# Design and Simulation of Triangular Arm Antenna for WLAN Application

**Rahul Singh Rathore, Sudeep Baudha, Neha Shrivastave**

***Abstract-*** ***In this paper, A newly design technique for enhancing Bandwidth that improves the performance of a conventional microstrip patch antenna is proposed. This paper presents a novel wideband triangular arm antenna. The design adopts contemporary techniques; A triangular arm patch antenna structure. The effect of these techniques and by introducing the novel single shaped patch, offer a low profile, broadband, high gain, and compact antenna element. The result showed satisfactory performance with maximum achievable return loss –19db and a fractional impedance bandwidth of 2.32GHZ-2.72GHZ. The design is suitable for WLAN, mobile communication, satellite communication & WPAN.***

## I. INTRODUCTION

Microstrip patch antennas have several well-known advantages, such as low profile, low cost, light weight, ease of fabrication and conformity.

However, the microstrip antenna inherently has a low gain and a narrow bandwidth. To overcome its inherent limitation of narrow impedance bandwidth and low gain, many techniques have been suggested e.g., for triangular arm, microstrip patch antennas on electrically thick substrate, triangular patch antenna have been proposed and investigated. In general, the impedance bandwidth of a patch antenna is proportional to the antenna volume, measured in wavelengths. However, by using triangular arm patch with the walls at the substrate, one can obtain enhanced impedance band width. A simple patch antenna with basic rectangular patch operates in a single frequency band. A patch antenna intended to operate at a centre resonance frequency fr mounted on a substrate having dielectric constant εr would have length L and width W. and the the triangular arm having its arm length inner width and the outer width and between these two arm a gap is there that is know as port gap.

## II. ANTENNA GEOMETRY AND DESIGN

A low-profile microstrip slot patch antenna is proposed as shown in Fig. 1.

Rectangular geometries were simulated to optimize the performance, starting with a triangular patch antenna on a triangular ground plane and ending up with an triangular shape, for both the radiator and the ground plane.

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Here two triangular arm was used which are similar shaped and dimensions actually both the triangular arms are duplicated to each other and placed on the goround plane of the substrate. The conventional shape of patch antenna shown in Fig. 1 has a substrate 71mm*71mm and 62mil thickness, Arm length 17.75mm, inner and outer width of arm is 0.89mm, 15.98mm respectively with port gap length 0.89mm and fr is 2.4GHZ.

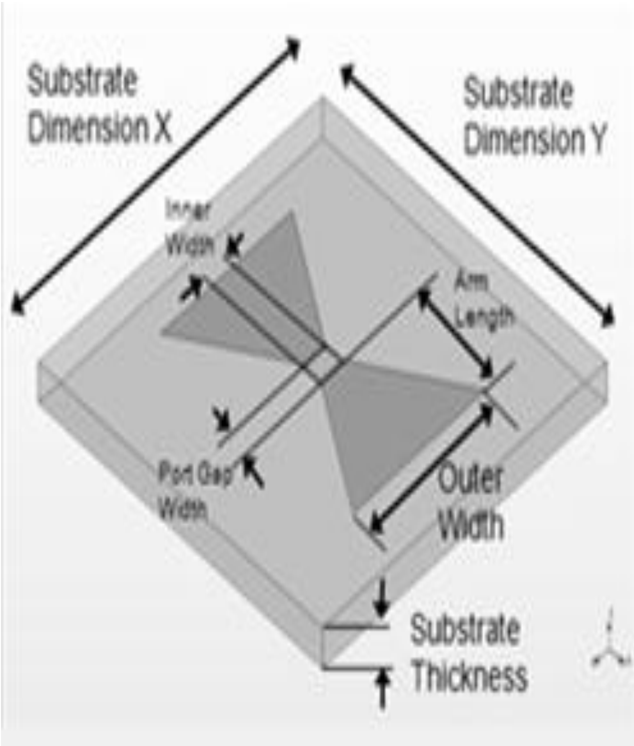


**Fig. 1 Triangular arm Antenna (Top view)**

## III. SIMULATION AND EXPERIMENTAL RESULTS

The antenna performance was investigated numerically and experimentally. The simulation was done using the commercial simulator HFSS ver. 13, When the parameters of the proposed antenna are selected as indicated in Figs. 1. Fig. 3 shows the gain of a slot antenna.Gain of the antenna reaches 2dB with an operating frequency 2.4 GHz. The overall impedance bandwidth (retum loss reaches -19 dB). The measurement results agree well with the predicted ones. The central frequency over the frequency range of interest is 2.4 GHz. The overall antenna thickness is about 62mil. results of the return loss and input impedance behaviour of the proposed single-patch slot antenna frequencies is obtained.

Fig. 2 shows the simulated and measured return loss with a single band whose measured bandwidth is 2.32GHZ – 2.72GHZ at -10dB.

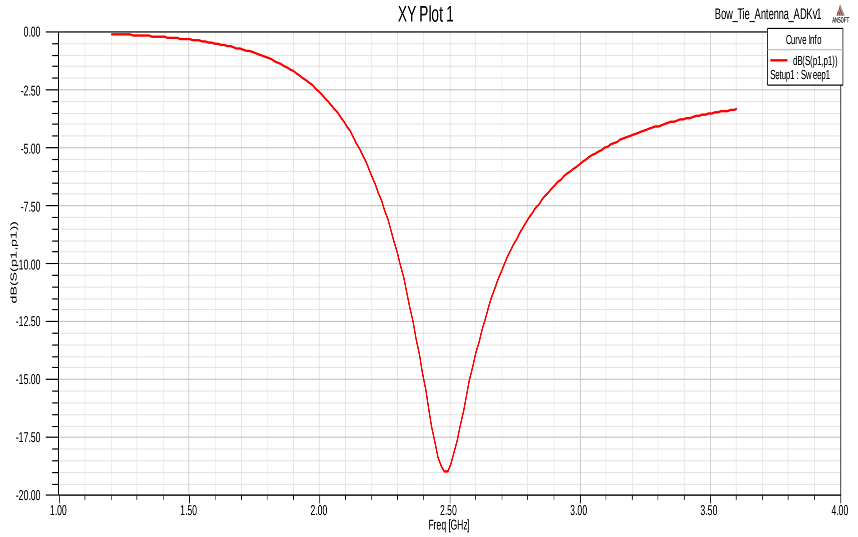


**Fig 2: Measured Return Loss**

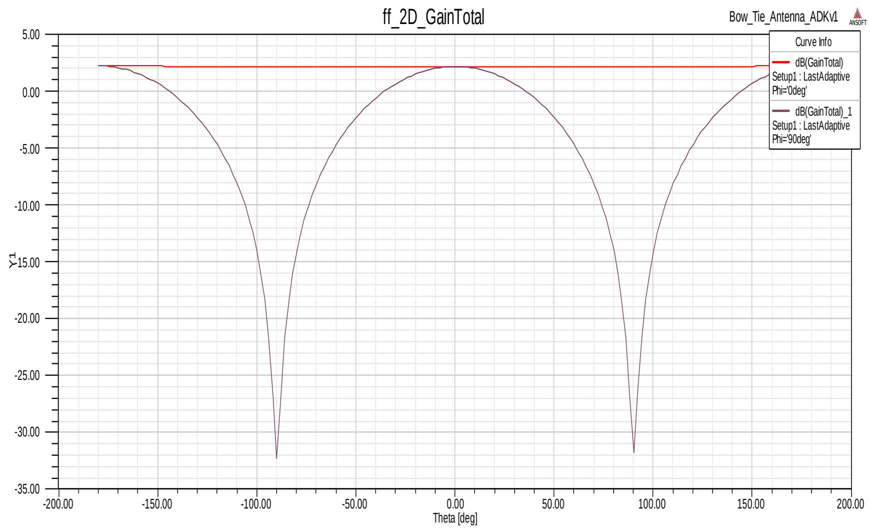


**Fig.3: Gain of the Antenna**

Fig. 4 show the smith chart of a triangular arm antenna (radiation pattern), which shows the direction of the radiation from the antenna.which gives the good impedance matching for 2.4GHz operating frequency that is to good result of the triangular arm antenna.

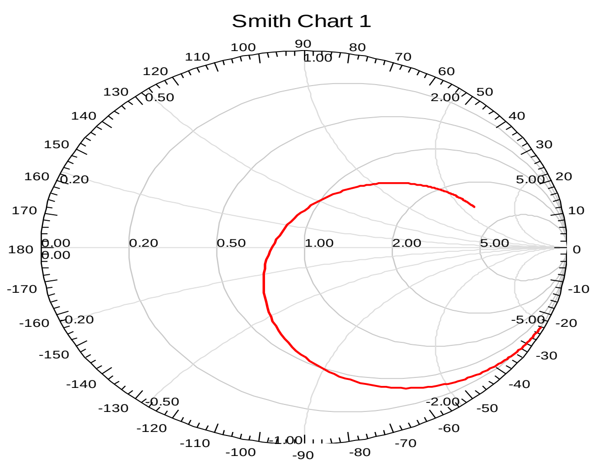


**Fig.4: Smith Chart Radiation pattern**

## IV. CONCLUSION

In this paper a novel triangular arm antenna with two arm Sub structure, two similar arm and single frequency operation has been presented. A wide-band multiple slotted stacked patch antenna has been designed for high gain. A novel technique for enhancing bandwidth and gain of microstrip patch antenna is successfully designed in this paper. The proposed microstrip triangular arm antenna achieves a fractional bandwidth of (2.32 to 2.72 GHz) at -10 dB return loss. The maximum achievable gain of the antenna is 2 dBi. By carefully displacing one feed from the principal axes of the single patch delicately, it is possible to realise resonant modes and achieve a wide impedance bandwidth (return loss < - 10dB) over the frequency range from 2.32 GHz to 2.72 GHz. Cause of the good bandwidth and its range it is very suitable for the WPAN and satellite communication applications. The measured and simulated results are in good agreement.

## REFERENCES

1. Luis Brás, Nuno Borges Carvalho and Pedro Pinho, "Pentagonal Patch-Excited Sectorized Antenna for Localization Systems", Transactions on antennas and propogation, IEEE March 2012 Vol. 60, NO. 3,
2. Amit Kumar Srivastava, Saswati Ghosh and Binay Kumar Sarkar, "Analysis of Circular Patch Antenna as an Electromagnetic Interference Sensor", IEEE 2012 Vol. 978-1-4673-1515-9/12
3. S.K. Podilchak, M. Caillet, D. Lee and Y.M.M. Antar, " Compact Antenna for Microsatellite Using Folded Shorted Patches and an Integrated Feeding Network", IEEE 2011 Vol. 978-1-4577-0919-7/12
4. Linxi Zhang, Qi Zhang, "The Influence of Dielectric Constant on Bandwidth of U-notch Microstrip Patch Antenna", International Conference on Ultra-Wideband IEEE, 2010.
5. Aditi sharma G. Singh, " Rectangular micro strip patch antenna design at THz frequency for short distance wireless communication systems" , infrared milli TeraHz Waves, 2009.
6. D. N. Elsheakh, Student Member, IEEE, H. A. Elsadek, E. A. Abdallah, H. Elhenawy, and M. F. Iskander, Member, IEEE, "Enhancement of Microstrip Monopole Antenna Bandwidth by Using EBG Structures", Antennas and wireless propogation letters, IEEE 2009 VOL8.
7. M.A. Matin, B.S. Sharif. C.C. Teesimenidis, "Broadband stacked Microstrip Antennas with Different Radiating patch", Springer LLC, 2009.
8. C.F. Yang, W.C. Tzou, J.H. Tsai, H.M. Chen and Y.F.Lin, "Enhance Antenna Bandwidth by UsingHigh Permittivity Ceramic and FR4 Stacked Structure", IEEE, 2007 IEEE, 2007 Vol. 1-4244-0878-4/07
9. Wang jain Zhang Hou Huang Wenli Huang Xueyu, "A novel wide band circular patch antenna", Journal of electronics (CHINA), Nov '2005 Vol.22 No.6
10. Indra Surjati and Eko Tjipto Rahardjo and Djoko Hartanto, "Increasing Bandwidth Dual Frequency Triangular Microstrip Antenna Feed By Coplanar Waveguide", IEEE, 2/06 /2006 Vol.I 1-4244-0574
11. Y. J. Sung', B.Y. Kim, T. U. Jang, and Y.-S.Kim, "Swithchable Triangular Microstrip Patch Antenna for Dual-Frequency Operation", IEEE 8/04/2004 Vol.0-7803-8302
12. Jui-Han Lu, Member, IEEE, Chia-Luan Tang, and Kin-Lu Wong, Senior Member, IEEE," Novel Dual-Frequency and Broad-Band Designs of Slot-Loaded Equilateral Triangular Microstrip Antennas", IEEE Transactions on antennas and propogation,IEEE, July 2000 Vol. 48, NO. 7
13. Vinode kumar Singh aAshok mittal, "Design of wide band micro strip antenna arry at millimeter wave nd frequencies", International journal of infrared and millimeter waves, Oct'1999 vol.21.No.2
14. Ting-Hua Liu & Wen-Xun Zhang, "Compound techniques for broadening the bandwidth of microstrip patch antenna", Asia Pacific Microwave Conference 1997.