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Design and Comparison of U - Slot Micro Strip Antennas with Different Slot Widths

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Design and Comparison of U - Slot Micro Strip Antennas with Different Slot Widths

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Abstract -This paper presents design and comparison of two U slot microstrip antennas of different dimensions fed by a coaxial probe. A coaxial feed microstrip antenna is proposed for linear polarization. These antennas are implemented on glass epoxy dielectric substrate with ε_r =4.4, h=1.6mm and resonant at 2 GHz. The simulations are carried out using Zeland IE3D software.

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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 εr 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].

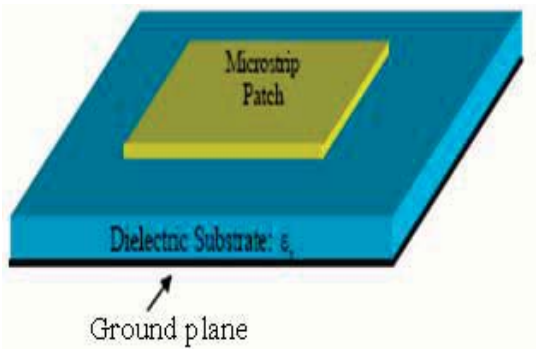

Figure 1: Rectangular Micro strip Patch Antenna

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II. Antenna Geometry and Design

A typical design of rectangular micro strip antenna has been presented here and results are discussed at centre frequency of 2 GHz. The width and length of the patch are given by [3, 4]:--

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

$$L = Leff - 2\Delta L \quad (2)$$

$$\Delta L = \frac{0.412h\,[\varepsilon_{eff} + 0.300]\left[\left(\frac{w}{h}\right) + 0.264\right]}{[\varepsilon_{eff} - 0.258]\left[\left(\frac{w}{h}\right) + 0.8\right]} \quad (3)$$

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

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

Where,

C = velocity of light,

ε_r = dielectric constant of substrate,

f = operating frequency

ε_{eff} = effective dielectric constant,

L_{eff} = effective length,

ΔL = edge extension

III. Designed 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	= 1.5 mm
Slot width of MSA geometry 2	= 2 mm

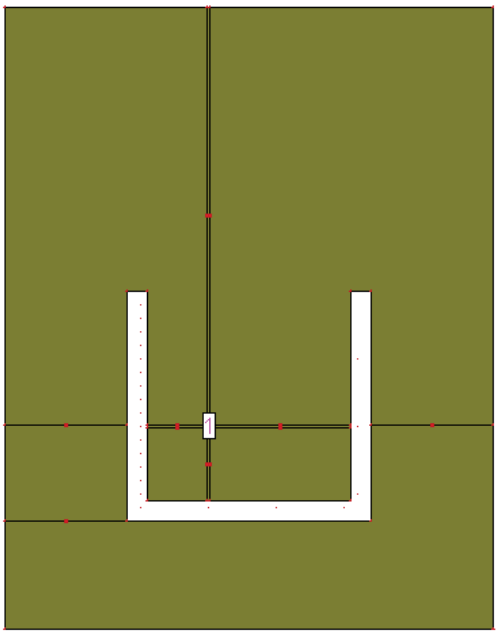

Figure 2: Geometry of U-slot MSA 1

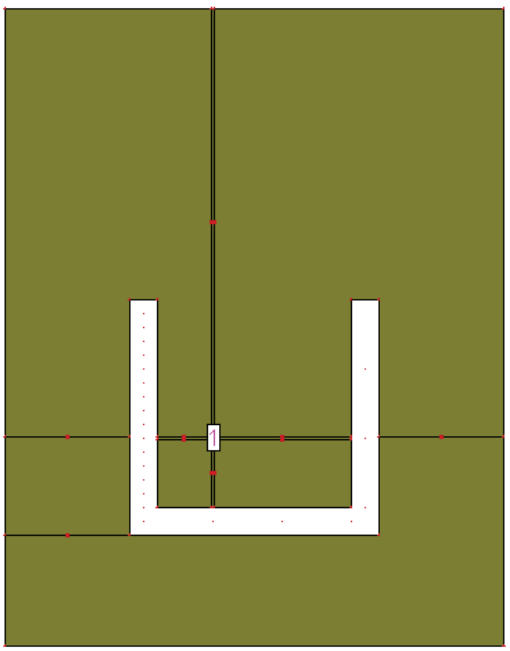

Figure 3: Geometry of U-slot MSA 2

IV. Antenna Fabrication and Results

After designing and simulation of U slot MSA with 1.5 mm slot, the return loss obtained is -39 db whereas U slot MSA with 2 mm slot gives a return loss of -28 db at the same designing parameters. Also, the VSWR for both the geometries is below 2 at the resonant frequency. The resulting data are presented in following figures

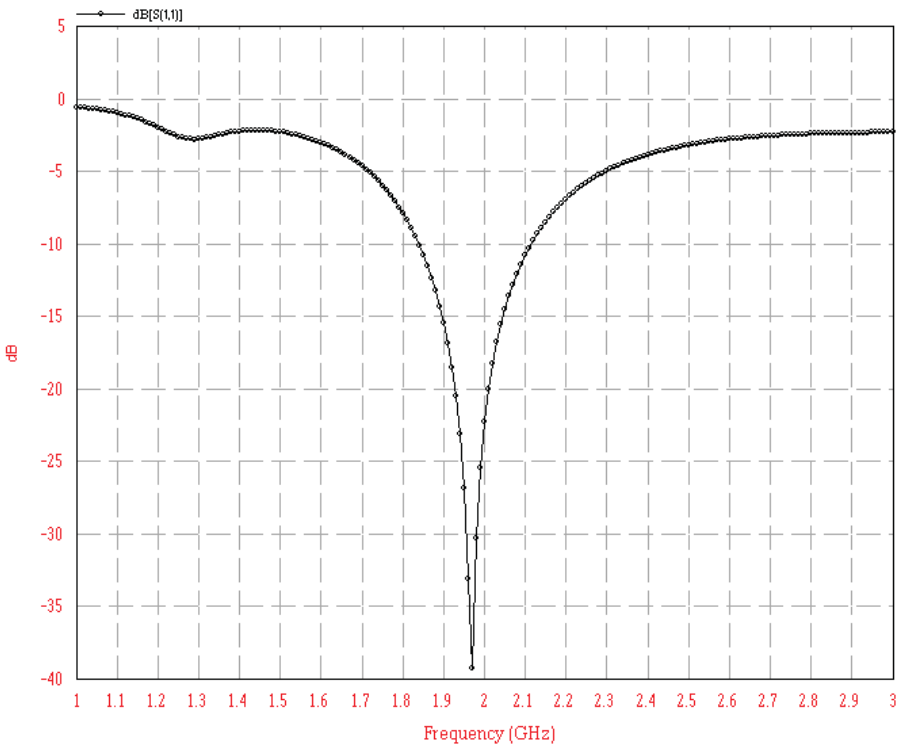

Figure 4: Return loss Vs frequency plot of U-slot MSA 1

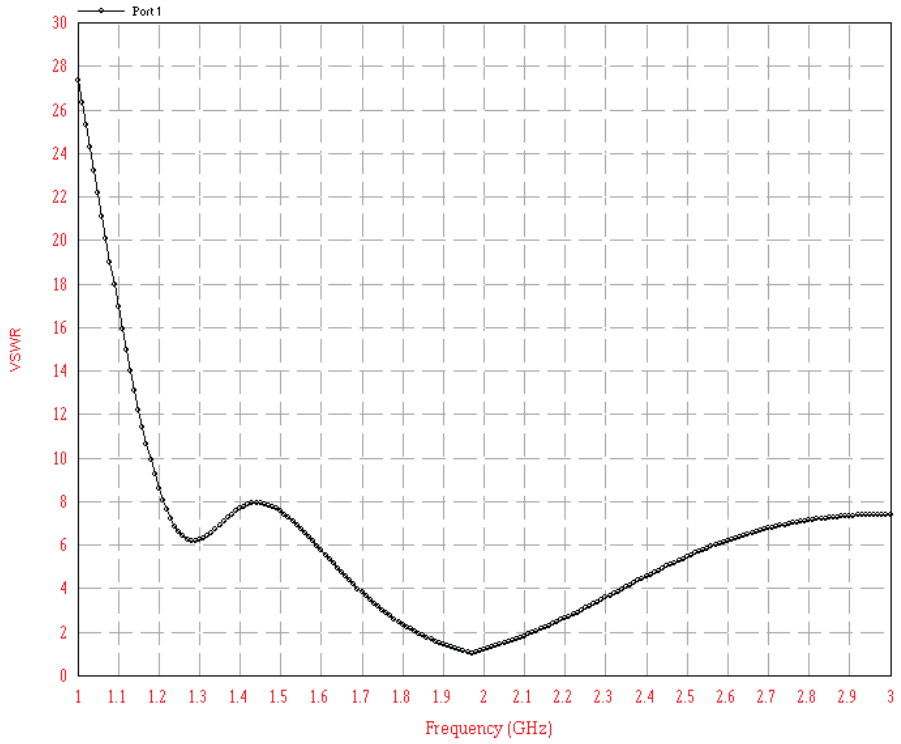

Figure 5: VSWR Vs frequency plot of U-slot MSA 1

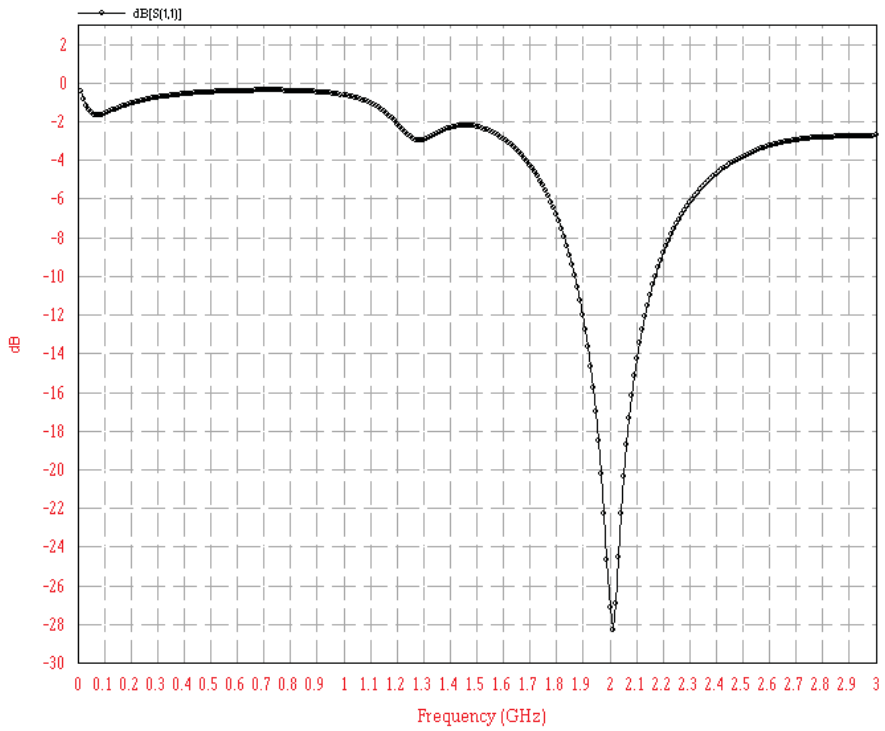

Figure 7: Return loss Vs frequency plot of U-slot MSA 2

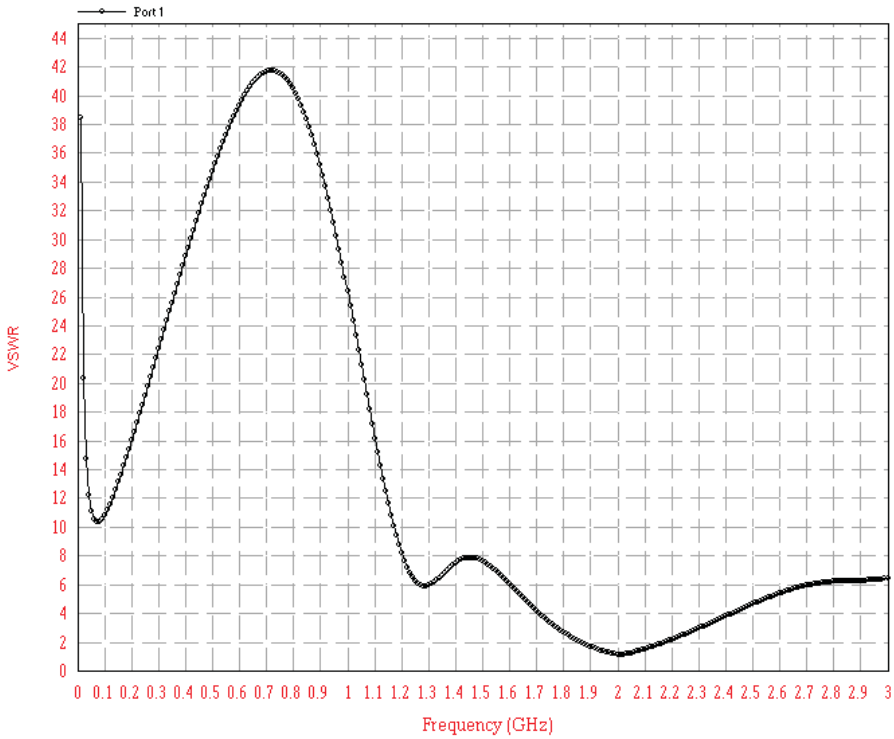

Figure 8: VSWR Vs frequency plot of U-slot MSA 2

V. Conclusion

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

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