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Effect of Feed Position for Same E-Type Microstrip Patch Antenna

Ms. Pragate Tomar, Dr. Javed Khan Bhutto
And Mr. Sandeep rankawat

M.Tech. Scholar, Rajasthan Technical University, Kota
Professor, Marudhar Engg. College, Bikaner
Assistant Professor Engineering College, Bikaner

ABSTRACT

This paper presents the design simulation and comparative analysis on a of E-shape microstrip patch antenna with wideband operating frequency for wireless application. The shape will provide the broad bandwidth which is required in various applications like remote sensing, biomedical application, mobile radio, satellite communication etc. The antenna design is an improvement from previous research and it is simulated using HFSS (High Frequency Structure Simulator) version 13.0 software. Direct microstrip line feed provided at different places are integrated in E-shape microstrip patch antenna. In this paper we compare the feeding techniques and we should prove that the feeding given at back side of patch, is provide better gain comparative than feeding provided at front side microstrip line feeding. Parametric study was included to determine affect of design towards the antenna performance. The performance of the designed antenna was analyzed in term of bandwidth, gain, return loss, VSWR, and radiation pattern.

General Terms: VSWR, Return loss, Radiation pattern,

Keywords: Single Band E-Shaped, Microstrip Line feed, Microstrip Patch Antenna, HFSS tool.

1. INTRODUCTION

Due to their many attractive features, microstrip antenna has drawn the attention of researchers over the past work [1-3]. Microstrip antennas are used in an increasing number of applications, ranging from biomedical diagnosis to wireless communications [4]. These wide ranges of applications, coupled with the fact that microstrip patch structures are relatively easy to manufacture, have turned microstrip analysis into a widespread research problem. Research on microstrip antenna in the

21st century aims at size reduction, increasing gain, wide bandwidth, multiple functionality and system-level integration. Significant research work has been reported on increasing the gain and bandwidth of microstrip antennas[5-6]. In this paper, an attempt has been made to design a single band microstrip antenna without any geometrical complexities.

With the wide spread propagation of wireless communication technology in recent years, the demand for compact, low profile and broadband antennas has increased significantly. To meet the requirement, the microstrip patch antenna have been proposed because of its low profile, light weight and low cost. However, the microstrip antenna inherently has a low gain and a narrow bandwidth. To overcome its inherent limitation of narrow impedance bandwidth and low gain, many techniques have been suggested e.g., for probe fed stacked antenna, microstrip patch antennas on electrically thick substrate, slotted patch antenna and stacked shorted patches have been proposed and investigated [2].

There are numerous and well-known methods to increase the gain of antennas, including decrease of the substrate thickness, feeding techniques and with the use of different optimization techniques [7-8].

In this research work, a comparative study of antenna feeding is to be placed at different side of patch for same type of microstrip line feeding. There are many other types of feeding used but they are so complex, e.g. aperture coupled feeding, L-probe feeding, non contact feeding, which are used to enhance the bandwidth.

The remaining paper is organized as follows: section 2 gives some information about microstrip line feeding. Section3 includes design analysis of single band E Shaped microstrip patch geometry at different feed position. Section 4 gives the results(antenna parameters) of different feed position at similar E-shaped patch. Section 5 gives comparative analysis of effect of feed position over the microstrip line feed antenna with its results. Section 6 gives conclusion and references respectively.

2. Microstrip line feeding

Microstrip line feed is one of the easier methods to fabricate as it is a just conducting strip connecting to the patch and therefore can be consider as extension of patch as shown in Fig1. [6]

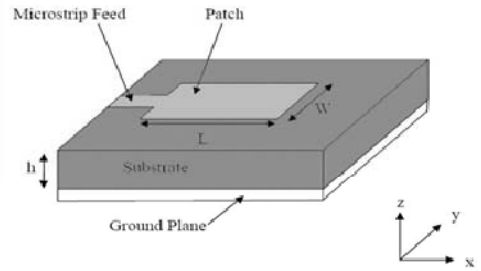

Fig 1: Rectangular Microstrip patch antenna with Microstrip Line feeding.

The width of conducting strip is small as compared to the patch and this kind of feed arrangement has the advantage that the feed can be etched on the same substrate

to provide a planar structure. Hence this is an easy feeding scheme because it provides ease of fabrication and simplicity in modeling as well as impedance matching. However as the thickness of the dielectric substrate being increases, surface waves and spurious feed radiations are also increases, which hamper the bandwidth of the antenna.

3.E-Shaped microstrip patch antenna at different feed position

Table 3.1: Geometry of the proposed antenna Categories of applications

Parameter	Label	Dimension (mm)
Patch	Width	15.7
	Length	10.9
Slot	Slot Length	1.0
	Slot Width	8.4
Centre Arm	Width	5.2
Ground	Width	60
	Length	60
FeedPosition: 1 (In Front Of Patch)	Width	1
	Length	26.1
FeedPosition: 2 (Back side Of Patch)	Width	1
	Length	25

We call it E-shaped microstrip patch Antenna because there are two rectangular slots in the patch which makes an E shape in the patch. E-shaped patch antenna can increases bandwidth above 30% compared to a regular rectangular patch antenna. Comparing both designs, the E-shaped is much simpler to construct by only adjusting length, width and position of slots.[9]

Firstly we consider a rectangular patch antenna, than for improving antenna parameters, slots are taken into the patch. The E-shaped microstrip patch Antenna is also designed on the basics of microstrip technology.[9]

4. DIFFERENT FEED POSITION OF SIMILAR E-SHAPED MICROSTRIP PATCH ANTENNA

4.1FEED POSITION FIRST:(IN FRONT OF PATCH)

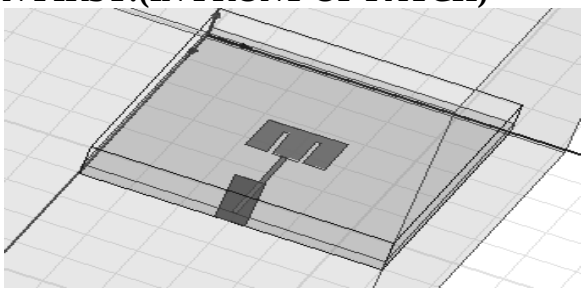

Fig 3: Geometry of Proposed Antenna using Stripline feed in front of E-Shaped patch

4.1.1 Return Loss

Figure 4 shows the S11 parameters (return loss) for the proposed antenna. The designed antenna resonates at 4.6644 GHz. The return loss at 4.66 GHz frequency is -35.93 dB

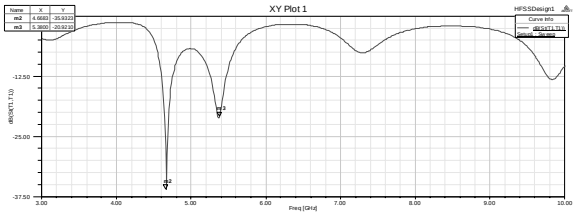

Figure 4: Return Loss of Stripline feed antenna (S11 in dB)

4.1.2 Bandwidth of Proposed antenna

The bandwidth of the antenna bandwidth of antenna can be calculated from return loss versus frequency plot. The bandwidth of the proposed patch antenna is 13.8 MHz is shown in Figure 4.

4.1.3 Voltage Standing Wave Ratio (VSWR)

The VSWR plot for Stripline feed antenna is shown in Figure 5. The value for VSWR is 1.0055. which has been achieved for the frequency 4.664 GHz

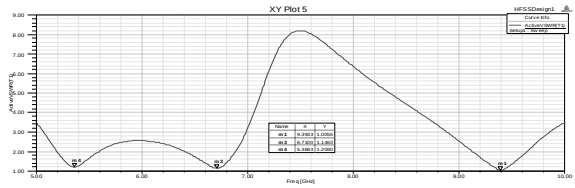

Fig.5: VSWR versus Frequency Plot of Stripline feed antenna

4.1.4 Radiation pattern of proposed antenna at Frequency 4.664 GHz

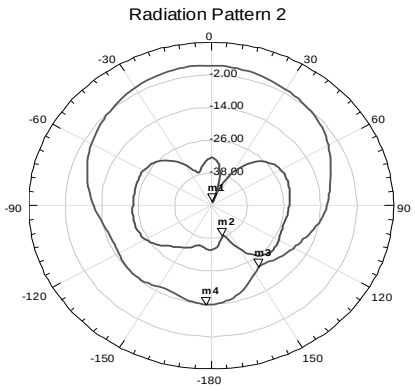

Figure 6: Radiation pattern of proposed antenna

4.2 FEED POSITION SECOND:
(BACK SIDE OF PATCH)

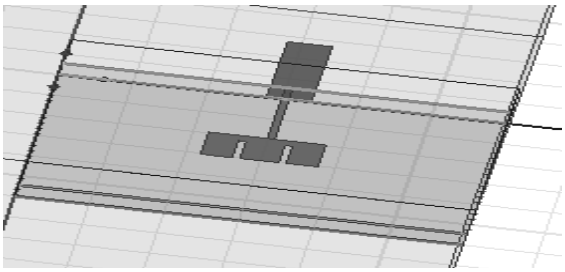

Fig 7: Geometry of Proposed Antenna using Stripline feed at back side of E-Shaped patch

4.2.1 Return Loss

Figure 8 shows the S11 parameters (return loss) for the proposed antenna. The designed antenna resonates at 4.6644 GHz. The return loss at 4.66 GHz frequency is -51.31 dB.

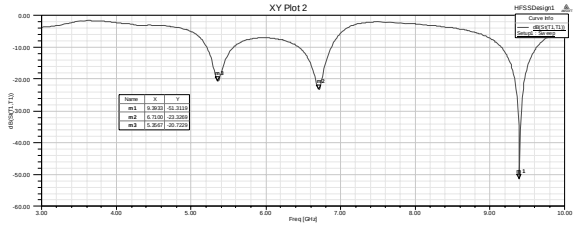

Figure 8 Return Loss of Stripline feed Antenna (S11 in dB)

4.2.2 Bandwidth of Stripline feed antenna

The bandwidth of the antenna can be calculated from return loss versus frequency plot. The bandwidth of the proposed patch antenna is 13.8 MHz

4.2.3 Voltage Standing Wave Ratio (VSWR)

The VSWR plot Stripline feed antenna is shown in Figure 9. The value for VSWR is 1.0055. which has been achieved for the frequency 9.38 GHz.

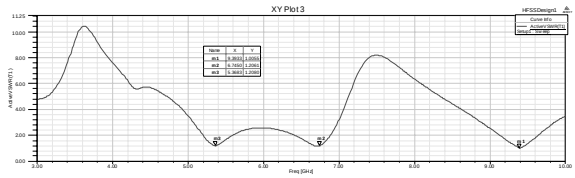

Figure 9: VSWR versus Frequency Plot of Stripline feed antenna

4.2.4 Radiation pattern of proposed antenna at Frequency 4.6644 GHz

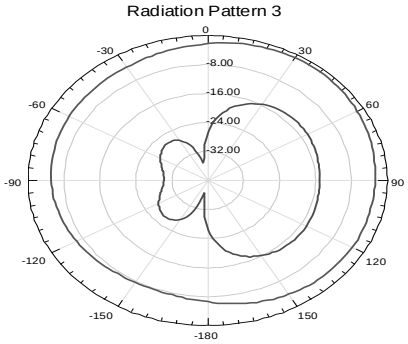

Figure 10: Radiation pattern of proposed antenna

5. COMPARATIVE ANAYLSIS OF FEED POSITION IN E-SHAPED MICROSTRIP PATCH ANTENNA

The optimized dimensions improving the gain and return loss as reported in [10], Direct microstrip line feed provided at different places are integrated in E-shape microstrip patch antenna. section 4 represents all the antenna parameter results. On the behalf of the results outcome we should prove that the feeding given at back side of patch, is provide better gain comparative than feeding provided at front side microstrip line feeding.

Table 3.2 Results of proposed antenna

Antenna parameter	Feed Position: 1 (In Front Of Patch)	Feed Position: 2 (Back side Of Patch)
Resonant Freq	4.66 GHz	4.66 GHz
Bandwidth	13.8 MHz	13.8 MHz
Return Loss	-35.93dB	-51.31 dB
Minimum VSWR	1.0055 dB	1.0055dB
Relative Bandwidth	3.29%	0.148%

6. CONCLUSIONS AND FUTURE SCOPE

In this paper, the microstrip line feeding is applied to design of E-Shaped microstrip patch antenna. The return loss, gain and radiation pattern of single band E-shaped microstrip antenna is presented in this paper clearly show that the antenna is a narrow bandwidth, higher gain and single tuned E-Shaped microstrip patch antenna. The achievement of higher gain with Feeding given at Back side of Patch is a focus of attention. The variation of the feed point (feed position) over feed line gives the flexibility to get higher gain and match the impedance, which is a notable feature of this antenna. This paper proved that the Feeding given at Back side Of Patch is a better than Feed given at In Front Of Patch, which affects positively to improve the gain, return loss, bandwidth and Relative bandwidth.

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