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A prototype model to Improve Bandwidth of S shaped Microstrip patch Antenna

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Abstract— **Microstrip patch antenna is widely used in wireless communication system. Patch antenna has number of advantages over other antenna. It is low volume, thin profile configuration, light weight and easy to integrate with accompanying electronics which can made conformal. But, Microstrip patch antenna has several limitations like narrow bandwidth and associated tolerance problem, lower gain and etc. Patch antenna can be designed on simulation software like HFSS. This paper present Design and simulation of S shaped microstrip patch antenna and presented results like; Bandwidth, Gain, Return loss etc.**

Keywords*-S shaped; microstrip patch antenna****; a****nsoft HFSS; Band width; Gain.*

I. INTRODUCTION

A microstrip antenna is used due to many advantages like, small in size, low cost and an ease of fabrication, low weight but main disadvantage of microstrip patch antenna is its low bandwidth. To overcome this limitation of microstrip patch antenna different bandwidth enhancement technique are adopted. In this S shaped patch antenna is used for enhancement of bandwidth.

II. MICROSTRIP PATCH ANTENNA

Microstrip patch antenna in simplest form consists of a radiating patch on one side of a dielectric substrate and ground plane on the other side [2]. The patch is made of copper or gold and can take any possible shape. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. The dimension of patch antenna will determine its performance and application.

Microstrip patch antenna radiate because of fringing field between the both the patch and ground plane. To enhance the fringing field from the patch, which account for the radiation, the width w of the patch is increased. The fringing fields are also enhanced by decreasing the ε_r or by increasing the substrate thickness h.

III. DESIGN PROCEDURE

The below equation are used for finding out the length L and width w of the patch antenna with the help of parameters like height of substrate h, the dielectric constant ε_r and resonant frequency f_r [9].

STEP 1: Width of microstrip patch can be calculated below equation as:

$$w = \frac{c}{2f0\sqrt{\frac{\varepsilon r+1}{2}}} \text{ ----------(1)}$$

STEP 2: Equation of effective dielectric constant as:

$$\varepsilon reff = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}\left[1 + 12\frac{h}{w}\right]^{1/2} \text{ -----(2)}$$

STEP 3: Equation effective length as:

$$Leff = \frac{c}{2f0\sqrt{\varepsilon reff}} \text{ ----------(3)}$$

STEP 4: Equation of the length extension as:

$$\Delta L = 0.412h \frac{(\varepsilon reff+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon reff-0.258)\left(\frac{W}{h}+0.8\right)} \text{----------(4)}$$

STEP 5: Equation of actual length of patch as:

$$L = Leff - 2\Delta L \text{----------(5)}$$

IV. ANTENNA CONFIGURATION

The Geometry proposed S shaped microstrip patch antenna presented work in fig 1. [10]

Design Specification:

Patch material	Copper
Substrate material	Roger RT duroid 5880
S0ubstrate height	12mm
Substrate dimension s	100mm×90mm
Feed point	(22,-17.5,0)

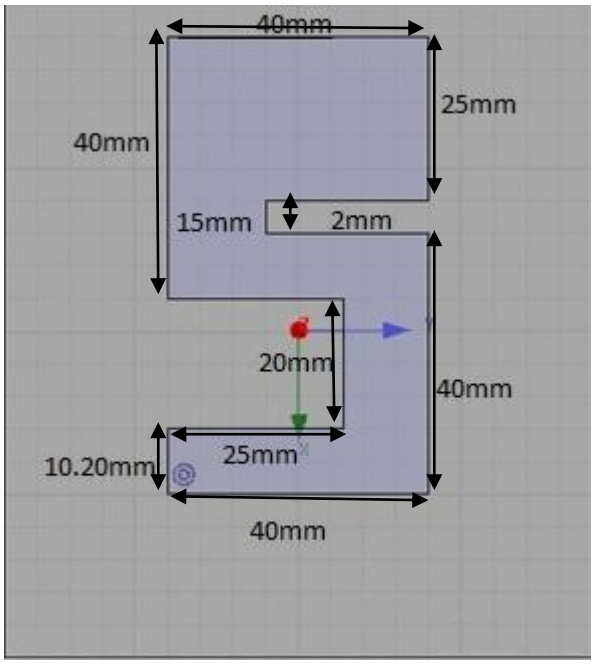


Fig.1 The Geometry of S shaped model (top view)

Fig.1 shows the dimension of the S shaped microstrip patch antenna.

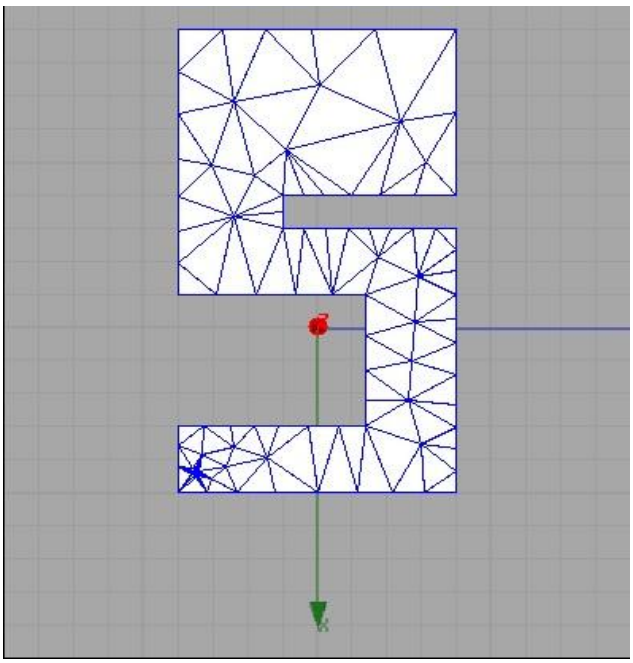


Fig.2 Mesh plot of S shaped model

Fig 2. Shows tetrahedral meshing on S shaped patch antenna.

V. RESULT AND DISCUSSION

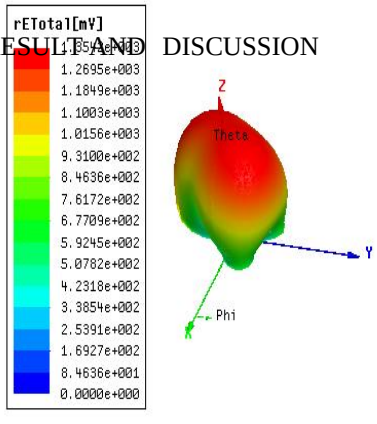


Fig.3 Radiation pattern 3Dpolar plot S shaped microstrip patch antenna

Above Fig.3 shows the radiation pattern of 3D polar plot S shaped of proposed geometry.

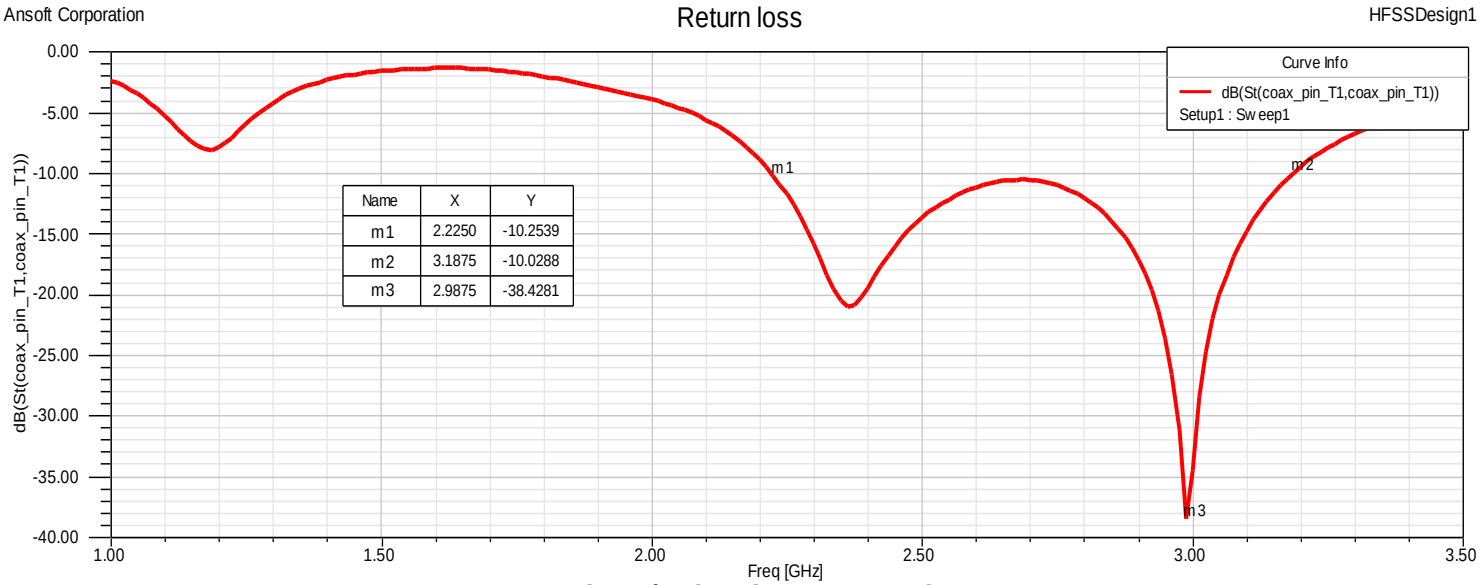


Fig.4 Return loss of S shaped microstrip patch antenna

Above fig.4 shows that return loss of the antenna. It is shows that the return loss is -38.4281 at 2.9875 GHz frequency. With the help of S shaped geometry 990 Mhz of bandwidth has been achieved.

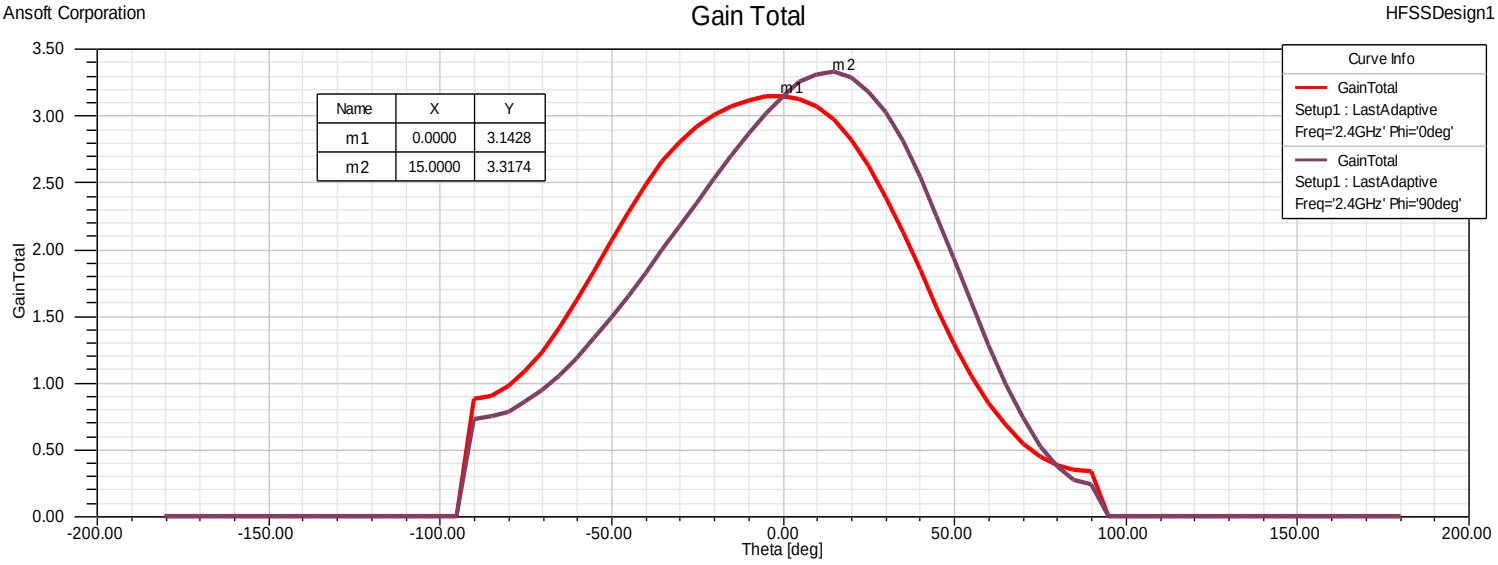


Fig.5 Total Gain of S shaped microstrip patch antenna

The Graph Represented total Gain, it depict that the maximum Gain is obtained 3.1428db at 0.000 Theta.

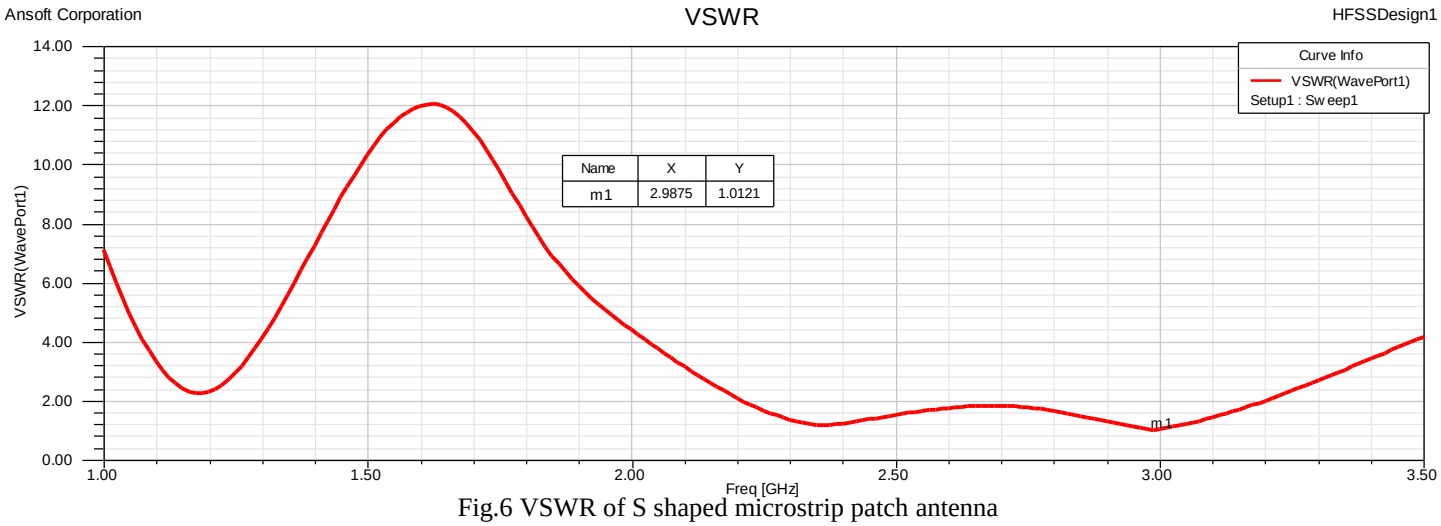
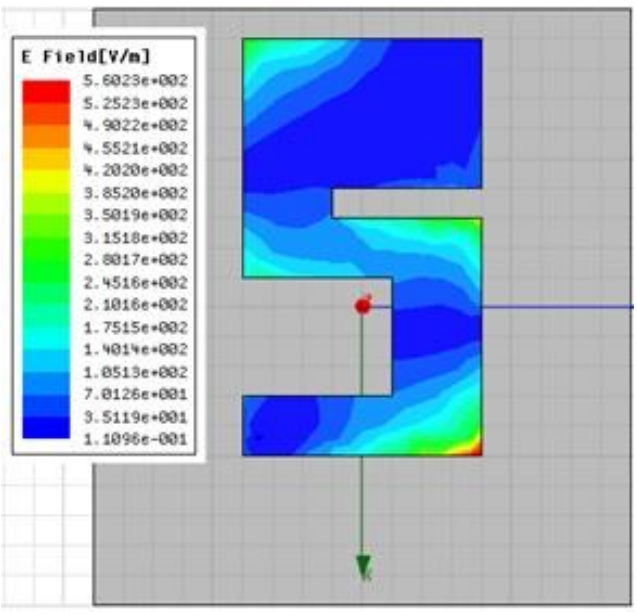


Fig.6 VSWR of S shaped microstrip patch antenna

The VSWR of the design shows that frequency band under observation. The value of observation is 1.0350db at 2.9875 GHz frequency.



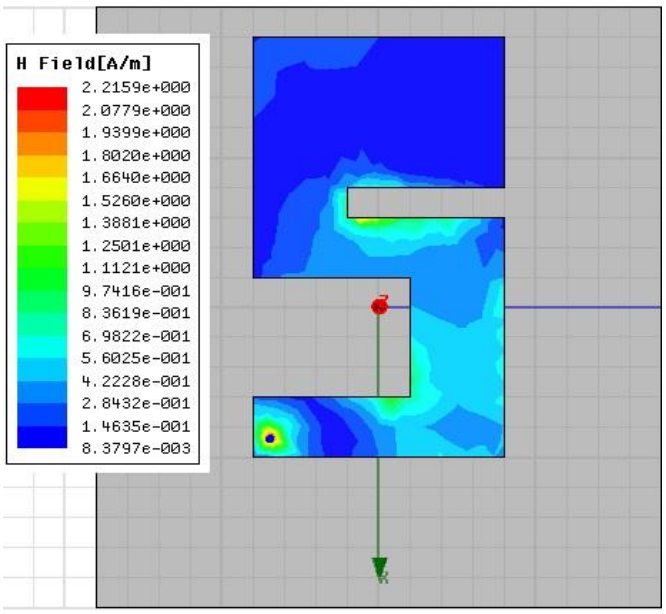


Fig.7 E field of S shaped microstrip patch antenna

Fig.8 H field of S shaped microstrip patch antenna

The distribution of electric field and magnetic field has been plotted on proposed structure.

VI. COMPARISION PROPOSED RESULT ANALYSIS WITH EXISTING RESULT

Parameter	Proposed result	Existing result 1 [2]	Existing result 2 [6]	Existing result 3 [5]
Frequency (Ghz)	2.9875	2.4800	2.400	3.0760
Return loss (db)	-38.8241	-29.5922	-23.33	-22.1519
Bandwidth (Mhz)	990 Mhz	400 Mhz	200 Mhz	12 Mhz
VSWR (db)	1.0121	1.0300	1.1500	1.1506

Above table shows the comparison of the existing result with proposed result and conclude that the parameter of the S shaped antenna like, returns loss, bandwidth and VSWR are improved compared to existing result.

VII. CONCLUSION

In this paper, S shaped microstrip antenna has been design, simulate, optimize and analyzed using ANSOFT HFSS software. The performance of the design antenna was analyzed and compare with existing results the Optimized S shaped result compare to the existing result and Bandwidth of antenna improvement is good compare to other existing result. From the comparison table it is evidenced that result of proposed structure better than existing model.

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