International Journal of Research, Science, Technology & Management
e-ISSN: 2455-2240, Volume 8 Issue 3, September 2017

Tri-band inverted U slotted Patch Antenna for L & S band Application

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***Abstract*— In this paper tri-band microstrip patch antenna have been design and analysis. A multi U slot micro-strip feed antenna with three band is designed. Slot in the rectangular patch increases the current length and discontinuity. This antenna is suitable for Wi-max & WLAN applications. The return loss is below −10 dB in Tri-band with considerable bandwidth. Resonant frequencies are 1.4GHz, 3.2GHz, 4.5GHz, and their respective return loss is -14dB, -32dB, -20dB. 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 analyzed by FEKO software based on Method of Moment.**

***Index Terms* — Tri-band antenna, Micro strip, antenna, Slot antenna, Rectangular patch.**

INTRODUCTION

Micro strip antennas have been used in transmission and reception of electromagnetic signals for wireless communication, aviation, mobile, and astronautics etc as it has light weight, easy to manufacture and small volume. However, it has very small bandwidth that restricts the use of these antennas for wideband/broadband applications. Micro strip 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 U slotted. It operates in L band (1 to 2 GHz), S band (2 to 4GHz). which makes it suitable for wi-max, WLAN and other wireless communication applications.

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. 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.

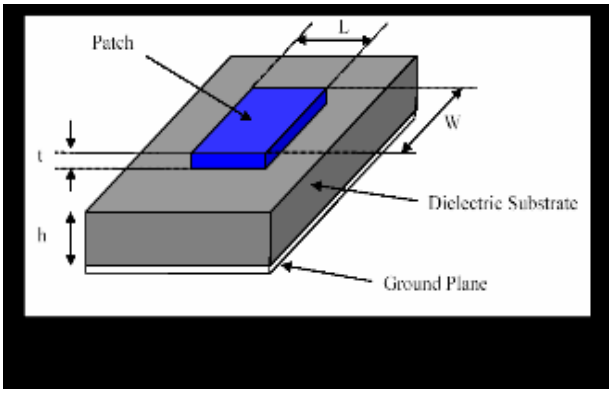

Fig.1 Basic Antenna Configuration

ANTENNA DESIGN AND CONFIGURATION

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

IJRSTM
ISSN ONLINE: 2455-2240
International Journal of Research, Science, Technology & Management
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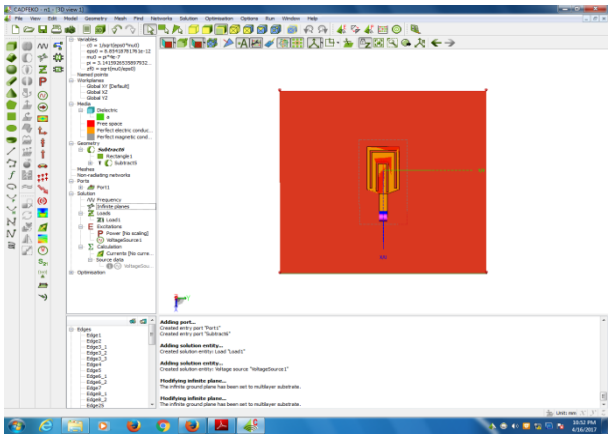

Fig. 2 Design of Antenna

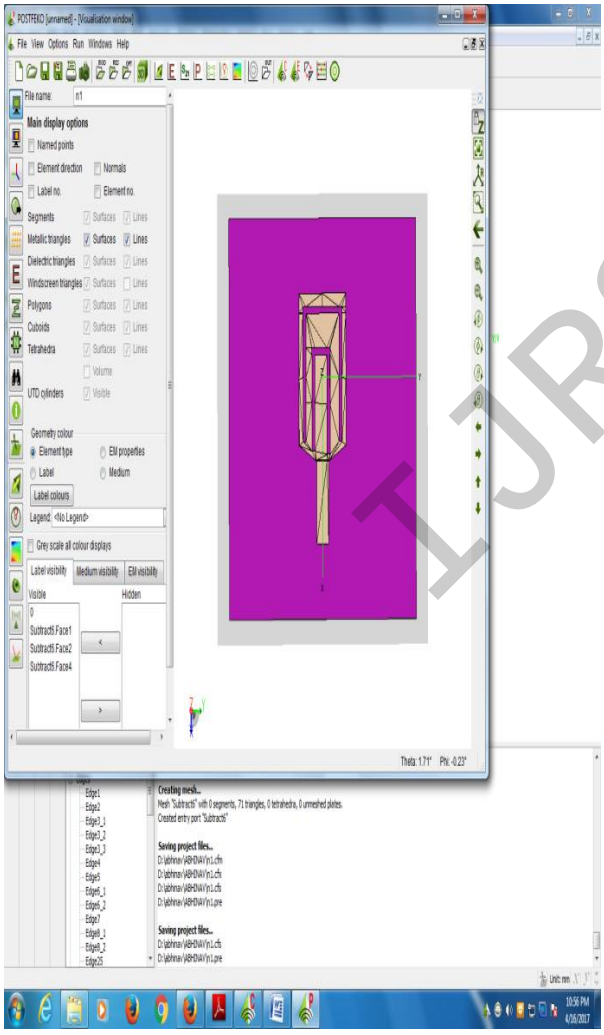

Fig. 3 Meshing of Patch in Antenna

In the fig.3 show the meshing of the patch. The dimension of the antenna is 40*50.

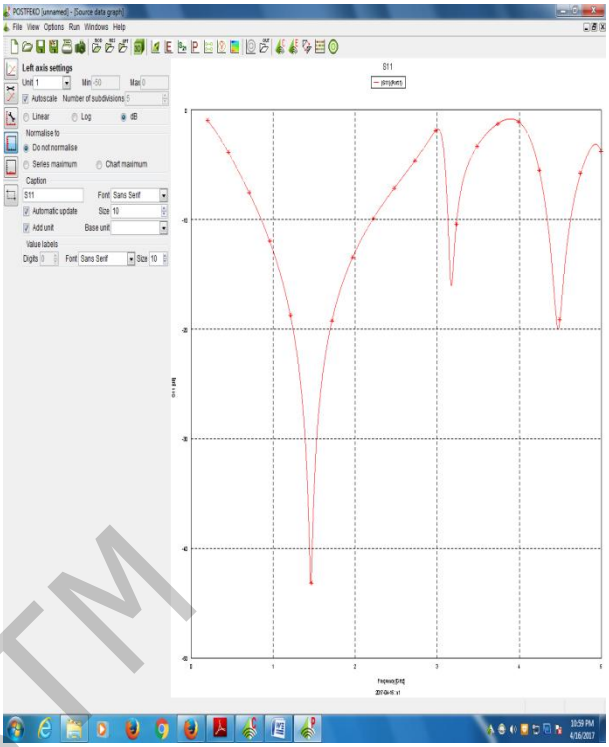

Fig. 4 Graph relating return loss & frequency

In the fig.4 return loss with respect to frequency is shown where antenna is resonating on three different frequencies which exist in L & S band of IEEE standard. On the first resonant frequency bandwidth is approximate 1.4GHz.

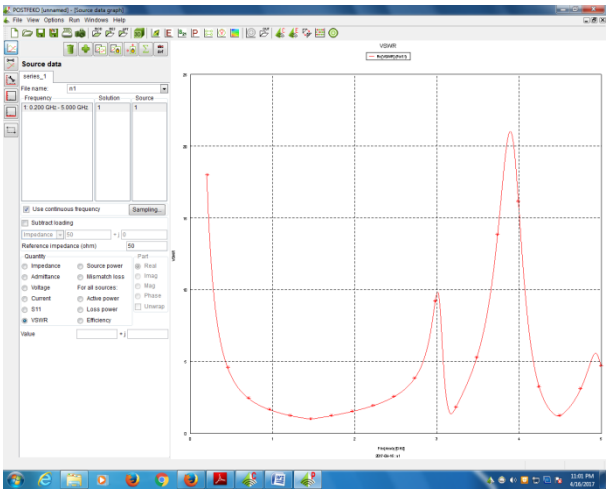

Fig. 5 Graph relating VSWR & frequency

In the fig.5 VSWR with respect to frequency is shown where antenna is resonating on five different frequencies at the same frequency the value of VSWR is less than unity which acceptable for antenna application.

TABLE I DESIGNED PARAMETERS OF THE PROPOSED ANTENNA

Parameter → / Frequency ↓	Return loss S11	VSWR	Band Width
F1(1.4GHz)	-44dB	1.5	1.4GHz
F2(3.2GHz)	-16dB	1.6	300MHz
F3(4.5GHz)	-20dB	1.6	400MHz

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 1.4GHz, 3.2GHz, 4.5GHz, and their respective return loss are -44dB, -16dB, -20dB. This is useful for most of the application like radio telecommunications, Wi-Fi, cordless communications. The antenna is thin and compact which makes it portable. The VSWR parameter is found to be 1.5, 1.6, and 1.6, for respective frequencies.

CONCLUSION & FUTURE SCOPE

A Tri-band U slotted rectangular 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 L & S 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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