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Design of Micro strip Patch Antenna for L band

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Abstract:

Microstrip patch antennas are widely used in different communication applications like GPS, Wi-Max & WLAN. They are having advantage like low weight & size, low cost, simple feeding techniques, possibility of linear & circular polarization, duel frequency & dual polarization etc. In this paper a Rectangular shaped Microstrip patch antenna is designed, which is operating in L (Long Wave) (1-2 GHz) band. Later on the rectangular Microstrip patch antenna is modified in S & E shaped antenna. A comparison of rectangular, Z & E shaped patch antenna is also part of this paper.

Keywords — **Rectangular Microstrip Patch antenna, CPW feeding technique, Return loss, VSWR.**

I. INTRODUCTION

The study on microstrip patch antennas has made a great progress in the recent years. Compared with the conventional antennas, microstrip patch antennas have more advantages and better prospects. In this era of next generation networks we requirehigh data rate and size of devices are getting smaller day by day. Microstrip antennas (MSA) have characteristics like low cost and low profile which proves their use in different communication applications.

A Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side and overview of MSA shown in fig. 1. The patch is generally made of conducting material such as copper or gold and can take any possible shape shown in fig. 2. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. The EM waves fringing off the top patch into the substrate and are radiated out into the air after reflecting off the ground plane. For better antenna performance, a thick dielectric substrate having a low dielectric constant is desirable since this provides better efficiency, larger bandwidth and better radiation.

The concept of microstrip antenna with conducting patch on a ground plane separated by dielectric substrate was undeveloped until the revolution in electronic circuit miniaturization and large-scale integration in 1970

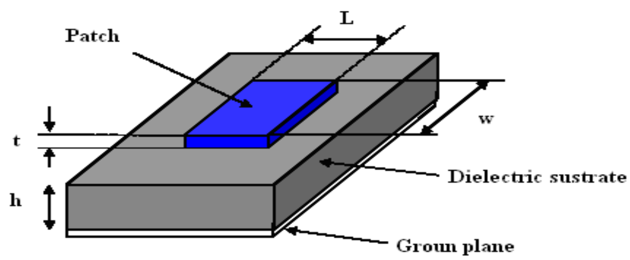

Fig. 1: Structure of Microstrip patch antenna.

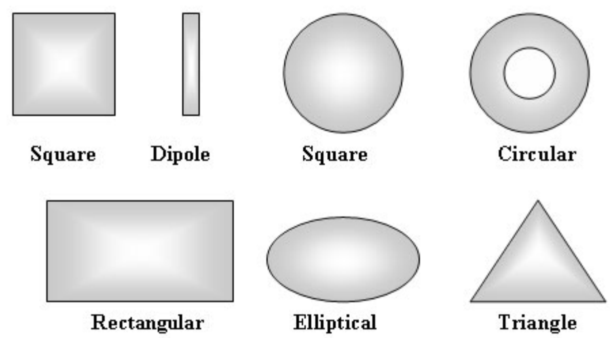

Fig. 2: Common shape of patch of microstrip antenna.

After that many researcher have described the radiation from the ground plane by a dielectric substrate for different configurations. The early work of Munson on micro strip antennas for use as a low profile flush mounted antennas on rockets and missiles showed that this was a practical concept for use in many antenna system problems.

Various mathematical analysis models were developed for this antenna and its applications were extended to many other fields. The micro strip antennas are the present day antenna designer's choice.

II. ANTENNA DESIGN

There are three essential parameters for design of a rectangular microstrip Patch Antenna. Firstly, the resonant frequency (f) of the antenna must be selected appropriately. The second important parameter of antenna is substrate thickness. The height of dielectric substrate (h) of the microstrip patch antenna with coaxial feed is to be used in S-band range frequencies.Hence, the height of dielectric substrate employed in this design of antenna is h= 1.6mm. The third important parameter of good antenna design is dielectric substrate (ε_r). A thick dielectric substrate having low dielectric constant is desirable. This provides better efficiency, larger bandwidth and better radiation. The low value of dielectric constant increases the fringing field at the patch periphery and thus increases the radiated power lower quality factor (Q). FR-4 Epoxy which has a dielectric constant of 4.4 and loss tangent equal to 0.02 can be used for antenna design.

A) Design of Rectangular Microstrip Patch Antenna

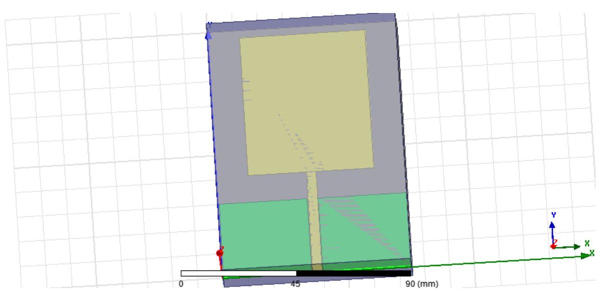

Fig. 3:Design of Rectangular patch antenna.

The geometry of antenna is as shown in above figure, the size of patch is 50*56 mm, and substrate size is 75*100 mm. The obtained results are as shown in following figure. 4.

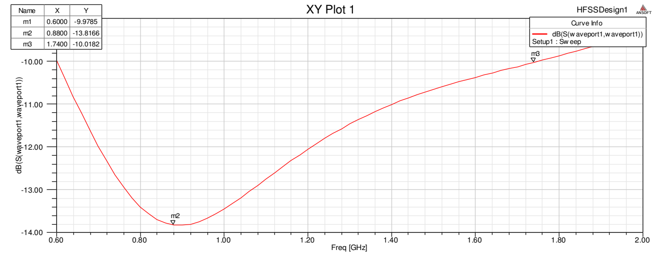

Fig. 4: Return Loss of Rectangular patch antenna.

From above figure it indicate that antenna is resonating at 0.8* GHz (marker M2), & gain of antenna is shown in figure 5.

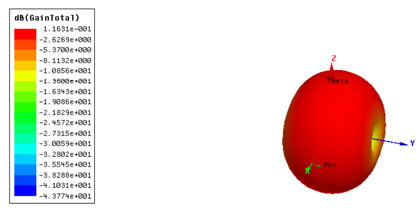

Fig. 5: Gain of Rectangular patch antenna.

B) Design of Z shaped Microstrip Patch Antenna

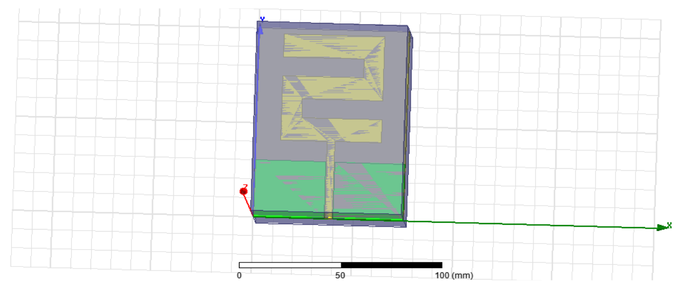

Fig. 6:Design of Z shaped patch antenna.

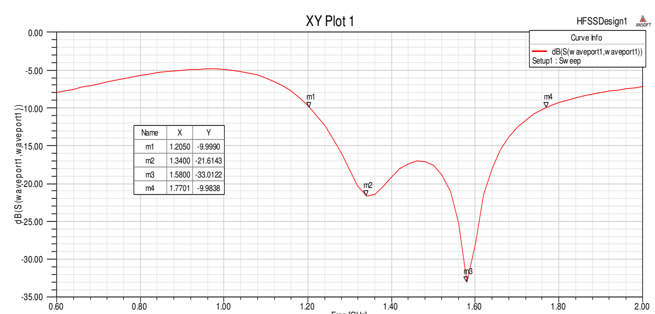

Fig. 7: Return Loss of Z shaped patch antenna.

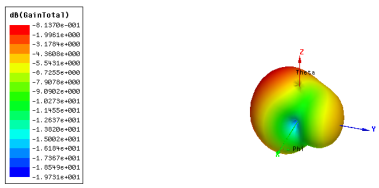

Fig. 8: Gain of Z shaped patch antenna

C) *Design of E shaped Microstrip Patch Antenna*

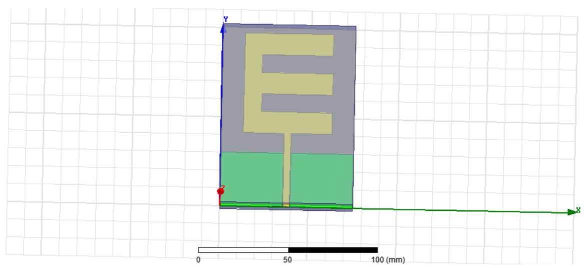

Fig. 9:Design of E shaped patch antenna.

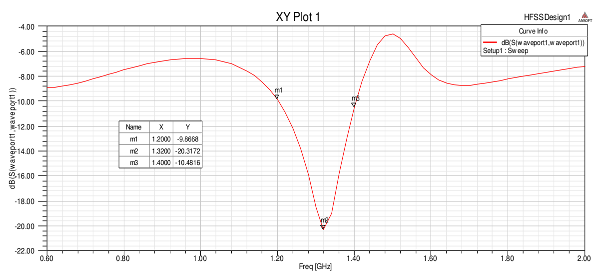

Fig. 10: Return Loss of E shaped patch antenna**.**

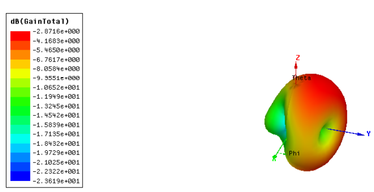

Fig. 11: Gain of E shaped patch antenna

III. Comparison between Rectangular, Z & E shaped Microstrip Patch Antenna

Parameter	Rectangular MSA	Z shaped MSA	E shaped MSA
Resonant Frequency	0.88 GHz	1.58 GHz & 1.77 GHz	1.32 GHz
Bandwidth	2.14 GHz	0.57 GHz	0.20 GHz
Gain	0.11 dB	0.08 dB	0.02 dB

The comparison between rectangular Z & E shaped microstrip patch antenna shows that, highest value of bandwidth can be obtained in case of rectangular MSA. The gain of all above antennas is lower, as there is always a trade-off present between bandwidth & gain of MSA.

IV. CONCLUSION

In above paper a rectangular, Z & E shaped microstrip patch antenna is designed using HFSS, which are operated in L (1-2 GHz) band. The technique used for antenna feeding is CPW feeding technique. All above antennas are resonating in between frequency of 1 & 2 GHz. The comparison between above antennas shows that, we obtain higher bandwidth using these antennas but lower gain, as there is always tradeoff between gain & bandwidth.

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