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Dual Notch UWB Antenna for Wireless Communication

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Abstract— **A dual notch band UWB antenna is designed here for UWB applications. Antenna proposed here is compact in size and has dimensions 40X40mm^2. FR-4 dielectric material is used for substrate here with dielectric constant 4.6. The height of antenna excluding ground plane is 1.5mm. The antenna proposed here has two rectangular patch and a circular patch as of radiating patch. Coplanar waveguide type of feeding is used here for giving input to antenna. The simulation and designing of following antenna is done on CST (Computer Simulation Technology) software. As the proposed antenna works on UWB band which has multiple short distance applications and even there are some band interference in its working of UWB band so here we are removing two bands WLAN range and some part of C-band to reduce interference in UWB band.**

Index Terms— **Dual band notched, UWB, CST, coplanar waveguide.**

I. Introduction

The spectrum allocated by FCC for various UWB applications is from 1.99-10.6 GHz, 3.1-10.6GHz or below 960 MHz for some specific applications [1]. According to FCC the following applications are possible using UWB band like, imaging system ground penetrating radar system, wall imaging system, medical system, communication vehicle radar system etc.[2]. With the improvements in communication technologies requirement for microwave devices has been increased. Now days devices with compact structure, wide bandwidth and good electrical characteristics are in high demand. However, over the designated frequency band. There exist some narrow bands for other communication systems, suchas WiMAX operating in the 3.3 - 3.7 GHz band, WLAN operating in the 5.15 - 5.82.5 GHz band and C-band satellite communication systems at 7.2 GHz. They may cause communication interference with the UWB system. For overcoming from such issues band notched antennas are in demand.

Using UWB for communication applications high data rates are possible due to the large number of pulses that can be created in short time duration [3]. Ultra Wideband is any communication technology that holds more than 500 MHz of bandwidth or more than 25% of the operating frequency. Most narrowband systems occupy less than 10% of the centre frequency bandwidth and are transmitted at far greater power levels[4].

When signals are sent via ultra-wide band antennas, a low level of signal by a broad frequency band, less power is required because it undergo from less interference. This means UWB antennas requires fewer energy to give access to internet, digital voice services and video telephony. Ultra-wide band antennas are basically used with software defined radios. The software prescribed radio or SDR that have one UWB antenna rather than numerous to cover any frequency range it is set for at that moment [5].

Many slot antenna elements suitable for a CPW-fed UWB configuration have been studied in literature. Study of CPW feed circular disc monopole for ultra wideband applications [6]. Compact SRR loaded UWB circular monopole antenna with frequency notch characteristics [7]. High performance direct coupled band pass filters on coplanar waveguide[8].

Antenna requirements for software defined and cognitive radio [9]. New reconfigurable antenna design for cognitive radio[10]. Yi-Cheng Lin has been discussed the design of three advanced band-notched 5–6 GHz UWB rectangular aperture antennas[11].

The organization of this paper is as follows. In Section II, basic design of antenna is described. In Section III, the simulated results of designed antenna are presented and finally, the paper is concluded in Section IV.

II. ANTENNA DESIGN

Here in this section design of proposed antenna is discussed. For designing this dual notch UWB band antenna a 40×40 mm^2 substrate is used of FR-4 substrate. Antenna here is feeded by using CPW feeding technique. The designing and simulation is done on CST (Computer Simulation Technology) microwave studio. The structure of antenna is shown in Fig.1. As it is clear from antenna that the two notches we are getting is due to the slots introduced in feed line. The notches introduced in feed line lead to variation in current distribution which varied inductance and capacitance of the patch which lead to change in frequency of band to be removed. The length and width of slot can be varied and with varying that the frequency band needed to be notched can be easily changed. With that there are two rectangular patch and one circular ring attached to feed line. The thickness FR-4 substrate used here is 1.5mm. We can achieve good results by maintain perfect gaps between the slots as the gas between the slots can help in improving characteristic impedance of the patch. The dimensions of antenna are mentioned in Table1.

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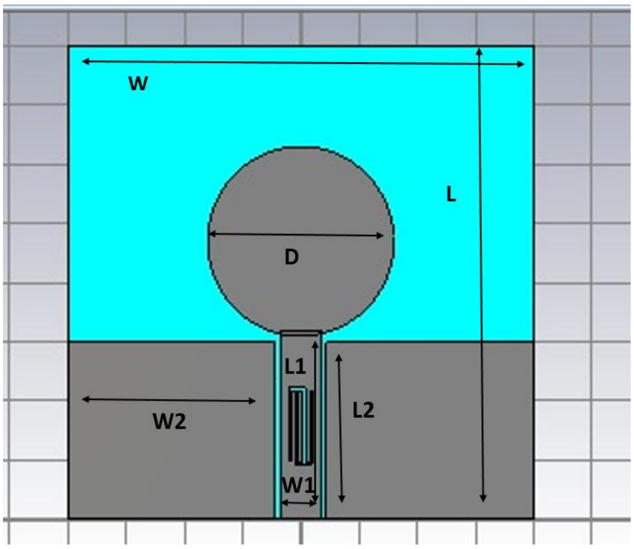


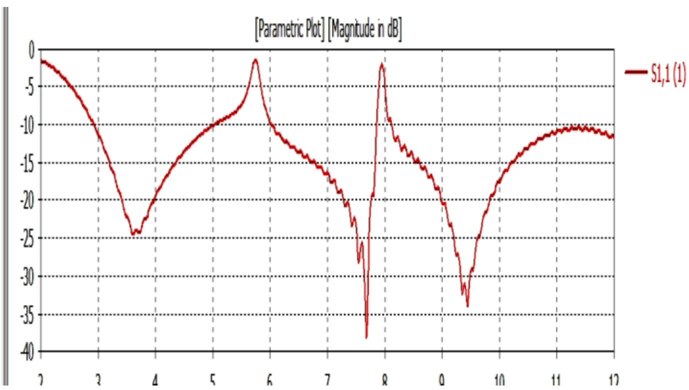
Fig.1 Structure of proposed antenna

TABLE 1 KEY DIMENSIONS OF ANTENNA DESIGN

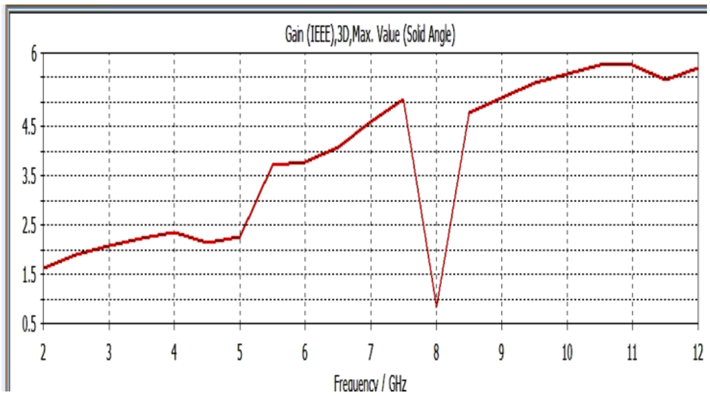
Antenna parameter	Value	Antenna parameter	Value
L	40mm	W	40mm
L1	21mm	W1	4.6mm
L2	22.15mm	W2	20mm
D	17mm		

III. SIMULATION RESULTS AND ANALYSIS

The antenna proposed here is designed and simulated on Electromagnetic (EM) simulation software CST (Computer simulation technology).CST is used to design patch antennas, filters, wire antennas, and various Radio frequency /wireless Devices. Using CST different antenna parameters like S11, gain, VSWR and radiation patterns are observed. Return loss vs. frequency and gain vs. frequency graphs are shown in Fig.2. As from return loss graph it is clear that antenna is showing dual notch behavior over UWB frequency range so that interference can be minimized across the band. Fig.3 shows the current distribution for the proposed antenna.



(a)



(b)

Fig.2 Simulated results of proposed antenna (a) Return loss (b) Gain

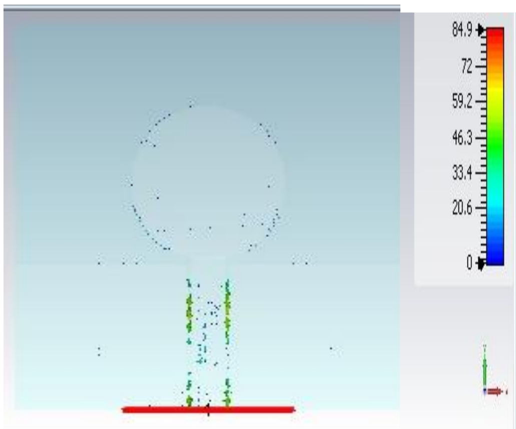
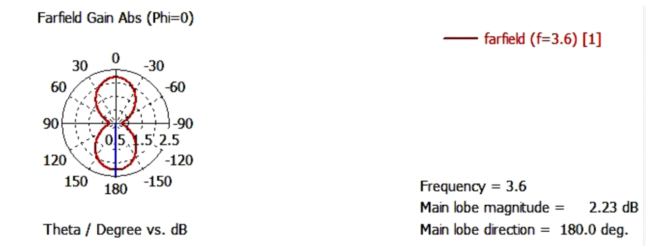
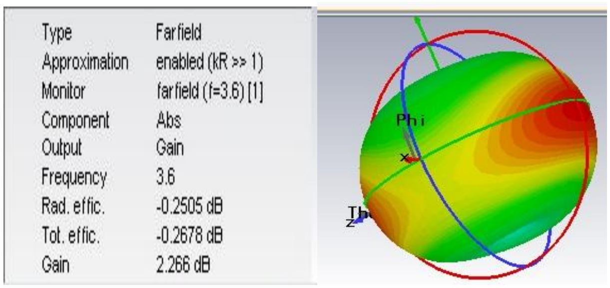


Fig.3 Current Distribution

The return loss graph presents two band notched in it one in WLAN and other in C-band which are the main interference regions of interference in UWB band. Fig.3 shows the surface current distribution. And Fig.4 shows the radiation pattern of the proposed antenna.





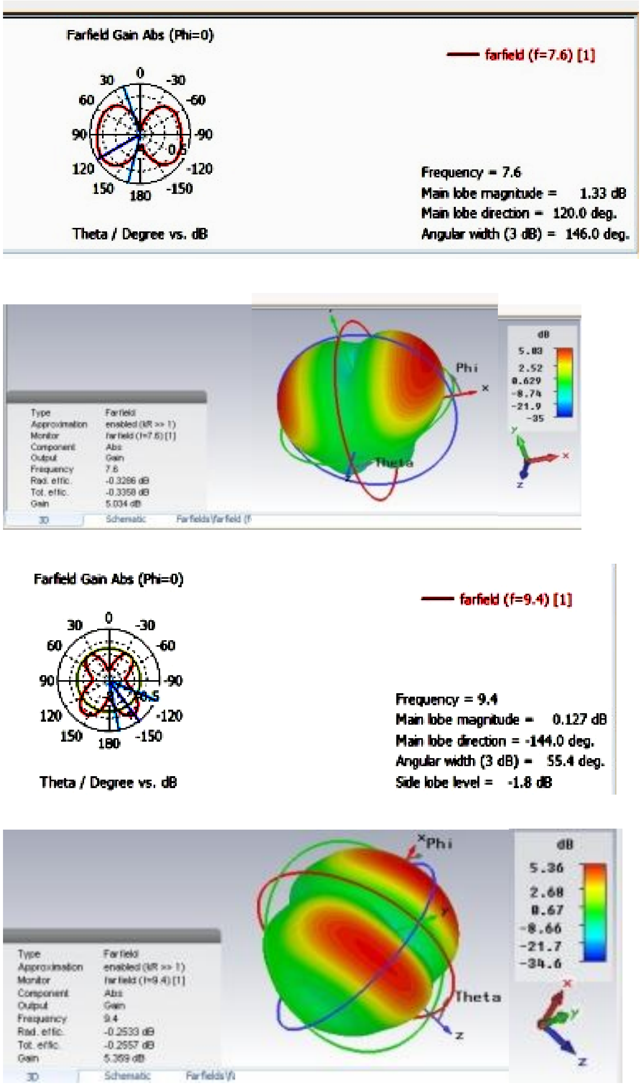


Fig.4: Radiation patterns for proposed antenna

IV. CONCLUSION

This paper here proposes a new structure for UWB band applications with notch bands for WLAN and C-band area which causes maximum interference to the signals of UWB band. The proposed antenna is designed to cover the frequency band of 3.1 to 10.6 GHz with two bands eliminated. Here in this designed antenna two rectangular slots are used for coplanar feeding and circular patch attached with microstrip feed line are used and for notch introduction two slots are cut in feed line. Further by varying the dimensions of slots in feed line we can easily vary the frequency to be notched. Various antenna results are mentioned in paper which show that with the use of slots a compact antenna structure can be designed with better applications. In future there will be more possibility to improve the efficiency and gain of antenna. Also we can convert it into a reconfigurable antenna by introducing RF diode or MEMS diodes for switching purpose.

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