

Analysis of Aperture Coupled Antennas Fed by Dielectric Image Line

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The Analysis of slot antennas with or without a dielectric overlay fed by a dielectric image line (DIL) is presented. The dielectric image line consists of a rectangular dielectric rod of relative permittivity ϵ_r backed by a perfectly conducting ground plane. It is assumed that only the fundamental mode of the DIL is the propagating mode. The power at the slot is determined using the spectral domain Green's function of the magnetic field in the DIL due to a magnetic current source of the slot. The voltage discontinuity in the DIL across the slot is used to determine the impedance of the slot antenna. This slot-coupled DIL can be a good candidate for low loss feeding network for different antenna structures at millimeter wave band. Two examples are considered; microstrip patch antenna and dielectric resonator antenna. Microstrip patch antenna is analyzed using the cavity model, and the power is obtained from the fields inside the patch. The dielectric resonator antenna DRA is analyzed using an open cavity model. The Q factors and radiation efficiency are computed. The power is obtained using the fields inside the DRA, and the losses are modeled by the Q-factor of the DRA. Effects of aperture dimensions and frequency on the input impedance of the antenna are considered.