A Comparative Study of Rectangular and Triangular Patch Antenna using HFSS

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***Abstract*— The microstrip patch is one of the most preferred antenna structures for affordable and compact design for wireless system and RF applications. Microstrip patch antennas are among the most common antenna types in use today, particularly in the popular frequency range of 1 to 6 GHz. This paper compares the rectangular patch antenna and equilateral triangular microstrip antenna in terms of their return losses and VSWR and bandwidth. For the comparative study the Ansoft HFSS V13 is used.**

***Keywords*— rectangular micro strip antenna, triangular micro strip antenna, return loss, VSWR, bandwidth.**

I. INTRODUCTION

Microstrip antenna consist of a very thin metallic strip called as patch placed at small distance above ground plane. Patch and ground are separated by dielectric sheet called as substrate. Various dielectric material with dielectric constant are available. Microstrip antennas are used in a wide range of applications because of their advantageous features in terms of low profile, low cost, light weight and easy fabrication. But low gain and narrow bandwidth is the two main disadvantages of
microstrip antenna.

Antennas enable wireless communications between two or more stations by directing signals toward the stations. It is a means for radiating or receiving radio waves [2]. An antenna is thus a metallic device (as a rod or wire) for radiating or receiving radio waves. Microstrip antennas are currently one of the fastest growing segments in the telecommunications industry and promise to become the preferred medium of telecommunications in the future. For wireless communication system, the antenna is one of the most critical components. A good design of the antenna can relax system requirements and improve overall system performance. The antenna serves to a communication system the same purpose that eyes and eyeglasses serve to a human [2]. Microstrip patch antennas are widely implemented in many applications, especially in wireless communication. This is due to attractive features such as low profile, light weight, conformal shaping, low cost, high efficiency, simplicity of manufacture and easy integration to circuits[3]. However the major disadvantage of the microstrip patch antenna is its inherently narrow impedance bandwidth. Much intensive research has been done in recent years to develop bandwidth enhancement techniques. These techniques includes the
utilization of thick substrates with low dielectric constant and slotted patch [3].

II. ANALYSIS OF RECTANGULAR PATCH ANTENNA

Fig. 1 provides the view of simple rectangular patch antenna with length and width (L,W) 40mm and 30mm. The antenna is designed using substrate made up of Rogers RT/duroid 5880 material with relative permittivity 2.2 , permeability 1 and having height from the ground plane is 3.2. Coaxial feed of radius 3.2 is used.Frequency of radiation is 2.4GHz.

TABLE I. PARAMETERS OF RECTANGULAR PATCH ANTENNA

Sr. No.	Parameters	Design Consideration
1	Patch dimension	40*30mm
2	Dielectric substrate(Rogers RT/duroid 5880)	relative permittivity 2.2 , permeability 1
3	Substrate height	3.2mm
4	Feed radius	1.6

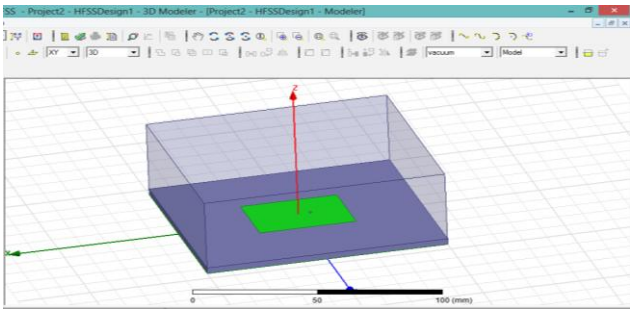

Fig. 1 a schematic representation of rectangular patch antenna

Fig. 2 shows the graph between return loss and frequency

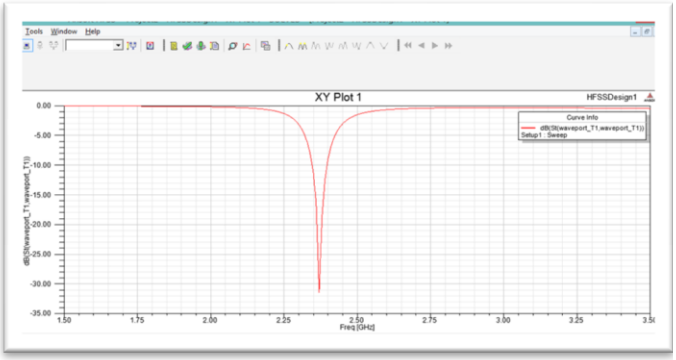

Fig. 2 return loss and frequency of rectangular patch antenna

Fig. 3 and fig. 4 shows VSWR and bandwidth respectively.

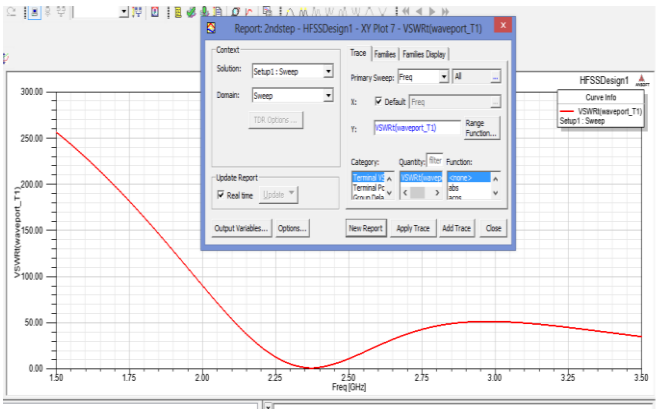

Fig. 3 VSWR of rectangular antenna.

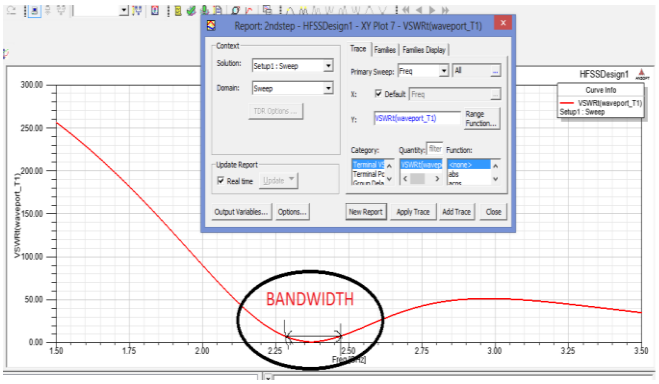

Fig. 4 bandwidth of rectangular patch antenna.

III. ANALYSIS OF TRIANGULAR PATCH ANTENNA:

Fig. 5 provides the view of simple triangular patch antenna with dimension 35mm. The antenna is designed using substrate made up of FR4 material with relative permittivity 4.4 , permeability 1 and having height from the ground plane is 1.59mm. Coaxial feed of radius 0.45 is used. The triangular patch antenna configuration is chosen because it has the advantage of occupying less metalized area on substrate than other existing configurations rectangular and circular geometries are most commonly used, Its dimension that tends to be small can make the overall dimension of the antenna very small too. The geometry of triangular patch antenna is shown in Fig. 5 . It is a triangular patch antenna with two slits. Slits improve the bandwidth of antenna.

TABLE II. PARAMETERS
OF TRIANGULAR PATCH ANTENNA

Sr. No.	Parameters	Design Consideration
1	Patch dimension	35mm
2	Dielectric substrate(FR4)	εr=4.4, tanδ=0.09
3	Substrate height	1.59mm
4	Feed radius	0.45mm

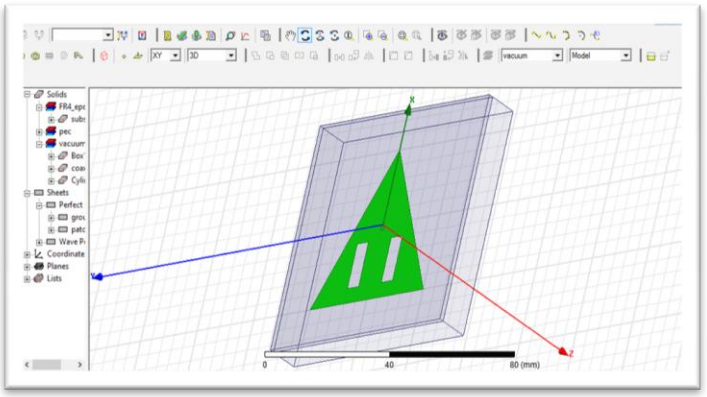

Fig. 6 and fig. 7 shows VSWR and bandwidth respectively.

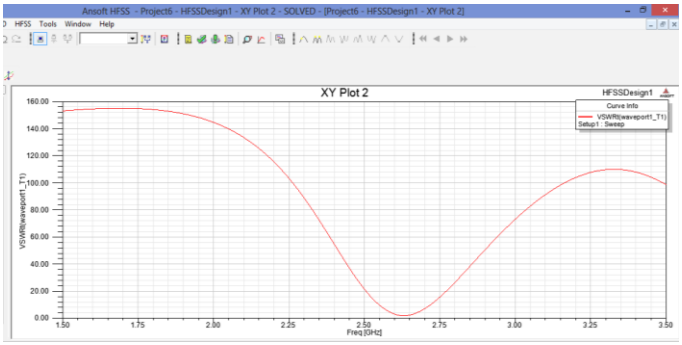

Fig. 5 VSWR of triangular antenna

IV. CONCLUSION

From the above discussion it is clear that triangular patch antenna has advantages over rectangular patch antenna.. From figure 2 and figure 6 we can observe that for rectangular patch antenna has return loss of 35dB at 2.40GHz and triangular antenna has return loss 10dB at 2.6GHz. VSWR for both the antennas is found in between 1 and 2. Triangular patch takes lower surface area than rectangular patch. Hence return losses are less.

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