Research Paper

Volume : 5 | Issue : 5 | May 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Ultra wide band patch antenna for C, X, Ku and K band applications

Engineering

KEYWORDS :patch antenna; high frequency; patch on edge; ultra wide band;

Manvir singh bhambra Department of ECEDAVIET, Jalandhar, India

Mrs. Neeru malhotra department of ECEDAVIET, Jalandhar, India

ABSTRACT

This paper primary focus on ultra wide banding techniques of patch antenna and thus designing an antenna which can be used for C band, X band, Ku band and K band application.

Introduction

In past few decades technology has grown to a great extent every gadget is going for wireless communication. Everything is going online, connected to internet. There is a new proposed future technology naming internet of thing in which all the things around us will incorporate with each other and thus will make our surrounding a better place for us to live a luxurious life. For such high requirement of interconnectivity with a very compact size we need an antenna which can transmit and receive at no of different frequencies simultaneously. Here we are proposing an antenna which has a ultra wide band (UWB) bandwidth. Benefits of using an UWB is that it is cost effective, can support higher data rates, consume low power and techniques like frequency hopping and OFDM can be used. Here we developed an antenna on edge of substrate which gives bandwidth of 159%. Antenna gives a return loss of less than -10db from 2.6 GHz to 21.4GHz. Here, we show that by sequentially embedding several pairs of rectangular notches and truncating them in two corners of the radiation patch, the stability of the radiation pattern is improved, bandwidth is enhanced and matching improvement are noticeably obtained.

Antenna Design And Configuration

Here we had designed a corner truncated stair case antenna with FR4 substrate having a dielectric constant of 4.4 and a substrate height of 1mm. Figure 1 show bottom view of patch antenna. Anternna is properly label and orange color show ground plane. All dimensions are in millimeter. Adding a a notch of 0.3 mm in length just under the feed provides better impendence matching for the patch as it provide an inductive load to feed. Ground plane has a slot cut out which enhance the bandwidth as it has been proved that open slot in ground plane enhance bandwidth.

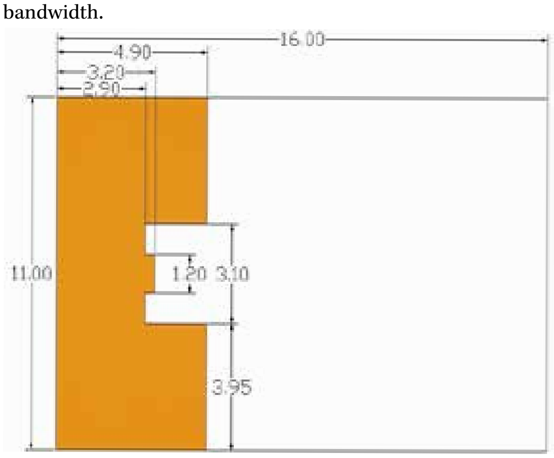

Figure 1.Bottom view show ground plane & its parameters

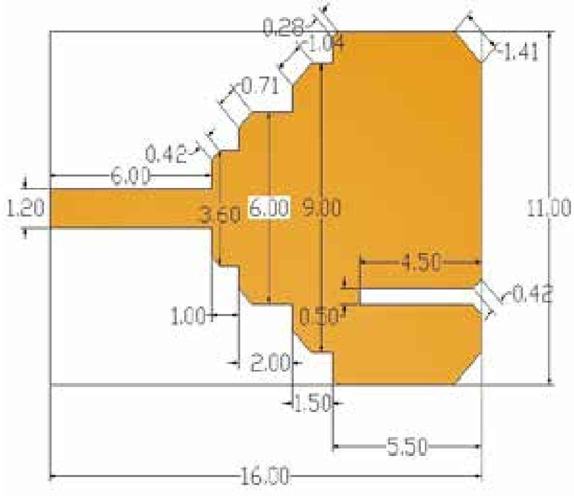

Figure 2 Top view showing Patch & design parameters

Figure 2 present the top view and the geometry details of radiating patch and feed. All dimensions in mm. a vertical slot has been cut on patch which acts divide the patch in two halves. These two halves act as capacitive load to each other and balance the overall impedance at higher frequencies. The feed has been given an offset of 0.05mm from the centre for proper matching.

simulated and mesured results

Proposed antenna structure is designed and simulated in HFSS (high frequency structure simulator version 13.0.0). We classify our antenna development in three stages ANT1 only truncated corners of patch no truncation at staircase structure, ANT2 corner truncation at staircase structure and shifted and ANT3 (proposed antenna). To simulate we consider two solution frequencies 8.4GHz and 25GHz. Figure 3, Figure 4 and Figure 5 shows results of ANT1, ANT2 and ANT3 (proposed antenna). Comparing these figures we can clearly see that return loss and uniformity of patch antenna has improved with the design geometry. ANT1 has frequency range from 4.4GHz to 17.9 GHz that is an operating frequency of 13.5GHz. ANT2 has better return loss and bandwidth response. It is a working range from 4.14GHz to 19.5 GHz that give us a working range of 15.5GHz. In t he last we have our final antenna with all corners truncated and an extended ground plane under the patch which provides us with a very uniform behavior of return losses and a very wide bandwidth ranging from 1.26GHz to 22GHz thus giving us an ultra wideband of 20.74GHz.

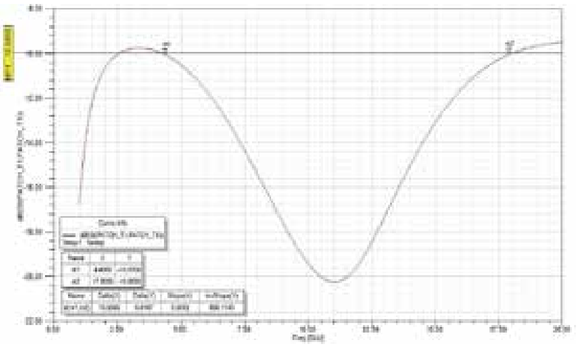

Figure 3 Simulated return loss of ANT1

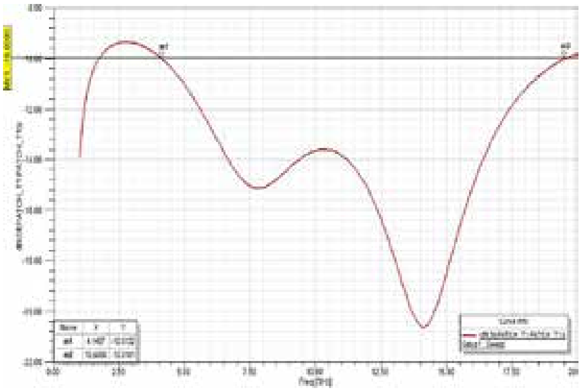

Figure 4.Simulated results of ANT2

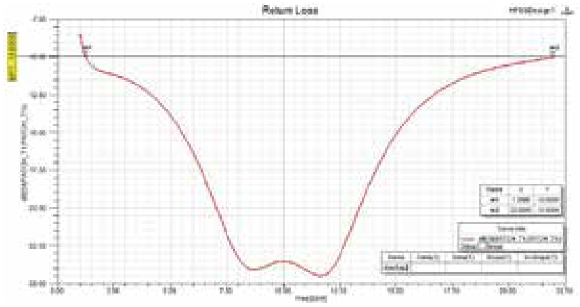

Figure 5 Simulated results of ANT3

Conclusion

A printed monopole antenna with a very compact size was presented and investigated. We showed that by implementing proper corner truncations and slots in patch and addition in ground plane exactly like feed with proper dimensions and positions in the staircase square patch, very good impedance matching and improved bandwidth are obtained. The measured results illustrate that the proposed antenna offers a very wide bandwidth from 1.26 to 22GHz for Return Loss of -10db. As a result, the proposed simple antenna can be very suitable for various applications of C, X, Ku and K band and the future developed UWB systems.

References

[1] R. Zaker , C. Ghobadi, and J. Nourinia , " Novel modified UWB planar monopole antenna with variable frequency band-notch function , " IEEE Antennas Wireless Propagation letter, vol.7, pp. 112–114, 2008.

[2] R. Zaker, C. Ghobadi, and J. Nourinia, "Bandwidth enhancement of novel compact single and dual band-notched printed monopole antenna with a pair of L-shaped slots," IEEE Trans antennas Propagation, vol.57, no. 12, pp. 3978–3983, Dec. 2009.

[3] S. S. Zhong, X. L. Liang, and W. Wang, "Compact elliptical monopole antenna with impedance bandwidth in excess of 21:1," IEEE Trans. Antennas Propagation, vol. 55, no.11, pp. 3082–3084, Nov. 2007.

[4] Q. Wu ,R. Jin, J. Geng, and M. Ding, "Printed omni-directional UWB monopole antenna with very compact size," IEEE Trans. Antennas Propag., vol. 56, no. 3, pp. 896–899, Mar. 2008.

[5] K. G. Thomas and M. Sreenivasan ,"Printed elliptical monopole with shaped ground plane for pattern stability," Electron. Lett., vol. 45, no. 9, pp.445–446, Apr. 2009.

[6] J. Jung, W. Choi, and J. Choi, "A small wide band micro strip-fed monopole antenna," IEEE Microwave wireless component letter, vol.15, no.10, pp.703–705, Oct. 2005.

[7] X. S.Yang, K. T. Ng, S. H. Yeung and K. F. Man, "Jumping genes multi objective optimization scheme for planar monopole ultra wideband antenna," IEEE Trans. Antennas Propag., vol.56, no.12, pp.3659–3666, Dec. 2008.