

# Compact CPW-fed Tri-band Antenna with a Defected Ground Structure for GSM, WLAN and WiMAX Applications

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**Abstract**—In this paper we propose and investigate a unique compact FR4 based CPW-fed tri-band antenna for wireless applications. The antenna comprises frequency shifting strips and a defected ground structure (formed by combining of metallic strips and cutting of an L-shaped slot from the ground). The proposed antenna provides three different impedance bandwidths of 0.57, 0.98 and 1.59 GHz which are sufficient to cover the frequency band of GSM 1800/1900, WLAN 5.5/5.8 GHz and WiMAX applications. The developed antenna has a size of 17×20 mm and operates over frequency ranges 1.50–2.08, 5.25–6.23 and 9.10–10.69 GHz centered at 1.702, 5.802 and 10.102 GHz, respectively. The antenna was designed and simulated using Ansoft HFSS software. The antenna's characteristics such as reflection coefficient, radiation pattern, impedance bandwidth and VSWR are presented.

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## 1. INTRODUCTION

A planar monopole antenna is widely used due to its good characteristics including efficient radiation, simple fabrication, wide bandwidth and low cost. Considerable research of this type of antenna has been conducted and is going on in order to combine multiple communication standards in a single wireless system. Recently, ultra wideband (UWB) and WLAN standards (Wi-Fi, WiMAX) have made the planar monopole antennas more attractive for the application in wireless networks.

Typically, smaller antenna has serious limitations such as low gain and narrow bandwidth, thus either the bandwidth or gain of an antenna must be decreased in the process of its designing. These are several feeding techniques used in the monopole antenna, namely a probe feeding [1–4], a microstrip feeding [5–7], and a coplanar waveguide (CPW) feeding [8–10].

In this paper, a compact CPW-fed tri-band antenna is proposed which consists of frequency shifting strips (FSS) for dual-frequency operation and an L-shaped slot etched out of its ground plane. The FSS allows the antenna to operate in dual-modes of 1.702 and 5.802 GHz, and resulting defected ground structure (DGS) provides an additional resonance at the frequency 10.102 GHz.

The idea of creating a multiband antenna using DGS by forming slots within a printed monopole antenna was proposed by many researchers [11–13]. In [12] the slots were cut out of the radiating element, while in [13] a single slot was etched out of the ground plane. A mobile must be able to switch its frequency of operation while visiting other countries to avail roaming facilities.

Therefore, the antenna was designed in order to provide the minimum required bandwidth of other countries GSM and WLAN services. The antenna proposed herein has advantages such as low profile, wide bandwidth, low cost, ease of fabrication. It is designed on a low-cost FR-4 dielectric, thus making it suitable for GSM 1800/1900, WLAN 5.5/5.8 GHz and WiMAX applications. The antenna's performance was simulated using Ansoft HFSS software.