DESIGN OF RECTANGULAR MIROSTRIP PATCH ARRAY ANTENNA IN C BAND APPLICATION

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ABSTRACT - The design of micro strip patch antenna with center frequency at 6 GHz for WI- FI,WLAN devices application. The micro strip rectangular antenna with micro strip line feeding based on quarter wave impedance matching technique. This antenna was designed and simulated using ANSOFT HFSS (high frequency structure simulator). A 3*1 array antenna designed and it is better than the single micro strip patch antenna parameters likereturn loss, voltage standing wave ratio (VSWR), radiation pattern and gain. The array antenna was then fabricated on the substrate material Rogers RT duriod with dielectric constant of 2.2 and thickness of 3.2mm respectively. The results shown good agreement with the array antenna simulated performances.

I. INTRODUCTION

There are various shapes of antenna depending on its application. In general, the Micro strip antenna has different properties which are depending upon its applications. These properties include low profile, light weight, compact and simple fabrication and Ease of installation. These properties contribute to the application of Micro strip antennas in the military applications, such as aircraft, missiles, space craft, and also in the commercial areas, mobile satellite system, cellular mobile communications, broadcast satellite system, wireless communication and global positioning system. The choice of antenna selection is based on the requirements of the application such as frequency band, gain, cost, coverage, weight, etc. Wi-Fi is the most rapidly growing area in the latterly wireless communication. This gives users the mobility to move around within a broad coverage area and still be connected to the network. This provides greatly increased flexibility. For the home user, wireless has become popular due to ease of installation, and location freedom. Portable antenna technology has grown along with mobile and cellular technologies.

II. MICROSTRIP PATCH ANTENNA

In this process, a Micro strip patch antenna consists of a radiating patch which is built on the dielectric substrate and substrate is attached on the ground plane. The patch is generically made of conducting material such as copper or gold and can take any possible shape.

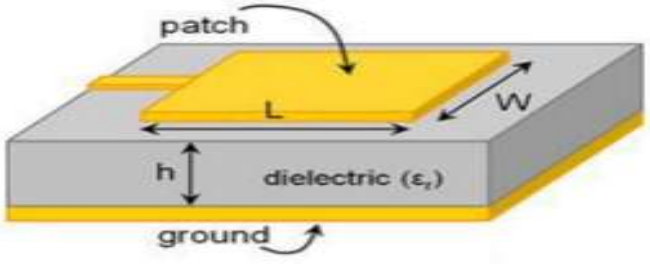


Figure (1): Structures of Micro strip patch Antenna.

The radiating patch and the feed lines are usually photo etched on the dielectric substrate. The relative permittivity of the dielectric substrate is very important for the calculations of the antenna dimensions. In order to simplify analysis, the patch is generically square, rectangular, circular, triangular, and elliptical or some other common shapes.The rectangular patch can be used. Micro strip patch antennas radiate primarily because of the fringing fields between the patch edge and the ground plane. For good antenna performance, a dielectric substrate having a deteriorated dielectric constant is desirable since this provides better efficiency, larger bandwidth and better radiation.

III. Design of the single antenna

The antenna is designed for a resonating frequency of 6 GHz. The substrate material Rogers RT duriod which has the relative permittivity of εr=2.2. The substrate thickness is designed as 3.2mm.

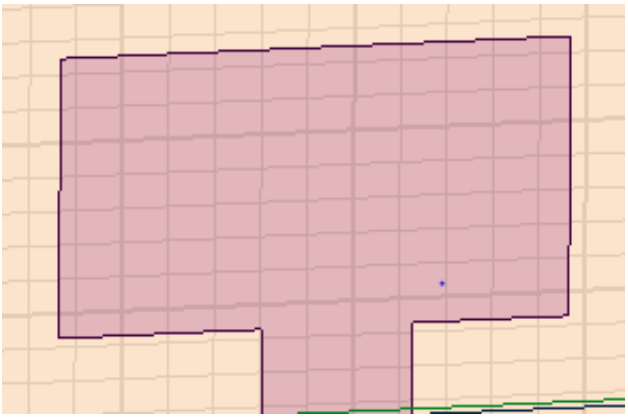


Figure (2): Rectangular micro strip patch antenna design.

Design specification of the proposed antenna:

Design parameter	Values
Dielectric constant	2.2
Length	70.51
Width	86.71
Feed length	-16.51
Feed width	16.3
Thickness	3.2
Operating frequency	6

The dimensions of the antenna can be calculated by using the following relationship.

1. Width of the Patch:

$$W = \frac{c}{2f_o\sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Where,

C= free space velocity of light.

F_r = resonating frequency.

ε_r = relative permittivity of substrate.

2. Effective dielectric Constant:

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}}$$

Where,

H= thickness of the substrate.

W=width of the patch.

3. Effective Length:

$$L_{eff} = \frac{c}{2f_o\sqrt{\varepsilon_{eff}}}$$

4. Iv. Patch length extension:

$$\Delta L = 0.412h\frac{(\varepsilon_{eff} + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\varepsilon_{eff} - 0.258)\left(\frac{W}{h} + 0.8\right)}$$

5. v.Length of the patch:

$$L = L_{eff} - 2\Delta L$$

6. vi.Width of the substrate:

$$L_g = 6h + L$$

7. vii.Length of the substrate:

$$W_g - 6h + W$$

IV. ANTENNA ARRAY DESIGN:

Antenna arrays are used to enhance various antenna parameters like bandwidth, directivity, gain, beam width and efficiency. There are a variety of methods to feed the signal into Micro strip patch antennas. Micro strip line feeding, coaxial feeding, inset feeding, aperture coupling. Using the center frequency 6 GHz with micro strip line feeding technique. Substrate material Rogers RT duriod with dielectric constant of 2.2 and thickness of 3.2mm.

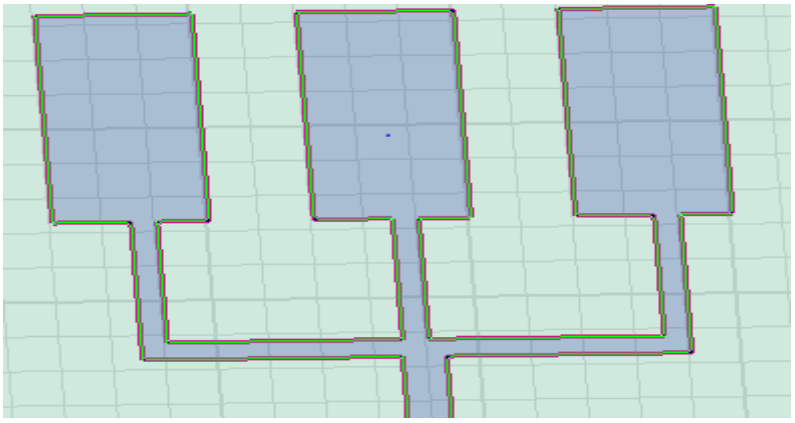


Figure (3): Rectangular Micro strip Patch Array Antenna Design.

Design specifications of the 3x1 array:

Design parameter	**Values**
Center frequency	6 GHz
Substrate	Rogers RT duriod
Substrate height	3.2 mm
Dielectric constant	2.2
Copper Thickness	0.035 mm
Loss Tangent	0.025

V. RESULTS AND DISCUSSIONS: The simulated results of the above antenna patch array for the following parameters are as follows.

A. Return Loss. S (1,1)
B. VSWR
C. Radiation pattern
D. Gain

Return loss:

The return loss determined for 3*1 array antenna and observed the better results. This array antenna is design to using the 6 GHz frequency with RTduroid as substrate with micro strip line feeding.

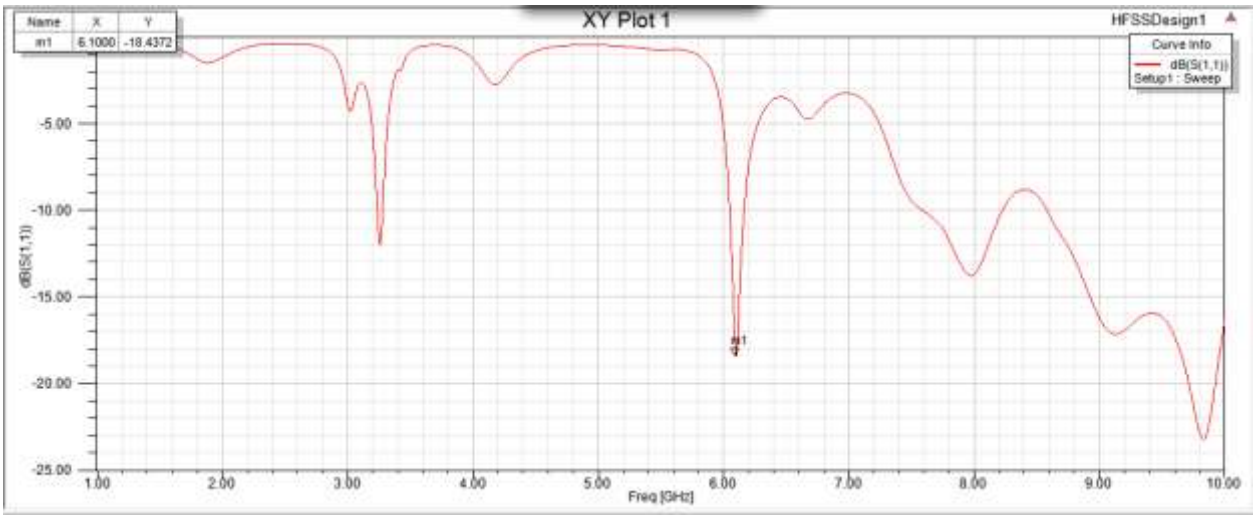
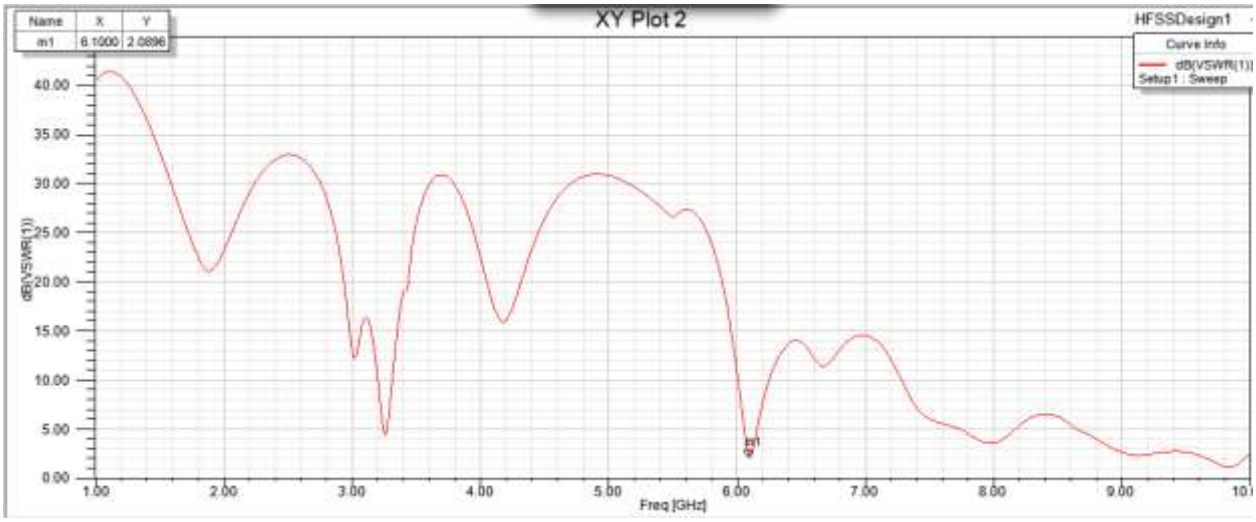


Figure (4) return loss at 6.1

VSWR:

The VSWR determined for 3*1 array antenna and observed the better results. This array antenna is design to using the 6 GHz frequency with RTduroid as substrate with micro strip line feeding.



Figure(5) VSWR at 6.1

Radiation pattern:

It is the strength of radio waves that provides the antenna for transmitting and receiving. It also measures the gain of an antenna. The radiation pattern of array antenna.

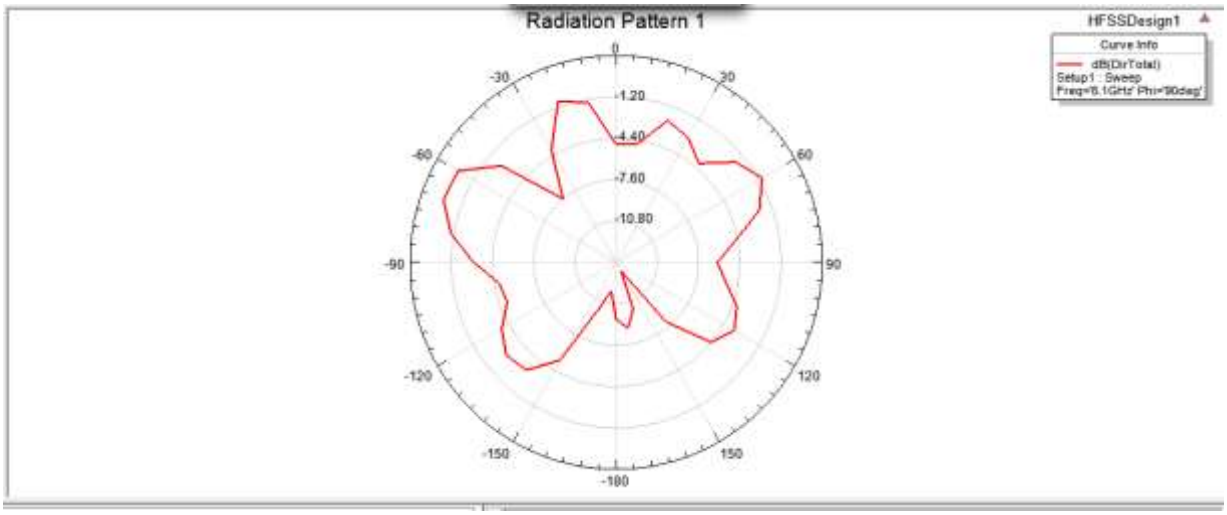


Figure (6) radiation pattern at 6.1

Gain:

The gain determined for 3*1 array antenna and observed the better results. This array antenna is design to using the 6 GHz frequency with RTduroid as substrate with micro strip line feeding.

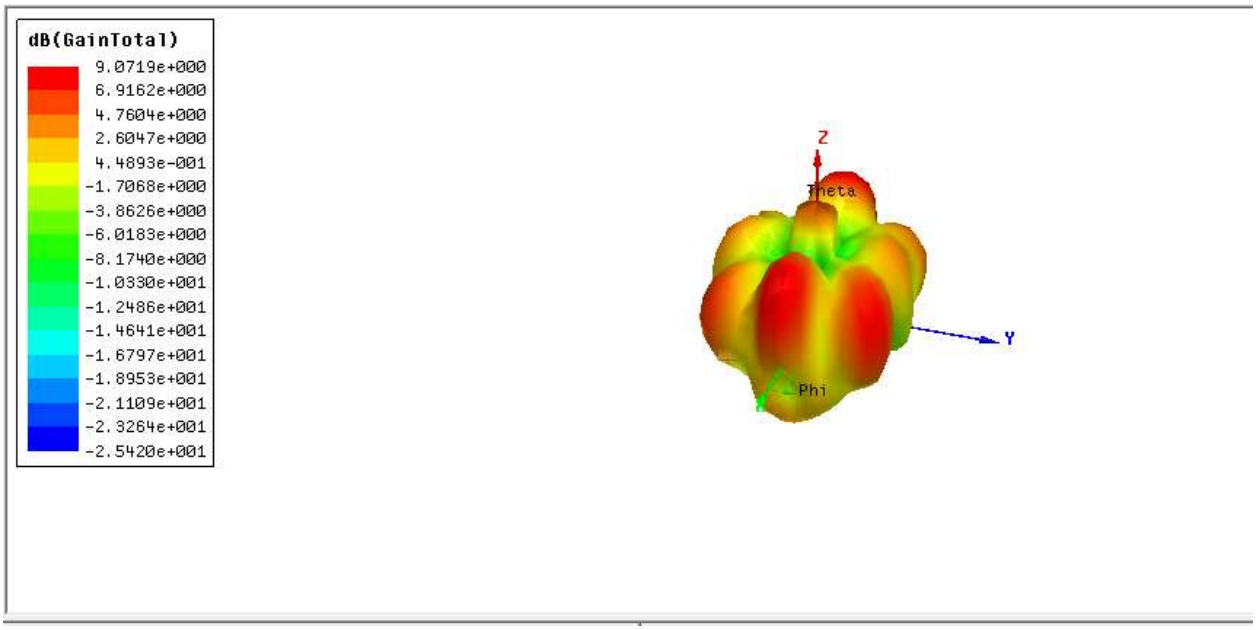


Figure (7) gain at 6.1

VI. CONCUCSION:

A 3x1 rectangular patch antenna array designed is successfully. It is designed at the frequency of 4-8 GHZ for various applications. Here micro strip line feeding technique is used for three element antenna array. Simulation using the HFSS 13.O Software. The array antenna gives better return loss, gain and VSWR.

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