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ACS-Fed e-Shaped Dual Band Uniplanar Printed Antenna for Modern Wireless Communication Applications

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Abstract—A printed small size (12×16.5 mm) ACS-fed e-shaped uniplanar antenna is proposed for dual band applications. The multiband operating characteristics have been achieved by integrating e-shaped radiating strips to the 50 Ω ACS feed line. Two simultaneously operating wide bands have been generated by using optimized radiating branch strips for the multiband applications. For obtaining size reduction and wider impedance bandwidth, e-shaped meandered elements are chosen in the design. The proposed design features the bandwidth (VSWR < 2, reflection coefficient below –10 dB) of 100 MHz in 2.4–2.5 GHz, and 2100 MHz in 4.0–6.1 GHz. The developed multiband antenna can be useful for several wireless communication applications, such as 2.4 GHz Bluetooth/RFID, WLAN (2.4/5.2/5.8 GHz), WiMAX (5.5 GHz), US public safety band (4.9 GHz), ISM band, radio frequency energy harvesting and internet of things (IoT) applications.

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1. INTRODUCTION

Current generation wireless communication systems demand the integration of multiple communication protocols into a single device within a specified area/volume. In this scenario antenna is a key element that decides not only device capability, but also its size. To address this issue, many researchers focused on the design of small antennas that work simultaniously for multiple frequency bands.

Recently, various antenna designs have been reported by using different structures/geometries and feeding techniques, such as microstrip feeding [1–3], coplanar waveguide (CPW)-feeding [4–8], and asymmetric coplanar strip (ACS)-feeding [9–19] for portable devices. As shown in Table 1, all the structures are complex and large in size; moreover, most of them operate in narrow bandwidth.

To address the above-stated wireless communication device requirements, this paper proposes a small size (12×16.5 mm) uniplanar ACS-fed e-shaped antenna for wideband operation and verifies its performance experimentally. The multiple resonant frequency bands are realized by integrating a half wavelength (λ/2) e-shaped radiating element to the basic 50 Ω ACS structure.

The antenna performance properties, such as return loss S_{11}, bandwidth, parametric studies, radiation patterns and peak gains are simulated and analyzed by using the CST MWS software package. The measured –10 dB impedance bandwidth values of the proposed dual band antenna are about 100 MHz in the range 2.4–2.5 GHz and 2100 MHz in the range 4.0–6.1 GHz, which can be used for 2.4 GHz Bluetooth/RFID, WLAN (2.4/5.2/5.8 GHz), WiMAX (5.5 GHz), US public safety band (4.9 GHz), ISM band, RF energy harvesting and IoT applications.

2. DUAL BAND UNIPLANAR ANTENNA DESIGN WITH ANALYSIS

The compact e-shaped geometry of dual band ACS-fed monopole antenna [15] is shown in Fig. 1 with its optimized parameter values given in Table 2, which comprises meandered rectangular strips in the form of an e-shape structure and a rectangular uniplanar ground plane. The electromagnetic simulation software (CST microwave studio package) is used to quicken the novel design of reported antenna. The uniplanar structure of dual band antenna is designed on a 1.6 mm thick glass epoxy substrate (FR4) having relative permittivity of 4.4 and compact size of 12×16.5 mm. The feedline strip width of 4 mm and the constant gap

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