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# BANDWIDTH IMPROVEMENT OF A LEFT ARM SHORTER U-SLOT MICRO STRIP ANTENNA

Lakhan Singh[1] , Rajesh Kumar Verma[2] , D.C. Dhubkarya[3]

*[1,2]Deptt. of Electronics & Comm. Engg. , IET, Bundelkhand University, Jhansi (U.P.)*

*[3]Deptt. of Electronics & Comm. Engg. , B.I.E.T., Jhansi (U.P.)*

***ABSTRACT*--This paper presents design and comparison of two left arm shorter U slot microstrip antennas of different dimensions fed by a coaxial probe. A coaxial feed microstrip antenna is proposed for linear polarization. In this paper, left arm shorter U slot microstrip antenna with 2 mm slot gives a bandwidth of 13%. If the slot width is increased to 3 mm, the bandwidth of 16.5% can be obtained. All the simulations are carried out using Zeland IE3D software.**

***Keywords*--Left arm shorter U slot MSA, Micro strip, patch antenna, VSWR, IE3D.**

## I. INTRODUCTION

A MSA in its simplest form consists of a radiating patch on one side of a dielectric substrate and a ground plane on the other side. Most commonly rectangular shape is used, however, other shapes, such as the corner truncated square, circular, triangular, semicircular, and annular ring shapes are also used. Radiation from MSA can occur from the fringing fields between the periphery of the patch and the ground plane. To enhance the fringing fields from the patch, which accounts for the radiation, the width W of the patch is increased. The fringing fields are also enhanced by decreasing the $\varepsilon_r$ or by increasing the substrate thickness h. Due to its advantages such as low weight, low profile, low fabrication cost and capability to integrate with microwave integrated circuits technology, the microstrip patch antenna is very well suited for applications such as wireless communication systems, cellular phones, pagers, radar systems and satellite communication system [1, 2].

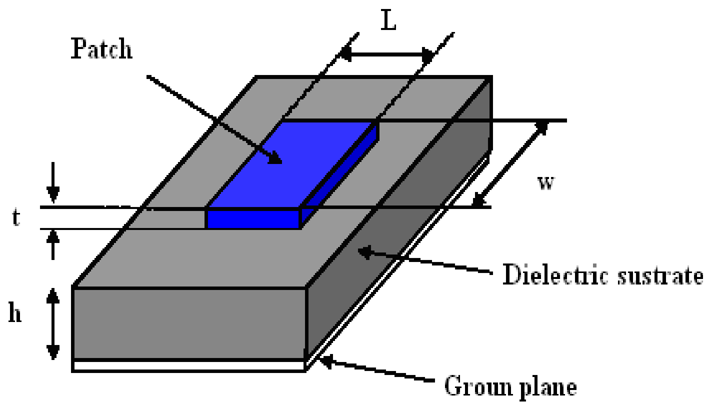



Fig. 1. Rectangular Micro strip Patch Antenna

The width and length of the patch are given by [3, 4]:--

$$W = \frac{C}{2f[\frac{\varepsilon_r+1}{2}]^{1/2}} \quad (1)$$

$$L = L_{eff} - 2\Delta L \quad (2)$$

$$\Delta L = \frac{-}{-} \quad (3)$$

$$\varepsilon_{eff} = (\varepsilon_r+1)/2+[(\varepsilon_r-1)/2](1+12h/W)^{-1/2} \quad (4)$$

$$f = \frac{C}{2\sqrt{\varepsilon_{eff}}\,(L_{eff})} \quad (5)$$

Where,

C = velocity of light,

$\varepsilon_r$ = dielectric constant of substrate,

f = operating frequency

$\varepsilon_{eff}$ = effective dielectric constant,

$L_{eff}$ = effective length,

$\Delta L$ = edge extension

## II. Antenna Geometry & Designing parameters

For designing the proposed antennas the following parameters are used:--

| | |
|---|---|
| Design frequency | = 2 GHz |
| Dielectric constant | = 4.4 |
| Loss tangent | = 0.2 |
| Thickness of substrate | = 1.6 mm |
| Length of the patch | = 36 mm |
| Width of the patch | = 46 mm |
| Location of feed point | = (15,15) |
| Slot width of MSA geometry 1 | = 2 mm |
| Slot width of MSA geometry 2 | = 3 mm |

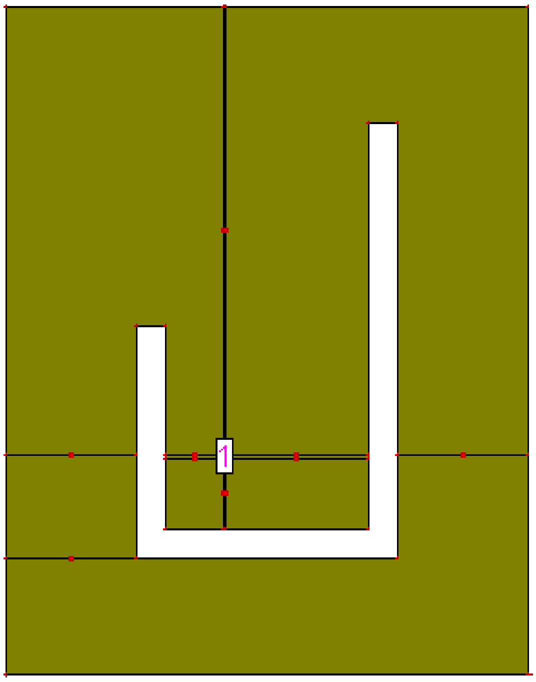



Fig. 2. Geometry of left arm shorter U-slot MSA 1

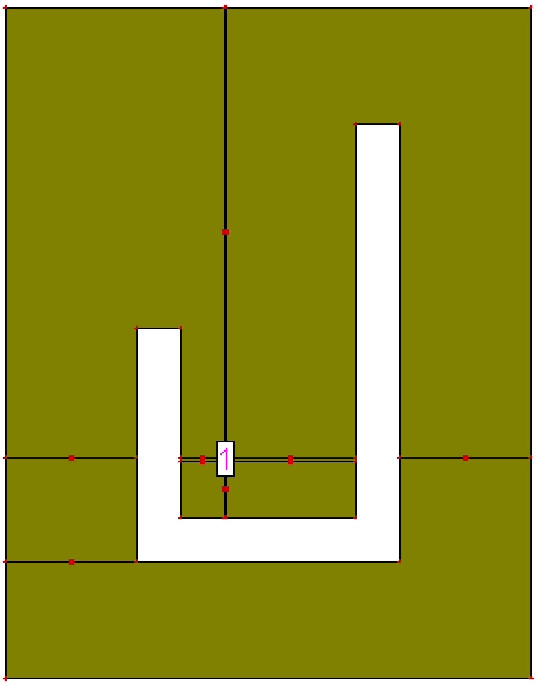



Fig. 3. Geometry of left arm shorter U-slot MSA 2

## III. RESULTS

After designing and simulation of left arm shorter U slot MSA with 2 mm slot , the return loss obtained is -21 db with bandwidth 13% whereas left arm shorter U slot MSA with 3 mm slot gives a return loss of -32 db with bandwidth 16.5% at the same designing parameters. The resulting data are presented in following figures:--

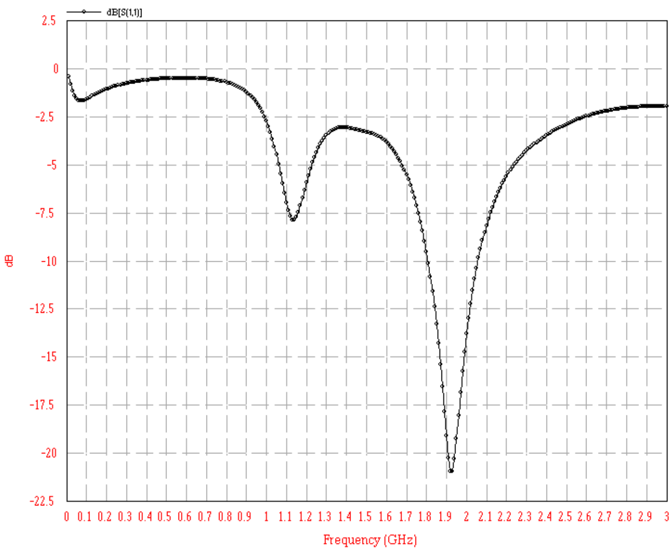



Fig. 4. Return loss Vs frequency plot of left arm shorter U-slot MSA 1

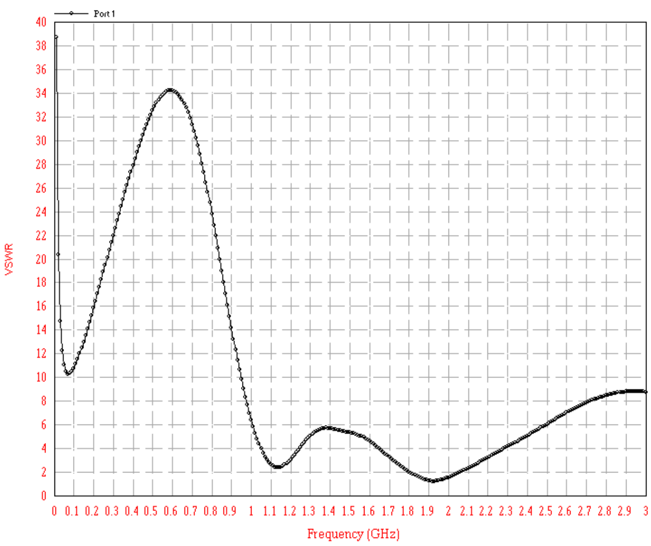



Fig. 5. VSWR Vs frequency plot of left arm shorter U-slot MSA 1

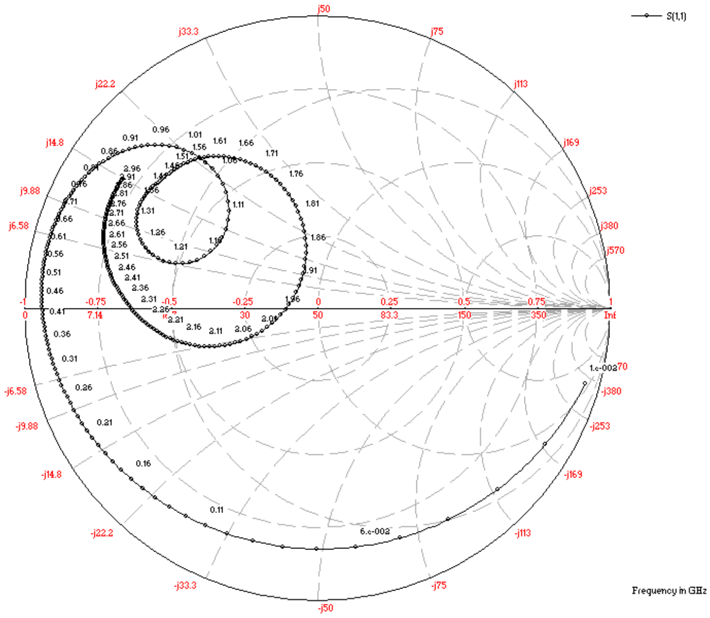



Fig. 6. Smith chart of left arm shorter U-slot MSA 1

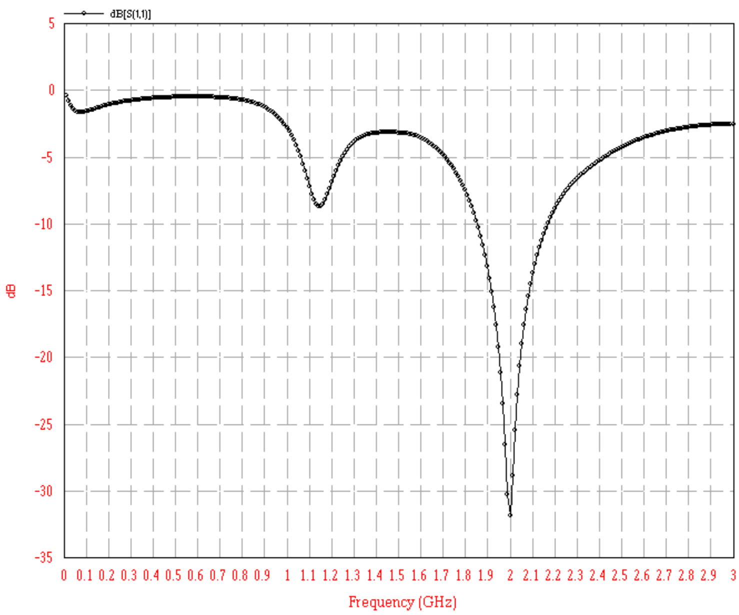



Fig. 7. Return loss Vs frequency plot of left arm shorter U- slot MSA 2

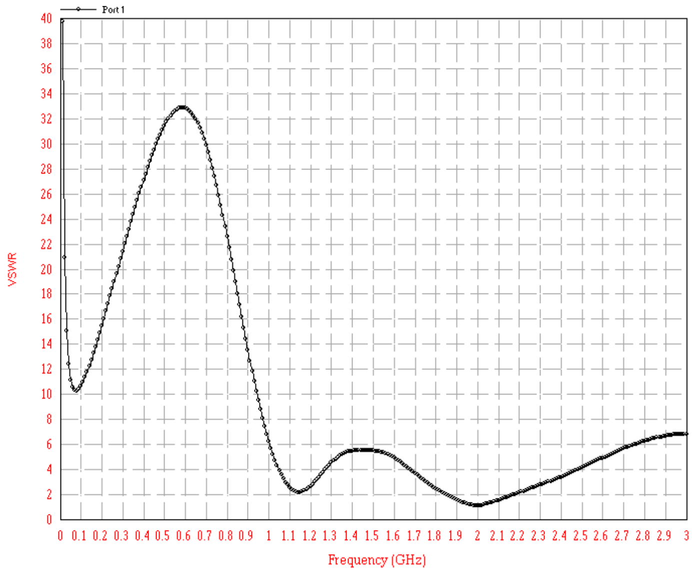
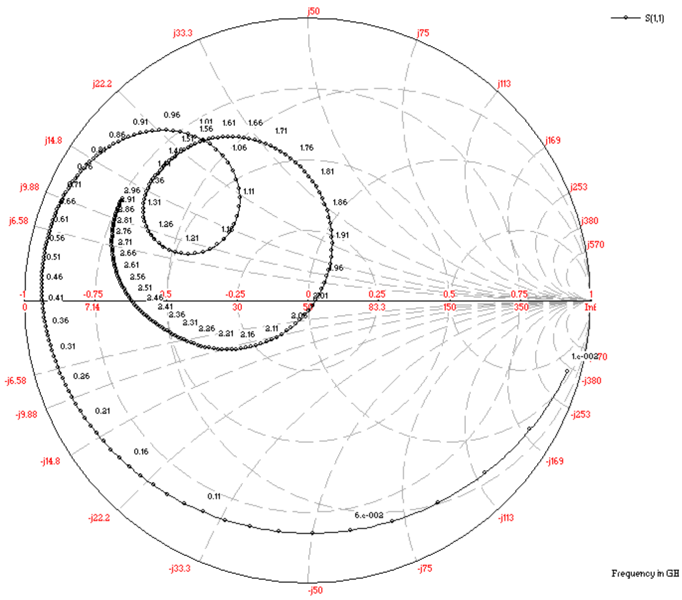



Fig. 8. VSWR Vs frequency plot of left arm shorter U-slot MSA 2




Fig, 9. Smith chart of left arm shorter U-slot MSA 2

## IV. CONCLUSION

It is observed that a coaxial feed, linearly polarized left arm shorter U slot MSA with different slot widths has been designed, simulated and compared. After comparison the left arm shorter U slot MSA with more slot width gives better results as compared to that of with less slot width. Both the antennas are suitable for implementing compact arrays, thus achieving even higher gain over specified bandwidth.

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## REFERENCES

[1] W.L.Stutzman and G.A. Thiele, *Antenna Theory and Design* , 2nd ed.New York; Wiley, 1998

[2] C.A. Balanis, *Antenna Theory*, 2nd ed.New York; John Wiley & Sons, Inc.,1997.

[3] Bahl, I.J. and Bhartia,P. *Microstrip Antennas*, Artech House, 1980

[4] G. Kumar , K.P. Ray, "*Broadband microstrip antenna*",Artech House Inc.,2003

[5] K. F. Tong and T. P. Wong "*Circularly polarized U slot Antenna*", IEEE Transactions on Antennas and Propagation,vol. 55, No. 8 ,August2007.

[6] IE3D User's Manual, Release 9, Zeland Software, Inc.