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Research Article

A Dual Band Slotted Patch Antenna on Dielectric Material Substrate

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A low profile, compact dual band slotted patch antenna has been designed using finite element method-based high frequency full-wave electromagnetic simulator. The proposed antenna fabricated using LPKF printed circuit board (PCB) fabrication machine on fiberglass reinforced epoxy polymer resin material substrate and the performance of the prototype has been measured in a standard far-field anechoic measurement chamber. The measured impedance bandwidths of (reflection coefficient < -10 dB) 12.26% (14.3–16.2 GHZ), 8.24% (17.4–18.9 GHz), and 3.08% (19.2–19.8) have been achieved through the proposed antenna prototype. 5.9 dBi, 3.37 dBi, and 3.32 dBi peak gains have been measured and simulated radiation efficiencies of 80.3%, 81.9%, and 82.5% have been achieved at three resonant frequencies of 15.15 GHz, 18.2 GHz, and 19.5 GHz, respectively. Minimum gain variation, symmetric, and almost steady measured radiation pattern shows that the proposed antenna is suitable for Ku and K band satellite applications.

1. Introduction

In response to the fast growing microwave technology, there is increasing demand of compact, low profile, low cost, and light weight wireless communication module. In order for the communication terminal to be small, the antennas are needed to be low profile and compact in size [1–3]. Further demand of the planar patch antennas is intensified due to the attractive properties like simple geometric structure, compact, low profile, ease of integration, and fabrication characteristics with wide bandwidth. Nowadays, there is increasing demand of portable wireless communication devices and it is necessary to be dual/multiband compatible to use in different areas or countries. Due to the scarcity of bandwidth in the lower band, Ku/K band antenna design receives significant research attention recently [4, 5]. As a result, the demand of satellite-based portable communication devices is increasing remarkably, especially vehicle tracking, portable satellite station, weather forecasting, and so forth. Numerous types of patch antennas have been studied and examined by several researchers due to their excellent properties. These antennas use the monopole configuration, such as ring, elliptical, circular disc, annual ring, triangle, pentagon, and hexagonal antennas, and the dipole configuration like bow-tie antennas [6–11].

In order to design small and compact wireless device, it is obligatory to miniaturize the antenna size accordingly. There are numbers of requirements such as wide bandwidth, less expensive, miniature size, steady radiation patterns, and consistent gain for multiband antennas [5, 12]. Several studies have reported applications and technologies of the multiband antenna design, including dipole antenna loaded with single-cell metamaterial [13], slot-ring antenna with single- and dual-capacitive coupled patch [14], metamaterial-based planar antenna [15, 16], dual-patch elements [6], E-shape fractal antenna [17], and electromagnetic band gap (EBG) structure-based antenna [10]. A numerous concentration has given by several researchers that cutting the printed slot at the edge of radiating patch to create the desired antenna shape with targeted resonant frequency can be obtained [18, 19]. Although the resonance of the antenna not only depends on