

Multi-Band Notched Antennas for UWB Applications

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Abstract—A compact ultra-wideband circular monopole antennas with single, dual, triple and quad-band rejection characteristics are proposed in this paper. The antenna units are designed using RT/DUROID substrate with permittivity 2.2 and all are fed through a coplanar waveguide (CPW). In the proposed antennas splitted concentric rings (SCR) are used to achieve band rejection characteristics. The proposed antennas will reject the existing WLAN (Wireless Local Area Network), WiMAX (World Wide Interoperability for Microwave Access), X-band downlink satellite communication and radio-frequency channel arrangements for fixed wireless systems to avoid interference. Simulations are carried out using CST Wave Studio Suite 2016. Antenna performance parameters like return loss, VSWR, radiation pattern and gain are evaluated for all the antenna units. The antenna units having dimensions of $30 \times 23 \times 1.57$ mm³ are fabricated and tested. The simulated and tested results are compared and reported. These antenna units provide good gain and a larger bandwidth over the frequency range 3–11.6 GHz.

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1. INTRODUCTION

In 2002 FCC has allotted a bandwidth of 7.5 GHz (3.1–10.6 GHz) to commercial applications allowing unlicensed usage. UWB can handle a large capacity of hundreds of Mbps. In addition, UWB systems function at exceedingly low levels of power transmission. Hence, they are able to offer an extremely safe and dependable communications system because the low energy density makes accidental detection rather difficult [1–8].

However, when new advanced wireless transmission techniques are introduced, this ultra-wide increases the complexity of transceiver. One way of improving the performance of a system, without changing architecture, which is a costly affair, is to employ advanced antenna design techniques. This created interest in researches to carry out work to find a compact and efficient ultra-wide band antenna. However, there are several challenges in this.

The antenna to be used with UWB systems has to accommodate ultra-wide bandwidth and its performance should be consistent and predictable over the entire band. It should provide high radiation efficiency. The design considerations of UWB antennas are different from those used with narrowband antennas.

The radio signals used with UWB systems are non-sinusoidal. Avoiding interference with existing narrowband services is the main challenge to design a compact wideband antenna with band rejection characteristics. The existing wireless services like WLAN operating in the frequency band (5.15–5.58 GHz), WiMAX operating in the frequency band (3.3–3.7 GHz), X-band downlink satellite communication operating the frequency band (7.25–7.75 GHz) and radio-frequency channel arrangements for wireless systems operating in the band 8.0–8.500 GHz. It is important to design an antenna that is not only compact but also has multi-band filtering.

In this paper filtering of the existing WLAN band, WIMAX, X-band satellite link and fixed wireless system bands are done using Splitted Concentric Rings (SCR) having different radii. In this paper to achieve better radiation characteristics, CoPlanar Wave guide feeding (CPW) is used. CPW feeding provides low

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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