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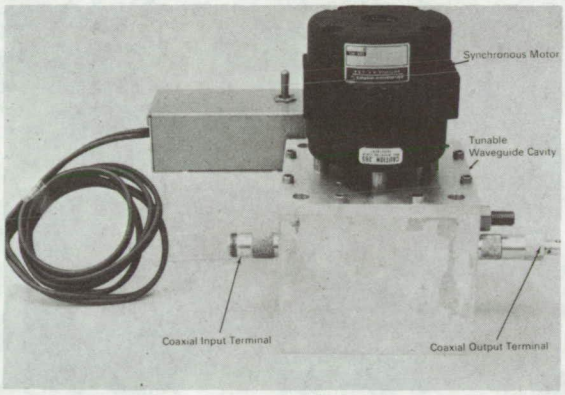
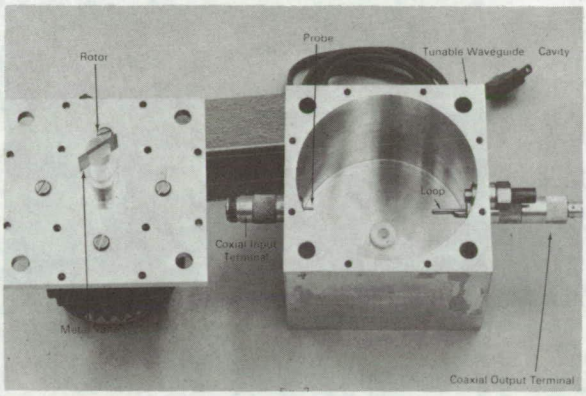
NASA TECH BRIEF

Sweep Frequency Detector





The problem:

A need existed for positive monitoring of the bandwidth of the input amplifier of a tracking receiver, this normally being the receiver's limiting factor. Previous methods of separately measuring the maser amplifier bandwidth used up appreciable operating time which could be put to better use if an independent, passive system could be devised.

The solution:

A sweep detector or passive spectrum analyzer (Figure 1) that includes a waveguide cavity, a capacitive rotor driven by a synchronous motor, and a diode detector. Used with an oscilloscope, it provides a visual display of a microwave amplifier bandpass (gain vs frequency). Amplified noise from the pre-amplifier under test provides power for the display and no oscillators are used, thus preventing interference to other receiver functions.

How it's done:

The sweep detector has power coupled into the tunable cavity from the coaxial input by a probe (Figure 2). A loop, mounted in the coaxial output termination, which contains the diode detector, provides the impedance transformation used for maximum power to the diode. A loaded Q of approximately 1750 provides an instantaneous detector bandwidth of 1.3MHz. The rotor supports a metal vane whose size determines the sweep width of the oscilloscope display. The rotor attaches directly to the synchronous motor output shaft.

Notes:

1. Plots of detector frequency versus motor rotation show a wave shape which must be duplicated in the horizontal sweep voltage supply to the oscilloscope to obtain a linear frequency display. A phase-variable circuit which approximates such a wave shape is used.

(continued overleaf)

2. The sensitivity response shows that a square law region exists up to -36dbm and provides sufficient dynamic range for a second generation (wide bandwidth) maser system. The lower limit is determined by noise in the amplifier following the detector (10uv peak-to-peak).
3. Documentation is available from:
   Clearinghouse for Federal Scientific
   and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10289

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, non-exclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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