Analysis and Design the Slotted Bowtie Antenna

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Abstract: In this paper we design and analysis the result of bow tie antenna by using slotting in ground plane for ultra wide band applications. The result and the design of the proposed antenna are evaluated for different parameters i.e. return loss, vswr, radiation pattern. From the result of the proposed antenna we get resonating frequencies (3 GHz, 4 GHz, 6 GHz & 9 GHz) which are useful for different mobile communication systems and Wireless applications. Obtained result gives better improvement in the return loss and gain than that of the other existing antenna from the return loss of proposed antenna the resonating frequency is 2-20 GHz.

***Index Terms* – Micro strip patch antenna, insertion loss, multi-band, mobile communication; bow tie antenna**

I. INTRODUCTION

In modern communication systems, light partisan, economical, compact, and easy to take and simple to use strategy are in demand [1]. In this view, the need of such antenna designs has been squeeze significantly by some researchers. To design an efficient antenna, this becomes needed to design it according to the theoretical calculations with correct external shapes and dimensions [2]. A micro strip element was invented and patented by Munson [3]. However, different micro strip structures 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 geometry 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 is then analyzed.

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II. ANTENNA GEOMETRY

The model is designed using commercial finite element method solver for electromagnetic Structures supported HFSS Vs 15 software.3D modelling is done on the substrate. Figure 1 shows the geometries of the designs selected to develop and analyze the planar Waveguide (PW) fed bowtie antennas. A lumped port excitation is used for the PW feed. The dimensions of the proposed antennas are place 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.

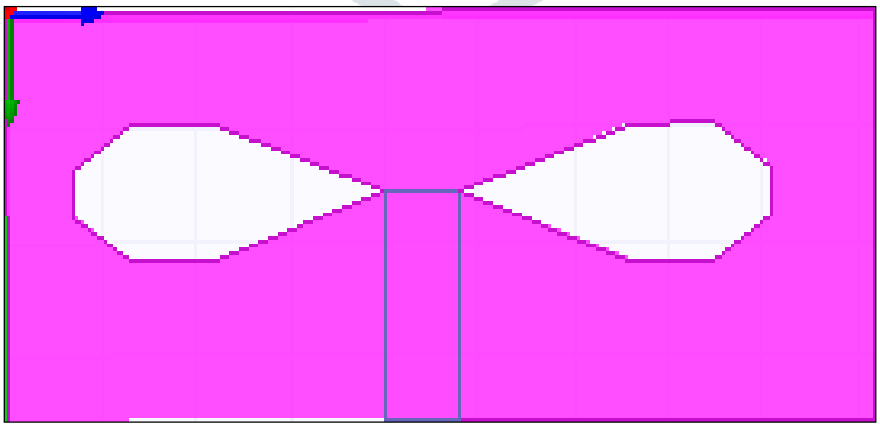


Fig 1. Proposed bow tie antenna

PHYSICAL DIMENSION PARAMETER OF PROPOSED ANTENNA DESIGN

Table I

S. no.	Parameters	Length(mm)	Width(mm)	Height(mm)
1	Ground	18	46	__
2	Substrate	18	46	1.66
3	Patch	18	46	__
4	Feed	10	4	__

PROPOSED BOWTIE ANTENNA:-

The width, W and length, L of the patch are calculated by using the transmission line model. For proper antenna design, some finite ground plane is required 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 times the substrate thickness. Thus the dimension of the design is shown in table 1.

III. RESULTS AND DISCUSSION

1. RETURN LOSS

Return loss is given by

$$\text{ReturnLoss}=-20\log|\rho|$$

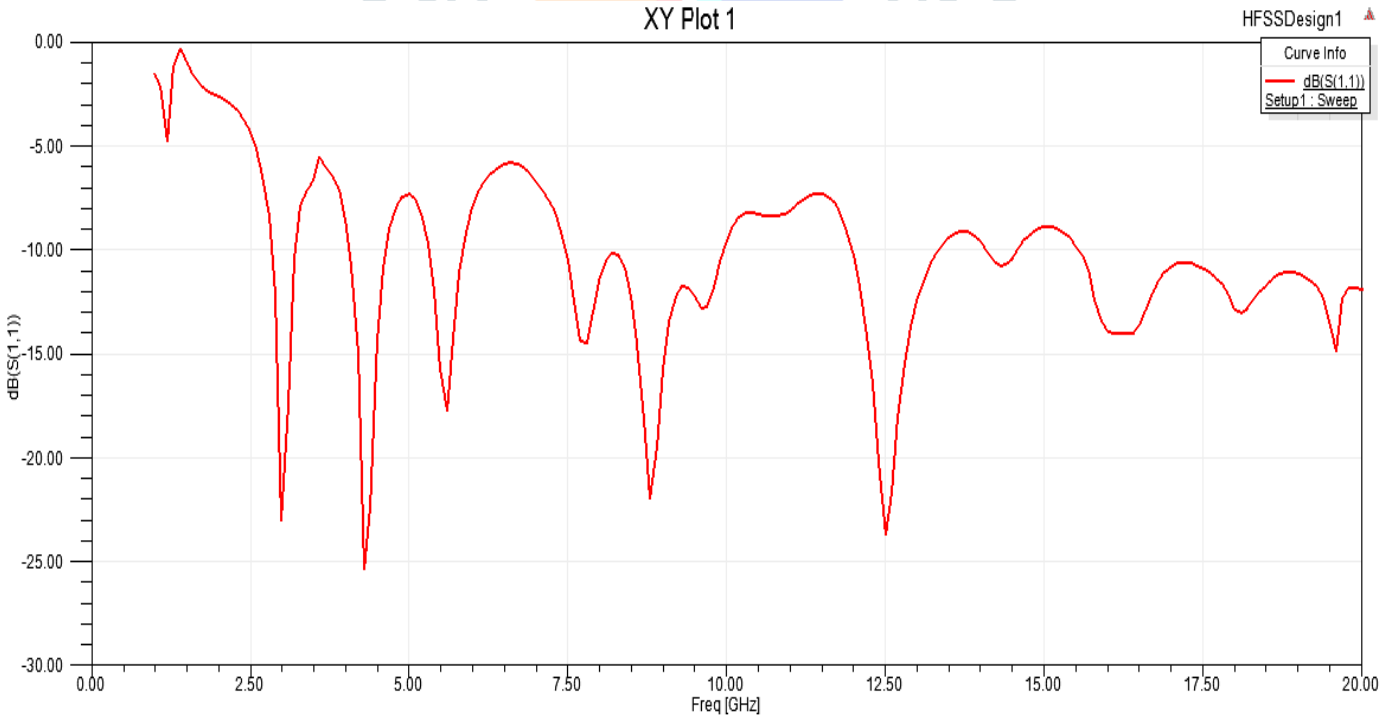
Where,

P= Reflection Coefficient.

By using the above given formula antennas parameters can be calculated [6].

The return loss for the reference and proposed antenna is given in Figure 1.2&1.3

From fig 1.2, we can observe different resonant frequencies like 3 GHz, 4.5GHz, 5.4GHz and 9GHz having return loss less than -10db, because reflections are negligible below -10db return loss [7].



.Fig 1.2 Return loss for reference design

From 2.2 return loss graph the resonating frequencies are 3 GHz, 4.9GHz, 5.4GHz and 8GHz at return loss -23db, -35db, -35db, -10db respectively.

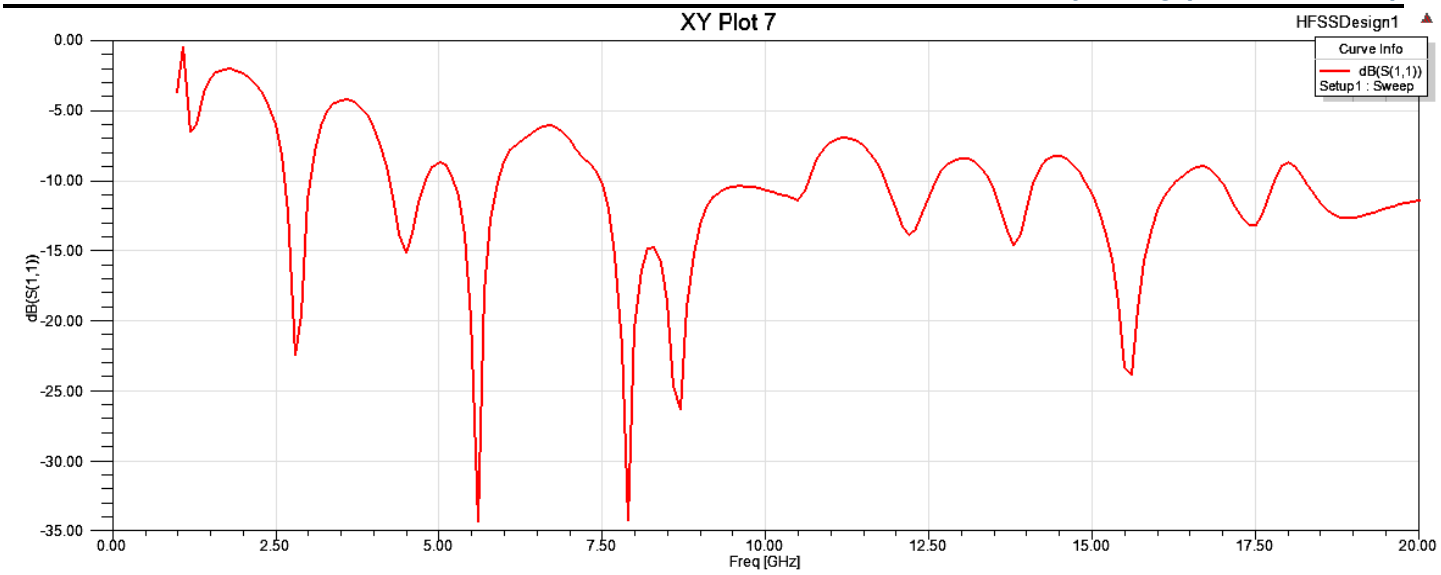


Fig 1.3 Return loss for proposed antenna design

2. VSWR

The return loss for the bow tie antenna is given in Figure 1.4 & 1.5

$$VSWR=\frac{1+|\rho|}{1-|\rho|}$$

Where,

P= Reflection Coefficient.

By using the above given formula antennas parameters can be calculated.

The voltage standing wave ratio tells about the impedance mismatch. If VSWR is increases it indicates an increase in mismatch between the antenna and the transmission line. VSWR with less value means good matching with minimum VSWR is one. It is always desirable for VSWR to be always less than 2. We can see that in the figure 1.4&1.5 all the resonating frequency bands have VSWR below 2db [8, 9].

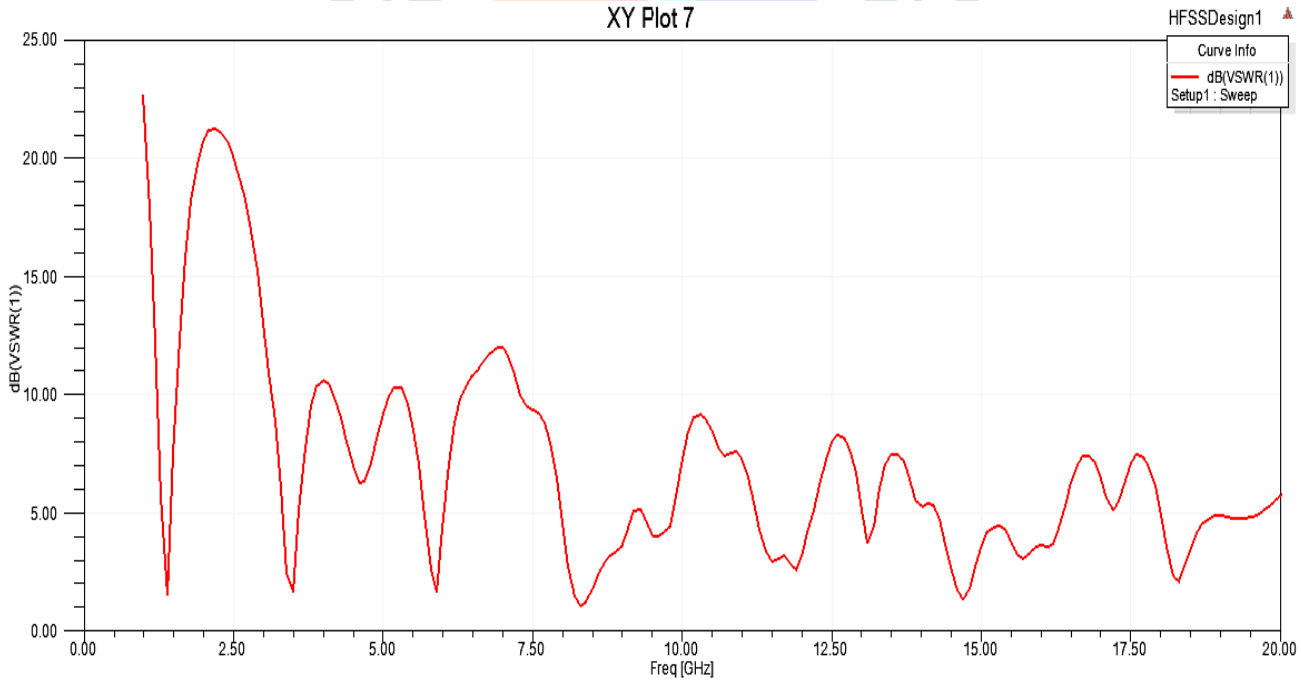


Fig 1.4 VSWR for reference antenna design

The VSWR graph for proposed antenna is given in fig 1.5.

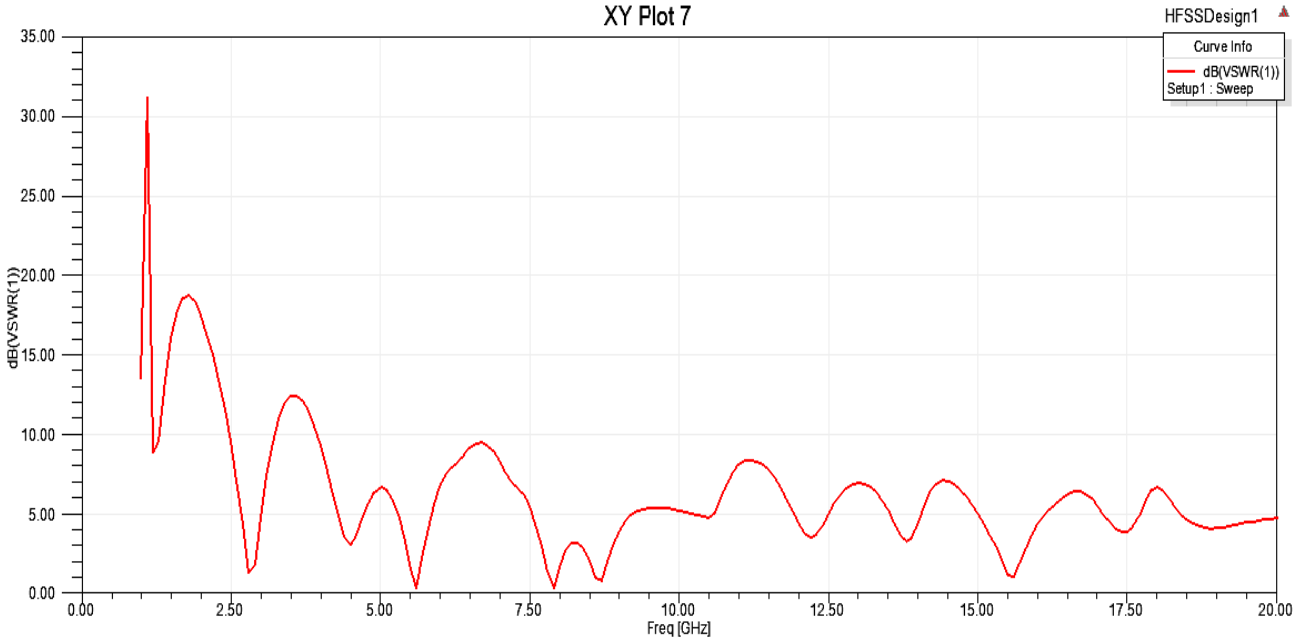


Fig 1.5 VSWR for proposed antenna design

3. RADIATION PATTERN

The radiation patterns of the proposed and reference antenna at the significant frequencies 2.4 GHz are shown in Fig 1.6&1.7. The results illustrate very monopole like radiation patterns with Omni directional radiation.

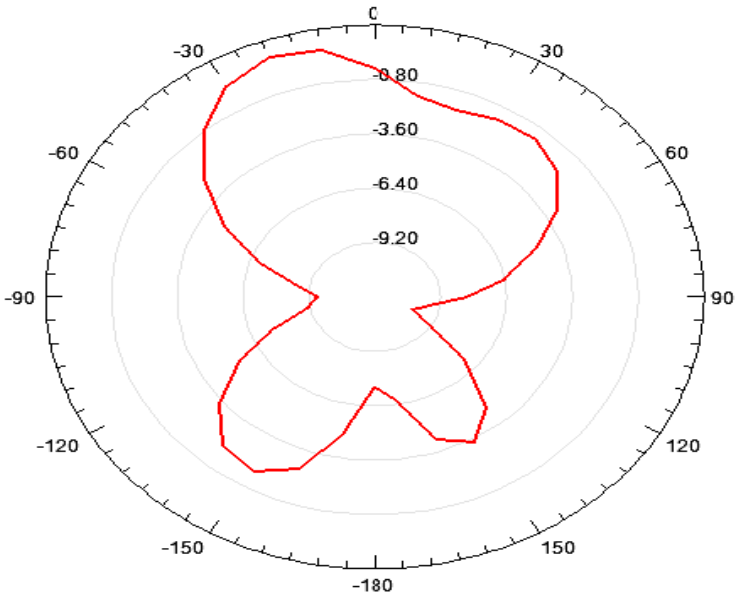


Fig 1.6 radiation pattern for reference antenna design

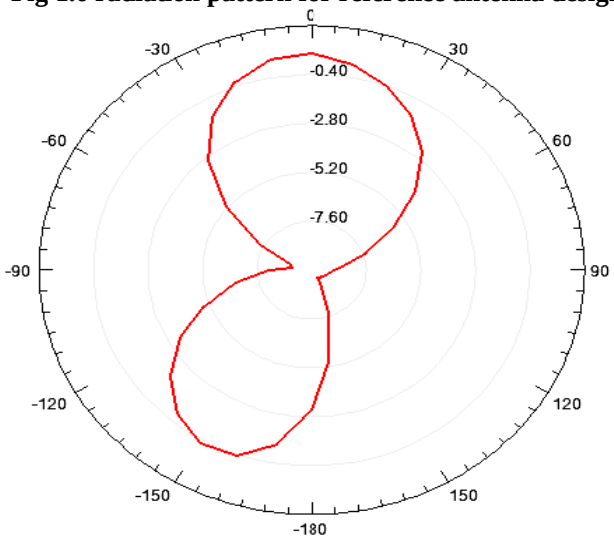


Fig 1.7 radiation pattern for proposed antenna design

From fig 2.5 &2.6 of bow tie antenna improvement in gain is obtained. And by using ground slotting of this antenna gain will also be increased is obtained

Table 2 show the table for measured result:-

Table 2

Sr. No	Parameters	Reference Paper [1]	Proposed Antenna
1.	F_L	3	2.6
2.	F_H	16	16
3.	F_0	3,4,6,9,12.5,14	2.6,4,5.5,12,15.5
4.	% B.W	26.8	34.8
5.	Return Loss	-26.220	-35.4276
6	VSWR	1.03	0.9
7.	Gain	-3.6309	4.8533

IV CONCLUSION

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 34 %. The proposed antenna designs can switch mutli frequencies by simply changing the bowtie shapes and covers lot of challenging 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.

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