

LTCC Partially-Filled Oversized Rectangular Waveguide-Fed Slot Array Antenna in the Millimeter-Wave Band

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A partially-dielectric-filled oversized-rectangular waveguide slot array antenna (M.Samardzija, et al., IEICE Trans. Commun., vol.93, no.4, pp.871-878, Apr. 2010.) is realized by installing an air-cavity in a radiating oversized waveguide with LTCC (Low Temperature Co-fired Ceramics: $\epsilon_r=6.6$) layers in the top and bottom sides as shown in Fig.1. This kind of structure can reduce the dielectric loss and increase the antenna efficiency. The air-cavity reduces the equivalent dielectric constant and enhances the bandwidth of the series-fed slot array antenna. The transmission loss and the effective permittivity for different filling rates are estimated at 60GHz assuming the loss tangent is 0.013 and the total thickness is 0.8mm. For a half -filled oversized rectangular waveguide, the effective dielectric constant can be reduced to 30% and 90% of dielectric loss in the radiation part can be reduced. The main beam tilting angles of three kinds of the half-filled antennas have been obtained by near field measurement and compare to those of the fully-filled antennas are shown in Fig.2. Two different sizes of the fully-filled antennas (with air cavity sized “35mm” and “45mm”) have also been measured as a comparison. The frequency characteristics of the main beam tilting angle θ in the E-plane which has been normalized at 58.5GHz in Fig.2. The slope of the angle gives the beam tilting characteristics in terms of frequency. It is reduced at about half at this moment by using the half-filled structures. Thereby smaller dielectric constants in propagation for the half-filled antenna suppress the long line effect and the slope of tilting angle is smaller than the fully-filled antennas.

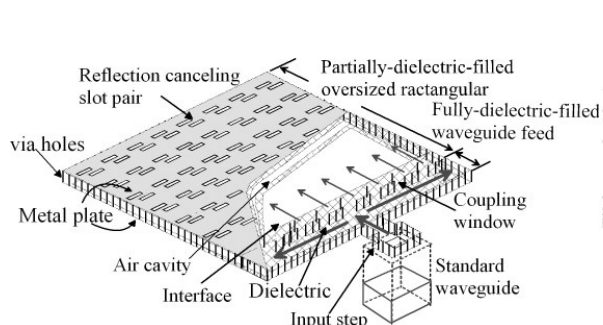


Fig.1 Fully-filled waveguide feed for a partially-filled oversized-rectangular waveguide slot array

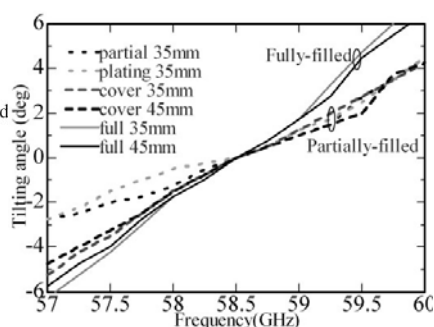


Fig.2 Frequency characteristic of the tilting angle