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Design of Ultra Wideband Patch Antenna

Anjaneyulu Katuru , Sudhakar Alapati

Abstract: ***This paper presents an ultra wideband(UWB) antenna which is in rectangular shape is designed and analyzed by Microwave Studio Computer Simulation Technology(MS CST).The antenna uses FR-4 substrate. The rectangular patch which is excited by micro strip line is printed on the top of the substrate and a partial ground plane is printed on the other side. The basic structure of antenna produces ultra-wideband characteristics. But these characteristics can further be improved by cutting the lower left corner of the patch as stair case and observed the simulated results like return loss(S11), voltage standing wave ratio(VSWR), gain and bandwidth(BW).***

Keywords : UWB; rectangular patch; return loss; VSWR; gain; bandwidth.

I. INTRODUCTION

In Feb. 2002, the Federal Communications Commission of United States (US FCC) was issued part 15 rules, according to which the frequency band, 3.1 - 10.6 GHz is meant for un-licensed use of UWB for indoor and short-range wireless communications and having low emission power spectral density of -41.3 dBm/MHz [1].Antenna is an important component of UWB system. Designing of patch antennas is easy, but having low efficiency and low bandwidth [2]. The required characteristics for UWB antenna, for many of the applications, are low-profile, stable and omni-directional antenna radiation patterns, VSWR (voltage standing wave ratio) ≤ 2, Return loss <-10 dB, high radiation efficiency, linear phase and constant group delay [3].A.K. Gautam, et al. also tried to increase the bandwidth and to produce multiple resonances[12], the antenna size is reduced and the ground plane is slotted [4]. In paper [5] by Nasser Ojaroundi has presented a new antenna design having partial ground in which two rotated slots which are in L-shaped are cut to enhance the matching characteristics and BW. In [6], S. K. Mishra, et al. proposed a fork shaped antenna which has a rectangular plane of ground for bluetooth and UWB characteristics. Anjaneyulu katuru and A.Sudhakar are trying to improve the matching characteristics and to enhance the impedance bandwidth, which consists of UWB frequency range, by using a matching transformer placed between the feed line and patch and a ground structure which is defected is used in the rare side of the patch [7].

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In [8], Anjaneyulu Katuru and Sudhakar alapati is presenting a new design which provides UWB characteristics by modifying the circular antenna with a defected ground structure. A compact CPW fed single layer rectangular p patch antenna has a shape of half elliptical slot and two similar stubs on either ends of the ground are enlarged to provide ultra wideband and impedance matching properties [9]. In this paper, we have presented a rectangular UWB patch antenna that has a stair case cut at one of the corners to improve the performance of the antenna[13][14].

II. ANTENNA CONFIGURATION

The structural configuration of antenna is represented in terms of parametric values such as Ls=Substrate length=35 mm, Ws= Substrate width=30 mm, h= Substrate height=1.6 mm, lp= patch length=14.5 mm, wp=patch width=15 mm, tp=patch thickness=0.1 mm, lf=Feed length=13.5 mm, wf=feed width=3.2 mm, the first stair case cut=Lnt1×Wnt1 mm^2 ($1\times1.5\ mm^2$), second stair case cut=Lnt2×Wnt2 mm^2 ($1.5\times1.5\ mm^2$), lg=ground length=12.5 mm, wh= ground width=30 mm.

III. SIMULATION RESULTS

The antenna fundamental structure and partial ground plane are depicted in figures 1 & 2 and the proposed antenna is represented in fig. 4.The observed simulation results are shown in figures 3 & 5At the resonating frequency (f_o=3.9 GHz) the results[10][11] we observed for fundamental structure are return loss (S11)=-22.2 dB, VSWR= 1.16, Gain(G)= 2.56 dB, and bandwidth=7.87 GHz(3.19-11.06 GHz).This antenna supports UWB characteristics. At the resonant frequency, f_o=6.8 GHz, the simulated results of proposed antenna are S11=-29.9 dB, VSWR=1.06, gain=3.14 dBi, BW=3.13 to greater than 12 GHz. We obtained the wide bandwidth [15][16]when compared to former case due to stair case cut at left corner of the patch and we also achieved better return loss VSWR, gain.Omni-directional radiation patterns are obtained from this antenna. The proposed structure also exhibits UWB characterization.

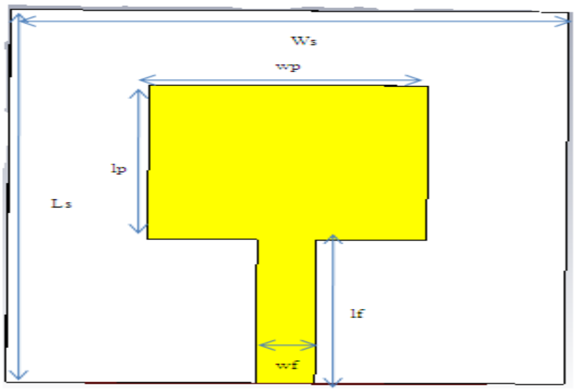

Figure :1 Antenna basic design

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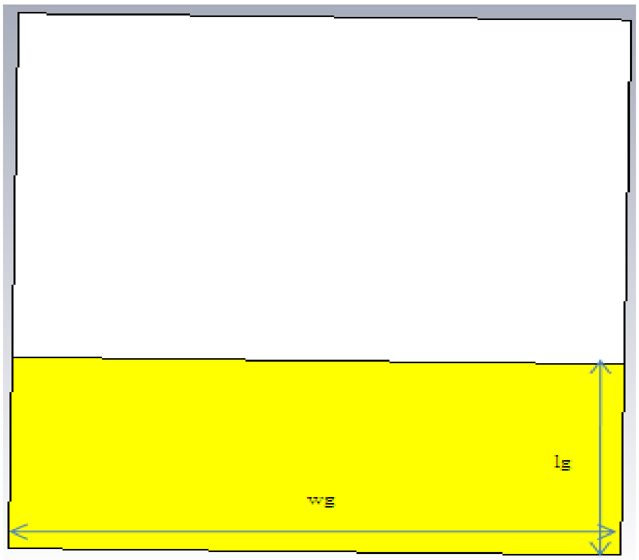
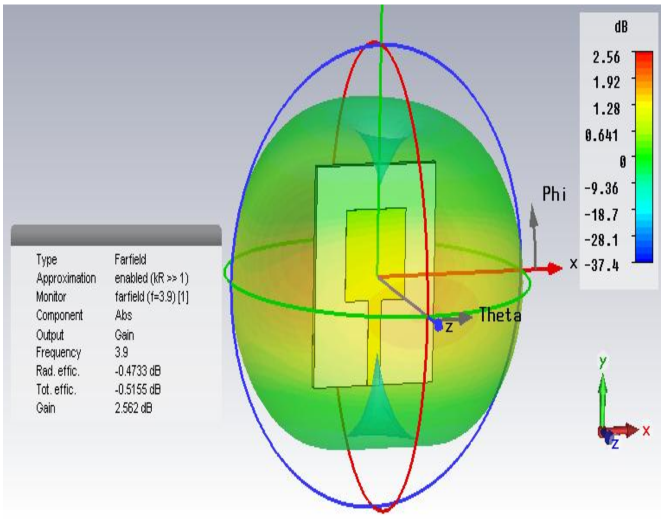
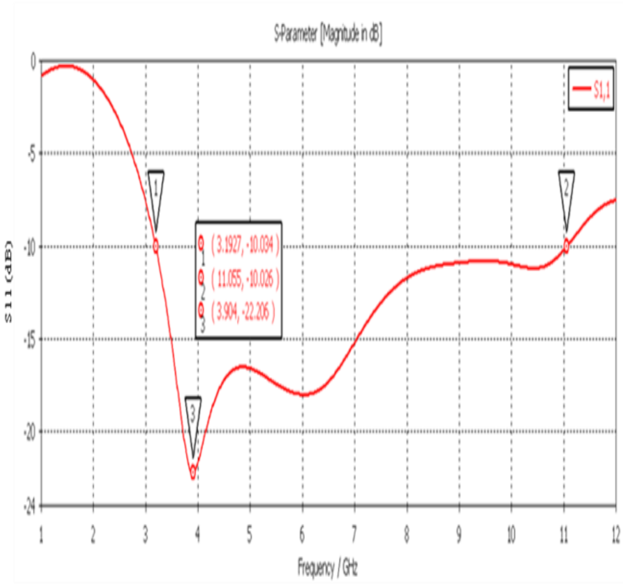


Figure 2: Partial ground plane



(c)

Figure 3: (a) Return loss parameter, (b) VSWR parameter, (c) Gain pattern parameter



(a)

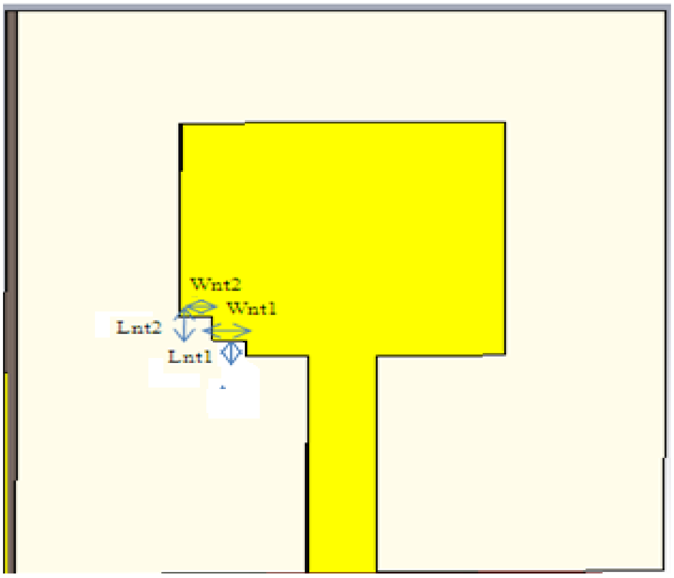
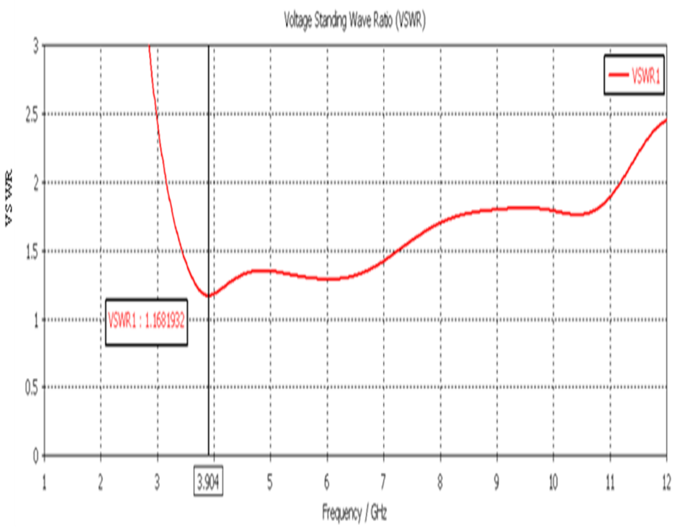


Figure 4: Proposed Design



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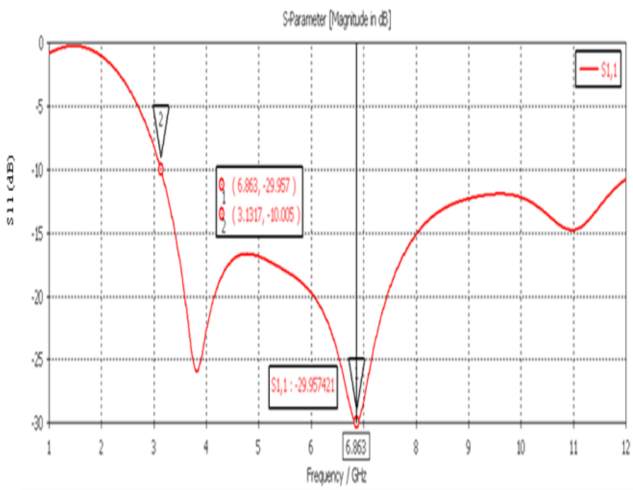
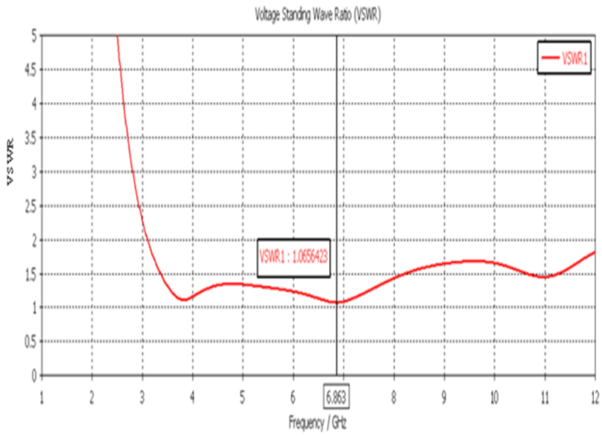
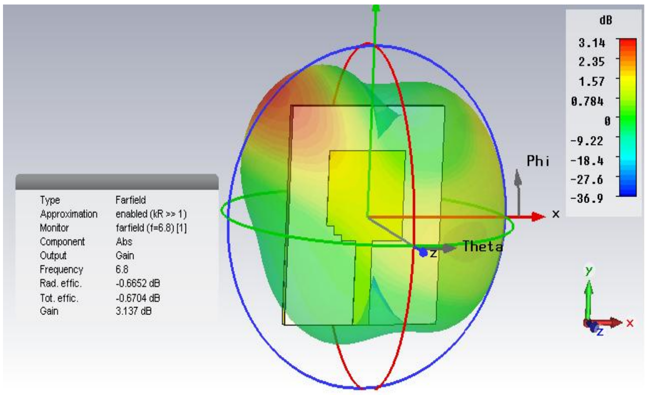


(a)



(b)



(c)

Figure 5: S11, VSWR, and antenna gain pattern are shown in (a), (b), & (c).

IV. CONCLUSION

A UWB antenna with a partial ground plane and a stair case cut at lower left corner of the rectangular patch was designed and simulated by utilizing CST. The partial ground and staircase cut provides wide impedance bandwidth. This antenna also produced S11<-10 dB, VSWR<2, gain<5 dBi and ultra wideband i.e. 3.1GHz to 10.6 GHz. From these results it is obvious that this antenna supports UWB applications

REFERENCES

1. First Report and Order, “Revision of part 15 of the Commission’s Rule Regarding Ultra-wideband Transmission System FCC 02-48,” Federal Communications Commission, 2002.
2. Girish Kumar and K.P. Ray, “Broadband Microstrip Antennas, ”Boston, London, 2003.
3. Ian Oppermann, Matti Hamalainen and Jari Iinatti, “UWB Theory and Applications, “John Wiley & Sons, Ltd. England, 2004.
4. A.K.Gautam, R. Chandel, and B. K. Kanaujia, “A CPW-fed hexagonal-shape monopole like UWB antenna,” Microw. Opt. Technol. Lett.,” vol. 55, no. 11, pp. 2582-2587, Nov. 2013.
5. Nasser Ojaroundi, “Compact UWB monopole antenna with enhanced bandwidth using rotated L-shaped slots and parasitic structures,” Microw. Opt. Technol. Lett., vol. 56, no. 1, pp. 175-178, Jan. 2014.
6. S. K. Mishra, R. K. Gupta, A. Vaidya, and J. Mukherjee, “A Compact dual-band fork-shaped monopole antenna for bluetooth and UWB applications,” IEEE Antennas Wireless Propag. Lett., vol. 10, pp. 627-630, 2011.
7. Anjaneyulu Katuru and A.Sudhakar, “Design and analysis of matched microstrip line feed antenna for ultra wideband applications,” Inter. J. Commu. Antennas Propag. (I.Re.C.A.P), vol. 6, N.6, pp. 369-374, Dec. 2016.
8. Anjaneyulu Katuruand Sudhakar Alapati, “Design and analysis of modified circular patch antenna with DGS for UWB applications,” 2nd Inter. Conf. Micro-Elect. Electrom. and Telecommu.(ICMEET), Lecture Notes in Electrical Engineering 434, Springer Nature Singapore Pte. Ltd., pp. 537-545, 2018.
9. Lakshman Narayana Vejendla and Bharathi C R,(2017),“Using customized Active Resource Routing and Tenable Association using Licentious Method Algorithm for secured mobile ad hoc network Management”, Advances in Modeling and Analysis B, Vol.60, Issue.1, pp.270-282. DOI: 10.18280/ama_b.600117
10. Lakshman Narayana Vejendla and Bharathi C R,(2017),“Identity Based Cryptography for Mobile ad hoc Networks”, Journal of Theoretical and Applied Information Technology, Vol.95, Issue.5, pp.1173-1181. EID: 2-s2.0-85015373447
11. A Peda Gopi and Lakshman Narayana Vejendla, (2019),” Certified Node Frequency in Social Network Using Parallel Diffusion Methods”, Ingénierie des Systèmes d' Information, Vol. 24, No. 1, 2019,pp.113-117. DOI: 10.18280/isi.240117
12. Lakshman Narayana Vejendla and A Peda Gopi, (2019),” Avoiding Interoperability and Delay in Healthcare Monitoring System Using Block Chain Technology”, Revue d'Intelligence Artificielle , Vol. 33, No. 1, 2019,pp.45-48.
13. Lakshman Narayana Vejendla and Bharathi C R ,(2018),“Multi-mode Routing Algorithm with Cryptographic Techniques and Reduction of Packet Drop using 2ACK scheme in MANETs”, Smart Intelligent Computing and Applications, Vo1.1, pp.649-658. DOI: 10.1007/978-981-13-1921-1_63DOI: 0.1007/978-981-13-1921-1_63
14. Lakshman Narayana Vejendla and Bharathi C R, (2018), “Effective multi-mode routing mechanism with master-slave technique and reduction of packet droppings using 2-ACK scheme in MANETS”, Modelling, Measurement and Control A, Vol.91, Issue.2, pp.73-76 DOI: 10.18280/mmc_a.910207
15. A Peda Gopi and Lakshman Narayana Vejendla (2018), “Dynamic load balancing for client server assignment in distributed system using genetic algorithm”, Ingénierie des Systèmes d'Information, Vol.23, Issue.6, pp. 87-98. DOI: 10.3166/ISI.23.6.87-98
16. A Peda Gopi and Lakshman Narayana Vejendla, (2017),” Protected strength approach for image steganography”, Traitement du Signal, Vol.35, No.3-4,pp.175-181. DOI: 10.3166/TS.34.175-181
17. K. Xu, Z. Zhu, H. Li, J. Huangfu, C. Li, and L. Ran, “A Printed single-layer UWB monopole antenna with extended ground plane stubs,” IEEE Antennas Wireless Propag. Lett., vol.12, pp. 237-240, 2013.