Design of Micro Strip Patch Antenna And Fabrication

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Abstract- *wireless communication plays a important role for communication in todays world. So in this paper we are going to discuss about microstrip patch antenna which is a type of wireless communicating antenna .we are going to discuss about different types of microstrip patch antenna .We will be discussing about the simulation graph results which we have done in the HFSS software after that we will be comparing it with the tested results of the hardware antenna.*

Keywords- Microstrip Patch Antenna,different feeding techniques, results of HFSS simulation, hardware results of microstrip patch antenna.

I. INTRODUCTION

Microstrip patch antenna is a type of wireless communicating device, we use it for wireless communication .microstrip patch antenna consists of a substrate of a particular dielectric constant. Above this substrate we a patch of a particular dimensions. Below this substrate there is ground. First we will design the patch antenna in HFSS software, after that we will analyse the results and then will work on hardware with those dimensions.

MICROSTRIP PATCH ANTENNA

A Microstrip Patch Antenna consists of a dielectric substrate with a patch on one side andon the other side we have a ground plane, as we have shown in Fig. 1.

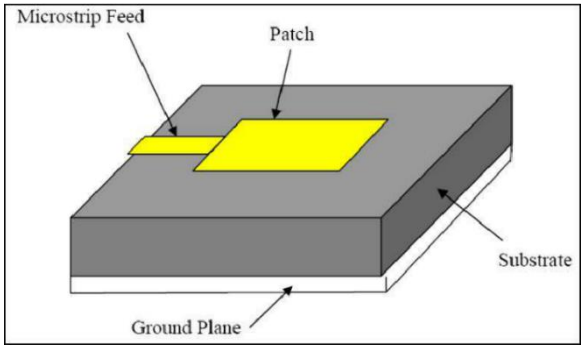


Fig. 1 Microstrip Patch Antenna

There are different shapes of Microstrip Patch Antennas such as circular,triangle,rectangular. Microstrip patch antenna are preferred over other antennas because they are very easy to install. Microstrip patch antennas are with low height and width also known as Low gain and bandwidth antenna. They can easily be mounted on any kind of plan it can be planer and non-planer. Microstrip patch antenna are not very expensive to manufacture.

There are many disadvantages microstrip patch antenna one of it is also gives poor efficiency, if the height of the antenna is increased substrate efficiency also gets increased but due to this there is a increase in Bandwidth of the antenna.

II. FEEDING TECHNIQUES OF MICROSTRIP ANTENNA

The patch antennas gets powered by different kinds of feeding techniques. These feeding techniques are.

A. Microstrip line Feeding Techniques :

In this type of feeding technique, the edge of the microstrip patch is directly connected to a conducting strip. In microstrip line technique a thin line of conducting microstrip feed is connected from the patch to the border of the substrate .this microstrip feed provides plan surface to the antenna. Due to this plane surface it is very easy to mount anywhere.

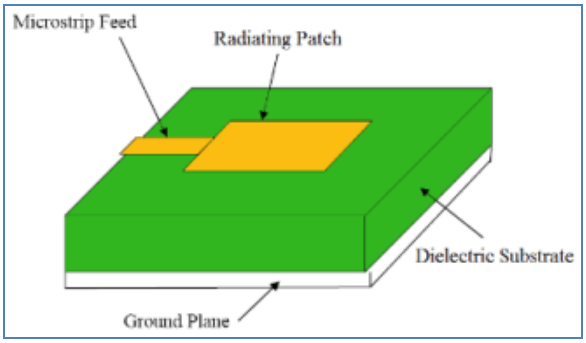


Fig-2 Microstrip line technique

B. Coaxial Probe Feeding Techniques:

In coaxial probe feeding technique the conductor of the coaxial connecter is directly attached to the ground plan , while the inside is extended to the dielectric substrate and is welded to the radiating patch of the antenna. The disadvantage of coaxial probe feeding technique is that it is very difficult to produce and built a narrow bandwidth as per the user requirement.

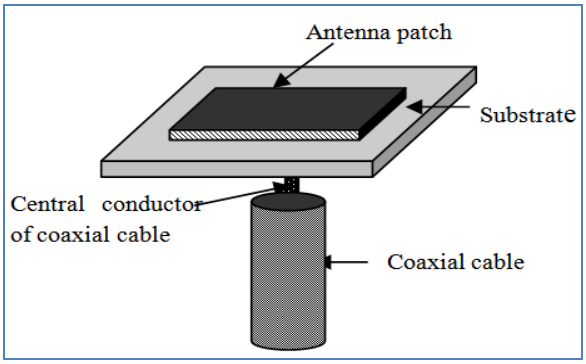


Fig-3 Coaxial Probe Feed

C. Feeding Techniques with Proximity coupled

In proximity coupled feeding technique in this typoe of feeding it takes two dielectric substrates in which the feed line is in between two substrates and on the other side the radiating patch is on the top the substrate of the antenna.

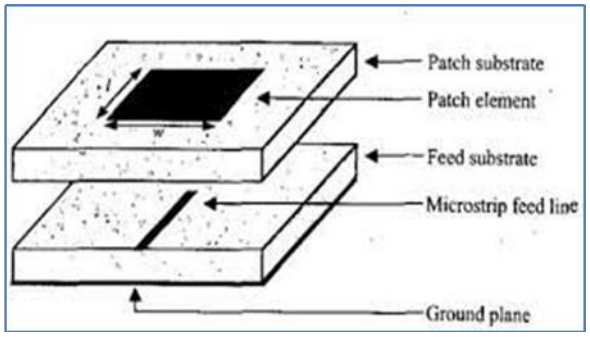


Fig-4 Feeding with Proximity coupled

III. DESIGN RECTANGULAR PATCH ANTENNA

In the process of designing a rectangular patch antenna we have to consider some of the basic factors to design.These parameters are .

Step 1: A parameter Width of the radiating patch is compute from this equation:

$$W = \frac{c}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}} \quad \text{.....(1)}$$

Where

C : velocity of light, 3*108m/s,

ε_r: dielectric constant of the substrate.

fr : resonant frequency

Step 2: Dielectric constant of themicrostrip patch antenna is calculated by

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left\{\frac{1}{\sqrt{1+\frac{2h}{W}}}\right\} \quad \text{.....(2)}$$

Step 3: The effective length is specified at the resonance frequency by.

$$L_{eff} = \frac{c}{2f_r\sqrt{\varepsilon_{eff}}} \quad \text{..... (3)}$$

Step 4: Extension length is calculated by the given formula:

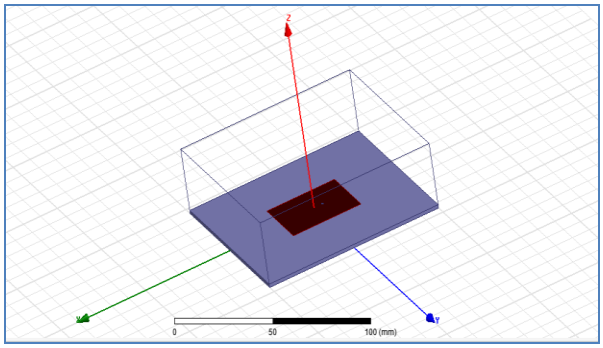
$$\Delta L = h * 0.412 * \frac{(\varepsilon_{eff}+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{eff}+0.)(\frac{W}{h}+0.264}$$

The length " L" of the microstrip patch antenna is calculates as:

$$L = L_{eff} - 2\Delta L \quad \text{..... (5)}$$

IV. HFSS SIMULATION

For the simulation process of the microstrip patch antenna we have used the software called Ansys High Frequency Structure Simulator (HFSS) software. HFSS is basically 3D electromagnetic simulation software which is used to design and simulate high-frequency antennas or microwave components, filters, IC packages, connectors and printed circuit boards. Engineers across the world used HFSS software to design and simulate high-frequency and high speed electronics found in communications systems. After the simulation and design of the antenna , the design of the antenna is shown in figure Fig-5



.Fig-5HFSS Design of microstrip antenna with rectangular patch

Parameters of the antenna are:

- Substrate: RT Duroid 5880
- Resonant Frequency:2.4 GHz
- Dielectric constant:2.2
- Height: 1.6 mm
- Feed: coaxial feed
- Length of patch : 40 mm
- Width of patch: 30 mm

The parameter VSWR**Voltage Standing Wave Ratio** is the measurement of the numerically describes how well the antenna is impedance matched to the transmission signal it is connected to.

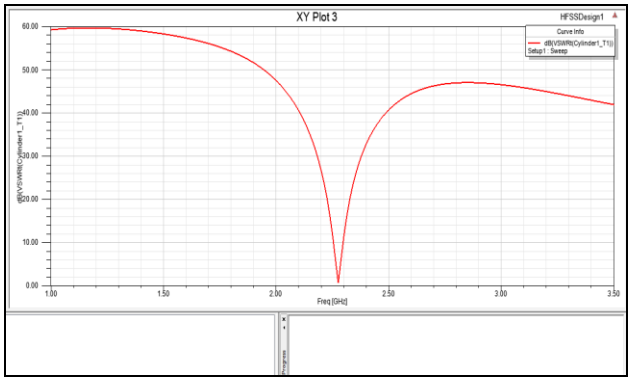


Fig. 6 VSWR

Return loss - basically return loss is the measurement of how much power is reflected back from the antenna due to the mismatch of the impedance. When connected to a network analyzer, S_{11} measures the amount of energy returning to the analyzer – not what's delivered to the antenna. The amount of energy that returns to the analyzer is directly affected by how well the antenna is matched to the transmission line..

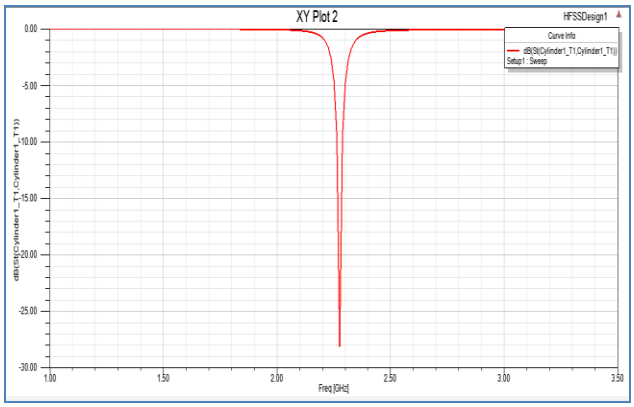


Fig-7Return Loss

The energy radiated by the microstrip patch antenna is represented or demonstrated by the Radiation pattern of the antenna. Radiation Patterns are diagrammatical or pictorial form of representing radiated energy into space, Fig. 6 it shows the radiation pattern of the patch antenna which we have designed.

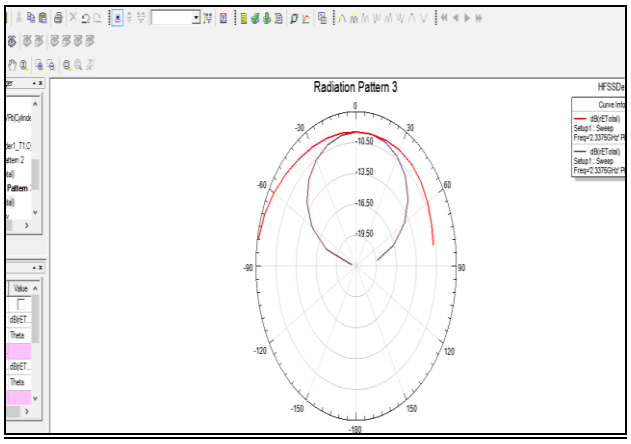


Fig-6 Radiation pattern

V. HARDWARE DESIGNING AND TESTING

After designing the microstrip patch antenna in HFSS and analysing the results of the simulation then hardware part is to be done . First proper substrate is to be taken in our case we chossed RT Durid 5880

Then we have to take the required dimensions of the rectangular patch and then we have to do the etching of the board with the help of the ferric chloride.

Fig-7 Microstrip Patch Antenna

After building the microstrip patch antenna we have to do the testing using spectrum analysis of 2.4Ghz and find out the VSWR and Return loss**.** The result of the spectrum analysis is shown in below table.

Table-results

Antenna	VSWR	Return loss	frequency
1(simulated)	-29.96	1.09	2.4Ghz
2(tested)	-30.2	1.5	2.4Ghz

V. CONCLUSION

In this paper we discussed about microstrip patch antenna what all components are used in microstrip patch antenna after that we discussed different feeding techniques. Then we designed the model in HFSS, then we took the simulated results and then worked on the hardware part and took the results in spectrum analyser.

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