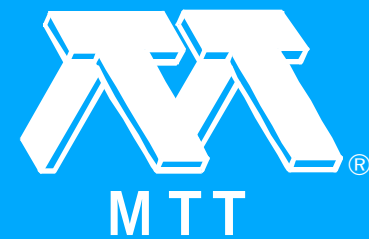
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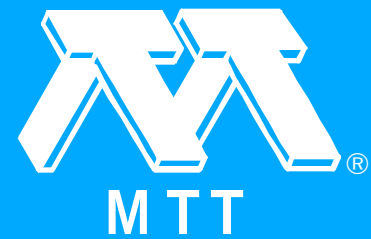
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"Table of Contents (Mar. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 129-129.



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Biography - Harold M. Barlow

"Biography - Harold M. Barlow." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 130-130.

Harold M. Barlow was born on November 15, 1899, in London, England. After graduating in engineering at University College, London, in 1922, he received the Ph.D. degree in physics in 1924, from the same school. His first academic appointment was as a lecturer in the design of electrical machinery at University College. Since World War II, he has specialized more particularly in high-frequency work. As Superintendent of the Radio Department at the Royal Aircraft Establishment, England, during the war years, he worked with radar, and it was largely as a result of that experience that he became so interested in microwaves. He still tries to maintain contact with the power side of electrical engineering, and as a teacher, discourages specialization except to a limited extent in the final year of the degree course. Professor Barlow is a member of the Council of the British IEE, the British Broadcasting Corporation's Scientific Advisory Committee, and the Radio Research Board.

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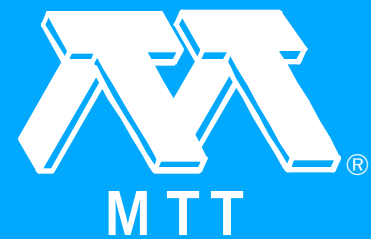


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Editorial (Mar. 1960 [T-MTT])

H.M. Barlow. "Editorial (Mar. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 131-131.

Electrical engineering as a technology necessarily embodies applications of physics, and in the microwave branch, a particularly close link exists between the two subjects of study. The phenomenal progress in microwave work has come about as a result of physicist and engineer working side by side, each making his own kind of contribution, much to the benefit of both. Cross fertilization of ideas is always profitable, and in microwaves, perhaps more than in many other things, this has had exceedingly valuable results. The engineers have discovered the need to broaden their approach to problems of the electromagnetic field and to delve much more deeply into matters concerning the behavior of electrical materials in such fields. The high frequencies involved have naturally been a dominant factor in the new work they had to do.



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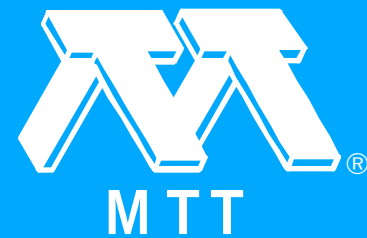


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Broad-Band Coaxial Choked Coupling Design

H.E. King. "Broad-Band Coaxial Choked Coupling Design." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 132-135.

Equations and curves are presented to predict the frequency bandwidth of coaxial choke couplings in terms of the choke parameters. Choke couplings discussed are those applicable to rotary joints and dc isolation units.



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A Study of Multielement Transmission Lines

H. Kogo. "A Study of Multielement Transmission Lines." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 136-142.

Although many papers have been published on the subject of multielement transmission lines, the application to practical problems seems rather inconvenient. The author proposes a solution to the general equations which relate the voltage difference between the lines and the mesh current. Under particular conditions, it is shown that only a single type of propagating mode exists. In this case, the solution has been obtained by the so called "decomposition method", i.e., assuming several virtual two element transmission lines in lieu of the existing multielement transmission line. The problem has been solved by means of the resolved superposed virtual lines taking into account the existing boundary condition.

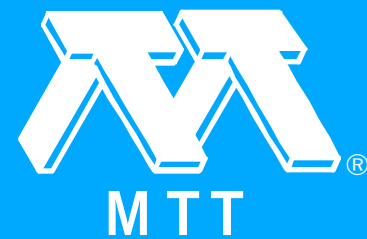


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Measurement of Relative Phase Shift at Microwave Frequencies

C.A. Finnila, L.A. Roberts and C. Susskind. "Measurement of Relative Phase Shift at Microwave Frequencies." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 143-147.

A method is described for measuring the relative phase shift of microwave devices, such as traveling-wave tubes, which utilizes the serrodyne technique to transfer the measurements into the audio-frequency range. The method is used to measure the phase shift incidental to the variation of the dc potentials applied to the several electrodes of a 2- to 4-kmc traveling-wave tube. This method is particularly useful in coaxial systems, where accurately calibrated phase shifters (and attenuators without phase shift) are not available.



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Resonant Modes in Waveguide Windows

M.P. Forrer and E.T. Jaynes. "Resonant Modes in Waveguide Windows." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 147-150.

Analysis and experimental verification of a class of resonant fields, called ghost-modes, occurring in waveguide dielectric windows are presented. Numerical solutions for a simple geometry are given through universal curves. Knowledge about ghost-modes has importance to designers of high-power windows. It also leads to a measuring technique for dielectric constants through a frequency measurement.



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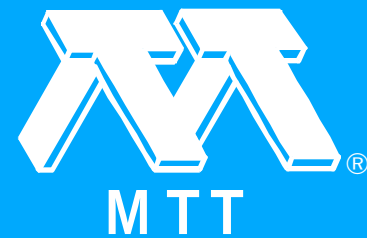


Abstracts

Temperature Compensation of Coaxial Cavities

J.R. Cogdell, A.P. Deam and A.W. Straiton. "Temperature Compensation of Coaxial Cavities." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 151-155.

This paper describes a technique for temperature compensation of coaxial cavities by controlling the capacitance between the end of the center conductor and an end plate across the outer conductor. A formula is derived for this capacitance which is verified experimentally. Supplemental design data are also obtained experimentally.



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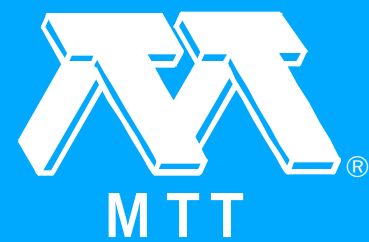
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A Graphical Method for Measuring Dielectric Constants at Microwave Frequencies

C.B. Sharpe. "A Graphical Method for Measuring Dielectric Constants at Microwave Frequencies." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 155-159.

This paper describes a graphical method for measuring the real and imaginary parts of the dielectric constant $\epsilon/\epsilon_0 = \epsilon' - j\epsilon''$ of materials at microwave frequencies. The method is based on the network approach to dielectric measurements proposed by Oliner and Altschuler in which the dielectric sample fills a section of transmission line or waveguide. In contrast to their method, the network representing the dielectric sample is analyzed in terms of the bilinear transformation $\Gamma' = (a\Gamma + b)/(c\Gamma + d)$; $ad - bc = 4$. The analysis proceeds from the geometric properties of the image circle in the r plane obtained by terminating the output line in a calibrated sliding short. The technique described retains the desirable features of the network approach but avoids the necessity of measuring both scattering coefficients. As a result the procedure is more direct and, in the case of the TEM configuration, leads to an entirely graphical solution in which the complex dielectric constant can be read from a Smith chart overlay.

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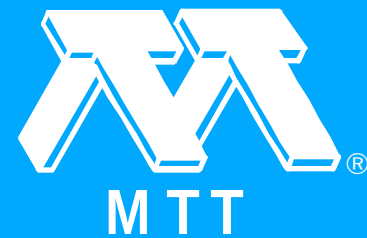


Abstracts

Wide-Band Strip-Line Magic-T

E.M.T. Jones. "Wide-Band Strip-Line Magic-T." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 160-168.

This paper presents theoretical performance calculations of a novel form of wide-band strip-line Magic-T that uses two dual strip-line band-pass filters. When all four ports are terminated in the same impedance, the VSWR at each port is less than 1.47 over a 2:1 frequency band, while the isolation between opposite ports is greater than 20 db over this frequency band.



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A General Theorem on an Optimum Stepped Impedance Transformer

H.J. Riblet. "A General Theorem on an Optimum Stepped Impedance Transformer." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 169-170.

With the assistance of a mathematical theorem demonstrated by Eaton in a companion paper, it is shown rigorously, in the limit of small impedance transformation, that the familiar binomial impedance transformer, consisting of equal quarter-wave steps, is the shortest, monotonic, maximally-flat, stepped, transmission-line transformer having steps commensurate in length with the midband guide-wavelength, and coincident zeros at the midband frequency. It is shown how this theorem places very severe limitations on any effort to improve on the performance of a quarter-wave transformer by increasing the number of its impedance steps without a corresponding increase in its length.

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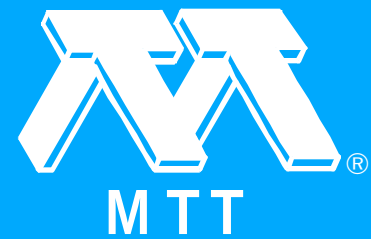


Abstracts

Minimal Positive Polynomials

J.E. Eaton. "Minimal Positive Polynomials." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 171-171.

A proof is given of a purely mathematical theorem on the polynomial of lowest degree with positive coefficients having a prescribed root of unity as a multiple root. H. J. Riblet has conjectured the theorem below. In the preceding paper, he applies his theorem to optimum impedance transformer design.



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Complementarity in the Study of Transmission Lines

G.H. Owyang and R. King. "Complementarity in the Study of Transmission Lines." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 172-181.

The principle of complementarity is applied to the slot transmission line. The properties of a dual circuit are investigated. The pairs of several possible duals for a given configuration are correlated and new quantities are defined for use with different types of circuits. A complete parallelism between the two-wire line and the two-slot line is established for the ideal cases and is extended by approximation to include the practical cases. Measurements were made with a two-slot transmission line and its associated probing system. The method of testing the line for balance is discussed. The transverse distribution of the longitudinal current and the attenuation constant were measured. The analogy between the steady-state field in a conducting medium and the electrostatic field in a dielectric is investigated. The expressions for the constants of a two-slot line are given in a form that permits a ready evaluation from experimental data obtained with the electrolytic tank. The measured results are compared with theoretical values.

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High Resolution Millimeter Wave Fabry-Perot Interferometer

W. Culshaw. "High Resolution Millimeter Wave Fabry-Perot Interferometer." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 182-189.

The design and operation of a microwave Fabry-Perot interferometer at wavelengths around 6 mm is described. This uses reflectors which are simple, easy to make, and which are capable of scaling for operation at short wavelengths in the ultramicrowave region. With power reflection coefficients around 0.999, very sharp fringes and Q values around 100,000 were obtained on the interferometer. Effects of diffraction in the interferometer are considered, and wavelength measurements with this particular interferometer indicate that accuracies of 0.04 per cent are obtained without any diffraction correction. Advantages of such an interferometer for ultramicrowaves are that the component parts are large compared with the wavelength, the effects of diffraction decrease with the wavelength, and the problem of maintaining a high Q with a single mode of propagation and a structure of adequate size is made much easier. Such an interferometer forms the cavity resonator for ultramicrowaves. It can thus be used for such conventional purposes as wavelength measurements, wavelength spectral analysis, dielectric constant, and loss measurements, or as the cavity resonator for frequency stabilization, or as the cavity resonator for a millimeter- or submillimeter-wavelength maser.

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Boundary Conditions and Ohmic Losses in Conducting Wedges

R.M. Chisholm. "Boundary Conditions and Ohmic Losses in Conducting Wedges." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 189-198.

The present work is concerned with the boundary conditions required to calculate the ohmic losses occurring in metallic wedges under the influence of electromagnetic waves which are sinusoidal in time. The validity of the surface impedance condition used in calculating waveguide wall losses is examined carefully, and a "modified" surface impedance condition, which can be applied to wedge problems in which the perfectly conducting solution is known, is developed. A simple waveguide having a circular cross section, a sector of which is occupied by a metal wedge, is used as an example. The tangential magnetic field variations along the surface of the wedge are shown graphically, demonstrating, near the tip of the wedge, a large deviation from the tangential magnetic field of the perfectly conducting solution.

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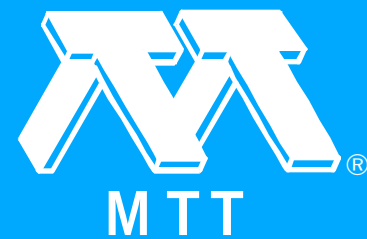


Abstracts

On the Theory of the Ferrite Resonance Isolator

E. Schlomann. "On the Theory of the Ferrite Resonance Isolator." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 199-206.

The attenuation constants for both directions of propagation in a rectangular waveguide loaded with a small slab of ferrite are calculated by means of perturbation theory. The maximum attainable ratio of reverse to forward attenuation is found to be inversely proportional to the square of the bandwidth, with a constant of proportionality that is dependent on the shape of the ferrite slab and the proximity of cutoff. The figure of merit is largest for the case of a thin ferrite slab magnetized perpendicular to the plane of the slab. It is shown that a significant increase in the figure of merit can be obtained by proper use of the anisotropy of grain-oriented materials or single crystals.



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Analysis of Microwave Measurement Techniques by Means of Signal Flow Graphs

J.K. Hunton. "Analysis of Microwave Measurement Techniques by Means of Signal Flow Graphs." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 206-212.

Microwave measurement techniques can be analyzed more simply by using signal flow graphs instead of the customary scattering matrices to describe the microwave networks used in the measuring system. This is because the flow graphs of individual networks are simply joined together when the networks are cascaded and the solution for the system can be written down by inspection of the over-all flow graph by application of the nontouching loop rule. This paper reviews the method of setting up flow graphs of microwave networks and the rule for their solution. A single directional-coupler reflectometer system for measuring the reflection coefficient of a load is then analyzed by this method. The analysis shows how auxiliary tuners can be used to cancel residual error terms in the measurement of the magnitude of the reflection coefficient at a particular frequency. The analysis also shows how an additional tuner can be used to measure the phase angle of the reflection coefficient. These reflectometer techniques are particularly useful in the measurement of very small reflections.

Click on title for a complete paper.



Stepped Transformers for Partially Filled Transmission Lines

D.J. Sullivan and D.A. Parkes. "Stepped Transformers for Partially Filled Transmission Lines." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 212-217.

In recent years, partially-filled transmission lines have been used to improve the characteristics of various ferrite and garnet devices. This paper presents a generalized outline for determining the approximate effective guide wavelength and characteristic impedance of two types of (dielectric-loaded) partially-filled transmission line. The results are used to determine the geometries required for the design of optimum stepped transmission line transformers. The stepped transitions are designed to yield a Tchebycheff-type response for any given bandwidth. The measured results for stepped transitions in partially filled coaxial line and partially filled double-ridge waveguide are presented. The data are found to approximate the theory closely.



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Parametric Diodes in a Maser Phase-Locked Frequency Divider

M.L. Stitch, N.O. Robinson, Jr. and W. Silvey. "Parametric Diodes in a Maser Phase-Locked Frequency Divider." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 218-221.

The use of an ammonia-beam maser in a portable frequency standard requires a frequency divider which can be transistorized. A divider which uses no microwave tubes and hence one that can be transistorized is described. An ammonia-maser-controlled signal generator used to tuneup the divider is also described. It is found that the use of a parametric diode frequency multiplier substantially improves the lock-in performance of the divider. Some data are given for comparing the performance of the maser frequency divider with and without the parametric diode frequency multiplier.

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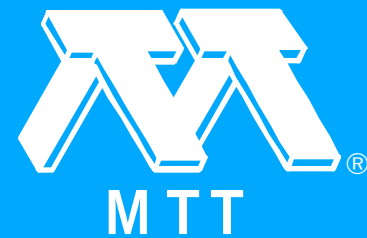


Abstracts

Parametric Devices and Masers: An Annotated Bibliography

E. Mount and B. Begg. "Parametric Devices and Masers: An Annotated Bibliography." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 222-241.

This bibliography is restricted to books and periodical articles published prior to October, 1959. No attempt has been made to include the voluminous material to be found in technical reports, patents or similar sources.



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"Index of Authors (Mar. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 241-243.



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Tables for Cascaded Homogeneous Quarter-Wave Transformers (Correction)

L. Young. "Tables for Cascaded Homogeneous Quarter-Wave Transformers (Correction)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 243-244.

Leo Young, the author of "Tables for Cascaded Homogeneous Quarter-Wave Transformers," which appeared on pages 233-237 in the April, 1959 issue of these Transactions, has requested that the following revisions be made in his paper.

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



Abstracts

Analysis of Split Coaxial Line Type Balun (Correspondence)

H. Kogo. "Analysis of Split Coaxial Line Type Balun (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 245-246.

Since the split coaxial type balun was developed, it has been widely utilized as a microwave radiator with dipole, and a duplexer of television transmitting unit for its superior working capacity. There are several papers on the analytical theory of this balancing unit. But, strictly speaking, there are still some points remaining to be rescruinized, such as the radiator receiving the effect of the split coaxial and its lines from the earth.



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Nonreciprocal Attenuation of Ferrite in Single-Ridge Waveguide (Correspondence)

T.-S. Chen. "Nonreciprocal Attenuation of Ferrite in Single-Ridge Waveguide (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 247-248.

The nonreciprocal transmission characteristics of rectangular and cylindrical waveguides containing ferrites have been extensively studied and utilized in the construction of microwave phase shifters, gyrators, circulators, and isolators. This note concerns the measurement of the nonreciprocal attenuation produced by ferrite in single-ridge waveguide transmitting dominant mode. In particular, three types of isolators in ridge waveguide are investigated including resonance-absorption isolators, field-displacement isolators, and isolators operating at low-biasing magnetic fields. Fig. 1 shows the dimensions of the single-ridge waveguide used in the measurement.

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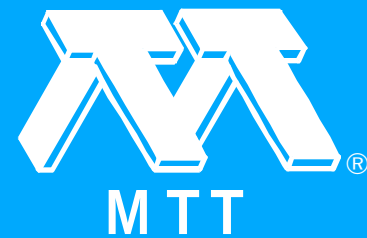


Abstracts

A New Automatic Frequency Regulation System (Correspondence)

J.R. Singer. "A New Automatic Frequency Regulation System (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 249-249.

A considerable number of frequency regulation systems for voltage tunable sources such as klystrons are presently available. The most prominent of these is the Pound Regulator which provides an excellent stable source. Perhaps the only disadvantages of the Pound system are the initial cost and the rather critical adjustments necessary when starting up.



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Abstracts

On Some Problems in Designing Microwave Faraday-Rotation Devices (Correspondence)

S.J. Lewandowski and J. Konopka. "On Some Problems in Designing Microwave Faraday-Rotation Devices (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 249-251.

During recent years a substantial effort has been made to obtain special ferrites for microwave applications. The authors opinion is that in many cases this effort was not supported by real necessity and that many existing commercial materials may reveal surprising microwave properties after a persistent and careful preparation of working conditions.



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Abstracts

Equivalence of 0 and -1 Space Harmonics in Helical Antenna Operation (Correspondence)

T.S. Maclean and D.A. Watkins. "Equivalence of 0 and -1 Space Harmonics in Helical Antenna Operation (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 251-251.

In considering the propagation of electromagnetic waves along helical conductors using the Tape Helix approximation, it is well known that the solution contains an infinite number of space harmonics.



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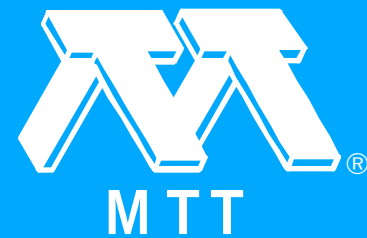


Abstracts

Application of Perturbation Theory to the Calculation of ω - β Characteristics for Periodic Structures (Correspondence)

M.D. Sirkis. "Application of Perturbation Theory to the Calculation of ω - β Characteristics for Periodic Structures (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 251-252.

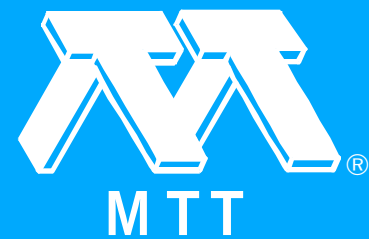
The effect of small periodic changes in the physical dimensions of closed periodic structures can be investigated using the perturbation theory developed by Muller and later by Slater.



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Ice as a Bending Medium for Wave-Guide and Tubing (Correspondence)

F.S. Coale. "Ice as a Bending Medium for Wave-Guide and Tubing (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 252-252.

Bending waveguide and metal tubing is very often a difficult and time-consuming task. Low melting temperature alloys are at times difficult to remove from waveguide and tubing. The piece to be bent may be filled with water which is then frozen by dry ice, liquid nitrogen, or by a deep freeze. In some applications where the piece to be bent is integral with a larger system, a block of dry ice may be held against it to freeze only the portion of water around the section to be bent. The use of these low temperatures causes not only the water to freeze into quite small crystals (which act like a sand packing), but also prevents the ice from melting because of the pressure of bending.

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On Higher-Order Hybrid Modes of Dielectric Cylinders (Correspondence)

S.P. Schlesinger, P. Diamant and A. Vigants. "On Higher-Order Hybrid Modes of Dielectric Cylinders (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 252-253.

In the course of investigations into the properties of various surface wave structures, it became necessary to investigate hybrid modes on dielectric cylinders for modes of order n , where $n > 1$. The case $n = 1$ has received extensive treatment in the literature.

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A Property of Symmetric Hybrid Waveguide Junctions (Correspondence)

J.M. Smith. "A Property of Symmetric Hybrid Waveguide Junctions (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 253-253.

It is well known that in symmetric hybrid junctions such as the short-slot, branched-guide, and transvar types, the signals in the main and auxiliary guides are in phase quadrature. Another property of fully symmetric lossless hybrids is that if all the arms are matched, the amplitudes of the waves traveling in the reverse direction in the main and auxiliary guides are equal. A proof is given below.

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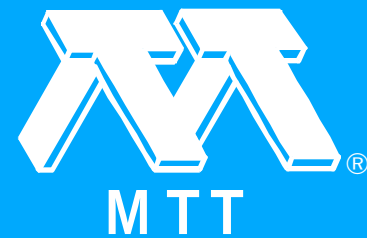


Abstracts

Attenuation in a Resonant Ring Circuit (Correspondence)

K. Tomiyasu. "Attenuation in a Resonant Ring Circuit (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 253-254.

The use of a resonant circuit will permit raising the strength of electromagnetic fields to values considerably higher than that available directly from a transmitter. In the usual resonant cavity, standing waves exist which may raise some doubt as to the usefulness of this method for testing certain components.



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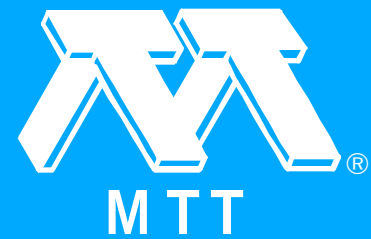


Abstracts

Reciprocal Ferrite Phase Shifters (Correspondence)

A. Clavin. "Reciprocal Ferrite Phase Shifters (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 254-255.

The Reggia-Spencer phase shifter has been the subject of a great deal of investigation because of the large amounts of phase shift possible with a relatively simple construction.



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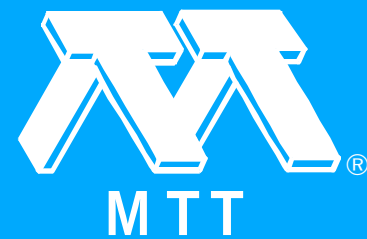
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Contributors (Mar. 1960 [T-MTT])

B.A. Begg, R.M. Chisholm, J.R. Cogdell, W. Culshaw, A.P. Deam, J.E. Eaton, C.A. Finnila, M.P. Forrer, J.K. Hunton, E.T. Jaynes, E.M.T. Jones, H.E. King, R.W.P. King, H. Kogo, E. Mount, G.H. Owyang, D.A. Parkes, H.J. Riblet, L.A. Roberts, N.O. Robinson, Jr., C.B. Sharpe, W. Silvey, M.L. Stitch, A.W. Straiton, D.J. Sullivan and C. Susskind. "Contributors (Mar. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 255-259.



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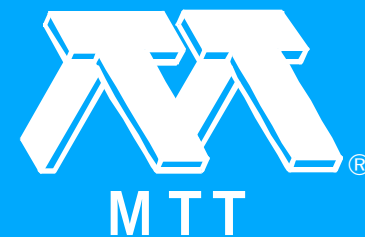
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1960 PGMTT National Symposium (Mar. 1960 [T-MTT])

"1960 PGMTT National Symposium (Mar. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 260-260.



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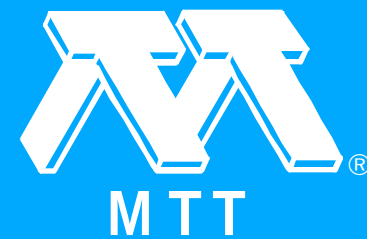
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Roster of PGMTT Members Listed by IRE Regions and Sections, as of March 1, 1960

"Roster of PGMTT Members Listed by IRE Regions and Sections, as of March 1, 1960." 1960 Transactions on Microwave Theory and Techniques 8.2 (Mar. 1960 [T-MTT]): 261-270.



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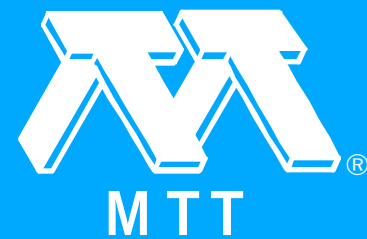
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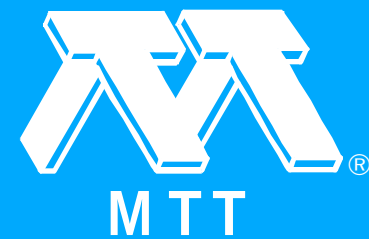
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Professional Group on Microwave Theory and Techniques Administrative Committee

"Professional Group on Microwave Theory and Techniques Administrative Committee." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 272-273.



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An Analysis of Four-Frequency Nonlinear Reactance Circuits

D.K. Adams. "An Analysis of Four-Frequency Nonlinear Reactance Circuits." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 274-283.

Several advantages of multiple-frequency nonlinear reactance circuits are described in this paper. In particular, a circuit is considered in which a nonlinear reactance couples four basic frequencies: ω_0 , ω_1 , ω_2 , and ω_3 ; these are so related that $\omega_2 = \omega_0 + \omega_1$ and $\omega_3 = \omega_0 - \omega_1$. Here, ω_0 is taken to be the power source or pump. It is found to be desirable to allow for the possible presence of the pump harmonic, $2\omega_0$, and individual cases are characterized by whether $2\omega_0$ is present or not. The major results are as follows: 1) Unlimited amplification gain is theoretically possible at frequencies higher than the pump, by reflecting negative input resistance at ω_2 , but without relying on any effects due to pump harmonics. 2) Unlimited up- or down-conversion gains between ω_1 and ω_2 are theoretically possible in the additional presence of the first pump harmonic, but without reflecting negative input or output resistance. 3) Unlimited amplification gain is theoretically possible at frequencies both lower and higher than the pump fundamental, without reflecting negative input resistance.

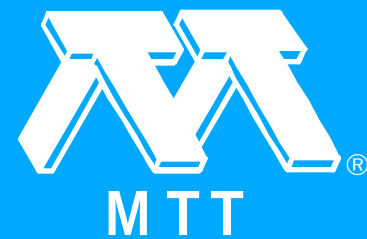


Abstracts

Some Properties of Three Coupled Waves

L. Solymar. "Some Properties of Three Coupled Waves." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 284-291.

The paper deals with the problem of three waves, 1, 2, and 3, in which waves 2 and 3 are coupled to wave 1 but not to each other. The general solution for the amplitudes of the waves is given in closed form. It is shown that for certain values of the parameters growing waves can exist. Numerical solutions for the location of the boundaries of the growing wave regions are plotted. It is shown furthermore that under certain conditions the power can be completely transferred from wave 1 to waves 2 and 3. Examples on traveling-wave tubes, waveguide couplers, and backward-wave oscillators illustrate the applicability of the theory.



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Noise Figures of Reflex Klystron Amplifiers

K. Ishii. "Noise Figures of Reflex Klystron Amplifiers." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 291-294.

The noise figure of the 2K25 reflex klystron amplifier was investigated. The noise figure of the reflex klystron amplifier depends on operating frequency, electronic impedance, circuit impedance, and operating electronic mode. Experimental results show that a noise figure of 5 db is possible under particularly carefully adjusted conditions. In order to obtain the low-noise figure, careful electronic tuning and the impedance adjustments are particularly important. Generally, relatively low noise figures were obtained when the electronic tuning was good. Noise figures of cascaded reflex klystron amplifiers were also investigated experimentally. Noise figures of the cascaded amplifier were generally higher than that of the single stage amplifier, but still low enough to use this reflex klystron amplifiers as a preamplifier of a microwave receiver to increase the sensitivity of the receiving system.

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Abstracts

On Measurements of Microwave $\bar{E}$ and $\bar{H}$ Field Distributions by using Modulated Scattering Methods

M.K. Hu. "On Measurements of Microwave $\bar{E}$ and $\bar{H}$ Field Distributions by using Modulated Scattering Methods." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 295-300.

The modulated scattering method of Justice, Rumsey, and Richmond for measuring $\bar{E}$ field distribution is extended to the measurement of $\bar{H}$ field distribution by using a loop scatterer formed by two diodes. This diode loop method has the particular advantage of eliminating the large and undesirable effect produced by the associated $\bar{E}$ field when measuring the $\bar{H}$ field. A scattering analysis of the modulated diode loop is presented. It explains the principle of this new method and also supports the advantage mentioned above. A similar analysis for the modulated diode scatterer used in measuring $\bar{E}$ is also presented. It is believed that the explanation based upon this analysis for the $\bar{E}$ measurement is more satisfactory than that given by Richmond which is based upon a qualitative description of the diode scatterer.



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Abstracts

Analysis of Certain Transmission-Line Networks in the Time Domain

W.J. Getsinger. "Analysis of Certain Transmission-Line Networks in the Time Domain." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 301-309.

Many linear components in nondispersive transmission line are made up solely of commensurate lengths of line of various characteristic impedances. Such components have impulse responses that are a series of equispaced impulses, and, as a result, their frequency responses can be written as a Fourier series. Given the period and coefficients of the Fourier series describing the frequency response, the time response of the circuit to any pulse can be written down immediately as a sum of replicas of the applied pulse, each replica having an amplitude given by the coefficient of a term in the series, and occurring at a time determined by the period of that term of the series. The pulse responses of stepped transmission-line transformers, backward-coupling hybrids, and branch-line hybrids are determined and, after assuming a simple applied-pulse shape, are plotted.



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Sets of Eigenvectors for Volumes of Revolution

J.G. Van Bladel. "Sets of Eigenvectors for Volumes of Revolution." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 309-319.

The electric and magnetic eigenvectors of a volume of revolution can be written in terms of two-dimensional scalar and vector functions. These functions are the eigenfunctions of certain linear transformations in the meridian plane. The form of the transformation is examined, and much attention is devoted to the orthogonality properties of their eigenfunctions and the calculation of their eigenvalues from variational principles.



Abstracts

A Printed Circuit Balun for Use with Spiral Antennas

R. Bawer and J.J. Wolfe. "A Printed Circuit Balun for Use with Spiral Antennas." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 319-325.

A novel printed circuit balun is described which is particularly well suited to applications where space is at a premium. The design utilizes unshielded strip transmission line, but is readily adaptable to all of the common printed circuit transmission line techniques. When the balun is housed within the cavity of a spiral antenna, boresight error is virtually eliminated, ellipticity ratios of less than 2 db are maintained over an azimuth angle greater than $\pm 60^\circ$, and the input standing-wave ratio is less than 2:1 over an octave frequency range. Experimental results are given and additional applications are described.



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The P-I-N Modulator, an Electrically Controlled Attenuator for MM and Sub-MM Waves

F.C. de Ronde, H.J.G. Meyer and O.W. Memelink. "The P-I-N Modulator, an Electrically Controlled Attenuator for MM and Sub-MM Waves." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 325-327.

The construction and performance of a millimeter wave modulator are described. The main part of the modulator consists of a p-i-n germanium structure inserted into a rectangular waveguide. A modulation depth of 11 db could be obtained at frequencies up to 5 kc, this modulation being caused for the greatest part by attenuation.



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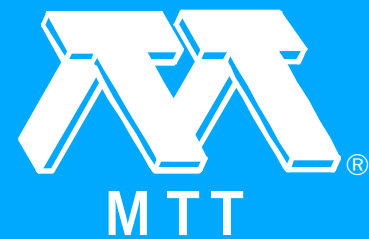
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Discontinuities in the Center Conductor of Symmetric Strip Transmission Line

H.M. Altschuler and A.A. Oliner. "Discontinuities in the Center Conductor of Symmetric Strip Transmission Line." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 328-339.

A systematic measurements program has been carried out to check the validity of theoretical formulas for the equivalent circuit parameters of a variety of discontinuities in the center conductor of symmetric strip transmission line. These theoretical formulas have been in part previously available and are in part new or modified. Results indicate that, in general, these formulas are adequate for most engineering purposes and that certain of the network parameters can be neglected.

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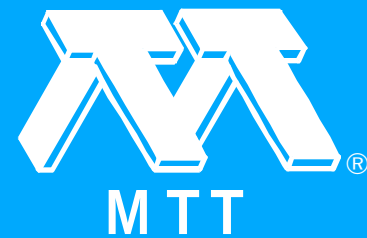


Abstracts

A Variational Integral for Propagation Constant of Lossy Transmission Lines

R.E. Collin. "A Variational Integral for Propagation Constant of Lossy Transmission Lines." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 339-342.

By assuming that the current on a lossy transmission line flows in the axial direction, only a variational integral for the propagation constant can be readily obtained. This variational integral shows that the usual power loss method of evaluating the attenuation constant is valid for general transmission lines. This variational integral also shows that the perturbation of the loss-free phase constant is due to the increase in magnetic field energy caused by penetration of the field into the conductors.



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Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation

D.S. Lerner and H.A. Wheeler. "Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 343-345.

Bandwidth is measured by transmission of a signal with sine-wave modulation through a microwave resonator under test. The modulation frequency is adjusted so that the envelope is delayed 45° with respect to the input, indicating that the two sideband frequencies are separated by the half-power bandwidth. The resonance ratio (Q) is then equal to the ratio of carrier frequency over twice the modulation frequency. This depends on observations of these frequencies and the modulation phase shift, but not on the amplitude. It is insensitive to detuning or incidental frequency variation of the resonator or the signal. In a resonant cavity tested, an observed bandwidth of 30 kc at 700 mc indicated that $Q=23,300$.

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A Y-Junction Strip-Line Circulator

U. Milano, J.H. Saunders and L. Davis, Jr.. "A Y-Junction Strip-Line Circulator." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 346-351.

The theoretical approach to the three-port symmetrical circulator is reviewed and presented in a form valid for the most general waveguide case. A strip-line Y-junction circulator is described and the performance of different units in the band 800-1600 mc is illustrated. The new type of device described offers, for the low-frequency region of the microwave spectrum, advantages of simple design, light weight, and great compactness with respect to the classical types. When operated with a permanent magnet it gives--in a bandwidth of about 4 per cent--isolation greater than 20 db, insertion loss ≤ 0.4 db, and input VSWR ≤ 1.20 .

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A Wide-Band UHF Traveling-Wave Variable Reactance Amplifier

R.C. Honey and E.M.T. Jones. "A Wide-Band UHF Traveling-Wave Variable Reactance Amplifier." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 351-361.

The techniques developed for designing periodically loaded traveling-wave parametric amplifiers using variable-reactance diodes are described in detail. An amplifier was built and tested with two different sets of eight diodes. The performance of the amplifier with each set of diodes agrees substantially with the theoretical predictions, the measured noise figures being about 1.2 db higher than the theoretical values in each case. The gain of the second amplifier varied from a minimum of 6.7 db to more than 13 db over the band from 550 to 930 mc, with a measured noise figure of 2.3 db for wide-band noise inputs in the middle of the band, corresponding to about 4.9 db for single-frequency inputs.

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Abstracts

On the Theory of Strongly Coupled Cavity Chains

M.A. Allen and G.S. Kino. "On the Theory of Strongly Coupled Cavity Chains." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 362-372.

A chain of identical cavity resonators coupled together through slots in their common walls forms a band-pass microwave filter. The pass band characteristics of such a system are determined by a combination of field theory and circuit theory. The fields in the cavities are expressed in terms of the normal modes of the uncoupled cavities. The fields in the neighborhood of a slot are determined by representing the slot as a transmission line. Irrotational components of the field in the cavities account for direct slot-to-slot coupling. The method successfully predicts both the dispersion characteristics and field distributions over large frequency ranges for many practical systems, such as slow-wave circuits for high-power traveling-wave tubes.



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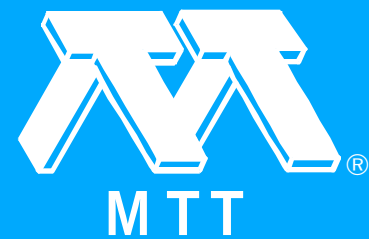
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Microphony in Waveguide

I. Goldstein and S.A. Soorsoorian. "Microphony in Waveguide." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 372-375.

This paper describes the mechanism of phase modulation by waveguide in the presence of a high intensity acoustic field. X-band rectangular was studied to determine the following: a) Resonant frequency in a transverse vibrational mode. b) Means of minimizing phase modulation.

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Abstracts

Discussion of Line Width and Gyromagnetic Ratio (Correspondence)

I. Bady. "Discussion of Line Width and Gyromagnetic Ratio (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 376-377.

A considerable amount of work has been reported on the measurement and interpretation of line width and gyromagnetic ratio of microwave ferrite materials. Most frequently, measurements are made on a small sphere placed in a resonant cavity. It is the purpose of this letter to summarize some of the significant results of this work, particularly from the point of view of an engineer using ferrites.



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Plotting Impedances with Negative Resistive Components (Correspondence)

R.L. Kyhl. "Plotting Impedances with Negative Resistive Components (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 377-377.

The plotting of impedances with negative resistive components on some sort of inverted Smith chart is becoming more common. This note suggests standardizing on a particular form, for psychological reasons. The suggested form is represented by " Γ " = $1/\Gamma$, where Γ is the actual complex reflection coefficient, and " Γ " is the value plotted on the chart. The corresponding impedance relation is " Z/Z_0 " = $-Z_0/Z$. The advantages claimed for this particular form are: 1) The transformation is analytic as opposed to the one mentioned by Stock and Kaplan. 2) If both negative and positive resistances are being plotted on two Smith charts, the result, as shown in Fig. 1, looks like the representation of the world on the covers of some atlases. It fits well with the concept of projection on the unit sphere. 3) It follows from 1) that if impedance is being plotted as a function of real frequency, then points of stability or instability as indicated by complex frequency will fall on the same side of the curve on both charts. A possible disadvantage is the opposite sense of rotation of the two charts for transmission-line calculations, but this seems natural and easy to remember for two circles in "contact."

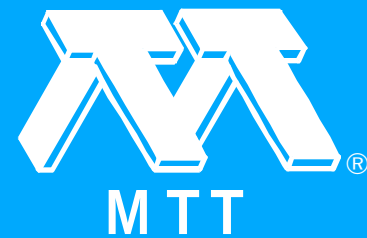


Abstracts

The Design of Ridged Waveguide (Comments)

R.M. Kurzrok. "The Design of Ridged Waveguide (Comments)." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 377-377.

An article by Hopfer, which appeared in 1955, takes into account the step discontinuity susceptance in the computation of the cutoff frequencies of ridged-waveguide. Cutoff frequencies are computed utilizing the transverse resonance method. Values of the normalized step susceptance that were used in computing the cutoff frequencies were taken from published data in the Waveguide Handbook.



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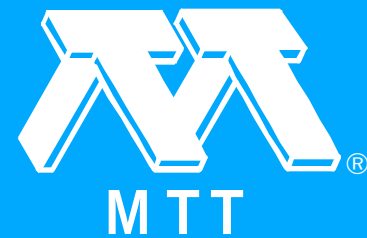
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Contributors (May 1960 [T-MTT])

D.K. Adams, M.A. Allen, H.M. Altschuler, R. Bawer, R.E. Collin, L. Davis, Jr., F.C. de Ronde, W.J. Getsinger, I. Goldstein, R.C. Honey, M.K. Hu, K. Ishii, E.M.T. Jones, G.S. Kino, D.S. Lerner, O.W. Memelink, H.J.G. Meyer, U. Milano, A.A. Oliner, J.H. Saunders, L. Solymar, S.A. Soorsoorian, J.G. Van Bladel, H.A. Wheeler and J.J. Wolfe. "Contributors (May 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.3 (May 1960 [T-MTT]): 378-380.



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"Table of Contents (Jul. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 381-381.



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Report of Advances in Microwave Theory and Techniques in Great Britain-1959

J. Brown. "Report of Advances in Microwave Theory and Techniques in Great Britain-1959." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 382-386.

The continued research effort in the microwave field is reflected by the number of papers, which is as great as in any previous year. The single topic attracting the largest number of contributions has been that of waveguides for long-distance communication. This is partly the result of a very successful International Convention organized by the Institution of Electrical Engineers in London during January, 1959. To some extent it also indicates the amount of work which has been proceeding during the last few years and which now suggests that operational waveguide communication links may be in service within the foreseeable future.



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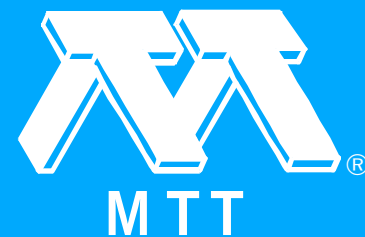


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Report of Advances in Microwave Theory and Techniques in Western Europe-1959

G. Goudet. "Report of Advances in Microwave Theory and Techniques in Western Europe-1959." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 387-394.

During 1959, the main progress in Western Europe was concerning further development of types "O" and "M" carcinotrons and studies about quantum devices. Nevertheless, other subjects have not been neglected.



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Report of Advances in Microwave Theory and Techniques in Japan-1959

K. Morita. "Report of Advances in Microwave Theory and Techniques in Japan-1959." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 395-397.

This report on advances in theory, experiments, and applications of the microwave field is based on papers appearing in the Journal of the Institute of Electrical Communication Engineers of Japan, which is the most widespread and well-esteemed journal in the communication and electronics field in Japan. Advances in the realms of microwave sources, detectors, transmission lines, measurements, radiation, and propagation are mentioned.



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The Design and Measurement of Two Broad-Band Coaxial Phase Shifters

C.F. Augustine and J. Cheal. "The Design and Measurement of Two Broad-Band Coaxial Phase Shifters." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 398-402.

Two mechanical (servo-driven) phase shifters were developed in response to systems requirements of low torque, compactness, octave bandwidth, and linear relation between mechanical motion and phase shift. One phase shifter relies upon the axial motion of a dielectric slug through a helix wound from modified miniature rigid coaxial cable. The second design consists of a 3-db coupler with ganged movable shorts on two ports. The helix design displayed phase shift of 720 degrees at 3 kmc and linearity to within ± 3 degrees. The coupler design is capable of achieving 720 degrees phase shift at 3 kmc and linearity within ± 2 degrees. A precision measuring facility (phase bridge) was developed for the purpose of determining the electrical performance of the phase shifters. A brief analysis is included to illustrate the prediction of maximum possible errors in the phase bridge and the phase shifters, in terms of transmission line parameters.

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A Dielectric Resonator Method of Measuring Inductive Capacities in the Millimeter Range

B.W. Hakki and P.D. Coleman. "A Dielectric Resonator Method of Measuring Inductive Capacities in the Millimeter Range." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 402-410.

A novel technique for the measurement of dielectric and magnetic properties of a homogeneous isotropic medium in the range of approximately 3 to 100 kmc is described. An accuracy of ± 1 per cent is possible in the determination of permittivity or permeability in those cases where the loss tangent is sufficiently small. The measuring structure is a resonator made up of a right circular cylindrical dielectric rod placed between two parallel conducting plates. For measurement of permittivity two or more resonant TE/sub onl/ mode frequencies are determined whereas for the measurement of permeability two or more resonant TM/sub onl/ mode frequencies are determined. The dielectric or magnetic properties are computed from the resonance frequencies, structure dimensions, and unloaded Q. Since the loss tangent is inversely proportional to the unloaded Q of the structure, the precision to which Q is measured determines the accuracy of the loss tangent.

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Summary of Measurement Techniques of Para-Metric Amplifier and Mixer Noise Figure

R.D. Haun, Jr.. "Summary of Measurement Techniques of Para-Metric Amplifier and Mixer Noise Figure." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 410-415.

Expressions are derived for the noise factor of a frequency mixing circuit under two different operating conditions: 1) single-sideband operation with input only in a band of frequencies at $\omega/2$; and 2) double-sideband radiometer operation with incoherent inputs in the bands both at frequency $\omega/2$ and at $\omega/2 = \omega_3 - \omega/2$. In both cases, the output is taken only at $\omega/2$. It is shown that the noise figure for radiometer double-sideband operation is not always 3 db less than for single-sideband operation. It is also shown that it is possible to obtain an output signal-to-noise ratio which is greater than the input signal-to-noise ratio for coherent double-sideband operation. Methods are analyzed for measuring the effective noise temperature of this circuit by using a broadband noise source.

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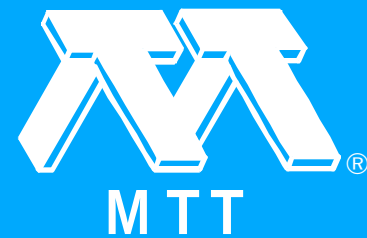


Abstracts

Duplexing Systems at Microwave Frequencies

A.F. Harvey. "Duplexing Systems at Microwave Frequencies." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 415-431.

The paper reviews the various methods of duplexing at microwave frequencies. General principles, including the use of passive and solid-state devices, are first discussed. The characteristics of gaseous-discharge duplexing tubes of both self- and externally-excited types are examined and data for typical examples given. The various arrangements of discharge tube duplexers and methods of measuring their performance are described. The survey concludes with a bibliography.



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Impedances of an Elliptic Waveguide (For the H_{10} Mode)

G.R. Valenzuela. "Impedances of an Elliptic Waveguide (For the H_{10} Mode)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 431-435.

The power-voltage, power-current and voltage-current impedances for the elliptical waveguide for the fundamental mode (H_{10} mode) are obtained by two different methods. The first method consists of using the exact fields inside a perfectly conducting elliptical pipe. Numerical results were obtained by numerical integration of the integrals involving Mathieu functions by the Gaussian Quadratures method by a digital computer. In the second method approximate fields which satisfy the boundary conditions were used. By this approximate method, actual expressions for the impedances are obtained as a function of minor to major diameter ratio with no need of numerical integration. The actual expressions for the impedance obtained by the approximate method give the impedance for elliptical waveguide within six per cent. On the basis of comparison with the exact numerical solution the expressions for the approximate impedance give the impedance of elliptical waveguide within three per cent if they are scaled by 1.03.

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Analysis of a Transmission Cavity Wavemeter

L. Young. "Analysis of a Transmission Cavity Wavemeter." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 436-439.

A section of transmission line partially closed off at each end constitutes a cavity wavemeter. If fixed in length, it may be used as a reference cavity; or if tunable, it maybe used to determine frequency. Such a cavity is here treated systematically as a lossy transmission line, with the two end couplings either lossless or symmetrical. The analysis is by means of the transfer or wave matrix. Various expressions are derived which have previously not been obtained, or for which only approximate expressions have been derived from "equivalent circuits."



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Scattering of a Plane Wave on a Ferrite Cylinder at Normal Incidence

W.H. Eggimann. "Scattering of a Plane Wave on a Ferrite Cylinder at Normal Incidence." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 440-445.

The scattered field is given as a series of cylinder functions. If the ferrite cylinder is magnetized along its axis the scattering pattern becomes asymmetrical about the direction of incidence. Approximation formulas for the thin cylinder and the far field zone are given. It is shown that in the first approximation the amplitude is an even function and the phase angle of the field is an odd function of the scattering angle. Exact numerical results have been obtained with a Univac digital computer. By a suitable arrangement of the ferrite cylinders, a unidirectional pattern can be obtained which is controlled by the applied magnetic dc field.

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Phase Adjustment Effects on Cascaded Reflex Klystron Amplifiers

K. Ishii. "Phase Adjustment Effects on Cascaded Reflex Klystron Amplifiers." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 445-449.

Reflex klystrons (type 2K25) were used as regenerative amplifiers for the X-band. Two 2K25 reflex klystron amplifiers were cascaded with a coupling circuit which contained a variable phase shifter. The effect of the phase adjustment was investigated in comparison with another coupling scheme which did not contain the phase shifter. The phase adjustment in the coupling circuit gave the amplifier system high gain (more than 50 db max.), and a reasonably low noise figure (8 db-17.5 db). High sensitivity was obtained. Proper phase adjustment of the two stage reflex klystron amplifier could give more than twice the gain in db of the single stage amplifier because of the regenerative feedback between stages. The linearity and dynamic range were considerably improved by the phase adjustment. But the frequency bandwidth became narrow (2 mc), and improvement in stability and directivity was not significant.

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TE Modes of the Dielectric Loaded Trough Line

M. Cohn. "TE Modes of the Dielectric Loaded Trough Line." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 449-454.

The properties of TE modes on a dielectric loaded trough waveguide have been investigated. In the case of the dominant mode of this line (TE/sub 20/), families of design curves giving the field distribution, guide wavelength, power handling capability, wall losses, and dielectric losses as a function of operating wavelength, waveguide dimensions and dielectric constant are presented. For a loosely bound wave, the losses are comparable to those of conventional rectangular waveguide and the power handling capability is an order of magnitude greater. The apparatus and procedure used to measure guide wavelength, rate of field decay in the transverse direction, and attenuation are described. The measured performance is in close agreement with the theoretically predicted characteristics.



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Abstracts

Coupling of Modes in Uniform, Composite Waveguides

L.C. Bahiana and L.D. Smullin. "Coupling of Modes in Uniform, Composite Waveguides." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 454-458.

The principle of coupling of modes is used to compute the phase constant in a uniform waveguide lilled with two ditferent dielectric materials. The natural modes of two hypothetical waveguides filled with the different dielectrics are computed. The propagation of the combined system is computed by considering the coupling between the two sets of modes. Comparison is made between the approximate theory and an exact theory.



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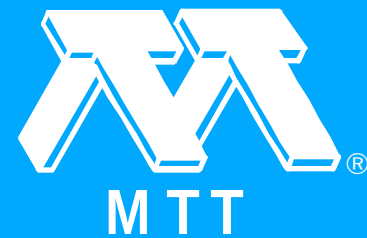


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Design of Linear Double Tapers in Rectangular Waveguides (Correction)

R.C. Johnson. "Design of Linear Double Tapers in Rectangular Waveguides (Correction)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 458-458.

R. C. Johnson, author of "Design of Linear Double Tapers in Rectangular Waveguides," which appeared on pp. 374-378 of the July 1959 issue of these Transactions has brought the following corrections to the attention of the Editor.



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The Extended Theory of the Manley-Rowe's Energy Relations in Nonlinear Elements and Nonlinear Lossless Medium (Correspondence)

H. Iwasawa. "The Extended Theory of the Manley-Rowe's Energy Relations in Nonlinear Elements and Nonlinear Lossless Medium (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 459-460.

Energy relations for a lumped nonlinear reactance excited by two different fundamental frequencies were derived by J. M. Manley and H. E. Rowe. R. H. Pautell developed the energy relations in a nonlinear resistive element. Furthermore, H. A. Haus extended the Manley-Rowe's energy relations to a nonlinear lossless medium excited by two fundamental frequencies. This paper extends the Manley-Rowe relations in the case of a lumped nonlinear element (lossless reactance and resistive element) and nonlinear lossless reciprocal medium excited by k numbers of fundamental frequencies, wherein the extended relations consist of k independent equations.

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



Abstracts

A Method of Improving Isolation in Multi-Channel Waveguide Systems (Correspondence)

G.F. Engen. "A Method of Improving Isolation in Multi-Channel Waveguide Systems (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 460-461.

In microwave measurements, frequent use is made of "two channel" or multiple channel systems, in order to obtain isolation from amplitude fluctuations in the generator output and/or various other benefits. In such systems it is generally required that the signal delivered to one channel be independent of changes in loading, etc., in the second channel, and a common problem is that of achieving or determining that an adequate degree of isolation exists between the different channels. It is the purpose of this letter to describe briefly procedures for obtaining and recognizing this condition.



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A Microwave Impedance Meter Capable of High Accuracy (Correspondence)

R.W. Beatty. "A Microwave Impedance Meter Capable of High Accuracy (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 461-463.

Recent applications of directional couplers with auxiliary tuners for accurate VSWR and phase shift measurements have made possible a microwave impedance meter capable of high accuracy. It is similar to some bridges in that one obtains an initial detector null and a final null, before and after connecting the unknown. Both the magnitude and phase angle of the reflection coefficient of the unknown are determined in this operation, and these can be made direct reading if desired. The principle of operation is as follows.

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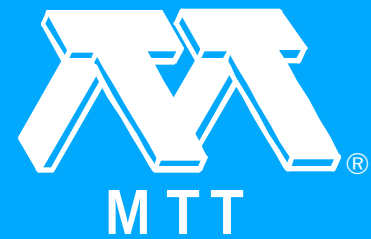


Abstracts

On the Noise Temperature of Coupling Networks (Correspondence)

E. Bedrosian. "On the Noise Temperature of Coupling Networks (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 463-463.

When a passive coupling network, such as a waveguide, transmission line, matching filter, etc., is used to connect a source to a receiver, it is apparent that it will contribute noise to the output because of its lossiness.



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Abstracts

A Logarithmic Transmission Line Chart (Correspondence)

P.I. Somlo. "A Logarithmic Transmission Line Chart (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 463-463.

In his article above, Hudson raises the question: "What length of line of what impedance will match a given impedance?" He states, "Conventional charts do not answer this question explicitly." This problem can be solved on the "conventional" Smith Chart explicitly without trial-and-error, by the following method. If A and B are two quite general impedances, the matched condition requires that A be transformed into B^* , the complex conjugate of B.



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Velocity Sorting Detection in Backward Wave Autodyne Reception (Correspondence)

J.K. Pulfer. "Velocity Sorting Detection in Backward Wave Autodyne Reception (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 463-464.

An electronically tunable microwave receiver which uses an oscillating backward wave amplifier driving a crystal detector has been described previously. This receiver has the advantages of large dynamic range and good rejection of unwanted signals, but has the disadvantage that its frequency response can be no better than that of its crystal detector. Since a variation in sensitivity of greater than 3 db over the tuning range of 8 to 12 kmc would seriously lower its usefulness as a spectrum display device, the restrictions on the crystal detector performance are quite severe.

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A Broad-Band Crystal Mount 10.5 kmc to 20 kmc (Correspondence)

A. Staniforth. "A Broad-Band Crystal Mount 10.5 kmc to 20 kmc (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 464-465.

Laboratory measurements at microwave frequencies very often require the use of a sensitive detector with broad-band characteristics. A crystal mount has been developed with a nearly uniform response from 10.5 kmc to 20.0 kmc using coaxial crystals type 1N26 or 1NT78A. The best over-all sensitivity is obtained with 1N78A crystals, although the 1N26 crystals are more sensitive from 17 to 20 kmc.

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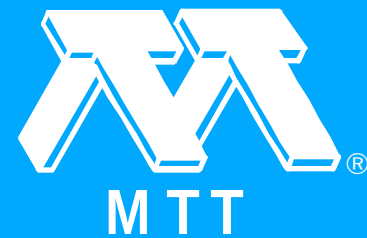


Abstracts

Proposed Parametric Amplifier Utilizing Ferroelectric Substance (Correspondence)

Y. Aoki. "Proposed Parametric Amplifier Utilizing Ferroelectric Substance (Correspondence)." *1960 Transactions on Microwave Theory and Techniques* 8.4 (Jul. 1960 [T-MTT]): 465-466.

Ferroelectric substance has been utilized as nonlinear substance in parametric amplifiers. However, all of these have been done at low-frequency regions. A surface-wave parametric amplifier employing-ferro-electric substance in the microwave region has been proposed.



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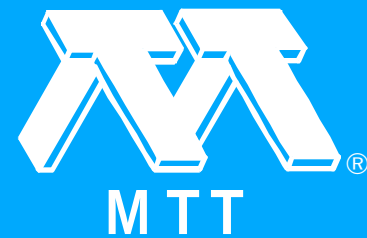


Abstracts

A Broad-Band Ferrite Reflective Switch (Correspondence)

C.M. Johnson and J.C. Wiltse. "A Broad-Band Ferrite Reflective Switch (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 466-467.

Several types of reflective ferrite switches have recently been described in the literature. These have typically made use either of the Faraday rotation effect or of a waveguide cutoff induced by a transversely-magnetized ferrite slab. A different and very simple type of switch, which exhibits similar reflective behavior, may also be obtained by the use of a short section of heavily-loaded (or filled) coax, stripline, or waveguide.



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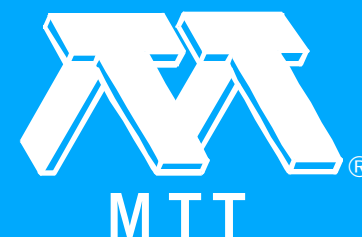
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C.F. Augustine, L.C. Bahiana, J. Brown, J. Cheal, M. Cohn, P.D. Coleman, W.H. Eggimann, G. Goudet, B.W. Hakki, A.F. Harvey, R.D. Haun, Jr., K. Ishii, K. Morita, L.D. Smullin, G.R. Valenzuela and L. Young. "Contributors (Jul. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.4 (Jul. 1960 [T-MTT]): 468-470.



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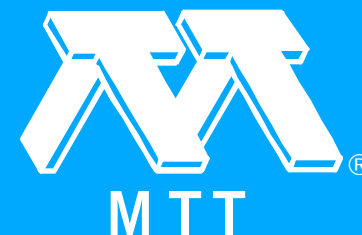


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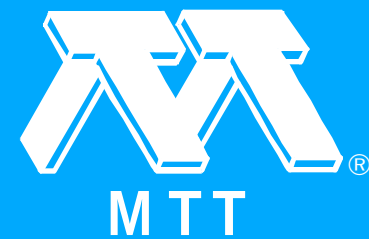
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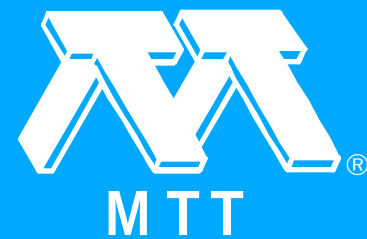


Abstracts

Noise Studies on Two-Cavity CW Klystrons

G.A. Espersen. "Noise Studies on Two-Cavity CW Klystrons." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 474-477.

The noise properties of a two-cavity CW 3-cm klystron oscillator are discussed with the purpose of studying the noise contribution located close to the center frequency in the audiofrequency range. A system permitting measurements to be made of the mean square frequency deviation is described. Comparisons are made indicating the noise performance of the klystron oscillator when operated under air-cooled and water-cooled conditions.



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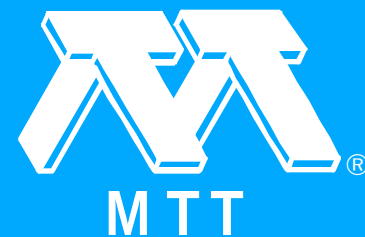


Abstracts

Optimum Quarter-Wave Transformers

L. Young. "Optimum Quarter-Wave Transformers." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 478-482.

The design of uniformly dispersive quarter-wave transformers is a well explored subject. Common examples are rectangular waveguide E-plane transformers, in which the a dimension is kept constant. In this paper, it is shown that the performance of conventional quarter-wave transformers of a single section can always be improved by making the middle section less dispersive than the input and output waveguides, and a formula for the optimum a dimension is given. The theory was verified experimentally. In this instance, the improved transformer measured 50 per cent more bandwidth than did the conventional one, and was 25 per cent shorter besides.



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The Quarter-Wave Transformer Prototype Circuit

L. Young. "The Quarter-Wave Transformer Prototype Circuit." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 483-489.

A quarter-wave transformer not only changes impedance levels, but will also behave as a band-pass filter. In practice, however, band-pass filters are usually required to terminate in equal input and output impedances. They often consist of several direct-coupled cavities, which are similar to transformers whose impedance steps have been replaced by reactive obstacles. It is demonstrated how one can synthesize a quarter-wave transformer, and then "distort" it to obtain a direct coupled cavity filter with a predictable performance. This is illustrated and confirmed by numerical examples. The method is particularly convenient to use in reverse. The quarter-wave transformer prototype is easily derived for a direct-coupled cavity filter which has already been designed by another approximate method, and thus gives an independent evaluation of its performance. If necessary, the filter can then be redesigned, as illustrated in this paper.





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Broad-Band Ridge Waveguide Ferrite Devices

E.S. Grimes, Jr., D.D. Bartholomew, D.C. Scott and S.C. Sloan, Jr.. "Broad-Band Ridge Waveguide Ferrite Devices." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 489-492.

The design and development of a medium CW power level, 1.57:1 bandwidth, quadruply-ridged circular waveguide Faraday rotator and two high CW power, 2:1 bandwidth, double ridge rectangular waveguide isolators are discussed. The rotator is designed in quadruply-ridged circular waveguide with a ferrite configuration somewhat different from that proposed by other investigators. It can be made to exhibit broadband rotation and large rotation per unit length of ferrite section, and maybe used in most medium CW power level applications. Forty-five degree rotation is achieved over the 7.0-kMc to 11.0-kMc band. The isolators operate from 2.0 kMc to 4.0 kMc in DR-37 waveguide and from 3.8 kMc to 7.6 kMc in D-34 waveguide respectively. The reverse to forward wave attenuation ratio exceeds 10.0 db to 1.0 db for both isolators.

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Radiation Patterns of a Noise-Excited Thin Slot

N. George. "Radiation Patterns of a Noise-Excited Thin Slot." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 493-500.

Theoretical and experimental radiation patterns are given in spectral form for the thermal radiation from a cylindrical discharge column which is adjacent to a long thin slot in a metallic plane. A spatial distribution is predicted which exhibits interference minima and maxima when the length of the slot and the wavelength of the emission are the same order of magnitude. The analysis is based on Maxwell's equations and the Leontovich-Rytov distributed source generalization of Nyquist's noise formula. Fraunhofer pattern measurements are presented in which an argon source is used to excite slots of 7.3pi and 9.5pi radians in length. Data are also presented to show the effects of variations in the pressure and the dc current of the discharge. The pattern measuring apparatus is a Dicke radiometer, having the following characteristics: frequency 9200 Mc, bandwidth to the detector 16 mc, modulation frequency 1000 cps, and residual noise level 0.3 rms°K. An interference phenomenon is predicted by the theory and demonstrated by an experiment, even though the source excitation is spatially distributed and essentially uncorrelated in time and in space. The patterns are not even approximately Lambertian, e.g., a thin slot of 9.5pi radians exhibits a pattern having nine relative maxima in 180°, with the maximum emission at 63° from the normal.

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Variational Principles and Mode Coupling in Periodic Structures

T.J. Goblick, Jr. and R.M. Bevensee. "Variational Principles and Mode Coupling in Periodic Structures." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 500-509.

Variational techniques are used in analyzing periodic "cold" microwave structures for the angular frequency, ω , as a function of assumed phase shift per periodic cell. Two variational expressions are given: one for ω in terms of the E- and H-fields, and one for $k^2 = \omega^2 \mu \epsilon$ in terms of the E-field. For structures with relatively light coupling between cells, the trial fields to be used with the variational expressions are composed of closed cavity modes, phase shifted by ϕ radians from cell to cell. Both variational expressions yield determinantal equations for $k^2(\phi)$ which agree with equations previously derived from a mode coupling point of view. One form of an equivalent lumped circuit is given to represent the structure within one of its pass bands. Curves compare the variational-mode coupling expression for $k^2(\phi)$ of a periodically lumped loaded transmission line with exact expressions.

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Determination of the Capacitance, Inductance, and Characteristic Impedance of Rectangular Lines

T.-S. Chen. "Determination of the Capacitance, Inductance, and Characteristic Impedance of Rectangular Lines." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 510-519.

This paper determines the capacitance, inductance, and characteristic impedance of rectangular lines by the method of conformal transformation. In practical applications, such lines may be used as transmission links of RF energy, as impedance-transforming sections, or as components in electron tubes. Formulas are given for the calculation of the parameters of rectangular lines having the following characteristics: 1) The inner conductor may have varying thickness compared with the depth of the outer conductor. 2) The axes of the conductors may coincide or may be displaced with respect to each other. 3) The edges of the inner conductor may be rounded to lessen the electrical stress occurring at sharp corners. Excellent agreement has been obtained between the calculated results and those found by use of the relaxation method, by direct measurement of models, and by electrolytic tank measurement.

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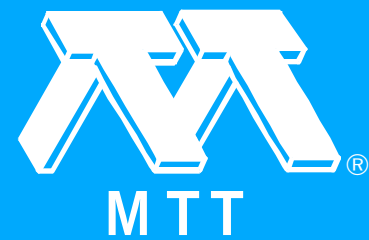


Abstracts

The Analysis of a Broad-Band Circular Polarizer Including Interface Reflections

S. Adachi and E.M. Kennaugh. "The Analysis of a Broad-Band Circular Polarizer Including Interface Reflections." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 520-525.

Transmission characteristics of a broad-band circular polarizer consisting of anisotropic dielectric plates are rigorously analyzed. The transmitted wave is formulated in terms of the incident wave including interface reflections. The influence of the interface reflections on the axial ratio of the polarization is numerically shown vs frequency. Frequency dependence of the power transmission ratio is also obtained. From the above analysis, it can be concluded that a circular polarizer of this type is promising as a new broad-band circular polarizer.



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Large Signal Analysis of a Parametric Harmonic Generator

K.M. Johnson. "Large Signal Analysis of a Parametric Harmonic Generator." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 525-532.

Large signal analysis of a harmonic generator using a semiconductor diode reveals a larger possible efficiency than a similar small signal analysis. As higher harmonic numbers are reached, large signal analysis becomes increasingly more important in predicting the maximum conversion efficiency. It is shown that there exists an optimum value for the diode bias voltage and an optimum coupling of the load and generator to the diode, and that the diode operating voltage should almost drive the diode into conduction. An expression is derived for the maximum conversion efficiency for any harmonic, and it is shown that the conversion loss increases with increasing harmonic number, approximately 2.9 db per n for large harmonic numbers in a typical case.

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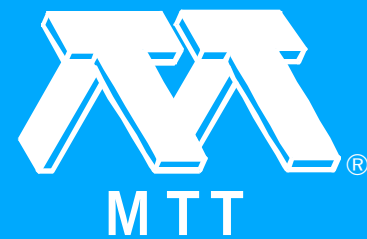


Abstracts

A Waveguide Switch Employing the Offset Ring-Switch Junction

R.C. Johnson, A.L. Holliman and J.S. Hollis. "A Waveguide Switch Employing the Offset Ring-Switch Junction." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 532-537.

This paper describes an X-band microwave ring switch employing a junction of new design. The insertion loss is less than $\frac{1}{4}$ db over the design band of 9.0-9.6 kmc; this low loss was obtained through the use of a coupling junction which is designated the offset ring-switch junction. A physical description, the electrical characteristics of the switch, and a qualitative theoretical discussion of the junction are included.



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Some Limitations on Parametric Amplifier Noise Performance

R.D. Weglein. "Some Limitations on Parametric Amplifier Noise Performance." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 538-544.

Now that the precursory period following the solid-state parametric amplifier invention has given way to an era of determined effort to reduce to practice some of the early, optimistic predictions, practical limitations setting an upper bound to the performance of this ingenious communications device have become apparent. In this paper, two such limitations are discussed: First, for a given diode Q and junction geometry, there exists a noninfinite idler frequency, which determines the lowest radar noise temperature. Second, because of its extreme noisiness the reverse-break-down current limits the maximum capacitance swing at both extremes and consequently the minimum noise performance. It is suggested that in certain cases refrigeration may be a partial remedy to both limitations.

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TE Mode Excitation on Dielectric Loaded Parallel Plane and Trough Waveguides

M. Cohn, E.S. Cassedy and M.A. Kott. "TE Mode Excitation on Dielectric Loaded Parallel Plane and Trough Waveguides." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 545-552.

A theoretical and experimental study of the launching of TE surface wave modes on dielectric loaded parallel plane and trough waveguides has been performed. The source is a linear transverse current filament perpendicular to and extending across the space between the parallel side walls. Families of curves are presented, which show the bidirectional launching efficiencies for the dominant TE modes of these two transmission lines as a function of dielectric constant, dielectric slab thickness, and current filament location. Measured bidirectional efficiencies are compared to the theoretically predicted values. Measured unidirectional launching efficiencies as high as 97 per cent were obtained for the case where a short circuit is located on one side of the current filament.

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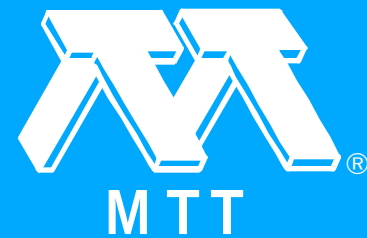


Abstracts

A New Semiconductor Microwave Modulator

H. Jacobs, F.A. Brand, M. Benanti, R. Benjamin and J. Meindl. "A New Semiconductor Microwave Modulator." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 553-559.

A new semiconductor device is proposed for use as an amplitude modulator for microwave transmission. The principle of action depends upon the increase of absorption with an increase of conductivity caused by the injection of excess minority carriers. Experiments conducted at 9600 Mc indicate little or no phase and frequency modulation. The mechanism of the modulation action and the device design are discussed here.



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Theory and Measurement of Q in Resonant Ring Circuits

H. Golde. "Theory and Measurement of Q in Resonant Ring Circuits." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 560-564.

The loaded and unloaded Q of a resonant ring circuit are derived on the basis of the fundamental definition. Simple experiments are described to measure $Q_{\text{sub } 0}$, $Q_{\text{sub } L}$, and the ring power gain without additional coupling to the ring. A number of graphs are given which are useful for these measurements.



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Ferrite Shape Considerations for UHF High-Power Isolators (Correspondence)

E. Stern. "Ferrite Shape Considerations for UHF High-Power Isolators (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 565-565.

Ferrite isolators deteriorate at high microwave power levels due to the gyromagnetic saturation phenomena described by Suhl. The onset of this deterioration is particularly detrimental to isolator performance when the main and subsidiary resonances coincide. At microwave frequencies the coincidence effect can generally be avoided if thin transversely magnetized ferrite slabs are used. However, at frequencies below 1 kMc, the finite slab thickness can contribute to main-subsidiary resonance coincidence unless care is taken to choose the proper length and width dimensions of the slab. The following calculations specify the ferrite slab shape needed to avoid this coincidence in UHF ferrite isolators.

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Measurement Technique for Narrow Line Width Ferromagnets (Correspondence)

J.I. Masters, B.R. Capone and P.D. Gianino. "Measurement Technique for Narrow Line Width Ferromagnets (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 565-566.

Measurement of the line width of a ferromagnetic resonance curve using the now well-known cavity perturbation technique offers some difficulty in the case of very narrow line width samples. Because of their large magnetic susceptibility, such samples produce a large effective filling factor with respect to the cavity.

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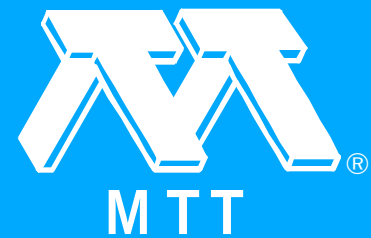


Abstracts

Multidiode Switches (Correspondence)

J. Galejs. "Multidiode Switches (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 566-569.

The impedance of crystal diodes is known to depend on the applied bias voltage. This has suggested the use of diodes as switching elements in the control of microwave signal transmission. In the simplest form, the diode switch consists of a transmission line which is shunted by a diode. Coaxial cables as well as waveguides have been used for the transmission lines that are shunted by point-contact and p-i-n diodes. Slab line or coaxial switches where a diode is inserted in series with the center conductor of the line have also been developed.



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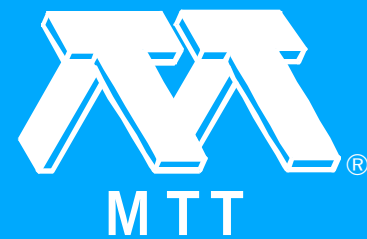


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Technique for Polishing Single Crystal Yttrium-Iron-Garnet Spheres (Correspondence)

P.D. Gianino, B.R. Capone, E. Kelly and J.I. Masters. "Technique for Polishing Single Crystal Yttrium-Iron-Garnet Spheres (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 569-569.

A simple method of polishing Yttrium-iron-garnet spheres which produces samples of fractional oersted linewidths has been employed at the Air Force Cambridge Research Center. The technique consists of "hand-polishing" the crystal spheres in diamond pastes and aluminum oxide powders of diminishing grit sizes. This method significantly increases, both by greater pressure and efficiency of abrasive contact, the rate of removing material from the surface of the sample, which is fundamental in the polishing process.



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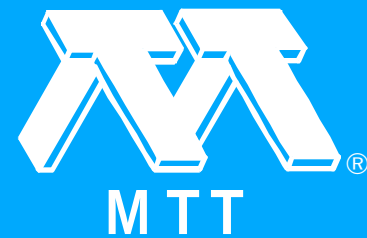


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Tunable Two-Mode Cavity with Capacitive Loading (Correspondence)

J.D. McGee. "Tunable Two-Mode Cavity with Capacitive Loading (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 569-570.

A cavity with two independently tunable modes in the 4- to 9-kMc frequency range was needed for experiments in paramagnetic relaxation. It had to be small enough to fit inside a liquid helium dewar and had to possess a region of approximately uniform RF magnetic field common to both modes over part of its volume.



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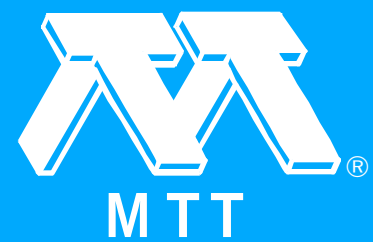
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Unloaded Q of Single Crystal Yttrium-Iron-Garnet Resonator as a Function of Frequency (Correspondence)

P.S. Carter, Jr. and C. Flammer. "Unloaded Q of Single Crystal Yttrium-Iron-Garnet Resonator as a Function of Frequency (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 570-571.

The practical feasibility of constructing magnetically tunable broad-tuning range microwave filters using single crystal yttriumiron-garnet resonators was demonstrated in a recent paper. Experimental results were presented on one- and two- resonator filters which can be tuned by varying a dc magnetic field bias over a full waveguide bandwidth and greater, at the same time maintaining an insertion loss performance which is comparable to mechanically-tuned cavity filters. The crucial parameter of the resonant elements in a band-pass filter is the unloaded Q , $Q_{sub u/}$. With a spherical single crystal of yttrium-iron-garnet the $Q_{sub u/}$ decreases with frequency below X-band frequencies reaching very low values at frequencies around 2000 Mc.

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A Note on the Derivation of the Fields in a Radial Line (Correspondence)

J.F. Dienst. "A Note on the Derivation of the Fields in a Radial Line (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 571-572.

The concept of a radial transmission line is frequently used in the description of such devices as cylindrical cavity resonators and horn radiators. An approach to the problem of determining the electric and magnetic fields in the radial line has been to solve Maxwell's equations in component form with appropriate boundary conditions. While the following derivation yields nothing new, it does, however, have the advantages of being simple and of requiring a minimum of guess work as compared to other methods of solving this problem.

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Surface Waves on Symmetrical Three-Layer Sandwiches (Correspondence)

J.H. Richmond. "Surface Waves on Symmetrical Three-Layer Sandwiches (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 572-572.

The theory of surface waves on plane dielectric slabs has been presented by Plummer and Hansen. Additional numerical results are shown in Figs. 1 and 2 for the lowest order TM and TE modes that can exist on a grounded dielectric slab. The slab has thickness d , and a relative dielectric constant of 4. It is separated by an air gap of thickness a from the ground plane. c/v represents the ratio of the velocity of light in free space and the phase velocity of the surface wave. By image theory, these modes (TM/sub 0/ and TE/sub 1/) can also exist on a symmetrical, three-layer, air-core sandwich to which the given numerical data also apply.

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Higher-Order Evaluation of Dipole Moments of a Small Circular Disk (Correspondence)

W.H. Eggimann. "Higher-Order Evaluation of Dipole Moments of a Small Circular Disk (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 573-573.

Bethe was the first to calculate the induced electric and magnetic dipole moments if a plane wave falls upon a circular hole in an infinite plane screen. The corresponding complementary problem of a circular disk can then be solved using Babinet's principle. In some recent experimental work on circular disks in a rectangular waveguide large discrepancies between experimental and theoretical results were found when Bethe's theory was used particularly for disks, where $ka > 0.5$ (a =radius of the disks, $k = 2\pi/\lambda$). Bouwkamp has shown that Bethe's results can be obtained by using a first order approximation for the surface current distribution on the disk. Following the same procedures, a sixth order approximation in (ka) for normal incidence and a third order approximation for oblique incidence has been found. The detailed results will be presented in a future paper. Here only the expressions for the electric and magnetic dipole moments will be given.





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Properties of Symmetric Hybrid Waveguide Junctions (Correspondence)

R. Levy. "Properties of Symmetric Hybrid Waveguide Junctions (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 573-573.

In his letter J.M. Smith states that in a fully symmetric lossless hybrid where all arms are matched, the amplitudes of the waves traveling in the reverse direction in the main and auxiliary guides are equal. To allow for the existence of the reflected waves this theorem should read: "In a slightly imperfect symmetric hybrid with matched loads on the output ports the amplitude of the reflected wave at the input port is equal to the amplitude of the wave at the isolated port."

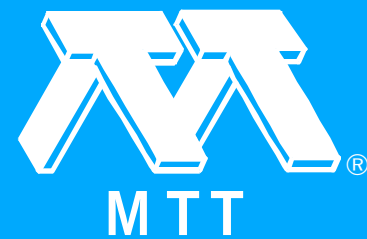
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Contributors (Sep. 1960 [T-MTT])

S. Adachi, D.D. Bartholomew, M. Benanti, R. Benjamin, R.M. Bevensee, F.A. Brand, E.S. Cassedy, T.-S. Chen, M. Cohn, G.A. Espersen, N. George, T.J. Goblick, Jr., H. Golde, E.S. Grimes, Jr., A.L. Holliman, J.S. Hollis, H. Jacobs, K.M. Johnson, R.C. Johnson, E.M. Kennaugh, M.A. Kott, J.D. Meindl, D.C. Scott, S.C. Sloan, Jr., R.D. Weglein and L. Young.
"Contributors (Sep. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): 574-577.



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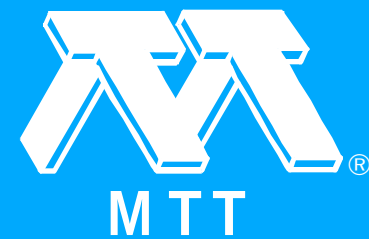
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"Back Cover (Sep. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.5 (Sep. 1960 [T-MTT]): b1-b1.



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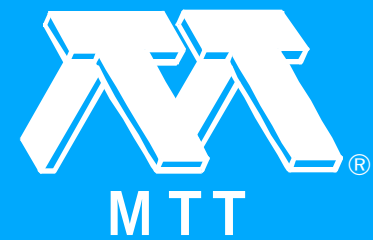
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"Table of Contents (Nov. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 579-579.



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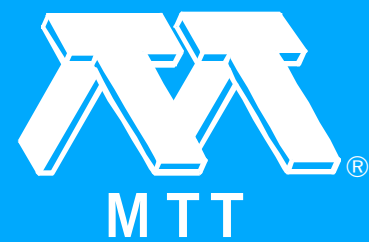
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Design of Wide-Band (and Narrow-Band) Band-Pass Microwave Filters on the Insertion Loss Basis

G.L. Matthaei. "Design of Wide-Band (and Narrow-Band) Band-Pass Microwave Filters on the Insertion Loss Basis." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 580-593.

A method for design of band-pass microwave filters is described that combines the image and insertion-loss points of view to give an approximate design method having simplicity, but also high precision. This method is applicable for filter designs ranging from narrow to very wide bandwidths (2 to 1 or more). The desired insertion loss characteristic is obtained by use of a lumped-element, Tchebycheff, or maximally flat (or other) low-pass prototype. With the aid of the concept of impedance inverters, the prototype is converted into a cascade of symmetrical (but differing) sections. The image properties of symmetrical sections of the band-pass microwave filter structure are then related to those of corresponding sections of the prototype. Straightforward design equations are given for filters using short-circuited or open-circuited stubs, and also for filters using parallel-coupled lines. Mapping functions are derived that permit accurate prediction of the microwave filter cutoff characteristic from that of the prototype. The responses of a number of filter designs were computed, and a Tchebycheff filter with a 2.2 to 1 band-width was built and tested. The responses of all of the filter designs were in close agreement with the prescribed characteristics, and the accuracy of the mapping functions was verified.

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Abstracts

Radio-Frequency System of the Cambridge Electron Accelerator

K.W. Robinson. "Radio-Frequency System of the Cambridge Electron Accelerator." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 593-596.

The requirements for the RF system of the Cambridge Electron Accelerator are investigated and the choice of the major parameters of the system is discussed. The strongly coupled waveguide cavity system is analyzed and the performance of the system with various types of imperfections is calculated.



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Model Studies of a Strongly Coupled Synchrotron RF System

A.E. Barrington, J. Dekleva and J.R. Rees. "Model Studies of a Strongly Coupled Synchrotron RF System." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 597-604.

The strongly coupled multicavity synchrotron system proposed for the 6-bev Cambridge Electron Accelerator operates at 475 Mc and, because of its large size, presents complex problems of assembly and tuning. To achieve a better understanding of the characteristics of the system, a scaled model operating at 9000 Mc was constructed. The work was undertaken in two stages; first a simple single-cavity ring was studied and later a more complicated double-cavity ring. An account is given of the design of cavities and waveguide links of variable electrical length, and instrumentation devised for various measurements is described. This is followed by experimental data which were in good agreement with theoretical predictions. Recommendations arising from the model study for the assembly and tuning of the 475-Mc system are put forward.

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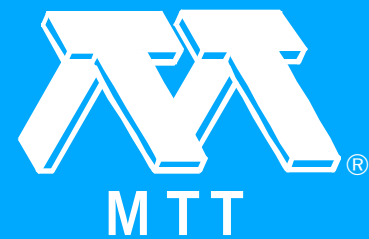
Operation of the Field Displacement Isolator in Rectangular Waveguide

R.L. Comstock and C.E. Fay. "Operation of the Field Displacement Isolator in Rectangular Waveguide." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 605-611.

A field displacement isolator in WR-159 rectangular waveguide consisting of a full height ferrite slab having a resistive film on one face is treated analytically. The resultant transcendental equation was programmed for a computer and values of the propagation constant found in the frequency range 5.90 to 6.45 kMc for various film resistivities. Two TE modes are found to exist whose relative behavior depends on the resistivity of the film. Reasonably close experimental verification of the results was obtained. for the total attenuation and for the predicted E-field distributions by E-field probe tests. Additional attenuation above that predicted by the theory for a single mode is observed as a result of an interference at the end of the ferrite. A partial height ferrite slab isolator was subjected to E-field probe tests. The field distributions were found to be similar to the full height case. Here, also, additional attenuation is obtained at some frequencies as a result of an interference.

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Peak Internal Fields in Direct-Coupled-Cavity Filters

L. Young. "Peak Internal Fields in Direct-Coupled-Cavity Filters." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 612-616.

Microwave filters are limited in their power-handling capacity by high fields generated inside the filter. Simple formulas are derived here for the peak fields inside each cavity of a direct-coupled-cavity filter at any frequency. The computed peak fields in each cavity of a three-cavity, a four-cavity, and a six-cavity filter as a function of frequency are reproduced up to several harmonics. Inside the pass band, the internal fields are generally minimum at center frequency, rising to sharp peaks just outside the pass band. Phase characteristics were also computed, and their relation to the internal field amplitudes is explained.

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Mismatch Errors in Microwave Phase Shift Measurements

G.E. Schafer. "Mismatch Errors in Microwave Phase Shift Measurements." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 617-622.

The phase difference between the incident and transmitted waves at the input and output ports, respectively, of a two-arm waveguide junction in a reflection free system is a characteristic of the waveguide junction and is defined as the "phase shift." The difference between the phase shift in a reflection free system and the "change of phase" observed in a system which is not reflection free will be termed mismatch error. The mismatch error depends not only on the reflections present in the system but also on the choice of the wave used as the reference wave in a phase measurement. Similar considerations hold for the measurements of variation of phase shift and the observed change of phase in adjustable components. A formal scattering matrix analysis is used to derive expressions for phase relationships of the wave amplitudes for a two-arm waveguide junction in a system with reflections. The results of this analysis are used to evaluate mismatch error for different choices of reference waves. Two techniques of variation of phase shift measurements are analyzed. Graphs of the limits of mismatch error in a commonly used method of measurement are presented.

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Abstracts

A Note on the Optimum Source Conductance of Crystal Mixers

R.J. Mohr and S. Okwit. "A Note on the Optimum Source Conductance of Crystal Mixers." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 622-627.

This paper describes an accurate and convenient technique for measuring the match of a crystal mixer. Use is made of the fact that with a proper RF drive level, the fundamental conductance of a mixer crystal may be made equal to the optimum source conductance of the crystal for mixer operation. The required drive level depends on certain crystal parameters and on the image frequency termination of the mixer. Design curves are given which simplify the determination of the proper RF drive level for a wide range of crystal parameters and their condition of image frequency termination.



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Microwave Switching with Low-Pressure Arc Discharge

R.M. Hill and S.K. Ichiki. "Microwave Switching with Low-Pressure Arc Discharge." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 628-633.

The characteristics of a low-pressure, hot cathode arc discharge have been studied and applied to microwave switching applications. The combination of rapid plasma build-up, low ignition voltage, and fairly rapid plasma decay, offers promise for the development of broad-band, high-power microwave switches which can be closed in tenths of microseconds and opened in a few microseconds or less. Experimental results on some particular switches are reported.

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Characteristic Impedances of Broadside-Coupled Strip Transmission Lines

S.B. Cohn. "Characteristic Impedances of Broadside-Coupled Strip Transmission Lines." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 633-637.

Formulas are given for the even- and odd-mode characteristic impedances of shielded coupled strip-transmission-line configurations that are especially useful when close coupling is desired. Applications may be made to wideband coupled-strip-line filters, 3-db directional couplers, and many other components. The cross sections considered are thin broadside-coupled strips either parallel or perpendicular to the ground planes. Modification of the formulas for thick strips is discussed. The derivations are outlined, with particular attention given to the underlying assumption that restricts the use of the formulas to cases of close coupling.

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Thickness Corrections for Capacitive Obstacles and Strip Conductors

S.B. Cohn. "Thickness Corrections for Capacitive Obstacles and Strip Conductors." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 638-644.

Capacitive thickness corrections are derived exactly for two basic geometries involving pairs of semi-infinite plates. In one arrangement the pair of plates are coplanar, while in the other they are parallel to each other. In each case the total capacitance per unit length between the pair of plates is infinite, but the incremental increase of capacitance when the thickness is increased from zero to a value t is finite. These capacitance increments are evaluated, and it is shown how they may be used as approximate thickness corrections in a great variety of more complicated geometries involving capacitive obstacles in waveguide, coaxial line, and artificial dielectric media. They may also be applied to coupled-strip-line conductors. As examples, the corrections are applied in detail to a waveguide iris, and to three useful coupled-strip-line cross sections.

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Inhomogeneous Quarter-Wave Transformers of Two Sections

L. Young. "Inhomogeneous Quarter-Wave Transformers of Two Sections." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 645-649.

An inhomogeneous transformer is defined as one in which the guide wavelength is a function of position; for a homogeneous transformer, the guide wavelength is independent of position. A previous paper has dealt with inhomogeneous transformers of one section; the existence of an optimum design (which is never homogeneous) was demonstrated. The mathematical tools for inhomogeneous transformers of two or more sections have been presented in another paper. Our purpose here is to apply these results to the solution of the two-section inhomogeneous transformer. The maximally flat ideal transformer was solved exactly and the design equations verified by subsequent numerical analysis. An approximate procedure to improve the performance over a finite bandwidth (similar to the Tchebycheff response of homogeneous transformers) is also explained.

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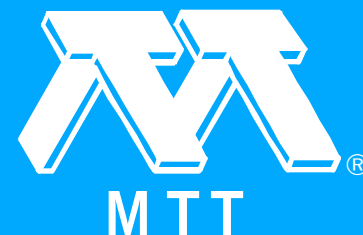


Abstracts

Errors in Dielectric Measurements Due to a Sample Insertion Hole in a Cavity

A.J. Estin and H.E. Bussey. "Errors in Dielectric Measurements Due to a Sample Insertion Hole in a Cavity." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 650-653.

The measurement of complex permittivities of isotropic media at microwave frequencies is performed with high precision by means of cylindrical cavity resonators. However, a hole in the cavity wall, for inserting the sample causes a frequency pulling of the resonator, which in turn introduces an error in the measured dielectric constant. These effects are measured, and with perturbation theory as a guide, correction factors are developed.



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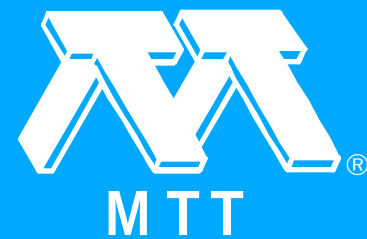


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Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation (Correction)

D.S. Lerner and H.A. Wheeler. "Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation (Correction)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 653-653.

D. S. Lerner and H. A. Wheeler, authors of "Measurement of Bandwidth of Microwave Resonator by Phase Shift of Signal Modulation," which appeared on pages 343-345 of the May, 1960, issue of these Transactions, have brought the following to the attention of the Editor.



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A Pre-TR Tube for High Mean Power Duplexing

D.W. Downton and P.D. Lomer. "A Pre-TR Tube for High Mean Power Duplexing." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 654-659.

A gas discharge tube for transmit-receive switching capable of handling average power levels up to at least 25 kw at 3000 Mc is described. The discharge is excited in the annular space between two concentric silica tubes and recovery time is controlled by the dimensions and gas pressure. In this way, a tube with constant characteristics during life has been achieved. The tube is mounted in a thick resonant iris, and sparking is avoided by using accurately ground silica mounted in a precision-bore hole. The arc loss of the tube in this form of mount is less than 0.1 db at 5 Mw peak 10 kw average, and the recovery time is about 100 μ sec to 3 db. The attenuation is about 30 db, and the insertion loss is less than 0.1 db. Performance of this form of tube is discussed for average power levels of up to 50 kw in a phase-shift duplexer and 25 kw in a balanced duplexer, and the expected performance during life is also considered. Lives in excess of 10,000 hours are deduced from extrapolated data obtained with radioactive krypton in tubes operating at 10 kw average.

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Circular Electric Mode Directional Coupler

B. Oguchi. "Circular Electric Mode Directional Coupler." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 660-666.

This paper describes a circular electric mode directional coupler, composed of two coaxial bifurcations in circular waveguide. The coupling coefficient of the directional coupler depends on the separation between the two bifurcations, and a hybrid junction for the circular electric mode may be obtained at the proper separation. The analysis is carried out in terms of scattering matrix elements characterizing each coaxial bifurcation. The scattering matrix elements were experimentally determined via the Weissfloch tangent method at 5000-Mc band. For convenience, experiments were carried out in sectoral waveguide instead of circular waveguide. Measured characteristics at 9000-Mc band are in good agreement with values determined by circuit calculations employing parameters of the coaxial bifurcation measured at 5000-Mc band. For the case of a hybrid junction, wide-band matching has been accomplished and verified experimentally. Applications of this directional coupler are outlined.

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An Equivalent Circuit of the Internal Cavity Reflex Klystron-Amplifier (Correspondence)

K. Ishii. "An Equivalent Circuit of the Internal Cavity Reflex Klystron-Amplifier (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 667-668.

The experimental results of microwave amplification by the reflex klystron 2K25 have been reported. An equivalent circuit of the 2K25 amplifier was developed and checked with the experimental results.

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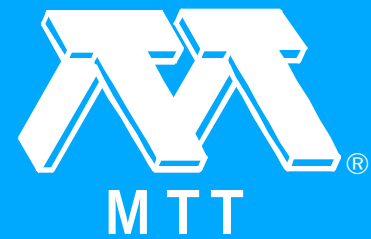


Abstracts

Some Comments on the Method of Kyhl (Correspondence and Author's Reply)

L.J. Kaplan, D.J.R. Stock and R.L. Kyhl. "Some Comments on the Method of Kyhl (Correspondence and Author's Reply)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 668-669.

The purpose of this letter is not to criticize the philosophy of Kyhl's method nor even to engage in a debate as to whether his method is, or is not, more useful than ours. We find his proposals both interesting and meaningful. First, we would like to call attention to two errors in his letter and then to show the close relation of his method to ours.



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Scattering Matrix for an N-Port Power-Divider Junction (Correspondence)

O.R. Price and M. Leichter. "Scattering Matrix for an N-Port Power-Divider Junction (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 669-669.

During the course of an investigation of a data-processing technique yielding effectively reduced sidelobes and beamwidth for a microwave radar antenna, the need arose for multiport power dividers. In order to avoid an undesirable decrease in the signal-to-noise ratio, it was necessary that these dividers waste no power. Consequently, a scattering matrix was sought which would have the obvious requirement that there be no wave reflected in the input port and which would allow the power to be divided into arbitrary but fixed relative parts.

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Lossy Resonant Slot Coupling (Correspondence and Authors' Reply)

R.M. Bevensee, G.S. Kino and M.A. Allen. "Lossy Resonant Slot Coupling (Correspondence and Authors' Reply)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 669-671.

The paper by Allen and Kino suggests a novel method of combating troublesome cut-off oscillations in periodic slow-wave structures. The idea is to couple loss periodically into the system through slots which are resonant at the center of the (narrow) oscillation range. The high Q of the slots will effectively decouple the loss in the operating range of the pass band.



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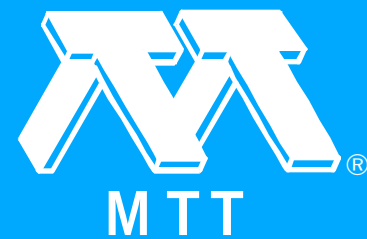


Abstracts

Broad-Band Hybrid Junctions (Correspondence)

S.J. Robinson. "Broad-Band Hybrid Junctions (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 671-672.

A coaxial version of the wide-band stripline magic T described by E. M. T. Jones in the March, 1960 issue of these Transactions was developed jointly at the Mullard Research Laboratories and the Laboratories of the General Electric Company, England, some years ago. It has proved a powerful component in the design of broad-band receiver circuits and has the advantage of small size and geometrical symmetry in addition to wide frequency coverage.



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Lightweight Y-Junction Strip-Line Circulator (Correspondence)

L. Freiberg. "Lightweight Y-Junction Strip-Line Circulator (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 672-672.

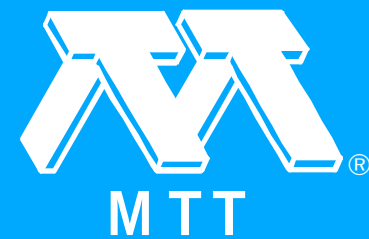
In a recent issue, the practical realization of a Y-junction strip-line circulator was described which used disks of yttrium iron garnet located at the junction of the Y, magnetically biased above resonance at approximately 2200 gauss. By using a material with a lower saturation magnetization (magnesium, manganese, aluminum ferrite, $4\pi M=600$) we have reduced the bias field required to approximately 190 gauss for frequencies in the 2-kMc range and to approximately 800° gauss for frequencies in the 1-kMc range, thus reducing considerably the weight of the circulator. If the circulator is to be operated as a switch, the reduced field requirements permit faster switching times or, for a given switching time, a considerable reduction in power supply requirements.

Abstracts

A Novel Broad-Band Balun (Correspondence)

J.H. Craven. "A Novel Broad-Band Balun (Correspondence)." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 672-673.

Broad-band baluns have recently become the subject of renewed interest, particularly those suitable to couple spiral or planar log periodic antennas to the commonly used coaxial lines.



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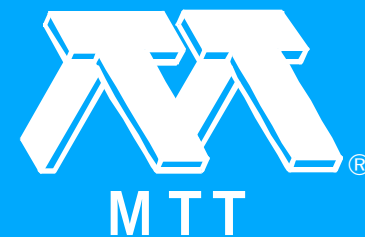
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Contributors (Nov. 1960 [T-MTT])

A.E. Barrington, H.E. Bussey, S.B. Cohn, R.L. Comstock, J. Dekleva, D.W. Downton, A.J. Estin, C.E. Fay, R.M. Hill, S.K. Ichiki, P.D. Lomer, G.L. Matthaei, R.J. Mohr, B. Oguchi, S. Okwit, J.R. Rees, K.W. Robinson and G.E. Schafer. "Contributors (Nov. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 674-676.



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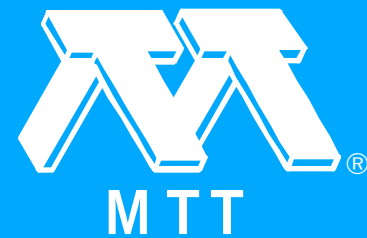


Abstracts

Symposium Issue, 1960 (Announcement) (Nov. 1960 [T-MTT])

"Symposium Issue, 1960 (Announcement) (Nov. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): 676-676.

A large group of papers from the 1960 National Symposium held at San Diego, Calif., will appear in the January, 1961, issue of the IRE Transactions on Microwave Theory and Techniques.



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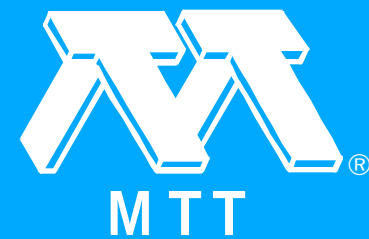
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Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-8, 1960

"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-8, 1960." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): i-v.



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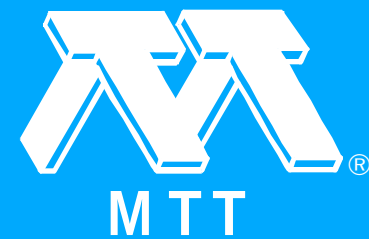
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Back Cover (Nov. 1960 [T-MTT])

"Back Cover (Nov. 1960 [T-MTT])." 1960 Transactions on Microwave Theory and Techniques 8.6 (Nov. 1960 [T-MTT]): b1-b1.



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Front Cover (Jan. 1961 [T-MTT])

"Front Cover (Jan. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): f1-f2.



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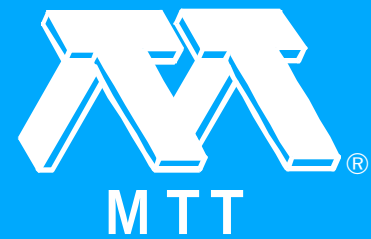
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Table of Contents (Jan. 1961 [T-MTT])

"Table of Contents (Jan. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 1-1.



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Microwave Prize (Jan. 1961 [T-MTT])

"Microwave Prize (Jan. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 2-2.



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UHF Strip Transmission Line Hybrid Junction

I. Tatsuguchi. "UHF Strip Transmission Line Hybrid Junction." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 3-6.

A hybrid junction has been developed using a symmetrical strip transmission line for application in the UHF range. It has a frequency band of ± 20 per cent where the input voltage standing-wave ratios at all ports are less than 1.26 (2 db), the power divisions are within 0.1 db, and the difference in power between the series input and parallel input ports is less than 0.3 db. The isolation is greater than 40 db and 24 db, respectively, for the two pairs of conjugate ports. These circuits are relatively small, light-weight, simple to build and reproduce, and are inexpensive. The approximate equivalent circuit of the configuration assuming transmission in the TEM mode is presented. The results of the analysis and the important features in the design and fabrication and a few modifications of the configuration are discussed.

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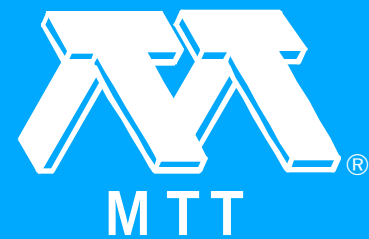
Gallium-Arsenide Point-Contact Diodes

W.M. Sharpless. "Gallium-Arsenide Point-Contact Diodes." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 6-10.

This paper describes some of the work on gallium-arsenide point-contact diodes which is currently in progress at the Bell Telephone Laboratories, Holmdel, N. J. Gallium arsenide, one of the Group III-V intermetallic compounds, possesses properties which tend to make it superior to either silicon or germanium for many high-frequency diode applications. By controlling the resistivity of the gallium arsenide and the point-contact processing techniques, diodes have been fabricated specifically for use as millimeter wave first detectors, high-speed switches, and reactive elements for microwave parametric oscillators and amplifiers. The operating characteristics of several different types of gallium-arsenide reactive diodes are discussed and mention is made of simple design formulas which may be used to tentatively evaluate the performance to be expected from such diodes. Noise figure measurements are included in a resume covering some of the experimental results that have been obtained using gallium-arsenide point-contact diodes as variable reactance elements in microwave parametric amplifiers.

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Characterization of Microwave Variable Capacitance Diodes

S.T. Eng. "Characterization of Microwave Variable Capacitance Diodes." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 11-22.

This paper will describe the electrical characterization of microwave variable capacitance diodes. The importance of some of the diode parameters is discussed from the application point of view, and suitable measurement techniques for these parameters are described, together with actual measurement data on some diodes. First, a general four-terminal transformation method is used, and some approximations lead to a fairly easy and accurate method of studying device characteristics. A resonant-cavity method is also considered, and it is explained under what condition it leads to a very simple test of the diode Q. Finally, a method is presented which is based upon modifications of the Weissfloch canonical network. These simplifications can be used to get an easy interpretation of the junction impedance or the diode Q.

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



Abstracts

Scattering of a Plane Wave on a Ferrite Cylinder and Normal Incidence (Correction)

W.H. Eggimann. "Scattering of a Plane Wave on a Ferrite Cylinder and Normal Incidence (Correction)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 22-22.

W. H. Eggiman, author of "Scattering of a Plane Wave on a Ferrite Cylinder and Normal Incidence," which appeared on pp. 441-445 of the July, 1960, issue of these Transactions, has brought the following to the attention of the Editor.



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A Study of the Optimum Design of Wide-Band Parametric Amplifiers and Up-Converters

G.L. Matthaei. "A Study of the Optimum Design of Wide-Band Parametric Amplifiers and Up-Converters." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 23-38.

Single-diode parametric amplifiers or up-converters using multiple-resonator filters as coupling networks can be made to have considerably larger bandwidths than corresponding amplifiers having single-resonator coupling circuits. Data are presented from which the coupling-filter bandwidths required for given coupling network complexity, diode parameters, and required gain can be determined for both parametric amplifiers and up-converters. In the cases of nondegenerate parametric amplifiers and up-converters, the fact that the diode must be brought to resonance at more than one frequency has an added limiting effect on bandwidth. Some trial amplifier designs are shown, and important considerations in the synthesis of the coupling filters are noted. It is seen that for the case upper-sideband up-converters, if a filter having n resonators is used in both the input and upper-sideband circuits, then the over-all response can be made to correspond to that of a filter with $2n$ resonators. The gain characteristics of the trial amplifier designs as determined with a digital computer are included. Computed responses ranging in bandwidth from 9 to 27 per cent are obtained for multi-resonator designs having $C_{\text{sub } 1}/C_{\text{sub } 0} = 0.25$.

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Abstracts

Impedances of an Elliptic Waveguide (For the H_{10} Mode) (Correction)

G.R. Valenzuela. "Impedances of an Elliptic Waveguide (For the H_{10} Mode) (Correction)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 38-38.

G. R. Valenzuela, author of "Impedances of an Elliptic Waveguide (For the H_{10} Mode)," which appeared on pp. 431-435 of the July, 1960, issue of these Transactions, has brought the following to the attention of the Editor.



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A Low-Noise X-Band Parametric Amplifier Using a Silicon Mesa Diode

R.D. Weglein and F. Keywell. "A Low-Noise X-Band Parametric Amplifier Using a Silicon Mesa Diode." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 39-43.

This paper summarizes a cooperative effort to develop silicon mesa variable-capacitance diodes and to evaluate their potential for achieving low-noise amplification in the high microwave frequency range. Cutoff frequencies of about 70 kMc at zero-bias voltage (corresponding to 140 kMc at maximum reverse bias voltage) with a total permissible voltage swing in excess of 5 volts have been obtained. A versatile degenerate X-band parametric amplifier was developed which, when used in conjunction with these silicon mesa diodes, achieved a radiometer noise temperature of 130°K at 8.5 kMc with a 50-Mc bandwidth at 17-db gain. The measured performance of the diode (figure of merit) is compared with the first-order theory in an operating radar system. The over-all performance of the amplifier improved the observed system sensitivity by 6 db.

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Design and Operation of Four-Frequency Parametric Up-Converters

J.A. Luksch, E.W. Matthews, Jr. and G.A. VerWys. "Design and Operation of Four-Frequency Parametric Up-Converters." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 44-52.

A theoretical analysis of a four-frequency parametric-diode up-converter is presented, retaining both sum and difference frequencies generated by mixing of pump and signal. Upper and lower sideband up-converters are compared, and it is shown that the gain limitations of the former can be overcome by combination with the latter, without appreciable loss of stability. Three different parametric amplifier configurations utilizing this four-frequency mode of operation have been designed, fabricated, and tested. These designs utilize sum-frequency up-conversion from 400 to 9400 Mc., and have exhibited noise figures below 1.5 db, gain in excess of 12 db, and bandwidths greater than 8 Mc.

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Ferrites with Planar Anisotropy at Microwave Frequencies

I. Bady. "Ferrites with Planar Anisotropy at Microwave Frequencies." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 52-62.

Materials with an easy plane of magnetization (planar anisotropy) have recently been discovered. The large anisotropy field that tends to keep the magnetization in the easy plane reduces the field required to cause ferromagnetic resonance, which makes the material promising for microwave applications. Equations are derived for the susceptibility, taking into account losses and a finite medium. Propagation in a longitudinal and transverse static field is considered. The location of a slab in a rectangular waveguide for minimum loss in the forward direction, and the use of the material as a phase shifter, are discussed. Experimental microwave data on some materials are given, and also data on an isolator and phase shifter incorporating these materials.

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Wide-Band Resonance Isolator

W.W. Anderson and M.E. Hines. "Wide-Band Resonance Isolator." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 63-67.

A parallel-plate transmission line loaded with capacitors or high dielectric constant material along a narrow strip has a circularly polarized RF magnetic field everywhere external to the loading over a very broad band. The magnetic resonance line of a narrow linewidth ferrite was inhomogeneously broadened by a very inhomogeneous magnetic field to provide resonance absorption over a wide frequency range. A prototype structure has given better than 15 db per inch attenuation in the reverse direction over a bandwidth from 1.5 kMc to 6.0 kMc. The forward loss caused by the ferrite is about 0.2 db to 0.4 db over this range of operation.



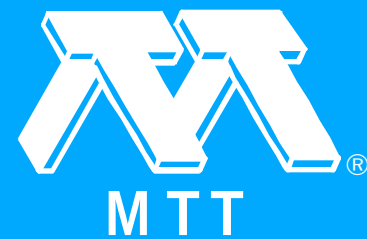
Abstracts

Maser Operation at Signal Frequencies Higher than Pump Frequency

F.R. Arams. "Maser Operation at Signal Frequencies Higher than Pump Frequency." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 68-72.

Methods using harmonic spin coupling for operating solid-state masers with signal frequencies higher than the pump frequency are discussed. Expressions for the population inversion ratios are presented, and the maximum signal-to-pump-frequency ratios are calculated. Experimental data is presented on a ruby maser which is operated using the symmetrical method.

Amplification was obtained at signal frequencies from 10,320 to 10,740 Mc, using pump frequencies ranging from 9580 to 9670 Mc. An experiment in which maser operation is obtained simultaneously at two frequencies is described.



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A Solid-State Microwave Source from Reactance-Diode Harmonic Generators

T.M. Hyltin and K.L. Kotzebue. "A Solid-State Microwave Source from Reactance-Diode Harmonic Generators." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 73-78.

The generation of harmonics with reasonable efficiencies has been made possible by the application of high Q nonlinear reactance diodes. An approximate solution for the conversion loss of harmonic generators utilizing these devices has been obtained and design curves relating conversion loss with harmonic number, diode Q, and voltage-capacitance coefficient are presented. Harmonic generators have been operated with silicon and gallium-arsenide mesa diodes in the UHF region and conversion losses approaching the theoretical value have been obtained. Three harmonic generation stages in miniature modular packages were cascaded to obtain 7-mw output at S band. These stages were driven by a transistorized crystal-controlled oscillator and power amplifier which supplied 200 mw at 140 Mc from 1.3-w dc.

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



Propagation of Waves in a Plasma in a Magnetic Field

W.P. Allis. "Propagation of Waves in a Plasma in a Magnetic Field." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 79-82.

The propagation of electromagnetic waves in a plasma in a magnetic field as given by the Appleton-Hartree theory is discussed in terms of the wave normal surfaces instead of the more conventional propagation vector plots, and the "ordinary" and "extraordinary" waves are defined in terms of their polarizations instead of using a continuity argument. This gives a different picture of "a wave" which has some advantages. In particular, "whistlers" become obvious, as are regions of high reflection and high absorption. The Appleton-Hartree theory is then extended to include the effect of electron temperature, and this results in a third wave whose velocity is of the order of electron thermal motions.

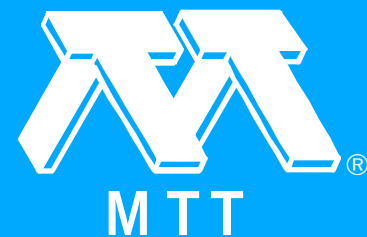


Abstracts

Magnetoplasma Effects in Solids

B. Lax. "Magnetoplasma Effects in Solids." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 83-89.

Plasmas in solids show a more complex behavior than in gases since they reflect the symmetry properties of crystals. Since the carrier concentration has a wide range in semiconductors and metals, the plasma phenomena can be studied from microwaves to the ultraviolet. The effect of magnetic fields on the electromagnetic properties of plasmas has been experimentally investigated at microwave and infrared frequencies and has been utilized to measure dielectric constant and band structure of such solids in the limit of low magnetic fields. The magneto-plasma exhibits effects analogous to the galvanomagnetic phenomena. However, near resonance in the classical limit, they show up as depolarizing effects in semiconductors and also give rise to a new type of cyclotron resonance under anomalous skin conditions in metals.



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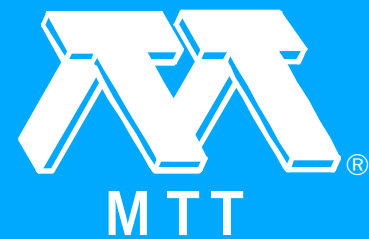
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Coherent Excitation of Plasma Oscillations in Solids

D. Pines. "Coherent Excitation of Plasma Oscillations in Solids." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 89-92.

Considerations are put forth concerning the feasibility of observing the coherent excitation of plasma oscillations in a two-component plasma of electrons and holes in semiconductors or semimetals. By coherent excitation k meant the onset of a high-frequency ("two-stream") instability arising from an appreciable drift of electrons vs holes under the action of an applied electric field. Conditions favorable to coherent excitation include a sizeable difference in electron and hole masses, and long relaxation times for both kinds of particles. The extent to which such conditions are present in InSb is discussed.

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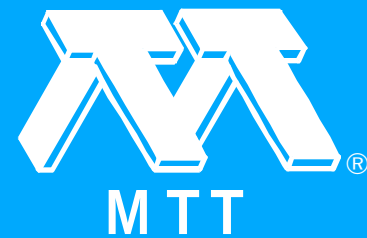


Abstracts

Pulsed Millimeter-Wave Generation Using Ferrites

B.J. Elliott, T. Schaug-Pettersen and H.J. Shaw. "Pulsed Millimeter-Wave Generation Using Ferrites." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 92-94.

A method is described for generating pulsed RF energy in the millimeter-wave spectrum. Low-loss garnets are used in the uniform precessional mode to store energy at S band and radiate at a higher frequency, which is controlled by the total magnetic field. Details are given of a K-band generator which operates at frequencies up to 32 kMc.



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Tuning Range of the Backward Traveling-Wave Parametric Amplifier (Correspondence)

T.M. Straus. "Tuning Range of the Backward Traveling-Wave Parametric Amplifier (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 95-95.

Experimental results obtained with backward traveling-wave parametric amplifiers indicate that their tuning range is greater than that predicted when TEM propagation is assumed. An analytical and graphical examination of the possible tuning range when non-TEM transmission lines are considered is given below. This examination shows how the tuning range may be optimized, and indicates what the maximum range would be using realizable transmission lines.

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Size Effect in the Measurement of Microwave Permeability of Ferrites (Correspondence)

B. Maher and L. Silber. "Size Effect in the Measurement of Microwave Permeability of Ferrites (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 96-96.

In the usual method of measuring the tensor permeability of ferrites at microwave frequencies, a small sample of the material is placed in a suitable cavity, and the change in resonant frequency and Q of the cavity, caused by the presence of the ferrite, are measured. The measured quantities are related to the quantities of interest-real and imaginary parts of permeability-by equations derived through perturbation theory.

Click on title for a complete paper.





Cutoff Variable Reactor (Correspondence)

K. Ishii. "Cutoff Variable Reactor (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 96-97.

When relatively high positive reactance is required for coaxial line circuits, the cutoff variable reactor can economize space. In Fig. 1, a schematic diagram of the cutoff variable reactor is shown. For $z < 0$, there is the coaxial line; and for $z > 0$, there is the cylindrical waveguide operated in cutoff region with the variable shorting plunger shorting the waveguide at the distance s . For simplicity, it is assumed that there is TEM mode alone on the coaxial line and TM_{01} mode alone in the waveguide.

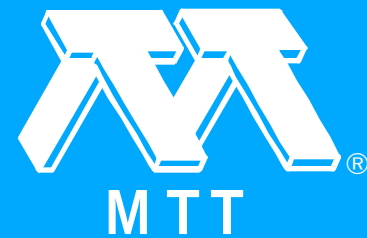


Abstracts

Single-Mode Cavity Maser at 2200 Mc (Correspondence)

D.W. Hanson and J.J. Rowley. "Single-Mode Cavity Maser at 2200 Mc (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 97-98.

Cavity masers which have been reported in the literature have utilized a dual-mode cavity resonant at the pump and signal frequencies, but Strandberg, et al., has reported an X-band cavity maser which can be operated with the cavity resonant only at the signal frequency. Siegmann has also reported a multiplicity of resonances in his cavity maser for the pump signal which might possibly be caused by some sort of dielectric loading effect.



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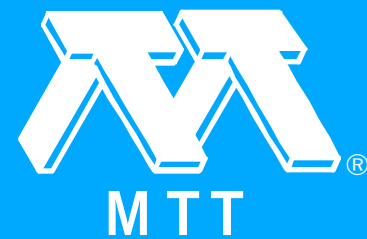


Abstracts

Higher-Order Evaluation of Dipole Moments of a Small Circular Disk for Arbitrary Incident Fields (Correspondence)

W.H. Eggimann. "Higher-Order Evaluation of Dipole Moments of a Small Circular Disk for Arbitrary Incident Fields (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 98-98.

In a recent note the induced electric and magnetic dipole moments P and M due to the diffraction of a plane wave on a small circular disk were given. The expression for the electric dipole moment holds, however, only if the electric field vector is parallel to the plane of incidence.



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Capacitance Definitions for Parametric Operation (Correspondence)

H. Heffner. "Capacitance Definitions for Parametric Operation (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 98-99.

The purpose of this note is to reconcile the various definitions of nonlinear or equivalent time-varying capacitance which appear in the literature concerned with parametric devices. The problem considered is one of a nonlinear reactive element, let us say a capacitance, which is pumped by strong pump source at frequency f_p and which couples two circuit modes at frequencies f_s and f_i , usually called the signal and idling frequencies. For parametric operation we demand either $f_p = f_i + f_s$ or $f_p = f_i - f_s$.

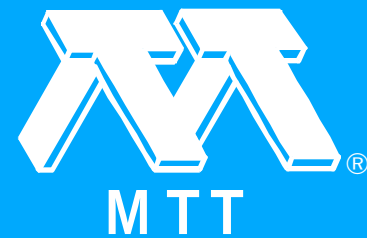


Abstracts

A Tunnel-Diode Amplifying Converter (Correspondence)

*L.E. Dickens and C.R. Gneiting. "A Tunnel-Diode Amplifying Converter (Correspondence)."
1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 99-101.*

Sufficient literature has already been presented to establish the fact that tunnel diodes appear to have a bright future as relatively low noise, low power consumption, amplifying devices.



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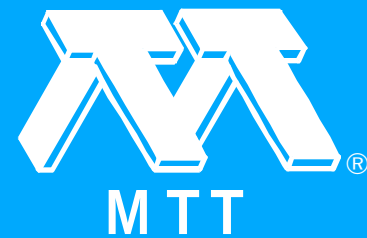


Abstracts

Impedance Matching by Charts (Correspondence)

M.R. Leibowitz. "Impedance Matching by Charts (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 101-101.

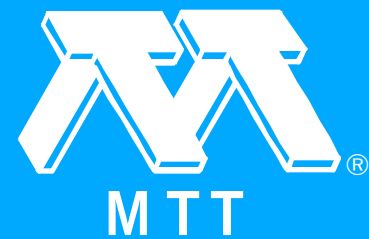
In a previous correspondence, Somlo sought to rectify a misstatement in an article by Hudson, by showing a Smith Chart method of matching impedances. The method entailed finding the correct line length of the right characteristic impedance that would match two arbitrary impedances.



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Theoretical Evaluation of Resonance Frequencies in a Cylindrical Cavity with Radial Vanes (Correspondence)

A. Singh and R.A. Rao. "Theoretical Evaluation of Resonance Frequencies in a Cylindrical Cavity with Radial Vanes (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 101-102.

When the walls of a cavity resonator are altered from a simple geometrical configuration by a small amount, the effect on the resonance frequencies can be determined by applying perturbation methods involving the use of plausible trial fields.

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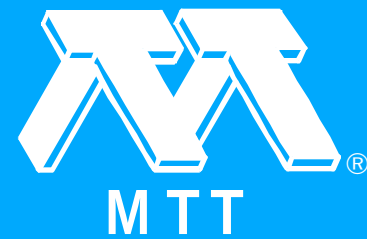


Abstracts

1960 National Microwave Symposium (Announcement) (Jan. 1961 [T-MTT])

"1960 National Microwave Symposium (Announcement) (Jan. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 103-104.

Members of the PGMTT San Diego Chapter appeared before the PGMTT Administrative Committee at Palo Alto, Calif., in January, 1959, to present a plan for holding the 1960 National Meeting in San Diego. The plan, which was accepted, emphasized holding the Symposium in a noncommercial, semi-isolated location where a technical atmosphere with a minimum of outside distractions could be obtained.



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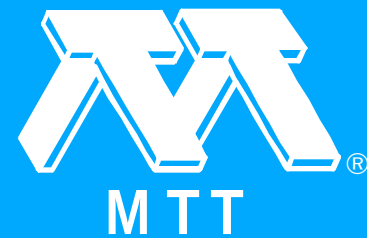
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Contributors (Jan. 1961 [T-MTT])

W.P. Allis, W.W. Anderson, F.R. Arams, I. Bady, B.J. Elliott, S.T. Eng, M.E. Hines, T.M. Hylltin, F. Keywell, K.L. Kotzebue, B. Lax, J.A. Luksch, G.L. Matthaei, E.W. Matthews, Jr., D. Pines, T. Schaug-Pettersen, W.M. Sharpless, H.J. Shaw, I. Tatsuguchi, G.A. VerWys and R.D. Weglein. "Contributors (Jan. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.1 (Jan. 1961 [T-MTT]): 105-107.



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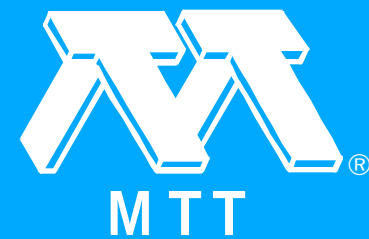
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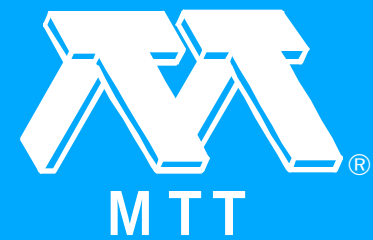
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"Table of Contents (Mar. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 109-109.



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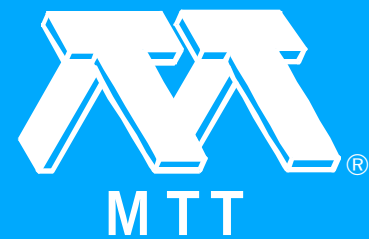
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Dynamic Interaction Fields in a Two-Dimensional Lattice

R.E. Collin and W.H. Eggimann. "Dynamic Interaction Fields in a Two-Dimensional Lattice." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 110-115.

In the theory of artificial dielectrics and aperture coupling in rectangular waveguides, a knowledge of the dynamic interaction fields is required in order to evaluate the polarizing fields. This paper presents suitable methods for evaluating the dynamic interaction fields in a two-dimensional lattice. Both electric and magnetic dipoles are considered. The results are presented in closed form apart from correction terms involving rapidly converging series. Cross-polarization interaction constants are also evaluated.

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TEM Impedance and Cross Coupling for Small Circular Center Conductors in a Double Ridged Waveguide

J.E. Storer and T.W. Thompson. "TEM Impedance and Cross Coupling for Small Circular Center Conductors in a Double Ridged Waveguide." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 116-123.

The even and odd mode TEM impedances and crosscoupling coefficient were found for two small circular center conductors in a double ridge waveguide structure. Expressions were found by the use of a variational approximation for the case where the centers of the circular conductors lie on the horizontal center line of the guide; the conductors were placed symmetrically about the vertical plane of symmetry of the guide, and the conductors were placed a reasonable distance from the guide and from the region between the ridges. Results calculated from these expressions agree reasonably well with experimental data. The experimental and theoretical results tend to indicate that proper placement of the two conductors in a double ridge guide could be used as a method of transmitting three different messages inside a single closed waveguide.

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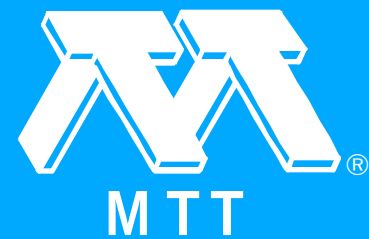
Design of a Coaxial Hybrid Junction

L. Stark. "Design of a Coaxial Hybrid Junction." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 124-129.

The design of a coaxial hybrid junction is discussed. The hybrid consists of a shunt junction and a series junction. The shunt junction is a broad-band stub compensated tee, and the series junction is basically a balun of the type used to excite a slotted dipole. There is inherent isolation between the shunt and series terminals. The useful bandwidth of the hybrid is at least 10 per cent, while the bandwidth of the shunt junction alone exceeds this by a factor of four. Design data are presented for frequency bands centered at 425 Mc and 220 Mc. Many of these hybrids have been manufactured for application, and the performance repeats very well. Performance data are given for VSWR, isolation, and peak power capacity.

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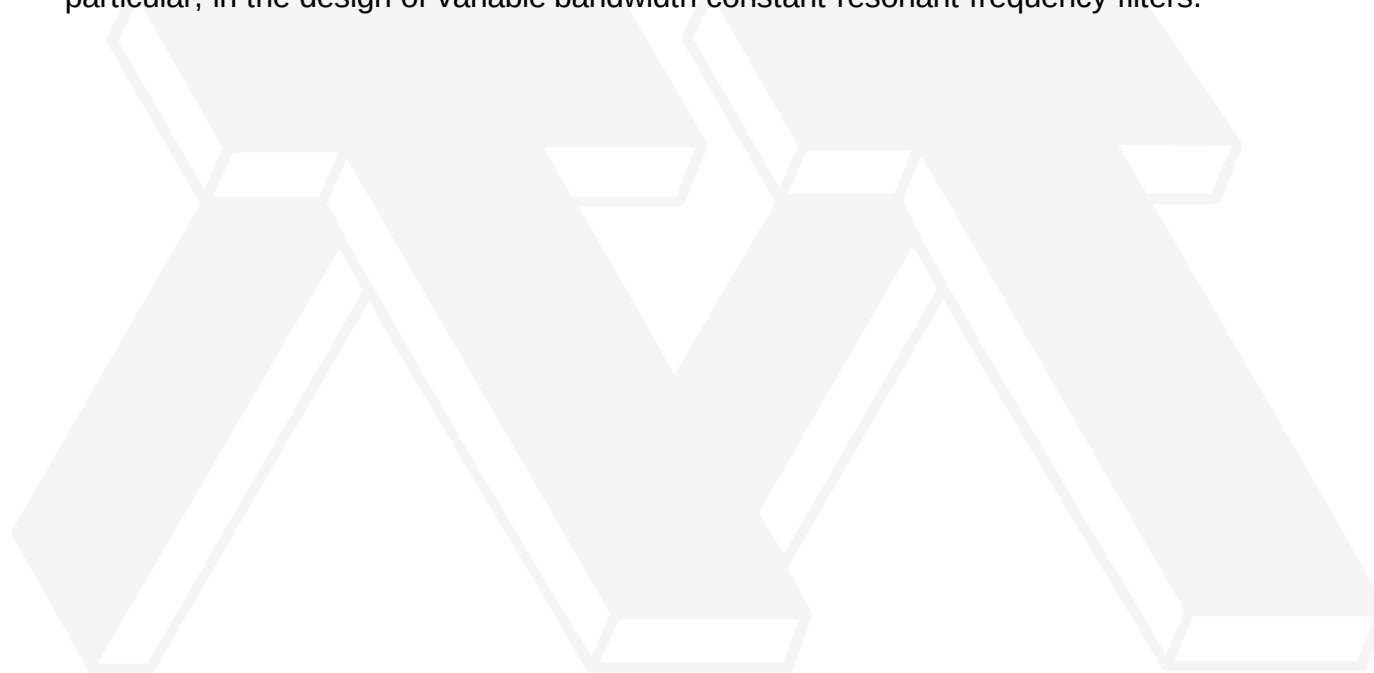
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Step-Twist-Junction Waveguide Filters

B.C. De Loach, Jr.. "Step-Twist-Junction Waveguide Filters." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 130-135.

The properties of step-twist-junction discontinuities in rectangular waveguide are considered. Methods are presented whereby these step-twist-junctions may be used in filter design and, in particular, in the design of variable bandwidth constant-resonant frequency filters.



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Resonators for Millimeter and Submillimeter Wavelengths

W. Culshaw. "Resonators for Millimeter and Submillimeter Wavelengths." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 135-144.

Further considerations on the mm-wave Fabry-Perot interferometer are presented. Computed Q values for parallel metal plate resonators indicate that at spacings around 2.5 cm, values ranging from 60,000 at 3 mm, to 300,000 at 0.1 mm wavelengths are possible. The plates must, however, be quite flat. These results are important for many investigations, and in particular for mm and sub-mm wave maser research. For the aperture per wavelength ratios possible here, diffraction effects should be small. Consideration is given to using curved reflectors or focused radiation in applications where the fields must be concentrated. For this purpose, re-entrant conical spherical resonators are treated in detail, as regards operation in the TEM mode at high orders of interference. Expressions for the Q and shunt impedance are given, and high values are possible at mm and sub-mm wavelengths. Quasi-optical methods of coupling into and out of such a resonator are proposed, and the higher modes possible in such a resonator are considered. Results indicate that it could have application to the mm-wave generation problem, and that it represents a good resonant cavity for solid state research at mm and sub-mm wavelengths, and for maser applications in particular.

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A Recording Microwave Spectrograph

D. Ilias and G. Boudouris. "A Recording Microwave Spectrograph." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 144-152.

The principle of operation and the fundamentals of realization of a recording microwave spectrograph designed for use in the study of the absorption and the index of refraction of gases under medium pressures (1 mm Hg to 1 atm) are presented. The apparatus results from a similar spectrograph with synchroscope, in which the responses of the cavity resonators are interpreted by means of a pulse method. The high performances of the apparatus render its use advantageous, not only as a spectrograph, but also as an accurate recording refractometer, as well as a direct-reading Q-meter.

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A Cavity-Type Parametric Circuit as a Phase-Distortionless Limiter

F.A. Olson and G. Wade. "A Cavity-Type Parametric Circuit as a Phase-Distortionless Limiter." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 153-157.

This paper is a study of the properties of a diode parametric frequency converter (negative-conductance type) when used to perform microwave limiting. Unlike the parametric amplifier, the output power of a converter cannot exceed a certain level, regardless of the amplitude of the input signal. Thus, the ability to limit is a fundamental property of regenerative parametric frequency converters. An experimental limiter circuit, consisting of two stages of parametric frequency conversion, provided an output which was constant to within ± 1 db over a range of input of 50 db, and had 10db small-signal gain. The phase variation was less than seven degrees over the entire range of input power.

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A Stripline Frequency Translator

E.M. Rutz. "A Stripline Frequency Translator." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 158-161.

A frequency translator is discussed which operates at C-band frequencies. The modulators in the frequency translator are crystal diodes, and modulation is obtained by periodic variation of the reflection characteristic of the crystal modulators. The conversion loss of the frequency translator is 6.5 db at 8-mw input power. The unwanted sidebands are at least 25 db below the translated signal.

Abstracts

An Approximate Solution to Some Ferrite Filled Waveguide Problems with Longitudinal Magnetization

S.S. Sandler. "An Approximate Solution to Some Ferrite Filled Waveguide Problems with Longitudinal Magnetization." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 162-168.

An approximate solution for the field structure and propagating modes in parallel plane, circular, and coaxial ferrite filled waveguide is presented. Bundles of plane waves are assumed to propagate in these structures which bounce back and forth along the guide. The solutions are classified into two types depending on the negative or positive equality of the incident and reflected waves. In the case of the circular guide the waves form a cone, and in the coaxial guide they form a frustum of a cone about the axis. The elemental plane waves are also assumed to satisfy Polder's relation and the boundary conditions at the guide walls. Simple relations are obtained with this equivalence for the propagation constant and the field. Comparison to rigorous theory is made in the case of the parallel plane and circular guide. Some experimental verification is presented for the completely filled coaxial waveguide.



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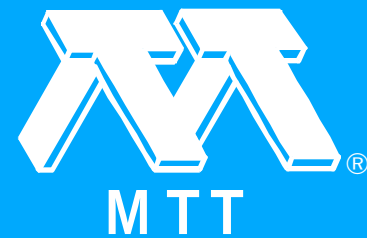


Abstracts

Synthesis of Low-Reflection Waveguide Joint Systems

P. Foldes and N. Gothard. "Synthesis of Low-Reflection Waveguide Joint Systems." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 169-175.

Some characteristics of flat-flange type joints are analyzed. Experimental evidence is given proving that it is possible to reproduce, in practice, waveguide joints which have identical complex-reflection coefficients. Such joints can be combined to form large joint systems by means of a synthesis method, which keeps the over-all reflection coefficient to a minimum. Both theory and experimental data are presented.



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A Channel-Dropping Filter in the Millimeter Region Using Circular Electric Modes

E.A.J. Marcatili. "A Channel-Dropping Filter in the Millimeter Region Using Circular Electric Modes." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 176-182.

A. channel-dropping filter in the millimeter region that transfers TE_{011} to TE_{101} square is described and analyzed. The important features are the use of TE_{101} mode in the resonant cavities combined with a mode-selective coupling between circular symmetric and rectangular waveguides which make both heat loss and mode conversion low. Design formulas and experimental results on a model filter centered at 56 kMc are included. Finally, several possible mode transducers and filters based on the idea of mode-selective coupling are described.

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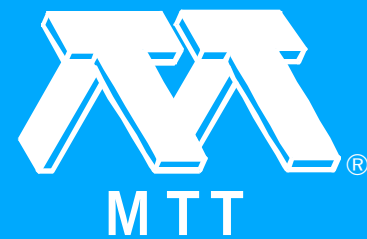


Abstracts

Coupled-Mode Description of Crossed-Field Interaction

J.E. Rowe and R.Y. Lee. "Coupled-Mode Description of Crossed-Field Interaction." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 182-186.

The coupled-mode theory is developed for two-dimensional M-type flow, and a system of five coupled-mode equations is obtained. A fifth degree secular equation is found for the perturbed propagation constants of the system. Under weak space-charge field conditions, both the forward-wave and backward-wave interactions may be described in terms of only two coupled modes. The two-mode theory is applied to the calculation of starting conditions for the M-BWO, and to the M-FWA. The conditions for beating-wave amplification are determined, and the variation of the mode amplitudes with distance is given.



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Broad-Band Cavity-Type Parametric Amplifier Design

K.M. Johnson. "Broad-Band Cavity-Type Parametric Amplifier Design." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 187-194.

This paper tells how maximum bandwidth can be obtained from a nondegenerate parametric amplifier which utilizes a circulator. Expressions are derived for the gain bandwidth product and maximum possible gain bandwidth product. It is then shown how the Q of the cavities used for the signal and idler circuits may be kept at a minimum without degrading the noise performance of the amplifier. It is shown that best performance results when the TEM mode is used in coax, or, if waveguide is used, when the operating frequency is far away from the waveguide cutoff frequency. The diode used should have as high a self-resonant frequency as possible and the line admittance should be approximately the diode susceptance. Using a diode with a self-resonant frequency at the idler frequency will be seen to give optimum performance. This paper also discusses double tuning the signal circuit to achieve broader bandwidths. In this case, the addition of the second tuned circuit will be seen to give much broader bandwidths than one would expect from conventional filter theory. Two sample amplifiers are considered and their bandwidths calculated. The effect of double tuning one of the amplifiers is then considered.

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Dependence of the Resonance Line-Width of Microwave Ferromagnetic Materials on Incident RF Power (Correspondence)

J.L. Carter, S. Dixon, Jr. and I. Reingold. "Dependence of the Resonance Line-Width of Microwave Ferromagnetic Materials on Incident RF Power (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 195-197.

The intrinsic resonance linewidth of ferromagnetic materials is a key parameter in delineating the characteristics of these materials. Most of the published data concerning the resonance linewidth of ferrites and garnets are valid for small-signal conditions. However, Suhl's theory has indicated that the linewidth is dependent upon the RF peak power to which the material is subjected.

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Green's Function Techniques for Inhomogeneous Anisotropic Media (Correspondence)

A.T. Villeneuve. "Green's Function Techniques for Inhomogeneous Anisotropic Media (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 197-198.

In many problems involving the guiding and radiation of electromagnetic waves the solution for the field quantities at points in space is given in terms of integrals of the field quantities over their values on a closed surface. These integrals are often derived through the application of vector Green's theorems. The Green's function used in any particular application is usually determined by the special considerations of that problem, but it is convenient to use, as the Green's function, a solution of the vector wave equation which is singular at the point where the field is to be computed. In this article the concept is extended to include media which are anisotropic and maybe inhomogeneous as well. Use is made of the generalized reciprocity relationships for anisotropic media. This involves the use of the media of a given problem termed "original media" and those characterized by transposed tensor parameters and termed "transposed media."



Abstracts

N-Way Power Divider (Correspondence)

H. Kagan. "N-Way Power Divider (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 198-199.

An N-way power divider is an $(N+1)$ port network with N equal outputs.



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Microwave Absorption Modulation by Electron Mobility Variation in n-Type Germanium (Correspondence)

M. Harmatz. "Microwave Absorption Modulation by Electron Mobility Variation in n-Type Germanium (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 199-200.

Microwave-radiation attenuation in a dissipative medium such as germanium in which the conductivity and microwave frequency conditions $\sigma < \omega \epsilon$ and $\omega \tau < 1$ are present has been shown by Gibson to be attributed to the absorption constant relation: $K = 1635\sigma/n$ db/meter where τ is the carrier relaxation time, ω the microwave angular frequency, and ϵ the permittivity. In the above equation, σ is the conductivity and n the index of refraction (4.05 in germanium).



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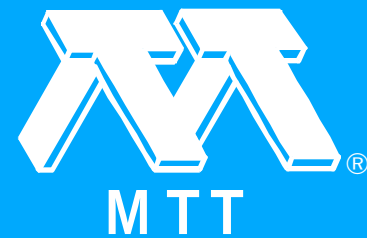


Abstracts

Coaxial to Strip Transmission Line Adapter (Correspondence)

J.H. Craven. "Coaxial to Strip Transmission Line Adapter (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 200-201.

Over the past few years, strip transmission line has shown itself capable of being utilized in a large number of microwave configurations which were previously constructed in coaxial line or waveguide. In many cases the components fabricated in strip transmission line are simpler to design and produce particularly where, as in the sandwich type of line, advantage may be taken of photo-etching techniques. This type of construction using copper-foil-clad dielectric material enables the foil to be used for both the center conductor and the ground planes.

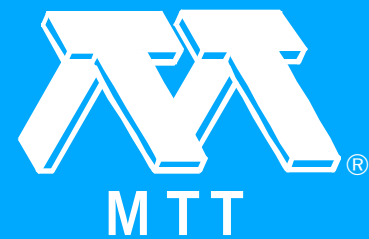


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A Note on Loaded Line Synthesis (Correspondence)

J. Reed. "A Note on Loaded Line Synthesis (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 201-202.

The purpose of this note is to present an alternate derivation of a formula for the synthesis of a loaded line. The problem is to determine the values of the normalized susceptances a and c mounted an exact quarter-wavelength apart along a uniform line. These are arranged in the order $a, c, c, \dots, c, a$ to achieve a loaded line with a given phase shift and perfect match. In order to analyze a particular line design for standing-wave ratio and phase shift over a band of frequencies on a digital computer, it is worthwhile to know the values of the susceptances to many more decimal places than one would achieve from a simple graph.

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X-Band Diode Limiting (Correspondence)

R.V. Garver and D.Y. Tseng. "X-Band Diode Limiting (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 202-202.

Broad-band, matched, low power, instantaneous, passive, X--band diode limiting has been demonstrated. The limiter, which uses standard microwave components, is an outgrowth of point contact germanium diode microwave switch research. In fact, the hybrid-tee switch makes a very good narrow-band limiter under the condition of zero bias voltage on the crystals (biasing terminals short circuited). The output power under these conditions is limited to 0.5 mw² for incident power up to 30 mw, deduced from Fig. 9 of Garver, et al. However, the bandwidth of the hybrid-tee switch when used as a limiter is insufficient for many applications such as limiting the amplitude of a 0.2-μsec magnetron pulse or flattening a frequency-modulated klystron mode.



Abstracts

A Note on the Difference Between Equiangular and Archimedes Spiral Antennas (Correspondence)

P.E. Mayes, J.D. Dyson, R. Bawer and J.I. Wolfe. "A Note on the Difference Between Equiangular and Archimedes Spiral Antennas (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 203-205.

There seems to exist in the literature considerable confusion about the various types of spiral antennas, their characteristics, and their bandwidth capabilities. One evidence of this confusion appeared in a paper by Bower and Wolfe, in which they state that the Archimedes spiral antenna can be specified in terms of angles and hence belongs in the class of "frequency--independent antennas. "Frequency--independent antennas are relatively new; in fact, until 1955 there was no evidence that a "frequency-independent" antenna did, indeed, exist. Therefore, it would appear appropriate to delineate the characteristics and the terminology of the antennas involved. Perhaps this brief report of some recent work at the University of Illinois Antenna Laboratory will aid in pointing up the differences in operation of the logarithmic (i.e., equiangular) and Archimedean spiral antennas.



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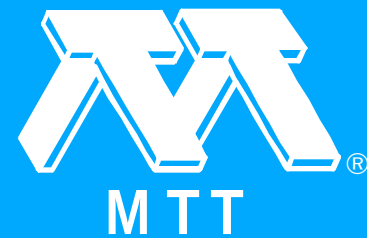
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G. Boudouris, R.E. Collin, W. Culshaw, B.C. De Loach, Jr., W.H. Eggimann, P. Foldes, N. Gothard, D. Ilias, K.M. Johnson, R.Y.Y. Lee, E.A.J. Marcatili, F.A. Olson, J.E. Rowe, E.M. Rutz, S.S. Sandler, L. Stark, J.E. Storer, T.W. Thompson and G. Wade. "Contributors (Mar. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 206-208.



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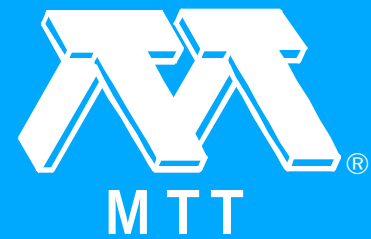
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"1961 PGMTT National Symposium (Sessions and Papers)." 1961 Transactions on Microwave Theory and Techniques 9.2 (Mar. 1961 [T-MTT]): 209-210.



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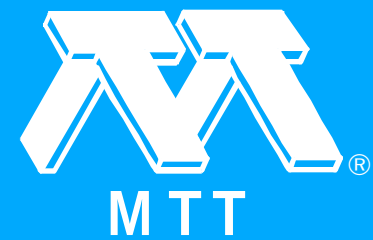
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Octave-Bandwidth UHF/L-Band Circulator

F. Arams, B. Kaplan and B. Peyton. "Octave-Bandwidth UHF/L-Band Circulator." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 212-216.

Test data are presented on two aluminum-substituted yttrium-iron-garnet (YIG) materials that have low-saturation magnetizations that permit the extension of ferrite devices well into the UHF/VHF region. In particular, one composition has a saturation magnetization of 300 gauss and a line width of 50 oersteds. Measurements are presented that compare the new materials with previously available higher-saturation magnetization materials. A broad-band UHF/L-band four-port circulator that operates over a 2-to-1 frequency band has been developed, using this 300 gauss material. Insertion loss is 1 db or less from 665 to 1320 Mc (with constant magnetic field) and 0.5 db or less from 800 to 1150 Mc. A compact and favorable circulator package design was obtained by using coaxial hybrids and dielectric-loaded strip transmission line. Data on the broad-band magic-tee used in the circulator are included. Isolator measurements down to 200 Mc are reported. Reverse-to-forward magnetic-loss ratios of 36 at 600 Mc and 12 at 300 Mc were obtained.

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A Five-Port Matched Pseudo-Magic Tee

A. Okaya. "A Five-Port Matched Pseudo-Magic Tee." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 216-219.

The five-port matched pseudo-magic tee consists of an input waveguide, two load arm waveguides which are coupled into the input waveguide with $+90^\circ$ and -90° phase shifts, respectively, and an output waveguide which is split into two load waveguides by a septum. The improvements include a much broader matching and isolation bandwidth, higher isolation between arms, better matching into arms, and a variety of modifications for different applications. These characteristics have been obtained by employing frequency-insensitive phase shifters. Hence, frequency coverage is mainly limited by mechanical asymmetry and the characteristics of the directional coupler in the magic tee. While this type of hybrid junction is not a true magic tee because the load arms are not used as the input arm, it does have several applications which an ordinary magic tee does not have. X-, K-, and M-band models were examined experimentally, and highly sensitive and accurate impedance measurements were made.

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Theory of Dielectric-Loaded and Tapered-Field Ferrite Devices

R.F. Soohoo. "Theory of Dielectric-Loaded and Tapered-Field Ferrite Devices." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 220-224.

Loading a ferrite resonance isolator or differential phase shifter with a dielectric or biasing the ferrite with an inhomogeneous dc magnetic field are very useful ways of improving the performance of these ferrite devices. Whereas these methods are very commonly used in transverse-field ferrite devices, no extensive analytical treatment of the subject has appeared in the literature. It is the purpose of this paper to present a theoretical analysis of the problem, chiefly by means of combined boundary-value and perturbation-theory approach. It will be shown that dielectric-loading and tapered-field techniques increase the bandwidth of isolators and phase shifters, the isolation-to-insertion loss ratio of the former, and the phase shift of the latter.

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Theory of TEM Diode Switching

R.V. Garver. "Theory of TEM Diode Switching." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 224-238.

The theory of TEM diode switching is presented for purpose of understanding and designing TEM microwave diode switches. A few experimental results are reported for the purpose of supporting the theory and demonstrating the exceptional bandwidth possible. An analysis is given of the switching action of one and of two or more diodes as well as the biasing of the center conductor of a TEM transmission line over broad-frequency bandwidths without interacting the RF signal. The use of point-contact germanium, and gold-bonded germanium diodes for TEM switching is discussed. Some considerations of switching speed and maximum power-handling capacity are given. A coaxial transmission line switch has been constructed in which two gold-bonded diodes provide 26-db or greater isolation and insertion ranging from 1.6 db to less than 1 db from 40 Mc to 4000 Mc. The addition of a bias lead should increase the insertion loss 0.4 db or less over the 100-to-1 bandwidth, the maximum increase being at the upper and lower bounds.

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Abstracts

Measurement of Small Dielectric Losses in Material with a Large Dielectric Constant at Microwave Frequencies

R.O. Bell and G. Rupprecht. "Measurement of Small Dielectric Losses in Material with a Large Dielectric Constant at Microwave Frequencies." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 239-242.

A method is described for measuring dielectric losses at microwave frequencies in materials with a large dielectric constant. By observing a dielectric resonance in a sufficiently large sample, the loss tangent of the material can be obtained. Results on SrTiO/sub 3/, single crystals at 20 kMc are presented.



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Abstracts

On the Existence of Leaky Waves Due to a Line Source Above a Grounded Dielectric Slab

E.S. Cassedy and M. Cohn. "On the Existence of Leaky Waves Due to a Line Source Above a Grounded Dielectric Slab." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 243-247.

The existence of a particular type of leaky wave is verified experimentally. The leaky wave considered is that due to an electric line source above a dielectric slab. Since such a leaky wave cannot exist by itself, it must be detected in the presence of the remainder of the continuous spectrum and often in the presence of a surface wave (or waves). This was done by probing the fields and observing an interference pattern between the leaky wave and the existing surface wave, as predicted by the theory. These results emphasize a need to take leaky waves into account in the design of surface wave components and antennas.



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Abstracts

A Broad-Band Glass-to-Metal Coaxial Vacuum Seal

W.M. Nunn, Jr. and L.E. Paul. "A Broad-Band Glass-to-Metal Coaxial Vacuum Seal." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 248-251.

The design procedure for a broad-band glass-to-metal seal is described, and experimental results are presented for a structure examined over the frequency range of 100 to 11,000 Mc. The seal described is capable of operating at bakeout temperatures as high as 450°C, with higher temperatures being attainable by the use of other materials.



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Magnetically-Tunable Microwave Filters Using Single-Crystal Yttrium-Iron-Garnet Resonators

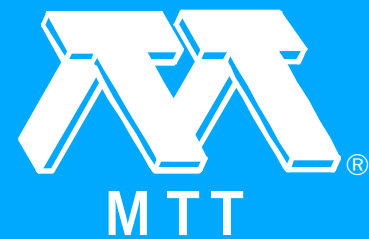
P.S. Carter, Jr.. "Magnetically-Tunable Microwave Filters Using Single-Crystal Yttrium-Iron-Garnet Resonators." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 252-260.

A new type of magnetically-tunable band-pass microwave filter that makes use of ferromagnetic resonance in single-crystal yttrium iron garnet is presented. The 3-db bandwidth can be adjusted from about 6 Mc to 100 Mc at X-band, and the center frequency can be tuned over a wide range of frequencies, by means of a varying dc field. A theoretical analysis of the operation and behavior of this type of filter is presented. Descriptions of single-resonator and two-resonator filters which can be tuned over the X-band frequency range are given and experimental data are presented showing their tuning range, insertion loss, and bandwidth.

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Linear Tapers in Rectangular Waveguides (Correspondence)

R.C. Johnson and D.J. Bryant. "Linear Tapers in Rectangular Waveguides (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 261-261.

Recently, the special case of a linear double taper in rectangular Waveguide propagating the TE/₁₀ mode in vacuum dielectric was examined. Approximate expressions for the reflection coefficient and voltage standing-wave ratio as functions of the taper dimensions and free space wave-length were derived and experimentally verified. This correspondence generalizes the equations to be applicable for wave-guides filled with dielectrics of arbitrary relative permittivity K . As a matter of convenience, equations are numbered to correspond with similar equations in the referenced paper.

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Abstracts

The Unloaded Q of a YIG Resonator from X-Band to 4 Millimeters (Correspondence)

D. Douthett and I. Kaufman. "The Unloaded Q of a YIG Resonator from X-Band to 4 Millimeters (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 261-262.

Carter and Flammner have reported measurements at lower microwave frequencies of $Q_{sub u}$, the unloaded Q of a single crystal YIG sphere treated as a resonator. In their paper a comparison of the measured and theoretical $Q_{sub u}$, the latter computed on the basis of a constant relaxation time, yielded good agreement only in the 2-5 kMc range.



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[Z/sub 0/ of Rectangular Coax \(Correspondence\)](#)

R.V. Garver. "Z/sub 0/ of Rectangular Coax (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 262-263.

The characteristic impedance $Z_{0/}$ of rectangular coax has long been the subject of experimental and theoretical investigations. The problem is to obtain an expression for $Z_{0/}$ which is both simple and precise to facilitate device design. The recent works of Chen and Cohn are summarized in Fig. 1 and compared with simple and precise calculations already known.



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An Easy Method of Matching Microstrip Loads and Attenuators (Correspondence)

G.H.B. Thompson. "An Easy Method of Matching Microstrip Loads and Attenuators (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 263-263.

This note describes a novel method of matching microstrip loads which gives good performance without critical adjustment and is particularly useful when the lossy material has to be chosen for mechanical reasons rather than optimum characteristic impedance. In the present instance, the method was applied to the design of clip-on sliding loads for measurement purposes and to highly stable calibrated attenuators in which a block of iron-dust loaded resin was used as the lossy element.

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An Empirical Design Method for Multisection Ridge-Guide Transducers of Large-Impedance Transformation (Correspondence)

G.H.B. Thompson. "An Empirical Design Method for Multisection Ridge-Guide Transducers of Large-Impedance Transformation (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 263-266.

The available analytical design procedures are inadequate for the design of broad-band ridge-guide transducers of large transformation ratio. Various authors have discussed the problem of obtaining maximum bandwidth with multisection quarter-wave transformers, and recently Young has extended the treatment to include inhomogeneous transformers where frequency dispersion varies from section to section. There is, however, no exact theory for dealing with the discontinuity susceptances which appear in practice at the junctions between sections and become important when large transformations are being attempted. Further uncertainties arise when ridge guide is used, because there does not yet seem to be agreement on a means of calculating the characteristic impedance which is applicable over the whole range of ridge sizes.

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Pulse-Operated Circulator Switch (Correspondence)

L. Freiberg. "Pulse-Operated Circulator Switch (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 266-266.

One of the major disadvantages of employing a ferrite circulator as a microwave switch is the holding current required to maintain the circulator in the switched position. One solution to this problem, reported by Levey and Silber, is the utilization of ferrite tubes as the differential phase shift element in a circulator. Switching is accomplished with a single pulse of current which reverses the magnetization in the closed ferrite tubes, and by virtue of the closed magnetic path, remains permanently magnetized in this new state. Using this technique, microsecond switching speeds have been obtained. This approach requires a ferrite that has both the requisite microwave and dc magnetic characteristics which all too often are unattainable in a commercially available material and necessitates the development of a special material.

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Abstracts

Polishing Technique for Garnet Spheres (Correspondence)

A.L. Pierce. "Polishing Technique for Garnet Spheres (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 266-267.

A new technique using a motor-driven polishing head intended primarily for the final stages of polishing yttrium-iron-garnet spheres has been developed. This method has produced several fractional oersteds line-width crystals including a matched pair of 0.060-inch diameter spheres ground simultaneously.



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Miniaturized, Temperature Stable, Coaxial Y-Junction Circulators (Correspondence)

J. Clark and J. Brown. "Miniaturized, Temperature Stable, Coaxial Y-Junction Circulators (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 267-269.

The problem of designing a circulator that is extremely small, durable, and lightweight immediately suggests the Y- or T-junction approach. For use with coaxial connectors, the strip transmission line Y-junction suggested by Auld and subsequently demonstrated by Milano, Davis and Saunders, has obvious advantages. A systematic approach to developing such a device calls for the symmetrical alteration of at least two physical characteristics of the junction. The obvious choice for one of these characteristics is the magnitude of the biasing magnetic field. The choice for the complementary characteristics can include any symmetrical change in the geometry of the junction (the adjustable ground plane of Fig. 1 is an example) and the symmetrical placing of isotropic and anisotropic material in the junction. The choice of this complementary characteristic most frequently mentioned in the literature is the diameter of the ferrite post. An alteration of the ferrite post height will also provide adjustment. The use of a metal pin along the axis of symmetry has also been suggested for this purpose. Thaxter and Heller have also reported on the use of a copper sleeve around the ferrite post for operation at 70 and 140 kMc.





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K-Band Reciprocal Ferrite Phase Modulator (Correspondence)

F. Reggia. "K-Band Reciprocal Ferrite Phase Modulator (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 269-270.

A rectangular waveguide reciprocal phase modulator, making use of a longitudinal magnetic control field, was reported by Reggia and Spencer in 1957. This X-band phase modulator consisted of a longitudinally magnetized ferrite rod centrally located inside a rectangular waveguide excited in its fundamental TE/sub 01/ mode. The outstanding advantages of this type modulator are the large phase shifts per unit length obtainable, simple geometric configuration, the high figure of merit possible, and the small magnetic control fields required. These modulators have since been designed for use at frequencies ranging from 3000 Mc to 70,000 Mc.

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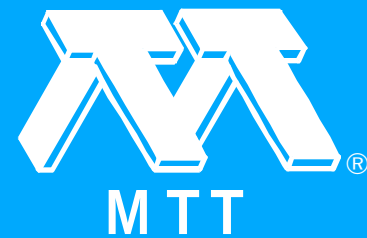


Abstracts

K/sub a/-Band Ferrite Phase Shifter (Correspondence)

*R.S. McCarter and E.F. Landry. "K/sub a/-Band Ferrite Phase Shifter (Correspondence)."
1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 271-271.*

In 1957, Reggia and Spencer utilized a new technique to develop a phase shifter at 9.1 kMc. This letter reports an extension of their technique to K/sub a/-band frequencies. A maximum figure of merit of 1100 degrees of phase shift per db of loss has been achieved at 35 kMc $\pm$ 500 Mc.



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Low-Temperature Microwave Power Limiter (Correspondence)

F.J. Sansalone and E.G. Spencer. "Low-Temperature Microwave Power Limiter (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 272-273.

A passive microwave power limiter, using the nonlinear properties of ferromagnetic resonance in yttrium-iron-garnet (YIG) has been evaluated at 4.2° K, 77° K, and 297° K. The limiter, of the DeGrasse type, consists of two decoupled, half-wavelength coaxial cavities as shown schematically in Fig. 1. Input and output coupling is made through the use of quarter-wavelength matching transformers. An optically polished sphere of single crystal YIG is placed in the position of maximum RF magnetic fields common to both cavities.





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New Coaxial-to-Stripline Transformers Using Rectangular Lines (Correspondence)

R. Levy. "New Coaxial-to-Stripline Transformers Using Rectangular Lines (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 273-274.

The most common form of coaxial-to-stripline transition consists of a simple inline butt joint, as described by Barrett. A typical transition between a 50-ohm high-Q triplate and a standard N-type connector is shown in Fig. 1. This gives a VSWR<1.15 at frequencies up to 7000 Mc deteriorating to 1.25 at higher frequencies up to 11,000 Mc. While these results are acceptable for many types of stripline components and assemblies, it was felt that the design of a better transition would be necessary in order both to test and to maintain the performance of high grade components (e.g., hybrids, directional couplers, and filters) and to avoid the manufacture of a special stripline standing-wave detector.

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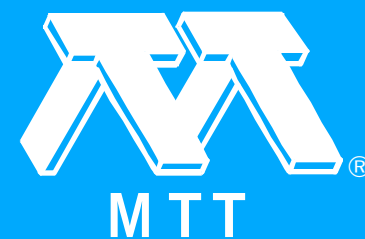


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Contributors (May 1961 [T-MTT])

F.R. Arams, R.O. Bell, P.S. Carter, Jr., E.S. Cassedy, M. Cohn, R.V. Garver, B. Kaplan, W.M. Nunn, Jr., A. Okaya, B. Peyton, L.E. Paul, G. Rupprecht and R.F. Soohoo.

"Contributors (May 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.3 (May 1961 [T-MTT]): 275-276.



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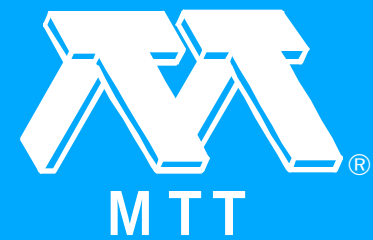
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Abstracts

Report of Advances in Microwave Theory and Techniques-1960

R.C. Hansen and M.T. Weiss. "Report of Advances in Microwave Theory and Techniques-1960." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 278-290.

This is a compendium of the principal advances in the microwave area for the calendar year 1960; only United States journals are included in this report which is not a catalog of all published papers, but rather, is intended to be a semicritical review of the major accomplishments in the field. The report is divided into four major sections which cover, respectively, tube sources, electromagnetic devices, solid-state devices, and measurements.



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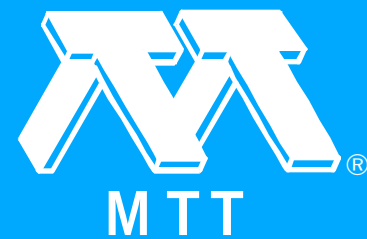


Abstracts

The Short Pulse Behavior of Lossy Tapered Transmission Lines

R. Stapelfeldt and F.J. Young. "The Short Pulse Behavior of Lossy Tapered Transmission Lines." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 290-296.

An analytic method is given which allows the design engineer to assess rapidly the short pulse characteristics of any given tapered-transmission-line type of pulse transformer. The method allows inclusion of both skin-effect losses and losses which are independent of frequency. The effects of mismatching at either end are shown to be as important as the taper function of the line itself. The results of this approximate method are expressed as simple integrals and matching terms to which it is easy to attach physical significance. The method is applied to the analysis of two tapered-line pulse transformers which are geometrically uniform coaxial structures with tapered dielectric constants. The line whose nominal characteristic impedance is an exponential function of electrical position is shown to have a good rise time and tilt distortion characteristics.



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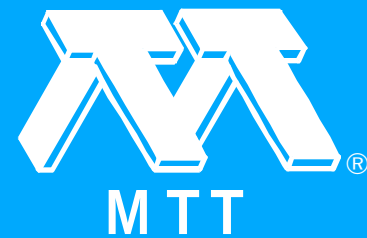


Abstracts

A Waveguide Quadruplexer System

P. Foldes and T.B. Thomson. "A Waveguide Quadruplexer System." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 297-306.

Practical design considerations are presented for a relatively simple four-channel wave guide branching system. The most important electrical characteristic of this system is an extremely low pass-band reflection coefficient (better than 1.5 per cent in 30-Mc band) which has only very small variations with the environmental conditions.



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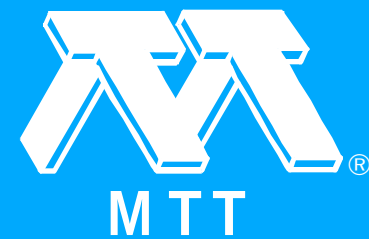


Abstracts

Some Recent Findings in Microwave Storage

J.D. Kellett. "Some Recent Findings in Microwave Storage." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 306-312.

This paper describes an experimental investigation of frequency memory in a recirculating amplifier storage device. The objective of the investigation was to determine what mechanism caused injected energy to shift to preferred storage frequencies. Using fast-acting crystal switches, the output energy was selectively viewed, and it was found that the energy in any circulation when viewed separately was of the input frequency. The spectrum photographs which are included in the paper show that the recirculating amplifier when operating with an open loop gain greater than unity does not oscillate at preferred frequencies.



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Excess Noise in Microwave Detector Diodes

J.J. Faris and J.M. Richardson. "Excess Noise in Microwave Detector Diodes." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 312-314.

The dependence of available excess noise in type microwave crystal-diode rectifiers on applied microwave power was measured. This may be approximated by a power law with stants characteristic of the particular crystal. As a consequence of the dependence of both excess noise and dc rectified power on power level, there is a level which minimizes the ratio of these titles. Similarly, in the case of a modulated microwave carrier there is an input level which minimizes the ratio of excess noise to power, and so provides optimum detection of small modulation.



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Quantum Fluctuations in Microwave Radiometry

L.P. Bolgiano, Jr.. "Quantum Fluctuations in Microwave Radiometry." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 315-321.

This paper assesses the possible significance of the quantum nature of electromagnetic radiation in limiting the measurement accuracy attainable with a microwave radiometer. Analogies are shown to exist between the form of a formula describing fluctuations in the radiometer output, and both a formula describing the radiometer input signal, and also, a formula describing the output of a photocell detector. Detailed quantum mechanical consideration of the processes of amplification and detection are circumvented by considering how the formula for fluctuations in the radiometer output might be modified so as to make it consistent with the measurement precision implied by these other formulas. A modified formula is suggested which includes a quantum fluctuation whose magnitude depends on signal power.

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Abstracts

On the Resolution of a Class of Waveguide Discontinuity Problems by the Use of Singular Integral Equations

L. Lewin. "On the Resolution of a Class of Waveguide Discontinuity Problems by the Use of Singular Integral Equations." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 321-332.

It is shown that a considerable number of solutions of rectangular waveguide problems appearing in the literature are all special cases of a general treatment focused around the known solution of a singular integral equation. In terms of this a number of typical results are re-examined. The method is then applied to four new configurations, and the range of application and the limitations are examined.



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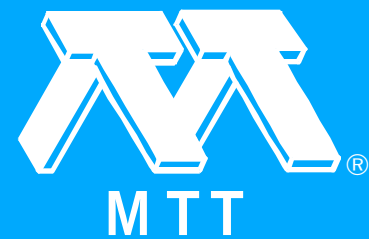
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A Dielectric Surface-Wave Structure: The V-Line

P. Diament, S.P. Schlesinger and A. Vigants. "A Dielectric Surface-Wave Structure: The V-Line." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 332-337.

Properties of the V-line, a wedge-shaped surface-wave structure comprising a cylindrical dielectric binding medium of sectorial cross section supported by two conducting plates, are considered in terms of its higher-order hybrid modes of propagation. Practical modifications of the ideal structure are emphasized. Design curves and equations are presented to determine various propagation parameters and their significance is discussed. Experimental verification of the theory is described.

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Abstracts

Wave Propagation in a Medium with a Progressive Sinusoidal Disturbance

A. Hessel and A.A. Oliner. "Wave Propagation in a Medium with a Progressive Sinusoidal Disturbance." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 337-343.

A recent paper by Simon derives approximate results, employing only three space harmonics, for the propagation characteristics of an electromagnetic wave traveling in a medium possessing a progressive sinusoidal disturbance. A rigorous result is presented here for this same problem, taking into account all of the space harmonics; also, a sufficiency condition for the convergence of this solution is discussed. This sufficiency condition is not satisfied in a particular case treated by Simon. It is shown that his analysis of this case is in error, and that the total field is singular there. The singular nature of the field is associated with "supersonic" effects in the medium containing the progressive disturbance.



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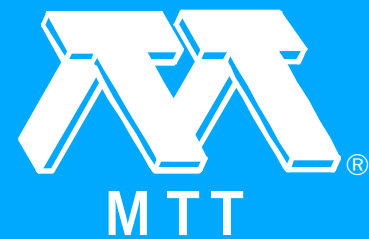
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A New Broad-Band Absorption Modulator for Rapid Switching of Microwave Power

F. Reggia. "A New Broad-Band Absorption Modulator for Rapid Switching of Microwave Power." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 343-349.

This paper describes a new technique for obtaining a broad-band absorption modulator for high-speed switching or amplitude modulation of microwave power. This ferrite modulator, an outgrowth of the longitudinal-field rectangular-waveguide phase shifter, has electrical characteristics particularly desirable in a microwave switch. These include a zero-field insertion loss of approximately 0.5 db in the ON state, an isolation of greater than 60 db in the OFF state which is nearly independent of the magnetic control field in this state, and a nearly matched input impedance for all values of applied field. These electrical characteristics are nearly constant over a 30 per cent bandwidth at X band. Also, it is possible to design the amplitude modulator to have negligible phase shift at the desired operating frequency. Other characteristics of this ferrite modulator include small physical size, magnetic control fields of less than 50 oersteds, operating temperatures up to 150°C, and a capability of less than one μ sec switching time.

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Rectangular Waveguide Theoretical CW Average Power Rating

H.E. King. "Rectangular Waveguide Theoretical CW Average Power Rating." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 349-357.

A theoretical CW average power rating, limitation imposed by a temperature rise resulting from power dissipation within the rectangular waveguide walls, can be determined by predicting the rise in temperature. Formulas for the evaluation of the CW average power rating have been developed and are presented here, and the power rating curves are given for the WR-2300 wave-guide (320 Mc) through the WR-19 waveguide (60 kMc). Localized hot spots, associated with a standing wave on a mismatched waveguide, require a derating factor. The axial flow of heat from these high current spots has been considered in calculating and plotting this derating factor.

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Wave Propagation in Coaxial-Cylindrical Slow-Wave Systems (Correspondence)

W.M. Nunn, Jr.. "Wave Propagation in Coaxial-Cylindrical Slow-Wave Systems (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 358-358.

Recent interest in E-type traveling-wave tubes, in which a ribbon-shaped electron beam is caused to follow a circular path by balancing the centrifugal force of the particle against a steady radial electric field force, has led to an investigation of wave propagation in azimuthally reentrant and nonreentrant coaxial-cylindrical slow-wave structures. The study is facilitated by the simplifying approximation that the actual azimuthally-periodic slow-wave circuit, situated along the inner conductor, can be replaced by a smooth dielectric cylinder. While such a dielectric cylinder would probably not be employed in the construction of an actual tube, because of its small value of surface impedance, it serves as a convenient model in determining the general forms of functional dependence for the field equations.

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



Ring Network Filter (Correspondence)

J.A. Kaiser. "Ring Network Filter (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 359-360.

A filter circuit comprising two ring networks which are connected by two quarter-wavelength lines is described. This circuit has one output with a relatively wide pass band and a second output with a sharp rejection band. A printed microstrip version designed for 1-Gc operation is shown in Fig. 1. Input is at terminal 1, band-pass output at terminal 3, and rejection band output at terminal 2.





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A Technique for Obtaining DC Isolation in Coaxial Cable RF Transmission Lines (Correspondence)

R.A. Sparks. "A Technique for Obtaining DC Isolation in Coaxial Cable RF Transmission Lines (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 360-360.

In many applications involving microwave tubes it is desirable to monitor the voltages and currents of the various tube elements. This is particularly true of experimental tubes. The situation may be illustrated by a high voltage pulsed traveling-wave tube in which the collector and body are operated at or near ground level with the cathode at a negative potential. In order to observe current pulses at collector and body it is necessary to ground these points through a series resistor. Since the RF terminals of the device are generally fixed to the body, some form of dc isolation is required on the input and output transmission lines. If the ports are of waveguide construction, one method commonly employed is to place a thin teflon or polyethylene window between two cover flanges which are held together with nylon insulating screws. Tubes with coaxial connectors are usually adapted to waveguide and the above procedure is followed. The technique described below has been developed for obtaining dc isolation quite simply in coaxial cable.



Abstracts

Push-Pull Tunnel Diodes (Correspondence)

L.E. Dickens. "Push-Pull Tunnel Diodes (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 361-361.

Presented in this note is a discussion of the advantages of using a pair of tunnel diodes arranged parallel to the signal and in series to the dc power supply. Large improvements are shown to exist in both dynamic range and large signal stability.



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Effects of Ferrite Strip Mounting Positions on Millimeter Wave Isolator Characteristics (Correspondence)

K. Ishii, J.B.Y. Tsui and F.F.Y. Wang. "Effects of Ferrite Strip Mounting Positions on Millimeter Wave Isolator Characteristics (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 362-362.

The position of the ferrite strip in a field displacement type isolator is an important problem. If x and L are defined as the mounting position of the ferrite strip and the width of the rectangular waveguide, respectively, as shown in Fig. 1, then, according to Soohoo, Lax, Fox, et al., and Button, the optimum value of x ranges from $0.095L$ to $0.27L$. The sign of the directivity (backward to forward ratio of attenuation) for very thin ferrite strip is the same if $x < L/2$.

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An L-Band Loop-Type Coupler (Correspondence)

B. Maher. "An L-Band Loop-Type Coupler (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 362-363.

The design of loop couplers for various loop length has been reported by Lombardini, Schwartz and Kelly. This device is useful for many applications as the over-all length can be held to about 6 inches, whereas a com-parable multihole coupler must be on the order of several feet long. The loop-type device couples a TE/sub 10/ waveguide mode from a RG-69/U to a TEM mode in a 3/8-inch coaxial line. A comb-type coupler, for coupling a coaxial line to TE/sub 10/ waveguide, was reported by Lombardini and Schwartz. This device made use of a multiple-capacitive probe situated in a longitudinal slot in the top wall of the waveguide.

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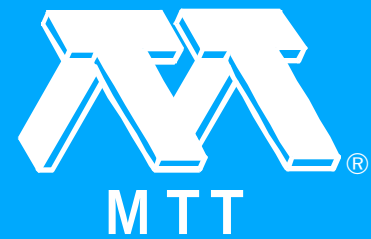


Abstracts

The Cutoff Wavelengths of Composite Waveguides (Correspondence)

G.R. Valenzuela. "The Cutoff Wavelengths of Composite Waveguides (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 363-364.

When electromagnetic waves propagate in waveguides of nonsimple cross section, no exact solution can be obtained by the conventional method of solving the wave equation by separation of variables. In such cases approximations are available such as perturbation methods, variational methods, etc.



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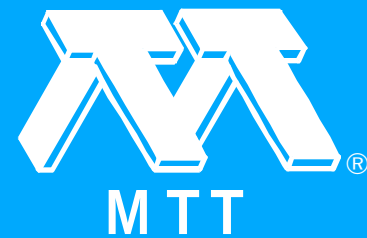


Abstracts

A Mechanical Waveguide Hybrid Phase Shifter (Correspondence)

J.Y. Wong. "A Mechanical Waveguide Hybrid Phase Shifter (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 364-365.

Some interesting results have been obtained on a waveguide-hybrid phase shifter under development for use in an S-band radio-astronomy interferometer antenna.



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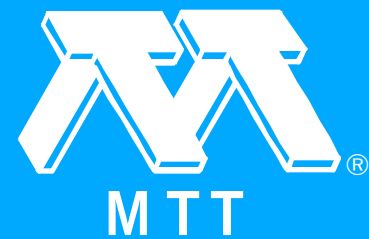
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Rectangular Waveguide Switches (Correspondence)

A. Clavin. "Rectangular Waveguide Switches (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 365-366.

Since the first disclosure by Reggia and Spencer of the rectangular waveguide phase shifter, a number of investigators have presented qualitative analyses describing observed performances. In general, these authors agree on two phenomena that occur. First, upon application of a longitudinal magnetic field to the ferrite (phase-shifter geometry shown in Fig. 1), there is a "trapping" process whereby the RF field is increasingly concentrated in the ferrite acting as if it were a "dielectric" waveguide. Second, there is a mode-conversion process that takes place simultaneously (probably a circularly polarized wave in the ferrite rod) that gives rise to an electric-field component in the ferrite region orthogonal to the electric field in the empty waveguide (TE/sub 10/ mode).

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



Stepped Transformers for Partially-Filled Transmission Lines (Comments)

M.R. Leibowitz, D.J. Sullivan and D.A. Parkes. "Stepped Transformers for Partially-Filled Transmission Lines (Comments)." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 366-367.

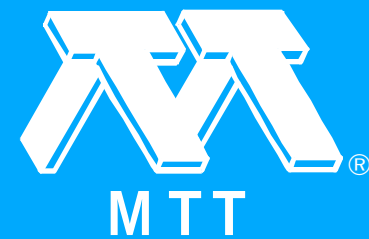
The use of a lumped equivalent circuit for the transverse section of a waveguide has been used to determine the cutoff frequency of ridged guide. In essence, the transverse section of the guide is equated to an LC tank and the resonant frequency of the tank is determined by the usual formula. Sullivan and Parkes have extended this method to the analysis of a ridged guide partially loaded with dielectric. They account for the additional capacitance introduced by the dielectric and include this capacitance as part of the LC tank to be analyzed for the resonant frequency. While the simplified lumped-network equivalents are always desirable in analyzing microwave networks, we should be wary of overgeneralizing them. In the case of dielectric slab loading in a waveguide, the location of the added capacitance as well as its magnitude has an effect in determining the cutoff frequency. (This can also be said of the discontinuity capacitance at the edge of a ridge.) Note how a dielectric slab when centered in a rectangular waveguide will lower the cutoff frequency far more than when flush with the sidewall. This is not accounted for in the LC tank equivalent. The effect of each increment of capacitance due to each lamina of dielectric will be largely determined by the distance from the lamina to the short-circuit walls. Therefore, the author believes that the case of a partially dielectric-loaded guide can only be genuinely analyzed by the transverse resonance method or by some other method which accounts for the distributed parameters involved.



Abstracts

Contributors (Jul. 1961 [T-MTT])

L.P. Bolgiano, Jr., P. Diament, J.J. Faris, P. Foldes, R.C. Hansen, A. Hessel, J.D. Kellett, H.E. King, L. Lewin, A.A. Oliner, F. Reggia, J.M. Richardson, S.P. Schlesinger, R. Stapelfeldt, T.B. Thomson, A. Vigants, M.T. Weiss and F.J. Young. "Contributors (Jul. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 368-370.



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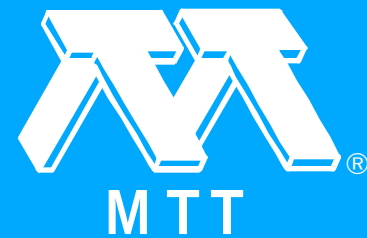


Abstracts

PGMTT News (Jul. 1961 [T-MTT])

"PGMTT News (Jul. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.4 (Jul. 1961 [T-MTT]): 371-371.

There are a few extra copies of the "Digest of Technical Papers" of the 1961 National Symposium still available at \$3.00 per copy. These Digests were a PGMTT Symposium "first" and were described as excellent by those who attended.



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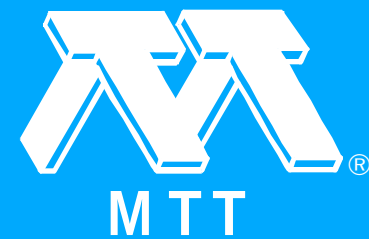
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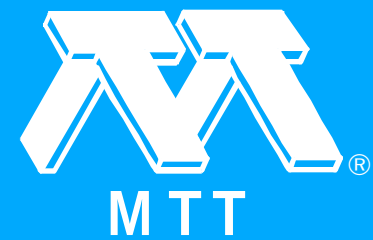
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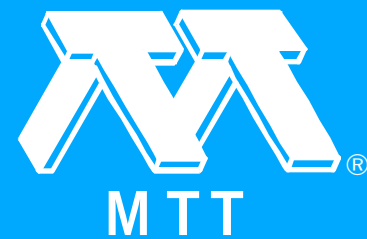


Abstracts

Microwaves--A Review of Progress in Great Britain During 1960

A.E. Karbowiak. "Microwaves--A Review of Progress in Great Britain During 1960." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 374-384.

The fields covered by the review are: Electromagnetic theory as applicable to wave propagation, theory of wave-guides and components, microwaves in fundamental measurements (such as time and atomic constants), designs of components, measurements, solid state devices and a summary of utilization. Future trends are also indicated. The review (with some exceptions) does not cover the following fields: Antennas, propagation and microwave tubes. In reviewing technical publications, preference is given to such aspects of work which are novel, fundamental or are of controversial nature or are likely to influence future trends; where appropriate, criticism of the work is given.



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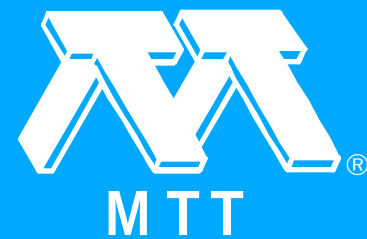


Abstracts

A New Type of Circular Polarizer Using Crossed Dipoles

M.F. Bolster. "A New Type of Circular Polarizer Using Crossed Dipoles." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 385-388.

A method of obtaining a circularly-polarized wave by use of two orthogonal dipoles driven in parallel by a common transmission line is shown. The lengths of the dipoles are so chosen that the real part of their input admittances are equal and the angle of the input admittances differ by 90° . When these two conditions are met the resulting radiated wave in a normal direction will be circularly polarized. The method is applicable both to a circularly-polarized radiating antenna and to the problem of producing a circularly-polarized wave of the TE/sub 1/ mode in a round waveguide. For the first case, an analysis and a method of design are shown, and for the second case an experimentally developed example is given. The second case employs monopoles rather than dipoles for convenience in energizing from a coaxial line.



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Rounded Corners in Microwave High-Power Filters and Other Components

S.B. Cohn. "Rounded Corners in Microwave High-Power Filters and Other Components." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 389-397.

Microwave high-power filters must be operated with internal air pressures of at least one atmosphere, or with a good vacuum. Pressures between these extremes result in reduced powerhandling ability. The breakdown processes for both high air pressure and vacuum are discussed, and it is made clear that any sharp corner on which the electric field would concentrate must be rounded if high-power operation is to be achieved. For good results in vacuum operation, the surfaces must be especially smooth and free of contamination, while in high-pressure operation, minor irregularities are less important. Various high-power filter configurations of importance are described, and the structural corners at which electric-field concentrations occur are pointed out. A number of simplified geometries are then shown that can represent the essential portions of the practical structures with sufficient accuracy for ordinary purposes. Formulas and graphs for these simplified geometries are presented that give the ratio of the maximum electric field strength on the boundary to a uniform reference field strength at a point sufficiently removed from the corner. In some cases, the boundary curve is an approximation to a circular arc, while in other cases a boundary shape is derived such that the electric field strength along the curve is constant. These constant-field-strength boundaries are optimum shapes from the standpoint of power-handling ability.

Click on title for a complete paper.



Abstracts

A Periodic Structure of Cylindrical Posts in a Rectangular Waveguide

E.E. Altshuler. "A Periodic Structure of Cylindrical Posts in a Rectangular Waveguide." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 398-402.

The propagation characteristics of a rectangular waveguide loaded with uniformly spaced cylindrical posts (periodic structure) are investigated at a frequency of 2840 Mc. A qualitative discussion on the expected behavior of the effective guide wavelength of this type of periodic structure is presented, and it is shown that the presence of the posts reduces the guide wavelength of the waveguide. The guide wavelength is then measured as a function of post diameter, post depth, and post spacing; and curves enabling one to design periodic structures which have guide wavelengths in the region of the free space wavelength are presented.



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Modes in Rectangular Guides Loaded with a Transversely Magnetized Slab of Ferrite Away from the Side Walls

G. Barzilai and G. Gerosa. "Modes in Rectangular Guides Loaded with a Transversely Magnetized Slab of Ferrite Away from the Side Walls." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 403-408.

The characteristic equation describing the general modal spectrum for a rectangular guide partially finned with a slab of ferrite transversely magnetized and situated away from the side walls is derived. This equation is numerically solved for particular cases and for modes of zero and first order with respect to the dependence along the direction of the dc magnetic field. Some experiments to verify the theoretical results are presented and show good agreement with the theory.

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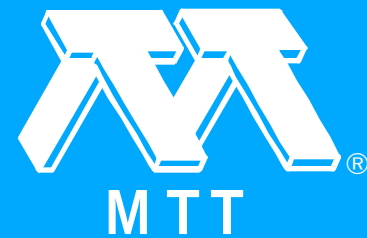


Abstracts

Higher-Order Evaluation of Electromagnetic Diffraction by Circular Disks

W.H. Eggimann. "Higher-Order Evaluation of Electromagnetic Diffraction by Circular Disks." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 408-418.

The problem of the diffraction of an arbitrary electromagnetic field by a circular perfectly-conducting disk has been solved by using a series representation in powers of $k = 2\pi/\lambda$ and the rectangular disk coordinates. The surface current density is given in terms of the field and its derivatives at the center of the disk. General expressions for the electric and magnetic-dipole moments, the farfield and the scattering coefficient for the case of a plane wave at arbitrary incidence are presented. The calculations agree with results published by other authors. A bibliography of the most recent publications on this problem is included.



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Low-Noise Properties of Microwave Backward Diodes

S.T. Eng. "Low-Noise Properties of Microwave Backward Diodes." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 419-425.

This paper describes, for what is believed to be the first time, the low-noise properties of backward tunnel diodes in microwave applications. The physics of the diodes are reviewed together with some of the characteristics and equivalent circuit parameters. The diodes are then considered as mixer diodes with IF in the audio range and also the standard 30-Mc IF. Another promising application considered is the use of the backward diodes in low-level detection. The results show that the noise figure at 13.5 kMc with a 1-kc IF is around 15 db better than any commercially available mixer diodes. Using 30-Mc IF, the noise figure of backward diode mixers is without special optimum design, comparable to the best mixer diodes on the market. Of great importance, especially in micro-miniaturization, is the fact that these diodes may be used with a very low local oscillator power (50 μ w or less). The high nonlinearity of the I-V characteristic at the origin and the low 1/f noise properties of these diodes are also of benefit in crystal video receivers and other low-level detector applications.



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Design Theory of Up-Converters for Use as Electronically-Tunable Filters (Sep. 1961 [T-MTT])

G.L. Matthaei. "Design Theory of Up-Converters for Use as Electronically-Tunable Filters (Sep. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 425-435.

The up-converters discussed use a single diode, a wide-band impedance matching filter at their signal input, a moderately wide-band impedance matching filter at their pump input, and a narrow-band filter at their sideband output. With a narrow-band filter at the sideband output, the frequency which will be accepted by the amplifier can be controlled by varying the pump frequency. Analysis of the impedance matching problem involved shows that tuning ranges of the order of a half-octave to an octave are possible. Theory is presented for both the lower-sideband and upper-sideband types of tunable up-converters and for the design of the required impedance matching networks. It is shown that, because of the pump input bandwidth required, it will generally be necessary to accept some mismatch at the pump input. But, by use of a properly designed impedance matching filter, the reflection loss can be kept nearly constant across the pump band, and the incident pump power required is not unreasonable. It is seen that properly designed devices of this type using voltage-tunable pump oscillators should have wide tuning range, fast tuning capability a useful amount of gain, no image response, and a low noise figure.

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Anisotropic Properties of Strip-Type Artificial Dielectric

N.J. Kolettis and R.E. Collin. "Anisotropic Properties of Strip-Type Artificial Dielectric." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 436-441.

Theoretical formulas for the propagation phase constant of a two-dimensional strip medium are presented for general directions of propagation. In addition a number of experimental results are included that verify the validity of the theory. Some of the difficulties encountered in defining equivalent dielectric constants for this medium are also pointed out.

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Optimization of Waveguide Tapers Capable of Multimode Propagation

C.C.H. Tang. "Optimization of Waveguide Tapers Capable of Multimode Propagation." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 442-452.

By converting Maxwell's equations, the general case of mode conversion in tapered waveguides is treated by matrix formulation in terms of an infinite set of coupled differential equations with nonuniform coupling coefficients and varying phase constants. An "orthogonalization" or "diagonalization" process is introduced through a nonlinear matrix transformation which is a function of taper length. The general matrix solution of the problem is obtained through a perturbation method in the form of an integral equation of the Volterra type, and the integral equation is solved by an iteration method. In view of the difficulties in finding eigenvalues, the problem is then reduced to the two-mode case, and the mode conversion is obtained in an explicit form revealing certain information which characterizes the choice of "mode-conversion distribution function." Optimization is first obtained through proper choice of the mode-conversion distribution function. In an attempt to approximate a Tchebycheff mode-conversion response, further optimization is realized by creating "new zeros" and thereby changing the density of the distribution of zeros in the vicinity of the origin of the mode-conversion curve and the nature of the optimization procedure essentially becomes that of synthesis. Through using the optimized distribution function, a total reduction of about 50 per cent in taper length is realized (when compared with the cosine-squared distribution) for the case of 50-db prescribed-mode discrimination in a taper connecting a 7/8-in ID waveguide to a 2-in ID waveguide operating in the circular electric mode up to 75 kmc.

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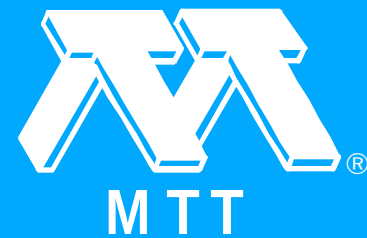


Abstracts

A Broad-Band Coaxial Ferrite Switch (Correspondence)

R.L. Booth. "A Broad-Band Coaxial Ferrite Switch (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 452-453.

A broad-band strip-line reflective ferrite switch has been described by Johnson and Wiltse, who also referred to the possibility of a similar switch in coaxial line. This note describes a coaxial on-off switch which will operate over the band 2500-4100 Mc; two such units can be combined to make a two-way switch. An isolation of 40 db was achieved, with a very low loss for the transmitting path, which, in both these devices, was obtained by magnetizing the ferrite well beyond the value for isolation.



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Abstracts

Conditions for Maximum Power Transfer (Correspondence)

C. Shulman. "Conditions for Maximum Power Transfer (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 453-454.

It is sometimes of interest to ask for the conditions of maximum power transfer from a fixed source into a load constrained to vary over an arbitrary contour in the impedance plane. There exists a simple graphical solution to this question as shown below. Consider the circuit shown in Fig. 1.



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A Comment on the Scattering Matrix of Cascaded 2n-Ports (Correspondence)

D.J.R. Stock and L.J. Kaplan. "A Comment on the Scattering Matrix of Cascaded 2n-Ports (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 454-454.

Epprecht calculated the scattering matrix of two cascaded two-ports. Redheffer does the same for the 2n-port using non-standard notation. This note will comment on the physical interpretation of the constituents of the resultant-scattering matrix.



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Use of Flow Graphs to Evaluate Mismatch Errors in Loss and Phase Measurements (Correspondence)

D. Leed. "Use of Flow Graphs to Evaluate Mismatch Errors in Loss and Phase Measurements (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 454-454.

The purpose of this note is to show how the signal flow graph technique illustrated by Hunton leads quite naturally to an expression for error due to mismatch when measuring insertion loss and phase.



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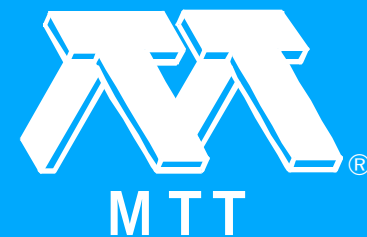
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Contributors (Sep. 1961 [T-MTT])

E.E. Altshuler, G. Barzilai, M.F. Bolster, S.B. Cohn, R.E. Collin, S.T. Eng, W.H. Eggimann, G. Gerosa, A.E. Karbowski, N.J. Kolettis, G.L. Matthaei and C.C.H. Tang. "Contributors (Sep. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.5 (Sep. 1961 [T-MTT]): 455-456.



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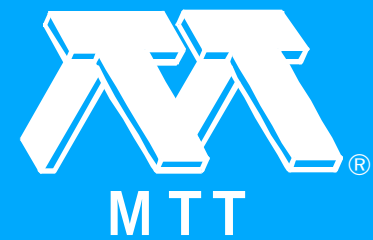
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"Table of Contents (Nov. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 457-457.



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Microwave Prize (Nov. 1961 [T-MTT])

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Passive Phase-Distortionless Parametric Limiting with Varactor Diodes

I.T. Ho and A.E. Siegman. "Passive Phase-Distortionless Parametric Limiting with Varactor Diodes." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 459-472.

The theory of passive parametric limiting with a varactor diode as the nonlinear element is developed and verified experimentally. The limiting is found to be flat and phase-distortionless. Expressions are given for threshold level, dynamic range, bandwidth, and power dissipation. The transient phenomena, comprising leading- and trailing-edge leakage spikes, are studied theoretically and experimentally, and found to be small in typical instances. Experimental results reported upon include a simple waveguide limiter structure at S band; a lumped-circuit limiter at 126 Mc; and a strip-line limiter using a pill varactor at S band. The latter has an insertion loss of 2.5 db below threshold, a threshold level of 2 mw, a dynamic range in excess of 20 db, and less than 5° of phase distortion. Agreement between theory and experimental results is excellent.

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Solid-State X-Band Power Limiter

W.F. Krupke, T.S. Hartwick and M.T. Weiss. "Solid-State X-Band Power Limiter." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 472-480.

An X-band solid-state power limiter has been designed and built to protect receiver crystals from high-power microwave pulses in the kilowatt region. This passive and reliable crystal protection has been achieved by utilizing the nonlinear properties of both ferrites and semiconductor diodes. An understanding of the ferrite nonlinear mechanism, which gives rise to the characteristically large leakage spike, has been achieved and quantitatively described. This formulation resulted in an essentially optimized high-power ferrite limiter, whose mode of operation is qualitatively understood. Use of this ferrite limiter for crystal protection requires a fast response, lower threshold secondary-limiting unit, which was developed by using semiconductor diodes for power limiting in a reactive mode of operation. The ferrite and diode limiters were combined in a single device with an over-all insertion loss of 2.0 db and a 200-Mc operating "bandwidth."

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Abstracts

On Spurious Outputs from High-Power Pulsed Microwave Tubes and Their Control

K. Tomiyasu. "On Spurious Outputs from High-Power Pulsed Microwave Tubes and Their Control." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 480-484.

Excessive spurious outputs from high-power pulsed magnetrons, klystrons and traveling-wave tubes can cause intolerable interference and deleterious effects in a high-power microwave system. The harmonic output from a klystron may vary appreciably with changes in operating conditions. Harmonic outputs from tubes cannot be eliminated but their radiation can be significantly reduced by using filters. If the parasitic or spurious oscillations are very strong, adverse effects such as amplitude and phase instability of the fundamental frequency output may occur. Some of the spurious outputs may be reduced or eliminated by redesign of the tube or its modulator.



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Practical Design and Performance of Nearly Optimum Wide-Band Degenerate Parametric Amplifiers (Nov. 1961 [T-MTT])

M. Gildea and G.L. Matthaei. "Practical Design and Performance of Nearly Optimum Wide-Band Degenerate Parametric Amplifiers (Nov. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 484-490.

The design of a two-resonator single-diode degenerate parametric amplifier is described, which incorporates features that give it nearly optimum wide-band performance. These features include the use of almost lumped circuit elements, a separate pump resonator which is very lightly coupled to the diode and pump circuits, and a diode resonated in series rather than in shunt, from which several advantages accrue. A bandwidth of 21 per cent with 15-db midband gain (double channel) is obtained at 1 Gc using two resonators, as compared with 8 per cent using one resonator. Both measured responses are found to be in excellent agreement with theoretical responses obtained with a digital computer. The measured double-channel noise figure was 1 db. Theoretical and experimental results are presented which show this type of amplifier to be remarkably insensitive to tuning errors. Good results were also obtained using two identical amplifiers in balanced operation with a 3-db coupler so as to eliminate the need for a circulator.



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Transmission-Phase Relations of Four-Frequency Parametric Devices

D.B. Anderson and J.C. Aukland. "Transmission-Phase Relations of Four-Frequency Parametric Devices." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 491-498.

The gain, bandwidth, and excess noise temperature properties of parametric amplifiers are generally known. However, a knowledge of their transmission-phase properties is also essential for the effective application of parametric amplifiers to angular detection systems, such as monopulse radars and interferometers. These angle detection systems derive even, odd, and quadrupolar spatial components of the antenna diffraction patterns. The differential amplitude and differential phase between these signal components contain the spatial information of position, extent, and shape of the target. Consequently, to employ parametric transducers in certain systems requires an understanding of the transmission phase properties which are delineated in this paper. The analysis follows the matrix representation of a nonlinear capacitive susceptance, four-frequency transducer wherein due note is taken of the phases. The transmission-phase relations are written which include the effects of nonzero port susceptance and nonlinear reactance element losses. At midband without losses, the relations reduce to easily remembered equations which are significant to the application of parametric transducers in phase-sensitive systems. Some applications and experimental results are cited.

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A Plasma Guide Microwave Selective Coupler (Nov. 1961 [T-MTT])

W.H. Steier and I. Kaufman. "A Plasma Guide Microwave Selective Coupler (Nov. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 499-506.

A new type of microwave coupler has been investigated in the X-band and S-band ranges. In this coupler, a gas discharge tube passes through two rectangular waveguides that are separated by some distance. A metal cylinder surrounds the discharge tube in the separation space. The coupling of microwave power via this plasma guide coupler can be varied electronically over a range greater than 30 db. Pulsed power levels of more than 100 w can be handled. When operated as a switch, a switching time of from 2 to 5 μ sec has been observed. This paper describes some of the operating characteristics that have been observed, an approximate theory of operation, and measurements pertinent to a complete description of the coupler.

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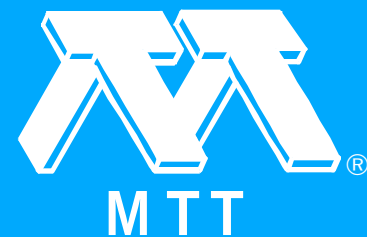


Abstracts

High-Power Duplexers

C.E. Muehe, Jr.. "High-Power Duplexers." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 506-512.

The various circuit arrangements used in duplexers are analyzed in terms of their power-handling ability in two situations: first, where the bandwidth is narrow so that insertion loss determines maximum Q, and second, where large bandwidths are required and the maximum Q is determined by available Q band-width products. In both cases the ATR duplexer has an advantage. Arc loss was measured for folded cylinder TR tubes. At medium current densities the results agree well with experimental measurements in dc positive columns. At high current densities a constant conductivity is reached. Graphs of power-handling ability for a unity coupler duplexer using different methods of cooling are presented. It is shown that the requirements for easy firing and long life limit the achievable recovery time.



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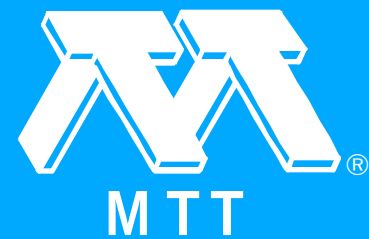
[Authors](#)

Quasi-Optical Surface Waveguide and Other Components for the 100- to 300-Gc Region

F. Sobel, F.L. Wentworth and J.C. Wiltse. "Quasi-Optical Surface Waveguide and Other Components for the 100- to 300-Gc Region." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 512-518.

Components and techniques for the generation, transmission, and detection of energy in the 100- to 300-Gc frequency region were investigated theoretically and experimentally. The design and construction of fundamental components, such as harmonic generators and detectors, were necessary since many items are not available commercially. A detailed theoretical analysis was performed for the propagation characteristics of single-conductor transmission lines, and attenuation calculations were made for several dielectric image lines. Experimental measurements were made at 105 and 140 Gc on these two types of surface waveguides. Attenuation of these lines is compared with that of dominant-mode rectangular waveguide. An analysis of phase-correcting Fresnel zone plates was carried out, and several zone plates were designed, constructed and successfully tested at frequencies of 140, 210, and 280 Gc. Zone plates were used at several frequencies to make relatively long path transmission measurements and were also used in a specially designed Michelson interferometer. The frequency stability of the source klystron and the dielectric properties of a number of plastic materials were determined by measurements made with the interferometer. A method of frequency filtering by focal isolation was demonstrated with this equipment.





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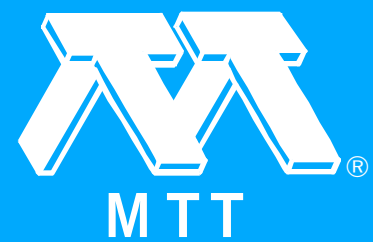
Broad-Band Isolators and Variable Attenuators for Millimeter Wavelengths

C.E. Barnes. "Broad-Band Isolators and Variable Attenuators for Millimeter Wavelengths." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 519-523.

A longitudinally magnetized rod of ferrite has been used as a dielectric waveguide which provides Faraday rotation independent of frequency in the band from 50 to 60 kMc. This rotator has been incorporated into broad-band isolators with forward losses of 1 db and reverse losses greater than 30 db with return losses of approximately 20 db over the band. It has also been used in a variable attenuator with a minimum loss of 1 db and a maximum loss greater than 30 db which is essentially constant over the band. Advantages of this type of rotator at millimeter wavelengths include bandwidths in excess of 20 per cent, low field requirements (25-50 /spl oelig/), relatively large dimensions, the use of common ferrites, and the absence of conducting waveguide walls which permits rapid switching of the control field. The last feature has been utilized in an automatic power leveling system capable of removing variations of several kc frequency content from the swept output of a millimeter wave BWO.

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A New High-Precision Method for the Measurement of the VSWR of Coaxial Connectors

A.E. Sanderson. "A New High-Precision Method for the Measurement of the VSWR of Coaxial Connectors." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 524-528.

A substitution method of measuring the very small reflections due to a pair of precision coaxial connectors has been developed. The connectors under test are mounted on a section of precision air line which serves as the impedance reference standard. The electrical length of this line, including connectors, is a multiple of one-half wavelength at the frequency of measurement. A slotted line and a termination, both having the same type connectors as those under test, are required. With the aid of an auxiliary slide-screw tuner, the slotted line and the termination are matched to each other. The output of the slotted line is then plotted by a graphic level recorder having an expanded-scale presentation and a mechanical linkage between the chart drive and the probe on the slotted line. The section of air line fitted with the connectors under test is then placed between the slotted line and the termination, and a second curve is recorded. The slotted line and termination errors still cancel each other, and any errors due to variations in probe coupling along the line also cancel out. The difference between the initial curve and the second curve represents the mismatch of the connectors under test with respect to the precision air line. With a recorder having a scale expansion of 2 per cent full scale, VSWR's as low as 1.001 are easily discernible.

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Hybrid-Ring Directional Coupler for Arbitrary Power Divisions

C.Y. Pon. "Hybrid-Ring Directional Coupler for Arbitrary Power Divisions." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 529-535.

A directional coupler in the form of a hybrid ring is described in this paper. A theoretical analysis using the scattering matrix has been carried out and experimental verification of the theoretical result has been achieved in a stripline network. Simple design equations which enable one to design a directional coupler with any degree of coupling have been derived. This coupler differs from the commonly used couplers in that the voltages at the output arms are either in-phase or opposite-phase with respect to each other. In addition, its geometrical symmetry makes it very convenient for use in symmetrical networks, particularly as a power divider in antenna feeding systems.

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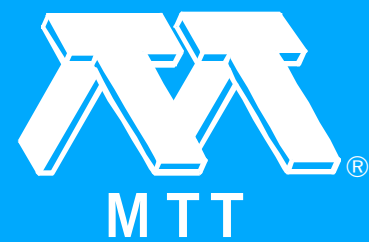
A Coupled Strip-Line Configuration Using Printed-Circuit Construction that Allows Very Close Coupling

W.J. Getsinger. "A Coupled Strip-Line Configuration Using Printed-Circuit Construction that Allows Very Close Coupling." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 535-544.

A new strip-line configuration is presented, applicable to printed-circuit construction, that allows very close coupling to be achieved without resorting to very small coupling gaps and excessively critical dimensions. Graphs of even- and odd-mode fringing capacitances are given. These graphs can be used with simple formulas, which also are given, to determine the dimensions of the configuration that will give specified even- and odd-mode characteristic impedances or shunt capacitances. The usefulness of the graphs and formulas was demonstrated by using them to design 3-db backward-couplers. The performance of the couplers in this new configuration was typical of similar couplers made in more conventional configurations, as expected. However, the devices shown have an advantage in that they can be manufactured by relatively inexpensive and rapid printed-circuit methods and, since the region between the conductors is solid dielectric, they are unusually rugged.

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The Measurement of Conductivity and Permittivity of Semiconductor Spheres by an Extension of the Cavity Perturbation Method

K.S. Champlin and R.R. Krongard. "The Measurement of Conductivity and Permittivity of Semiconductor Spheres by an Extension of the Cavity Perturbation Method." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 545-551.

A technique based on cavity perturbation theory is described with which one can determine the microwave conductivity and dielectric permittivity of a small sphere of completely arbitrary conductivity. These properties follow from the measured frequency shift and quality change occurring when the sample is inserted into a region of maximum electric field in a cavity resonator. The range of validity of the quasi-static internal field approximation is discussed, and curves are provided for extending the measuring technique beyond this range. The extended theory is valid for the entire conductivity range from zero to infinity. Measurements on several samples of known conductivity and permittivity in which the approximation is not satisfied are seen to agree with the theory. For highly conductive materials, the present method is closely related to the "eddy current loss" measuring technique discussed by others. The two methods are compared from the point of view of perturbation theory in order to determine their relative merits. Because the measuring technique employs a spherical sample, it may be applied profitably to materials with nonisotropic carrier mobilities and to semiconducting materials for which contact fabrication techniques are poorly known.

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The Dominant Cutoff Wavelength of a Lunar Line

A.Y. Hu and A. Ishimaru. "The Dominant Cutoff Wavelength of a Lunar Line." 1961
Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 552-556.

A method is presented for calculating the lowest cutoff wavelength of a new microwave transmission line, the "lunar line," which is formed by two eccentric circular metal tubes connected with a metal bar or tangential to each other. The lunar-shaped cross section is approximated by introducing a series of steps in the outer guide wall and by dividing the cross section into m fan-shape regions. Thus, the problem is reduced to one of a multiple-step waveguide and can be solved by introducing the angular parameter α_i for the individual regions. The radial boundary conditions require a combination of Bessel functions of noninteger order for each region. The common boundaries between regions give m integral equations that represent the total power in one region transferred into the next region. The integral equations are solved approximately by solving only the first terms of an infinite series expansion of the tangential electric field at the common boundary. The solution of the m -stepped waveguide results in a system of $2m$ equations containing $2m$ unknowns: the cutoff wave number β_c , the order of the Bessel function p_i , and the angular parameter α_i . A successive approximation method is applied to obtain the cutoff wavelength. The calculated value is in close agreement with experimental results.

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The Negative-Conductance Slot Amplifier

M.E. Pedinoff. "The Negative-Conductance Slot Amplifier." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 557-566.

It has been suggested that the incorporation of active solid-state devices into the elements of an antenna may lead to the simplification of the over-all microwave system and at the same time to a reduction in size, power and weight requirements. This paper will discuss several approaches to a study of the microwave properties of a slotted antenna element shunted by a tunnel diode biased into its negative-conductance region. The first approach involves calculation of the lumped parameter equivalent circuit of the slot amplifier system at resonance and can be extended to determination of the gain bandwidth and noise performance of the device, whereas the second approach is concerned with the admittance of the slot and the diode as a function of frequency over a wide frequency range. The latter method of analysis successfully predicts the conditions of oscillation and amplification at fundamental as well as higher frequency resonances and leads to a method for stabilization of the system. Preliminary experimental results indicate a transmission gain of 21.5 db at 2.7 kMc with a Hughes Number PC-3 GaAs tunnel diode in the slot amplifier.

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Measurement of the Conversion Conductance of Esaki Mixer Diodes (Correspondence)

R.A. Pucel. "Measurement of the Conversion Conductance of Esaki Mixer Diodes (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 567-568.

In order to compare the theoretically predicted and the experimentally observed behavior of frequency converters using Esaki diodes, it is necessary to evaluate various mixer parameters, in particular, the conductance elements of the conversion matrix. It is well known, these conductance elements are certain Fourier coefficients of the periodic series representing the incremental time-varying diode conductance. This conductance is produced by the large local oscillator (LO) voltage acting on the non-linear diode. Although one can determine these element values using a numerical Fourier analysis, this approach is both time-consuming and laborious. As an alternative, we suggest an experimental technique originally proposed by Dicke over ten years ago for use with conventional (positive-conductance) crystal mixer diodes. Since this method is quite easy to apply in that it only involves several low-frequency bridge measurements and one standing-wave measurement, and since, apparently, it is not well known, we shall risk repetition by describing a simplified version of it which we have modified to apply to Esaki diodes.

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A Versatile Phase Measurement Method for Transmission-Line Networks (Correspondence)

P. Lacy. "A Versatile Phase Measurement Method for Transmission-Line Networks (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 568-569.

Current phase-measurement methods for transmission-line circuits fall into two general categories. The first is the comparison method, where the path under measurement is compared with another calibrated, variable one. The phase shift through the variable path is adjusted to equal that of the unknown path, and this condition is shown by a null detector. Null indication by both phase and amplitude adjustment is usually required; however, null indication by phase adjustment alone can be effected. The second category of phase measurements includes those measurements which provide voltage or meter output indication of phase angle. This category includes direct high frequency phase-detector circuits of limited frequency phase-detector circuits of limited frequency range or frequency-conversion methods where analog or digital circuits measure phase at a converted lower frequency.

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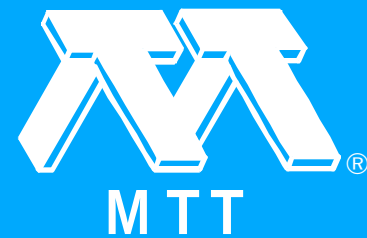


Abstracts

A VHF High-Power Y-Circulator (Correspondence)

G.V. Buehler and A.F. Eikenberg. "A VHF High-Power Y-Circulator (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 569-570.

A number of articles on the theory, design and application of three-port circulators may be found in the literature. Specific devices of this kind are commercially available for low signal power levels. In this letter a high-power version of a three-port or V-circulator is presented. The characteristics measured at high power are compared with measurements performed at low power.



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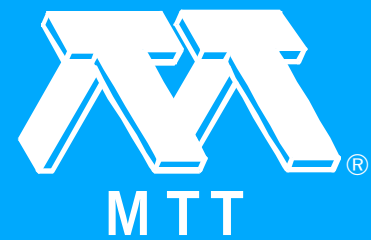


Abstracts

N-Terminal Power Divider (Correspondence)

R.W. Peterson. "N-Terminal Power Divider (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 571-571.

Recently Wilkinson has described an N-way hybrid power divider which decouples the outputs.



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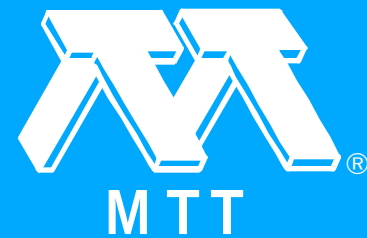


Abstracts

10-DB $X/\text{sub } L$ Cross Guide Coupler (Correspondence)

RZ. Gerlack. "10-DB $X/\text{sub } L$ Cross Guide Coupler (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 571-571.

Two interesting points were noted while working with half-height cross guide couplers. The first was that if the same size coupling holes were used as in the full size waveguide, coupling was increased approximately 3 db. The second, and more important, was that the value of coupling was much more constant over a given frequency band, with essentially no change in directivity.



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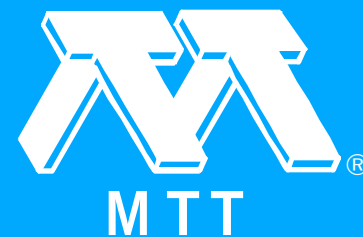


Abstracts

Design Note on an L-Band Strip-Line Circulator (Correspondence)

W.S. Koop and A.K. Jordan. "Design Note on an L-Band Strip-Line Circulator (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 571-572.

The technique of using magnetized yttrium-iron-garnet slabs in dielectrically-loaded strip transmission line as the reciprocal elements in a UHF and low-microwave frequency, 4-port circulator has been demonstrated most effectively by Arams, et al. This communication reports the results of an independent and concurrent development program at our laboratory which led to a similar L-band circulator using a some what different configuration.



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A Stepped-Dielectric Transformer for Rectangular-to-Circular Waveguide (Correspondence)

B. Maher. "A Stepped-Dielectric Transformer for Rectangular-to-Circular Waveguide (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 572-573.

A low-reflection transition between rectangular waveguide and circular guide can be made using a teflon transformer inserted into the circular guide. The transformer to be described was designed to mate a circular guide with WR(112) rectangular waveguide. A stepped-dielectric transformer of this type for WR(90) waveguide was reported by Olin and a stepped-dielectric transformer inserted in a rectangular waveguide was reported by Whiteman, et al.

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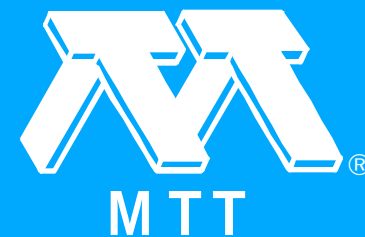


Abstracts

A Microwave Power Divider (Correspondence)

R.J. Mohr. "A Microwave Power Divider (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 573-573.

Recent literature has described the theoretical performance of unmatched power dividers.



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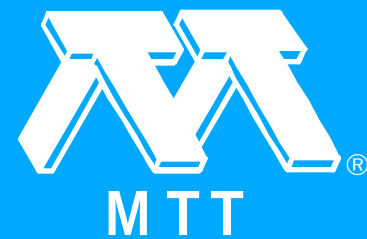


Abstracts

On the Efficiency of the Excitation of Surface Waves by Distributed Coupling (Correspondence)

E. Ravid-Weissberg. "On the Efficiency of the Excitation of Surface Waves by Distributed Coupling (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 573-575.

The excitation of surface waves on reactive surfaces is accompanied by loss of power which is radiated directly from the region of the feed. Since a surface wave supported by a surface wave line is a (nonhomogeneous) plane wave, it cannot be excited as the only field of a current distribution of finite size and amplitude.



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Higher-Order Mode Resonances in Strip-Line Y-Junction Circulators (Correspondence)

A. Clavin. "Higher-Order Mode Resonances in Strip-Line Y-Junction Circulators (Correspondence)." 1961 *Transactions on Microwave Theory and Techniques* 9.6 (Nov. 1961 [T-MTT]): 575-575.

Because of its small physical size, the Y-junction circulator has been the recipient of a great amount of investigation. Various theorists and experimentalists have devoted time to understanding the behavior of this device, both on the far and near side of ferrimagnetic resonance.



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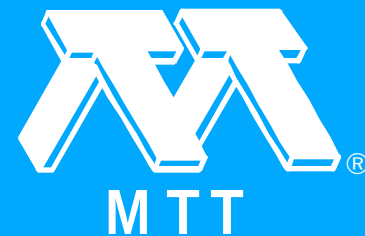


Abstracts

A Proposed Design to Enhance Microwave-Power-Limiter Characteristics (Correspondence)

W.H. Wright, Jr.. "A Proposed Design to Enhance Microwave-Power-Limiter Characteristics (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 575-576.

A design is proposed for a device which would enhance the properties of presently available microwave power limiters, thereby making their use as crystal protectors in duplexing units of microwave systems more desirable. This design is a combination of a power-sensitive, nonlinear element with a traveling-wave ring resonator.



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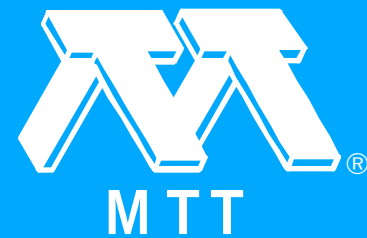


Abstracts

A High-Power Coaxial Ferrite Phase Shifter (Correspondence)

A.S. Boxer, S. Hershenov and E.F. Landry. "A High-Power Coaxial Ferrite Phase Shifter (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 577-577.

An L-band, reciprocal, coaxial, ferrite phase shifter with a low insertion loss, excellent high-power stability at peak power levels up to at least 300 kw, and a figure-of-merit in excess of 1000 has been developed. These characteristics were achieved by using longitudinal biasing fields considerably greater than the field required for resonance.



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A Duplexer Using the Zero Permeability Characteristics of Ferrite (Correspondence)

L.K. Wilson and G.J. Neumann. "A Duplexer Using the Zero Permeability Characteristics of Ferrite (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 578-578.

It has been shown by Polder and others that a ferrite material can be made to exhibit an effective zero permeability to a wave that has a positive sense of circular polarization (positive wave) and a corresponding nonzero permeability to a wave with polarization in the negative sense (negative wave). Melchor, et al., and Duncan and Swern have demonstrated that a ferrite material which is magnetically biased such that the real part of its positive wave permeability is zero will largely exclude the positive wave. The negative wave, however, will be concentrated in the ferrite; and, under certain conditions of ferrite geometry and operating frequency, the negative wave will propagate through the ferrite in a dielectric mode.





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A Series-Connected Traveling-Wave Parametric Amplifier (Correspondence)

T.H. Lee. "A Series-Connected Traveling-Wave Parametric Amplifier (Correspondence)." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 578-579.

The conventional parametric amplifier consisting of a single variable element with its accompanying resonant circuits is inherently a narrow-band device. Analysis has also shown that such amplifiers when operating at high gain are extremely sensitive to pump power, i.e., small variations in pump power lead to large variations in gain. Traveling-wave parametric amplifiers, in which not one but many variable elements are involved, have been designed or built to overcome the two limitations mentioned above. This paper is concerned with the analysis of one such amplifier in which the variable elements are placed in series with the signal line as opposed to one in which the elements are placed in shunt. In particular, the variable elements are capacitance diodes.

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Abstracts

1961 PGMTT National Symposium (Nov. 1961 [T-MTT])

"1961 PGMTT National Symposium (Nov. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 580-581.

The 1961 PGMTT National Symposium was held on May 15, 16, and 17, 1961, at the Sheraton Park Hotel in Washington, D. C. Planning for this Symposium began more than a year before the meeting; the Symposium Committee was formed in March, 1960.



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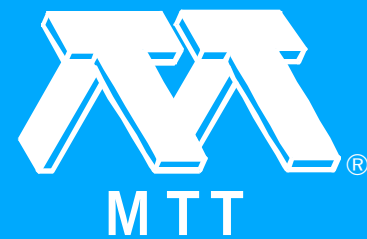
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Abstracts

Contributors (Nov. 1961 [T-MTT])

D.B. Anderson, J.C. Aukland, C.E. Barnes, K.S. Champlin, W.J. Getsinger, M. Gilden, T.S. Hartwick, I.T. Ho, A.Y. Hu, A. Ishimaru, I. Kaufman, R.R. Krongard, W.F. Krupke, C.E. Muehe, Jr., M.E. Pedinoff, C.Y. Pon, A.E. Sanderson, A. Siegman, F. Sobel, W.H. Steier, K. Tomiyasu, M.T. Weiss, F.L. Wentworth and J.C. Wiltse. "Contributors (Nov. 1961 [T-MTT])." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): 582-585.



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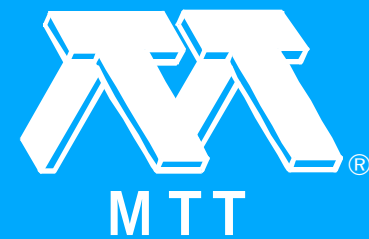
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Abstracts

Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-9, 1961

"Index, IRE Transactions on Microwave Theory and Techniques, Volume MTT-9, 1961." 1961 Transactions on Microwave Theory and Techniques 9.6 (Nov. 1961 [T-MTT]): i-v.



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Front Cover (1961 [MWSYM])

"Front Cover (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): f1-f1.



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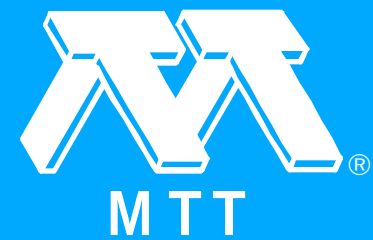
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Copyright (1961 [MWSYM])

"Copyright (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): i-v.



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Abstracts

A Word from the Symposium Chairman

R.O. Stone. "A Word from the Symposium Chairman." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): iii-iii.

Within the memory of many of us, radio was the upstart offspring of electrical engineering and microwaves were no more than an oddity. Yet today, the IRE Professional Group on Microwave Theory and Techniques has attracted almost 1000 scientists and engineers from all over the country to its National meeting.



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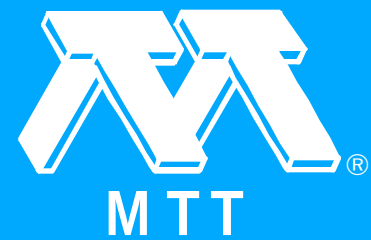
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Table of Contents (1961 [MWSYM])

"Table of Contents (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): iv-iv.



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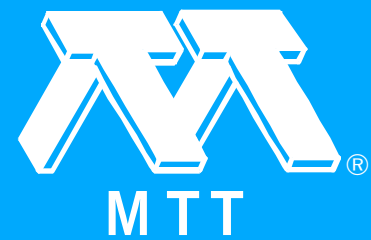
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Abstracts

Quasi-Optical, Surface-Wave Guide, and Other Components for the 100 to 300 kmc Region

F. Sobel and J.C. Wiltse. "Quasi-Optical, Surface-Wave Guide, and Other Components for the 100 to 300 kmc Region." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 1-2.

Analytical and experimental studies were carried out to assess the value of various components and techniques in the frequency range from 100 to 300 kmc. The basic instrumentation consisted of adaptations of conventional rectangular waveguide devices, and signal power was provided by crystal harmonic generators driven with a few tens of milliwatts at a fundamental frequency of either 35 or 70 kmc. When silicon crystals are employed with video detection, output signal levels have a dynamic range of about 45 db above noise at 105, 140, and 210 kmc and somewhat less at 280 kmc. In an effort to obtain improvement, experiments are underway with gallium arsenide and other crystals.



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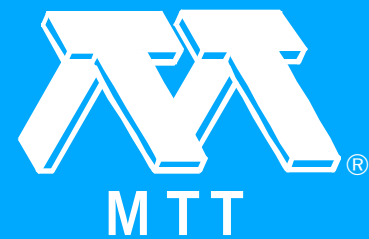
A Millimeter Wave Fabry-Perot Maser

W. Culshaw and R.C. Mockler. "A Millimeter Wave Fabry-Perot Maser." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 3-4.

So far a major limitation to the development of millimeter, and sub-millimeter wavelength beam masers, has been the lack of a suitable high Q resonant structure of adequate dimensions for these wavelengths. This is necessary so that a sufficient number of state-selected molecules can be injected into the resonant structure, for the weak molecular stimulated power emission to exceed losses, and give maser oscillation or detectable amplification. Recent developments in Fabry-Perot interferometers, or resonators for millimeter research, appear very significant for such maser applications, and indicate the possibility of operating such devices at shorter wavelengths, utilizing rotational transitions in molecules such as HCN, and NH/sub 3/.

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Broadband Isolators and Variable Attenuators for Millimeter Wavelengths

C.E. Barnes. "Broadband Isolators and Variable Attenuators for Millimeter Wavelengths." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 5-6.

A Faraday rotator has been developed which provides rotation independent of frequency in a band greater than 20% centered at 55 kmc. The loss characteristics plotted in Fig. 1 are typical for broadband variable attenuators incorporating this rotator. The minimum and maximum loss characteristics are for fixed fields of 0 and ~30 oe, respectively. Figure 2 contrasts the performance of a broadband isolator (solid curves) utilizing this rotator with a "conventional" Faraday rotation isolator (dashed curves). The broadband isolator has a forward to reverse loss ratio >30 over a band 10 times as great as that for the "conventional" rotator and from 3 to 5 times greater than any other isolator known, to the author, to operate at these frequencies.

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Transmission Phase Relations of Four-Frequency Parametric Devices

D.B. Anderson and J.C. Aukland. "Transmission Phase Relations of Four-Frequency Parametric Devices." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 7-8.

The transmission-phase properties of parametric amplifiers are tantamount to gain, bandwidth, excess noise temperature, and pump power in angular detection systems such as monopulse radars and interferometers. These angle detection systems employ antenna and hybrid junction labyrinths which derive even and odd spatial components of the antenna diffraction pattern. The labyrinth ports usually supply even, elevation odd, azimuth odd, and quadrupolar components. The source signal or target echo, differential amplitude and differential phase, between labyrinth ports contain spatial information of position, extent, and shape of the target. Consequently, to employ the potential of parametric devices in monopulse detection systems requires an understanding of the transmission phase properties of parametric devices. It is the purpose of this paper to delineate these properties.

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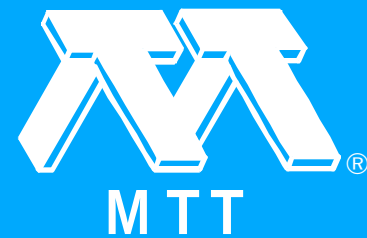


Abstracts

A Traveling Wave Parametric Amplifier

T.H. Lee. "A Traveling Wave Parametric Amplifier." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 9-10.

This paper is concerned with the analysis of a broadband traveling wave parametric amplifier in which the variable elements are connected in series with the signal line as opposed to one in which the elements are in shunt. In particular, the variable elements are taken to be variable in capacitance diodes.



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Abstracts

A Novel Traveling-Wave Parametric Amplifier

R.C. Honey. "A Novel Traveling-Wave Parametric Amplifier." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 11-12.

The traveling-wave parametric amplifier to be described in this paper consists of a TEM line-over-plane transmission line periodically shunted by eight varactor diodes to propagate the signal and idler frequencies and a wave guide paralleling this transmission line to propagate the pump frequency. The pump power is lightly coupled to each diode by means of probes, the sign of the coupling alternating from diode to diode. This effectively introduces an additional 180-degrees phase shift per section along the pump line, producing several interesting features of this simple configuration.



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Practical Design and Performance of Nearly Optimum Wideband Degenerate Parametric Amplifiers (1961 [MWSYM])

M. Gilden and G.L. Matthaei. "Practical Design and Performance of Nearly Optimum Wideband Degenerate Parametric Amplifiers (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 13-14.

The design and performance of degenerate parametric amplifiers is described as that in which large bandwidth is achieved through the use of multiple-resonators as suggested by Seidel and Herrmann. However, instead of setting frequency derivatives of the gain function equal to zero, filter-theory design procedures as developed by Matthaei were used. These design procedures have been verified by the authors with a single-diode degenerate amplifier operated with a directional coupler and in this paper the work has been extended to include the cases of balanced amplifiers and cascaded balanced amplifiers with contiguous pass bands.

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Abstracts

Design Theory of Up-Converters for Use as Electronically Tunable Filters (1961 [MWSYM])

G.L. Matthaei. "Design Theory of Up-Converters for Use as Electronically Tunable Filters (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 15-16.

The up-converters discussed use a single variable-capacitance diode, a wideband impedance-matching filter at the input, a moderately wideband impedance-matching filter at the pump input, and a narrowband filter at the side-band output.



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Passive Phase-Distortionless Parametric Limiters

A.E. Siegman and I.T. Ho. "Passive Phase-Distortionless Parametric Limiters." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 17-18.

This paper presents theoretical and experimental results on a type of limiting action occurring in parametric circuits. Let a signal at frequency ω be passed through a resonant tank at this frequency which is coupled by a non-linear element to a resonant tank at the half frequency $\omega/2$. Above a certain threshold, the signal transmission through the ω tank will suddenly and sharply limit, in part because some of its energy goes into subharmonic $\omega/2$ oscillations, in part because the input VSWR to the device increases. This limiting principle can be implemented with varactor diodes or other parametric elements; it also explains the operation of previously known ferrite types of limiters.

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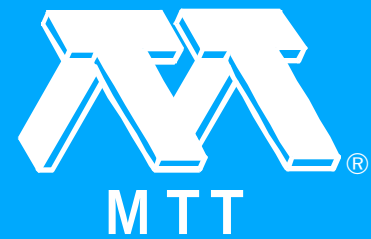


Abstracts

Field Displacement Devices

G.J. Wheeler. "Field Displacement Devices." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 19-20.

An electromagnet was placed on a field displacement isolator in place of the permanent magnet. Variations of attenuation with field for a variety of conditions are shown in the accompanying figures. Figure 1 shows variations with frequency as a parameter and Fig. 2 with position as a parameter.



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A Field Displacement Isolator at 57 kmc

C.E. Fay and E.F. Kankowski. "A Field Displacement Isolator at 57 kmc." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 21-22.

Ferrite devices employing the field displacement principle or ferromagnetic resonance are difficult to build in the millimeter wavelength region because of the high magnetic fields usually required for biasing the ferrite. In conventional ferrites, the upper limit of the saturation magnetization, $4\pi M/\text{sub } s/$, is about 6000 gauss. For resonance with the most favorable ferrite shape, namely, a thin slab magnetized in the direction of one of its longer dimensions, the Kittel relation for resonance becomes, $f = \gamma / \text{spl } \text{radic } H/\text{sub } A/(H/\text{sub } A/+ 4\pi M/\text{sub } S/)/$. Here f is the frequency of operation, γ is the gyromagnetic ratio of the electron, and $H/\text{sub } A/$ is the applied biasing field. Using a 6000 gauss ferrite, for resonance at 55 kmc, the required biasing field, $H/\text{sub } A/$, is about 17,000 oersteds. This field is obviously difficult to obtain in a device of convenient size.

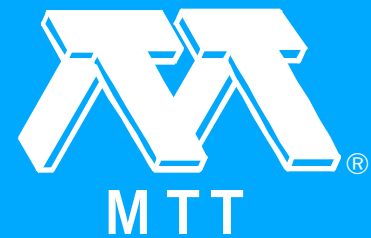


Abstracts

Solid State X-Band Power Limiter

W.F. Krupke, T.S. Hartwick and M.T. Weiss. "Solid State X-Band Power Limiter." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 23-24.

An X-band solid-state power limiter has been designed which completely protects receiver crystals from high power microwave pulses in the kilowatt region. This passive and reliable crystal protection has been achieved by utilizing the nonlinear properties of both ferrites and varactor diodes.



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Frequency Doubling with Planar Ferrites and Isotropic Ferrites with Large Saturation Magnetizations

I. Bady. "Frequency Doubling with Planar Ferrites and Isotropic Ferrites with Large Saturation Magnetizations." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 25-26.

In experiments on frequency doubling using ferrite slabs in a rectangular wave guide, planar ferrites consistently had much greater conversion efficiency than isotropic ferrites. The principle results are shown in Fig. 1. The geometry used is also shown in Fig. 1. The primary frequency was in the range of 8.5 to 9.1 kilomegacycles. The reference power level (0 db) was one watt peak power. The duty cycle was 10/sup -4/. The material properties are given in the appendix.





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Octave Bandwidth UHF/L Band Circulator

F. Arams, B. Kaplan and B. Peyton. "Octave Bandwidth UHF/L Band Circulator." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 27-28.

Nonreciprocal ferrite devices - in particular, low-loss circulators - are increasingly difficult to realize at the lower microwave and UHF frequencies. Previous low-loss S-band and L-band circulators used a high-density magnesium manganese ferrite with aluminum substitution (General Ceramics R-6). Measurements show that the loss of R-6 in broad-band circulators increases rapidly when the operating frequency is decreased below 1100 Mc. Therefore, a new material is required for UHF application.

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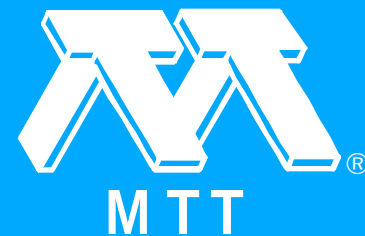


Abstracts

A New Balanced Type Ferrite Switch

T. Kuroda and A. Cho. "A New Balanced Type Ferrite Switch." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 29-30.

This paper will describe a new type of ferrite switch that was invented by the author. Generally, a microwave ferrite switch has unstable characteristics because of the unstable characteristics with temperature of the ferrite material used. A stable ferrite switch can be made using two hybrids and two new wave guide elements with ferrites, and making the best of balancing characteristics obtained by combining the wave guides.



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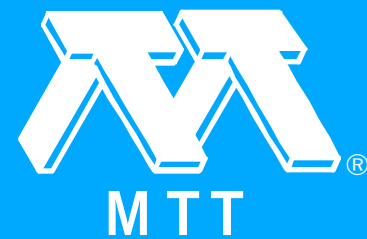


Abstracts

Spurious Outputs from High Power Microwave Tubes and Their Control

K. Tomiyasu. "Spurious Outputs from High Power Microwave Tubes and Their Control." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 31-32.

The emission of spurious outputs from microwave tubes has been known for a long time. With steady increase in transmitter power level, receiver sensitivity and number of radiating equipment, the problem of spurious outputs has taken on greater significance in terms of radiation interference. As the power levels of high power tubes have increased so have the spurious output power levels, and in a microwave system the presence of the spurious power may have deleterious effects such as arcing in chokes, arcing at flanges and signal transmission through ionized duplexers. In addition, if large amounts of spurious power are generated, the microwave tube may suffer in its own performance by decreased efficiency and by introducing an objectionable amount of amplitude and phase instability of the fundamental frequency output.



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Abstracts

The Design and Test of High-Power Waveguide Windows

D.B. Churchill. "The Design and Test of High-Power Waveguide Windows." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 33-34.

The trend toward increased power has brought the waveguide window problem into sharp focus. Window failures have impeded the development of high-power microwave tubes. Punctures and fractures of the dielectric materials are frequently preceded by excessive heating which cannot be ascribed to dissipative losses within the body of the dielectric element. There is evidence that the temperature rise in part is due to electronic discharge on the low-pressure side of the window.



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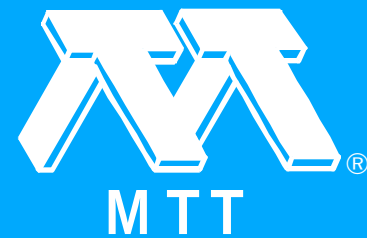


Abstracts

High Power Duplexers

C.E. Muehe, Jr.. "High Power Duplexers." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 35-36.

The most difficult problem facing the duplexer designer today is that of switching ever increasing powers while still maintaining short recovery time and low loss in the receiver circuit. A thorough knowledge of microwave circuits and gaseous discharge phenomena is essential.



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Low-Noise Traveling-Wave Tubes

D.A. Watkins. "Low-Noise Traveling-Wave Tubes." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 37-38.

Recent developments have made available a number of different devices for low-noise microwave amplification. These include the maser, the solid-state and electron-beam parametric amplifier, and the traveling-wave tube. In some applications, the ultimate in noise figure offered by the solid-state maser is important and useful, so that it is the only choice. In many other applications, such as the background temperature being near room temperature or countermeasures or sources of interference determining the minimum detectable signal, all of the available devices are suitable from a noise standpoint and the choice of which device to use is made on the basis of other factors. Some of these factors are: gain, bandwidth, weight, size, reliability, stability, large-signal performance, phase characteristics, and power requirements.

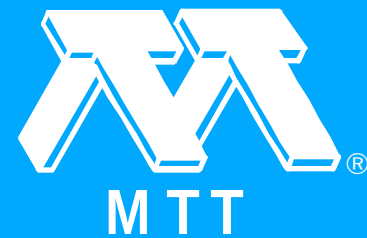


Abstracts

Parametric Amplifiers - Status 1961

R.D. Weglein. "Parametric Amplifiers - Status 1961." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 39-40.

Challenged by recent significant noise reduction schemes in traveling-wave tubes and by the ultra low noise capabilities of masers, four years of continued effort on the part of the most capable engineering talent has advanced parametric amplifier technology to the point that today this device enjoys a favorite position as a building block in the retrofitting of present and in the planning of future systems.



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Abstracts

Solid State Masers as Low Noise Amplifiers

H.E.D. Scovil. "Solid State Masers as Low Noise Amplifiers." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 41-42.

This paper will review the present status of solid state masers as low noise amplifiers. The maser is the most sensitive of existing amplifiers - in fact, its sensitivity is sufficiently close to the theoretical quantum limit that further improvements in sensitivity will be small. Present devices still fall short of the expected performance limit in other respects. In some applications, increased bandwidths are desired. Although fast recovery and freedom from saturation difficulties has been achieved this has still not been obtained simultaneously with large gain bandwidth products. Some remarks will be made with respect to improvements which may be anticipated in these characteristics.



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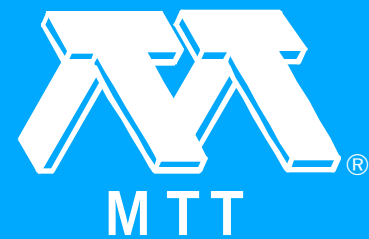
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Microwave Instrumentation for Plasma Research

E.G. Schwarz and H.H. Grimm. "Microwave Instrumentation for Plasma Research." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 43-44.

This instrumentation has been developed to make extensive microwave measurements on shock induced plasmas each of which exists for a small number of milliseconds. The over-all equipment can irradiate the plasma at two frequencies, one near 8 kmc, and the other near 60 kmc. The irradiation at 8 kmc propagates parallel to the glass shock tube axis, and the 60 kmc propagates perpendicular to the axis as shown in Fig. 1.

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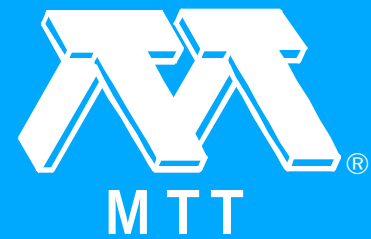


Abstracts

Optical Dielectric Waveguides

E. Snitzer. "Optical Dielectric Waveguides." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 45-46.

By cladding a high index of refraction glass core of sufficiently small cross-section with another glass of lower refractive index, dielectric waveguides have been made with one or a few modes of propagation in the visible region of the spectrum.



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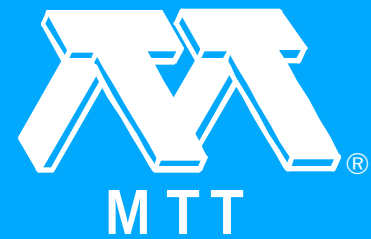


Abstracts

Electromagnetic Properties of Weakly Ionized Argon

F.L. Tevelow and H.D. Curchack. "Electromagnetic Properties of Weakly Ionized Argon." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 47-48.

The electromagnetic properties of a rectangular dielectric slab enclosed in waveguide has been previously analyzed and reported.



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Abstracts

The Radiation Field and Q of a Resonant Cylindrical Plasma Column

W.D. Hershberger. "The Radiation Field and Q of a Resonant Cylindrical Plasma Column." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 49-50.

A cylindrical plasma column placed across a waveguide or situated in free space in such a fashion that the electric field of an incoming wave is perpendicular to the axis of the column displays a series of resonant responses constituting a reflection and absorption spectrum. The spectrum may be elicited and observed at a fixed microwave frequency by varying the current through the column on which the incoming wave impinges and noting the reflected power. The present paper discusses (1) the electromagnetic field associated with the assumed electronic motion for the principal member of the spectrum and (2) the effect of radiation damping on the Q for this member.



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A Plasma Guide Microwave Selective Coupler (1961 [MWSYM])

W.H. Steier and I. Kaufman. "A Plasma Guide Microwave Selective Coupler (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 51-52.

A new type of microwave coupler, the plasma guide coupler, has been investigated. The coupling of microwave power via this plasma guide coupler can be varied electronically over a range greater than 30 db over an entire waveguide band. Pulsed power levels of more than 100 watts can be handled. When operated as a switch, a switching time of 5 μ sec has been observed. The plasma guide coupler is shown in Fig. 1.

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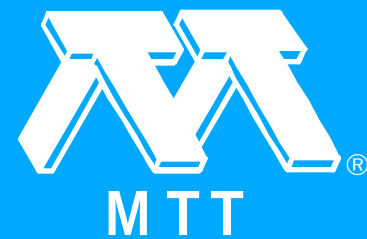


Abstracts

Elementary Considerations of Noise Performance

R. Adler, R.S. Engelbrecht, H.A. Haus, M.T. Lebenbaum and W.W. Mumford. "Elementary Considerations of Noise Performance." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 53-57.

It is generally recognized that the output noise of a receiving system contains components contributed not only by the generator at the input of the receiving system but also by the receiver itself. Furthermore, the evaluation of the output signal-to-noise ratio of the system will depend not only on the output noise but also on the nature of the signal that is impressed on the input of the receiver and that appears in the output utilization circuit. Hence, any meaningful evaluation of noise performance of receivers when they are used in a particular system must include considerations, under operating conditions, of the sources that contribute to the output noise, the bandwidth and gain of the receiving system in all of its responses, the nature of the signal and the efficacy of the output utilization circuit. It is evident that no single number can describe completely how well a given receiver will perform in all kinds of systems.



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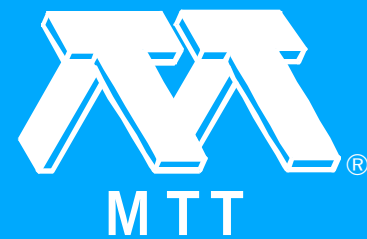


Abstracts

1961 PGMTT National Symposium (Information and Committees)

"1961 PGMTT National Symposium (Information and Committees)." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): 58-58.

The 1961 PGMTT National Symposium features seven sessions at the Sheraton-Park Hotel (Sheraton Hall and Exhibit Hall) devoted to broad advances in microwave techniques, circuitry, measurements, and low-noise amplification. Twenty contributed papers make up four of these sessions, describing such topics as millimeter wave masers and quasi-optical surface waveguides, ferrites, parametric amplifiers, and plasmas. Seven ferrite papers are included in this group which describe X-band power limiters, new and improved microwave switches, absorption modulators and broadband isolators, octave-bandwidth cmc"lators for UHF, and frequency doubling with planar ferrites.



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Abstracts

Electronically Tunable, Octave-Wide, Backward-Wave Parametric Amplifier with Constant Output Frequency

S. Okwit and E.W. Sard. "Electronically Tunable, Octave-Wide, Backward-Wave Parametric Amplifier with Constant Output Frequency." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): in1-in1.

The conventional cavity-reactance amplifier uses a single variable-reactance diode that couples several tuned circuits together. There are many modes of operation of this type of amplifier, each of which has been analyzed in detail.



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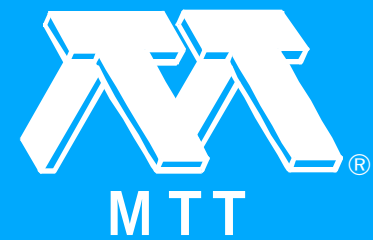
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Abstracts

Errata for 1961 PGMTT National Symposium Digest

"Errata for 1961 PGMTT National Symposium Digest." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): in2-in2.



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Abstracts

Back Cover (1961 [MWSYM])

"Back Cover (1961 [MWSYM])." 1961 PGMTT National Symposium Digest 61.1 (1961 [MWSYM]): b1-b1.



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