Design of Ultra Wide Band Antenna

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Abstract— *In this paper we propose a Ultra wide band antenna which operates on UWB range (3.1 to 10.6GHz). We use micro strip line feeding and rectangular shape as a base shape for patch.FR4 is used as a substrate material with thickness 1.57mm with copper cladding for a ground and patch as 0.035mm. Rectangular patch and defected ground structure is used to attain UWB range. The design is carried out using CST microwave studio 2014.Maily used in the application like military, satellite, cognitive radio etc…*

Keywords- *FR4, CST, rectangular patch*

I. INTRODUCTION

UWB is a fast emerging and most promising technology exists in this modern era. Ultra Wideband has a lot of features which attracts us to research in this field such as it is work on impulse technology, often in the picoseconds range and consume very less power as compare to conventional technology. The UWB becomes more promising and attractive wireless topic since the Federal Communication Commission (FCC) released the unlicensed 10-dB band of 7.5 GHz (3.1 - 10.6 GHz) with an Effective Isotropic Radiated Power (EIRP) spectral density of -41.5dBm/MHz as UWB communications utilization for short distance communication in 2002 [8].

As the demand of UWB antenna is increasing day by day

because of its attractive features and numerous advantage. The research in this field is very important as it can integrate with a lot of attractive technology. The goal of proposed paper is to provide ease of communication to user with miniaturized size which can easily fabricate with different portable devices.

Defected Ground Structure technology is proposed in this

paper to reduce the size of antenna. As per the literature reviewed DGS provide the considerable miniaturization, good impedance matching and wider bandwidth in the design UWB antenna and make it compact size for portable uses]. Recently researches focuses on designing UWB antenna with band rejection capability to eliminate interference from narrowband wireless application. DGS technology can be easily created by embedding different elements or slits on radiating patch. In this proposed paper introduces rectangular patch with dgs supported ground plane i.e. partial ground. DGS can be used as an alternative approach to enhance the resonating performance of various antennas. UWB technology then becomes the most prolific wireless communication technology having the advantages of faster data transmission rate, simplicity, inexpensiveness, and low spectral power density, low power consumption, low interference, and easy installation. The high demands on such a communications system have stimulated research into many UWB antenna designs. Nonetheless, antenna designs for UWB applications face many challenges including their impedance matching, radiation stability, compact size, low manufacturing cost and electromagnetic interference (EMI) problems. The EMI problems are quite serious for UWB systems since there are several other existing narrowband services which occupy frequency bands within the designated UWB bandwidth. Printed rectangular patch antenna fabricated on substrate with defective ground plane provide large impedance bandwidth which is useful for designing UWB micro strip antennas. Since there exists some standard narrow bands in between the frequency range of UWB, Therefore, to prevent the UWB devices from the interference due to these standard narrow bands, band notched characteristics is introduced in UWB antennas. Lots of conventional techniques have already been proposed to design UWB antennas with band-notch characteristics. These include embedment of different types of slots on the radiating patch or on the ground plane, use of parasitic elements/patches, etching of split-ring resonators, use of tuning stubs, meandering of ground plane, use of folded strips, use of resonated cells on the coplanar waveguide, and

use of embedment of strip lines, [1-3] have been reported in the literature. To achieve the band notched characteristics in rectangular patch a rectangular shape slot is being cut on radiating patch. The paper starts with the design of simple compact UWB rectangular patch antenna. The antenna radiates over the frequency band of 3.4 GHz to 11.6 GHz with VSWR< 2.

II. ANTENNA DESIGN

A. UWB rectangular Patch antenna

The proposed miniaturized UWB rectangular patch antenna
is shown in Fig. 1. The antenna is designed on FR4 substrate
with dielectric constant (εr) 4.4, thickness 1.6 mm, overall size 20x15 mm², and height (h) 1.6mm.The antenna consists of rectangular patch. Primarily, the base of the antenna is designed using formula for simple patch antenna design [6], after that the parameters are optimized to get UWB characteristics.

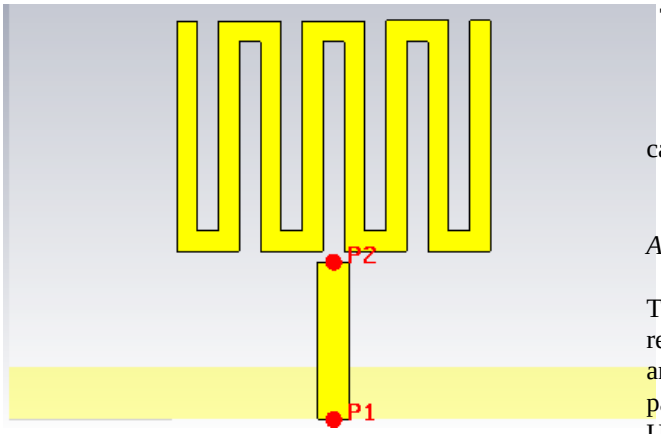

Fig 1Geometry of proposed UWB antenna

A novel shape is being cut on rectangular patch of length 'L' and width 'W'. The optimized parameter of proposed
antenna is given in following table1. By varying the slot parameters, the notch band can be achieved effectively by
introducing novel shape slot.

Specification	Dimensions
Width of Ground/Substrate	31 mm
Length of Ground	2.5 mm
Thickness of ground/Patch	0.035 mm
Thickness of Substrate	1.57 mm
Width of Patch	15mm
Length of patch	11 mm
Substrate Material	FR-4
Ground/Patch Material	Copper

Table1. Variable values of proposed UWB antenna

Specification	Dimensions
Thickness of Slot	0.035 mm
Width of slot	1.5mm
Length of slot	7.5 mm
Slot Implementation	Patch
Substrate Material	Copper

Table2. Variable values of proposed UWB antenna

The above mentioned specifications are used to carry out the proposed model design of UWB antenna.

III. SIMULATED RESULTS AND DISCUSSION

A. Return loss (S11) Variation with Frequency

The variation of S11 with frequency for UWB rectangular
antenna characteristics is shown in the Fig. 1.Simple patch as well as w slot on radiating patch fulfilling UWB condition and giving stable band throughout. The Plot of return loss is shown in fig.1 illustrating band range.

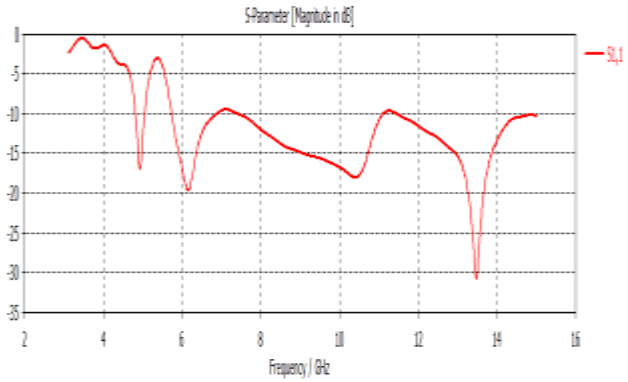

Figure2. Variations of S11 with frequency for UWB antenna .

B. Voltage Standing Wave Ratio (VSWR)

The variation of VSWR with frequency for UWB hexagonal
antenna with from fixed U-NII band 5.15GHz to 5.85GHz
band notched characteristics is shown in the Fig. 3. The VSWR value at the notched bands is more and for the remaining band the value is less than 2 (VSWR < 2).

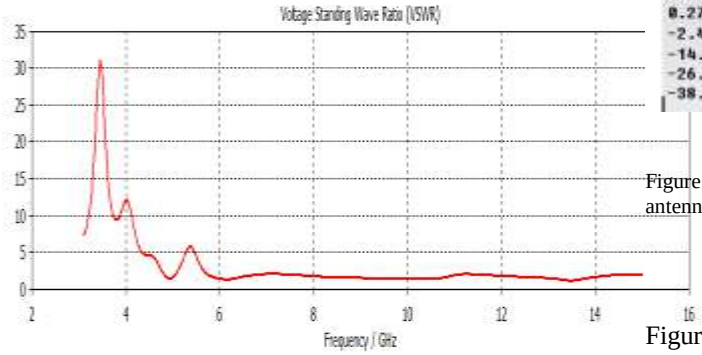

Figure3. Variation of VSWR with frequency UWB antenna.

FIG 2, 3 shows the S-Parameter and VSWR range of the proposed UWB antenna

C. Radiation Pattern

Figure 4,5 shows the Radiation pattern of proposed UWB antenna at 4.9GHz in two and three dimensional pattern

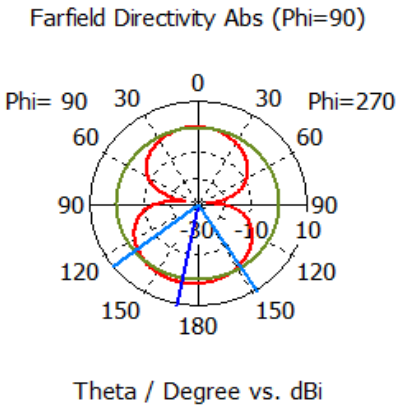

Figure4. Two dimension radiation pattern of proposed UWB antenna.

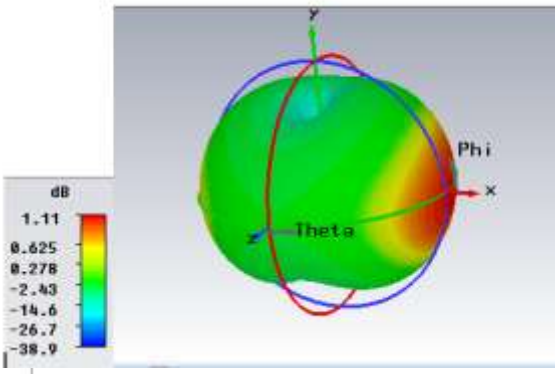

Figure 5. Three dimension radiation pattern of proposed UWB antenna.

Figure 6,7 shows the Radiation pattern of proposed UWB antenna at 13.47GHz in two and three dimensional pattern

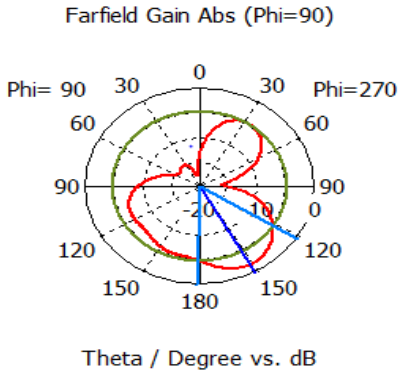

Figure 6. Two dimension radiation pattern of proposed UWB antenna.

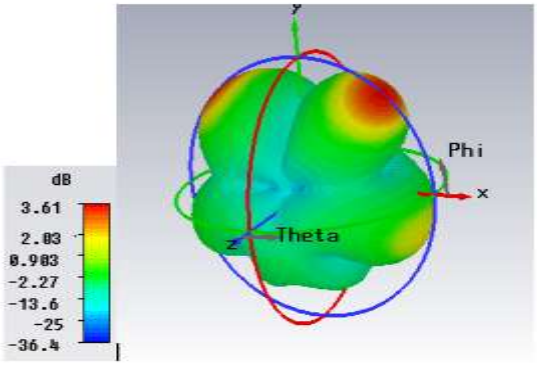

Figure 7. Three dimension radiation pattern of proposed UWB antenna.

IV. CONCLUSION

A UWB antenna with Fixed band (3.1 to10.6GHz).This characteristics of antenna has been presented by using rectangular slot on the patch.The parameter of rectangular patch UWB antenna is simulated using CST 2014 software.The rectangular UWB antenna is compact one which can easily be integrate with portable device like USB. These characteristics is achieved by varying the parameters of the proposed rectangular slot.The proposed antenna is expected to be an excellent for UWB short distance applications like military,satellite,cognitive radio etc…..

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