A Rectangular Monopole antenna for UWB Applications.

Rashmi J. Bhatiya.
Department of Electronics and Telecommunication
Muchhala polytechnic, Thane, India.
rashmibhatiya@gmail.com

R.K.Gupta.
Department of Electronics and Telecommunication
Terna engineering college, Nerul, India.
rajivmind@gmail.com

***Abstract*—This paper presents a compact wideband microstrip-fed planar monopole antenna composed of a rectangular patch and truncated ground structure. By placing stubs on the sides of the radiating patch, provides wide-band characteristics and compact size. The antenna is small in size and simple to design due to less number of design parameters, compared with the existing UWB antennas. The bandwidth, radiation pattern and other antenna parameters are at acceptable level. IE3D simulation software based on method of moments is used for design and analysis.**

Keywords—UWB; Monopole Antenna; Rectangular patch; Stubs.

I. INTRODUCTION

There are rapid developments in wireless communication systems to meet the growing demands for various communication services. However, the technologies for wireless communication still need to be improved further to satisfy the higher resolution and higher data rate. UWB communication system covering from 3.1 to 10.6 GHz has been released by the FCC in 2002. UWB system requires a compact antenna pro-viding wideband characteristic over the whole operating band. Due to their appealing features of wide bandwidth, simple structures, omnidirectional patterns and ease of construction, planar metal-plate monopole antennas have been proposed for such applications [1]. A microstrip-fed planar monopole antenna is thus suitable due to its attractive features such as low profile, low cost and light weight [2].

Recently various wideband monopole configurations such as circular disc, rectangular patch and ring have been reported. In particular circular disc and rectangular monopole antennas have been widely studied due to the feature of simple structure [3]. Also several planar monopole antennas with various shapes have been investigated. Some of these antennas include E-shaped slot, S-shaped-slot, use defected ground structure and slot in the tapered radiating etc. These antennas are either relatively large, have limited impedance bandwidth or exhibit non–omnidirectional radiation patterns [4-6].

So, in this paper an attempt is made to use stubs to obtain the wide bandwidth with reduced size. The ground plane of the antenna is truncated symmetrically. The antenna is designed and simulated.S_{11} is less than -10dB over 3.1-12.72 GHz.

II. ANTENNA DESIGN

The geometrical configuration of the proposed wideband printed monopole antenna is shown in Fig 1. The antenna is designed using FR4 substrate of thickness 1.6 mm, relative dielectric constant εr = 4.4 loss tangent of 0.02. The 50Ω microstrip feed line is used to excite the pro-posed antenna. The basic antenna structure is a rectangular patch of 14 mm × 13 mm width. The dimensions of the ground plane are 16 mm × 3.5 mm. In the next step the square stubs with size (1 × 2) mm have been placed at a distance of 1 mm on three sides of rectangular patch and positioned above semicircle patch. The ground plane is truncated as shown in Fig 1 such that it has two stairs at both side of feed line. All the parameters of the antennas are optimized by using IE3D simulation software. The optimum physical parameter of antenna are as shown in Fig 1, all dimensions are in mm.

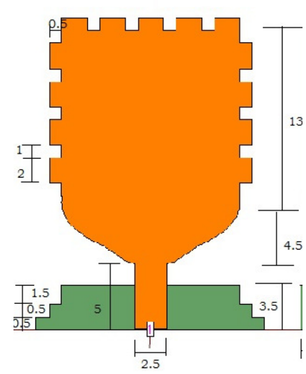


Fig. 1. Antenna 1 structure.

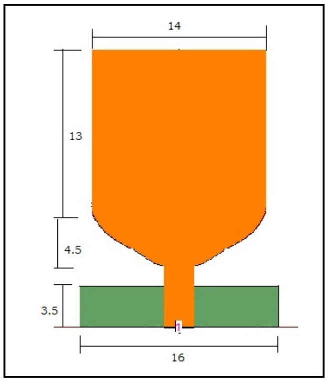


Fig. 2. Antenna 2 structure.

III. Simulation and Measurement Results

The proposed antennas were analyzed by using Mentor Graphics IE3D simulator. The simulated reflection coefficient or return loss of the proposed antennas are shown in Fig 3 The simulation results show impedance bandwidth between 3.1 & 12.8 GHz with respect to S11 < –10 dB reference level. However, the overall impedance bandwidth between 3.1 & 12.8 GHz is consistent and more than FCC range with respect to higher frequency. When the stubs have been placed in the radiating patch and ground plane is truncated (Antenna 1), it is observed that there is little increase in the bandwidth around 200 MHz at lower frequency and 2.8GHz at higher frequency compared to Antenna 2. The simulated results are shown in Fig 4.Further the antenna radiation patterns in E-plane and H-plane were studied and the radiation patterns for Antenna are shown in Fig 5.

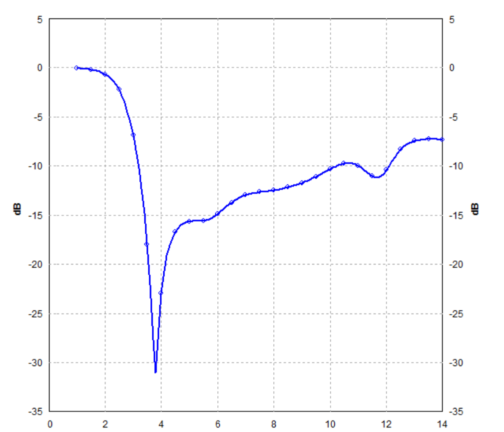


Fig. 3. S_{11} charecteristics.

IV. Conclusion

A compact wideband rectangular monopole antenna with square stubs on the radiating patch, and truncated ground plane has been studied. All prototype antennas operate over UWB frequency range of 3.08 to 12.8 GHz. They provide bi-directional radiation pattern in E-plane and nearly omnidirectional radiation pattern in H-plane. In addition the antennas geometry is of a relatively simple configuration enabling easy fabrication at low cost.

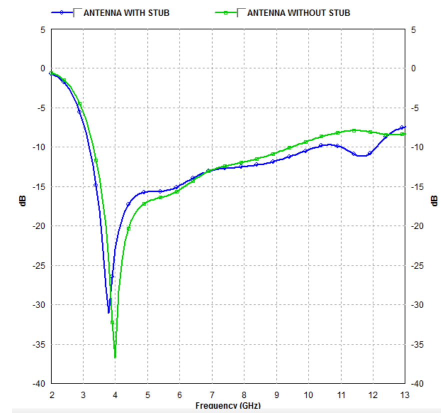
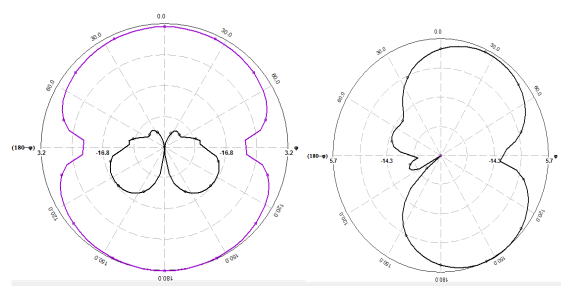
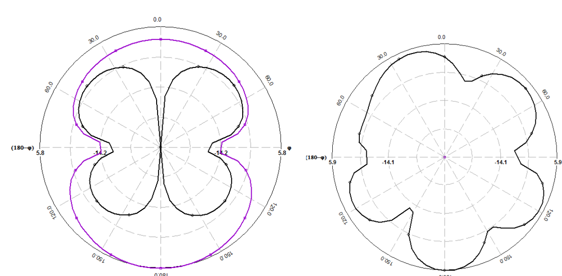


Fig. 4. S_{11} charecteristics of antenna with stub,without stub.

(a)



(b)



(c)

Fig. 5. Radiation patterns in H-plane and E-plane at: (a) 3 GHz, (b) 6 GHz, (c) 12 GHz.

REFERENCES

[1] G. Kumar and K P. Ray, *Broadband Microstrip Antennas*, Norwood, MA Artech house, 2003.

[2] Constantine A. Balanis, *Antenna Theory and Design*, 3rd Edition, John Wiley and sons Inc. USA, 2005.

[3] J. D. Kraus and R. J. Marhefka, *Antennas*, 3rd ed., McGraw- Hill, 1988.

[4] S.Oudaya Coumar, RNakkeeran and G.Ashwath, " Development of Compact Monopole Antenna for UWB Applications " Computing Communication & Networking Technologies (ICCCNT), 2012 Third International Conference , pp 1-5 July 2012.

[5] Yashar Zehforoo, Rarnazanali Sadegzadeh, Navid Minnotahhary, "A Modified Planar Monopole Antenna for UWB Applications", lEEE Symposim on Compliers and Informatics, 2011.

[6] Kuiwen Xu, Zhongbo Zhu, Huan Li, Jiangtao Huangfu, Changzhi Li, , and Lixin Ran, "A Printed Single-Layer UWB Monopole Antenna With Extended Ground Plane Stubs" IEEE Antennas Wireless Propag. Lett., vol, 12, pp 237-240, March 2013.

[7] IE3D release 12.0, Zeland software Inc., Fremont, CA., USA, 2006.