Design and Performance Analysis of Dual-Bands Two-Port Guitar Microstrip Patch Antenna Array for 5G Applications

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ABSTRACT

A guitar-shaped microstrip patch antenna with rectangular slots was developed and designed to increase bandwidth and improve gain for use in wireless communication applications such as GPS and Wi-Fi. The patch design consists of two half circle sections separated by a space containing four rectangular slots of varying lengths. These slots are arranged along the feed strip line within the second half circle, spaced 0.5 mm apart. The first half circle, with a radius of 10 mm, contains two square apertures of dimensions 2×2 mm^2 , while the second half circle, with a radius of 8 mm, contains a central rectangular aperture of 3×1.5 mm^2. The patch and ground layer have a thick of 0.035 mm. FR-4 substrate with dielectric constant 4.4 and dimension 1.55×40.3×36 mm^3, HFSS simulation software was used to design the antenna. The antenna receives and operates at two specific frequencies, 2.8 GHz and 6.8 GHz, with S_{11} reflection coefficients of -35 dB and -45 dB, respectively, demonstrating good matching and low power loss. By studying the resonant frequencies, it was found that the proposed antenna in this paper achieves gain values at 2 dB and 2.39 dB. As for the bandwidth, it was (0.5, 2.89) GHz at -10dB during the simulation process, while it was (0.43, 2.2) GHz in the experiment. The antenna efficiency is clearly shown in the C-band such as Satellite Communications, Weather Radar Systems, Wi-Fi and Cordless Phones and the X-band, such as Maritime Radar, and Air Traffic Control.