SOME COUPLED-WAVE THEORY AND APPLICATION TO WAVEGUIDES

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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.

(Abstract)

AUDIO MODULATION SUBSTITUTION SYSTEM FOR MICROWAVE ATTENUATION MEASUREMENTS

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Summary---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.

Introduction

One of the several methods used by the Electrical Measurements Laboratory for microwave attenuation measurements is the audio modulation substitution method which is capable of a measurement range up to 40 db from 200 - 40,000 mc. A simplified block diagram of this system is shown in Fig. 1. The audio modulated klystron oscillator is used as a stable source of r-f power and the barretter as a square-law detector. Any attenuation of the microwave carrier results in a linearly proportional change of the modulation superimposed on that carrier. Upon reaching the barretter mount, the modulated r-f power develops an audio frequency voltage across the barretter. This a-c voltage passes through the audio attenuator, is amplified, and then measured by the output level indicator. The requisite for successful operation of the system is that this level, once selected, is maintained constant by matching any changes in the unknown microwave attenuator being tested with an equal and opposite change of the standard audio substitution attenuator. The change in the microwave power level at the barretter is then equal to the change in the calibrated audio attenuator.

The basic principles involved in this method are relatively simple. However, a careful analysis has disclosed many possible sources of error. This article summarizes the improvements which have been made in the system in use at the present time.

Equipment Used

The particular use of a barretter in this system should not be confused with its use in the measurement of microwave power. Ordinarily a barretter is used in conjunction with some type of bridge circuit to measure microwave power. In this system, however, it is used as a detector to recover modulation from a microwave carrier.

Since the measurement technique is based on the use of a barretter as a detector, a few basic facts pertaining to the physical and electrical characteristics of a barretter will help in understanding the design requirements for the measurement system.