Design OM Shaped quad band Microstrip patch antenna using partial ground and defected ground structure.

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Abstract— **This paper presents the design of microstrip patch antenna for Quad band applications. The designed antenna can be used for L, S, C & X band applications. The designed antenna has width of the patch, *Wp*= 38.83mm and length of the patch, *Lp* = 47.21mm. FR4 dielectric substrate is used as a substrate layer which has dielectric constant of 2.4 and height of dielectric substrate is 1.6mm.The designed antenna can be used for applications like in X-band it can be used for military communication and wideband global satellite communication systems (WGS), for S-band it can be used for terrestrial microwave and radar, specially police traffic speed-detector and for K-band it can be used in airport surface detection equipment (ASDE).**

Keywords—Quadband,returnloss,VSWR,Radiation pattern,Hfss Simulation software

I. INTRODUCTION

A impressive Development in Wireless Communication Systems Leads to the Demand for Compact Microstrip Antennas with High Gain and Wide Band Operation. A Microstrip Antenna usually Consists Of A Dielectric Substrate Between A Radiating Patch On The Top And A Ground Plane On The Other Side. Microstrip Antennas Have Advantages Such As Low Profile, very Light Weight And very Low Manufacturing Cost [1]. However, The Main Disadvantages Is Its Narrow Bandwidth. Return Loss(S11 Parameter) Must Be As Minimum As Possible For Best Operation. Lot's of Methods Were Developed to Increase the Bandwidth of Antennas Such As Increase of Substrate Thickness, Use Of Low Dielectric Substrate [2-3]. The Techniques Include FSS (Frequency Selective Surfaces) [4-5], Employing Stacking [6], Slot Antennas Like U-Slot [7], Double U-Slot [8], L-Slot[9], And Feeding Methods such as Probe Feed [10], And Circular Co-Axial Probe Feed[11]. The Paper Presents on Om-Shaped microstrip Patch Antenna having Coaxial Feeding. Defected Ground Substrate Is also used to improve bandwidth and return loss.

II. ANTENNA DESIGN

Primarily the microstrip patch antenna has 3fundamental layers namely i) metallic layer(Patch) as a radiating element ii) dielectric substrate iii) metallic layer as a ground plane. The rectangular patch antenna is made onto FR4 dielectric substrate which has dielectric constant of 2.4 and height of dielectric substrate is 1.6mm.

The effective length of the patch Leff now becomes

$$\mathbf{L_{eff}} = \mathbf{L + 2\Delta L}$$

For a given resonant frequency f0, the effective length is

$$\mathbf{L_{eff}} = \frac{\mathbf{C}}{\mathbf{2f_0\sqrt{\varepsilon_{reff}}}}$$

Where εreff

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(1 + \frac{12h}{W}\right)^{-0.5}$$

Width of patch is

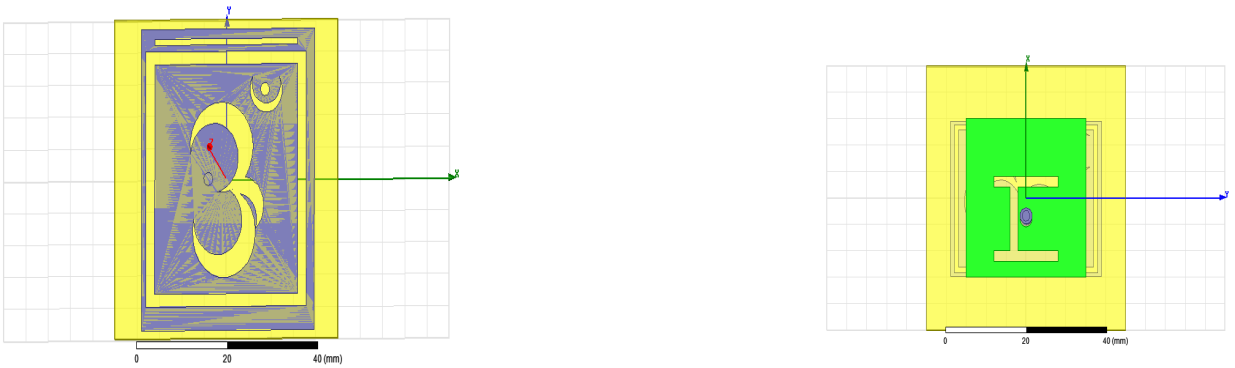
$$W = \frac{C}{2f_0}\left(\frac{\varepsilon_r + 1}{2}\right)^{-0.5}$$

The defected ground structure has been made on the ground of the patch antenna which has I shape by etching the ground plane. The antenna parameter is given in table below:

Variable	Value
Length of the Patch	41mm
Width of the Patch	38.83mm
Width of the Ground(Partial)	30
Length of the Ground(Partial)	30
Width of the Substrate	50
Length of the substrate	50
Height of the Substrate	1.6mm

Table 1.1 : Design parameter for proposed antenna

Proposed antenna:



(a)Top view *(b)Bottom view*

Fig 1: Microstrip patch antenna with Partial & defected Ground structure
(a) Top view of antenna (b) bottom view of antenna

(a) (b)

Fig 2: Microstrip patch antenna with no defected ground
(a) Top view of antenna (b) bottom view of antenna

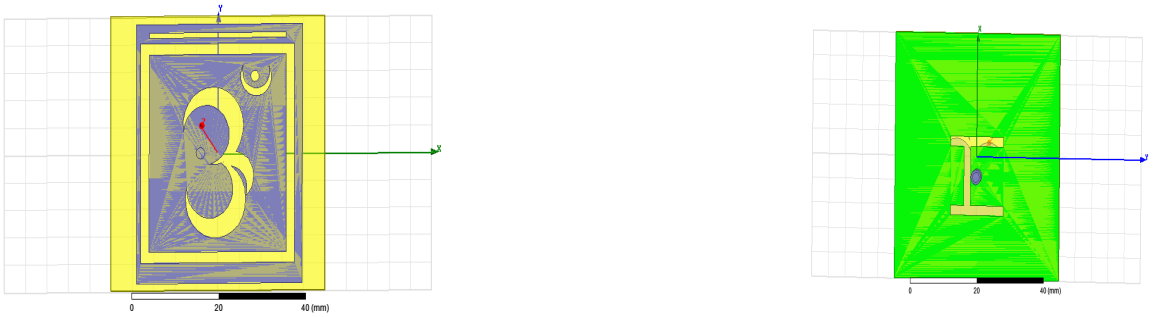


Fig 3: Microstrip patch antenna with defected ground
(a) Top view of antenna (b) bottom view of antenna

III ANTENNA RESULT

1. Return loss Parameter
2. VSWR Parameter
3. Radiation pattern

1. Return loss Parameter

a) S11Parameter Vs Frequency: in this paper we observe return loss varition with ground(Partial ,full , partial with defected ground)

1. Variation in return loss with frequency in full ground condition:

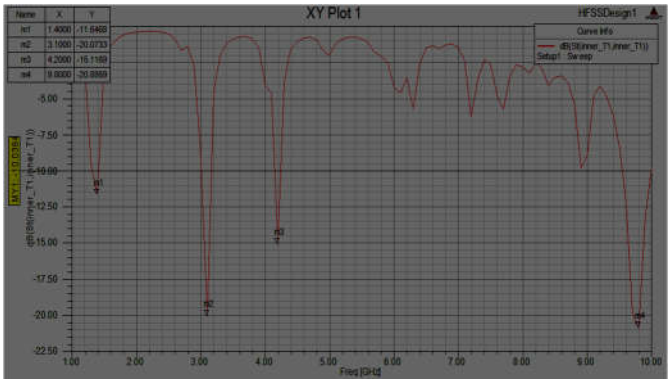


Fig 4: S11 Parameter Vs Frequency

2. Variation in return loss with frequency in defected ground condition:

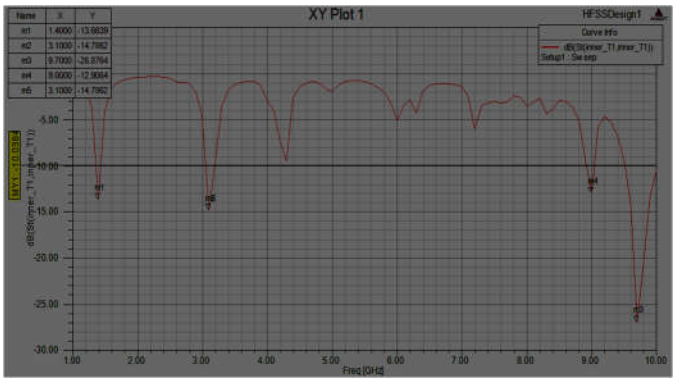


Fig 5: S11 Parameter Vs Frequency

3. Variation in return loss with frequency in Partial and Defected ground condition:

4.

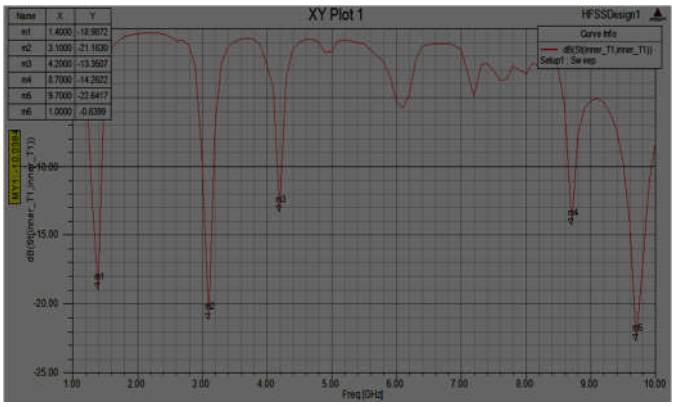


Fig 6: S11 Parameter Vs Frequency

2. VSWR Vs Frequency: For a good antenna VSWR should be in range of 1-2

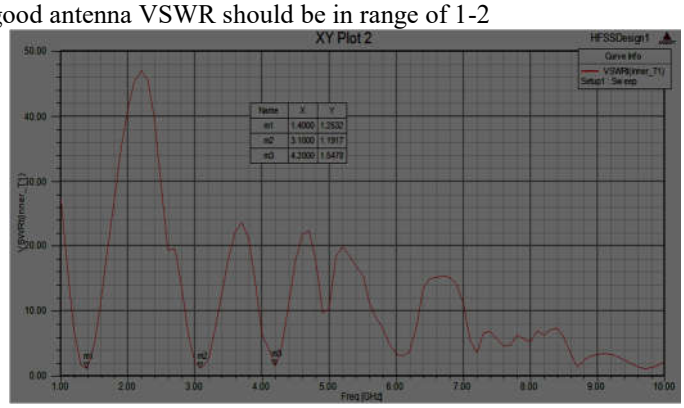


Fig 7 : VSWR Parameter for Proposed antenna

3. Radiation Pattern:

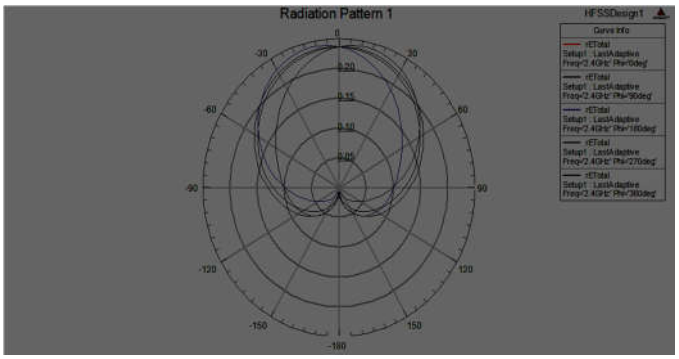


Fig 8 : Radiation Pattern For Proposed antenna

IV CONCLUSION:

The proposed antenna work in four frequency bands(L,S,C,and X). so this antenna is suit able for various application like military telemetry, GPS, mobile phones (GSM), amateur radio, wireless LAN, Bluetooth, ZigBee, long-distance radio telecommunication, satellite communications, radar. The antenna provides the better bandwidth and return loss in each frequency band.

V References:

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