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# Implementation of Engraved Micro-Strip Antenna

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**ABSTRACT**
This paper asserts the study of a square shaped micro-strip patch antenna with Ultra-wideband characteristics. The antenna is composed of micro-strip line fed tosquare patch and lopsided shaped substrate. Various dielectric substrates are examined for the better performance and eventually used FR4-lossy as a substrate. Gain parameter, far-field radiation patterns and Voltage Standing Wave Ratio values are calculated and graphically represented at frequencies 3 GHz and 10 GHz respectively. It is shown that proposed antenna with escalated dimensions and copper as dielectric substrate has very low Return losses and high gain parameter for a Impedance bandwidth of 3 to 10 GHz at VSWR=1 in CST Microwave studio 2014.
**Keywords:** Far-field patterns, Gain parameter, patch antenna, Ultrawide-band, VSWR.

## I. INTRODUCTION

Engraved patch antennas(also called as Micro-Strip antenna)composed of a metal facet, conventionally a plane plate, with a groove clipped out. The groove radiates EM waves similar to that of a dipole antenna when a plate is driven as an antenna with certain driving frequency. Radiation pattern distribution is determined by shape, size of the groove, driving frequency. Radio waves are often furnished by a waveguide and the slots in the waveguide are responsible for radiation by an antenna. Often, Patch antennas are preferred at Ultra High Frequencies and microwave frequencies to that of line antennas because radiation pattern can be more easily controlled. Sector antennas are used for cell phone base stations whereas Patch antennas are extensively utilized in Radar antennas, Often, they are found in standard microwave sources used for research designs.

A groove antenna's main advantages are its size, design lucidity, durability, and appropriate modification to an assembled production using PC board technology.

In this paper, the presented Ultra Wide Band grooved antenna is fed by micro-strip line. The firm coupling between the slot and the feed line are enhanced by the shape of the lopsided substrate. The square patch is established to minimize the return losses of the patch antenna.[1]

Furthermore, to broaden the operating bandwidth of antenna and to exhibit nearly omnidirectional radiation pattern, the square patch and the substrate shape is varied. All the simulations are performed by using CST Microwave studio 2014.

## II. ANTENNA GEOMETRY

The propounded compact micro-strip patch antenna is illustrated in Fig-1. For the micro-strip patch antenna, the slot and the feeding line are printed on distinct sides of the dielectric substrate. The patch is etched on the substrate with thickness of 2.6mm and a relative dielectric constant 4.5. The antenna patch consists of two sections: The outer quadrilateral and the inner quadrilateral. Apart from these, there is a feedline which is printed on dielectric substrate which is gradually narrowed.[2]

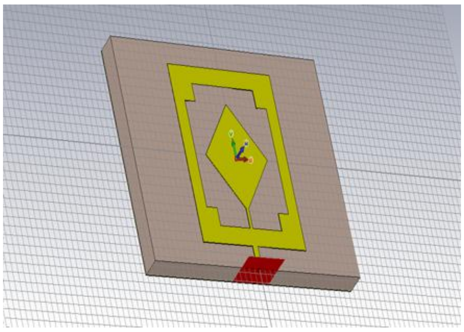

**Fig-1** Micro-Strip patch antenna

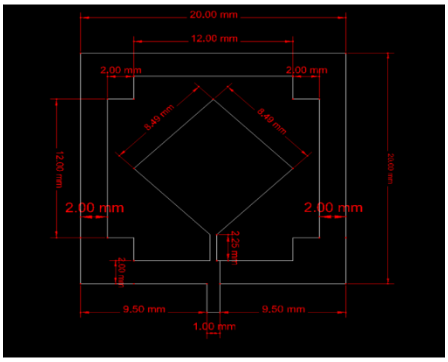


**Fig-2** Antenna Measurements

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## III. PERFORMANCE CHARACTERISTICS OF MICROSTRIP PATCH ANTENNA

In this section Return loss, radiation patterns, current distributions, VSWR of proposed micro-strip slot antenna are discussed. The antenna has dimensions of 40*25*2.8 mm is quite small when compared to many ultra-wide band antenna. Epoxy resin, FR4, glass, Rogers RO3003, Rogers RT5880, Rogers RT4350 are different substrates that can be used to examine their performance characteristics individually. Fig-1 shows us the frontal view of the micro-strip antenna which is designed and tested in Microwave studio 2014. The performances and characteristics of antenna have been investigated by carrying out transient analysis and the results are discussed.[3][4]

### 3.1 Volatge Standing Wave Ratio

The ratio of the maximum voltages to that of minimum voltages in the transmission line is called Voltage Standing Wave Ratio (VSWR). It measures how accurately the load impedance is matched to a source. The value of VSWR is always expressed as a ratio with 1 in the denominator (2:1, 3:1, 10:1 etc.). By measuring VSWR, radiated power over certain frequency ranges is used as a technique for determining the bandwidth of an antenna under some consideration. A "standing-wave" pattern is formedwhen EM waves propagates inside a transmission line. In telecommunications, the ratio of amplitude of a partial standing wave at antinodes to the amplitude at a node, in an electrical transmission line is called SWR. Fig-2 shows the simulated VSWR plots of elliptical slot antenna. In this figure we can see the VSWR plot with FR-4 lossy as the dielectric material. It can be observed that VSWR plot with FR-4 lossy assubstrate gives us the maximum value of VSWR=1 at 5.94GHz frequency.[5]

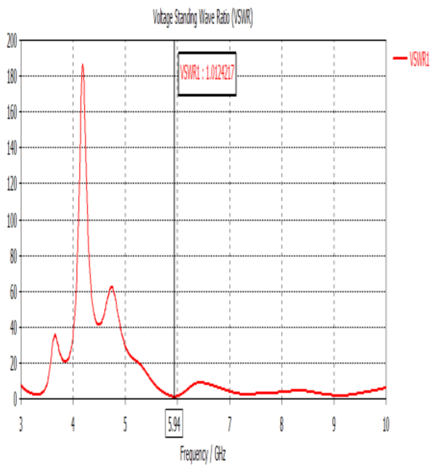


**Fig-3** VSWR Plot

### 3.2 Radiation Patterns

Antenna characteristics can be successfully measured on either a near-field or far-field range with appropriate implementation. There are significant cost, size, and complexity details which will lead to a recommendation of one type over the other. In this section far-field patterns of micro-strip patch antenna substrate are studied.

The E-plane pattern is monopole like, and the number of lobes rises with the increase of frequency which means the antenna gets more directional. The E-plane determines the polarization of the radio wave. For vertically and horizontally polarized antennas E-plane coincides with elevation and azimuth planes respectively. H-plane contains magnetic field vector and direction of maximum radiation. For verticallyand horizontally polarized antennas H-plane coincides with azimuth and elevation planes respectively. The H-plane pattern is nearly omnidirectional at lower frequency and at higher frequency. Furthermore, there may be asymmetry at higher frequency due to radiating elements in the structure of antenna. Far field radiation patterns of micro-strip patch antenna for substrate: FR-4 lossy is examined as they have better return loss curves than the antenna designed using other substrates. Fig-3 shows the far field radiation patterns of micro-strip patch antenna with FR-4 lossy substrate.[6][7]

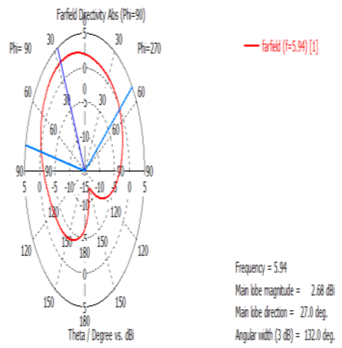


**Fig-4** Far-Field pattern

### 3.3 Gain Parameter

The term gain in antenna representspower gain which is defined as the ratio of radiation intensity from a far field source of given antenna's beam axis to the isotropic antenna. As a transmitting antenna, the gain describes how well the antenna converts input power into radio waves headed in a specified direction. As a receiving antenna, the gain describes how well the antenna receives and converts radio waves arriving from a specified direction into electrical power. When no direction is specified, "gain" is understood to refer to the peak value of the gain. A plot of the gain as a function of direction is called the radiation pattern. Usually this ratio is expressed in decibels, and these units are referred to as "*decibels-isotropic*" (dBi).[9][10]

$G_{dB}$= 10.$\log_{10}$(G).

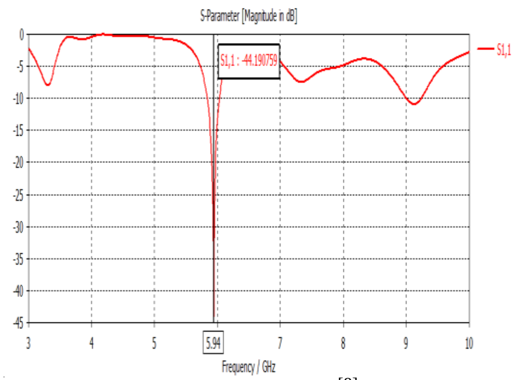


**Fig-5** Gain plot[8]

In fig-5 we can observe that the gain of the microstrippatch antenna is -44.190 at a frequency of 5.94GHz at which the VSWR=1.

## IV. CONCLUSION

It has been displayed that ultra wide-band characteristics have been attained for printed compact micro-strip patch antenna using microstrip feed line with lopsided patch. Different dielectric substrates can be examined for best antenna performance and characteristics. It is found that the most suitable dielectric substrate observed for the proposed design is FR-4 lossy. The lopsided patch and slot dimensions thickness of substrate 2.6mm is the most important design parameters that determine the characteristics of antenna. Simulatedresults have confirmed UWB characteristics of the proposed antennas as well as closely omnidirectional radiation properties over a majority of the operating bandwidth. These characteristics and their minute sizes make these antennas more attractive for unlimited illimitable UWB applications.

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