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Comparative Analysis of E–Shape and H-Shape Microstrip Slotted Antenna on the Basis of Return Loss and Bandwidth

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Abstract **-Micro-strip patch antenna is more popular as compared to other antennas and widely used today in modern wireless communication system because of its elegant weight, low fabrication price, easy to feed, ease to fabricate, easy to analyze, and attractive radiation characteristics. Though patch antenna has several advantages but has some disadvantages as well, like limited bandwidth and low gain. In last few years, Different techniques such as Electromagnetic Band Gap (EBG) structure, artificial magnetic conductor (AMC)/ and modifying the structure of microstrip patch antenna are used to overcome the above mentioned limitations. In this paper, we propose two different geometry shape antennas i.e. E and H-shaped which is developed from the rectangular patch and compare the performance of the proposed antennas on the basis of gain and Bandwidth with the same physical dimensions. The CST Micro studio simulator is used to study the antennas. Bandwidth and Return loss of E-shaped Antenna is much better than that of H-shaped antenna. The results obtained clearly demonstrations that, the implementation of the E-Shape is much better in term of bandwidth and return loss compared to the H-shaped patch antenna. So it's better to use E-shaped antenna for modern wireless communication system.**

Keywords: Microstrip patch antenna, E-Shape, H-shape, Bandwidth, Wireless communication system.

I. Introduction

Microstrip antenna is a significant Element in mostly every wireless communication and global positing system (GPS) since it was first explaining by Heinrich Hertz in 1886 and in 1901 Gulielmo Marconi demonstrate its practical application [1]. Further scientists are more interested in compact design of antenna for communication systems. In last few years, microstrip antennas have caught the attention of researchers for their application in mobile communication, satellite communication,

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and wireless communication systems because of their compact elegant weight, size, and easygoing fabrication characteristics.

Microstrip antenna is utmost shared option used to understand millimeter wave monolithic integrated circuits for radar, microwave and communication purposes [2]. The fundamental Alignment of a microstrip antenna is a metallic piece printed on thin, grounded dielectric substrate [1]. Initially, the element was fed with a coaxial line over the base of the substrate, or by a coplanar microstrip line, let feed network and other circuitry to be fabricated in the same configuration as the antenna element. The microstrip antenna emitted microwaves in a comparatively broad beam broadside of to the plane of the substrate, therefore the microstrip antenna has a very low profile, and can be fabricated using printed circuit procedure [3].

The frequency of the patch antenna at which it will operate is determined by the length L of patch. The center frequency will be approximately given by According to the above equation the patch antenna should have a length equal to one half (1/2) of a wavelength within the dielectric (substrate) medium [4].

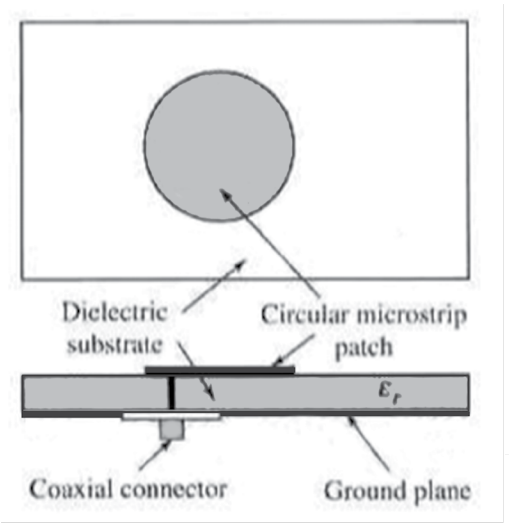
$$f_c \approx \frac{c}{2L\sqrt{\varepsilon_r}} = \frac{1}{2L\sqrt{\varepsilon_0\ \varepsilon_r\ \mu_0}} \quad (1)$$

II. Literature Survey

Basically, Microstrip patch antenna comprises two type of radiating patches i.e. Rectangular or circular, these patches are made up of substrate on one side and ground plane on the other side [1]. Micro strip Patch antennas have a significant role in the field of wireless communication. Usually microstrip fabrication technique is used for the construction of a microstrip patch antenna as this method is the simplest one.

The patch is made of mostly of copper which work as conducting material and can modify to any shape as shown in Figure 1 (a, b). The microstrip patch is usually triangular, circular, elliptical, square and rectangular or in some other shapes like diamond as well [4-7].

The rectangular Microstrip patch antenna is generally used for all the kinds of Microstrip antennas. It's easy to fabricate, tough design is easy to handle. When source signal is applied to Microstrip patch antenna at patch, the electromagnetic waves will be emitted. This patch is a strip of length L and width W on a dielectric substrate with constant εr, height of the patch is denoted by h and thickness is represented by t is sustained by a ground plane.



a) Circular Micro Strip Antenna b) Rectangular Micro Strip Antenna

Figure 1. Different geometry of micro strip antenna

A. Methods to analyze performance of microstrip antenna

There are few different methods to analyze the performance of microstrip antenna the most popular parameters are:

1) Return loss

2) Bandwidth

3) Far field radiation (Directivity and Gain)

1. RETURN LOSS:

First parameter is return loss. Basically, it is a logarithmic ratio measured in dB which matches the power reflected by the antenna to the power that is fed into the antenna through the transmission line. Voltage standing wave ratio (VSWR) is a way to measure transmission line imperfections. Return loss is calculated at -10dB [1] as shown in Figure 2.

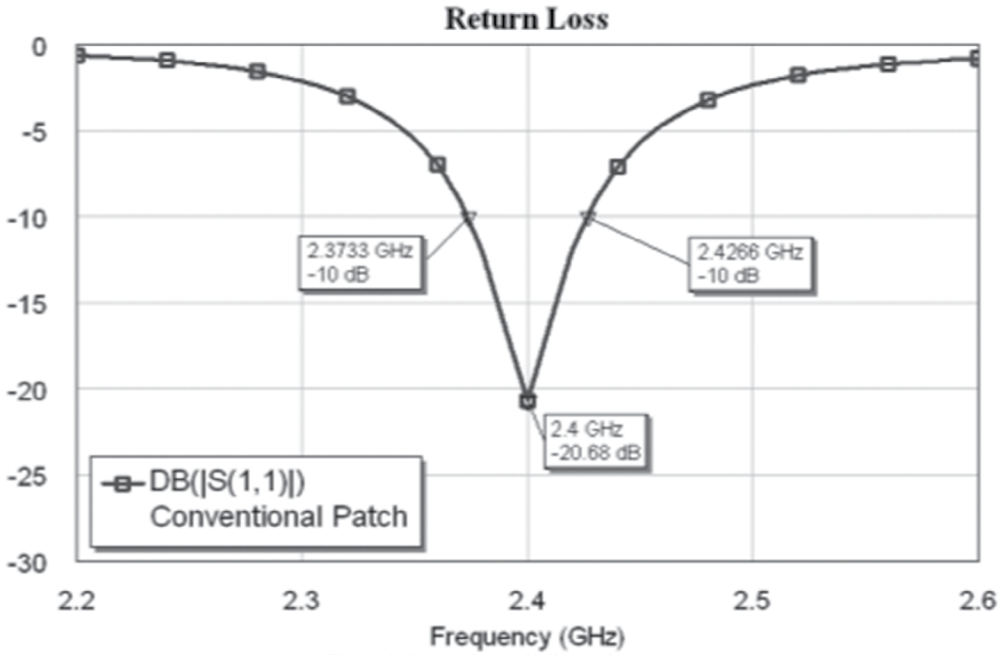


Figure 2: Return loss of Microstrip antenna

2. BANDWIDTH:

One of the limitations of the microstrip antenna is its narrow bandwidth. The bandwidth can be defined in terms of its VSWR, for circularly polarized antenna, bandwidth is expressed in terms of Axial Ratio. Bandwidth is defining inform of percentage [3].

3. FAR FIELD RADIATION (DIRECTIVITY AND GAIN):

Far field radiation parameters are mostly Gain and directivity

3.1. Gain

Antenna gain is a degree of how much more power an antenna under test (AUT) will emit in a specific direction regarding that of a dipole antenna or isotropic Emitter (dBi) [1].

3.2. Directivity

Directivity is an amount of how 'Specific' an antenna's radiation pattern is. Directivity is the gain measured supposing an isotropic antenna. Actual antennas have losses, and gain is just the directivity multiplied by the proficiency of the antenna [1].

III. Problem Statement

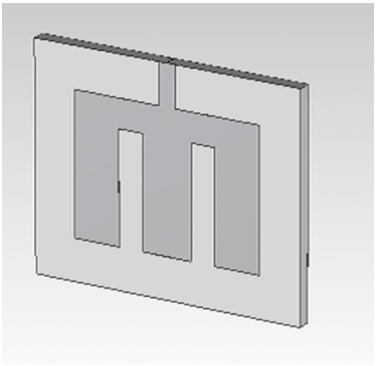
In general, Microstrip antennas resonate effectively at a specific frequency related to their major mode and having normally narrow bandwidth (1-2%) and low Directivity as well. Because of these drawbacks in conventional form of microstrip antennas fail to find much Attention in modern wireless communication [3].

Wireless communication system which must be capable of operating at two different or more frequencies at a time and must present broadband performance [6], considering this requirement, conventionally printed circuit antenna fail to serve their purpose in wireless communications system and therefore modifications in conventional microstrip antenna geometry is recommended [1] like Compact Arrays antenna [8] A Microstrip Slotted Patch Antenna Using Artificial magnetic conductor (AMC) [9-14].

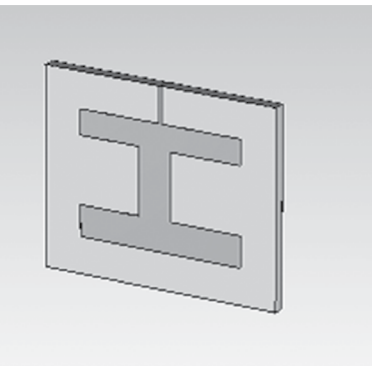
Because of its low profile structure, Microstrip patch Antennas have a number of advantages However, narrow bandwidth has been the main disadvantage for this antennas. There is numerous technique which has been applied by different researcher to overcome narrow bandwidth issues, i.e. indulging parasitic elements, rising the substrate thickness, stacking configuration, introducing ring in patches or modifying the patch shape includes designing an E shaped-shaped and H-shaped antenna [1,3,5]. It has been discovered that H-slot microstrip antenna offers bandwidth up to 30% while E shaped patch antenna can raise bandwidth above 30%. In this paper, we will compare the performance of E & H Shaped slotted antenna structure on the basis of above mention parameters.

IV. Proposed Model and Design

In this design, we will study two different geometry shapes H and E slotted antenna as shown in Fig 3(a, b). The two proposed antennas are simulated using the CST STUDIO SUITE, and results matched with each other, and the shape with improved bandwidth will be adopted and implemented.



a) E-shaped slotted antenna



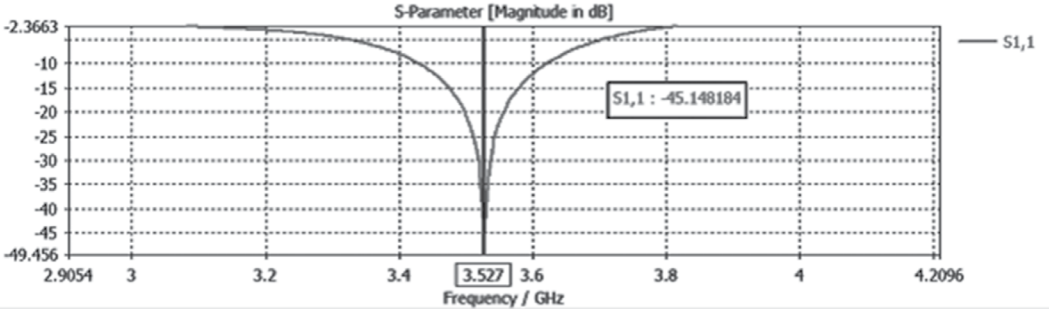
b) H-shaped slotted antenna

Figure 3: E and H shaped microstrip antenna

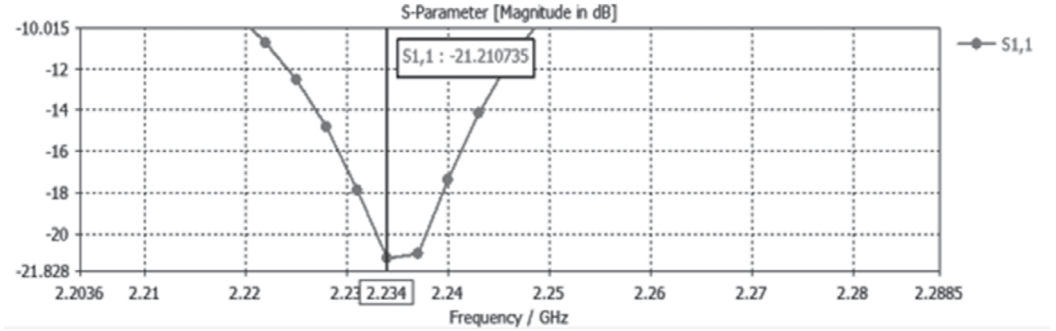
V. Results and Discussion

Figure 3 shows the geometry of E and H shaped microstrip antenna, in Fig 4(a, b) it is shown that E and H designed slotted micro strips are resonated at frequency of 3.527Ghz and 2.234Ghz Respectively.

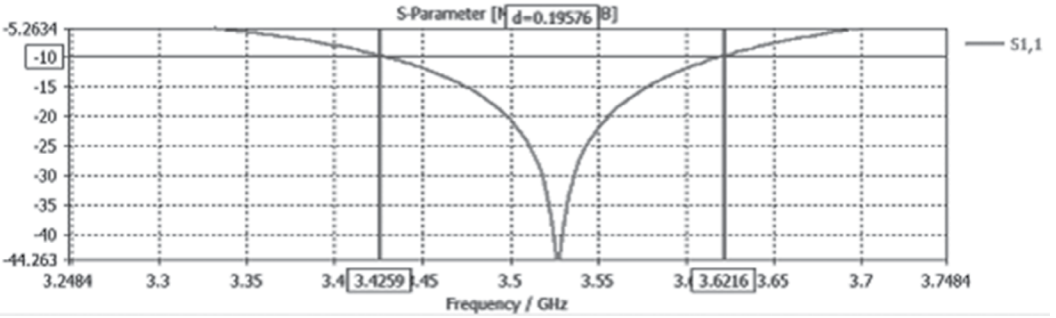
Figure 4 (a, b) shows the return loss of E shaped antenna which is -45.14dB while on the other side H- shape antenna has -21.21dB return loss, if we check out the most important parameter, bandwidth of both antenna, it is clear from the table1 that E shape antenna is far better than H- shape patch antenna, which is 5.55% and 1.27% respectively, Figure 4 (c, d).



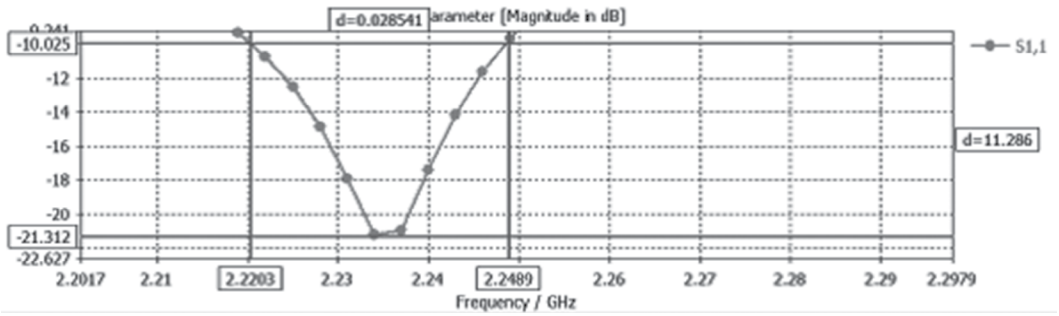
a) Return loss E shaped antenna



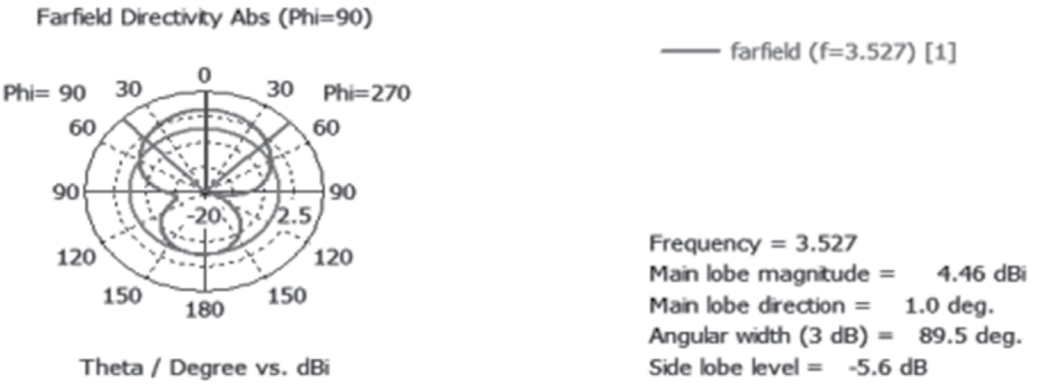
b) Return loss H shaped antenna



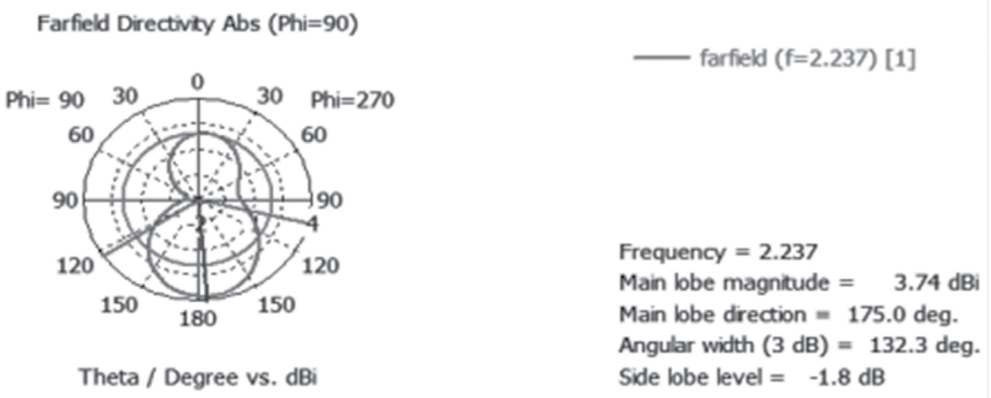
c) Bandwidth of E-shaped antenna



d) Bandwidth of E-shaped antenna



e) Directivity of E-shape antenna



f) Directivity of E-shape antenna

Figure 4 Analysis of different parameters of E and H Shape Antenna

TABLE 1
COMPRESSION ON DATA OF E AND H SHAPED ANTENNA

S/N	Type	Return loss	Bandwidth	Directivity
1	E-shape	-45.14dB	5.55%	4.46dBi
2	H-shape	-21.21 dB	1.27%	3.71dBi

VI. CONCLUSION

In this paper, the aim was to judge the performance of two antennas having different geometry. We have selected two different patch antennas and the simulated results compare with each other. The results obtained clearly shows in table 1 that bandwidth of E-shaped slotted antenna has higher than that of H-shaped patch antenna. We have observed that E-shaped patch antenna has highest Return loss as well. The reported results indicate that the proposed antenna geometry (E-shaped) Full fill all the requirement for an antenna used for wireless communication systems.

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