International Journal of Engineering, Management, Humanities and Social Sciences Paradigms (IJEMHS)
Volume 31, Issue 03, Quarter 03 (2019)
Publishing Month and Date: July 29, 2019
An Indexed and Referred Journal with Impact Factor: 2.75
ISSN (Online): 2347-601X
www.ijemhs.com

Analysis and Design the Slotted Bowtie Antenna

Pooja Singh[1] and Ankit Kumar[2]
[1]M. Tech. Scholar, CBSGI, Fatehpuri, Jhajjar, Haryana
[2]A.P, ECE, CBSGI, Fatehpuri, Jhajjar, Haryana

Abstract

The demand of compact, efficient and economical communication devices has been tremendously increased. Same demand has been observed in antennas for multi-band applications. In this work, different designs of bowtie antennas are studied. The proposed antennas are designed, and results are evaluated to study different output parameters. The results confirmed that the proposed antennas may be useful for different mobile communication systems and Wireless applications. The results showed sufficient isolation among the operating frequency bands with improvement in gain and directivity. The results obtained had showed better improvement in the return loss and radiation pattern in comparison to the other existing antenna. The resonant frequency for the return loss of the design antenna is 9.2 GHz.

Keywords: *Micro strip patch antenna, insertion loss, multi-band, mobile communication; bowtie antenna.*

I. Introduction

In modern communication systems, light weighted, economical, compact, easy to carry and simple to use devices are in demand [1]. In this regard, the need of such antenna designs has been squeezed significantly by several researchers. To design an effective antenna, this becomes necessary to design it according to the theoretical calculations with proper external shapes and dimensions [2]. A micro strip element was invented and patented by Munson [3]. However, different micro strip geometries for antenna applications were studied by Weinschel [4]. The extensive work by Munson on the development of micro strip antennas gave birth to a new antenna industry [5]. The micro strip patch antennas are attracting the attention due to their advantages like light weight, low cost of fabrication, thin profile and easy of manufacturing. Micro strip antennas have different geometrical structures depending on the demand of application. The present structure of Bowtie consists of two triangular patches arranged such that one is mirror image to another. The micro strip patch antennas are attracting the attention due to their advantages like light weight, low cost of fabrication, thin profile and easy of manufacturing. Micro strip antennas have different geometrical structures depending on the demand of application. The present structure of Bowtie consists of two triangular patches. The micro strip patch antennas are attracting the attention due to their advantages like light weight, low cost of. Four different bowtie shapes were studied after theoretical analysis, i.e., parabolic bowtie, triangular bowtie, bow shaped, and circular shaped mirror arms. Aperture feed is used and the antenna are then analysed.

The micro strip patch antennas are attracting the attention due to their advantages like light weight, low cost of fabrication, thin profile and easy of manufacturing. Micro strip antennas have different geometrical structures depending on the demand of application. The present structure of Bowtie consists of two triangular patches accordance to the designed dimensions and geometries. Further, the designed antennas are evaluated for results in the form of output parameters. The resonant frequency from the return loss of the design antenna is 9.2GHz.

II. Antenna Geometry

The model is designed using commercial finite element method solver for electromagnetic Structures supported CST (Computer Simulation Technology) software.3D modeling is done on the substrate. Figure 1 shows the geometries of the designs selected to develop and analyze the planar Waveguide (PW) fed bowtie antenna's. It consists of two mirror structures on the planer dipole patch. A lumped port excitation is used for the PW feed. The dimensions of the proposed antennas are set using theoretical analysis. The output parameters depend on the distance, position and the orientation of the bowtie .Fig 1show the design for the proposed bowtie antenna.

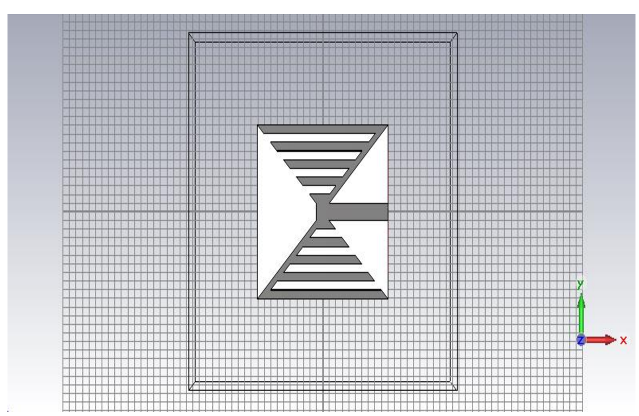

Figure 1: Schematic showing Shape of Bowtie Antenna

International Journal of Engineering, Management, Humanities and Social Sciences Paradigms (IJEMHS)
Volume 31, Issue 03, Quarter 03 (2019)
Publishing Month and Date: July 29, 2019
An Indexed and Referred Journal with Impact Factor: 2.75
ISSN (Online): 2347-601X
www.ijemhs.com

Table 1: Parameters and Dimensions of the Proposed Bowtie Antenna

Ref .No	Name	Length	Width	Height
1	Antenna	20	20	1.696
2	Slot 1	17	1	1.66-1.696
3	Slot 2	13	1	1.66-1.696
4	Slot 3	9	1	1.66-1.696
5	Slot 4	5	1	1.66-1.696
6	Feed	10	2	1.66-1.696

The width, W and length, L of the patch are calculated by using the transmission line model. For proper antenna designs, some finite ground plane is necessary below the substrate. Similarly, for practical design of micro strip patch antenna, it is essential that the ground plane should be greater than the actual patch dimensions by about six time the substrate thickness, thus the dimension of the design are shown in table 1.

III. Results and Discussions

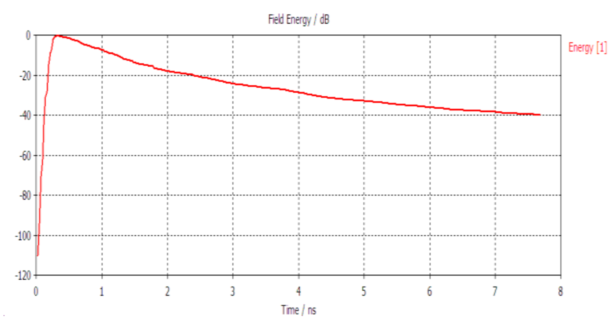

Figure 2: The Result for Field Energy of the Design Antenna

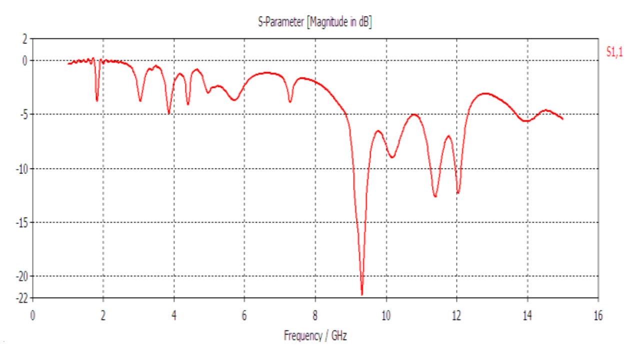

Figure 3: The result for the return loss of the design antenna

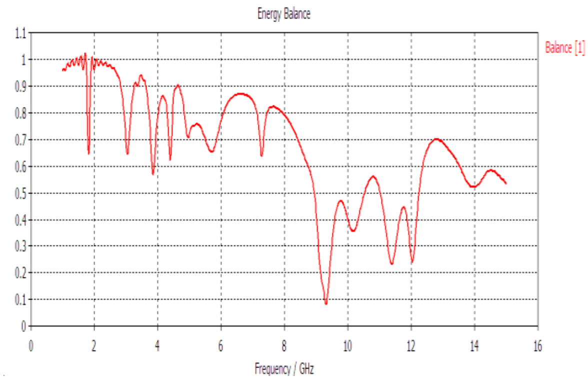

Figure 4: The Result for the Energy Balance of the Design Antenna

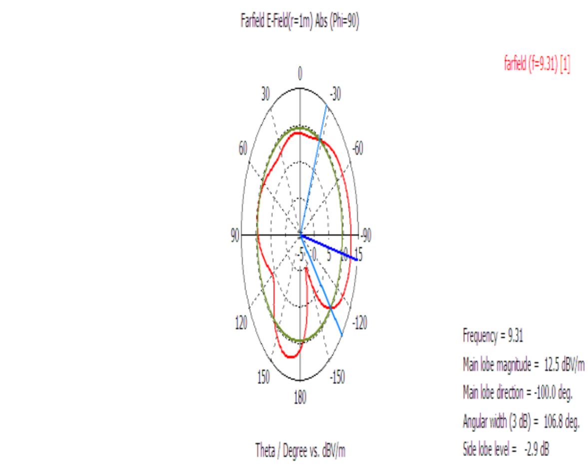

Figure 5: The radiation pattern for far field (E field)

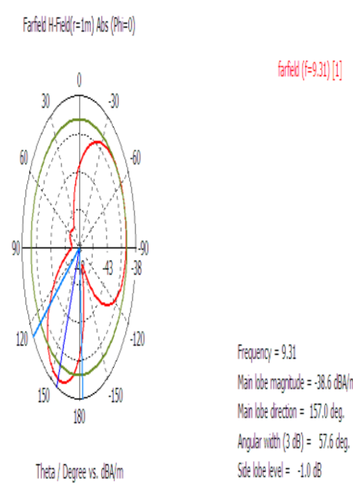

Fig 6

Figure 6: The radiation pattern for far field (H field)

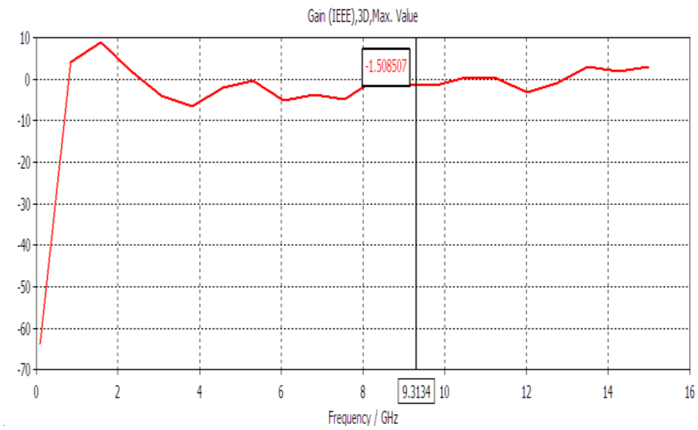

Figure 7: The result for gain of design antenna

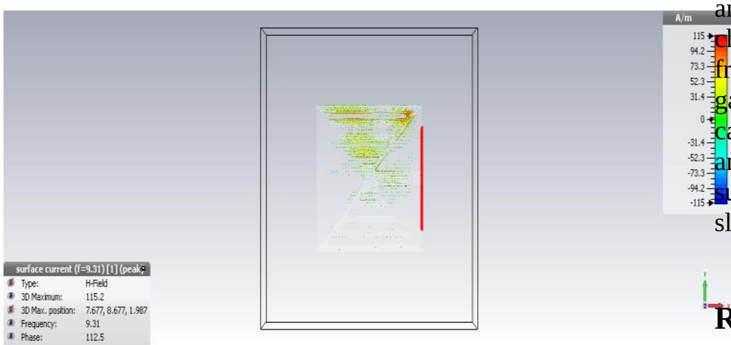

Figure 8: Show the surface current

The proposed design is simulated on the computational machine with processing speed of
2.6 GHz and 4 GB RAM. The virtual memory used during simulation is 2.1 GHz. A precise sized meshing is not selected to avoid the computational load. Frequency domain setting is selected for simulating the model. The characteristic impedance (Z0) of the simulated design comes out to be 50 Ω. Figure 2 shows the polar graph showing field energy the designed antennas are then enclosed in the rectangular air box. Figure 3 shows the return losses for the proposed antenna designs. Figure 4 shows the energy balance of PW fed bowtie antenna. Parabolic bowtie antenna shows satisfactory results.

Table 2: The table for measured result

Ref .No	Frequency(GHz)	Return Loss(db)	Bandwidth %
1	9	-15	-
2	9.2	-22	5
3	9.3	-15	-
4	11.5	-14	4.5
5	12	-13	3.4

IV. Conclusions

These antennas are used to design a single, dual band antenna. This design is based mono layer, single patch and does not require complex circuitry. The gain of the antenna is as high 9.01 dB and as smaller as -1.55db value of gain. The bandwidth of the design antenna is 5GHz. The proposed antenna designs can handle mutli frequencies by simply changing the bowtie shapes and covers lot of demanding frequency bands used in everyday communication systems the gain of the design antenna for some point is negative but we can improve it by designing the other shape of antenna this antenna also give better application for the future use . The surface current of the design antenna is nearly closed to the slot.

References

[1] Y. P. Zhang and J. J. Wang, "Theory and analysis of differentially-driven micro strip antennas, "IEEE Transactions on Antennas and Propagation, Vol. 54, pp. 1092-1099, 2006

[2] K. P. Yang and K. L. Wong, “Dual band circularly polarized square micro strip antenna,” IEEE Trans. Antennas Propagat. Vol. 49, No. 3, 378–382, March 2001.

[3] E Munson, “Single slot cavity antennas assembly,” U.S. Patent No. 3713 162, Jan. 23, 1973.

[4] H. D. Weinschel, “Progress report on development of micro strip cylindrical arrays for sounding rockets,” Physic. and Sci. Lab., New Mexico State Univ., Las Cruces, 1973.

[5] [5] K. Buell, H. Mosallaei and K. Sarabandi, “A substrate for small patch antennas providing tunable miniaturization factor," IEEE Trans. Microwave Theory Tech., Vol. 54, 135-139, 2006.

[6] D. M. Pozar, Microwave Engineering: Wiley Inter-science, 2006.

[7] R. Chair, C. L. Mak, K. F. Lee, K. M. Luk, A. A. Kishk, “Miniature wide-band half U-slot and half E-shaped patch antennas,” IEEE Transactions on Antennas and Propagation., Vol. 53, pp. 2645–2652, 2005.

[8] H. Nakano, K. Vichien, “Dual- Frequency Patch Antenna with a Rectangular Notch,” Electronics Letters, vol. 25, No. 16, pp. 1067-1068, 1989.
[9] S. Arya, S. Khan, C. Shan, P. K. Lehana, “Design of a Microstrip Patch Antenna for Mobile Wireless Communication Systems, “Journal of Computational Intelligence and Electronic Systems, Vol. 1, No. 2, pp. 178-182, 2012.
[10] A. Aslam, F. A. Bhatti, “Matching Technique for Microstrip Patch Antenna Using GCPW Feed,” International Conference on Emerging Technologies, pp. 66 – 69, 2009.
[11] R. Arora, A. Kumar, S. Khan, S. Arya, “Finite Element Modeling and Design of Rectangular Patch Antenna with Different Feeding Techniques,” Open journal of Antenna and Propagation, vol. 1, no. 1, 2013.
[12] S. Arya, S. Khan, C. K. Shan, P. Lehana, “Design of Small Integrated Antenna for Peer to Peer Wireless Communication, ”International Journal of Mobile Network Communications & Telematics, Vol. 2, no. 3, pp. 11-20, 2012,
[13] R. Arora, A. Kumar, S. Khan, S. Arya, “Design Analysis and Comparison of HE shaped and E Shaped Microstrip Patch Antennas,” International Journal on Communications Antenna and Propagation, Vol. 4, no. 1, pp. 27-31, 2014.
[14] L. C. Tsai, "A Dual-Band Bow-Tie-Shaped CPW-Fed Slot Antenna for WLAN Applications," Progress In Electromagnetics Research C, Vol. 47, 167–171, 2014.
[15] J. P. DeVilliers and J.P. Jacobs, “Gaussian process modeling of CPW-fed slot antennas,” Progress In Electromagnetics Research, Vol. 98, 233–249, 2009.
[16] C. Y. Huang, C. C. Lin, and W. F. Chen, “Multiple band-stop bow-tie slot antennas for multiband wireless systems,” IET Micro., Ant. Propag., Vol. 2, No. 6, 588–593, Jun. 2008.