

Compact Dual-band 4-MIMO Antenna Elements for 5G Mobile Applications

Authors : Fayad Ghawbar

Abstract : The significance of the Multiple Input Multiple Output (MIMO) system in the 5G wireless communication system is essential to enhance channel capacity and provide a high data rate resulting in a need for dual-polarization in vertical and horizontal. Furthermore, size reduction is critical in a MIMO system to deploy more antenna elements requiring a compact, low-profile design. A compact dual-band 4-MIMO antenna system has been presented in this paper with pattern and polarization diversity. The proposed single antenna structure has been designed using two antenna layers with a C shape in the front layer and a partial slot with a U-shaped cut in the ground to enhance isolation. The single antenna is printed on an FR4 dielectric substrate with an overall size of 18 mm×18 mm×1.6 mm. The 4-MIMO antenna elements were printed orthogonally on an FR4 substrate with a size dimension of 36 × 36 × 1.6 mm³ with zero edge-to-edge separation distance. The proposed compact 4-MIMO antenna elements resonate at 3.4-3.6 GHz and 4.8-5 GHz. The s-parameters measurement and simulation results agree, especially in the lower band with a slight frequency shift of the measurement results at the upper band due to fabrication imperfection. The proposed design shows isolation above -15 dB and -22 dB across the 4-MIMO elements. The MIMO diversity performance has been evaluated in terms of efficiency, ECC, DG, TARC, and CCL. The total and radiation efficiency were above 50 % across all parameters in both frequency bands. The ECC values were lower than 0.10, and the DG results were about 9.95 dB in all antenna elements. TARC results exhibited values lower than 0 dB with values lower than -25 dB in all MIMO elements at the dual-bands. Moreover, the channel capacity losses in the MIMO system were depicted using CCL with values lower than 0.4 Bits/s/Hz.

Keywords : compact antennas, MIMO antenna system, 5G communication, dual band, ECC, DG, TARC

Conference Title : ICMCSS 2022 : International Conference on Mobile Communication Systems and Security

Conference Location : London, United Kingdom

Conference Dates : June 27-28, 2022