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Full Length Article

Design, simulation, and fabrication of a double annular ring microstrip antenna based on gaps with multiband feature

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Abstract

A novel double annular-ring microstrip antenna, split into six sectors, is proposed to achieve multiband operation with high gain and impedance bandwidth. The gaps on the driven and parasitic patches excite resonant frequencies that are located in the Ku-, K-, and Ka-bands thus making the antenna capable of these multiband applications. The present design is numerically and experimentally investigated. This investigation indicates that the suggested antenna achieves four operating bands, with impedance bandwidths of 1.72 GHz (12.16–13.88 GHz), 2.04 GHz (19.28–21.32 GHz), 1.54 GHz (24.04–25.58 GHz), and 1.97 GHz (27.37–29.34 GHz) which correspond to the resonant frequencies of 13.10 GHz, 20.72 GHz, 25.00 GHz, and 28.85 GHz, respectively. Also, the new design achieves good values of gain (6.11–8.31) dB and a return loss of between −16.14 dB and −21.52 dB. The commercial tool Ansoft high frequency structure simulator is used to simulate the designed antennas and it compared with the obtained measurement data. The comparison shows close agreement between the simulations and measurements.

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Keywords

Microstrip antennas; Multiband antennas; Annular ring patch; HFSS software; K-bands

1. Introduction

Wireless communications applications continue to grow very rapidly. These growing applications call for the continued miniaturization of the antennas, particularly as mobile devices become smaller or more densely packed with features. Compact and multiband antennas are needed to meet these size reduction requirements. This integration of compact antennas in small packages often calls for the use of multiple resonances and impedance matching methods. Therefore, compact and multiband antennas are of considerable interest in the research and application communities. Research into these antennas has been mostly concerned with the use of multiple resonance approaches [1], [2], [3], [4], [5], [6]. While maintaining good radiation features and reduction of the antenna size are among the most pressing problems in