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Design and Simulation of Rectangular Microstrip Patch antenna for Wireless Communication

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Abstract
This paper presents the design of microstrip patch antenna using high frequency structure simulator (HFSS 12). The two different configurations simple rectangular and dual stacked rectangular patch are designed. The performance of two antennas is analyzed in terms of bandwidth ,return loss & gain. The material used for substrate is FR4 having the dielectric constant 4.4 .This material is easily available & has low cost.The return loss of simple rectangular patch is -33.3db & gain is 4.6161db whereas the return loss for dual stacked is -30.045db & gain is 8.3313db.

Keywords

Microstrip patch, multistack,HFSS,Gain,Return loss.

I.Introduction

Microstrip Patch antennas are a smart solution for compact and cost effective wireless communication system. Features such as light weight ,low volume,low profile, low fabrication cost,robustness,ease of mounting on the host surfaced integration with the printed circuits led their use in a wide range of applications. However these antennas suffer from a no. of drawbacks suchas narrow bandwidth,low gain,poor radiation performance due to excitation of surface waves etc. The multistacking of patch improves bandwidth & gain while increasing the volumetric size & cost.

II.Antenna Design

A. Simple Rectangular Patch Antenna

Fig.1 shows the design of simple rectangular patch antenna. The antenna design is implemented using HFSS 12 (High Frequency Structure Simulator).

The various design parameters are:

Substrate Material : FR4

Dielectric Constant : 4.4

Size of Substrate : 100X95X8mm

Size of Patch : 72X67 mm

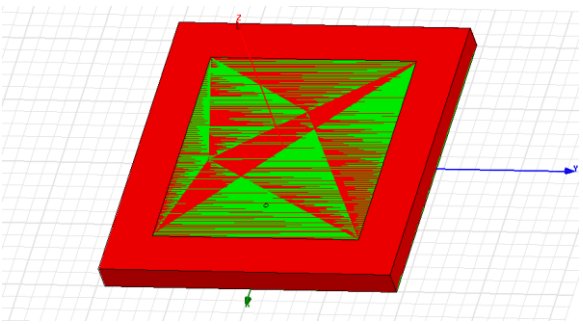

Fig. 1 Simple rectangular patch

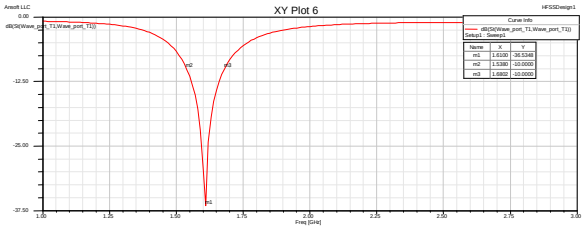

Fig.2 Freq. vs Return loss of simple rectangular patch

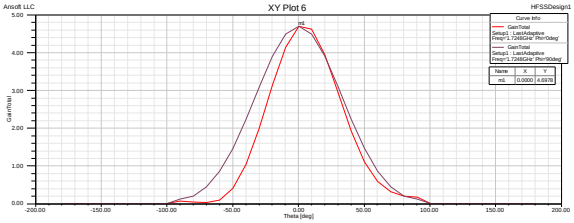

Fig.3 Gain Vs Theta graph of simple rectangular patch

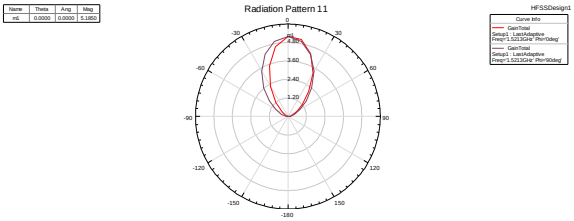

Fig 4 Total gain of simple rectangular patch

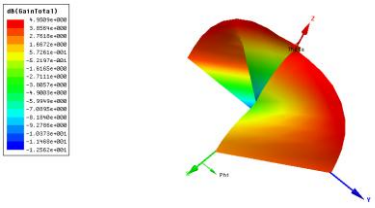

Fig.5 3-D plot of gain

Fig. 2,3,4 & 5, show the return loss, gain vs theta ,total gain and 3-D plot of gain. The return loss is -33.3 db & gain is 4.6161%.

B. Dualstacked Rectangular Microstrip Antenna

Fig. 6 shows the design of dualstacked rectangular microstrip antenna.

The design parameters are:

Substrate material: FR4

Dielectric Constant: 4.4

Size of Substrate : 120X95X8 mm

Size of Patch : 52x67 mm

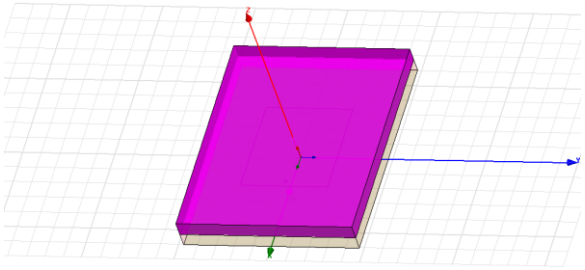

Fig.6 Dualstacked layer

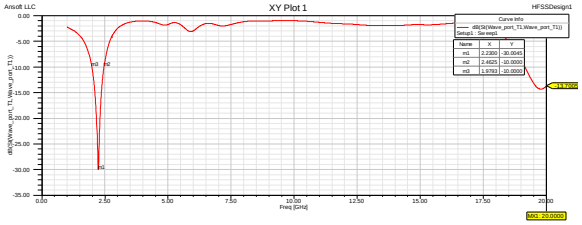

Fig.7 Return Loss of dualstacked patch.

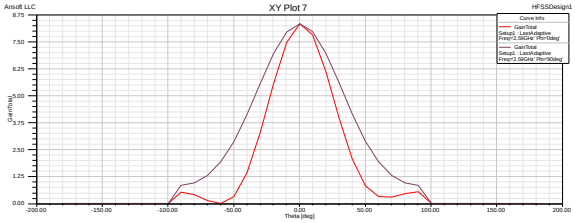

Fig. 8 Gain Vs Theta of dualstacked patch

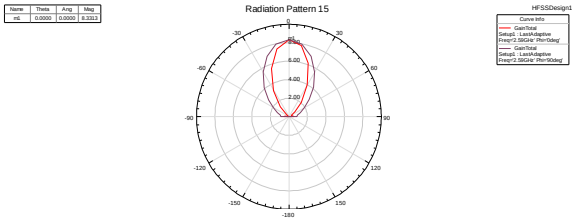

Fig. 9 Total gain of Dualstacked patch

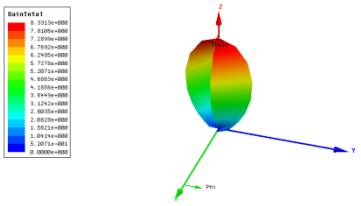

Fig.10 3-D plot of gain

Fig. 7,8,9 & 10 show the return loss,gain vs theta, total gain and 3-D plot of gain respectively.The return loss & gain of dualstacked rectangular microstrip antenna is -30.0 45db & 8.3313% respectively.

III .Comparative Analysis:

Table 1 gives the comparative analysis of two antenna configurations.The parameters compared are bandwidth ,return loss and gain.

S No.	Parameter	Simple Rectangular Patch	Dual Stacked Rectangular Patch
1	FL (GHz)	1.7059	1.9793
2	FH(GHz)	1.9064	2.4625
3	FO (GHz)	1.8023	2.23
4	Bandwidth(%)	11.124	21.6
5	Return Loss(db)	-33.3	-30.045
6	Gain(db)	4.6161	8.3313

Table 1. Comparative analysis of two antenna configurations

IV. Conclusion:

After designing and simulation of two antenna configurations we conclude that multistacking increases the bandwidth & gain of the antenna.Due to multistacking bandwidth gets approximately doubled and there is an increase of 4db in gain approx.

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