International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 10, October-2014, pp: (91-94), Impact Factor: 1.252, Available online at: www.erpublications.com

An Ultra Wideband Π- Shaped Slot Antenna with Band Notch Characteristics

Vandita Choudhary[1], Garima Srivastava[2], Swati Sharma[3]

[123]Department of ECE, Ambedkar Institute of Advanced Communication Technologies & Research, Geeta Colony, Delhi, India

Abstract: In this paper a microstrip-fed ultra wide-band (UWB) printed monopole antenna with frequency band-notch characteristics is proposed. The proposed antenna has a size of 12mm x 20 mm. The antenna comprises of a π shaped slot on square radiating patch placed on FR4 substrate. The π shaped slot generates band rejection performance in the frequency range of 5.37-5.77 GHz .The truncated ground plane matches the patch with the feed line thus enhancing the UWB range of the antenna.

Index Term: square monopole antenna-shaped sleeve, ultra wideband (UWB), π-shaped slot, antenna design.

INTRODUCTION

UWB antennas are widely used in wireless communication as they deliver high bandwidth, reduces multipath fading yet needs low power and simple in design [1]. Worldwide the frequency band from 3.1 to 10.6 GHz is used for UWB applications as assigned by Federal Communication Commission (FCC). The main problem arises that this frequency range interferes with various narrow band communication systems such as GPS and Wireless-LAN (WLAN) systems. To avoid this problem we need UWB band with small rejection bands, also called as notches. Several notched antenna have been researched and developed so far [2],[3].

In this paper a monopole antenna with π-slot is proposed. The band notch characteristic, covering 5.37- 5.77 GHz frequency range, is obtained with the single π shaped slot on the rectangular radiating patch. This antenna is small in size and offers a bandwidth of more than 6 GHz in UWB range.

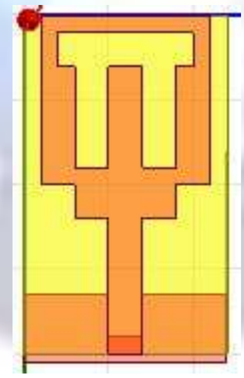


Fig.1: Proposed antenna with π-shape slot

ANTENNA DESIGN:

The designed antenna comprises of a square patch with a π shaped slot on the top of the substrate placed on a ground plane with a truncated rectangle. The π shaped slot is etched on the square patch to develop a notch in the frequency band. The 10 mm long and 10 mm wide patch is fed by a microstrip line. The 50 Ω feed line is 8mm long and 2 mm wide. The patch is located on a FR4 substrate with a relative permittivity of 4.4 and loss tangent of 0.0018. Beneath the substrate lays a ground plane having a length of 4 mm and a width of 12 mm. It comprises of a truncated rectangular plane. The distance (d) between the truncated ground plane at the bottom and the patch on the top plays a very crucial role in enhancing the bandwidth of the antenna. The coupling between the patch and ground can be increased by controlling the distance (d) .The distance d can be calculated by the given formula:

d= (Microstrip Length) – (Length of Ground)

This antenna provides the desired high attenuation near the notch frequency and thus serves our purpose.

RESULTS AND DISCUSSION

For achieving large bandwidth and good impedance matching between patch and ground plane, following parameters are to be considered-

A. Length and Width of π shape-This determines the frequency rejection band in UWB range.

B. Length and Width of patch step-This determines the ultra wideband range (VSWR <2) for which the antenna will radiate.

C. Truncated Ground Plane-This improves matching between the patch with the feed line and thus increasing UWB range of the antenna.

The simulated results are obtained by Ansoft simulation software HFSS [4]. The simulated VSWR and Return Loss curves are plotted.

Figure 2 shows the VSWR versus frequency curve. In general, if the VSWR is under 2 the antenna match is considered very well. From the figure, it can be seen that VSWR is less than 2 for the frequency range 3.8 GHz to 9.9 GHz .This antenna presents a band rejection from 5.37- 5.77 GHz(VSWR>2) in the desired UWB range.

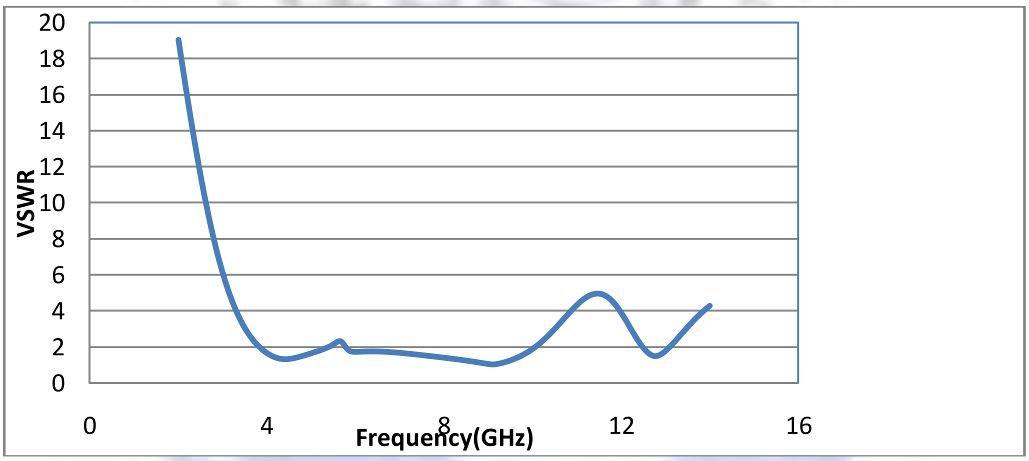


Fig. 2: Simulated VSWR curve for the proposed antenna

Figure 3 shows the return loss graph of the antenna. Generally, an antenna radiates in the frequency band for which return loss is -10 dB or less. We can see that this antenna has a good impedance matching from 3.8-9.9 GHz for which S11 is smaller than -10 dB except for 5.37- 5.77 GHz with S11 greater than -10 dB.

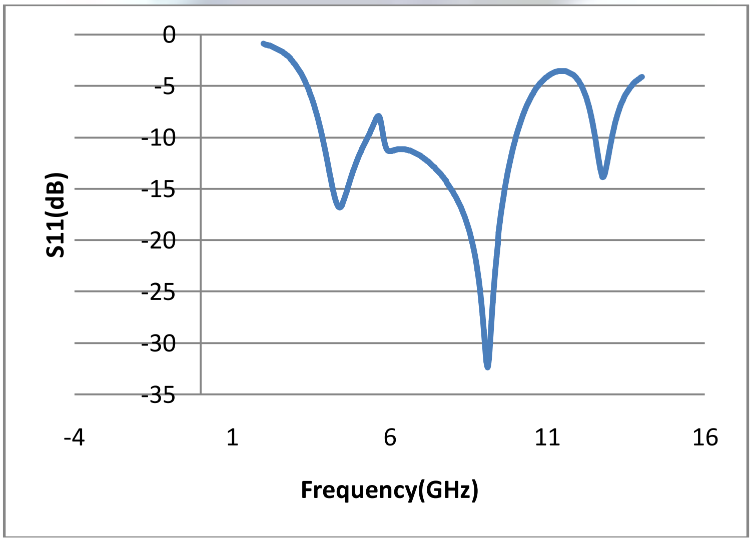
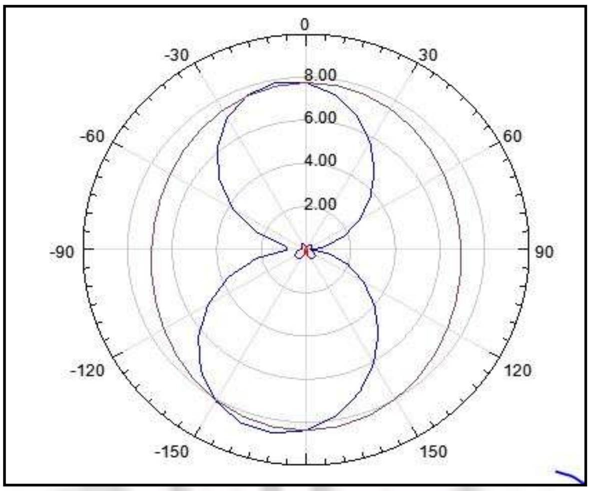
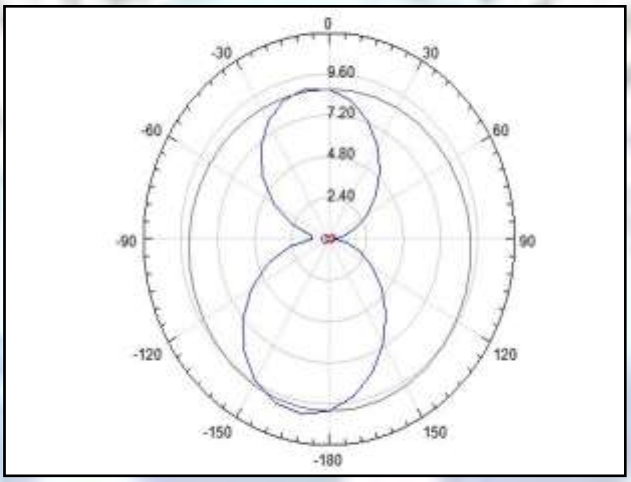


Fig. 3: Simulated Return Loss characteristic for the designed antenna.

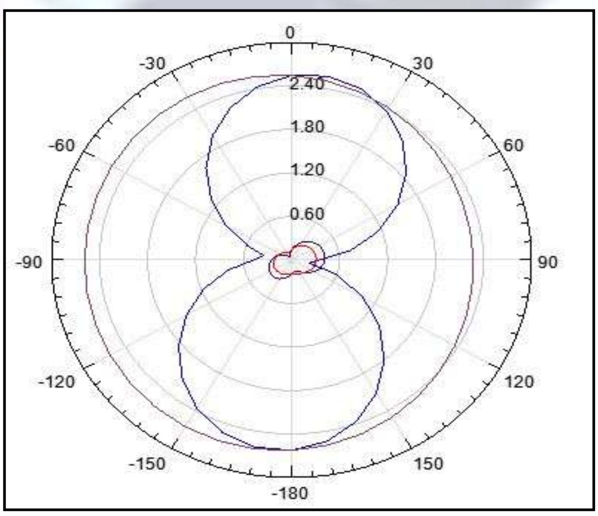
Figure 4 shows radiation pattern of the π- slot antenna including the co polarization and cross polarization in the H-plane(y-z plane) and E-plane(x-z plane) at different frequencies. The obtained radiation pattern is omnidirectional.



(a)



(b)



(c)

Fig. 4 shows radiation pattern of the proposed antenna. (a) 5.5 GHz (b) 9.6 GHz (c) 2.4 GHz

Figure 5 shows current distribution of the proposed antenna. The current is converged on the interior and exterior of the π -shaped slot which produces high attenuation at the notch frequency.

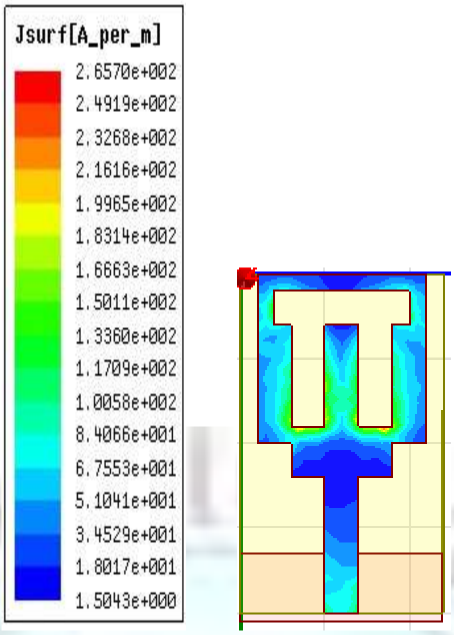


Fig. 5: Plot fields of the π-slot antenna.

CONCLUSION

The proposed antenna offers an ultra wideband range of around 6.1 GHz from 3.8 GHz to 9.9 GHz with a rejection band from 5.37- 5.77 GHz. The proposed antenna can be easily fabricated and is small in size as compared to the conventional monopole antennas. The possible conflict among UWB and existing narrowband services is minimized and thus this antenna can be used in various applications.

REFERENCES

[1]. Schantz, H.G. ; Wolenec, G. ; Myszka, E.M , " Frequency notched UWB antennas, "IEEE Conference on Ultra Wideband Systems and Technologies, 2003.
[2]. Chia-Ching Lin Peng Jin , Ziolkowski R.W, "Single, Dual and Tri-Band-Notched Ultrawideband (UWB) Antennas Using Capacitively Loaded Loop (CLL) Resonators" IEEE Transactions on Antennas and Propagation, VOL. 60,2012.
[3]. Feng Wei , Zhu Dan Wang , Fan Yang ,Xien Wei Shi "Compact UWB BPF triple-notched bands based on stub loaded resonator," Electronics Letters VOL. 49 ,2013.
[4]. Ansoft High Frequency Structure Simulation (HFSS). ver. 13, Ansoft Corporation, 2005.