Multiple U Slotted Microstrip Antenna Design for Wimax and Wideband Applications

Trupti Wable and Snehal Somwanshi

December 5, 2019

Multiple U Slotted Microstrip Antenna Design for Wimax and Wideband Applications

Ms. Trupti K. Wable[1]
[1] Department of Electronics & Telecommunication , Sir Visvesvaraya Institute of Technology, Nashik, Savitribai Phule Pune University , Nashik, India
e-mail: trupti.wable@pravara.in,

Mrs. Snehal S. Somwanshi[2]
[2] Department of Electronics & Telecommunication. Sir Visvesvaraya Institute of Technology, Nashik, Savitribai Phule Pune University, Nashik, India
e-mail: snehal.somwanshi@pravara.in

Abstract— A novel miniaturized configuration of a unique U- slotted micro-strip radio wire is printed seeable of focus repeat regarding four. seven gigacycle per second with insulator steady (εr) for four. four additionally substrate thicknesses from claiming a pair of 2.4mm. The steered radio wire may meet the interest from claiming WiMax and band requisitions. The approach parameters like come back loss, VSWR, gain, radial asymmetry would simulated, stone-broke down and optimized utilizing high back structure check system. The suggested radio wire is formed and tried utilizing the Rhode additionally Schwarz vector organizes analyser R&S® ZVL-13 and its execution aspects would got. Those Outcomes indicate that the Inclination offers Inclination of the suggested radio wire may create improbably progressed contrasted with customary micro-strip metropolis antennas.

Keywords— Microstrip antennas, WiMaX, Return Loss, VSWR.

I. INTRODUCTION

The advantages of micro-strip patch antenna area unit low profile, easy fabrication, lighter in weight, low volume, low cost, smaller dimension, conformity and compatibility with integrated circuits. Micro-strip patch antenna provides twin frequency operations, frequency legerity, Omni directional patterning and broad band dimension .These antennas area unit utilized in completely different handheld communication devices.

There would distinctive routines to nutritious the micro-strip patavium radio wire like, line nutritious methodology, concentric nutritious technique then on. This paper employs concentric bolstering technique. In concentric nutritious methodology the inward conductor of the concentric connecter extends through a insulator and is soldered of the transmittal patch, same time the external conductor is also related to the bottom plane Like-wise indicated in fig. 1.

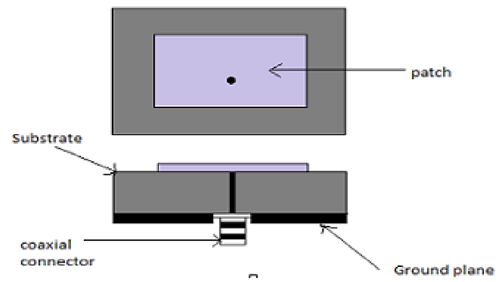

Fig.1 Coaxial Feed or Probe Feed

The fundamental taking part in purpose concerning this type for bolster set up would like those encourage may be set toward any wished space within those throwback On mind with its data resistance ought to|and will be straightforward should manufacture would like low spurious radiation.

II. ANTENNA CONFIGURATION AND DESIGN

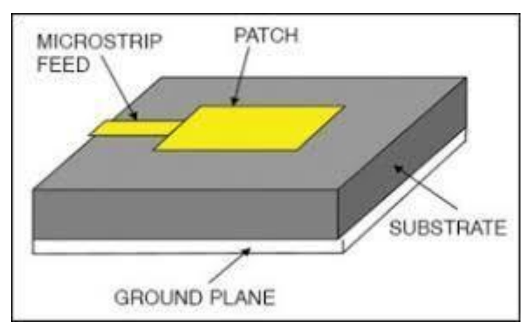

Fig.2 Microstrip patch Antenna

To coming up with of a micro-strip patavium radio wire as incontestible on fig. 2, those crucial parameters needed area unit full frequency, non-conductor medium and substrate thickness that radio wire ought to build planned.

Those parameters on build discovered area unit equally as under:

Width (W) of the sending patavium is also provided

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

Throughan equation:……………………(1).

Where, fo is that the full frequency, εr is those non-conductor steady or relative permittivity and c's are going to be the speed from claiming light-weight in allowed house. Viable permittivity alternately powerful non-conductor consistent of the non-conductor substrate the purpose once W/h > one, are going to be provided for Toward those equation:.

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

L is those length of the patavium antenna, which is able to be that is solely the tip of the iceberg accountable for superior radio wire execution by and huge lies the center of $\lambda o/3$ and $\lambda o/2$. However, it should be provided for by the equation:.

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

ΔL is also those enlarged line amount on either side of the dynamic patavium as a result of those impact from claiming fringing fields [7] is also 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:

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

The line model is also pertinent with limitless ground planes simply. However, to helpful issues it'll be key to bring a restricted ground plane. It would like been incontestible that comparable comes near to restricted and limitless ground plane may well be non-heritable tho' the live of the bottom plane are going to be a lot of prodigious over those patavium measurements through roughly the six fold the substrate thickness perpetually on round the fringe. Hence, to the present style, those ground plane measurements may well be given as: The line model is also pertinent with limitless ground planes simply. However, to helpful issues it'll be key to bring a restricted ground plane. It would like been incontestible that comparable comes near to restricted and limitless ground plane may well be non-heritable tho' the live of the bottom plane are going to be a lot of prodigious over those patavium measurements through roughly the six-fold the substrate thickness perpetually on round the fringe. Hence, to the present style, those ground plane measurements may well be given as:

$$L_g = 6h + L \text{ ---------------------------------- (6)}$$

$$W_g = 6h + W \text{------------------------------ (7)}$$

In this style, desired input feed purpose Yf on coordinate axis are going to be zero and solely desired input feed purpose axis Xf on coordinate axis are going to be varied to find the optimum feed purpose. The optimum feed purpose is given by the subsequent equation [7].

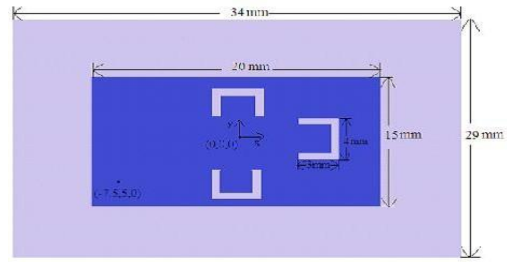

Fig.4 Design of three u slotted microstrip patch antenna for f_0=4.7 GHz, ε_r=4.4 and h=2.4 mm

Table-1 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, radial asymmetry, VSWR and 3D gain of 3 U slotted small strip patch antenna in operation at four.7 GHz are premeditated.

It is discovered from Fig-4.1 that the return loss vs Frequency plot has the maximum peak value -16.88dB at 6.8 GHz. It conjointly resonates at 3 additional frequencies and a higher performance is discovered at those frequencies.

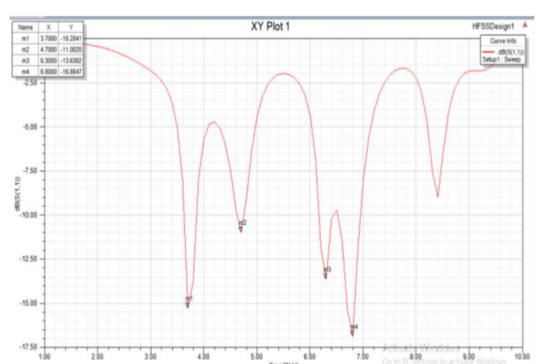

Fig.4.1 Return loss vs Frequency plot for three U slotted micro strip patch antenna for f0=4.7 GHz, εr=4.4 and h=2.4mm

The frequency plot versus VSWR shown in Fig. 4.2 is found that the VSWR is less than 2 for ultra-wide band range. The resonant frequency 4.7 GHz has VSWR 1.78.

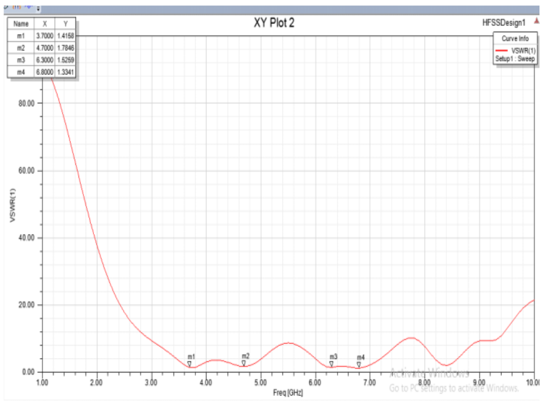

Fig. 4.2 VSWR vs Frequency plot for three U slotted microstrip patch antenna for f0=4.7 GHz, εr=4.4 and h=2.4

VSWR of 1.151, 1.40, 1.31 and 1.653 at 3.8 GHz, 4.7 GHz, 6.6 GHz and vi.8 GHz severally. The slight changes within the return Loss and also the resonant frequencies will be accounted because of fabrication errors. The developed antenna resonates at intervals the given waveband and has sensible return loss and this means that the antenna is

IV. FABRICATION AND TESTING PROCESS

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

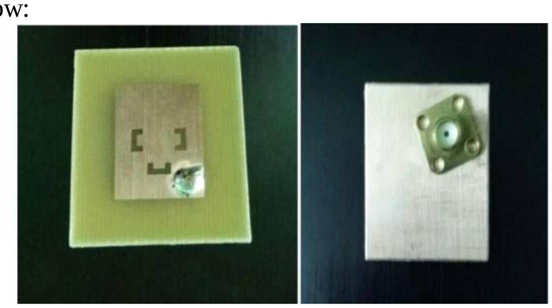

Fig. 5.1 Fabricated Antennas

The testing of the antenna after fabrication is finished with the help of R&S®ZVL-13 two Port Vector Network Analyzer developed by Rhode and Schwarz. The R&S®ZVL-13 is also associate degree expense economical, powerful, system instrument within the conservative category, during this manner good to be used for development, preparation & administration. It going to be the most navigation can consolidate the capacities from claiming organize instrument, vary instrument, moreover management meter in associate degree single box, & consequently can staggeringly expand those value of effort effectiveness.

A. Test Results:

a. Return loss: It is discovered that once the fabricated antenna was tested much is found to resonate at four frequencies i.e., 3.8 GHz, 4.7 GHz, 6.6 GHz and vi.8 GHz. It exhibits a return loss of -19.66 dB, -15.719 dB, -18.613 sound unit and -12.566 sound unit severally.

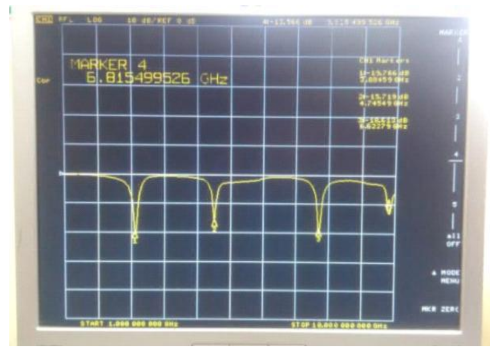

Fig. 5.3 Return loss

2. VSWR: The antenna once tested after frabrication much exhibits a VSWR of one.151, 1.40, 1.31 and 1.653 at 3.8 GHz, 4.7 GHz, 6.6 GHz and vi.8 GHz severally.

V. CONCLUSIONS

The antenna once tested after fabrication results found to resonate at four frequencies i.e., 3.8 GHz, 4.7 GHz, 6.6 GHz and vi.8 GHz. It exhibits a return loss of -19.66 dB, -15.719 dB, -18.613 sound unit 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 vi.8 GHz severally. The fabrication errors are responsible for slight changes in resonant frequency and return Loss. The developed antenna resonates at intervals the given waveband and has sensible Return loss and this means that the antenna is compatible for the wireless communication application meant.

REFERENCES

[1] Vikram Thakur "Implementation and development of single feed design using multiple U slotted patch antenna for wireless applications ", International Journal of Engineering Research & technology (IJERT).

[2] C. A. Balanis, *"Antenna Theory, Analysis and Design",* John Wiley & Sons, New York, 1997.

[3] Indrasen Singh, V.S. Tripathi, *"Microstrip patch antenna and its applications: A Survey",* International journal of Computer Technology and Applications, Vol. 2(5), pp.1595-1599, 2011.

[4] I.J. Bahl, P. Bhartia, "*Microstrip Antennas*", Artech House, 1980.

[5] Keith R. Carver, "James W. Mink, "*Microstrip Antenna*

Technology", IEEE Transactions on antennas and propogations,Vol.AP-29, No.1, January 1981.

[6] R.E Collin, "*Foundations for Microwave Engineering*" ,IEEE Press 2nd Edition, 2002.

[7] S. E James, M.A. Jusoh, M. H. Mazwir and S.N.S. Mahmud, "*Finding The Best Feeding Point Location of Patch Antenna using HFSS*", ARPN Journal of Engineering and Applied Sciences, Vol.10, No. 23, December 2015

[8] Vinaybankey, N.AnveshKumar, *"Designand performance issue of microstrip patch antennas"*, International journal of Scientific and Engineering Research volume6,Issue 3,March-2015 1572