Wide Axial Ratio Bandwidth Circular Polarized Dielectric Resonator Antenna

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Dielectric resonator antenna (DRA) has attracted considerable interest due to its inherent advantages of light weight, small size, low cost, ease of excitation and less conductor loss compared to patch antennas. DRAs can be made with different materials with a wide range of permittivities. DRAs have been designed to provide a variety of performance characteristics, such as wide band, dual band and circular polarization. In particular, with suitable design, the impedance bandwidth of a DRA element can attain 30% or more.

In [1], a 45° rotated rectangular DRA with permittivity 10.8 is excited by a narrow rectangular slot. It radiates circularly polarized waves with 6.6% axial ratio (AR) bandwidth. Wider AR bandwidth (in the range of 10% – 20%) designs reported in the literature usually involve either complex excitation or in the array form [2, 3].

In this paper, using a stair case structure, a simple aperture coupled DRA with wide AR bandwidth is presented. The 45° rotated stair DRA is excited by a microstrip line through a narrow rectangular slot. Using rectangular DR shapes with a length to width ratio of 1.9, two degenerate orthogonal modes are excited, generating circular polarization. The measured results show an impedance matching impedance bandwidth (S_{11} < -10 dB) of 36.6% with $\varepsilon_r = 12$ and a measured AR bandwidth (AR < 3-dB) of 10.6%, with stable broadside radiation patterns. The AR bandwidth of the proposed simple DRA is comparable to more complicated designs reported in the literature. Simulation (from HFSS) and measured results show good agreement.

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