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Design and Comparison of Two X Slotted and One Wide Slot 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 two X shape slots and one wide slot at the surface of the square patch. Using proposed antenna design and probe feeding at proper position we will compare the resultant return loss, VSWR and impedance with the results of no slot loaded square shaped micro-strip patch antenna. We are using IE3D simulation software for designing and analysis. We have observed that using slotted patch antenna and using probe feed at proper location we can get better return loss, VSWR and impedance.

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]. Future trend in communication design is towards compact devices. Low cost of fabrication and low profile features attract 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. Since patch antennas can be directly printed onto a circuit board, these are becoming increasingly popular within the mobile phone market. They are low cost, have a low profile and are easily fabricated. One of the key drawbacks of such device is their narrow bandwidth [2]. Micro-strip patch antenna is widely considered to be suitable for many wireless applications, even though it usually 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 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 two X shape slot and one wide slot in square shaped patch 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 two X shape and one wide slot is cut at the surface of the square patch. The dimensions of the patch are 30x30 mm. The antenna is fabricated on a substrate of dielectric constant 4.4 and thickness h=1.6mm. The probe feeding is used for optimum results.

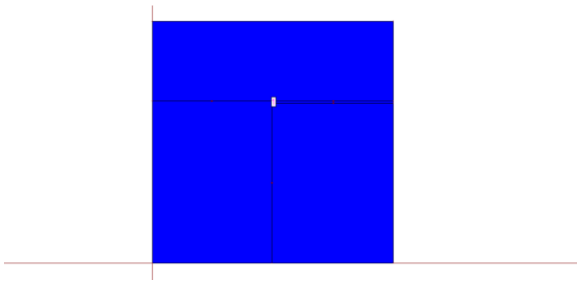

Figure (1): No slot loaded square shaped Micro-strip Patch Antenna

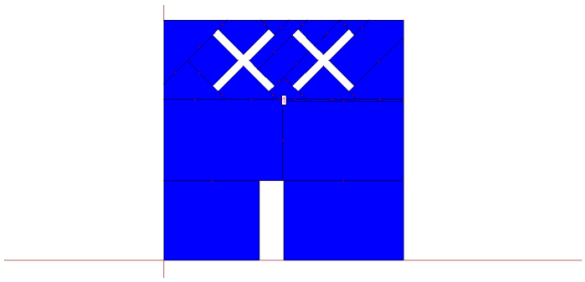

Figure (2): two X shape slot and one wide slot Loaded square shaped Micro-strip Patch Antenna

3. ANTENNA RESULT

The simulation of micro-strip patch antenna is done by using IE3D simulation software. The variation of return loss with frequency of square shaped patch antenna with a no slot loaded and two X shape slot and one wide slot loaded is shown in figure(3) and figure(6) respectively. The return loss is defined as the ratio of the Fourier transform of the incident pulse and the reflected signal. It

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is an important parameter to reckon with [2]. The VSWR graph for a no slot loaded antenna and two X shape slot and one wide slot loaded antenna is shown in figure (4) and figure (7) respectively.

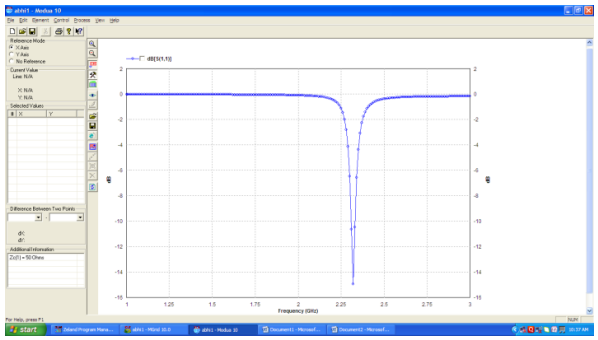

Figure (3): Return loss of the No slot loaded square shaped Micro-strip Patch Antenna

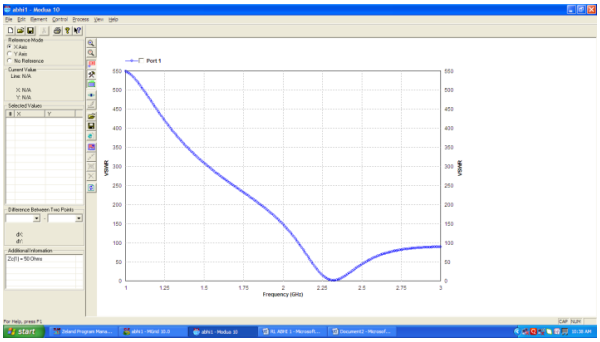

Figure (4); VSWR of the No slot loaded square shaped Micro-strip Patch Antenna

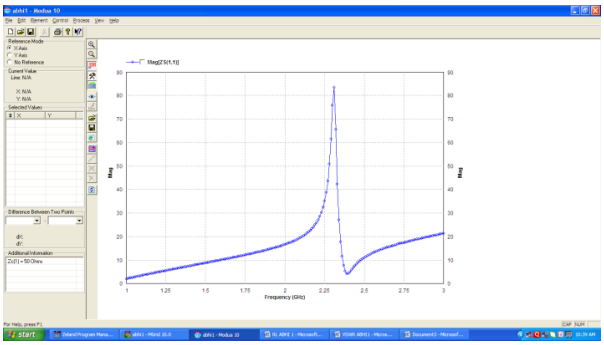

Figure (5); Impedance of the No slot loaded square shaped Micro-strip Patch Antenna

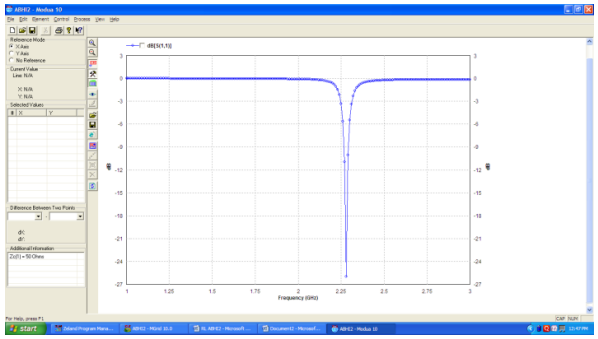

Figure (6): Return loss of proposed two X shape slot and one wide slot Loaded square shaped Micro-strip Patch Antenna

The VSWR indicates the mismatch between the antenna and the transmission line. For perfect matching the VSWR value should be close to unity. The impedance for the no slot loaded square shaped patch and two X shape slot and one wide slot Loaded micro-strip patch antenna is shown in fig. (5) and (8).

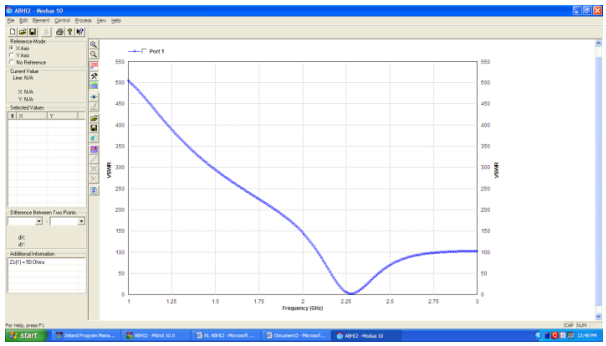

Figure (7): VSWR of the proposed two X shape slot and one wide slot Loaded square shaped Micro-strip Patch Antenna

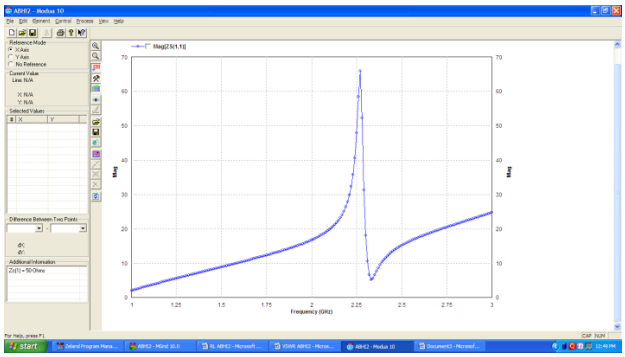

Figure (8); Impedance of the two X shape slot and one wide slot loaded square shaped Micro-strip Patch Antenna

4. COMPARISON

The table 1 shows the comparison between the no slot loaded square shaped micro-strip patch antenna and the two X shape slot and one wide slot loaded square shaped patch micro-strip patch antenna.

Table 1

S. No	Antenna	Best Return Loss(S_{11})	Best VSWR	Impedance(Ohm)
1	No slot loaded micro-strip patch antenna	-14.92 dB	1.43	65.50
2	Two X shape slot and one wide slot loaded micro-strip patch antenna	-25.95 dB	1.10	52.12

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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.

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