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Broadband Printed Antenna with Modified Rectangular Patch and U-Slot in Ground Plane[1]

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Abstract—A broadband patch antenna is presented with a modified rectangular patch containing three symmetrical slots and an asymmetrical slot. A U-slot is inserted into the ground plane, which enables a wide operational fractional bandwidth of 143% ranging 2.9–17.5 GHz. The modified rectangular patch offers acceptable omnidirectional radiation pattern at higher frequencies with radiation efficiency of 83 to 95%. The maximum achievable gain is 5.48 dBi across the entire bandwidth. The electromagnetic wave modeling is conducted using high frequency simulator structure (HFSS) and the circuit model is simulated with Advance Designing System (ADS) software. The housing effect is studied using vertical orientation of antenna to approximate its performance in the presence of conducting bodies. The proposed antenna architecture has small electrical dimension of $0.17\times0.11\lambda$. Simple configuration and wide bandwidth makes proposed patch antenna a suitable candidate for versatile communication applications.

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1. INTRODUCTION

The demand of wideband radios in the modern wireless communication systems is increasing due to its higher bandwidth and large transmission data rate specifications. The current significant advances in wireless communication have raised the demand of miniaturized low cost antennas that can operate at multiple frequencies with sufficiently large bandwidth.

Ultra-wide band (UWB) is a compelling technology with fascinating features for several applications, such as location tracking, data communication and ground penetrating radar. In 2002 the US federal communications commission (FCC) announced the fractional bandwidth of 110% (7.5 GHz) and central frequency ranging from 3.1 to 10.6 GHz as UWB radio systems. The advantageous superiority of UWB is its immunity to multipath fading effects, large channel capacity and high data rate [1, 2].

Facilitated with the advantage of relatively simple structure, lightweight, broad impedance bandwidth, good radiation pattern and steady gain, printed antennas have drawn the attention of numerous research groups. In recent years, numerous UWB and wideband antennas have been presented [3–15]. Among printed slot antennas, narrow slot antennas usually satisfy narrow bandwidth while a wide slot antenna shows broad range of bandwidth.

The majority of the compact antennas presented in the literature exhibit omnidirectional radiation pattern with an observable impulse response and low gain. These types of antennas have good application for the short range indoor and outdoor communication as well as for microwave imaging systems, such as biomedical applications.

In [3] circularly polarized monopole broadband antenna consist of C-shaped radiator and modified ground plane having dimensions of 49×55 mm and footprints of 2695 mm^2 is presented. It covers 2.25–7.35 GHz bandwidth, which is applicable for many wireless communication applications. A C-shaped monopole

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