Design of Circular Patch Antenna for UWB Applications

Mr. B. Praveen Kitti
Assistant Professor
Dept., of ECE
PSCMR, Vijayawada, A.P

Mr. K Teja Santosh
Student of Antenna Research Group
Dept., of ECE
PSCMR, Vijayawada, A.P

Ms. A V Chandrika
Student of Antenna Research Group
Dept., of ECE
PSCMR, Vijayawada, A.P

Mr. K. Rajesh
Student of Antenna Research Group
Dept., of ECE
PSCMR CET, Vijayawada, A.P

Mr. K. Anil Kumar
Student of Antenna Research Group
Dept., of ECE
PSCMR CET, Vijayawada, A. P

***Abstract* - This paper exhibits a little size UWB patch reception apparatus with triple channel.J-formed opening is stacked in the patch of the receiving wire for frequency band dismissal.The antenna is designed utilizing the industrially accessible HFSS modeling.The space measurements are methodically balanced and streamlined to accomplish the sought band dismissal reactions. The accomplished results show that the sensor of electromagnetic waves has great execution over the whole UWB band (3.1 GHz to 10.6 GHz) with the reception of frequency bands. In addition, the simulation results of the designed antenna receiving 3 bands are tentatively accepted.**

Keywords - UWB patch antenna, slots, band stop channel, HFSS;

I. INTRODUCTION

Ultra Wide Band (UWB) innovation is the premise of distinctive strategies for remote correspondences. In 1896, the to begin with UWB correspondences framework was set up in London to interface two post workplaces, which were more than a mile separated [3]. From that point forward, a contemporary UWB system was presented in 1960 and the U.S. military made utilization of pulse transmissions to cover imaging, radar and stealth and many other wireless applications [8]. After this, UWB has activated a colossal interest in receiving antenna with new open doors and challenging difficulties for antenna designers.

By Shannon-Hartley hypothesis, the primary advantage of the UWB system is that it is channel limit relates to the data transfer capacity. The UWB can deal with a huge limit of many Mbps in light of it is broad frequencies transfer speed. Power consumption for the transmission is very low in UWB system. As a result of low energy density, it is capable to offer a safe and trustworthy communications.

Due to the baseband character of the signal transmission UWB is substandard and trouble-free.[6]-[7]. In February 2002, the Federal Communications Commission (FCC) assigned the UWB applications from 3.1 GHz to 10.6 GHz. FCC concluded that, any frequency that takes up at minimum 500 MHz of range can be utilized in UWB system. Consequently, UWB is no more restricted to drive antenna alone, yet likewise incorporates any innovation that uses 500 MHz of range and satisfies the various essentials for UWB. Subsequent to drive antenna -based UWB system transport pulses of power, they can transmit information at a quicker rate contrasted with narrow band frequency carriers.Some UWB applications require the reception of desirable frequency groups by method for discrete band-pass channels in request to defeat the issue of electromagnetic impedance (EMI). The essential test in UWB antenna outline is accomplishing the wide data transmission while keeping up high gain, great radiation effectiveness with a less assembling versatile nature. For the most recent decade, scientists have drawn closer the branch of knowledge in various diverse ways. A various space arrangements installed in the radiation patch or the ground planes are the most well-known ways to deal with understand the reception of desirable frequency groups and to decrease the receiving antenna size [5]-[4].

II. ANTENNA DESIGN

The geometry of the ordinary UWB plan for round patch antenna without step channel [1]. In addition, the proposed UWB round patch antenna with triple bands is outlined in Fig. 1. The patch antenna was imprint on a standard FR4 substrate having relative permittivity (ε_r) of 4.4, dielectric loss tangent (tan δ) of 0.019 and substrate thickness of 1.6 mm. The receiving antenna substrate and ground plane sizes approach 47×40 mm^2 and 19.3× 40 mm^2 separately. The roundabout patch has a micro strip sustain line with measurements 20.3 × 2.6 mm^2 to accomplish the impedance coordinating 50 Ω.

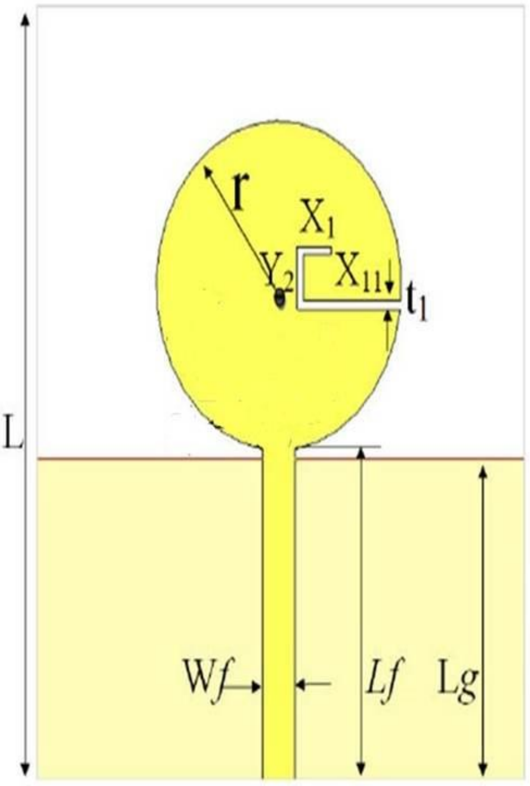


Figure 1: Proposed Design

To decide the general measurements of a patch receiving antenna TABLE I. Critical DESIGN PARAMETERS OF THE ANTENNA structure. As a rule, the numerical equations of round patch receiving antenna at a particular resonance frequency can utilize [2]. Geometry of the proposed UWB receiving antenna configurations is shown in fig: 1. Table I condenses the streamlined receiving antenna physical parameters and principle highlights. One indent was stacked on the roundabout patch of the reception apparatus as a wanted frequency band channel instrument. The slot (J-molded) was balanced by varying its length. The measurements of the slot are advanced to get the required frequency band reception with VSWR> 2 and S11> - 10 dB, utilizing the following comparisons.

$$(X1 + X11 + Y1 - 2t1) = L1 = \frac{c}{4 f notch \sqrt{\epsilon eff}}$$

Where L1 in the above comparison is three length of the J-molded score, f_{notch} is the indent frequency, c is the rate of light, and ε_{eff} is the successful dielectric consistent of the substrate.

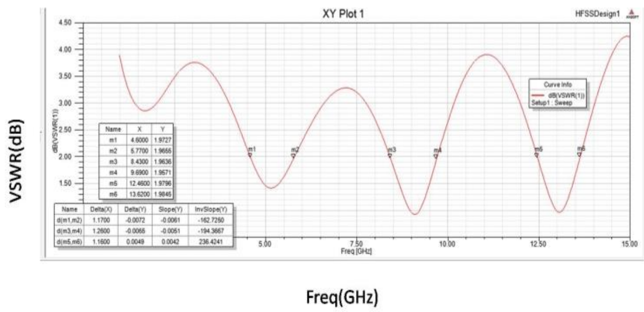
Parameter	Value
Antenna Dimensions	L=47mm,W=40mm,L_g=19.3mm,W_g=40mm, W_f=2.6mm, L_f=20.3mm,r=10mm
Optimized Slot Dimensions	X11=8.5m,Y1=3.8mm, X1=2.8mm,t1=0.5mm
Substrate	FR4:ε_r=4.4,h=1.6mm, tan δ=0.019

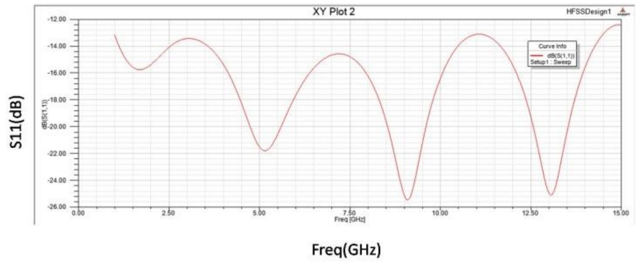
III. PARAMETRIC STUDY

The exhibitions of the proposed UWB patch reception apparatus are completely studied. The slot length (L1) are efficiently fluctuated and optimized to accomplish scored band. The receiving antenna is planned and mimicked using HFSS software. In the first place, the conventional UWB roundabout patch receiving antenna was simulated and a VSWR of fewer than 2 and estimation of S11 less than - 10 dB are gotten over the entire configuration frequency range (3.1 – 10.6 GHz). The slot lengths determine using the above equation is optimized to get the maximum results. Fig. 2 shows the recreated VSWR of the planned reception apparatus on various opening lengths. Similarly, the outcomes demonstrate a VSWR of more than 2, implying that the composed antenna has demonstrated an unwanted band over spectrum; Measured and Simulated return loss curves Figure 3.

IV. RESULTS

The reception apparatus return loss and VSWR are recorded furthermore, outlined with the examination of the simulated results. Created UWB roundabout patch receiving Antenna with J shape indents. It is appeared in Fig. 3 that the arrival loss execution of the receiving antenna is superior to anything - 10 dB for the whole working frequency range with the reception of ‘C’, ‘X’ and ‘Ku’ frequencybands. Also, the results demonstrate that the receiving antenna says impedance had great coordinating over all the wanted bands. It is additionally watched that the balanced J-molded opening length, thus accomplishes better band reception (4.59 GHz – 5.79 GHz, 8.42 GHz - 9.69 GHz, 12.46 GHz - 13.62 GHz)Fig 2. Measured and Simulated VSWR bends (with and without indents). In any case, the flexible lengths of these three channels were enhanced for a decent band reception execution, which can be an extreme answer for electromagnetic impedance issues and UWB frameworks. Because of the impact of the indent at this specific band. This implies the step channel parameters were streamlined to give a decent band-reception over the specified spectrum. The reception apparatus pick up radically increments after this band. It can be compressed that the addition expanded when the recurrence increment for the proposed UWB reception apparatus.





V. CONCLUSIONS

A little size UWB patch receiving antenna with a decent band- reception execution have been outlined and measured. One diverse space was inserted in the patch of the antenna as indent channel. The space measurement was advanced for frequency band reception. The accomplished results demonstrate that the proposed reception apparatus has good exhibitions as far as radiation example, addition and reflection coefficient for the whole working frequency range with the reception of ‘C’, ‘X’, ‘Ku’ bands.

VI. REFERRENCES

[1] B.Allen, M. Dohler, E. E. Okon, W. Q. Malik, A. K. Brown, “Ultra widebandAntenna and Propagation: for Communications, Radar and Imaging,” John Wiley & Sons Ltd., 2007.
[2] C. A. Balanis, “Antenna Theory, Analysis and Design,” 3rd edition, John Wiley & Sons, Inc., 2005.
[3] H. Nikookar and R. Prasad, "Introduction to ultra wideband for wireless communications," Springer, vol. 2200, 2009.
[4] 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,” Antennas and Propagation, IEEE Transactions on, vol. 57, pp. 397 8-3983, 2009.
[5] J. R. Panda and R. S. Kshetrimayum, "A Compact CPW-Fed Monopole Antenna With An U-Shaped Slot For 5 GHz/6 GHz Band-Notched Ultra wideband Applications," India Annual IEEE Conference (INDICON), 2009.
[6] J. Liang, "Antenna study and design for ultra wideband communication applications," PhD thesis, university of London, 2006.
[7] Y. S. Hu, M. Li, G. P. Gao, J. SS. Zhang, and M. K. Yang, "A double-printed trapezoidal patch dipole antenna for UWB applications with band-notched characteristic," Progress In Electromagnetic Research, vol. 103, pp. 259-269, 2010.
[8] H. G. Schantz, “A brief history of UWB antennas,” IEEE Aerospace and Electronic Systems Magazine, vool. 19, pp. 22-26, 2004.
[9] S. Kalraiya, H.S. Singh, G. K. Pandey,A. K. Singh, A.K. and M. K. Meshram, “CPW-fed fork shapeed slotted antenna with dual-band notch characteristics,” Engineering andd Systems Students Conference (SCES), 2014.
[10] A. A. Awaleh, S. H. Dahlan, MM. Z. M. Jenu, “A Compact Flat Lens Antenna with Aperture-Coupled Patch Elements,” IEEE Asia-Pacific Conference on Applied Electromagnetics, APACE 2014, Johor Bahru, Malaysia, 20 – 23, 2014.
[11] W.C. Liu and P. C Kao, “CCPW–fed triangular antenna with am frequency-band notch function for ultra-wideband application,” Microwave Opt. Technol. Let., vol. 48, no.6, pp.1032-1035, 2006.