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Inverted E Slot Micro-strip Patch Antenna for Multiple Wireless Applications

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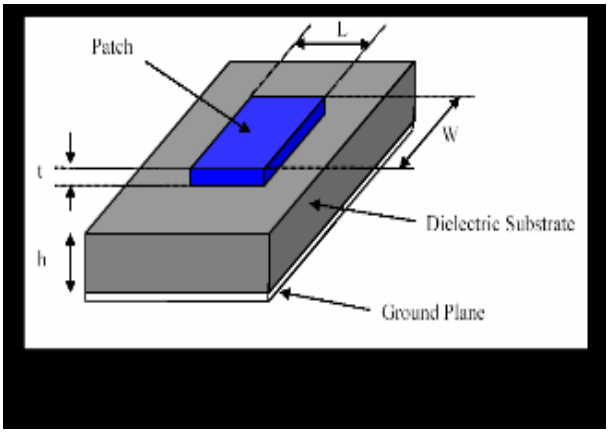
Abstract: In this paper multi band micro strip patch antenna has been design and analysis. Inverted E slots are introduced in rectangular geometry to enhance radiation. Micro-strip feed technique is used for this design. Four resonant frequencies generated. Slot in the rectangular patch increases the current length and discontinuity. This antenna is suitable for L & S band applications. The return loss is below −10 dB in quad band with considerable bandwidth. Resonant frequencies are 0.4GHz, 1.4GHz, 2.2GHz, 2.6GHz, and their respective return loss are -53dB, -35dB, -32dB, -28dB. The antenna is thin and compact which makes it portable. The VSWR parameter is found to be less than 2 within the operating frequency range. The antenna is designed and simulated on FR4 substrate with dielectric 4.4 and thickness of 1.6 mm. The design is analysed by FEKO software based on Method of Moment.

Keywords
Quad band antenna, Microstrip antenna, Slot antenna, Rectangular patch.

1. INTRODUCTION

Microstrip antennas are attractive due to their numerous advantages such as low cost, light weight, low profile planar configuration, and easy to manufacture. The micro strip patch antennas are very commonly used and preferred in this modern era for their compatibility to be fit in Mobile, Aircraft, and Satellites owing to very small sizes. Antennas is designed and fabricated in multi-rectangular slotted. It operates in L & S band (1 to 3 GHz). So it is suitable for radio telecommunications, Wi-Fi, cordless communications and radar.

The rapid advancement in the wireless communication field in the past few decades has led to the improvement of more efficient antenna design to be used for various cutting edge applications. Antenna is an important structure in any wireless communication system and good antenna design definitely improves the overall performance of the system. Most applications require low cost, minimum weight, low profile antennas that are capable of providing high performance over a large range of frequency. The continuous improvement in modern integrated circuit technology has made sure that the size and weight of wireless electronic system must keep on reducing. In order to work with miniature size electronic system, high performance antenna designs are the need of the time. All the above mentioned needs are best met by micro strip antennas. They are easily fabricated and are also easy to integrate into arrays or into microwave printed circuits. The design of high performance micro strip antenna has always been a challenge for the antenna designers Micro-strip patch antenna consists of a radiating patch which is generally made of conducting material such as gold or copper and can take any possible shape.
The radiating patch and the feed lines are usually photo etched on the dielectric substrate which has a ground plate as shown in Fig. 1.



As shown in Fig.1 three layers of patch radiating patch on the top, dielectric material in the middle and ground plane in the bottom.

2. ANTENNA DESIGN

The proposed antenna design is a rectangular slotted antenna as shown in Fig 2. The design is simple and the feed used is micro strip line. The dimensions of antenna are $40 \times 50 \times 1.6\ mm^3$used for the simulation. There are eight rectangular slots in this patch to increase the bandwidth.

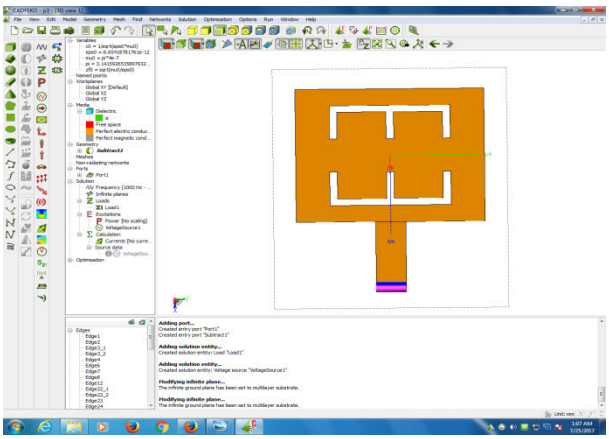


Fig.2

In the fig.2 first geometry with eight rectangular slots is introduced. The dimension of the antenna is 40*50, and dimensions of slot are 2*40.

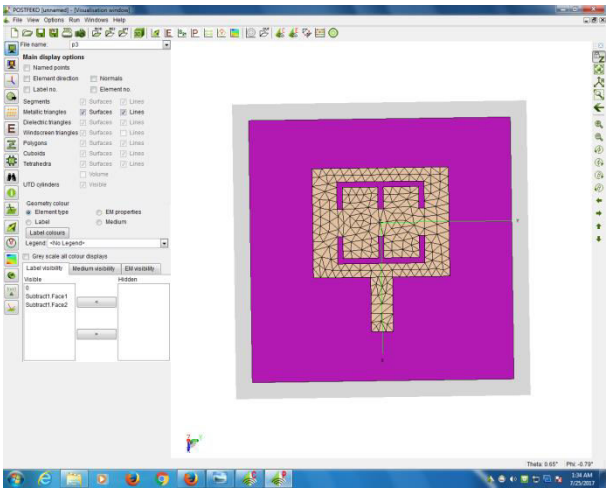


Fig.3

In the fig.3 show the meshing of the patch. The dimension of the antenna is 40*50, and dimensions of slot are 2*40.

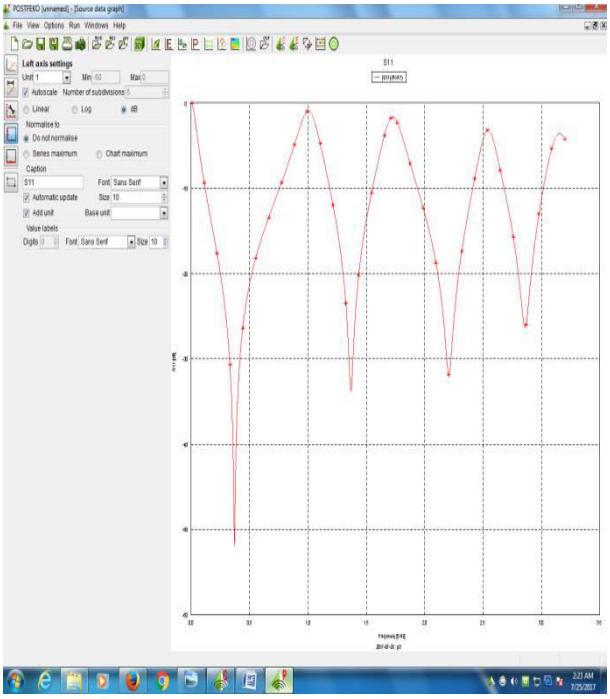


Fig.4

In the fig.4 return loss with respect to frequency is shown where antenna is resonating on five different frequencies which are exist in L & S band of IEEE standard.

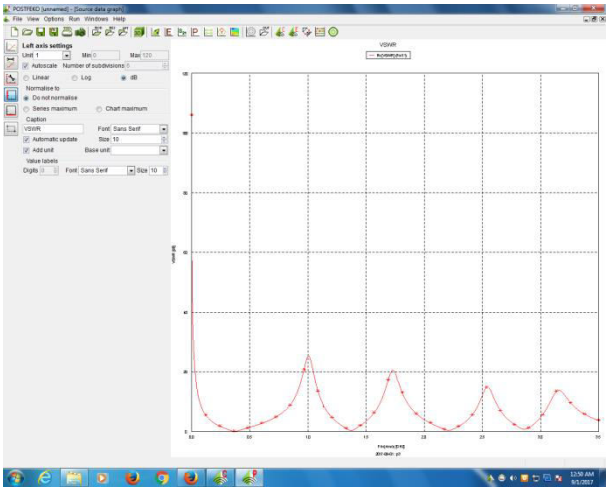


Fig.5

Table 1 Designed parameters of the proposed antenna

Frequency →	F1(0.4GHz)	F2(1.4GHz)	F3(2.2 GHz)	F4(2.6 GHz)
S11(RETURN LOSS)	-53	-35	-32	-28
VSWR	Less Than Two	Less Than Two	Less Than Two	Less Than Two

3. RESULT

In this project, FEKO simulation software has been used which work on method of moment generally called MOM. The S-parameter (return loss) of the proposed antenna is shown in the Fig. 4. It can be seen that resonant frequencies are 0.4GHz, 1.4GHz, 2.2GHz, and 2.6GHz. Their respective return loss is -53dB, -35dB, -32dB, -28dB. This is useful for most of the application like radio telecommunications, Wi-Fi, cordless communications and radar. The antenna is thin and compact which makes it portable. The VSWR parameter is found to be less than two for all frequencies.

4. CONCLUSION & FUTURE SCOPE

A Quad band eight rectangular slotted micro strip patch antenna is presented in this paper. Structure of this antenna is simple and compact size of $40 \times 50 \times 1.6\,mm^3$ which makes it easy to be incorporated in small devices. Results show that the frequency bandwidth covers C band like telecommunications, cordless telephones, some Wi-Fi devices, weather radar systems. The parameter like gain, directivity, VSWR, impedance bandwidth of antenna can be further improved. Antenna miniaturization can be possible by different technique. Multi layer dielectric may be used for bandwidth enhancement. Different combination of material can be used for substrate layer and modify thickness to increase the bandwidth of antenna. The antenna can also be manufactured for its result measurement and verification. Additionally, Defected ground structure is a new concept which has great scope in future development of micro-strip patch antenna. DGS is very easy to implement as it does not involve any complexity. The antenna array [8] can be designed for the further work.

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