Design and Comparison of Three Rectangular-Slots-Loaded and No Slot- Loaded Square Shaped Micro-strip Patch Antenna

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ABSTRACT
In this paper we present a proposed design for square shaped micro-strip patch antenna by cutting three rectangular slots on the surface of the square patch. Using proposed antenna design and probe feeding at proper position we will compare the resultant return loss and VSWR and bandwidth with the results of no slot loaded square shaped micro-strip patch antenna. For perusal and scheming IE3D simulation software has been used. In this paper it is noticed that by the use of slotted patch antenna and using probe feed at proper location we are able to obtain better return loss, Voltage Standing Wave Ratio and bandwidth.

General Terms
Stacked patch antenna pattern, Simulation impedance bandwidth, Rectangular slot

Keywords
Slotted square shaped micro-strip patch antenna, Return loss, VSWR.

1. INTRODUCTION
Antenna is a key building in wireless communication and global positioning system(GPS) since it was first demonstrate in 1886 by Heinrich Hertz and its practical application by Guglielmo Marconi in 1901 [1].In coming years communication design is inching towards size reduction. Economy in fabrication and low profile characteristics entice many researches to investigate the performance of a micro-strip patch antenna in various ways. Micro-strip antenna was first proposed by G.A. Deschamps in 1953. Micro-strip patch antennas are often uses where thickness and conformability to the host surfaces are the key requirements. In view of patch antennas as it can be straight away printed on a circuit board, these are becoming progressively popular within the mobile phone market. They are less costly and are easily fabricated. One of the major shortcomings of such device is their narrow bandwidth [2]. Micro-strip patch antenna is widely considered to be suitable for many wireless applications, although it has a narrow bandwidth [3]. The bandwidth limitation can be addressed by using thick substrates, cutting slots in the metallic patch, using aperture coupled stacked micro strip patch antenna [2]. The stacked patch antenna have multilayer structure consisting of several parasitic radiating elements placed one above the other and above the driven element[4]. However this approach has the inherent disadvantage of increased overall thickness and issues related on aligning various precisely. In this paper we compare a octagonal shaped micro-strip patch antenna with and with no slot. By cutting a slot in micro-strip patch enhance its bandwidth as compared to micro-strip patch antenna with no slot.

2. ANTENNA DESIGN
The proposed antenna design by cutting three rectangular slots in square shaped patch is as shown in fig. (2). Cutting of these slots in antenna increases the current path which increases current intensity as a result efficiency is increased. The rectangular slots are cut at the surface of the square patch. The dimension of the patch is 30X30 mm. The antenna is fabricated on a substrate of dielectric constant 4.4 and thickness h = 1.6 mili meter. For getting optimum results probe feeding is used.

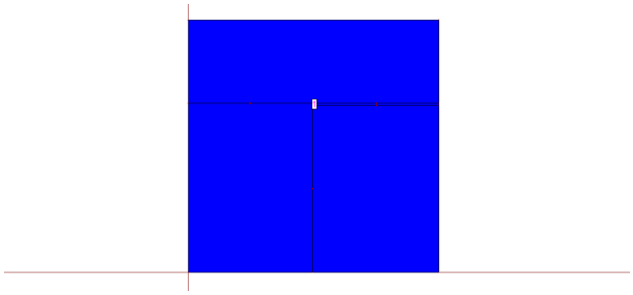

Figure (1): No slot loaded square shaped Micro-strip Patch Antenna

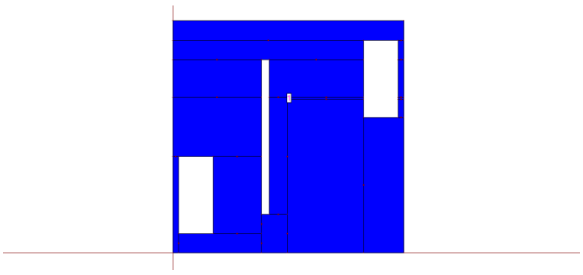

Figure (2): Proposed Three Rectangular Slot Loaded square shaped Micro-strip Patch Antenna

3. ANTENNA RESULT
IE3D software is used for the simulation of micro-strip patch antenna. The change in return loss with respect to frequency of a square shaped patch antenna with a no slot loaded and three rectangular slots loaded is shown in figure(3) and figure(5) respectively. The return loss is defined as the ratio of the Fourier transform of the incident pulse and the reflected signal. It is an important parameter to reckon with [2]. The VSWR graph for a no slot loaded antenna and three rectangular slots loaded antenna is shown in figure (4) and figure (6) respectively. The VSWR indicates the mismatch between the antenna and the transmission line . For perfect matching the Voltage Standing Wave Ratio value should be close to unity. The simulation impedance bandwidth for the

no slot loaded square shaped patch micro-strip patch antenna as shown in fig. (1) is 0.02 GHz and the best return loss (S11) is -12.46 dB at 2.32 GHz. The bandwidth is calculated at the frequency range where the return loss is approximately below the -10dB. Whereas the simulation impedance bandwidth for the proposed rectangular slot loaded octagonal micro-strip patch antenna as shown in fig. (2) is 0.04 GHz and the best return loss (S11) is -24.48 dB at 2.32 GHz .

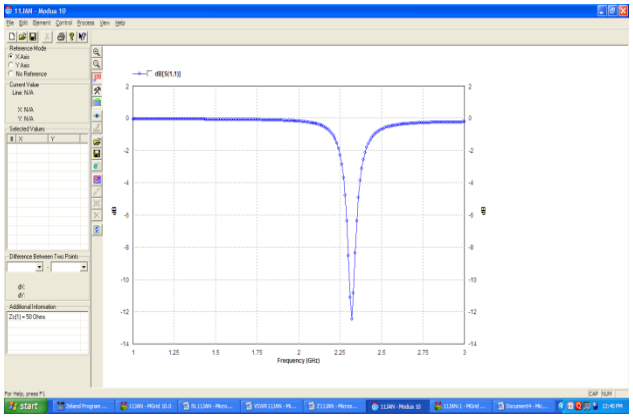

Figure (3): Return loss of the No slot loaded square shaped Micro-strip Patch Antenna

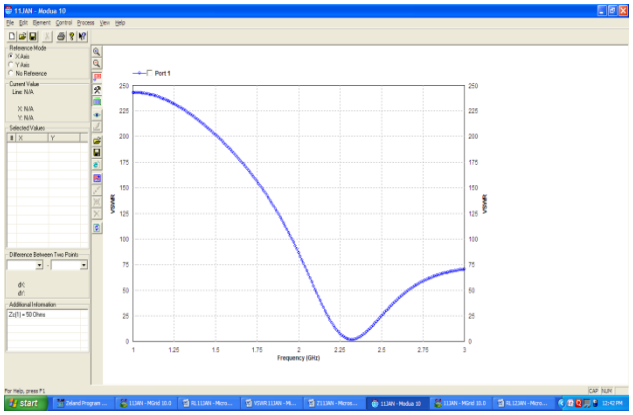

Figure (4); VSWR of the No slot loaded square shaped Micro-strip Patch Antenna

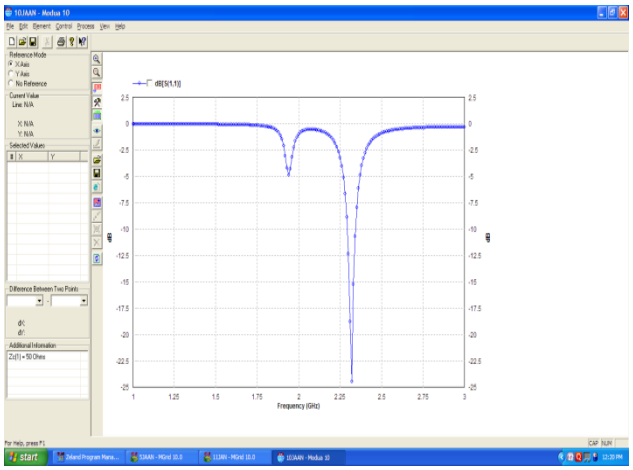

Figure (5): Return loss of proposed Three Rectangular Slot Loaded square shaped Micro-strip Patch Antenna

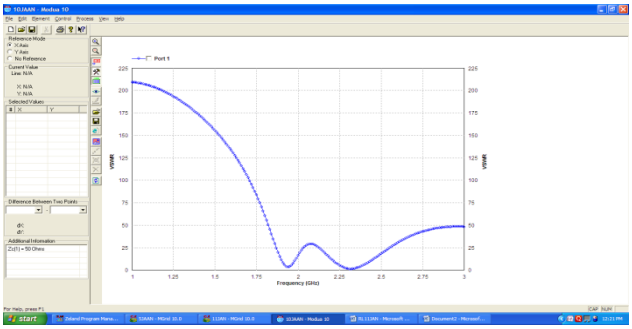

Figure (6): VSWR of the proposed Three Rectangular Slot Loaded square shaped Micro-strip Patch Antenna

4. COMPARISON

The table 1 shows the comparison between the no slot loaded square shaped micro-strip patch antenna and the three rectangular slot loaded square shaped patch micro-strip patch antenna.

Table 1

S.No.	Antenna	Best Return Loss(S_{11})	Best VSWR	Bandwidth (GHz)
1	No slot loaded micro-strip patch antenna	-12.46 dB	1.62	0.02
2	Three Rectangular slot loaded micro-strip patch antenna	-24.48 dB	1.12	0.04

5. CONCLUSION

It is observed that a probe feed, slot loaded and no slot loaded antenna has been designed and compared. After comparison the slot loaded antenna gives better result as compared to the no slot loaded antenna as shown in table 1. The slotted antenna gives better return loss, VSWR and enhanced bandwidth as compared to no slot loaded antenna. Future scope is in configuring different antennas for improved related performance and manufacturing it which will be helpful in advanced analytical modeling of microstrip antennas.

6. REFERENCES

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