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(57) Abstract :
The fast development of wireless communication requires high-gain antenna systems with multiple frequency band support and less interference. This research introduces the design and gain boost of triple-band multiple-input multiple-output (MIMO) antenna for 5G WiFi, and advanced broadband utilization. The designed antenna is developed to work effectively in three different frequency bands, providing easy communication and enhancing spectral efficiency. The design and gain increase of an octagonal slotted antenna with edge feeding, working over three particular frequency bands for 5G WiFi, and enhanced broadband applications. The frequency ranges that the antenna is best suited to cover are presented in this study 2.62GHz (2.51-2.68 GHz), 4.66GHz (3.97- 4.97 GHz), 5.64GHz (5.57-5.67GHz). The antenna is tiny enough to be integrated 5G WiFi with the dimensions 30mm x 45mm x 1.2mm and is made of low loss dielectric material Rogers RO3003 (tm) and it achieves efficient resonance within each frequency band. The geometry utilizes high-end techniques like metamaterial-based structure, slotted patch configuration, and edge feeding optimization to facilitate wideband resonance and increased radiation performance. The designed antenna is optimized for operation in the sub-6 GHz 5G WiFi and broadband frequency bands to facilitate next-generation wireless networks and high-speed internet devices. The MIMO elements are wisely placed to offer high isolation, minimized mutual coupling, and augmented diversity gain, which all contribute significantly towards retaining safe data transmission over densely crowded communication scenarios. The antenna designed on a low-loss dielectric substrate, and its shows high efficiency and stable performance in practical applications. The optimized design provides low interference and stable connectivity, which makes it a good candidate for integration into 5G base stations, WiFi routers, and broadband communication systems. By overcoming some of the key challenges of MIMO antenna design, this work helps advance next-generation wireless technologies that enable greater data rates, low latency, and secure communication for future applications like smart cities, IoT networks, and ultra-fast broadband services.

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