Result Comparison between I and + Sign Slotted Micro Strip Patch Antennas for Wi-Max applications

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***Abstract* - Electrical simulation of the proposed antenna was performed using IE3D software. With the loss of IE3D Return software, VSWR, antenna efficiency and radiation pattern can be tested for its structure. In this molded paper I shaped a microstrip patch antenna designed and compared to a + sign shaped with a microstrip patch antenna. Cutting the slot on the antenna increases the current pressure and as a result the efficiency increases. The Probe feed process is used for profit, efficiency and bandwidth of the microstrip patch antenna. Profit development has been achieved through appropriate cutting areas in a rectangular section using the feeds of the investigation. We've got a great feed point for providing the results you want. Electrical simulation of the proposed antennas was performed using IE3D software. Performance analysis will be based on changing the geometry of the clip and the results obtained are mainly compared to gain, VSWR, antenna efficiency and radiation pattern.**

***Index Terms* - Small strip antennas, upgrades, antenna efficiency, radiation pattern.**

1.INTRODUCTION

The rapid growth of communication technology over the past few decades has led to the development of a wide variety of microstrip patch antennas with various attractive features such as low profile, low weight, easy production process using printed circuit technology and compatibility with monolithic microwave circuit integrated (MMIC). These facilities make it suitable for different uses such as Missile Technology, Satellite and telecommunications, Global Positioning System, Remote Sensing, etc. In addition to its many advantages, the microstrip antenna has low operating bandwidth, which puts it at a disadvantage in using it in a number of applications such as cases where operating frequency may vary. Any wireless connection requires high gain and if the antenna bandwidth is also increased and gain will be an additional profit but increasing both gain and bandwidth at the same time is a challenging task. Our goal is to reduce the size of the antenna. The proposed antenna (substrate with $\varepsilon_r = 2.2$) also has gain of 6.56 dB. The simulation was performed by IE3D software [11].

2. ANTENNA DESIGN

The proposed antenna structures are designed by cutting I shaped and + sign shaped slots of fixed dimensions. Cutting of these slots in antenna increases the current path which increases current intensity as a result efficiency is increased and desired parameters are obtained. Start off by calculating basic equation of typical rectangular patch and then convert its equivalent area to a rectangular form. The Essential parameters of this Rectangular micro strip patch antenna are W=30 mm, L=27 mm, Length of ground plane= 39 mm, Width of ground plane= 42 mm. The rectangular micro strip patch antenna designed on one side of glass/epoxy structure with $\varepsilon_r = 2.2$, loss tangent=0.0009. Design is being calculated.

STEPS FOR CALCULATING THE DIMENSION OF PATCH [10]

Step1: Calculation of the Width (*W*)

The width of the Micro strip patch antenna is given as:

$$W = \frac{c}{2f_o\sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Substituting c = 3.00e+008m/s,ε_r=2.2 and f_o= 3.25 GHz, we get:
W= 0.0300 m=30.00 mm

Step 2: Calculation of Effective dielectric constant ($\varepsilon reff$)

The effective dielectric constant is:

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

Substituting ε_r = 2.2, W=30.00mm and h = 2 mm we get:
ε_{reff}=2.4049

Step 3: Calculation of the Effective length (L_{eff}) The effective length is

$$L_{eff} = \frac{c}{2 f_o \sqrt{\varepsilon_{reff}}}$$

Substituting ε_{reff} = 2.4049, c = 3.00e+008 m/s and fo = 3.25 GHz we get:
L_{eff} = 0.02667 m = 26.67 mm

Step 4: Calculation of the length extension (ΔL)
The length extension is

$$\Delta L = 0.412h \frac{(\varepsilon_{reff} + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{W}{h} + 0.8\right)}$$

Substituting ε_{reff} = 2.4049, W = 30.00 mm and h = 2 mm we get:
L=1.23 mm

Step 5: Calculation of actual length of patch (L)
The actual length is obtained by:

$$L = L_{eff} - 2\Delta L$$

Substituting L_{eff} = 26.67 mm and L = 1.23 mm we get:
L = 25.44 mm

Step 6: Calculation of the ground plane dimensions (Lg and Wg)
The transmission line model only applies to non-stop international flights. However, for active observation, it is important to have a non-stop flight. It has been shown by [9] that the same effects of finite and unlimited ground planes can be obtained if the size of the ground plane is larger than the patch measurements about six times the size of the Substrate around the boundary.
Hence, for this design, the ground plane dimensions would be given as:
$Lg = 6h$ + L= 6(2) + 27= 40mm
$Wg = 6h$ + W = 6(2) + 30= 42mm

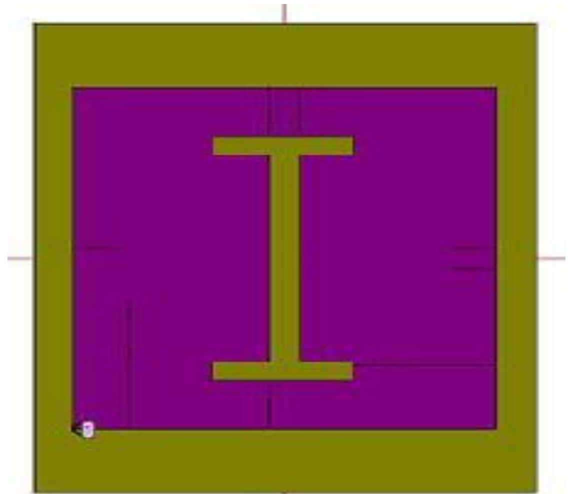

Fig. 1: Proposed Rectangular Micro-Strip Patch Antenna with I shaped slot with feed point at (-12.8, -16.01)

3. ANTENNA RESULT WITH +SIGN SLOTTED PATCH

Simulation of micro-strip patch antenna is performed using IE3D simulation software. A VSWR graph of a molded antenna is shown in Figure (2). The VSWR shows the difference between the antenna and the transmission line. For a perfect match the value of VSWR should be close to unity. The VSWR for this attached antenna is 1.03. A recovery loss graph is shown in the figure (3) and it is -31.23 dB, the total field gain & frequency is shown in figure (4),

Parameters	Value (+ Sign Slotted Patch)	Value (I Slotted Patch)
VSWR	1.0	1.03
Directivity	7.43dBi	7.56dBi
Gain	6.53dBi	6.56dBi
Efficiency	85%	87%
Radiation Efficiency	89.2%	90%
R.L	-31.213dBi	-31.2313dBi

Fig. 1: Result Comparison

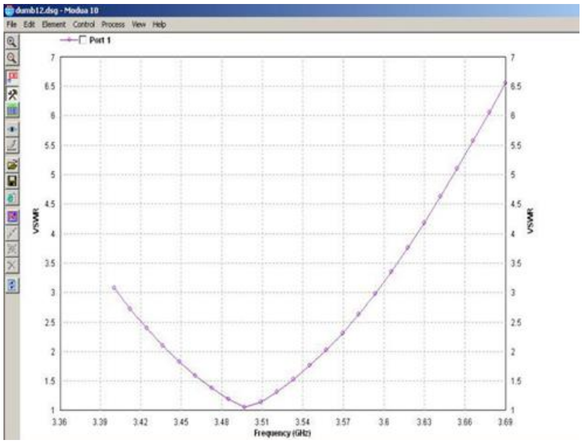

Fig. 2: VSWR of the Proposed Antenna= 1.03 at 3.5GHz

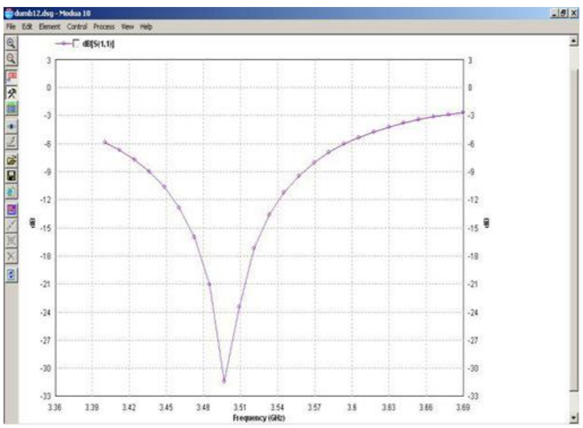

Fig. 3: Return Loss of the Proposed Antenna =-31.2313 dBi at 3.5 GHz

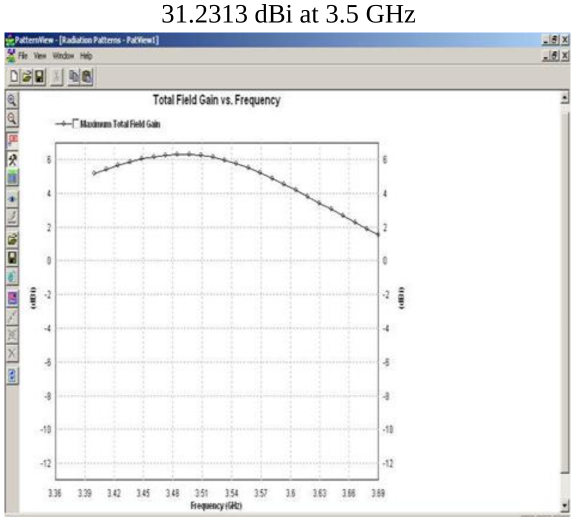

Fig. 4: Total field gain & frequency of proposed antenna =7.56 at 3.5 GHz

4. CONCLUSION

From a detailed experimental study, it is concluded that micro-strip patch antennas can be designed to give the desired results. The gain and direction of the I slotted patch antenna is better than the + sign patch antenna but the loss of retrieval is almost the same in both patches. The slotted shape patch worked well with radiation higher than + signaling patch with the spaces as shown in the table above. Both proposed antennas have a combined size of (27x30x2) and can successfully cover wireless functions such as Wi-Max.

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