Design & Performance Analysis of CPW Fed Square slot Antenna and Horizontal H-Shaped Stub Antenna

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Abstract: **Easily approachable design is proposed in this paper. This design created by using CST Microwave Studio tool version of 2012. In this paper performance has been analyzed between the CPW Fed Square Slot Antenna and Horizontal H shaped stub antenna. Bandwidth and frequency are measured for both antenna to proposed appropriate result and conclusion. The bandwidth of both antenna determined by the 10-db return loss. In this paper results of both antennas are compared.**

Keywords: **antenna bandwidth, coplanar waveguide, stub, broadband operation, horizontal slot antenna, feed line, H-shaped, CST Microwave Studio Tool, return loss**

I. INTRODUCTION

Due to low profile, easiest geometry and minimum cost now these days the Coplanar Waveguide (CPW) antenna is very popular. Its fabrication cost is also very less compare to other antenna. It does also generate circular polarization as well linear polarization due to its very less weight.The main reason to become CPW Fed antenna is so popular because of its wide range of Bandwidth generation and easily integration with circuits. The impedance bandwidth of can achieved 30% by using CPW Fed-square Slot antenna [1].Due to its Circular polarization nature CPW fed antenna is very popular in wireless communication system [2]. As previous considerations various design including wide rectangular slot [3], Circular slot [4], bow-tie slotted antenna [5], hybrid slotted antenna [6], the impedance bandwidths in range of 34% to 50 % has been achieved [7]. Due to various advantages of Coplanar waveguide including wide range of bandwidth, less coupling between two adjust line and easy integration with solid state devices [8].

In this proposed paper the various parameter has been investigated to achieve wide range of bandwidth and comparison has made between the both antenna internal slotted antenna and Horizontal H-shaped stub antenna. This paper also represents that we change the shape and size of antenna its affects the bandwidth and other parameter of antenna.

II. DESIGN DESCRIPTION

The design of proposed CPW fed horizontal H-shaped stub antennaand internal slotted antenna has been represented by figure 1 and figure 2.

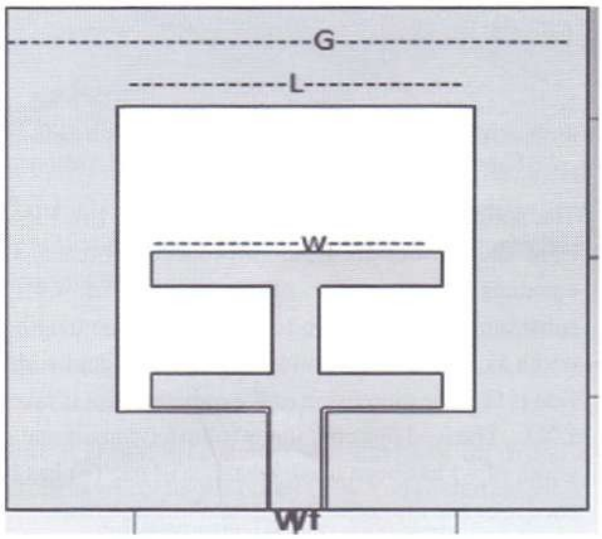

Figure-1: Horizontal H-Shaped Stub antenna

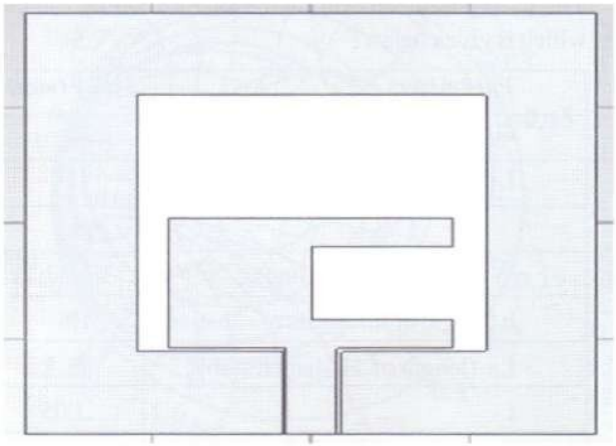

Figure 2: Internal Slotted antenna

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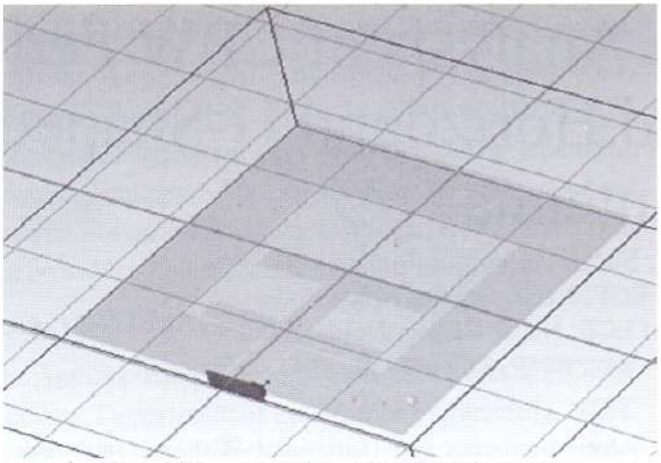

Figure 3(a) - Free View of H-shaped antenna

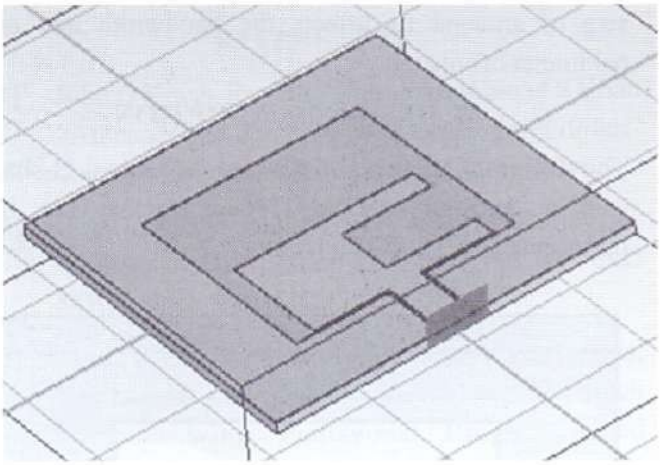

Figure 3(b) - Free View of Internal slotted Antenna

The substrate of thickness having 1.6 mm (h), FR4 has been used to design the both proposed antenna. Both antennas having value of permittivity of 4.4. The substrate plane is chosen to be having same length and width as square representing has its length and width of side is G. The dimension of the radiating slot is taken as L X L. The feed line contains 50 ohm having a metal strip width of wf has been used. Distance of gap (g) has been used to excite the proposed antennaboth antennas.

III. PARAMETER AND THEIR VALUES

The used parameter and their value shown by the table which is given below:

Parameters	*Value (mm)*
G (Length of Ground Plane)	'36
L (Length of slot)	22
S	.5
Wf (Width of feed line)	6.37
h (height or thickness of substrate)	1.6
Ls (length of H-shaped stub)	22.5
t	.1 05
g (distance of gap)	.5

Given table represents the various used parameters and their value.

IV. SIMULATION & RESULTS

After simulation of both antennas some conclusion has been made which also shown by the figure. At the first step the capability of the impedance matching to a 50 ohm CPW feed line for the both antenna slotted antenna and H-shaped stub is considered.

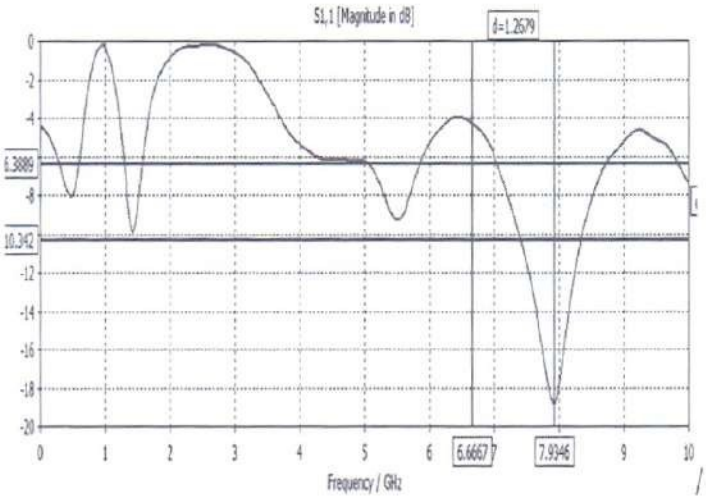

Figure 4 (a) - Simulation graph of H-shaped stub antenna

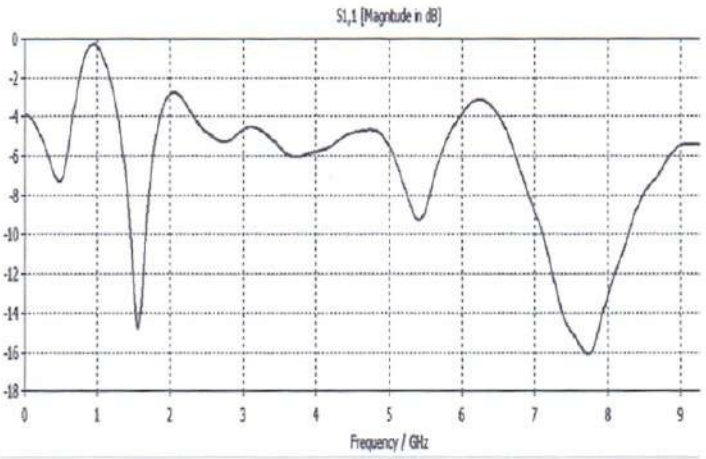

Figure 4 (b) Simulation CPW fed internal Slotted antenna

In above simulation result its show the generation of multiband in case of slotted antenna. As we consider the above simulation result then we can say that slotted antenna creating multiple bands whereas H-shaped horizontal stub antenna only provides single band so in term of band Slotted antenna is more considerable. In terms of bandwidth the slotted antenna provides more bandwidth compare to horizontal slotted antenna. In horizontal H-shaped stub antenna frequency band occurs at 7.93 GHz which is very useful in wireless satellite communication system. In proposed CPW Fed slotted antenna two band occurs, first band at 1.5 GHz and second band occurs at 7.73 GHz and bandwidth of proposed antenna is also greater than H-shaped Horizontal stub antenna. This proposed antenna shows that variations in design also affect the performance of antenna.

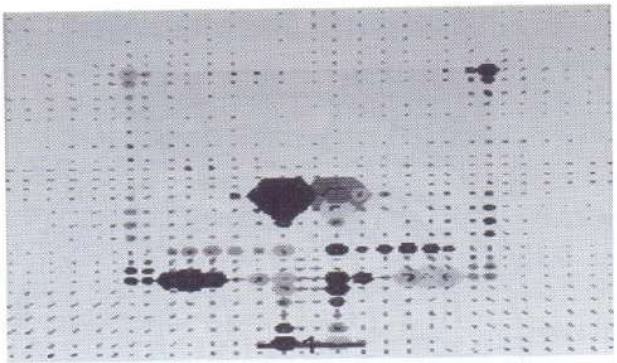

Figure 4(c) Surface Current of Horizontal H-shaped antennas

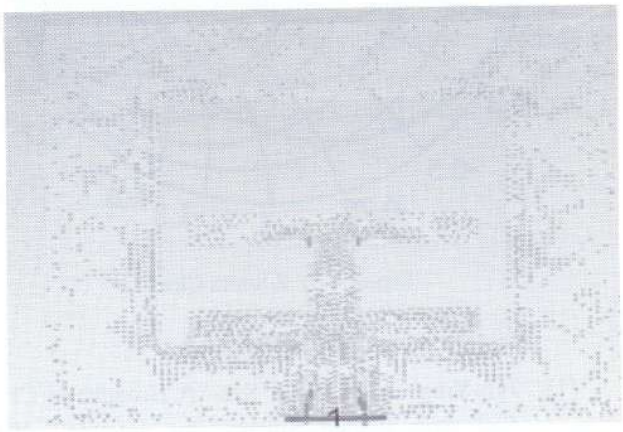

Figure 4(d) Surface Current of Slotted antennas

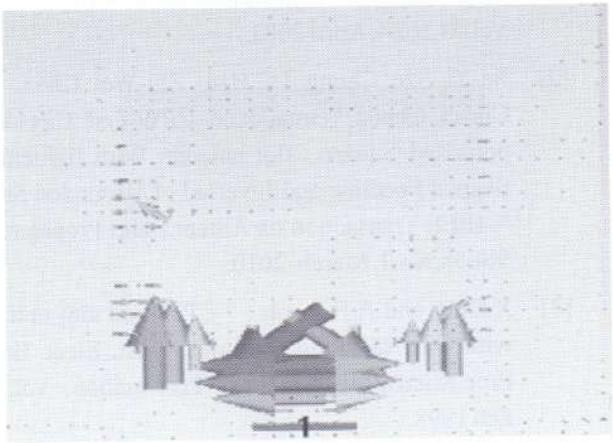

Figure 4 (e) E-Field of H-Shaped Stub

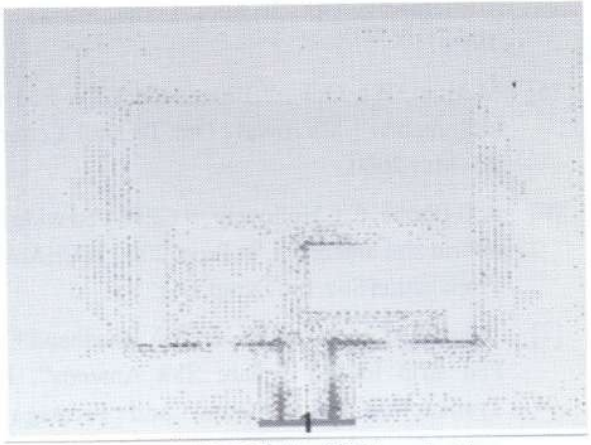

Figure 4(f) H-Field of H-Shaped stub

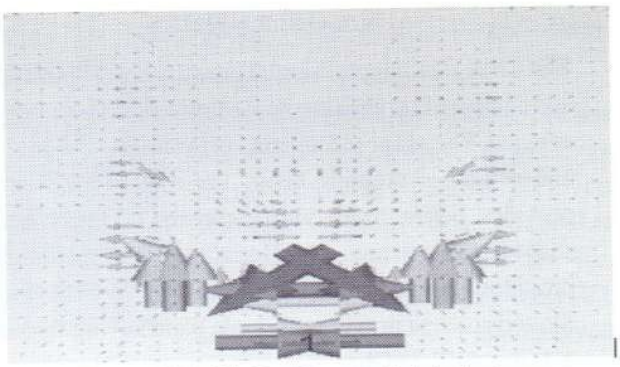

Figure 4(g) E-Field of proposed slotted antenna

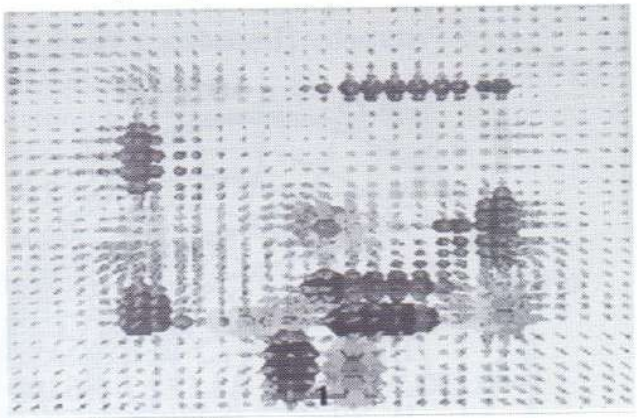

Figure 4(h) H-Field of proposed slotted antenna

The above figures represent the flow of surface current that shows the performance of both antennas. The E-field and H-Field of H-shaped antenna has been shown in given below picture. That represents the working of designed H-shaped antenna.

Figure 4.9 and 4.10 show the smith chart for Y and Z- axis respectively for designed H- shaped stub antenna for above discussed parameters.

Figure 4.11 and 4.12 show the smith chart for Y and Z-axis respectively for proposed CPW Fed slotted antenna.

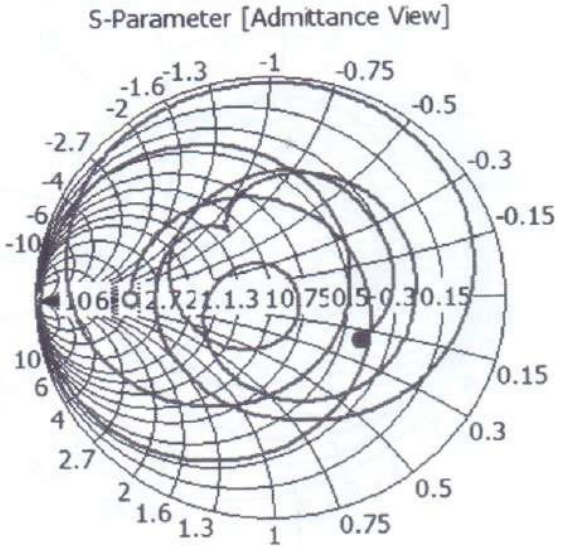

Figure 4 (i) Y Smith Chart

V. CONCLUSIONS

The CPW Fed Internal slotted antenna has been designed and compare the performance to horizontal H-shaped stub antenna. The proposed antenna provides good impedance and generates multiple band. The slotted antenna also provides better bandwidth compared to horizontal H shaped stub antenna. The Horizontal H shaped antenna provides a single band of frequency of 7.93 GHz whereas Slotted antenna provides multiple band having frequency 1.4 Ghz and 7.73 Ghz.

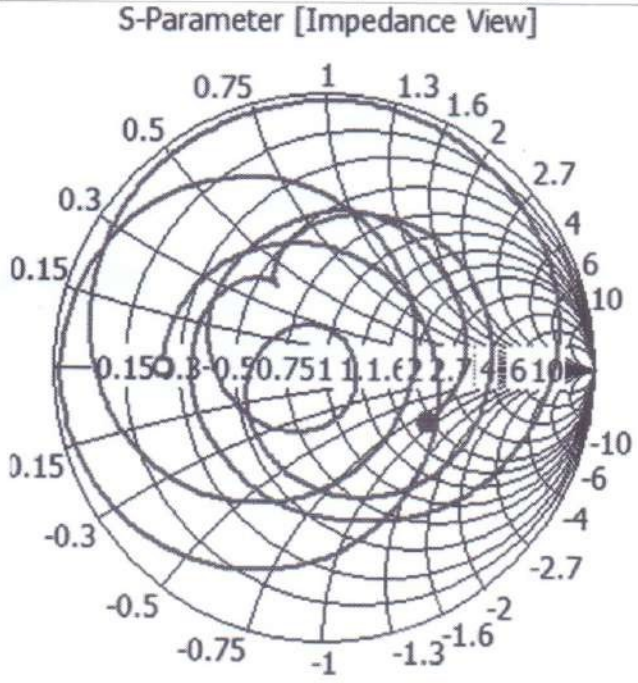

Figure 4(j) Z- Smith Chart

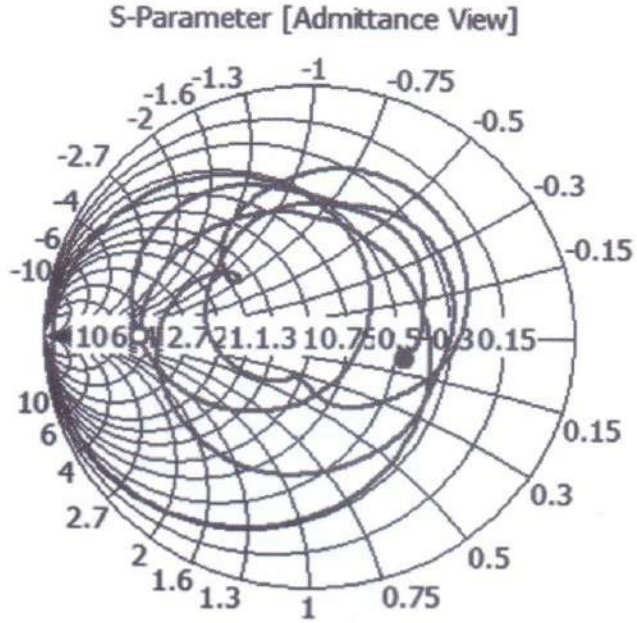

Figure 4 (k) Y Smith Chart

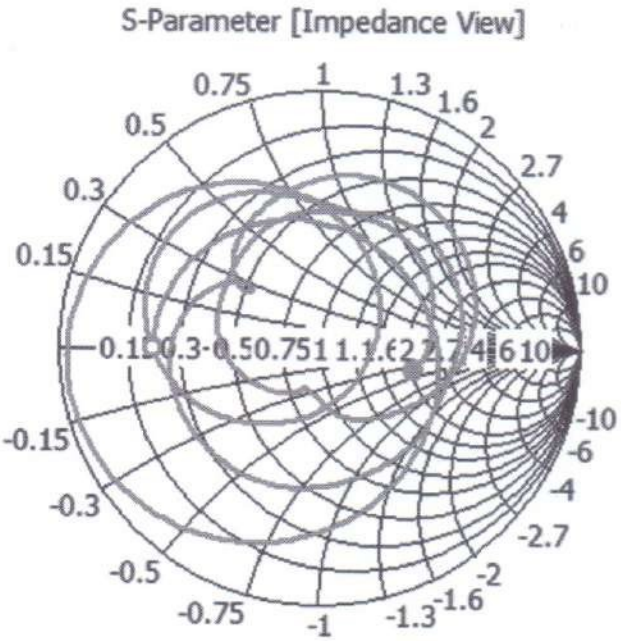

Figure 4 (l) Z Smith Chart

REFERENCES

[1] Jyh-Ying Chiou,Jia-Yi Sze "A Broadband CPW-Fed strip loaded Square slot antenna", IEEE Transaction on Antenna and Propagation, Vol.51,No.4, April 2003.

[2] Jia-Yi Sze Chung I.G.Hsu, Zhi-Wei Chen, Chi Chaan Chang "Broadband CPW-Fed Circularly polarized Square slot antenna With lightening-Shaped Feedline and Inverted –L grounded Strips ", IEEE Transaction on Antenna and Propagation, Vol.58,No.3, March 2010.

[3] X.Ding and A.F Jacob , " CPW-Fed slot antenna with wide radiating apertures," Inst. Elect. Engg. Proc.Microwave Antennas Propagation, Vol.145 Feb 1998.

[4] E.A Soliman, S. Berbles, "CPW-Fed Cusp antenna " Microwave Opt. Technol. Letter, Vol 22 , Aug 1999.

[5] M.Miao, B.L Ooi , " Broadband CPW-Fed wide slot antenna " Microwave Opt. Technol. Letter, Vol 22 , May 2000.

[6] A.U Bhobe, C.L Holloway , " CPW-Fed wide band hybrid slot antenna ", in Proc. 2000 IEEEAntenna Propagation Soc. Int. Symp. Dig.

[7] Jyh-Ying Chiou ,Jia Yi sez, " A Boadband CPW-Fed strip loaded Square Slot Antenna", IEEE Transaction on Antenna and Propagation, Vol.51,No.4, April 2003.

[8] NederFelegari, J.Nourina, C.Ghobadi " Boadband CPW-Fed Circularly Polarized Square Slot antenna with Three Inverted L- Shape Grounded Strips ", IEEE Antenna and Wireless Propagation, Vol.10, 2011.

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