ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 2, February 2018

Comparison of Upper Ultra Wide Band Antennas: A Review

[1] Arya S, [2] R. Sindhu, [3] Rekha G Nair
[1] P G Student, [2] Professor, [3]Asst Professor

***Abstract:* - This paper describes the design of Ultra Wide Band (UWB) antenna suitable for upper UWB frequency applications. In this context, three UWB antennas are designed: the first is with circle slot in a square, second is with triangle slot in a square and the third is with G shaped elements. The antenna element with small size of 8 x 8 mm2 is designed for UWB applications. The antenna element is fed through a 50 ohm microstrip line (MTL) and a thin strip is provided at the end of the MTL to provide impedance matching. It is printed on FR4 - epoxy substrate. The output is simulated on Ansoft HFSS (High Frequency Structure Simulator). The Parameters like return loss and bandwidth is discussed. From these three antennas, G shape antenna gives more return loss (S11) of -21.50dB compared with other two.**

***Index Terms:* - Ultra Wide Band, FR4-epoxy, Return loss, Bandwidth, HFSS..**

I. INTRODUCTION

Due to increase in number of users, data transfer rate is extremely increased. Ultra wide band (UWB) systems have received a growing interests due to the applications in high data transfer rate, multimedia streaming, radar and biomedical imaging. UWB communication systems get attention in wireless world because of its advantages. Some of the advantages of UWB systems are high data rate, low spectral power density, high precision ranging, low cost, large channel capacity, high immune to multipath interference [1]. Federal Communications Commission (FCC) has approved the use of the frequency range of 3.1–10.6 GHz for UWB communication systems. The performance of the UWB systems is determined by antenna element [2]. Thus the major challenge is to design an UWB antenna. Compact antenna size, impedance matching, and low cost are the major challenges. Most of the UWB antenna has WLAN and WiMAX applications. In today world, massive MIMO is used in 5G communications. For that the UWB antenna should operate on the upper UWB frequency. In this paper, three UWB antennas are considered which operates in upper UWB frequency. First a circle slot in square patch, second a triangle slot in square patch and G shape antenna. These antennas are operating in the frequency 7.9 GHz, 8.2 GHz and 10.2 GHz. And has bandwidth of 500MHz, 600MHz and 900 MHz. Since G shape antenna has high bandwidth in upper UWB frequency, it can be used for MIMO application. Patch antenna is widely used because of its advantages such as simple design, low profile and low fabrication cost [3]. But it has a drawback of narrow bandwidth, when the antenna is implemented on a thin substrate [4]. Bandwidth enhancement can be realized using parasitic patches [6], impedance matching networks [5], and using various shapes of radiating element such as circle, triangle, square [7], [8] etc. While these modifications to the patch antenna is valid, it have some design challenges such as increased complexity of the antenna topology and the determination of optimum design requires handling of multiple antenna geometry simultaneously. In this paper, three antenna geometries are considered. These are done by providing different shapes of slot in order to find better antenna geometry. Here, impedance matching is provided by the strip line connected between the square patch and the Microstrip Transmission Line (MTL). The antennas are then designed and simulated on Ansoft HFSS (High Frequency Structure Simulator)and the results are analyzed.

II. ANTENNA DESIGN

The ultra wide band antenna having circle slot on square patch, triangle slot on square patch and G shape antenna is shown in figure 1. The antenna is designed on FR4-epoxy substrate of 41 x 25 mm2 and thickess of 1.6 mm. FR4-epoxy has a relative permittivity of 4.6. The square patch has the dimension of 8 x 8 mm2 and it is fed through 50 ohm microstrip line (MTL) of width 3mm. At the end a strip line is designed to provide an impedance matching. Strip line has a dimension of 6.5mm length and 1mm width.

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 2, February 2018

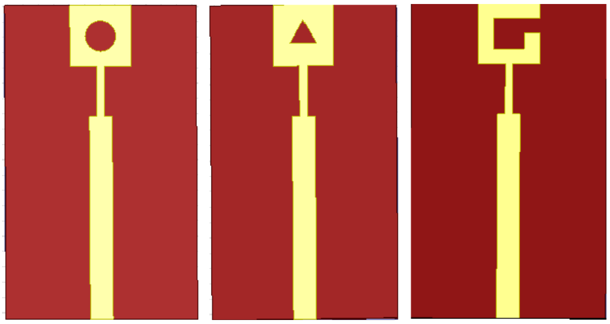
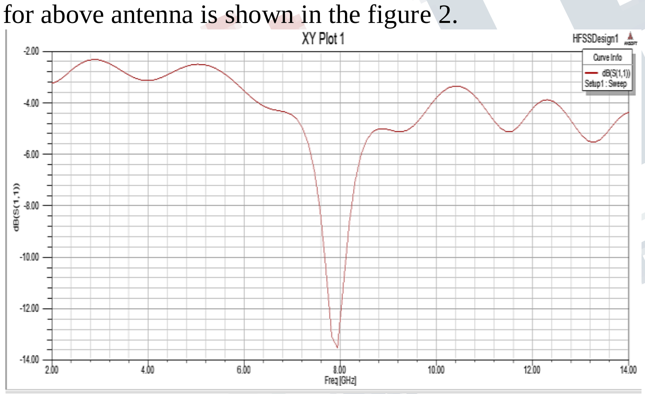


Figure 1. (a) Circle slot in square patch (b) Triangle slot in Square patch (c) G shape

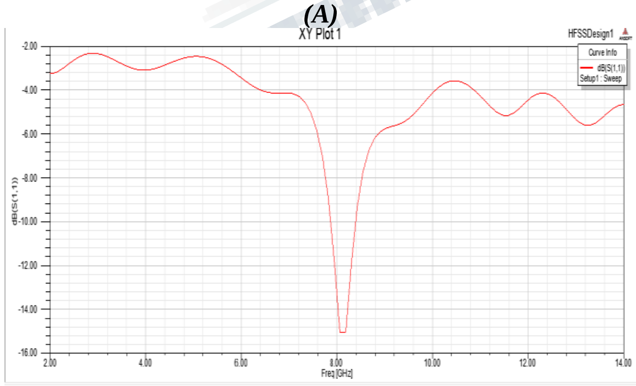
In the first antenna, the square patch has a slot of a circle of radius 2mm. In the second antenna, the square patch has a slot of an equilateral triangle of side 3.4mm. In the third antenna, G shaped slot is created in square patch by making 4 x 4mm2 square and a 2 x2mm2 square slots. These slots are provided in order to enhance the bandwidth.

III. RESULTS AND DISCUSSION

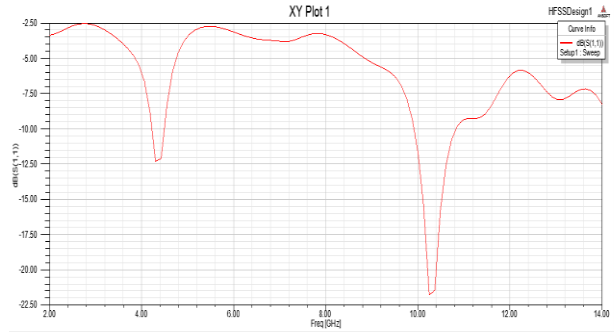
The UWB antennas are designed and simulated in Ansoft HFSS (High Frequency Structure Simulator). Return loss for above antenna is shown in the figure 2.



(A)



(B)



(C)

Figure 2: Return loss Vs frequency of (A) Circle slot in square patch, (B) Triangle slot in square patch, (C) G shape antenna.

From this graph, the return loss (S11 parameter) is -13.5 dB for circle slot in square patch, -15dB for triangle slot in square patch and -21.50 dB for G shape antenna. Thus G shape antenna works better in upper UWB frequency compared with circle and triangle sot in square patch. The circle and triangle slot in square patch , G shape antenna have bandwidth of 500 MHz, 600MHz and 900MHZ respectively. From this graph it is clear that, G shape antenna have higher bandwidth and better return loss when compared with other two. Since it enhances the bandwidth in upper UWB frequency, it can be further used in MIMO.

IV. CONCLUSION

From these three antennas, G shape antenna provides better results. G shape antenna has a bandwidth of 900 MHz, it can be used for UWB applications. And also, it provides a return loss of -21.50 dB in 10.2 GHz frequency, it works better on upper UWB frequency compared with other two antennas. For massive MIMO applications, the antenna should work better in upper UWB frequency. Thus G shape antenna can be used for MIMO application since it works better in upper UWB frequency and provide wide bandwidth.

REFERENCES

[1] Kartikeyan, Machavaram, Malik, et.al "Compact Antennas for High Data Rate Communication Ultra-wideband Uwb and Multiple-input-multiple-output Mimo Technology" -Springer Verlag.

[2] Rezual Azim, M.T. Islam et.al " Compact planar antenna for UWB applications" world academy of science, engineering and technology 43, 2010. pp no: 917 - 920.

[3] F. Yang, X.-X. Zhang, X. Ye, and Y. Rahmat-Samii, "Wide-band E-shaped patch antennas for wireless

communications," IEEE Trans. Antennas Prop., vol. 49, no. 7, pp. 1094-1100, 2001.

[4] S. Xiao, B.-Z. Wang, W. Shao, and Y. Zhang, "Bandwidth-enhancing ultralow-profile compact patch antenna," IEEE Trans. Antennas Prop., vol. 53, no. 11, pp. 3443-3447, 2005.

[5] S. Shi, W. Che, W. Yang, Q. Xue, "Miniaturized Patch Antenna With Enhanced Bandwidth Based on Signal-Interference Feed," IEEE Ant. Wireless Prop. Lett., vol. 14, pp. 281-284, 2015.

[6] Z.-X. Yang, H.-C. Yang, J.-S. Hong, Y. Li, "Bandwidth Enhancement of a Polarization-Reconfigurable Patch Antenna With Stair-Slots on the Ground," IEEE Ant. Wireless Prop. Lett., vol. 13, pp. 579-582, 2014.

[7] C.A. Balanis, Antenna theory analysis and design, 3rd ed., John Wiley & Sons, Hoboken, 2005.

[8] Z.-X. Yang, H.-C. Yang, J.-S. Hong, Y. Li, "Bandwidth Enhancement of a Polarization-Reconfigurable Patch Antenna With Stair-Slots on the Ground," IEEE Ant. Wireless Prop. Lett., vol. 13, pp. 579-582, 2014