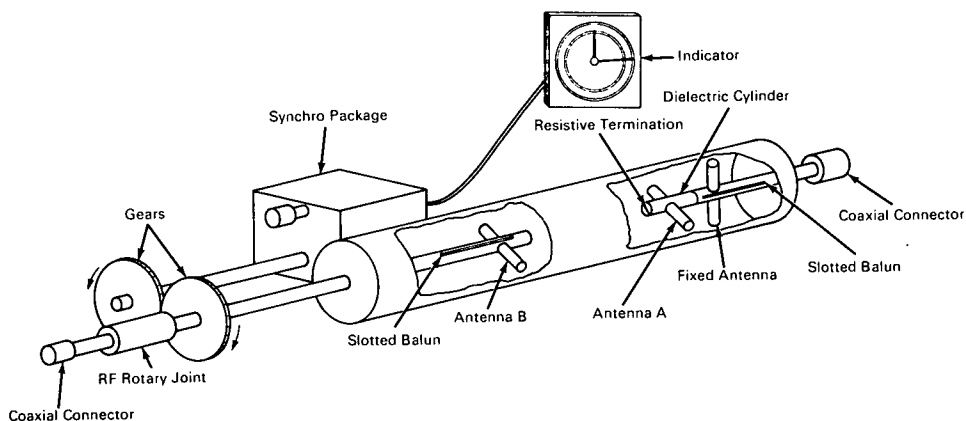


NASA TECH BRIEF



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Rotary Antenna Attenuator



This innovation is an accurate radio frequency attenuator having negligible insertion loss at minimum attenuation. It can be used for making precise antenna gain measurements.

The apparatus consists of an input dipole antenna electrically coupled to an output dipole antenna within a circular waveguide. The antennas are rotatable with respect to each other. The attenuation is proportional to the angle of rotation $20 \log_{10} \sec \theta$; thus the electrical drive/readout can be calibrated in dB attenuation. The advantages of this configuration are: (1) negligible insertion loss at minimum attenuation compared to a conventional piston waveguide-beyond-cutoff attenuators (which has 20 db minimum); and (2) small size compared to a rotary-vane attenuator.

The innovation is currently in use as a transfer standard in making precise antenna gain measurements. An S-band version (2297 MHz) has a circular wave guide 4" dia \times 20" long.

The advantages of the innovation are: (1) greatly reduced size relative to competitive devices; (2)

low initial insertion loss; (3) low variation of attenuation with angle: $20 \log_{10} \sec \theta$ vs $20 \log_{10} \sec^2 \theta$ variation for rotary-vane attenuators; (4) input and output dipole antennas mounted coaxially in a circular waveguide section and rotatable relative to each other; and (5) calibrated drive/readouts measuring the angle between the planes of the two dipoles accurately, whereby the attenuation may be read directly.

Note the figure. An RF signal injected in the RF rotary joint, which allows the angular rotation of antenna B, will be attenuated by polarization mismatch upon excitation through the fixed antenna. This attenuation varies with the angular difference between the planes of the two antennas in accordance with the relation $20 \log_{10} \sec \theta$.

The gears, synchro package and indicator allow the precise reading of angle θ . Antenna A, which is oriented 90 degrees with respect to the fixed antenna and coaxial therewith, is provided with a resistive termination in order to match out the cross polarized

(continued overleaf)

component between the antennas as antenna B is rotated relative to the fixed antenna. All antennas are housed in the circular waveguide and terminate in the coaxial connectors.

The excited dipoles are fed by use of slotted baluns. The terminated dipole is supported by a dielectric cylinder that needs no balun.

Note:

This Tech Brief is complete in itself. No additional information is available.

Patent status:

No patent action is contemplated by NASA.

Source: R. M. Dickinson and J. C. Hardy of
Caltech/ JPL
under contract to
NASA Pasadena Office
(NPO-10648)