U-SHAPED MICROSTRIP RECTANGULAR ANTENNA

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Abstract: In this paper U-Shaped Rectangular Microstrip Patch antenna is used in wireless communication. Now in this configuration modified antenna patch shape is rectangular. This modified U-Shaped antenna gives good results return loss is -38dB and height is 2.4mm.The frequency band used in this configuration 4.5GHz. U-Shaped antenna is used in WI-MAX applications. This antenna gives the max gain upto 8dbB .Firstly desined simple patch antenna using HFSS . The substarate developed material RT/duroid 5880 glass micro-fiber reinforced .

Key words : U-Shaped patch, printed antenna,Wi-Max(Worldwide Interoperability for Microwave Access)

1 Introduction

In recent years, Multiple-input, multiple-output (MIMO) antenna systems are used in different application standards including WiMAX, WiFi and mobile services with great increment due to an interesting solution to multipath challenge which arises due to multipath signals. In MIMO systems, multiple antennas are placed close to each other to take advantage of the diversity that system. But, due to close spacing between antennas elements introduces a significant inter element coupling [1]. This coupling also referred as mutual coupling effect, which alters the radiation properties, like input impedance, radiation pattern distortion. So in order to preserve the radiation properties and maintain the isolation between antenna elements, the separation gap between patch antennas are to be maintained of at least half of wavelength (λ/2) at their operating frequency band [2]

Generally, the wireless data that is transferred from transmitter (*TX*) to receiver (*RX*) through a communication channel takes different paths on its travel to the receiving end[2]. Strength of signal at the receiving end will vary depending on the distance traveled by the signal as shown in Figure 1(a) [3]. The loss of signal power can be attributed mainly to the path loss and to the fading across the channel as shown in Figure 1(b).

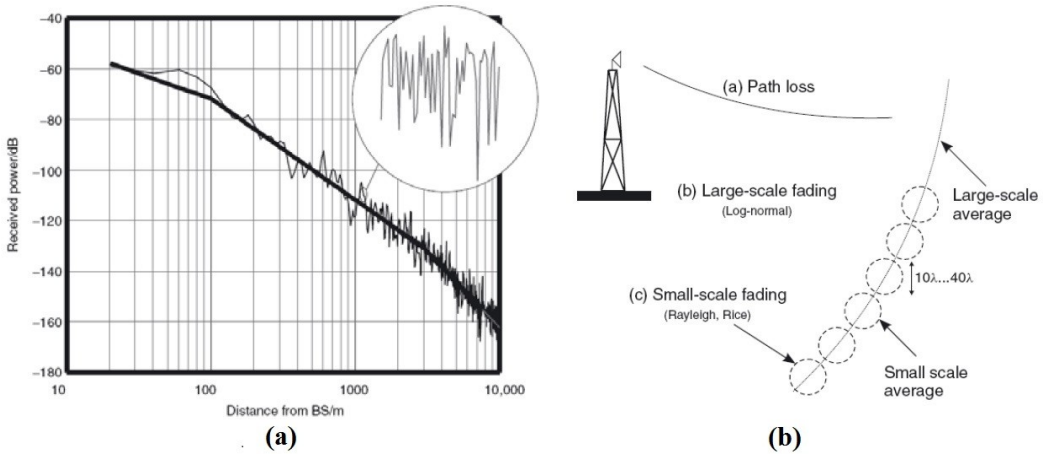

Figure 1.: (a) Received Power v/s distance between TX and RX (b) Losses in the received power

2 Antenna Configuration

Wi-MAX is a broadband wireless communication. Modified rectangular patch U-Shaped used for wireless communication[4] . First designed ground plane with required dimensions. Next apply substrate material FR4 . Use High Frequency Structure Simulator software design rectanular patch with U-Shaped. Remove the some portions of the rectangular patch depending upon requirement some portions of patch removed that portions forms like a U-Shaped microstrip[5].The simple design of the microstrip U-Shaped rectangular patch shown in figure 2.1

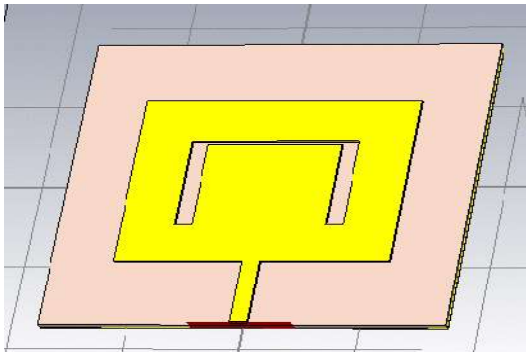

Figure 2.1 : Microstrip U-shaped rectangular patch antenna

The microstrip U-shaped rectangular patch antenna is shown in fig 2.1. first ground plane according to dimensions design using HFSS then after substrate design use RT/DUROID material after design substrate according to the width and lenght dimensions of the

rectangular patch design. Here am using ceter tap feeding . this center tap feeding connects in between patch and supply[6]. Using one more rectangular patch that patch in between main patch . All these rectangular patches arrange U-Shaped model. This U-Shaped rectangular patch is operated in 4.4GHz[7].

Thickness is 0.1mm for ground plane. The height of the substrate is 2.4mm. The Rt/duroid 5880 material used for design substrate with permittivity and tangent loss=0.0009. The patch dimensions width and Lengh are designed according to requirements.

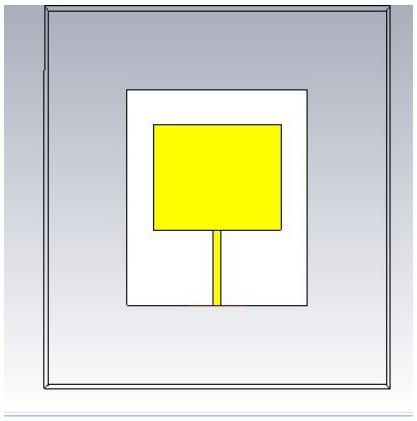

Figure 2.2: Basic Patch Antenna

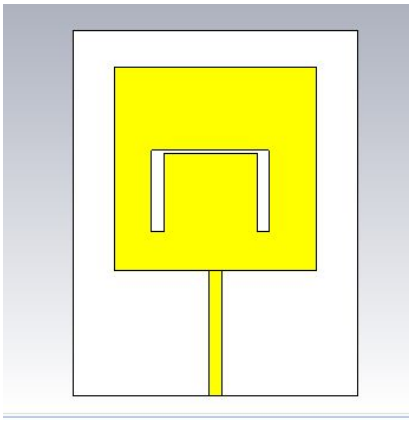

Fig 2.3: U- Shaped Rectangular Antenna

Intially patch antenna is designed in fig 2.2 and three rectangular patches design on main patch. Thar are arranged U-Shaped patch antenna in fig 2.3.

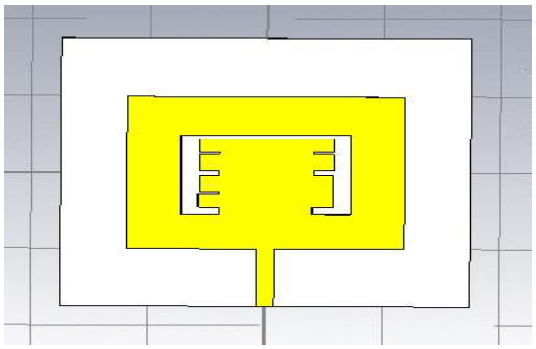

Figure 2.4: Modified design Microstrip rectangular patch antenna

In figure 2.4 shows Modified design Microstrip rectangular patch antenna . In this design more number of rectangular patches designed[8]. This will give the excellent return loss compared to the U-Shaped micro strip patch antenna.

3 Results and Discussion

This paper, to increase the antenna performance using in Wi-MAX applications. Figure 2.4 shows modified rectangular U-shaped patch antenna has S11 is -38dB and gain around 7.834 dB. In this design compared to modified U-Shaped microstrip rectangular patch antenna gives the good results compare to U-Shaped .it gives the good return loss and performance is also better.The frequency band is 4.5GHz. in this frequency band it will give the better return loss i.e below 10dB .

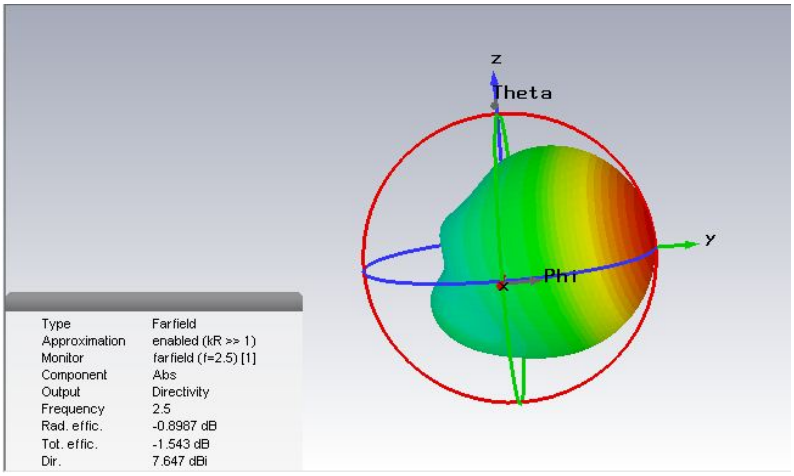

Fig 3.1: 3D Pattern of U-Shaped rectangular antenna

Figure 3.1 &3.2 shows the radiation pattern of U-Shaped and modified rectangular pattern at far field distance with frequency 2.5GHz . modified U-Shaped gives the excellent gain compared to the U-Shaped patch antenna

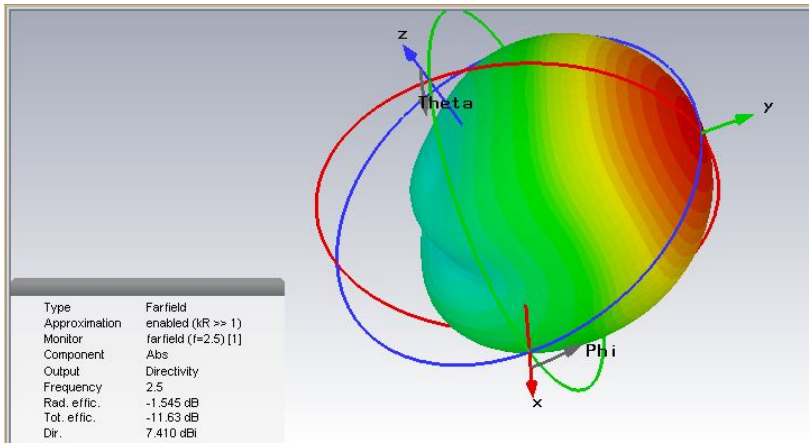

Fig 3.2: 3D pattern of modified patch antenna

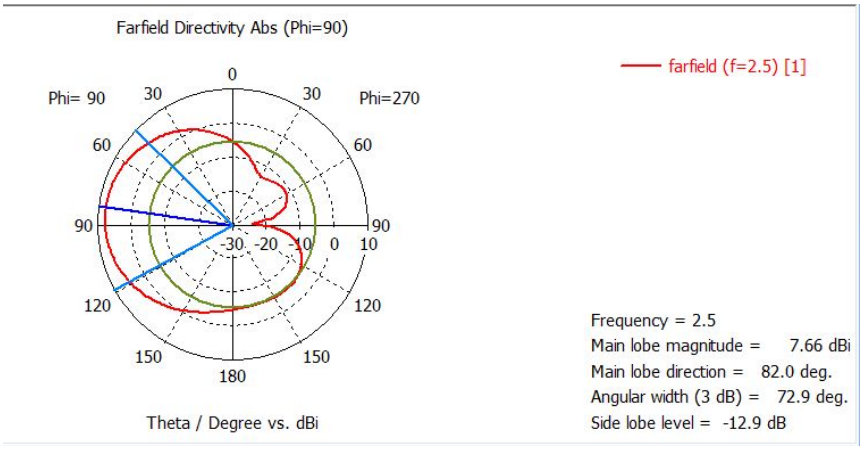

Fig 3.3: Polar plot of U-Shaped antenna

Figure 3.3 and 3.4 shows the polar plot far field variation with frequency 2.5GHz and main lobe magintudes 7.66 dB and 7.42 dB the main lobe directions 82 and 87 degrees. The total electromagnetic signal available in main lobe only. In the polar diagram far field radiation pattern is also good. In the MIMO communication system the U-Shaped microstrip antenna is suitable.

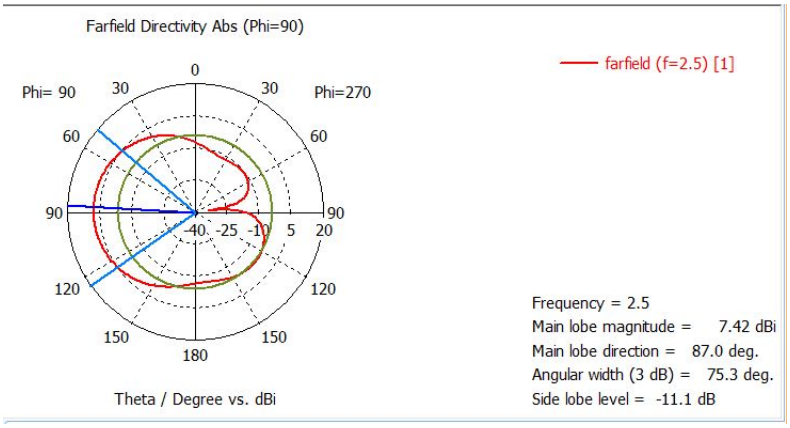

Fig 3.4:Polar plot of modified microstrip antenna

Figure 3.5 and 3.6 shows the reflection coefficient characteristics. Return loss is good at frequenct 4.5GHz -32.5 Db and -33Db. S11 it shows the how much power is reflected back from the antenna. Here reflected power is very less.

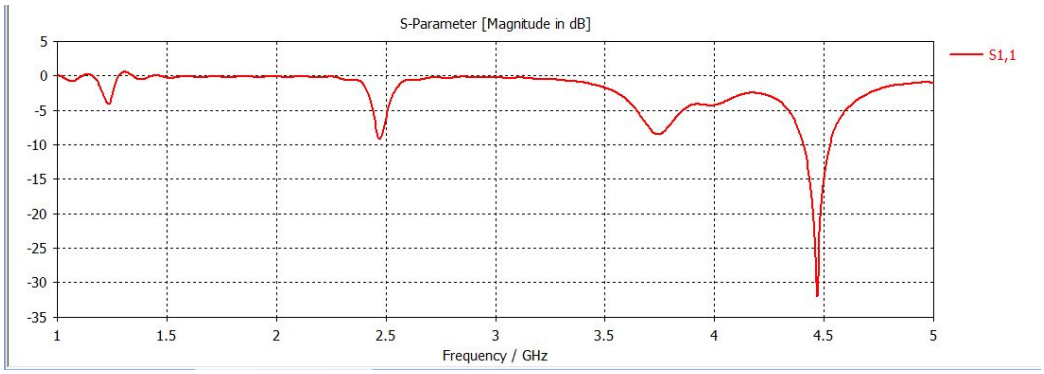

Fig 3.5 :S11 U –Shaped antenna

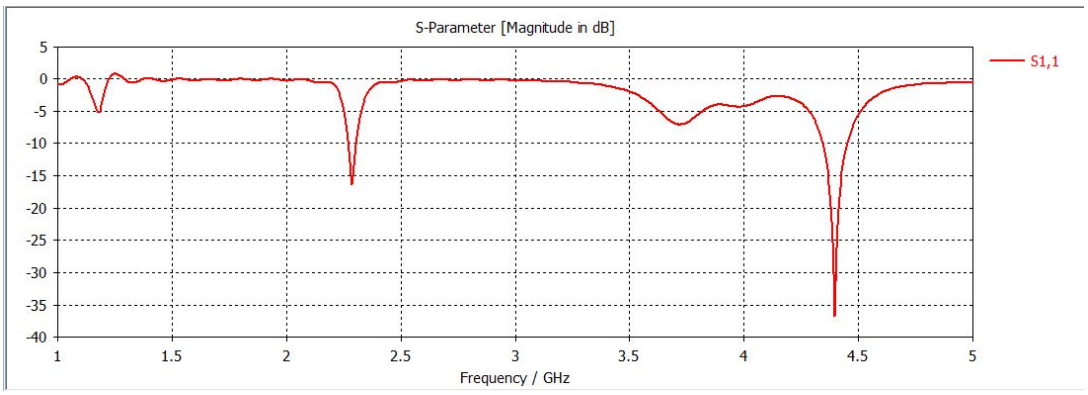

Fig 3.6: S11 for modified microstrip antenna

Conclusion: The microstrip U-Shaped rectangular patch antenna is designed. It gives excellent isolation and gain . The polar plot is given at frequency 2.5 GHz magnitude is 8.85db and major lobe angle is 82degree and angular width 79.3 is achived. The reflection coefficient is -38 db achieved at frequency of 4.4GHz. the modified U-Shape antenna gives good return loss of than the u-shaped microstrip antenna.This modified U-Shaped microstrip rectangulr patch antenna is suitable for Wi-Max communication applications and used for UWB band of frequencies.

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