iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VII **Month of publication:** July 2017

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

Quasi Self Complementary (QSC) Ultra-Wide Band (UWB) Antenna Integrated with Bluetooth

Sk.Jani Basha[1], U.Rama Krishna[2]
[1]*Communication & signal processing M. Tech,* [2]*Assistant Professor in ECE Department R.V.R&J.C College of Engineering, Guntur, Andhra Pradesh (522019), India*

Abstract: ***This paper introduces UWB antenna integrated with Bluetooth. This can cover the band of Bluetooth application (2.4GHz) and the band of UWB application (3-12GHz). The proposed antenna consists of semi ring connected with tapered section for more matching. The dielectric material for this is FR4-expoxy having thickness of 1.5 mm and has compact size 16×14.5mm^2. The antenna the parameters of: the Omni directional radiation patterns with appreciable gain across the operating bands, ultra band width including with Bluetooth band, and the antenna compact in size. The design and simulation of the antenna is carried out using CST microwave Studio simulation software.***
Keywords: Ultra-wide band (UWB), Bluetooth, Flame Retardant 4 (FR4), Computer Simulation Technology (CST).

I. INTRODCUTION

The Ultra-wide band (UWB) technology has become more popular due to various applications such as medical imaging applications, multimedia connectivity, personal communications, ground penetrating radar and sensor networks. Also, one of the very important leading wireless communication systems is an ultra-wideband (UWB) system due to low power consumption, high speed, and efficient frequency use. In the current, the FCC has allocated at bandwidth of 7.5 GHz of ultra-wideband devices in the band from 3.1 to 10.6 GHz [1-2]. Nowadays, the requirements of UWB antenna are wider bandwidth, stability of radiation pattern, small size, and constant gain [3].

Where Bluetooth band (2.4–2.484 GHz) have the advantage of license free operation in the industrial, scientific and medical (ISM). A planar integrated antenna working on both Bluetooth and UWB has been recently introduced by using different methods to integrate both bands were used specifically, a strip resonance, design an UWB antenna operating in the band of 2.2-10.6 GHz and slot on the current path [4]. A dual band U shaped monopole is introduced with adding strip line for Bluetooth band, the antenna is design on FR4 substrate with thickness 1.6 mm, and size 50 mm × 24 mm where the length of the antenna is increased due to strip line [5]. UWB antenna is proposed with notch between UWB and Bluetooth band. The slot is etched to increase current route or to introduce notch [6]. Bluetooth and UWB band is integrated by a small-sized monopole antenna, by using etched slot on the current route [4], which produces a 2.28–2.52GHz Bluetooth band and the antenna is design on FR4 substrate with size 18×30 mm2 with high isolation between the Bluetooth and UWB band.

On the other hand, several ways for planar monopole antennas to achieve minimizing UWB antenna in size and Cost UWB antenna with fractal structures is introduced which have the characteristics of wideband [7-10], radiation patterns and input impedance similar to larger antennas. A Nano-arm fractal antenna suitable for ultra-wideband applications are introduced, the antenna covers the band from 2.55 GHz to 11.84 GHz [8]. Recently, in [9] Self complementary antenna is introduced. The main property of the Self-complementary antennas is constant impedance where the antenna is SCA when the open area and the metal area are congruous. In 2013 [10] introduced Quasi self-complementary antenna QSCA with size 16×60 mm2 for UWB.

In this paper, the proposed antenna is quasi self-Complementary QSC UWB is introduced to achieve wide impedance bandwidth and compact size 16 × 14.5 mm2 compared to the previous techniques. The UWB antenna is fabricated on a FR4 substrate with relative permittivity of 4.5, and thickness of 1.5 mm.

II. ANTENNA DESIGN

A. Proposed Design

The proposed antenna is a planar micro strip antenna with compact size (16 × 14.5) mm2. The geometry of the proposed antenna is shown in Figure. 1. The dimensions of the proposed antenna are given in Table 1. The antenna is a quasi-self-complementary with rectangular stepped tapered which has step width of 1mm with fed line 50Ω of width Wf at the feed point and linear tapered to

width Wi at the patch to cover UWB with Bluetooth. The proposed antenna is design on a FR4 substrate with relative permittivity of 4.5, thickness of 1.5 mm. The antenna is designed in 4steps.

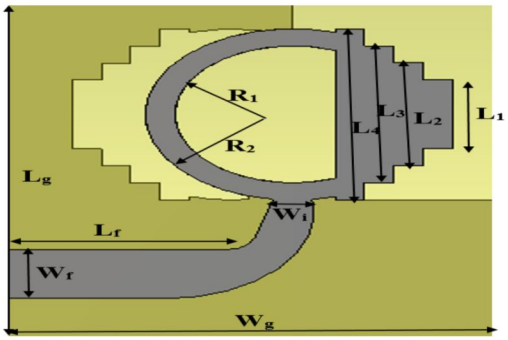


Figure 1: Proposed antenna.

R1	R2	L1	L2	L3	L4	Lg	Lf	Wf	Wg	Wi	W1	W2	W3
4	5	4	6	8	11	14.5	5	2.58	16	1.4	1	1	1

Table 1: The optimized dimensions of the proposed antsenna (all dimensions in mm).

B. Design Steps

The proposed antenna is designed in 4 steps.

Step 1: Antenna 1 is conventional circular monopole antenna to obtain UWB but the size is large with circular radius 15 mm.

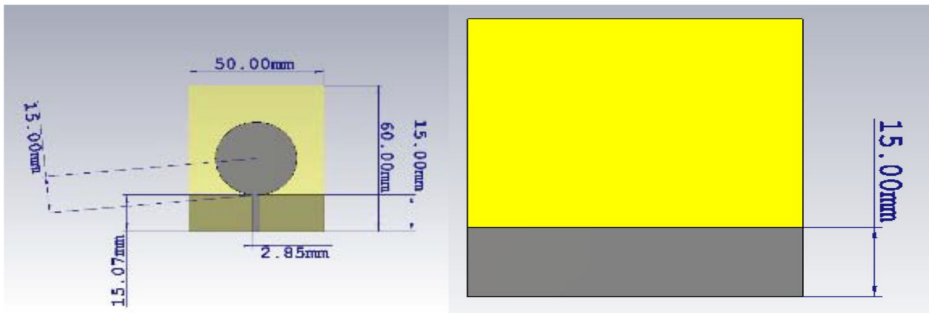


Figure 2: Antenna 1 design.

Step 2: Antenna is designed for compact size ,the semi circular designed with the same radius but the return loss is not matched for a overall UWB.

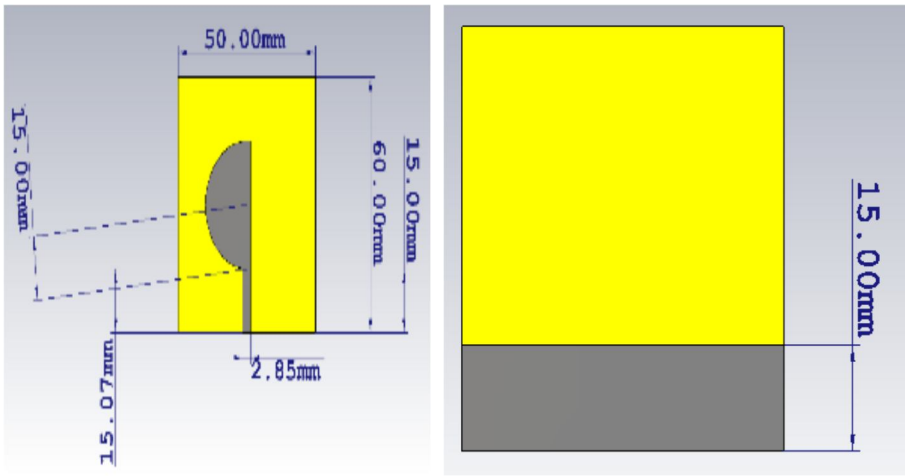


Figure 3: Antenna 2 Design.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

Step 3: In this design step the semi circular is attached with step rectangular with 1mm step is introduced for enhancement band. width.

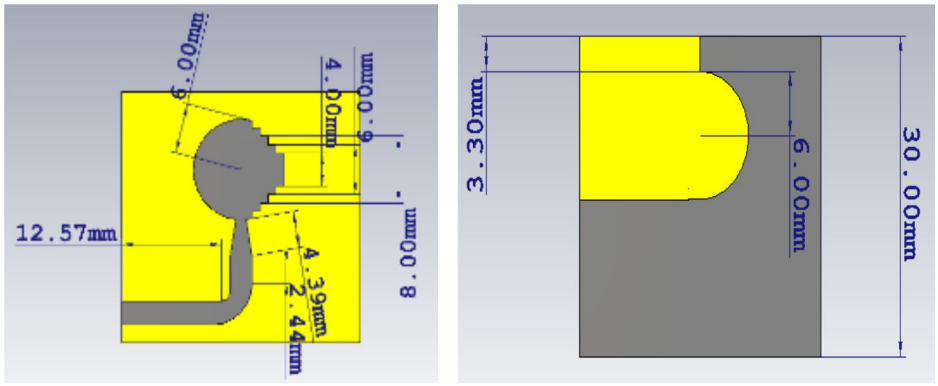


Figure 4: Antenna 3 Design.

Step 4: This design introduces the final propose antenna design with more matching, compact size and integrate the Bluetooth.

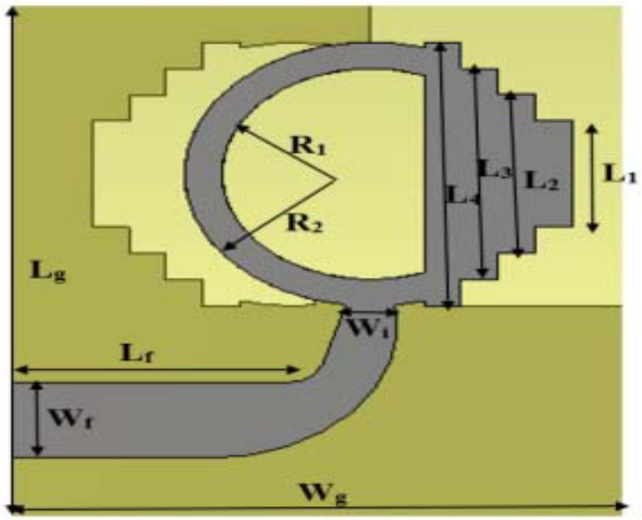


Figure 5: proposed Antenna.

Return losses of the 4 designed antennas can be showed as follows.

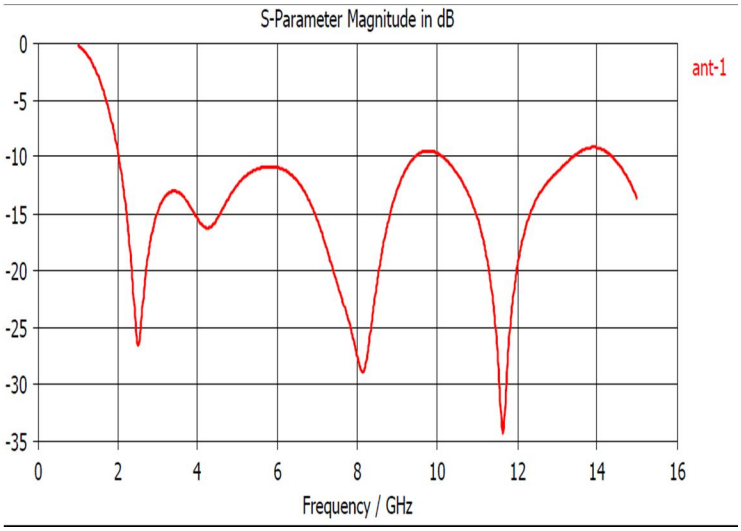


Figure 6: Return loss of the Antenna 1.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

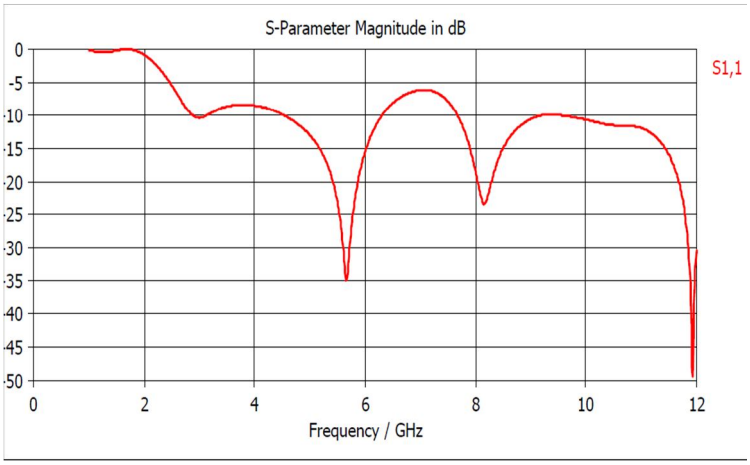


Figure 7: Return loss of the Antenna 2.

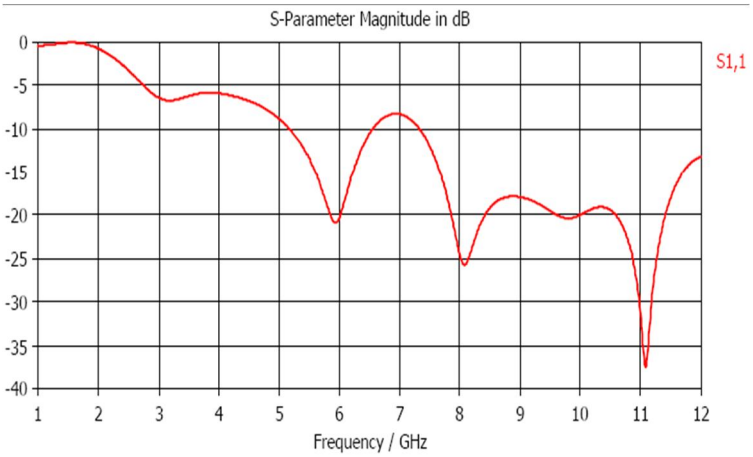


Figure 8: Return loss of the Antenna 3.

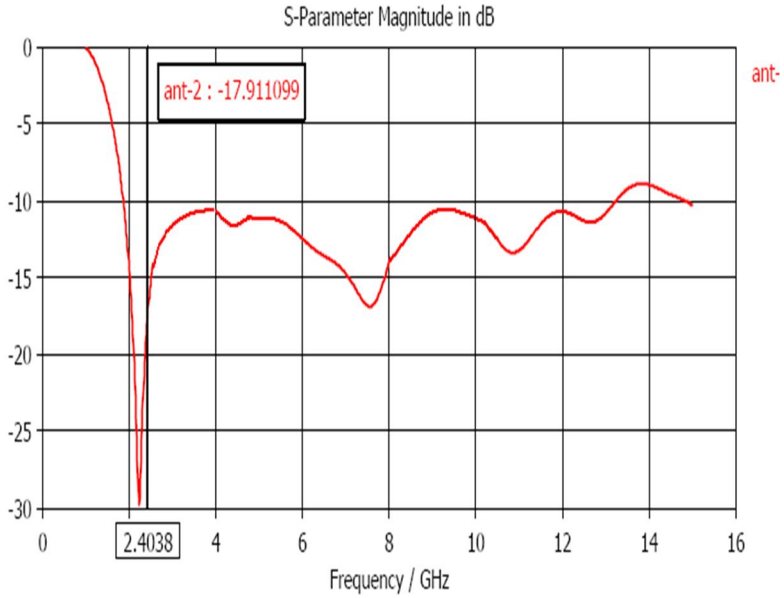


Figure 9: Return loss of the Antenna 4.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

III.SIMULATION AND MESURMENT

From the figure 9 it is observed that the final proposed antenna can covers the UWB with Bluetooth band as ensured by the simulated results where the return loss is below the -10dB at Bluetooth band 2.4 GHz and the ultra-wide band from 3.1 to 12 GHz. The CST Microwave Studio 2011 is used to design and simulation for the proposed antenna. Good agreement is obtained between the simulated and experimental results. The gain and efficiency of the antenna can be showed in the figure 10. From that figure the gain is acceptable in the operating bands with maximum value 5.5 dB at Bluetooth.

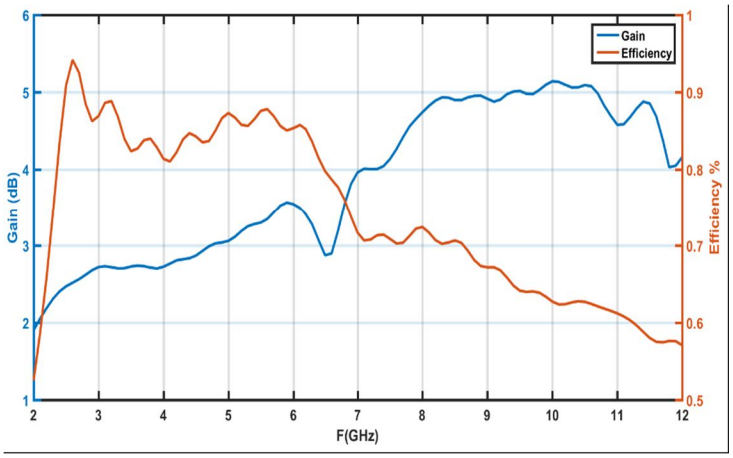


Figure 10: The antenna gain and radiation efficiency.

The radiation patterns of antenna which simulates in both the E-plane and H-plane at 2.4 GHz and 8GHz.it is observed that that the proposed antenna radiation pattern is nearly Omni-direction.

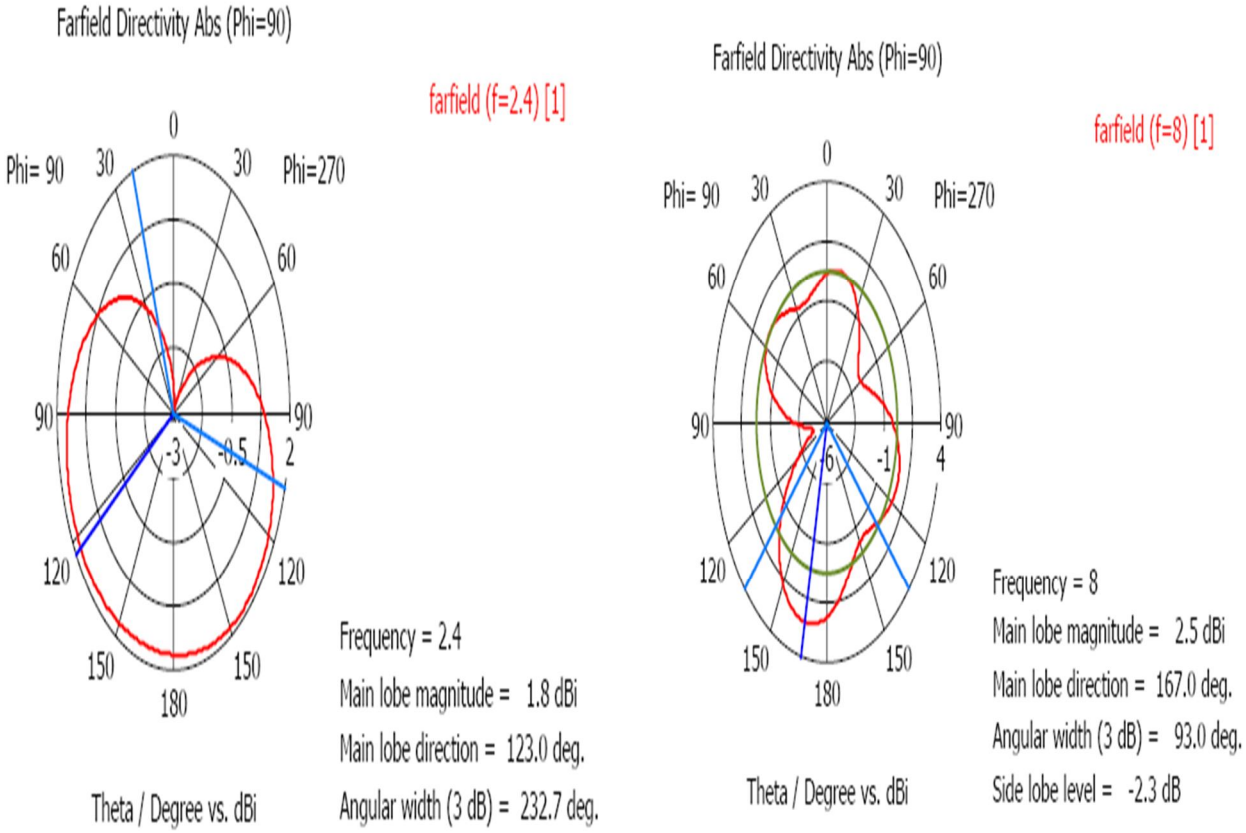


Figure 11: The radiation pattern of the antenna at different frequencies.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

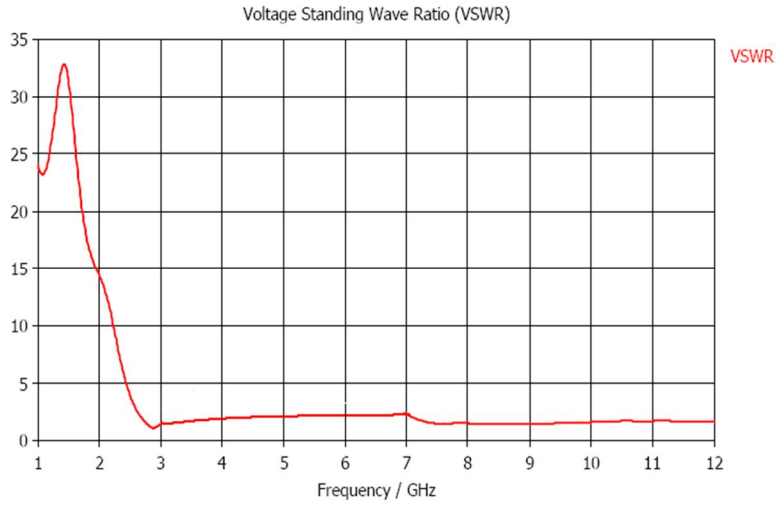


Figure 12: VSWR of the proposed antenna.

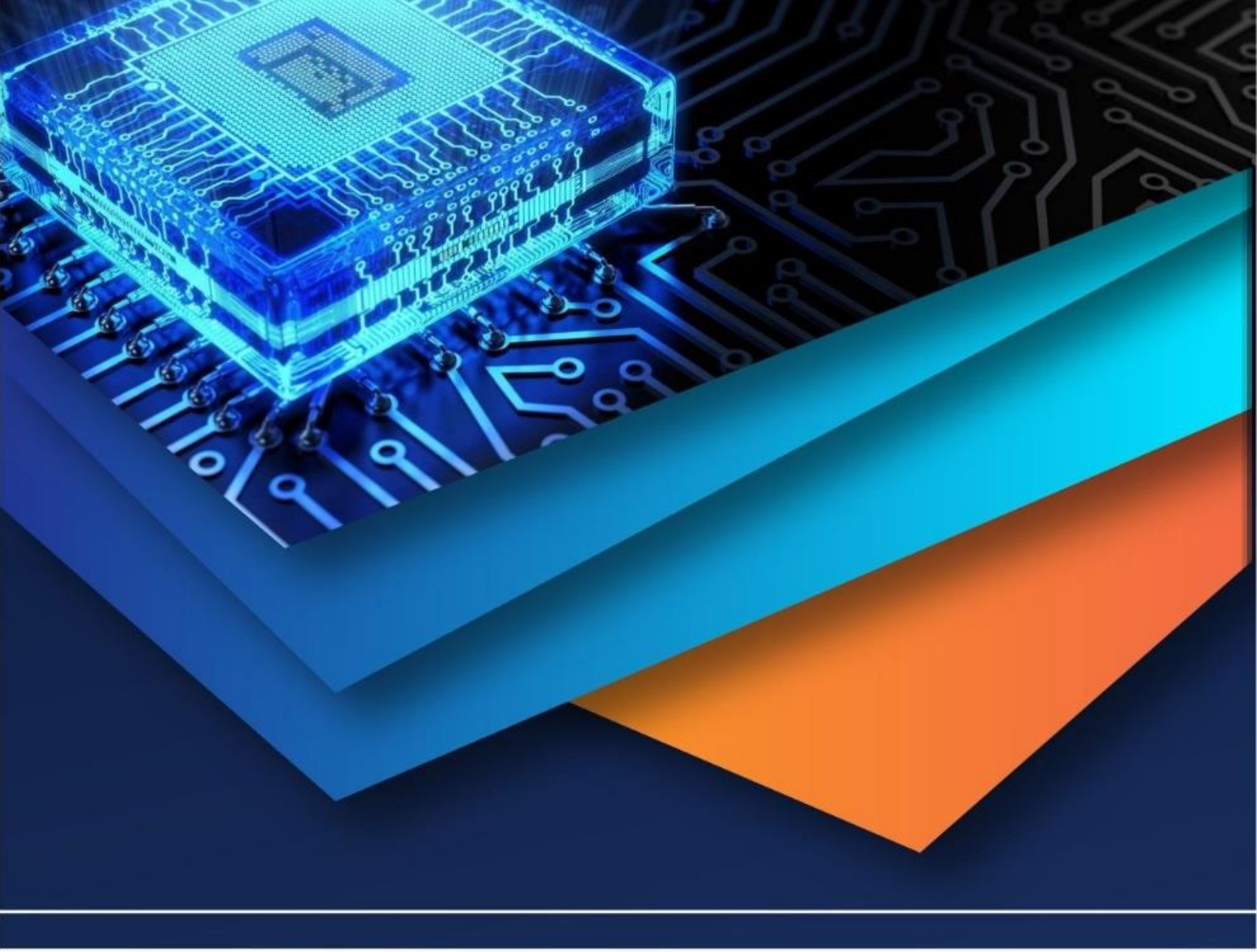
From the figure 12, it shows that voltage standing wave ratio of the antenna .It is observed that the VSWR is below 2.It can concludes that the proposed antenna can be use full for transmitting the data without any loss .

IV. CONCLUSION

In this paper, a novel UWB/ Bluetooth antenna for wireless application is introduced with compact size. The proposed antenna is quasi self-complementary feed by micro strip line and consists of semi ring and tapered rectangular section for more matching. The prototype of the antenna is fabricated on FR4-expoxy material. Comparing with other published antennas the proposed antenna has more compact size. The simulation results of the antenna were achieved by using the CST simulator. The antenna satisfies an impedance bandwidth of UWB and Bluetooth frequency bands. Good agreement is obtained between the simulated and the experimental results.

REFERENCES

[1] J. N. Lee, J. H. Kim, J. K. Park, and J. S. Kim " Design of Dual band Antenna with U-shaped Open Stub for WLAN/UWB Application" Microwave and Optical Technology Letters, Vol. 51, pp. 284-289, 2009.
[2] Y. L. Cheng and K. J. Hung "Compact Ultra-Wideband Rectangular Aperture Antenna and Band Notched Design" IEEE Tran. on Antennas and Propa., Vol. 54, pp. 3075- 3081, 2006.
[3] M. C. Tang, R. W. Ziolkowski, and S. Xiao "Compact Hyper Band Printed Slot Antenna with Stable Radiation Properties" IEEE Tran. on Antennas and Vol. 62, No. 6, PP. 2962-2969, 2014.
[4] L. Xiong and P. Gao "Dual Band Planar Monopole Antenna for Bluetooth and UWB Applications with WiMAX and WLAN Band Notched" Progress In Electromagnetics Research Letters, Vol. 28, pp. 183–194, 2012.
[5] B. S. Yildirim, B. A. Cetiner, G. Roqueta, and L. Jofre, "Integrated Bluetooth and UWB Antenna" IEEE Antennas and Wireless Propagation Letters, Vol. 8, pp. 149–152, 2009.
[6] Z. Q. Li, C. L. Ruan and L. Peng "Design and Analysis of Planar Antenna with Dual WLAN Band Notched for Integrated Bluetooth and UWB Applications" Journal of Electromagnetic Waves and Applications, Vol. 24, No. 13, pp. 1817–1828, 2010.
[7] J. Y. Sze and S. P. Pan "Miniaturized UWB Monopole Microstrip Antenna Design by Combination of Giusepe Peano and Sierpinski Carpet Fractals" IEEE Tran. on Antennas and Wireless Propagation Letters, Vol. 10, pp. 67-70, 2011.
[8] R. Kumar, and S. Gaikwad " On the Design of Nano-arm Fractal Antenna for UWB wireless Applications" Journal of Microwave, Optoelectronics and Electromagnetics, Vol. 12, No. 1, pp. 158-171, 2013
[9] X. Zhang, H. Guo, X. Liu, and H. Hu " A broad-band Self-Complementary Printed Antenna with Axe Shape " 9th International Symposium on Antenna Propagation and EM theory(ISAPE),pp. 267-270, 2010.
[10] Abd El-Hameed A. S., D. A. Salem, E. A. Abdallah, and E. A. Hashish " Quasi Self-Complementary UWB Notched Microstrip Antenna for USB Applications" Progress In Electromagnetics Research B, Vol. 56, pp. 185-201, 2013.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY