ISSN:2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 10, October 2016

DESIGN AND FABRICATION OF ULTRA WIDEBAND MICROSTRIP ANTENNA FOR ULTRA WIDEBAND APPLICATIONS

Shikhar Bahl, Himanshu Nagpal
M.Tech, E.C.E
Ajay Kumar Garg Engineering College,
Ghaziabad, India

Abstract— **In this paper, an Ultra Wideband antenna for UWB applications and a coplanar Waveguide Feed is presented. The size of the antenna is 25 mm x 25 mm x 1.6 mm^3 and it is prototyped on FR-4 epoxy substrate material which has a dielectric constant of 4.4 at a frequency of 3.03 GHz. The proposed antenna provides a bandwidth of 11.36 GHz from 10.44 GHz to 15 GHz which can be used for Ultra-Wideband applications. The ground plane incorporates a rectangular slot with parameterized center and dimensions. By adding strips along the patch and at the bottom of the patch of width 0.2 mm on both sides and a cut is made out in the ground plane to obtain the accurate results. As a result, proposed UWB antenna is presented and simulation is done on HFSS software. The return loss, band, VSWR and bandwidth of the proposed UWB antenna are presented.**

***Index Terms*- CPW Feed, HFSS, Proposed UWB antenna, Simulated Results.**

I. INTRODUCTION

The designed antenna operates over a bandwidth of 11.36 GHz (i.e., 10.44-15 GHz). The designed antenna is applicable for ultra wideband applications because it has wider bandwidth, good impedance and stable radiation loss. S. Hakimi et al, [4] proposed that a compact CPW-fed patch operation is antenna designed by simply adding two types of shaped slots into a rectangular patch for achieving dual-band operation. The designed antenna can operate over dual band characteristics to achieve good impedance bandwidth. Y. Sung et al, (2012) [6] proposed that Compact UWB Printed low-profile antenna consists of an octagonal-shaped slot fed by a beveled and stepped rectangular patch for covering the UWB band (3.1–10.6 GHz).

The designed antenna is done by adding L-shaped strips along the patch on both sides and at the bottom of the patch to obtain the notch characteristics and a cut is made out in the ground plane on both sides to obtain the bandwidth of the antenna.

Different types of feeding are used to excite the patch antenna, but in this paper antenna is fed by coplanar waveguide (CPW), as it has advantages in ease of fabrication and easier integration in monolithic circuits and 50 Ω input impedance is used to excite the patch antenna [1-3]. Various parameters like return loss, bandwidth of UWB antenna, and band are measured on HFSS software and discussed. Joon Il Kim et al, [7] proposed that an eye-shaped UWB antenna was designed to extend the lower frequency band under a limited antenna size and operate over a bandwidth of as high as 142%. It is realized that a low profile disc monopole antenna with a CPW feed possesses good radiation characteristics, stable impedance matching and shows insensitivity in its feed ground for mobile devices [8-11].

II. ANTENNA DESIGN

Fig.1 describes the geometry of conventional UWB antenna as the dimensions are shown in Table 1. Fig. 2 describes the geometry of the proposed antenna. The dimension of the ground plane is 25 x 25 mm^2, substrate used if FR4 with a dielectric constant of 4.4 and the height of substrate is 1.6 mm. The two strips have been added along the patch and at the bottom of the patch of width and height of 0.2 mm each on both sides. The height and width of rectangular slot drawn are 25 and 6.5 mm respectively and two strips were made at the bottom of the patch of width 0.2 mm each. Cut is made out in the ground plane of width 2.4 mm each on both sides. The dimensions of the proposed antenna are given below:

Table 1 Dimension of proposed antenna

Parameters	L_{P1}	L_{P2}	L_{P3}	L_{g1}	L_{g2}	L_{pd}	L_d
Unit(mm)	5	7	6.5	8	1	0.8	4
Parameters	W_{P1}	W_{P2}	W_{P3}	W_{g1}	W_{g2}	W_{g3}	W_f
Unit(mm)	2.5	2.5	5	10.7	4	2	1

III. RESULTS

Table 2 shows the design parameters of CPW fed UWB antenna as follows

Table 2 Design Parameters of UWB antenna

Parameters	Values
Operating frequency (f_0)	3.03 GHz
Substrate height (h)	1.6 mm
Dielectric constant (ε_r)	4.4
Loss tangent (δ)	0.02

Fig. 3 shows return loss of conventional UWB antenna. At the frequency of 3.03 GHz, VSWR is less than 2. In VSWR, there is always a reflection of the power which leads to standing waves, so that antenna may scatter all the waves' incident on it. It can be said that when the load is mismatched the whole power is not delivered to the load there is a return of the power and that is called loss, and this loss that is returned is called the 'Return loss'.

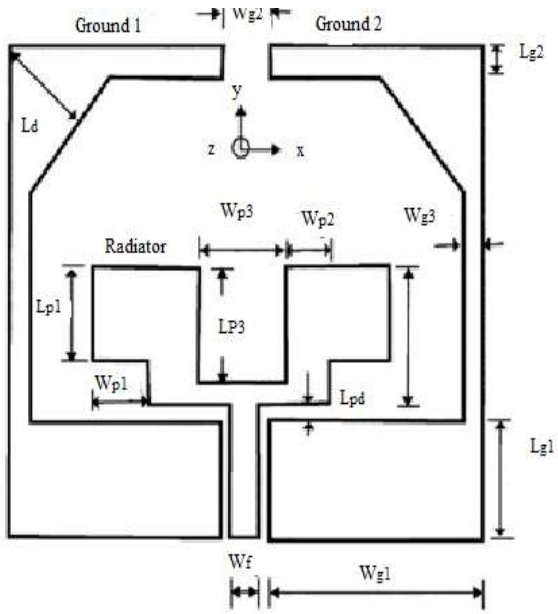

Fig. 1 Geometry of Conventional UWB antenna

As in Fig. 1 there are two ground planes and a radiator consists of a rectangular slot of dimensions Lp3 x Wp3. The two ground planes on the patch's upper two sides provide a stable radiation patterns and good impedance bandwidth. The two inverted L shaped strips from the patch's upper two sides of dimensions Lp2 x Wp2 and Lp1x Wp1 respectively [5]. As the ground planes from the patch's left and right sides are embedded to provide the CPW feed. Each of the embedded grounds has a vertical and horizontal section of 25 mm each. The width of CPW feed line is fixed to provide the characteristic impedance of 50 Ω. It uses a FR4 substrate material with dielectric constant of 4.4 because of its ease and good availability.

As in above fig., the two ground planes were etched on the same plane like monopole. The designed skills provide the ultra-wideband over the entire frequency band. Since the radiator is surrounded by ground plane for reducing antenna area, is a major factor to cause capacitive coupling. The horizontal section (x-axis) is separated from the ground by a gap of 0.4 mm.

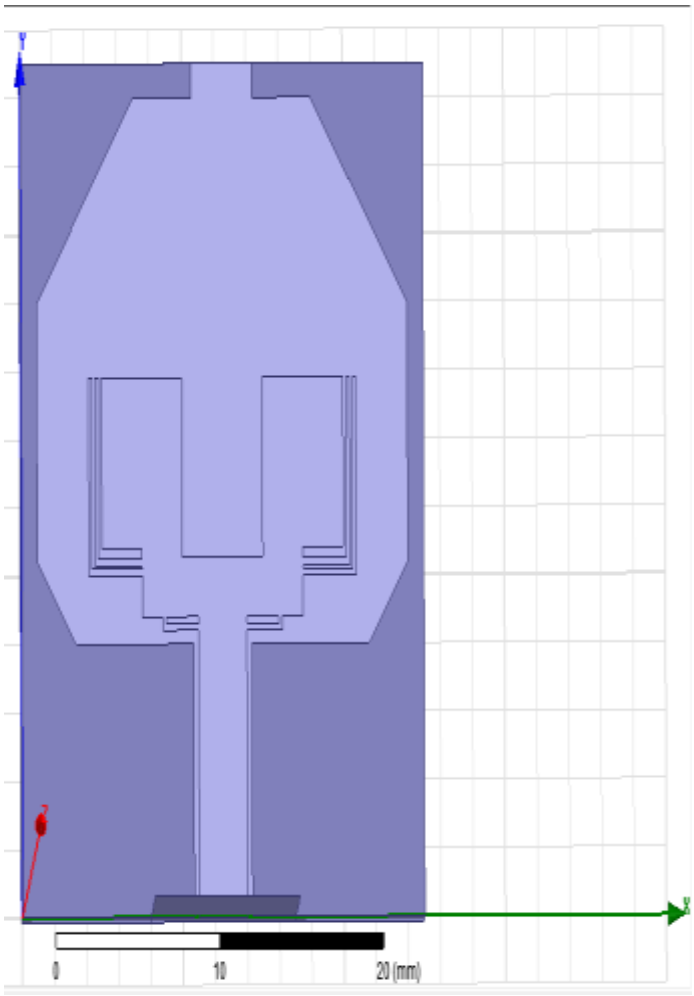

Fig. 2 Geometry of Proposed antenna

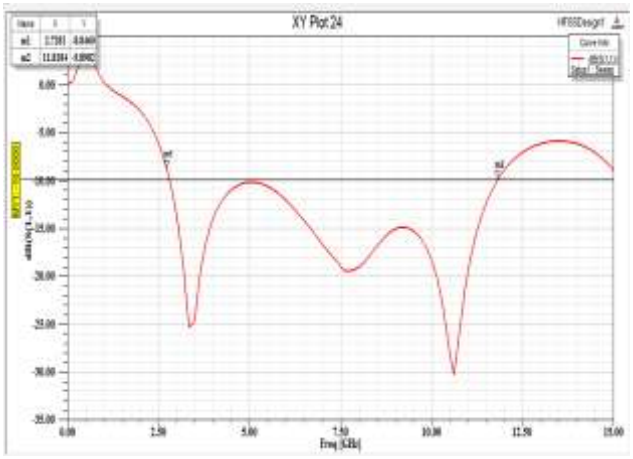

Fig. 3 Return Loss (single band) of conventional UWB antenna

The bandwidth is 11.36 GHz of the proposed antenna model as it ranges from 10.44-15 GHz for UWB applications. Bandwidth of the proposed antenna is shown in Fig. 4. As the bandwidth specifies the "the range of suitable frequencies within which the performance of the antenna, w.r.t some characteristic, conforms to a specific standard". Radios typically are designed for 50 ohm characteristic impedance and an efficient antenna configuration has other than 50 ohm characteristic impedance.

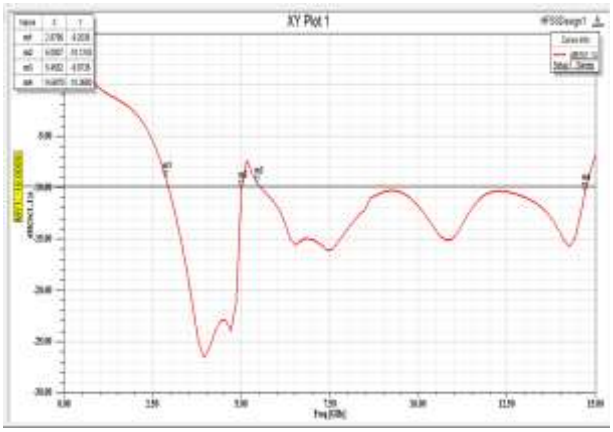

Fig. 4 Bandwidth and Dual Band of proposed Antenna

The VSWR of the proposed antenna is less than 1.8 as shown in Fig. 5 as it specifies the stable characteristic of the antenna. The Voltage Standing Wave Ratio (VSWR) is an indication of the quality of the impedance match. VSWR is often abbreviated as SWR. A high VSWR is an indication the signal is reflected prior to being radiated by the antenna.

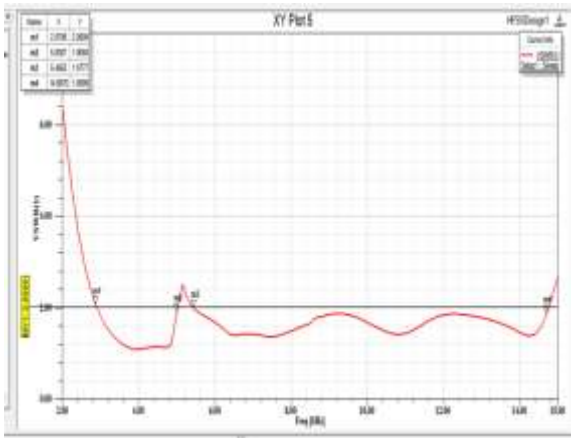

Fig. 5 VSWR of proposed antenna

The bandwidth of the antenna specifies the difference between the highest frequency component and the lowest frequency component.

IV. CONCLUSION

In this an antenna is designed for ultra wideband applications and operates over a bandwidth of 11.36 GHz ranging from 10.44 to 15 GHz. The antenna is made by adding two strips along the patch on both sides and at the bottom of the patch. A cut is made out in the ground plane to provide the good impedance bandwidth. Substrate used is FR4 because of its low cost and easier availability. Return loss, bandwidth, band and VSWR of antenna are measured and simulation is done on Ansoft HFSS V_{13}.

ACKNOWLEDGEMENT

I sincerely thanks ECE department of Ajay Kumar Garg Engineering College, Ghaziabad for providing the opportunity and guidance for research work.

REFERENCES

[1] D. T. Nguyen, D.H. Lee, 2012 "Very compact printed triple band-notched UWB antenna with quarter-wavelength slots", *IEEE Antennas Wireless Propag. Lett*, Vol.11, No.5, pp. 411–414.

[2] S. R. Emadian, 2012 "Bandwidth enhancement of CPW-fed circle-like slot antenna with dual band- notched

characteristic", *IEEE Antennas Wireless Propag. Lett*, Vol.11, No.6, pp. 543–546.

[3] O. Ahmed, A. R. Sebak, 2008 "A Printed Monopole Antenna with two steps and a Circular Slot for UWB Applications", *IEEE Antennas and Wireless Propag. Lett*, Vol. 47, No.21, pp. 411-413.

[4] S. Hakimi, S.M. Noghabaei, 2014 "CPW-Fed Transparent Antenna for Extended Ultra-wideband Applications", *IEEE Antennas and Wireless Propag. Lett*, Vol. 13, No.6, pp. 1251-1254.

[5] B. S. Yildirim, M.M. Samadi Taheri, 2009 "Integrated Bluetooth and UWB antenna", *IEEE Antennas Wireless Propag. Lett*, Vol.8, No.2, pp. 149–152.

[6] Y. Sung, 2012 "UWB monopole antenna with two notched bands based on the folded stepped impedance resonator", *IEEE Antennas Wireless Propag. Lett*. vol.11, No. 23, pp. 500–502.

[7] M. Bod, 2012 "Compact UWB printed slot antenna with extra Bluetooth, GSM, and GPS bands", *IEEE Antennas Wireless Propag. Lett*, Vol. 11, No.8, pp. 531–534.

[8] Seyed Amir Hossein Saghanezhad, Zahra Atlasbaf, 2015 "Miniaturized Dual-Band CPW-Fed Antennas Loaded with U-Shaped Metamaterials", *IEEE Antennas Wireless Propag. Lett*, vol.14, No.2, pp.658-661.

[9] H. D. Chen, 2003 "Broadband CPW-fed square slot antennas with a widened tuning stub", *IEEE Trans. Antennas Propag.*, vol. 51, No. 8, pp. 1982–1986.

[10] M. A. Antoniades, G. V. Eleftheriades, 2008 "A compact multiband monopole antenna with a defected ground plane", *IEEE Antennas Wireless Propag. Lett*, vol. 7, No. 34, pp. 652–655.

[11] Nader Behdad, Kamal Sarabandi, 2005 "A Compact Antenna for Ultrawide-Band Applications", *IEEE Trans. Antennas Propag.*, vol.53, No.7, pp.2185-2192.

Shikhar Bahl is pursuing M.Tech from Ajay Kumar Garg Engineering College, Ghaziabad (affiliated to Uttar Pradesh Technical University, Lucknow) in electronics and communication engineering. His areas of interest are Control Systems, Electronic Devices and Circuits and Wireless Communication. He completed his B.Tech from Meerut Institute of Engineering and Technology, Meerut (affiliated to Uttar Pradesh Technical University, Lucknow) in Electronics and Telecommunication Engineering with first class in the year 2013. During his career he had done his industrial training at BSNL and RRVNL. He had done his major work on project in filter design and its specifications in the respective branch for consecutive four years during his batch.

Himanshu Nagpal received his degree of M.Tech in RF and Microwave from Ambedkar Institute of Advanced Communication Technologies and Research; Govt.of NCT of Delhi affiliated to GGSIPU and has 2 years of teaching experience. His area of interest in RF and Microwave, but presently he is doing work in the field of Antennas and Wave Propagation. Presently he is an assistant professor in AKG.