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Design of Microstrip Antenna For Wireless Communication

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Abstract : Communication is key since the dawn of humanity human beings are trying to communicate among each other. We have come a long way from sign language to wireless communication. Wireless communication has skyrocketed since the introduction of mobile phones and in this smartphone era we are utilizing the maximum efficiency of the wireless communication system. One of the main reasons the world is using microstrip antenna in the communication department is its availability and price. The size of the antennas are directly tied to the wavelength at the resonant frequency. We have designed this antenna to work at an unlicensed ISM Band of 2.4 GHz. We have chosen fr4 epoxy as the substrate because it is versatile and low cost which is essential as we need to produce communication devices in a mass quantity and it also has good strength to weight ratio. We are using Ansys High Frequency Structure Simulator or HFSS to simulate and design this antenna. The proposed design has dimension of 60 x 60 x 1.6 mm^3. It has a resonant frequency of 27.44 GHz and the return loss is -32.299 dB. In this paper we will be discussing the materials that we have use alongside the results that includes S-parameter, gain, VSWR and also our proposed model.

***IndexTerms* – Microstrip, HFSS, S parameter, VSWR, gain.**

I. INTRODUCTION

Our race always had the urge to connect with each other as efficiently we can. The technological advances are nothing but a blessing nowadays as it helps us to communicate even better at times. The electronics and telecommunication industry is growing in a rapid rate which means the communication system must be easily accessible to everyone. Wireless communication is nothing but a process of sending and receiving radio signals with antennas. In this journal we have designed a microstrip antenna using HFSS [1] software. We chose microstrip antenna[2] because is it very commonly used and cost effective so that anyone can use it in day to day basis. We have included graphs and charts of the simulation along the whole simulation process for a better idea.

1. PROPOSED DESIGN OF THE SUBSTRATE:-

Depending on the characteristics of the material the reflections combined with the incident fields and it creates the constructive and destructive interferences. This type of basic concept is applied to design a perfect micro strip antenna[3]. By using extra two or more materials, we can modify the characteristics of the substrate. The most important is dielectric constant. A substrate which has low dielectric constant not only can reduces the surface of wave loss but it also help to improve the bandwidth of antenna and impedance matching.FR4-epoxy is one of these types of substrate which is used for the designed of a micro strip patch Antenna. By using this substrate we observed the improvement of bandwidth.

Features of FR4-EPOXY:-

- FR4 is a thermoset plastic material bonded which consists of bromine and halogen compounds with the EPOXY resin hence it is flame redundant and water resistant.
- This type of material is used to make applications like circuit boards, electric switches.
- FR4-EPOXY is commonly used in PCB fabrication.

PROPERTIES OF FR4-EPOXY:-

PARAMETERS	VALUES
Permittivity	Around 4.4
Permeability	Around 1
Density	1.850 g/cm3
Thermal conductivity	0.25 W / m-K
Specific heat capacity	1100J/K

2. PROPOSED GEOMETRY OF ANTENNA:-

The dimensions of width, length, height and thickness of the micro strip patch antenna were calculated by using the rectangular patch design equations as shown below:-

$$W = \frac{c}{2f\sqrt{\varepsilon_{eff}}}$$

$$L = \frac{c}{2f\sqrt{\varepsilon_{eff}}} - 2\Delta$$

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(1 - \frac{10H}{W}\right)^{-\frac{1}{2}}$$

$$\frac{\Delta}{H} = 0.412\frac{\varepsilon_{eff} + 0.3}{\varepsilon_{eff} - 0.258} X \frac{\frac{W}{H} + 0.262}{\frac{W}{H} + 0.813}$$

Length of substrate(Lg)=6h+L

Width of substrate(Wg)=6h+W

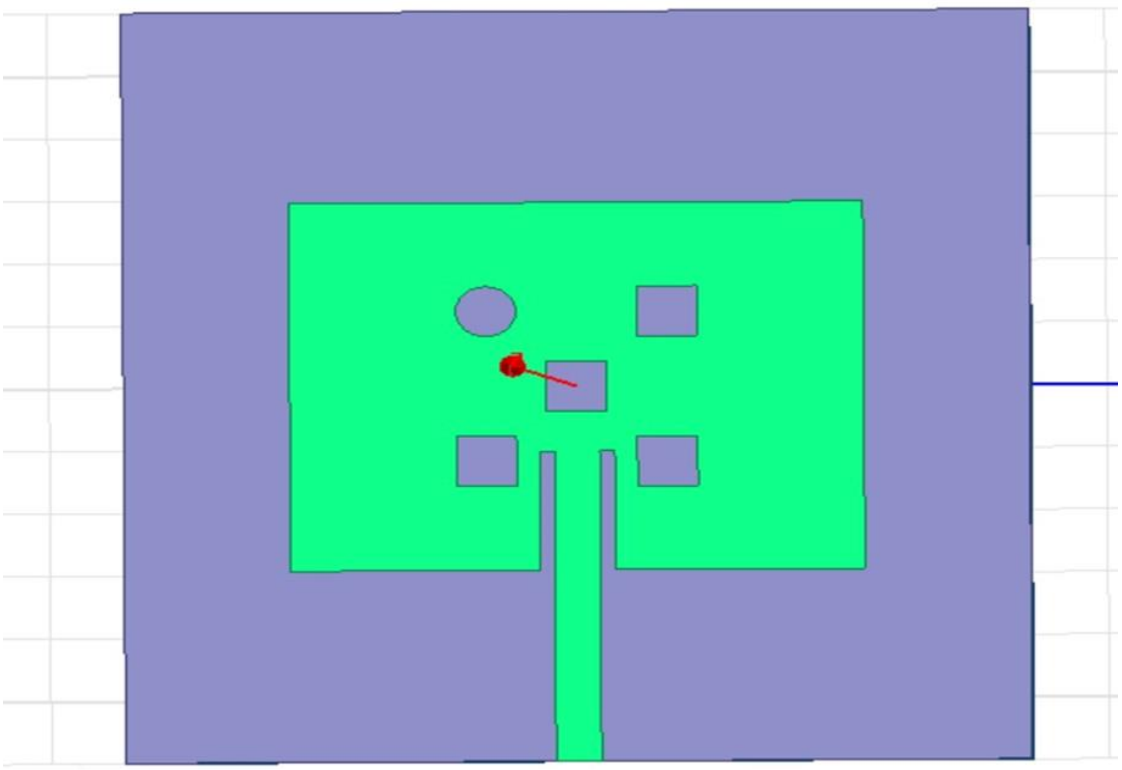

Fig3:Patch Antenna

3. SIMULATION RESULT:-

REFELCTION COEFFICIENT:-

S-boundaries (or dissipating boundaries) are utilized to portray how energy can spread through an electric organization. S-Parameters are utilized to depict the connection between various ports, when it turns out to be particularly critical to portray an organization as far as adequacy and stage versus frequencies, as opposed to voltages and flows. S-Parameters are utilized to show a convoluted organization as a basic discovery and to effortlessly introduce what befalls the sign-in that network. The reflection coefficient(S-boundary) of the recreated plan is displayed the Fig.4. From this graph, we can infer that the antenna resonates at -32.29 GHz and we know that the performance of the antenna will be better if the return loss is less than -10dB.

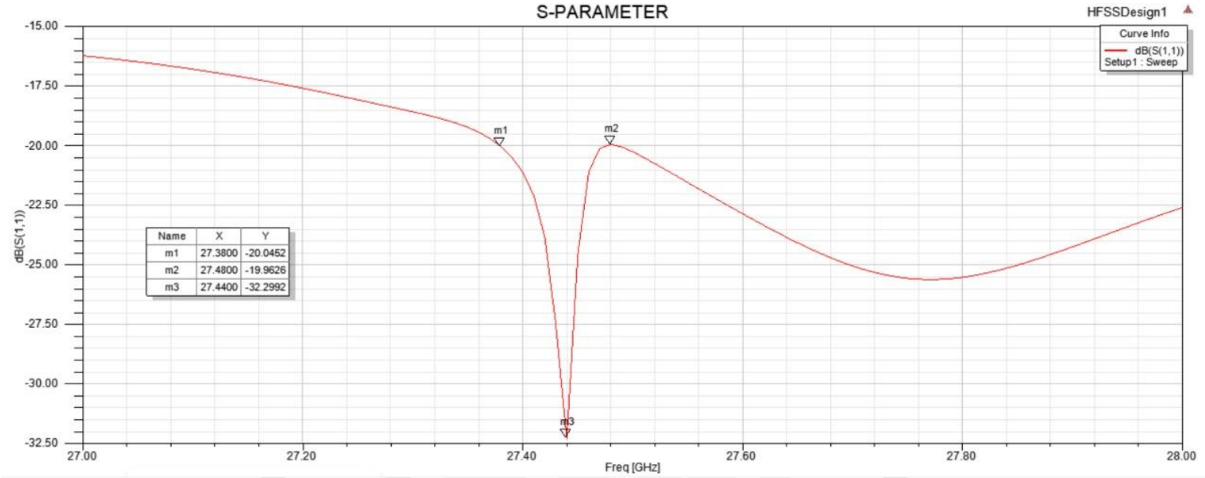

Figure 4

DIRECTIVITY:-

Directivity gives the proportion of force thickness between the heading of the most grounded emanation of the receiving wire and optimal isotropic radiator. The directivity of the radio wire brought about 3.94dBi as displayed in figure 5.

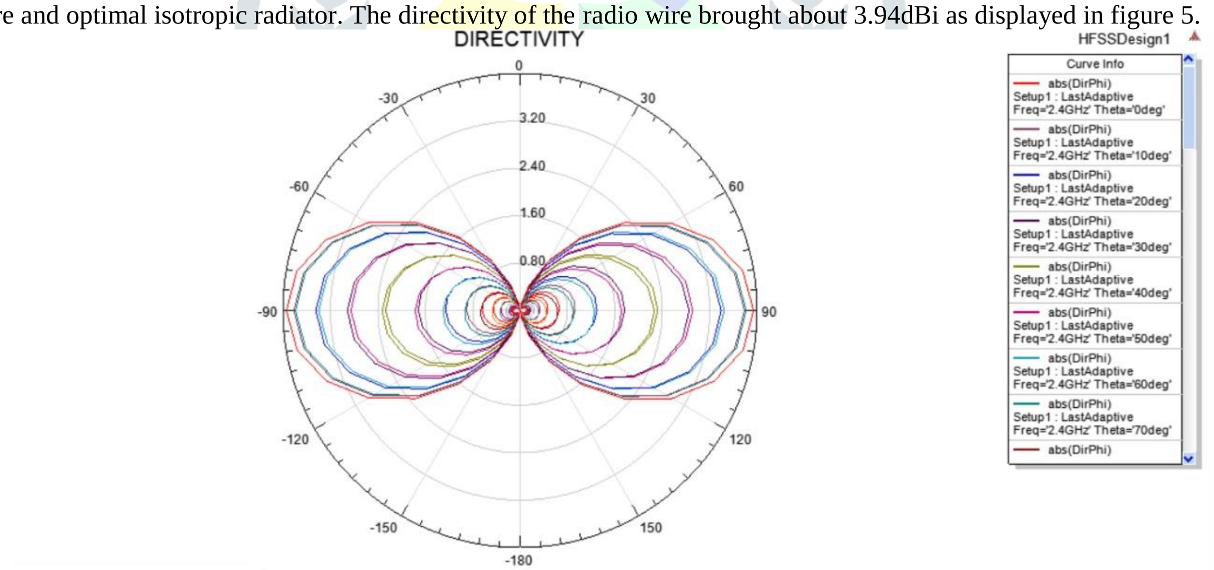

Figure 5

GAIN:-

Radio wire gain is the capacity of the recieving wire to emanate pretty much toward any path contrasted with a hypothetical receiving wire. On the off chance that a receiving wire could be made as an ideal circle, it would emanate similarly every which way. The increase of planned radio wire is 1.7464dBi as displayed in Fig.6. Acquire is equivalent to the region of the isotropic circle (4Br)^2 isolated by the sector(ccross-sectional region.

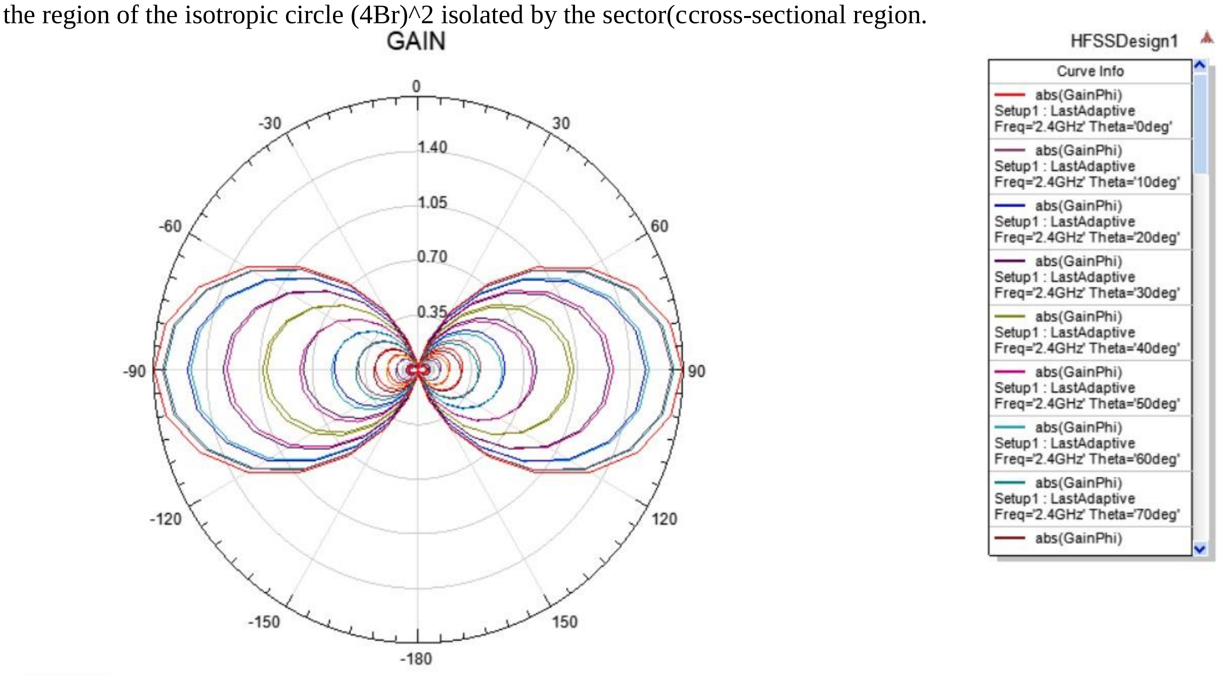

Figure 6

VSWR:-

Voltage standing wave proportion depicts the reflected power from the receiving wire. The exhibition of a receiving wire will be better when VSWR esteem is less. The ideal worth of VSWR is solidarity and the most extreme worth can be 2, which is an adequate worth of any radio wire. The planned wearable radio wire has better VWSR of 0.4217 at 27.44 GHz as displayed in the Fig.7.

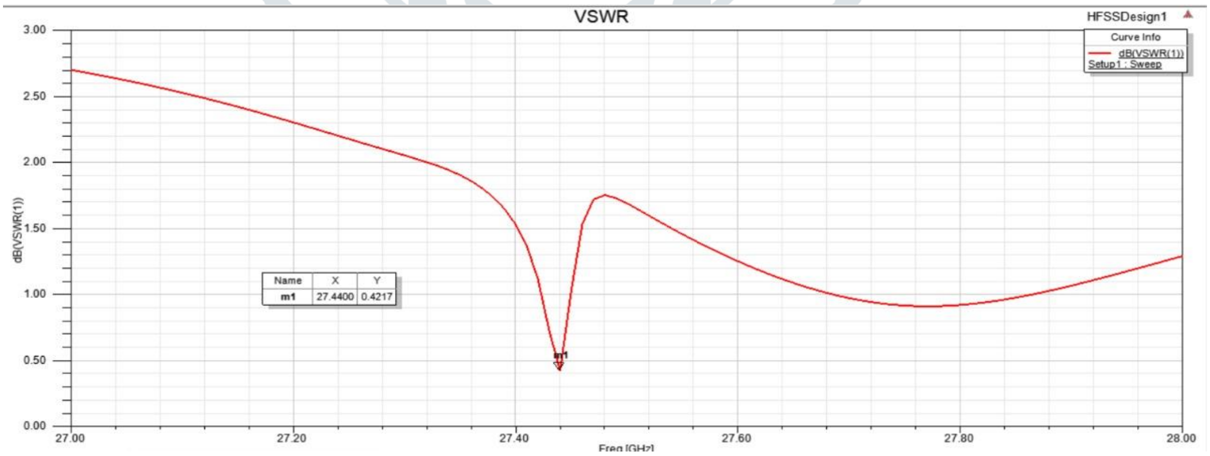

Figure 7

4. CONCLUSION:

A microstrip or patch antenna is a low profile antenna that has a number of advantages over other antennas it is lightweight, inexpensive, and easy to integrate with accompanying electronics. It has a resonant frequency of 27.44 GHz and the return loss is-32.299 dB. In this paper, we will be discussing the materials that we have used alongside the results that include S-parameter, gain, VSWR, and also our proposed. Among any remaining substrates, RTduroid5880 is equipped for giving ideal recreation results. In close future, different other substrate materials will be thought of also, the radio wire attributes will be investigated with summed up and quantized results.

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