# Design of Multiple U Slotted Microstrip Antenna for Wimax and Wideband Applications

**N. Krishna Jyothi, V. Anitha**

***Abstract--A novel miniaturized configuration of a different U-slotted micro-strip radio wire is outlined in view of focus recurrence about 4. 7 GHz with dielectric steady (εr) for 4. 4 also substrate thicknesses from claiming 2. 4mm. The suggested radio wire might meet the interest from claiming WiMax and wideband requisitions. The way parameters like return loss, VSWR, gain, directivity would simulated, broke down and optimized utilizing high back structure test system. The recommended radio wire is created and tried utilizing the Rhode Also Schwarz vector organizes analyzer R&S® ZVL-13 and its execution aspects would got. Those Outcomes indicate that the Inclination offers Inclination of the recommended radio wire could make incredibly progressed contrasted with customary micro-strip patavium antennas.***

***Index Terms- Microstrip antennas, WiMaX, Return Loss, VSWR.***

## I. INTRODUCTION

The advantages of micro-strip patch antenna are low profile, ease of fabrication, lighter in weight, low volume, low cost, smaller dimension, conformity and compatibility with integrated circuits. Micro-strip patch antenna provides dual frequency operations, frequency agility, Omni directional patterning and broad band width .These antennas are used in different hand held communication devices.

There would distinctive routines to nourishing the micro-strip patavium radio wire like, line nourishing method, coaxial nourishing technique and so on. This paper employs coaxial bolstering technique. In coaxial nourishing method the inward conductor of the coaxial connector extends through a dielectric and is soldered of the transmitting patch, same time the external conductor may be associated with the ground plane Like-wise indicated in fig. 1.

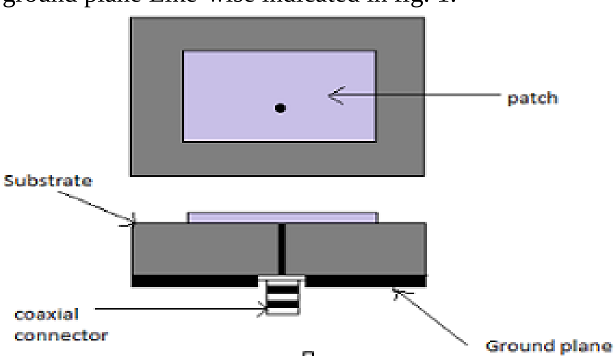


**Fig.1 Coaxial Feed or Probe Feed**

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The fundamental playing point about this sort for bolster plan need those encourage could be set toward any wanted area inside those atavism On mind with its information impedance and may be simple should manufacture need low spurious radiation.

### 1. Antenna Configuration And Design

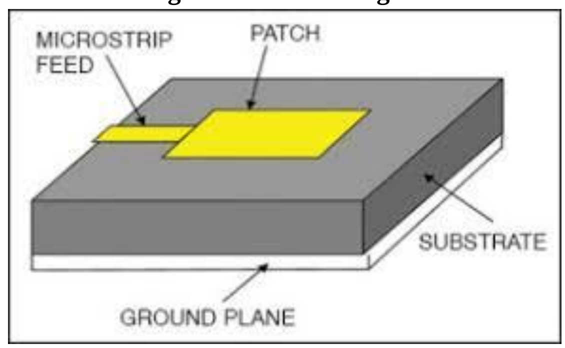


**Fig.2 Microstrip patch Antenna**

To planning of a micro-strip patavium radio wire as demonstrated On fig. 2, those crucial parameters required are full frequency, dielectric medium and substrate thickness for which radio wire should make planned.

Those parameters on make ascertained are Similarly as under:.

Width (W) of the transmitting patavium may be provided throughan equation:.

$$W = \frac{c}{2f_0\sqrt{\left(\frac{\varepsilon_r+1}{2}\right)}}$$ ----- (1).

Where, f*o* is the full frequency, εr is those dielectric steady or relative permittivity and c's will be the speed from claiming light in allowed space. Viable permittivity alternately powerful dielectric consistent of the dielectric substrate The point when W/h > 1, will be provided for Toward those equation:.

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

L is those length of the patavium antenna, which will be that's only the tip of the iceberg answerable for superior radio wire execution by and large lies the middle of $\lambda o/3$ and $\lambda o/2$. However, it may be provided for by the equation:.

$$L = L_{eff} - 2\Delta L$$ ------ (3).



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ΔL may be those enlarged line period on both sides of the dynamic patavium because of those impact from claiming fringing fields [7] may be provided for Toward those equation:.

$$\Delta L = 0.412h\,\frac{(\varepsilon_{reff} + 0.3)(\frac{W}{h} + 0.264)}{(\varepsilon_{reff} - 0.258)(\frac{W}{h} + 0.8)} \quad \text{----- (4)}$$

Effective length is calculated by the formula:

$$L_{eff} = \frac{C}{2f_0\sqrt{\varepsilon_{reff}}} \quad \text{----- (5)}$$

The transmission line model may be pertinent with limitless ground planes just. However, to useful considerations it will be key to bring a limited ground plane. It need been demonstrated that comparable comes about to limited and limitless ground plane might be acquired though the measure of the ground plane will be more stupendous over those patavium measurements through roughly the six times the substrate thickness constantly on around the fringe. Hence, to this design, those ground plane measurements might be given as:

$L_g = 6h + L$ ----- (6)

$W_g = 6h + W$ ----- (7)

In this design, desired input feed point $Y_f$ along y-axis will be zero and only desired input feed point axis $X_f$ along x-axis will be varied to locate the optimum feed point. The optimum feed point is given by the following equation [7].

$$Xf = L/2\sqrt{\varepsilon_{reff}} \quad \text{- ---- (8)}$$

$$Yf = W/2 \quad \text{----- (9)}$$

## II. Design Of Three U Slotted Microstrip Antenna

The three fundamental parameters for those configuration of recommended radio wire are:.

An) Recurrence from claiming operation (f0): the full recurrence chosen to this plan is 4. 7 GHz. B) dielectric consistent of the substrate (εr): the dielectric material chose for this configuration will be FR4_epoxy which need a dielectric steady of 4. 4. A substrate for secondary dielectric consistent need been chose since it lessens those extents of the radio wire. C) Stature of the dielectric substrate (h): the tallness of the dielectric substrate is 2. 4mm.

Resonant frequency ($f_0$) = 4.7 GHz

Dielectric constant ($\varepsilon_r$) = 4.4

Substrate thickness (h) = 2.4mm

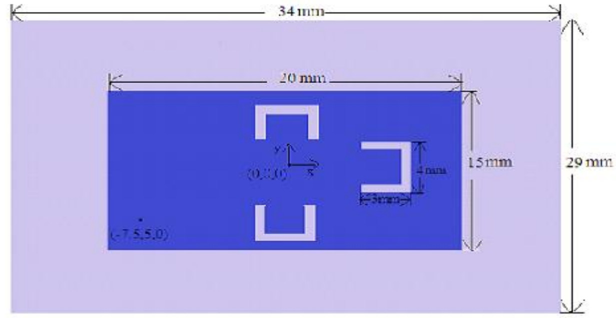


**Fig.4 Design of three u slotted microstrip patch antenna for $f_0$=4.7 GHz, $\varepsilon_r$=4.4 and $h$=2.4 mm**

Table. I Optimized design parameters of antenna

| Parameters | Value |
|---|---|
| Length of the patch (L) | 20mm |
| Width of the patch (W) | 15mm |
| Length of the ground ($L_g$) | 34mm |
| Width of the ground ($W_g$) | 29mm |
| Thickness of the substrate (h) | 2.4mm |
| Feeding Technique Used | Coaxial feeding |

## III. SIMULATION RESULTS

The simulated results are obtained and plots of return loss, directivity, VSWR and 3D gain of three U slotted micro strip patch antenna operating at 4.7 GHz are plotted.

It is observed from Fig 4.1 that the Return loss vs Frequency plot has the peak value of -16.88dB at 6.8 GHz. It also resonates at three more frequencies and a better performance is observed at those frequencies.

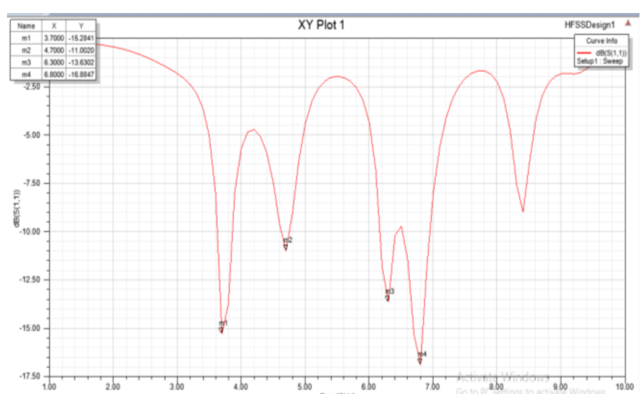


**Fig.4.1 Return loss vs Frequency plot for three U slotted micro strip patch antenna for $f_0$=4.7 GHz, εr=4.4 and h=2.4mm**

The VSWR vs frequency plot shown in Fig. 4.2 is found to be less than 2 along the ultra-wide band range. The VSWR at the resonant frequency 4.7 GHz is found to be 1.78.


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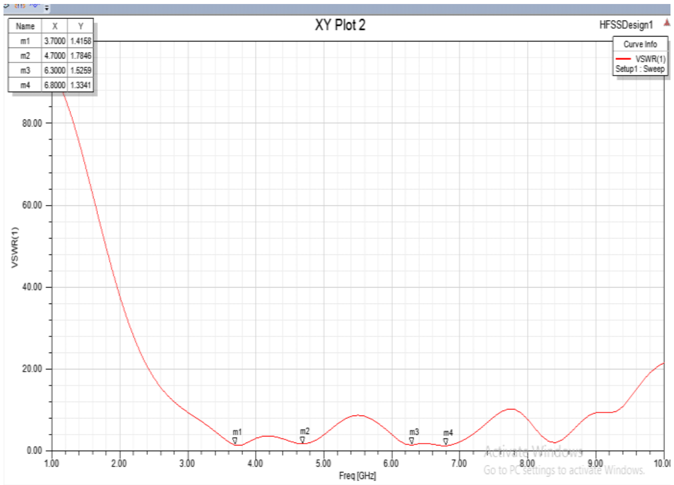


**Fig. 4.2 VSWR vs Frequency plot for three U slotted microstrip patch antenna for $f_0$=4.7 GHz, εr=4.4 and h=2.4**

The 3D Gain plot shown in Fig. 4.3 has the gain of 3.40dB.

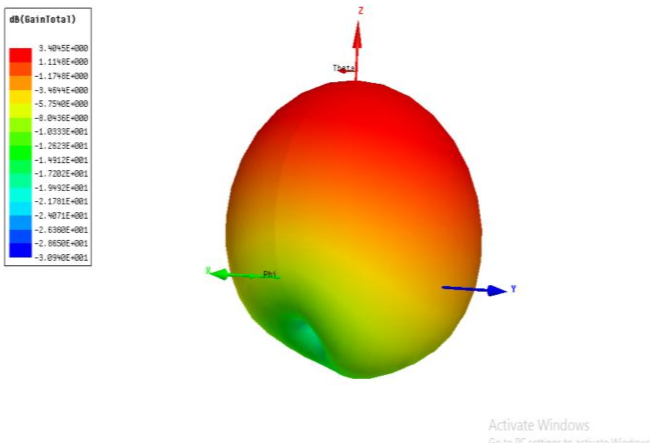


**Fig.4.3 3D Gain plot for three U slotted microstrip patch antenna for f0=4.7 GHz, εr=4.4 and h=2.4mm**

The 3D Directivity plot shows the gain of 3.05dB.

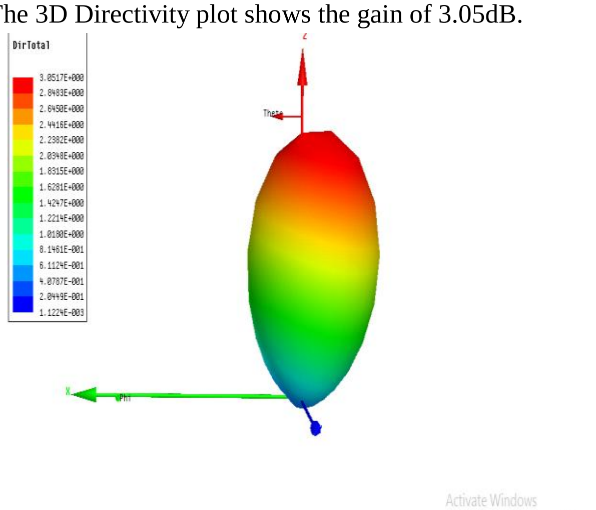


**Fig.4.4 3D Directivity plot for three U slotted micro strip patch antenna for f0=4.7 GHz, εr=4.4 and h=2.4mm**

## IV. ABRICATION AND TESTING PROCESS

The fabricated design of the antenna is as shown in the figure below:

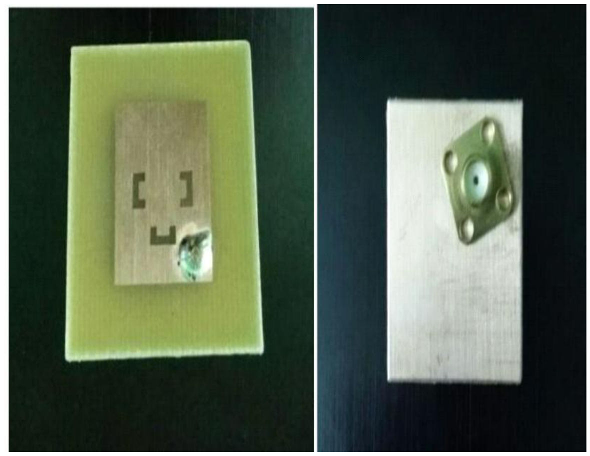

**Fig. 5.1 Fabricated Antennas**

The testing of the fabricated antenna is done using R&S®ZVL-13 Two Port Vector Network Analyzer by Rhode and Schwarz. The R&S®ZVL-13 may be an expense efficient, powerful, & transportable system analyzer in the conservative class, & may be in this manner perfect for use for development, preparation & administration. It may be the main instrument flying will consolidate the capacities from claiming organize analyzer, range analyzer, Furthermore control meter in an single box, & consequently will enormously expand those worth of effort effectiveness.

***Test Results:***

1. Return loss: It is observed that when the fabricated antenna was tested practically is found to resonate at four frequencies i.e., 3.8 GHz, 4.7 GHz, 6.6 GHz and 6.8 GHz. It exhibits a return loss of -19.66 dB, -15.719 dB, -18.613 dB and -12.566 dB respectively.

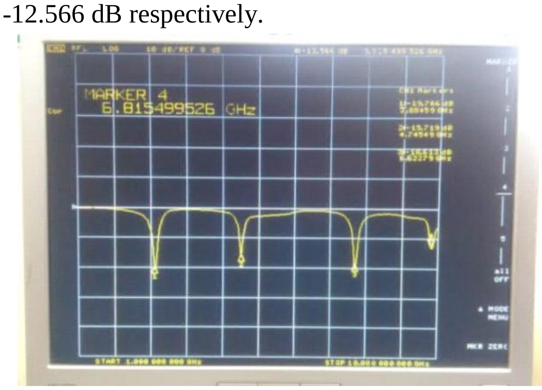


**Fig. 5.3 Return loss**

2. VSWR: The fabricated antenna when tested practically exhibits a VSWR of 1.151, 1.40, 1.31 and 1.653 at 3.8 GHz, 4.7 GHz, 6.6 GHz and 6.8 GHz respectively.


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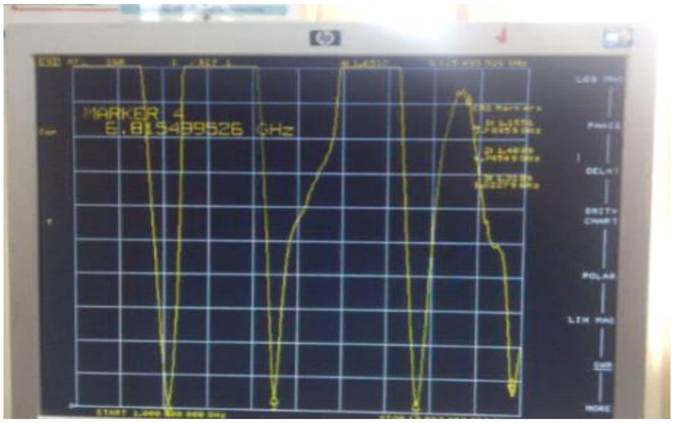


**Fig. 5.4 VSWR**

The simulated and tested results are 90% matched, the 10% losses are due to lose soldering connections, due to presence of air or due to lose SMA connector connections. After these small variations in the results due to some reasons the results are still acceptable.

**Precautions :**

1. While measuring the return loss of antenna there should not be any metallic and human bodies close by. Otherwise readings will get affected.
2. It is advisable to turn off the RF power to the antenna by selecting PWR BW > RF OFF as microwave radiation may affect the human body.

## V. CONCLUSIONS

The fabricated antenna when tested practically is found to resonate at four frequencies i.e., 3.8 GHz, 4.7 GHz, 6.6 GHz and 6.8 GHz. It exhibits a return loss of -19.66 dB, -15.719 dB, -18.613 dB and -12.566 dB, VSWR of 1.151, 1.40, 1.31 and 1.653 at 3.8 GHz, 4.7 GHz, 6.6 GHz and 6.8 GHz respectively. The slight changes in the Return Loss and the resonating frequencies can be accounted due to fabrication errors. The developed antenna resonates within the given frequency band and has good return loss and this indicates that the antenna is well suited for the wireless communication application intended.

## VI. FUTURE SCOPE

In future the radiation characteristics of the three U slotted Microstrip patch antenna can be improved by using different feed techniques.

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