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# A Comparative Study of Rectangular and Triangular Patch Antenna using HFSS and CADFEKO

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***Abstract*—The microstrip patch is one of the most preferred antenna structures for ofordable and compact design for wireless system and RF applications. This paper compares the rectangular patch antenna and equilateral triangular microstrip antenna in terms of their return losses and radiation pattern. For the comparative study the Ansoft HFSS V11 is used.**

***Keywords*— rectangular micro strip antenna, return loss, triangular micro strip antenna**

## I. INTRODUCTION

Microstrip antenna consist of a very thin metallic strip called as patch placed a small fabrication of wavelength above ground plane. For a rectangular patch the length L of the element is usually $\lambda_0/3$ <L< $\lambda_0/2$. the strip and ground plane is separated by a dielectric sheet referred as substrate their dielectric constants are in the range of 2.2<$\varepsilon_r$<12 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. The schematic representation of a rectangular patch antenna is shown in fig.1

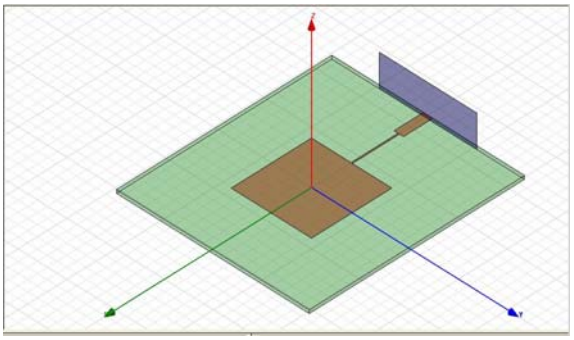

Fig. 1 a schematic representation of rectangular patch antenna

## II. ANALYSIS OF RECTANGULAR PATCH ANTENNA

Fig. 1 provides the view of simple rectangular patch antenna with length and width (L,W) 41.08mm, length of transmission line feed is 15mm and width is 4.84mm. in this simulation quarter wave transformer is used of length 24.05mm and width 0.72mm the antenna is designed using Duroid(tm) substrate having relative permittivity of $\varepsilon_r$=2.2 having the height from the ground plane is 1.57mm.

Frequency for the solution is used as 2.4 GHz
Fig. 2 shows the graph between return loss and frequency. Fig. 3 and fig. 4 shows radiation pattern and 3D polar plot respectively.

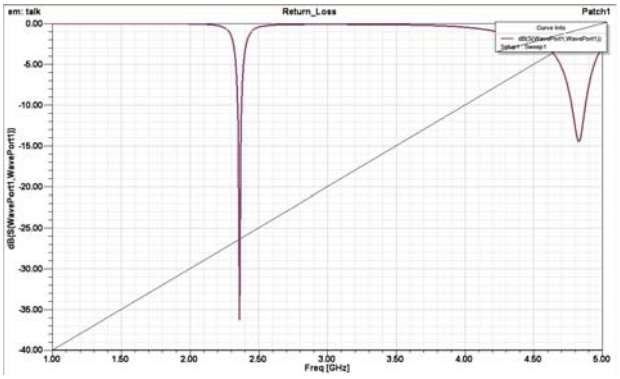


Fig. 2 band width Vs return loss of rectangular patch antenna

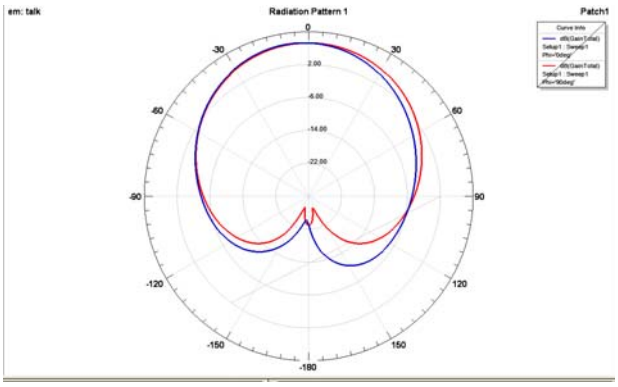


Fig. 3 radiation pattern of rectangular patch antenna

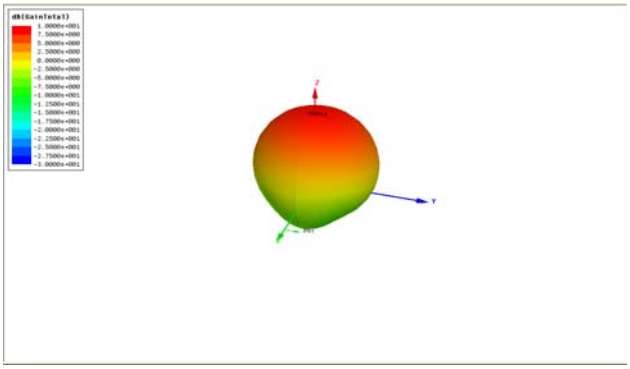

Fig. 4 shows 3D polar plot of rectangular patch antenna.

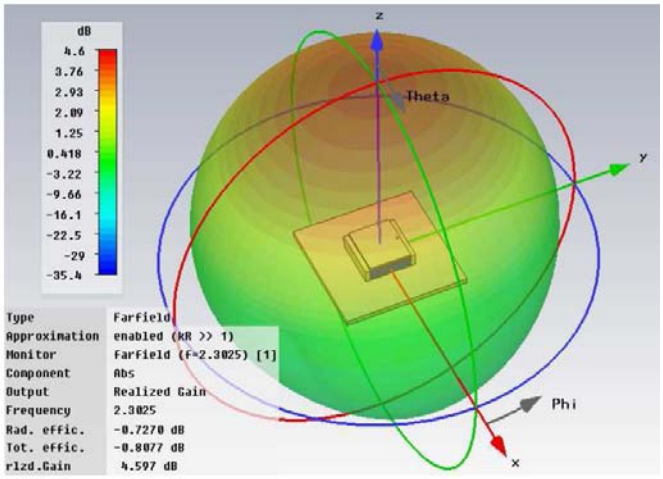


Fig. 5 direction of fields in 3D analysis

## III. ANALYSIS OF TRIANGULAR PATCH ANTENNA

The equilateral triangular patch antenna is designed at the frequency of 5.8GHz for the Wi-Max applications this band is used for the IEEE 802.11c standard and other medical and scientific purposes. Simulation of triangular patch antenna is performed on CADFEKO . 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. 6 . it is a triangular patch antenna with two cuts one at the base and other at one arm of equilateral triangle. In this design the side length is taken as S=38mm with the substrate height of 1.55mm. dielectric substrate of FR4 is taken having $\varepsilon_r$=4.4. in this design co axial probe feed technique is used

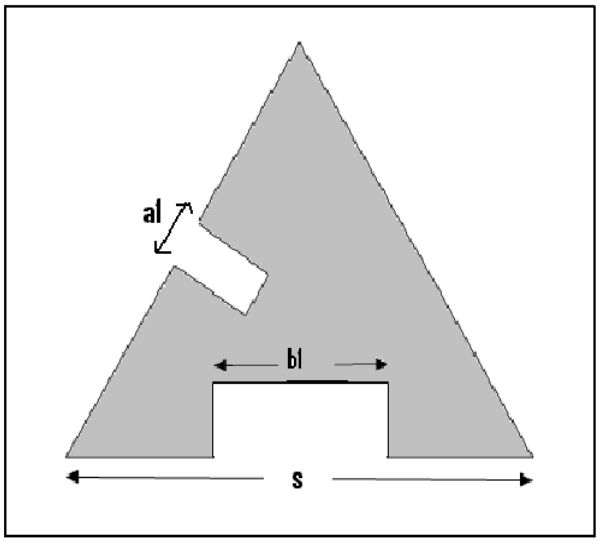


Fig. 6 geometry of triangular patch antenna with S=38, al=2,bl=5

Figure 7 shows the graph between bandwidth and return loss. Figure 8 shows the radiation pattern.

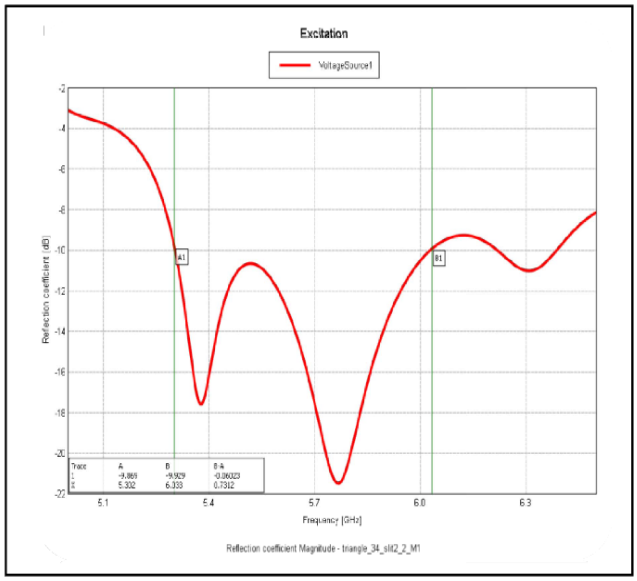


Fig. 7 bandwidth VS return loss for triangular micro strip antenna

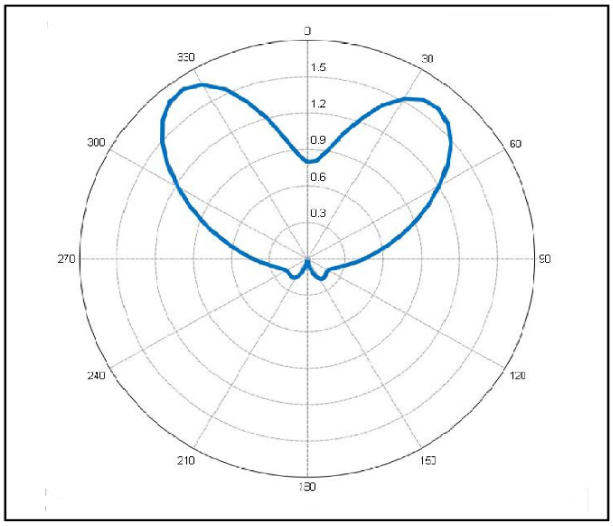


Fig. 8 radiation pattern of triangular micro strip antenna

## CONCLUSION

From the above discussion it is clear that at lower range of frequencies rectangular patch antenna works better but as the frequency increases towards the Wi-Max applications which is more than 5GHz triangular patch antenna gives better result.

From figure 2 and figure 7 we can observe that for rectangular patch antenna have return loss of 35dB at 2.40GHz. If we compare at approx 5GHz frequency triangular patch antenna have minimum return loss as compared to rectangular patch antenna. Hence it is clear that for Wi-Max applications triangular patch antenna produces better result as compared to rectangular patch antenna.

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