Circularly Polarized Dielectric Resonator Antenna For UMTS and WLAN Applications

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A circularly polarized dielectric resonator antenna (CPDRA) configuration is proposed, analyzed, investigated, and optimized using the CST- MW-simulator. The presented antenna is fed by a microstrip sequential phase power divider (MSPPD). Both microstrip and DRA have numerous benefits in wireless communication and radar systems applications. This is due to their small size, low cost, less weight, easy fabrication, and excellent compatibility with the typical manufacturing process of planar circuits. With the rapid progress of wireless technology, satellite communication systems use circularly polarized (CP) antennas to overcome the problems of mobility and weather conditions.

The MSPPD has a shape of a semi-ring of length corresponds to $3\lambda_g/4$. The MSPPD composed of three main branches each have a length value of $\lambda_g/4$. The four feeds of the MSPPD have been designed and investigated so that the phase shift between each two successive feeds to the DRA antenna is 90°. The distance between each two successive ports is $\lambda_g/4$. All the four feeds have the same magnitude. The dielectric resonator antenna have rectangular shape, its length and width are equal so that all the four side faces are identical. Therefore, the dielectric antenna operates as a circularly polarized antenna. The power is coupled to the dielectric resonator antenna by the four output ports of the MSPPD. The transition between the MSPPD and the DRA is designed so that there is no mismatch or any leakages in the power. The power is coupled to the DRA using four metallic wires. Each wire is mounted on a metallic plate attached to the DRA. The proposed CPDRA antenna is fed by a 50Ω microstrip line.

Using the previously described MSPPD to couple its four outputs to the rectangular dielectric resonator antenna ends up with an antenna configuration composed of DRA antenna that is excited on its four sides with same value and a sequential phase shift of 90°. This configuration is investigated and optimized to have the finest results. Finally, the proposed antenna configuration has -10 dB reflection coefficient bandwidth and 3 dB axial ratio (AR) bandwidth are 29.63 % (1.85-2.50 GHz) and 10.5 % (1.98-2.20 GHz), respectively. Good radiation characteristics with a gain of more than 6 dB over the operating frequency band are obtained. This antenna is suitable for UMTS and WLAN applications.