A Band Notched Ultrawideband Antenna

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Abstract :

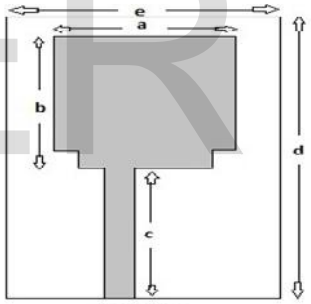
This paper presents the design of Microstrip line feed rectangular-cut ultra wideband (UWB) antenna with notched-band characteristic. The antenna has been designed on a FR4 substrate with dielectric constant Ɛr = 4.4, loss tangent (tan δ) =0.002 The antenna has been optimized to exhibit UWB characteristics from frequency range 3.1GHz–12 GHz except the notched-band frequency 5.2 GHz to 5.8 GHz. The radiation pattern of this antenna is nearly omni-directional in H-plane and bidirectional in E-plane. The effect of various design parameters on notched characteristics have also been analyzed using CAD Feko 6.1 simulator using MoM[14]. The simulated results are in good agreement with FCC standards showing VSWR <2 throughout the band 3.1GHz to 12GHz, except the notched-band. This antenna can be easily integrated with microwave circuitry and useful for UWB applications.

Keywords:**Microstrip antenna, Monopole antenna, Band-notched, Microstrip line-feed and UWB system, Stepped Impedance Resonators.**

I. INTRODUCTION :

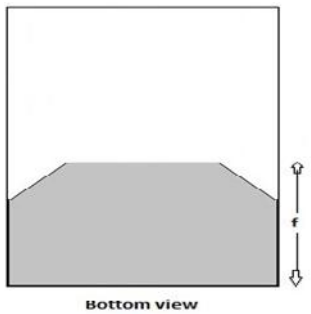
In 2002, Federal Communication Commission (FCC) authorized unlicensed use of UWB band ranging from 3.1GHz to 10.6 GHz. UWB system plays a crucial role in communication system as the antenna is one of thewireless communications components. The UWB antenna is a specific component whosetransmitting andreceiving properties differ from those for conventional narrowband operation. There lies different wirelesscommunication systems which overlap the UWB band. To avoid interference due to these frequencies, UWBantenna must be able to reject such frequencies with very fine rejection characteristics. For this purpose,numerous notches are created at particularfrequency band which have rejection characteristic over a limitedbandwidth.

A number of antennas with band-notched property have been discussed and various methods havebeenused to achieve the function. UWB antenna can beachieved byuse of simple microstrip line and properdesigning of ground structure [1]. While widely used methods for notched-band are created slots on the patch oron the ground plane, i.e., straight, triangular, E-shaped, H-shaped, U-shaped, and folded strip-line slots [2-5].The all these notches techniques are very expensive way to obtain notched characteristics in an expected bandof frequency [6]. The notched bands can be generated by a band notched filter composed of double steppedimpedance resonators (SIRs) [7-8]. Split ring resonator is one of the widely used and appreciated structure usedfor creating notches at particular frequencies [10-11]. Adding parasitic element is another advantageous methodto generate notched band [9]. Square ring resonator and a square parasitic element can be used to have notchedcharacteristics in UWB antenna [12-13]. The notched-band characteristic achieved by parasitic elements so farreported by having parasitic element on the back of substrate or adjacent to patch. This requires the double sideprinting or increase the overall size of antenna. In this paper, parasitic element to create notched-band isproposed, which does not require double side printing and also not increase the size.



Top View

Fig. (1)



Bottom view

Fig. (2)

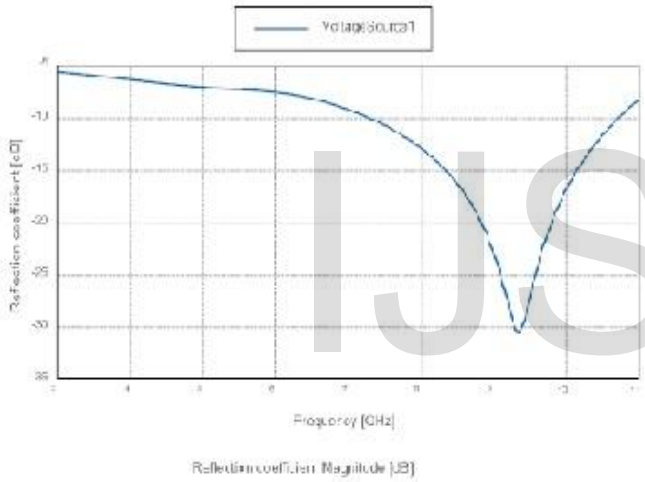
II. ANTENNA DESIGN:

Fig. 1 And 2 shows the geometry of a UWB monopole antenna. The antenna is fabricated on FR4 substrate with dielectric constant of 4.4 and thickness of 1.6 mm. The radiating element and feeding line are printed

on the top side of the substrate and the ground plane on the bottom side. The width of the microstrip feed line is chosen as 3 mm to achieve the characteristic impedance of 50Ω .

In the proposed design, themonopole antenna and the ground plane form an equivalent dipole antenna . The current distribution on the patch affects the impedance characteristics of the antenna. By cutting the two notches of suitable dimensions at the two lower corners of thepatch , impedance bandwidth gets enhanced. This phenomenon occurs because the two notches affect the electromagneticcoupling between the rectangular patch and the ground plane. The gap between the radiation patch and ground plane is also an important parameter to control theimpedance bandwidth. The patch and the ground plane form an equivalent dipole antenna. The ground plane is beveled, resulting in a smooth transition from one resonant mode to another and ensuring good impedance match and stable gain over a broad frequency range. The proposed antenna can achieve high gain at low and high frequency with bevel on the ground plane.

III. RESULTS AND DISCUSSION:



The reflection coefficient Should be -9 to -50 dB for frequency 3.1GHz to 12GHz.

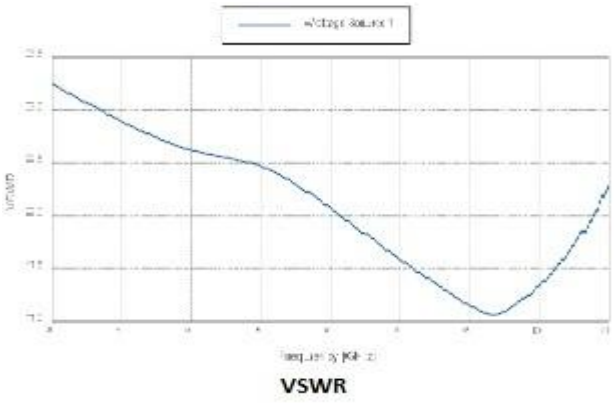


Fig. 4 describes about VSWR. The operating band of any antenna is described by VSWR less than or equal to 2.

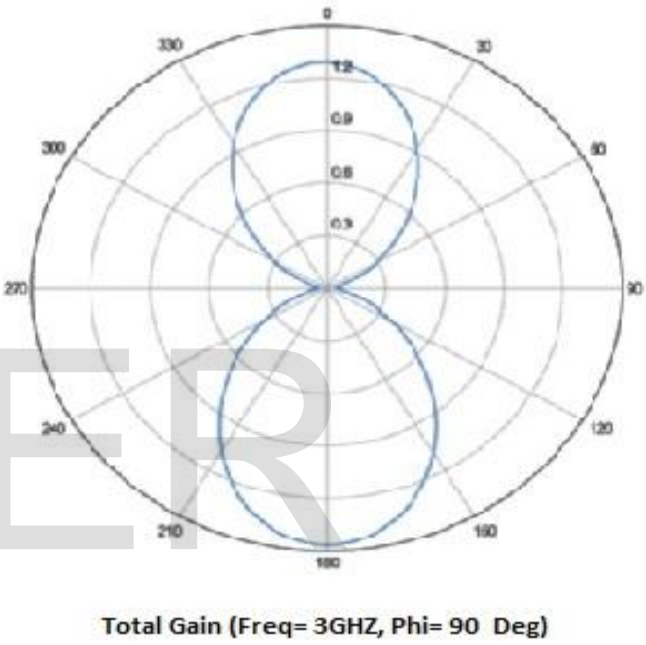


Fig 5. Shows the result of radiation pattern . The radiation pattern of this UWB antenna is bidirectional in E-plane.

IV. CONCLUSIONS :

Simulated results shows that putting corner notches on the radiating patch improves the electromagnetic coupling between the radiating patch and the destructive ground plane and results into the enhanced bandwidth. Also beveling of the ground plane causes smooth transition from one resonant frequency to other; which has further improved impedance bandwidth. Obtained radiation pattern nearly omnidirectional. Present antenna has successfully notched the frequency from 5.2GHz to 5.8GHz. Hence interference to existing wireless system can be avoided.The antenna presents in this paper provides a brief idea of Ultra Wide Band RSMA. Smoothening of corner of rectangle

increases reflection and current at the boundary of patch. Truncation of RSMA with straight edge truncation to required UWB operation of antenna.

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