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THE MEASURED PERFORMANCE OF A 170 GHz REMOTE STEERING LAUNCHER

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The Measured Performance of a 170 GHz Remote Steering Launcher

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The remote steering mechanism [1–3] has been shown in several low power experiments [4,2] to work as predicted with the rf magnetic field (H) in the plane of steering. The results with the electric field (E) in the plane of steering did not show as large a useful steering range as with the orthogonal polarization, contrary to the basic theory. This theory [1] assumes, however, that the square or rectangular corrugated waveguide propagates ideal HE_{n1} modes independent of polarization. Since higher order HE_{n1} modes are only excited in the plane of steering, and those modes are much more sensitive to the corrugation depth and surface flatness with E perpendicular to the corrugated surface, it seemed likely that the details of the corrugations are the source of the behavior. We therefore have implemented a method to produce, even in copper, highly reproducible corrugations.

In the present work, we describe the results of measurements made using square waveguide of inside dimension 45.7 mm having all four walls corrugated with a 0.66 mm pitch and with a variation in corrugation depth of < ±0.006 mm. This waveguide is made of copper and is vacuum tight, so that it can be used at high peak and average power. Low power measurements of steering with a waveguide run 4.644 m long show a very large fraction of power radiated at the intended angle up to 13° for either polarization, as shown in Figs. 1 and 2. This compares well for either polarization with the prediction of the basic theory, which is shown in Fig. 3.

We have shown that for a sufficiently precise corrugation geometry at the shortest wavelength currently available at the megawatt power level, remote steering works for either polarization up to the largest angle the theory predicts will be usable. This has also been shown recently at 158 GHz [5].

This waveguide will also be tested under vacuum at high peak and average power later this year.

ACKNOWLEDGMENT

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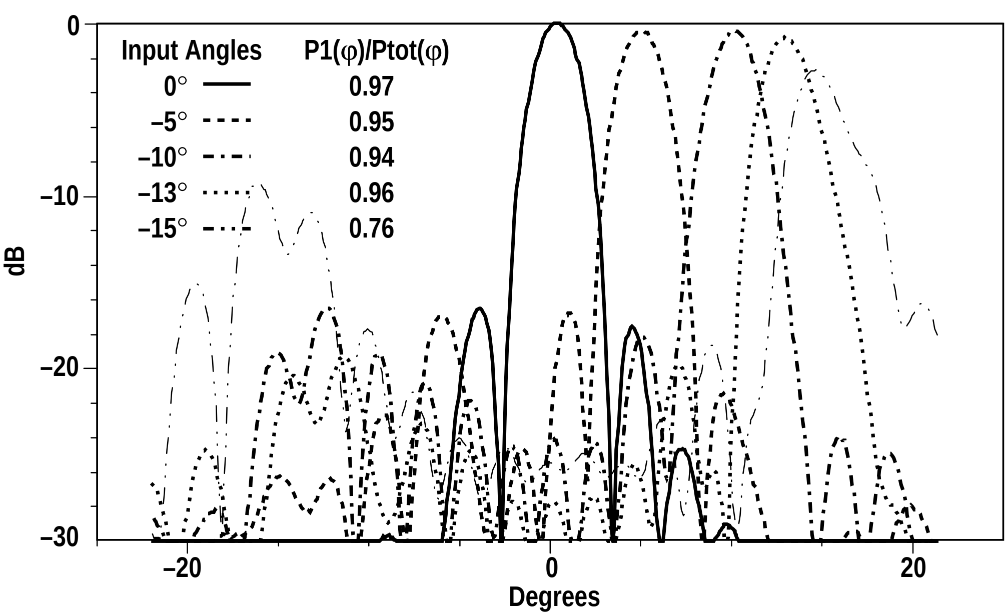

Fig. 1. Measured H-plane steering far field radiation patterns at 170 GHz. P1(φ) is the integral of power between the first nulls around φ and Ptot is the integral of power from –22° to 22°. φ is the incident angle of input beam.

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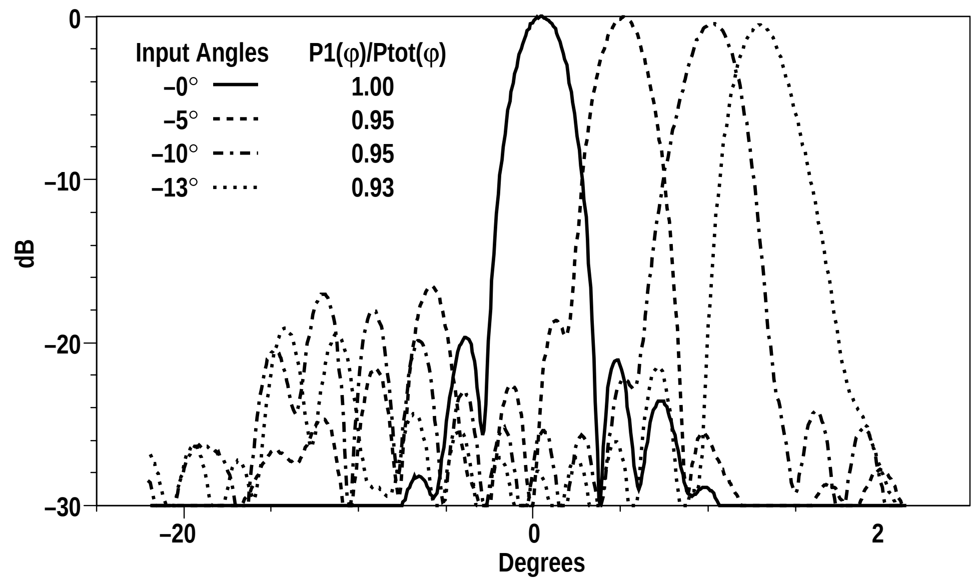

Fig. 2. Measured E-plane steering far field radiation patterns at 170 GHz. P5(φ) is the integral of power from –5° to 5° and Ptot(o) is the integral of power from –22° to 22°. Total length of 45.7×45.7 mm corrugated waveguide is 4644 mm.

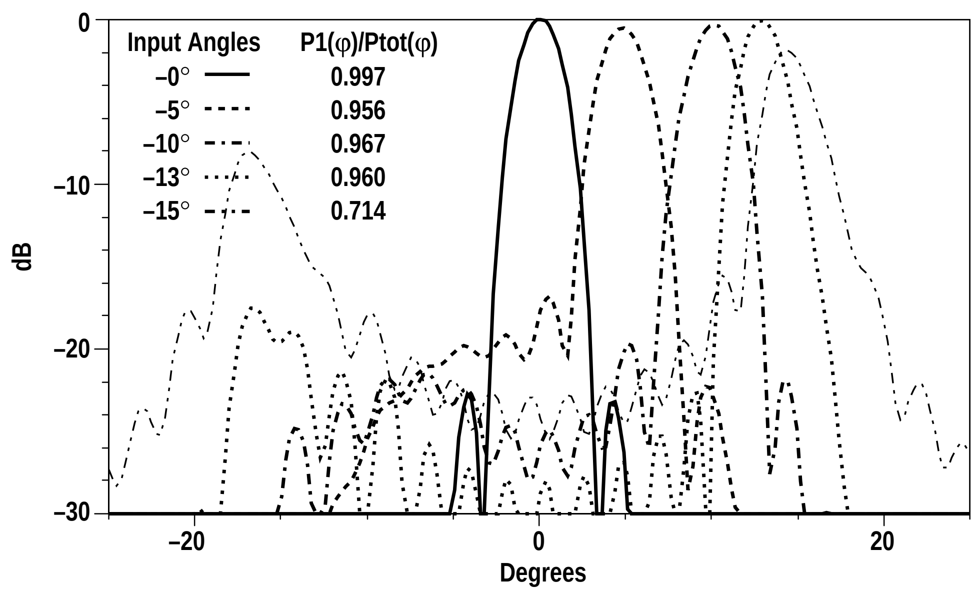

Fig. 3. Calculated far field radiation patterns at 170 GHz. P5(φ) is the integral of power from –5° to 5° and Ptot is the integral of power from –22° to 22°. Calculation assumes L=464.4 cm, b=4.5778 cm, and cm=1.802 inches.