DESIGN OF CO-AXIAL FED MSPA FOR MULTI FREQUENCY

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Abstract- Our paper presents a method of designing the micro strip antenna which could be used in multiple applications, such as mobile radio and wireless communications. Here we design a coaxial fed micro strip patch antenna. The designed antenna can simultaneously cover the multiple frequencies. Parameters like Bandwidth, Gain, and Return loss will be simulated using HFSS.

Keywords- Coaxial feed, Micro strip patch antenna, multiple frequencies

1.0 Introduction

The micro strip patch antenna has inherent advantage of small size, low profile, light weight and ease of integration with other circuits. It is very suitable for wireless communication. Presently there are many other government and commercial applications, such as mobile radio and wireless communications with similar specifications. To meet these requirements, micro strip antennas can be used. This paper describes a method of design of the rectangular Coax-Fed micro strip antenna with its distinguish resonant frequencies. The simulation is done using ANSOFT HFSS software; High Frequency Structure Simulator (HFSS) is high- frequency simulation software which is based on a finite element method and its accuracy and powerful features makes it a common tool for antenna designers. The future generation wireless networks require systems with broad band capabilities in various environments to satisfy numerous applications as smart grid, personal communications, home, car, and office networking. its conformability makes it very much desirable for the use in mobile phone, hand held devices and vehicles such as aircrafts, space crafts, marine craft, trains and cars.

2.0 Antenna Analysis

The most commonly employed micro strip antenna is the rectangular patch antenna. These antennas are low profile, conformable to any surface, simple and inexpensive to manufacture using modern printed circuit technology, mechanically robust when mounted on rigid surfaces, compatible with MMIC designs; they are versatile in terms of frequency, polarization, pattern, and impedance. Therefore, we have used this antenna.

Its major drawbacks are low efficiency, low power, high Q, poor polarization purity, very narrow bandwidth which we have overcome by choosing appropriate substrate with proper dielectric constant. Increasing the thickness of the substrate improves the efficiency of the antenna. Stacking of micro strip elements can also be used to increase the bandwidth.

The different types of feeds used are Micro strip line feed, Coaxial feed, Aperture feed, and Proximity feed. We have chosen Coaxial feed for it is easy to install, fabrication and impedance matching is easy. It has low spurious radiation. It enhances gain.

There are numerous substrates that can be used for the design of micro strip antennas. Their dielectric constants range between $2.2 \leq \varepsilon r \leq 12$.The most desirable for good antenna performance are thick

substrates. Thick substrates are advantageous because their dielectric constant is in lower end which provide better efficiency, larger bandwidth, loosely bound fields for radiation into space.
FR-4 glass epoxy is a popular and versatile high-pressure thermos set plastic laminate grade with good strength to weight ratios. With near zero water absorption, FR-4 is most commonly used as an electrical insulator possessing considerable mechanical strength. The rectangular patch is by far the most widely used configuration. It is very easy to analyse using both the transmission-line and cavity models, which are most accurate for thin substrate.

3.0 Antenna Design

In this approach, the Rectangular metal film was printed on a dielectric substrate, which is sitting on and perpendicular to a perfectly conducting ground plane. The Micro strip antenna is designed to operate at a multiple frequency band, The length (L) of the patch is 30mm and width (W) is 40 mm. The area of the ground plane sets 100 X 90mm2.A substrate with the thickness of 3.2mm.
A 50 Ω coax probe feed is directly attached via the circular cut out (Lumped port) with a radius of 1.6mm circular port. The cylindrical coax pin is made up of the pec (Perfect electric conductor) material with a radius of 0.7mm and the height of 1.6mm. The coaxial-line feed defines; where the inner conductor of the coax is attached to the radiation patch while the outer conductor is connected to the ground plane. For the radio frequency system, application of these antennas must be matched to the traditional 50Ω impedance of the front end circuitry. Therefore, the impedance network has to be plugged between the source and antenna.

4.0 Configuration

In micro strip patch antenna, there are some well-known methods to increase the bandwidth of patch antennas such as cutting a resonance slot in the patch, reduce ground plane, the use of thick substrate, the use of low dielectric substrate, the use of various impedance matching feeding techniques, the use of slot antenna geometry and multi resonator stack configuration.

To decrease the resonant frequency of an antenna for a given surface, the current path must be maximized within the area. For efficient radiation, the size of micro strip antenna should be λ/2.We have changed substrate for same antenna to obtain the multiple frequency, with minimum return loss.

5.0 Results

We obtained the result using various substrate.The substrates are as follows:

1. RT DUROID

   Here we used RT Duroid as a substrate whose dielectric constant is 2.2.

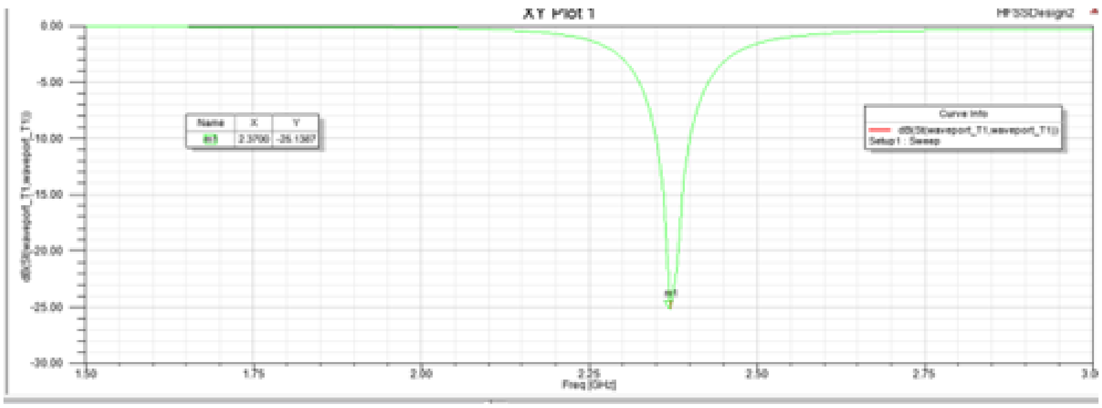

Figure 1: Return Loss of RT duroid as dielectric

Whose return loss -25.138db for 2.37GHz.

S/N	Frequency (GHz)	Return Loss(dB)	Bandwidth (MHz)
1	2.37	-25.138	50

2. AIR

We changed the substrate as AIR whose dielectric constant is 1.

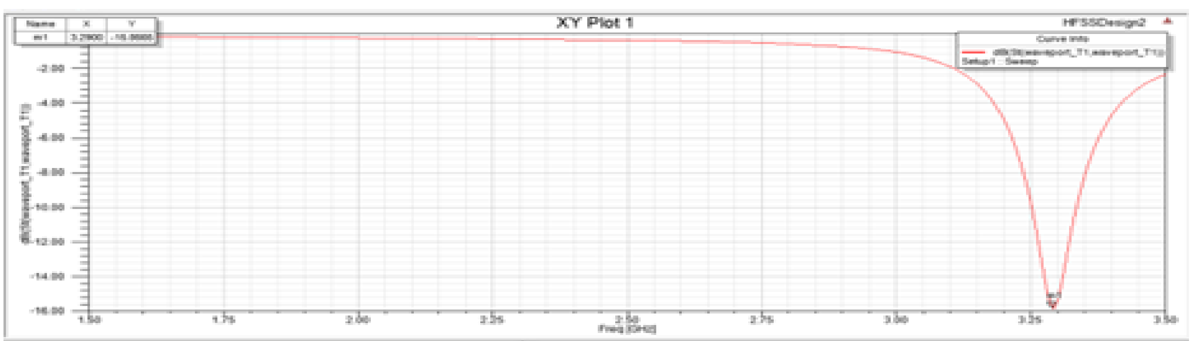

Figure 2: Return Loss when air is dielectric

Whose return loss is -15.866 for 3.29 GHz

S/N	Frequency (GHz)	Return Loss(dB)	Bandwidth (MHz)
1	3.29	-15.866	90

3. FR4 Epoxy

We changed the substrate as FR4 Epoxy whose dielectric constant is 4.4. Here we obtained multiple frequency with return loss respectively.

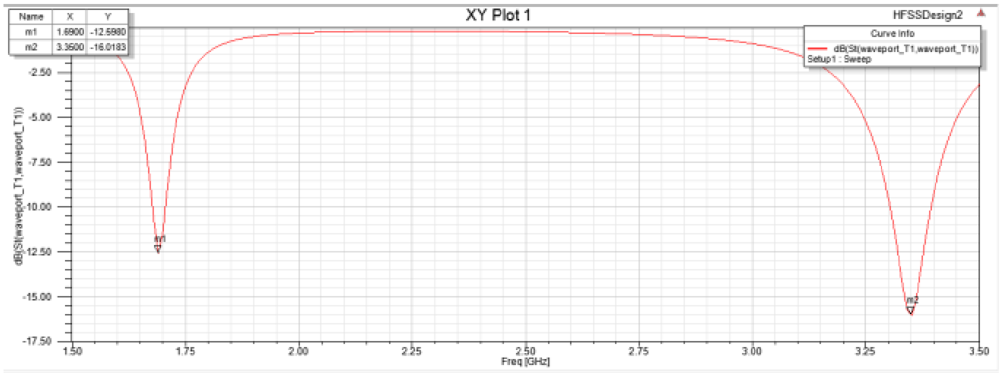

Figure 3: Return Loss when FR4 Epoxy used as dielectric

S/N	Frequency (GHz)	Return Loss(dB)	Bandwidth (MHz)
1	1.69	-12.698	30
2	3.35	-16.01	90

4. TACONIC TLC

We changed substrate as Taconic whose dielectric constant is 3.2. In this method we obtained multiple frequency with respective return loss.

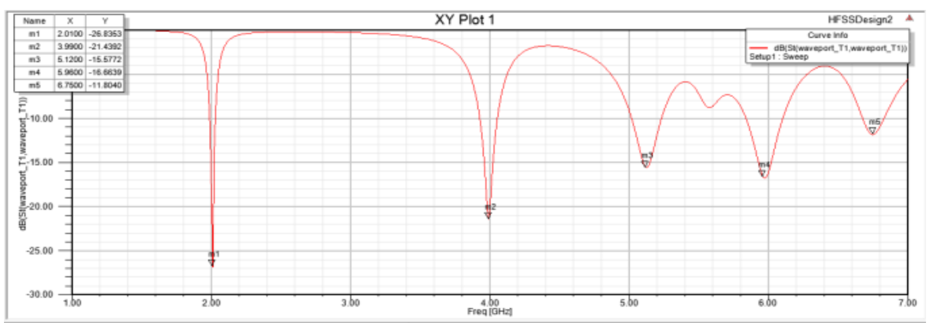

Figure 4: Return Loss when TACONIC TLC is used as dielectric

S/N	Frequency (GHz)	Return Loss(dB)	Bandwidth (MHz)
1	2.01	-26.83	40
2	3.99	-21.43	120
3	5.12	-15.57	200
4	5.9	-16.66	230
5	6.7	-11.80	140

6.0 Conclusion

The designed antenna with Taconic substrate provides multiple frequency with return loss respectively. The simulation results of the Micro strip rectangular patch antenna were also presented

References:

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