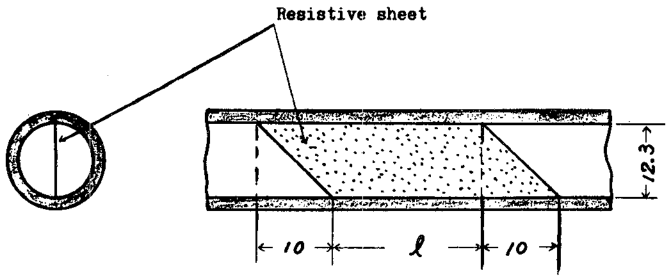

Fig. 3. Mode filter for attenuating the TE_{11} mode having a polarization parallel to the resistive sheet. Dimensions are in millimeters.

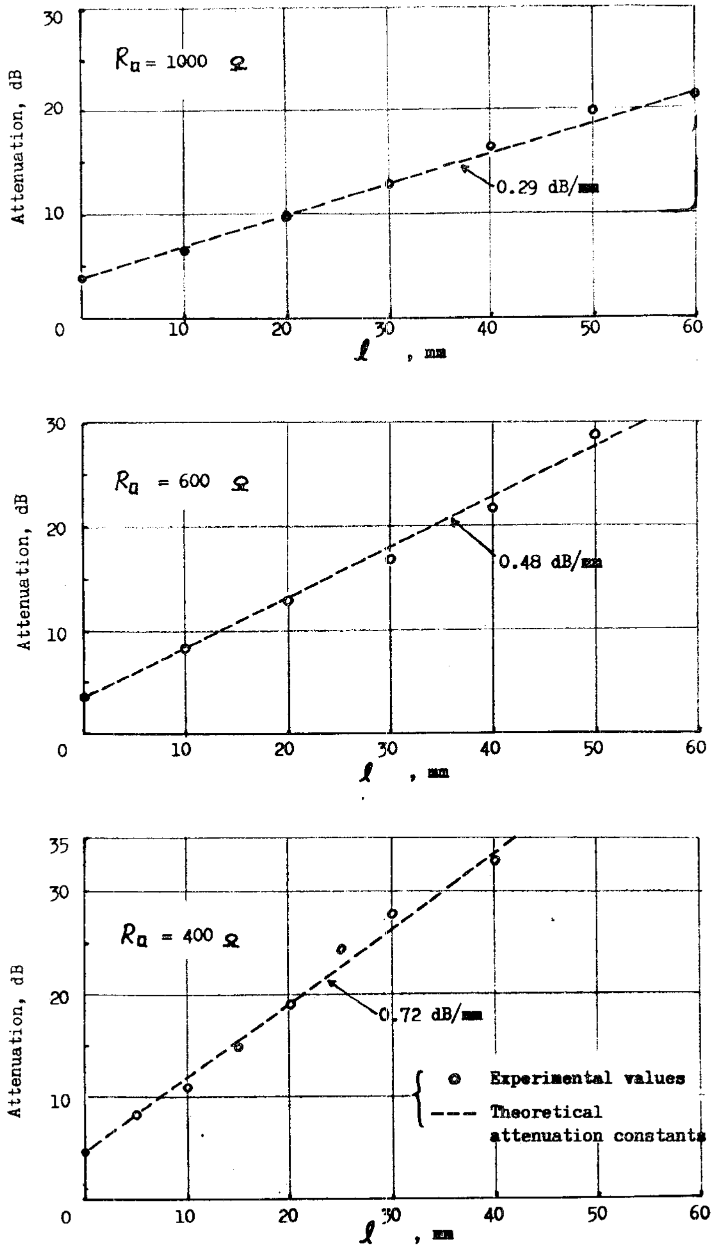

Fig. 4. Attenuations of the TE_{11} mode in the mode filter of Fig. 2. The frequency is 50 Gc/s.

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Calibration of Coaxial Bolometer Mounts

The Radio Standards Laboratory announces that an additional service is now available for the measurement of the calibration factor[1] of nominal 50-ohm coaxial bolometer units. The new service provides for calibration at 3 GHz, in addition to the frequencies of 100 MHz and 1 GHz that have been available for a number of months. Measurements are made of the 1- and 10-milliwatt power levels only, with no provision at present for the calibration of bolometer-coupler units.

The limit of uncertainty in determining the calibration factor at 3 GHz is within 1.5 percent for well-designed bolometer units. Limits of uncertainty may be greater for bolometer units having a VSWR higher than 1.1. The service includes the calibration of both barretter and thermistor types of bolometer units having operating resistances of 50, 100, and 200 ohms.

NATIONAL BUREAU OF STANDARDS
Engineering Division
Radio Standards Laboratory
Boulder, Colo.

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[1] The calibration factor of a bolometer unit is defined as the ratio of the substituted dc power in the unit to the RF power incident upon the bolometer unit.

Rectangular Waveguide Short Circuit with Cylindrical Slugs

The design of precision waveguide choke shorts imposes many problems, especially as concerns millimeter wave devices. A guide consisting of a rectangular waveguide with a cylindrical rod placed along its axis may help to solve the problem. Such arrangements are used in coaxial-to-strip line adapters [1], [2]. Adequate electric characteristics can be achieved in very simple mechanical designs of shorts comprising cylindrical sections of low and high impedance [3]. To design such a short it is necessary to know, however, the wavelength in the rectangular waveguide comprising a cylindrical rod—a problem which still appears to be unsolved.

The cutoff wavelength of the TE_{11} mode excited in a waveguide with a rod placed inside may be calculated from the empirical equation

$$\frac{\lambda_c}{2a} = 1 + \frac{1}{2}\left[\left(\frac{D}{b}\right)^2 + 1\right] \cdot \left[\frac{a}{2b}\left(\frac{D}{b}\right)^2 + 0.1\frac{D}{b}\right]$$

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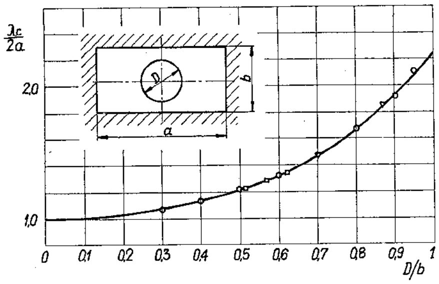

Fig. 1. TE_{11} mode cutoff wavelength. ∇, O, and □ measured in band 8 mm, 3 cm, and 4.5 cm, respectively.

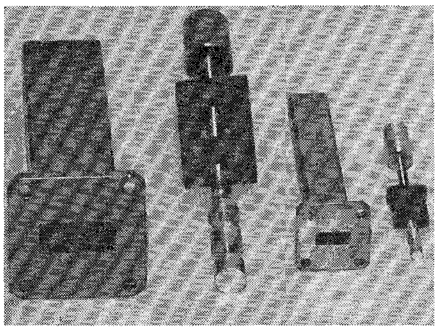

Fig. 2. Four sectional waveguide shorts.

where

λ_c = cutoff wavelength
a = waveguide width
b = waveguide height
D = rod diameter.

When $D=0$, the equation reduces to the expression for the cutoff wavelength of the TE_{10} mode in rectangular guide; the TE_{11} mode is no longer present.

The cutoff wavelength in the waveguide has been determined by wavelength measurements. Rods of various diameters have been placed within the axis of symmetry of a slotted line made of standard waveguide sections, WR-137 (IEC R70), WR-90 (IEC R100), and WR-28 (IEC R320).

Measurements were made over three frequency bands (7.5, 10, and 36 Gc/s), and results are shown and compared with the foregoing function in Fig. 1. Results are well within 2 percent off the theoretical curve. Shorts (Fig. 2) have been built according to the plot, comprising four sections to cover 8.2 to 12.4 Gc/s and 18 to 26.5 Gc/s. The input VSWR of both shorts is over 200 ($\Gamma \geq 0.99$) in their respective frequency bands.

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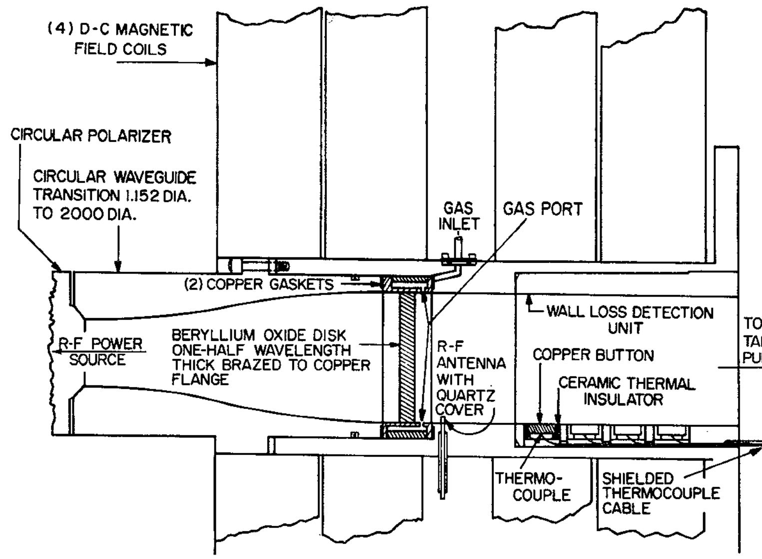
An Experimental X-Band Electron-Cyclotron-Resonance Plasma Accelerator

The electron-cyclotron-resonance plasma accelerator represents a new and potentially important application of microwave power. Uses in space propulsion engines and thermonuclear energy generators are currently under investigation. In this type of accelerator, the plasma is generated and accelerated to high velocities by RF power. The high-frequency nature of the electrical energy allows efficient, electrodeless coupling to the plasma. Conduction and control of the power is also relatively easy. Finally, for the space application, a combined communication and propulsion system can reduce total system weight and complexity. With new, high efficiency RF generators now coming into being [1], [2], the efficiency of the RF energy conversion process is no longer prohibitive. This type of plasma accelerator has been previously described [3], its theoretical basis has been explored [4], [5], and results with medium [4], [5] and high power [6] experiments have been reported. This correspondence describes in more detail some of the early higher powered experiments. Although the goal of these studies has been somewhat different, the experiments have much in common with the electron-cyclotron-resonance studies at Oak Ridge National Laboratories [7]–[9] and at Saclay [10], [11].

The experimental X-band accelerator is shown in Fig. 1. RF power (8350 Mc/s) from a CW klystron (VA-823J) is delivered from a circular polarizer into the left-hand end of the accelerator. It should be noted that the



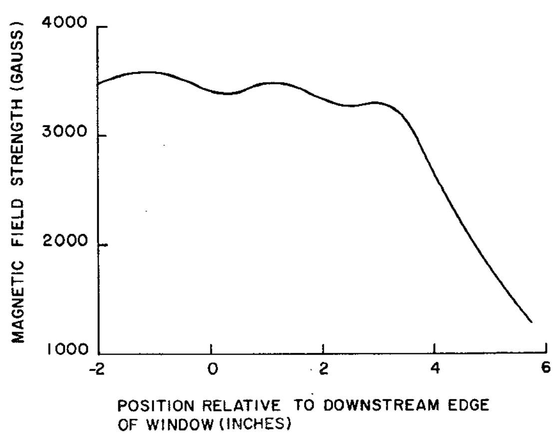


Fig. 1. X-band, longitudinal-interaction accelerator showing 3450 gauss (average) magnetic field.

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