High Aperture Efficiency Ka-Band Horn Using Hard Boundary Walls

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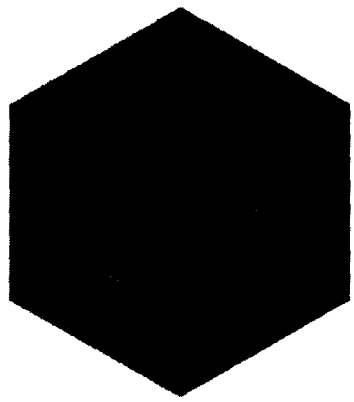
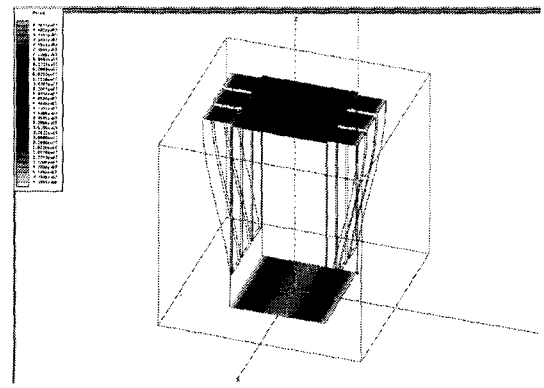
A prototype horn has been developed using dielectric-filled longitudinal corrugations in the vertical walls to create a hard boundary condition. The result is a field distribution in the horn aperture that is uniform in amplitude and phase. FEM modeling in Ansoft Corporations High Frequency Structure Simulator (HFSS) provided preliminary analysis of horns with an initial corrugation depth chosen based on the work presented by P.S. Kildal (*Elect. Let.*, vol. 24, pp168-170, 1988).

The horn is fed by a square waveguide with the corrugations increasing in depth until the desired field excitation is achieved. The depth increases along a cosine taper. The horn is fed by the transition piece shown in Figure 1. Preliminary results show that this geometry will provide a better impedance response than would a linear taper.



(a)



(b)

Factors considered in choosing the depth of the corrugations include the field distribution in the aperture, the S-parameter response and the value of the complex propagation constant. The values were obtained by simulating transition sections with varying corrugation depths. Through comparison of the results a design exhibiting the highest likelihood of success was chosen for fabrication.

Geometries employing more numerous and narrower corrugations were simulated and have shown even better field responses that could lead to higher aperture efficiencies. However, the manufacturing cost of such a design is prohibitive at this stage of development. Additionally, simulations have been run with a single dielectric slab using both linear and cosine tapers. Measured results will be compared to the simulations and presented for the chosen design.