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Band-Notched Planar UWB Microstrip Antenna with T-Shaped Slot

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Abstract—Ever growing demand for higher data rates requires appropriate radiation systems with large bandwidth and stable gain. Microstrip antennas with unidirectional radiation patterns and stable gain are most useful for this purpose. A ground plane defect of microstrip patch antenna is used to breed multiband applications. As a result, the performance of gain, directivity, and bandwidth is enhanced, the geometry and shape of an ultrawideband (UWB) antenna are simplified, and its size is reduced. Thus, it results in the efficient performance with respect to wideband operation. A novel band notching of microstrip truncated UWB antenna is implemented for insusceptibility in the range 5.2–5.8 GHz. The suggested structure contains circular truncated and T-shaped slots for band notching. The optimal results can be obtained by selecting the antenna parameters. Advantages of the proposed antenna include small size, better impedance match and simple design. Details of the suggested and observational solutions are demonstrated in this paper. The S_{11} parameter of antenna is –45.5 dB at a resonant frequency of 4.6, 5.5, and 9.8 GHz. The gain of antenna is 5.47 dB, and the value of VSWR is smaller than 2, which makes the proposed structure an ideal choice for its application in wireless communication, 5G and IoT.

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1. INTRODUCTION

The FCC (Federal Communication Commission) has turned over a permission of utilizing the band 3.1–10.6 GHz for the function of commercial applications. Since then, ultrawideband (UWB) has diverted the attention of academicians and engineers [1]. Microstrip planar antenna for UWB application is the key element in the UWB system. It possesses a high data rate, immunity to interference and high impedance spectrum (range of frequencies where antenna has good impedance matching), which are the key characteristics of UWB antenna [2].

There are several wireless communication systems operating in 3–10 GHz range, which results in the interference in the UWB application band. Hence, this problem can be solved by using various band notching methods.

During several years, many band notching techniques like a single band notch, double band notch, band notching with U-shaped and T-shaped slots have been used [3–7].

In this work, planar microstrip patch antenna is designed with inset feed. The proposed antenna is notched by using a T-shaped slot. Several specifications of antenna design are explored. The simulation and experimental results of gain, directivity, polar plots and return loss of the implemented antenna are described.

2. MATHEMATICAL MODELING

The resonance frequency of planar microstrip patch antenna in TM_{mn} mode is given by expression [8–10]:

$$f_{\mathrm{r}} = \frac{c\sqrt{m^2 + n^2}}{2a\sqrt{\varepsilon_r}}, \tag{1}$$

where c is the velocity of light, a is the side length of a patch, m and n are mode indications, ε_r is the reflective index.

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