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Design of Micro strip patch antenna by two different feeding methods at resonant frequency of 5.08GHz

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Abstract: **- In wireless communication, there are different types of microstrip antenna; the most commonly used antenna is patch antenna. In this paper, we designed a patch antenna operated at 5.08GHz for WLAN application by two different feeding methods and analysed results radiation pattern, input impedance, return loss and gain using Ansoft HFSS 13.0 software. The result displays coaxial feeding technique is good in radiation pattern, return loss, input impedance and gain compared with microstrip feeding technique.**

Keywords**: Microstrip, HFSS, Radiation pattern, Impedance.**

I. INTRODUCTION

Microstrip antennas plays a major role in communication areas due to its useful features such as low profile, light weight, conformal and non-conformal shaping, low cost, easy manufacturing and integration to printed circuit boards. It has some disadvantages like low impedance bandwidth, low gain, extra radiation occurs from its feeds and junctions and excitation of surface waves and the researcher are to try to increase the bandwidth[1-3]. Different type of radiating patch may be square, rectangular, circular and triangle. Out of these the most widely used shape is rectangular patch antenna and our analyse is based on the rectangular patch antenna and it is easy to analyse the transmission line model.[4]. The introduction of slot in the patch, single band antenna can be modified into multi band antenna by proper adjustment of their shape and position of the feed.[5-8] The improvement of bandwidth is obtained by increasing the distance between ground plane and microstrip patch, low value of substrate material.[9-13] The microstrip patch antenna is designed using simulation software Ansoft HFSS 13.0 at a resonant frequency of 5.08 GHz. The Comprehensive experimental and numerical investigation on patch is done and a new empirical equation is proposed that describes the behaviour of patch antenna resonance. The analysis of conventional patch antenna for WLAN applications is done and optimized at 5.08GHz[10]. The antenna parameters are analysed by different feeding methods. A simple rectangular microstrip patch antenna consisting of conducting patch, ground plane and substrate having a particular value of dielectric constant. Two different types of feed are given and the results are compared for radiation pattern, impedance matching and return loss.

II. DESIGNING

In this paper the proposed rectangular microstrip patch antenna designed using a substrate (RT/duroid 5880) with dielectric constant of 2.2, height h=1.5748 mm to resonate at 5.08 GHz.

1. The width of the patch is calculated using

$$w = \frac{1}{2fr\sqrt{\mu 0 \varepsilon 0}}\sqrt{\frac{2}{\varepsilon r+1}} = \frac{v0}{2fr}\sqrt{\frac{2}{\varepsilon r+1}} \quad (1)$$

C_0 – speed of light
ε_r – value of the dielectric substrate.

2. Effective dielectric constant of the patch is

$$\varepsilon reff = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}\left[1+12\frac{h}{W}\right]^{-1/2} \quad (2)$$

3. Length of the patch extended by ΔL on each side

$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon reff+0.3)(\frac{W}{h}+0.264)}{(\varepsilon reff-0.258)(\frac{W}{h}+0.8)} \quad (3)$$

4. Effective length of the patch is

Leff = L + 2ΔL (4)

ΔL – actual increase in length
ε_{reff} - effective refractive index.

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5. Length(Lg) and width(Wg) of the ground plane

$$Lg = 6h+L \quad (5)$$

$$Wg = 6h+W \quad (6)$$

III. ANTENNA CONFIGURATION:

The rectangular microstrip patch antenna is designed at resonant frequency of 5.08GHz by proper dimension of the antenna. The length and width of patch antenna and ground plane 19x23.34 and 37.9x44.5mm. The height of the patch with respect to ground is 1.5748mm. Two different feeding techniques coaxial feed and edge feed are used for analysing the microstrip patch antenna For feeding the microstrip patch antenna, coaxial probe feed and edge feed techniques are used.

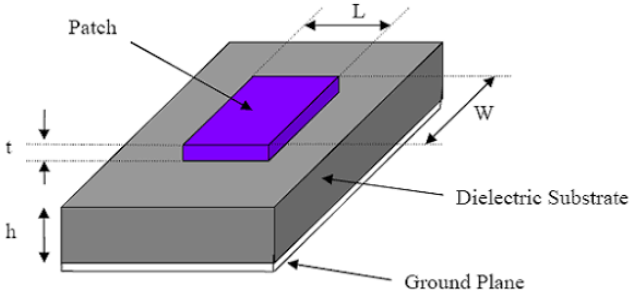

Fig.1 Patch Antenna

IV. SIMULATION RESULTS

The microstrip patch antenna was analysed and optimized with HFFS 13 simulation software. The PCB materials of Rogers RT/ duroid 5880(tm) is used for antenna design. For feeding microstrip patch antenna the coaxial probe feeding method and edge fed methods are used. The simulation results are obtained and compared for both feeding mechanisms. The fig.2 shows the input impedance, radiation pattern and the return loss of microstrip patch antenna with coaxial feed mechanism. The fig.3 shows the input impedance, radiation pattern and the return loss of microstrip patch antenna with edge fed mechanism.

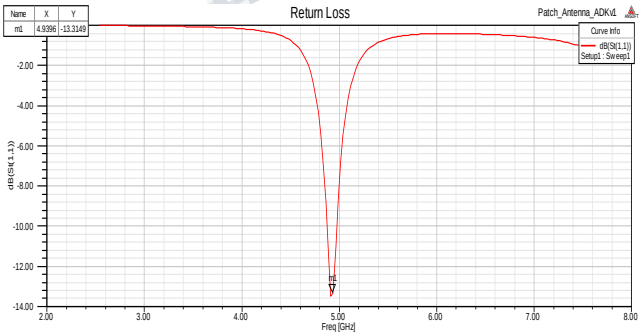

Fig.2(a) Return loss of patch antenna

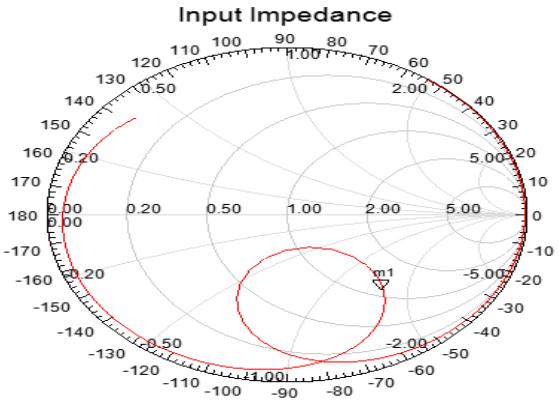

Fig.2(b) Input impedance of patch antenna

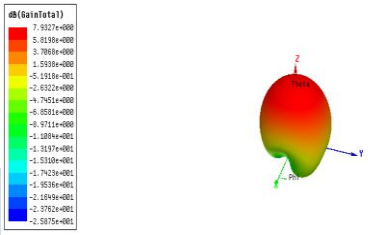

Fig.2(c) Gain of the microstrip antenna

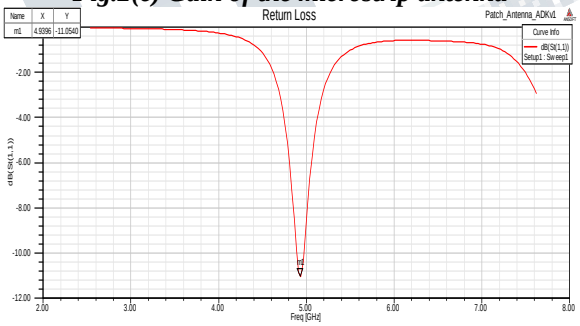

Fig.3(a) Return loss of microstrip antenna

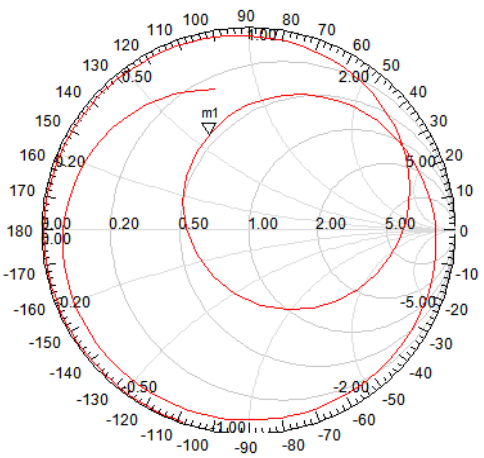

Fig.3 (b) Input impedance of patch antenna

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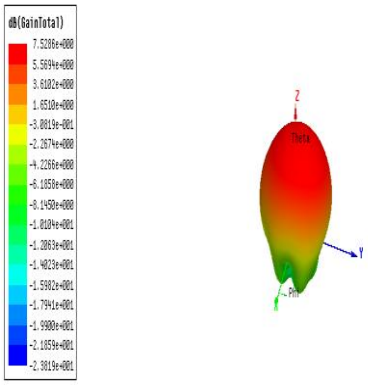

Fig.3(c) Gain of patch antenna

The fig.4 shows the comparison results of return loss obtained from both coaxial probe feed and edge fed mechanism.

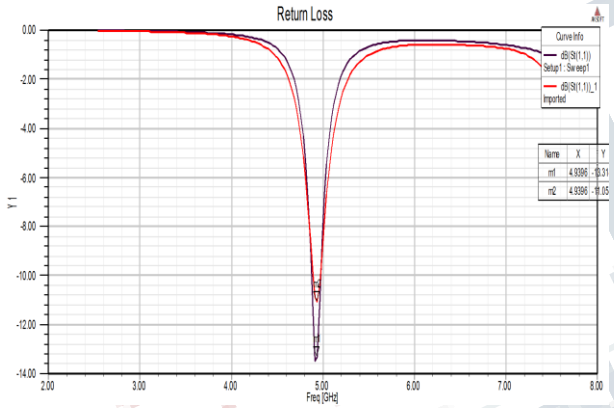

Fig.4. Return loss of both feeding techniques

From the fig.4, it can be seen that return loss and gain is high for coaxial feeding technique when compared to edge fed rectangular patch antenna.

V. CONCLUSION

This paper gives an analysis of microstrip patch antenna by giving different types of feed. A comparative study is done for both coaxial feed and edge feed patch antenna. The gain and bandwidth obtained is high for coaxial feed patch antenna. The gain can be further increased by changing the position of the feed point and bandwidth can be increased by increasing the height of the substrate.

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