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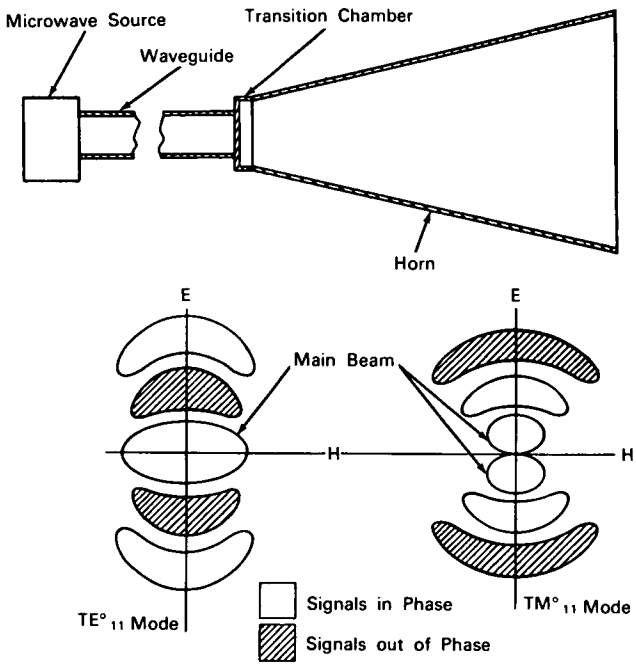
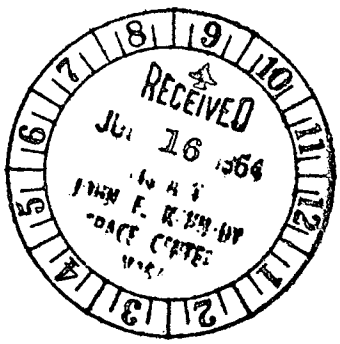
NASA TECH BRIEF

Novel Horn Antenna Reduces Side Lobes, Improves Radiation Pattern





The problem: Reduction of side lobes and improvement of radiation characteristics of antennas. Side lobes are common to all antennas and are generally a cause of noise and unwanted signals.

The solution: A horn antenna of novel design, which combines two modes of propagation at selected power ratios. The main beams of each mode, being in phase, are additive; the side lobes, being mutually out of phase, tend to cancel.

How it's done: Microwaves are conducted through a circular waveguide into a circular transition chamber and are then radiated by a horn with a 6-degree flare. Two modes, TE°_{11} and TM°_{11}, are propagated in such a manner that parts of the radiation patterns cancel and side lobes are thereby reduced.

The waveguide must be small enough to insure that microwaves are propagated only in the TE°_{11} mode, and the diameter of the transition chamber must be large enough to permit the propagation of both the TE°_{11} and the TM°_{11} modes. At the plane of transition, both modes are approximately in phase. By adjustment of the sizes of the waveguide, chamber, and horn, the power in the elevation and horizontal planes can be made equal, the beamwidth in each plane can be given various ratios, and side lobes can be suppressed.

(continued overleaf)

At 9,600 megacycles, side lobes are greatly reduced and equal beamwidths obtained in the E and H planes by using the following dimensions: diameter of waveguide, 1.25 inches; diameter of transition chamber, 1.60 inches; length of transition chamber, 0.25 inch; angular opening of horn, 6 degrees; and diameter of mouth of horn, 5.4 inches.

Note:

This novel approach to the problem of suppressing side lobes and unwanted signals should be of interest to makers and users of microwave equipment. Although this technique may impair the wideband characteristics of the horn antenna, it should be useful for many measurements and communications tasks.

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