

Research Article

Compact Modified Swastika Shape Patch Antenna for WLAN/WiMAX Applications

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A compact simple structure modified Swastika shape multiband patch antenna is designed and investigated. The antenna, which occupies an overall dimension of $0.305\lambda \times 0.305\lambda \times 0.012\lambda$ at lower frequency, has a simple structure which comprises of a planar wide square slot in the ground with four slits and Swastika shape radiation patch with a rectangular slot. The proposed Swastika shape antenna was designed and analyzed by using a finite element method based high frequency structural simulator HFSS. The experimental and numerical results exhibit that the antenna operates over the frequency ranges 950 MHz (2.28–3.23 GHz), 660 MHz (3.28–3.94 GHz), and 1120 MHz (5.05–6.17 GHz) suitable for WLAN (2.4/5.2/5.8 GHz) and WiMAX 2.5/3.5/5.5 GHz applications. It has a good omnidirectional radiation pattern and reaches 3.97 dBi at 2.44 GHz, 4.04 dBi at 3.5 GHz, and 3.25 dBi at the band of 5.98 GHz. A prototype is fabricated and then measured. The experimental and simulation results show good impedance bandwidth, radiation pattern, and stable gain across the operating bands.

1. Introduction

Recently, wireless communications have been developed widely and rapidly, which leads to a great demand in designing low-profile and multiband antennas for mobile terminals, especially the WLAN and WiMAX applications. In order to meet the wireless local area network (WLAN: 2.4–2.48, 5.15–5.35, and 5.72–5.85 GHz) and worldwide interoperability for microwave access (WiMAX: 2.5–2.69, 3.40–3.69, and 5.25–5.85 GHz) standards simultaneously, multiband antennas which are integrating these two communication standards into a single device are required with good performance [1].

Many types of antennas have been proposed recently to achieve multiband and wide band functions and applications, such as [2–7]. The Double-T shaped monopole antenna was presented for only WLAN-band applications [2]. A coupled dual-U-shaped antenna was presented for only WiMAX triple-band operation [6]. Although the above antennas have many advantages, there are still some performances to be improved. For example, only two bands were involved in [2, 6], which limited the numbers of working modes in

portable devices. The designs of the antenna may increase the cost or complexity of practical terminal design in [4] which possibly limits the integration level of the future wireless communication system. On the other hand, various types of antenna [8–14] which can both cover WLAN and WiMAX bands have attracted more and more attention in recent years: A double coupled C-shaped strips antenna [8], a circular ring and a Y-shaped strip antenna [10], L-shaped microstrip feed line and open-ended slot on the ground plane triple frequency antenna [11], a symmetrical door-shaped circular ring patch antenna [13], and triple-band microstrip-fed planar monopole antenna with defected ground structure [14] which have disadvantageous to some level such as incompetent well match for the whole WLAN/WiMAX bands and relatively complex structure. But they are all complicated in configuration to reduce the antenna applications.

In this study, a compact monopole patch antenna consisting of a Swastika shape patch with extra slot and wide slotted ground with four extra slots is presented in detail. The five rectangular slots in the patch radiator change the patch of the surface current. Furthermore, the slots and slits in the ground