Improved Bandwidth of a Plus Shape Micro Strip Patch Antenna

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ABSTRACT— This is time to achieve a high speed communication between transmitter and receiver. and microstrip patch antenna is such type of a antenna which can be used for high frequency and high speed for data transfer. But for this communication, bandwidth play a special role. So in this paper we are improving the bandwidth of a microstrip patch antenna for the various applications.

Keywords — plus Shape, Micro strip Patch Antenna, Return Loss, Bandwidth

I. INTRODUCTION

Deschamps first proposed the concept of the MSA in 1953[1].however the practical antenna were developed by Munson [2,3] and Howell in 1970. The main advantage of MSA is its light weight small volume and easy to fabrication using printed circuit technology. With increasing requirement for personal and mobile communications the demand for smaller an wide bandwidth antenna is also increases.
Recently, many novel planar antenna designs to satisfy the requirements of mobile cellular communication systems have been developed
The MSA has proved to be an excellent radiator for many applications because of its several advantages. Such as Dual and triple frequency operations, allow both linear polarization and CP and etc.
But MSA also have some disadvantages as Narrow Bandwidth, Low Gain and low Power handling capability.MSA have narrow BW , typically 1-5%,which is the major limiting factor for the widespread application of these antennas. Increasing the bandwidth of MSA has been the major thrust of research in this field and broad Bandwidth up to 70% has been achieved [4,5]
So it is a great challenge to increasing the bandwidth of MSA. And here in this paper we are taking a plus shape antenna. And here we are achieved the 55 % increased bandwidth and also we simulate the return loss, radiation pattern, axial ratio, directivity and efficiency. Planar antennas are also very attractive for applications in communication devices for global poisoning system, and wireless local area network (WLAN) systems
In this paper, a broad-band Plus-shaped microstrip antenna for wireless communications is designed. Many parametric studies has been carried out to understand the effects of various dimensional parameters and to optimize the performance of the final design.

II ANTENNA MODEL

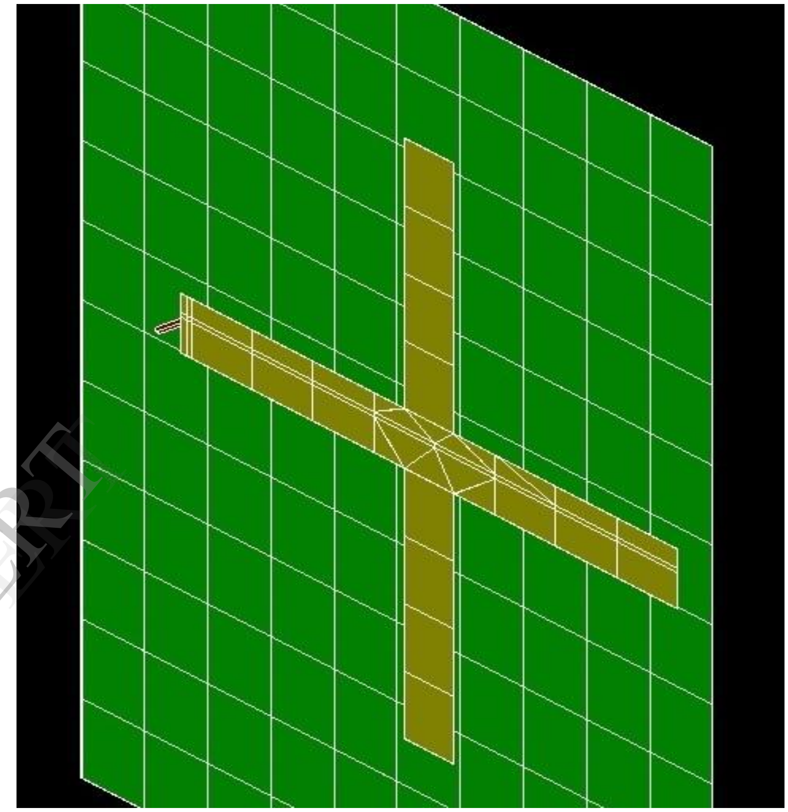

Figure 1: Design of Proposed Antenna

III. ANTENNA DESIGN CONSIDERATIONS:

The proposed structure of the antenna is printed on an epoxy substrate with dielectric constant of 4.3 and loss tangent of .02 .The operation is done at 3Ghz frequency and height of a substrate is 1.6mm. For the simulation we are used the IE3D v 9.0 software.
(1) The width of the rectangular MSA is given by

$$W = \frac{c}{2f_r\sqrt{\frac{2}{\epsilon_r+1}}}$$

(2) Effective dielectric constant is given as

$$\epsilon_{reff} = \frac{\epsilon_r+1}{2} + \frac{\epsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-\frac{1}{2}}$$

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(3)The length extension can be find by

$$\Delta L = 0.412h\frac{(\epsilon_r + 0.3)(\frac{W}{h} + 0.264)}{(\epsilon_r - 0.3)\left(\frac{W}{h} + 0.8\right)}$$

(4)The actual length is given by

$$L = \frac{c}{2f_r\sqrt{\epsilon_{reff}}} - 2\Delta L$$

(5)Width of the ground plane can find out by

$$W_g = 6h + W$$

(6) And the length of the ground plane find by equation

$$L_g = 6h + l$$

Where
C = Velocity of Light
ε_e = Dielectric constant of a substrate
f_r = Antenna frequency

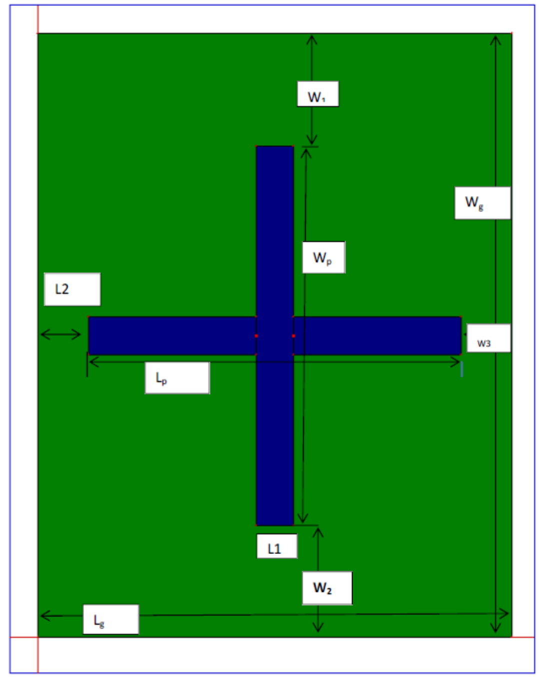

Figure 2: Dimensions Proposed Antenna

A. **Table 1: Design Parameters Of Proposed Antenna**	
B. **Antenna Parameters**	*C.* **Dimension in mm**
D. h	*E.* 1.6
F. W_g	*G.* 47.76
H. L_g	*I.* 38.16
J. W_p	*K.* 30
L. L_p	*M.* 30
N. W_1	*O.* 8.88
P. L_1	*Q.* 5
R. W_2	*S.* 8.88
T. L_2	*U.* 4.08

IV. RESULT :

The structure is studied and simulated over IE3D simulation software version 9.0, A Mom based simulation Software.
It is a measure of the reflected energy from a transmitted signal which is commonly expressed in positive dB. The larger the value the lesser is the energy that is reflected.
The designed antenna is simulated using IE3D software. The results obtained are mentioned below.
A return loss of -22 dB at 2.7 GHz.

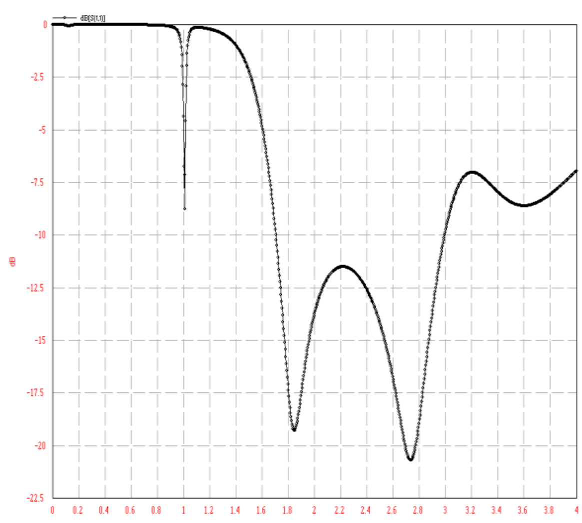

Figure 3: Return loss

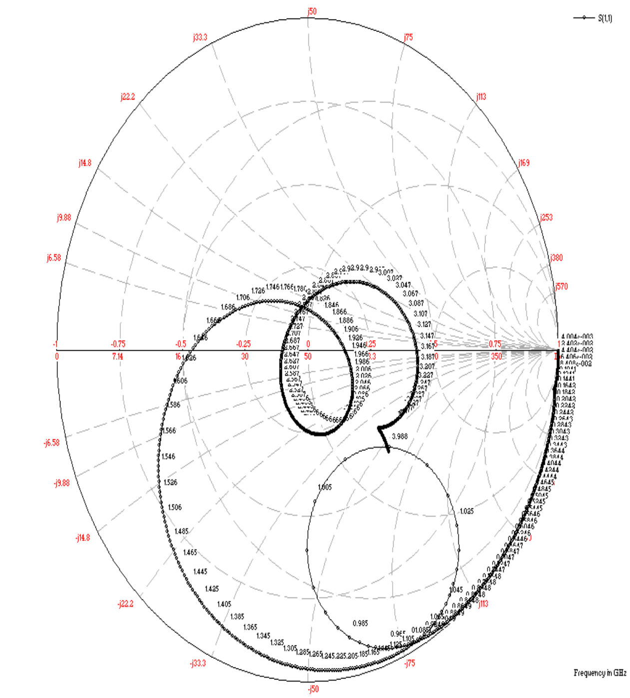

Figure 4: Smith chart of s parameters

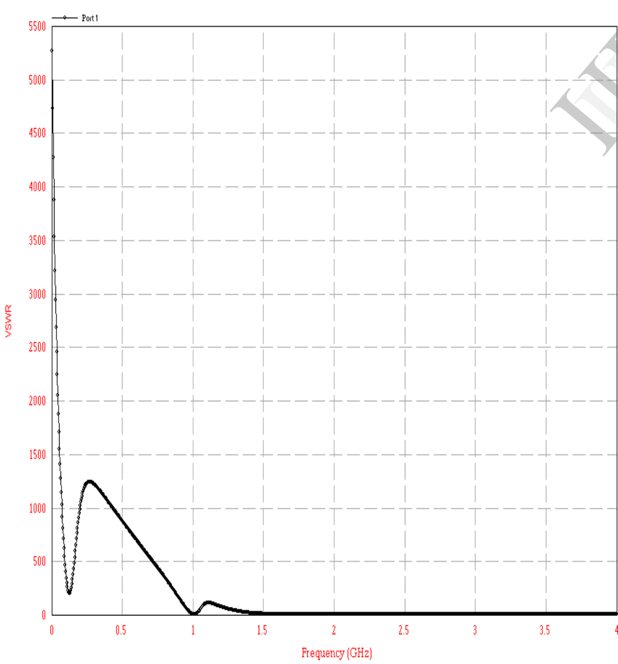

Figure 5: VSWR Vs Frequency

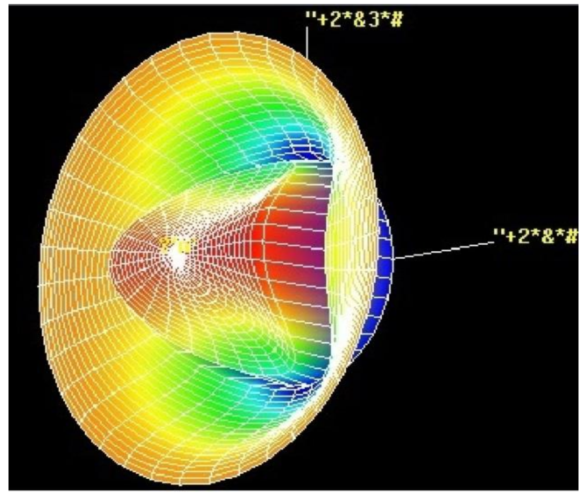

Figure 6: Radiation pattern

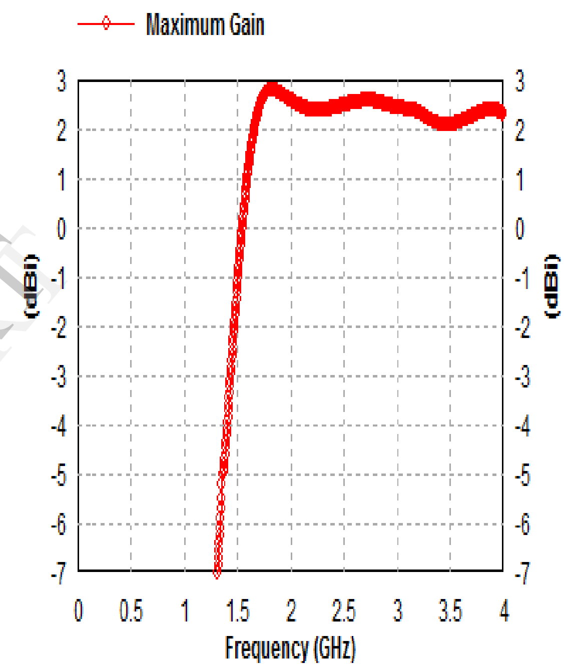

Figure 7: Gain Vs Frequency

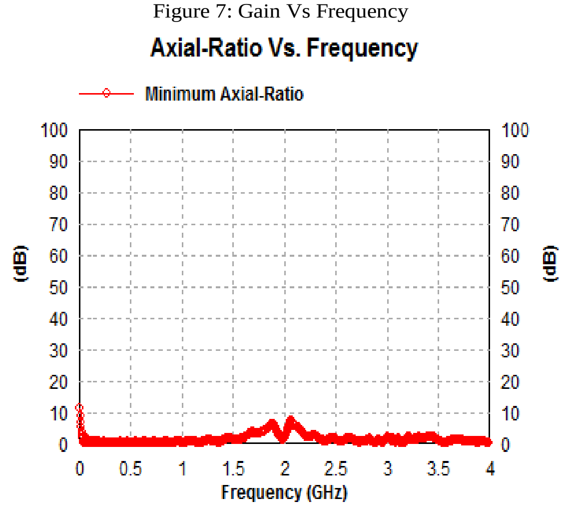

Figure 8: Axial Ratio Vs Frequency

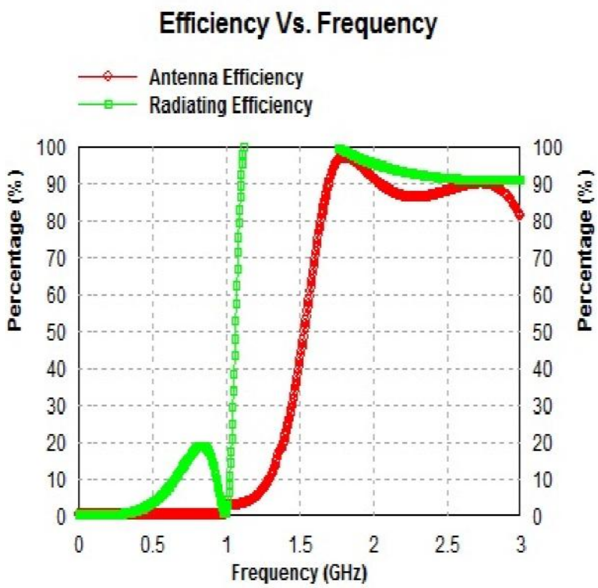

Figure 9: Efficiency Vs Frequency

The simulated return loss for proposed antenna is presented in figure 3.the antenna can be operated from 1.7 GHz corresponding to 3.0 GHz and the maximum return loss is obtained at frequency 2.7 GHz.

The practical impedance bandwidth of this proposed plus shape antenna is calculated using Equation

Bandwidth (%) = $\mathbf{[f_H - f_L / f_c]}$ x100%

Where f_H and f_L are the higher and lower cut off frequency of the band resepctivily.From the formula we are calculated bandwidth of 55% at 3 GHz for VSWR<2

Figure 4 display smith chart showing good input impedance matching behaviour with the presence of loop at the centre

Figure 5 shows the measured Voltage standing wave ratio characteristics and is found to be less than 2 at independent resonant frequencies validating that lower reflection loss is obtained for the proposed antenna.

V. CONCLUSION

From the measurement results, it is clear that the proposed antenna exhibited a compactness of 55 % with omnidirectional radiation characteristics. the gain of the antenna is low, this is attributed to the loss tangent of the epoxy substrate material. Hence, the proposed patch antenna is a low cost, moderate gain antenna solution for various S-band wireless applications.

VI. FUTURE SCOPE

The designed antenna structure provides a good amount of gain and bandwidth to that of conventional antenna designs. Further enhancement of gain can be achieved by adding more air gaps, changing the feed methods and the location of the feed points. The designed antenna can also provide the dual bandwidth at another feed point.

VII. REFERENCES

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