http://www.jctjournals.com ISSN(ONLINE):2278 – 3814

Volume-8, Issue-01, January, 2019
JOURNAL OF COMPUTING TECHNOLOGIES (JCT)
International Journal
Impact Factor– 3.017

Flexible Wide Band Bow Tie Shape Patch Antenna for WLAN Application

[1]Leena Rahangdale (M.Tech DC), [2]Sudesh Gupta (Associate Professor)
Department of Electronics and Communication[1,2]
Technocrats Institute of Technology and Science, Bhopal
leenarahangdale9403@gmail.com[1]

***Abstract*— A flexible bow-tie antenna based on a multi metal sheet on top of a very thin flexible substrate is introduced. The antenna is constructed from two right-angle triangles fed by a microstrip waveguide transmission line. A prototype is designed, characterized on computer simulated technology (CST). The tenability is proven by considering the version in free-space. Measurements demonstrate good agreement with simulations. The proposed multi-layer flexible bow tie antenna cover the WLAN (2.4 GHz, 3.65 GHz) and Wi-Max (2.3 GHz, 2.5 GHz, and 3.5 GHz) spectra, with an overall impedance bandwidth of 3.004 GHz (69.76%). The return loss 4 GHz of proposed flexible bow tie antenna is -38.5 dB and the VSWR at this point is 1.23. The radiation of the antenna is bi-directional with maximum gains of 3.02 dB for the free-space.**

***Keywords*— Flexible antennas, Bow-Tie, Microstrip feed line, Return Loss (S-11) and Voltage Standing Wave Ratio.**

I. INTRODUCTION

The two triangular pieces of stiff wire or 2 triangular flat antenna metal plates, organized within the configuration of a bowtie, the triangle's apex have the feed point at the gap between them. As a simple (and non-manufacturable) infinitely wideband antenna, let's consider an infinite bow-tie antenna: infinite bow-tie antenna. In Figure 1, shows an antenna that's specified solely by the angle between the 2 metal items, D. The radio positive and negative terminals connection point is the antenna feed which is at the middle of the antenna. Resulting that, the antenna would have an infinite bandwidth in the theory, resulting the working in all frequencies, then the antenna looks the same at all wavelengths. In terms of creating a real antenna, we can take the easy approach and simply clip it after some distance and then looking what happens. The other two names are butterfly or bio conical. Antenna is a key device for any wireless communication system. An antenna is a means of radiating or receiving radio waves, this definition is given in IEEE. Or we can say that antenna acts as an interface for electromagnetic energy, propagating between free area and guided medium. Satellite and Wireless communication has been developed quickly within the last few years and it has left a great impact on human life. Recently the trend in commercial and government communication systems has led to developing low value, low profile, minimal weight, and broadband antennas that are able in the maintenance of the high performance over a very huge range of frequencies. The trend in technology has centered a lot of effort in the designing of Microstrip antennas which are referred as patch antenna.

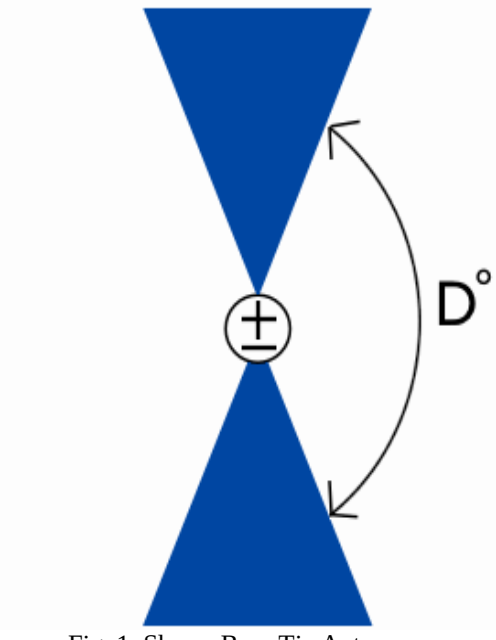

Fig. 1. Shows Bow Tie Antenna

II. WIDE BAND ANTENNA

The When information's are transferred a system is said to be in a **wideband** is when the message bandwidth significantly exceeds the coherence bandwidth of channel. Many of the communication links have a high data rate that's why they're forced to use a wide bandwidth; other links might have low data rates, and use a wider bandwidth. A band antenna is one with concerning or precisely the same operative characteristics over an extremely wide pass band. It's distinguished from broadband antennas

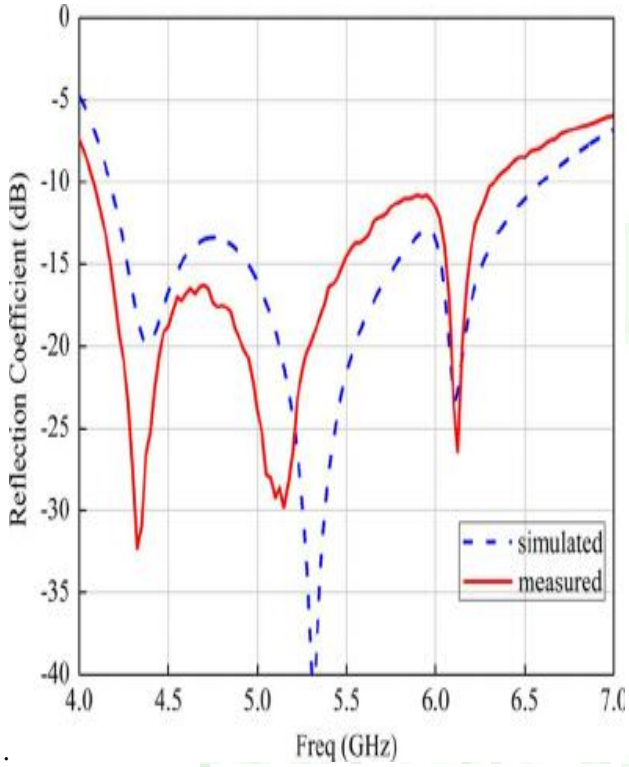

Fig. 2 Wide band antenna Return loss graph

Wireless technology grow speedy with starting of 4th generation (4G) system. In this way Wi-Max also shows the fast of growth. The study of small strip patch antennas has created a good progress within the recent years, compared with the standard antennas. Subsequent generation networks we have a tendency to need higher data rate and size of devices are abundant smaller. During this evolution two vital standards are Wi-MAX [1] and Wireless local area network [2] antennas are standard for his or her well-known engaging options such as tiny dimension and easy to fit on chip. The demand of flexible antenna is increases rapidly due to its good poperies such an easy to fabricate, easy to fit any communication device and also use in different places where require flexible technology structure. For the flexible technology in antenna use different type of substrates such as Graphene [5], copper indium gallium [6]. [03].The next generation of technology is based on flexible electronics, for the growth of this technology, proposed flexible antenna shows a vital role. [7]

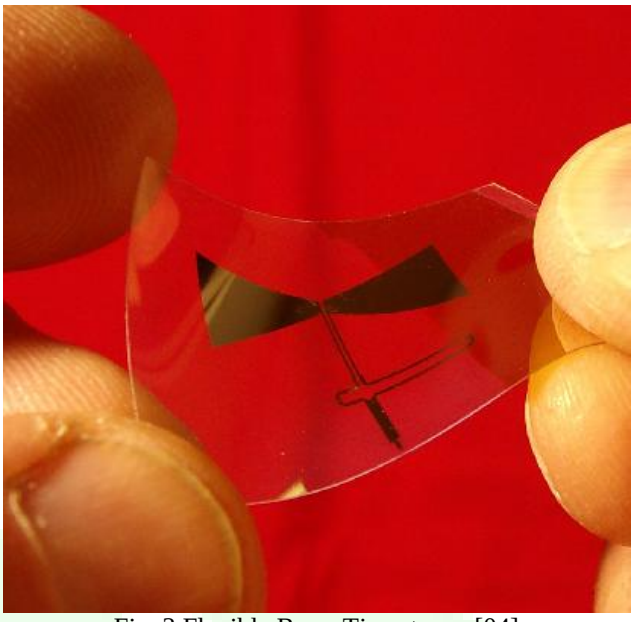

Fig. 3 Flexible Bow- Tie antenna [04]

In the above figure 3 shows the proto type of flexible bow tie antenna. This flexible antenna design of flexible rubber substrate.

III.PROPOSED DESIGN

In this presented work shows the flexible bow-tie patch antenna designed. In this antenna apply defected ground structure (DGS) technique to enhance bandwidth (B.W.) and gain (G) of the antenna. Flexible patch antenna has become popular day by day the reason behind this is ease of flexibility and fabrications in cloths. Flexible patch antenna is designed for Giga hertz frequency range 2 to 5 GHz where this frequency range accommodate in the various band in the wireless fidelity range 3.4 GHz and wireless local LAN all are in GHz range frequency. Flexible patch antennas have Gaining importance in the applications of Wireless Local Area networks (WLAN). The simulated results such as Return Loss S_{11}, VSWR, Gain, and Radiation Pattern, Vector diagram of electric field and Mesh field is made. So the details of the antenna designs and simulated results are presented in this part. New micro strip antennas have enhanced gain and radiation pattern is presented in this proposed design.

Proposed Flexible Microstrip Bow Tie Antenna (FMBTA)

In the research work present a flexible bow tie antenna, it is good step for flexible technology. During this evolution two vital standards are Wi-MAX [1] and Wireless local area network [2] antennas are standard for its well-known engaging options, like a small size, easy to fabricate and easy to use. The demand of flexible antenna is increasing rapidly due to its good properties such an easy to fabricate, easy to fit any communication device and also use in

different places where require flexible technology structure. For the flexible technology in antenna use different type of substrates such as Graphene [5], copper indium gallium [6]. [03].The next generation of technology is based on flexible electronics, for the growth of this technology, proposed flexible antenna shows a vital role. [7].

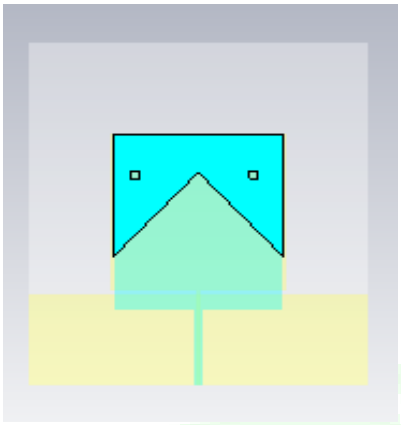

Fig. 4 (a) proposed design

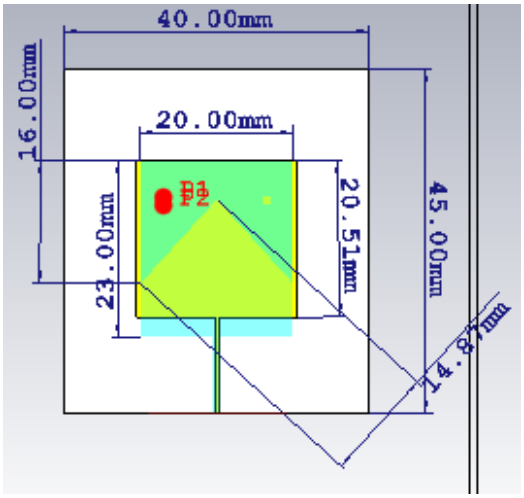

Fig. 4 (b) Proposed shape with dimension

Table 1: Dimension of Antenna

Antenna Parts	Antenna dimension	Dimension Length(L) × Width (W) × height(h)mm^3
Substrate (s)	Substrate (s)	40 × 45 × 0.125
Ground (G1)	Ground (G1)	40 × 12 × 0.0635
Patch (P)	P1[Rectangular (brick B1)]	20 × 20.51 × 0.035
	P2[Bow Tie Patch]	16 × 20.50 × 0.0635
Microstrip feed line (f_l)	$feed\ line\ (f_L)$	12.5 × 1 × 0.0635

In the table 1 shows the all parameter of antenna design specification of proposed antenna. In this antenna substrate dimension are length (L), width (W) and height is $40 \times 45 \times 0.497$. The dimension of ground in which design the dipole which is made by the combination of different shapes which in deeply describe in the next section.

Design of basis Microstrip Patch Antenna

For the design of bow tie antenna first design simple microstrip patch antenna. For design of simple microstrip patch antenna require some mathematical calculation. The square patch is easily designed widely used simple to analyze and easy to manufacture. To design square patch following method are used. In the conventional procedure design of rectangular micro-strip patch antenna, three essential parameters are:

Frequency of operation (f_0): The antenna resonance frequency must be chosen appropriately. Communication systems using the frequency range of 1 to 6 GHz at different wireless frequency range. The selected resonance frequency for proposed design is 1 to 6 GHz.

Di-electric constant of the substrate (εr): The di-electric constant of the substrate material plays an important role in the design of the patch antenna. So there is a compromise between size and performance of the patch antenna. In this thesis, use flexible Rogers RT duriod 5880 substrate with di-electric constant 2.2.

Height of di-electric substrate (*h*): The height of the di-electric substrate must be less. In this thesis substrate height is taken 0.497 mm.

To design a rectangular micro-strip patch antenna according to parameters such as di-electric constant (εr), the resonance frequency (f_o) and the height (h) are taken into consideration for the calculation of the length and width of the room.

IV. SIMULATION AND RESULT

Parametric Study on feed line (f_L) with Ground Width (G_w)

Figure 5 shows the return loss of parametric sturdy of antenna. In this figure analyzed the microstrip feed line in the range on 0.2 to 0.5. In this range the optimum result is obtain at 0.2 mm feed line (f_l). In the below table 2 shows the different outcomes at different frequencies. In the above table clearly see that when the width of feed line deceases the return loss incenses and similar effect on bandwidth also reduces with reduce the bandwidth feed line.

Result Comparison of Proposed Antenna

At the last compare our calculated results with other methods. That is shown in table 2. This table shows the compression on the basic parameters of antenna that is frequency range return losses and number of bands. Our proposed design shows better result as compare to other antenna.

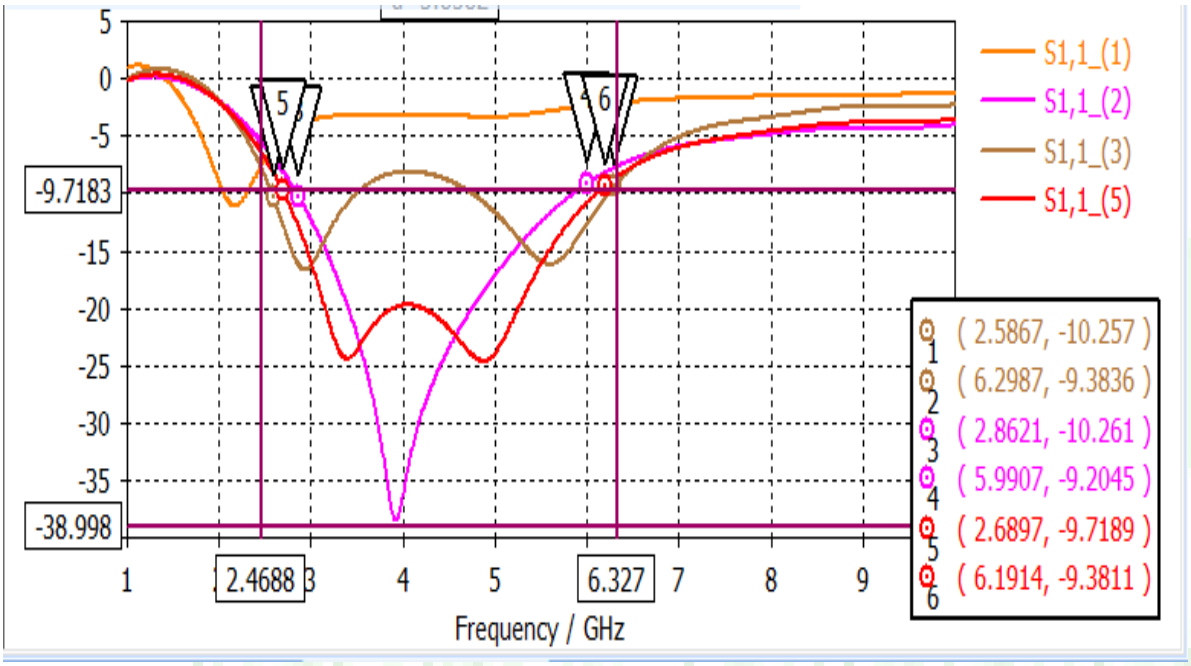

Fig. 5. shows the Return Loss (S-11) of the feed line (f_L) with Ground Width (G_w)

Table 2. Compares ion on the basis on S -11 and number of bands

S. No Ref.	Year	Size of the antenna	Feed Technique	Range	S - Parameter	Flexibility
0	2018	40X45	Microstrip Feed	1 to 6 GHz	**3.004 GHz (69.79%)**	Yes
[1]	2017	80x60	CPW feed	1 to 6 GHz	-35 dB (Wide band bandwidth 1.79 GHz) **57.7%**	Yes
[7]	2011	35X35	Microstrip feed	1 to 6	1.405GHz (46.56%)	Yes

[3]	2014	60X45	Microstrip feed	1 to 6	1.94GHz (32.33 %)	No

The proposed design 3 shows better result as compare to other method. In the above table 2 in terms of gain (G), bandwidth (B.W.), size of antenna and number of bands. In the next chapter discuss the conclusion and future work of proposed method. In the above table 2 compare the proposed work with different previous antenna. Proposed modified flexible bow tie antenna shows better results in terms of Gain (G), return loss (S-11), number of band and bandwidth of the antenna.

V. CONCLUSION

This presented work shows the design of flexible bow tie antenna with rectangular slots. The proposed design shows good result as compared to other previous method's results on the basis of basic antenna parameters such as VSWR, gain, Return Loss and bandwidth. The proposed antenna shows a wide band and cover Wi-Fi ranges whose frequencies is between 1 to 6 GHz. The range of proposed design cover the wireless fidelity and Wi-Max range. Also shows the good result in terms of return loss that is (S-11) -38.442dB as well as VSWR that is 1.08.

REFERENCES

[1] Akuku, Sallam, Mai O., Sara M. Kandil, Vladimir Volski, Guy AE Vandenbosch, and Ezzeldin A. Soliman. "Wideband CPW-fed flexible bow-tie slot antenna for WLAN/WiMax systems." *IEEE Transactions on Antennas and Propagation* 65, no. 8 (2017): 4274-4277.

[2] Jilani, S. F., and A. Alomainy. "An inkjet-printed MMW frequency-reconfigurable antenna on a flexible PET substrate for 5G wireless systems." (2017): 13-3.

[3]

[4] Casula, Giovanni Andrea, Giorgio Montisci, Paolo Maxia, Giuseppe Valente, Alessandro Fanti, and Giuseppe Mazzarella. "A low-cost dual-band CPW-fed printed LPDA for wireless communications." *IEEE Antennas and Wireless Propagation Letters* 15 (2016): 1333-1336.

[5] Kumari, Namrata, and Deepak C. Karia. "Design of Apollonian Gasket Bow Tie antenna for satellite application." In *Global Trends in Signal Processing, Information Computing and Communication (ICGTSPICC), 2016 International Conference on*, pp. 291-297. IEEE, 2016.

[6] Tang, Ming-Chun, Ting Shi, and Richard W. Ziolkowski. "Flexible efficient quasi-Yagi printed uniplanar antenna." *IEEE Transactions on Antennas and Propagation* 63, no. 12 (2015): 5343-5350.

[7] Shao, Shuai, AsiminaKiourti, Robert J. Burkholder, and John L. Volakis. "Broadband textile-based passive UHF RFID tag antenna for elastic material." *IEEE Antennas and Wireless Propagation Letters* 14 (2015): 1385-1388.

[8] Naidu, Praveen Vummadisetty, and Akshay Malhotra. "Design & analysis of miniaturized asymmetric coplanar strip fed antenna for multi-band WLAN/WiMAX applications." *Progress In Electromagnetics Research* 57 (2015): 159-171.

[9] Tsai, Lin-Chuan. "A triple-band bow-tie-shaped CPW-fed slot antenna for WLAN applications." *Progress In Electromagnetics Research* 47 (2014): 167-171.

[10] Naidu, Praveen Vummadisetty, and Raj Kumar. "Design of a compact ACS-fed dual band antenna for Bluetooth/WLAN and Wi-MAX applications." *Progress In Electromagnetics Research*55 (2014): 63-72.

[11] Raad, Haider R., Ayman I. Abbosh, Hussain M. Al-Rizzo, and Daniel G. Rucker. "Flexible and compact AMC based antenna for telemedicine applications." *IEEE Transactions on antennas and propagation* 61, no. 2 (2013): 524-531.

[12] Khaleel, Haider R., Hussain M. Al-Rizzo, and Ayman I. Abbosh. "Design, fabrication, and testing of flexible antennas." In *Advancement in Microstrip Antennas with Recent Applications*. InTech, 2013.

[13] Lin, Chun-Cheng, En-Zo Yu, and Chih-Yu Huang. "Dual-band rhombus slot antenna fed by CPW for WLAN applications." *IEEE Antennas and Wireless Propagation Letters* 11 (2012): 362-364.

[14] Yoon, Joong Han, and Young Chul Lee. "Modified bow-tie slot antenna for the 2.4/5.2/5.8 GHz WLAN bands with a rectangular tuning stub." *Microwave and optical technology letters* 53, no. 1 (2011): 126-130.

[15] Khaleel, Haider R., Hussain M. Al-Rizzo, Daniel G. Rucker, and Yahiea Al-Naiemy. "Flexible printed monopole antennas for WLAN applications", In *Antennas and Propagation (APSURSI), 2011 IEEE International Symposium on*, pp. 1334-1337. IEEE, 2011.

[16] Anagnostou, Dimitris E., Ahmad A. Gheethan, Anthony K. Amert, and Keith W. Whites. "A direct-write printed antenna on paper-based organic substrate for flexible displays and WLAN applications." *Journal of Display Technology* 6, no. 11 (2010): 558-564.

[17] Soliman, E. A., W. De Raedt, and G. A. E. Vandenbosch. "Reconfigurable slot antenna for polarization diversity." *Journal of Electromagnetic Waves and Applications* 23, no. 7 (2009): 905-916.

[18] Chen, Yan-Lin, Cheng-Li Ruan, and Lin Peng. "A novel ultra-wideband bow-tie slot antenna in wireless communication systems." *Progress In Electromagnetics Research* 1 (2008): 101-108.

[19] Wu, Ya-Jie, Bao-Hua Sun, Jian-Feng Li, and Qi-Zhong Liu. "Triple-band omni-directional antenna for WLAN application." *Progress In Electromagnetics Research* 76 (2007): 477-484.

[20] Qu, Shi-Wei, and Cheng-Li Ruan. "Effect of round corners on bowtie antennas." *Progress In Electromagnetics Research* 57 (2006): 179-195.

[21] Salonen, Pekka, Jaehoon Kim, and YahyaRahmat-Samii. "Dual-band E-shaped patch wearable textile antenna." In *Antennas and propagation society international symposium, 2005 IEEE*, vol. 1, pp. 466-469. IEEE, 2005.

