Designing of Co-axial Feed Y-Shaped Micro-strip Patch Antenna for CDMA Applications

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ABSTRACT

In telecommunications, there are several types of micro strip antennas, the most common of which is micro strip patch antenna. Patch antennas are also relatively inexpensive to manufacture and design because of simple 2D physical geometry. In this paper a micro-strip patch antenna is designed to improve the efficiency which can be used at high frequencies due to their low compact size and low cost. Here the designed antenna was co-axial feed Y-shape micro-strip patch antenna. Different elements like gain(3D & 2D) measured in dB with value 7.911, return loss of -15.017 at 1.3GHz, radiation pattern total in 3D and 2D, E-field(4.8996e+002), H-field(1.6956e+000) and current distribution(2.4095e+000) with mesh plot can be simulated using HFSS 13.

Keywords: Co-axial feed, micro-strip patch, slot antennas.

I. INTRODUCTION

In wireless communication, there are several types of micro strip antennas the most common of which is the micro strip patch antennas. A micro-strip patch antenna, in its simplest form, is just a single corner conductive plate that is spaced above a ground plane. Patch antennas are attractive due to their low profile and ease of fabrication. The radiation pattern of a single patch is characterized by a single main lobe of moderate beam width. The radiation can be regarded as being produced by the "radiating slots" at top and bottom , are equivalently as a result of the current flowing on the patch and the ground plane. Frequently, the beam widths in the azimuth and elevation planes are similar, resulting in a fairly circular beam, although this is by no means universal. The beam widths can be manipulated to produce an antenna with higher or lower gain, depending on the requirements. An antenna built with a single patch will have a maximum gain of about 9 dib or a bit less. This is a simple rectangular patch built over a rectangular ground plane. The radiation patterns exhibit typical patch antenna characteristics. There is a single main lobe with a fairly wide beam width with shallow nulls pointing up and down from the antenna. Other than that, there aren't many features to the pattern. These are not uncommon beam widths for single patch antennas. Due to the numerous advantages of patch antenna[1] and in view of various techniques to improve the performance of corner micro-strip patch antenna mentioned in [1], a co-axial probe feed to enhance the bandwidth of proposed antenna is chosen. Here slots are placed in the patch. Slot antenna consists of a metal surface, usually a flat plate or a slot cut out. Advantages of slot antennas are its size, design simplicity, robustness, and convenient adaptation to mass production using PC board technology.Various attempts are made to adjust the dimensions of the patch to improve the elements like return loss, gain along θ, Ø directions, radiation pattern in 2-D and 3-D, E and H Field Distributions, Current Distributions using HFSS 13.0 which is a high performance full wave EM field simulator. This HFSS simulator employs the field distributions in 3D and plotting the corner meshing.

II. DESIGN CONSIDERATIONS

The proposed structure of the antenna is shown in Figure 1. The antenna is simulated on an Rogers RT/duroid 5880(tm) substrate with a permittivity constant of 8.854 and a permeability of 1.25. The thickness of the substrate is 831.25*3 cm. The area of the antenna is 63.412*2cm, which is suitable for mobile applications. Rectangle patch with Y-shape slots cut is taken with a co-axial feed shape as shown in Figure 1.slot antennas are used typically at higher frequencies 300MHz and above. Slot antennas are popular because they can be cut out of whatever surface they are to be mounted on ,and have radiation patterns that are roughly unidirectional. These slot antennas are often used in aircraft applications because they are made to conform to the surface on which they are mounted. These are also widely used in radar antennas, for the sector antennas used for cell phone base stations and, are often found in standard desktop microwave sources used for research purposes.

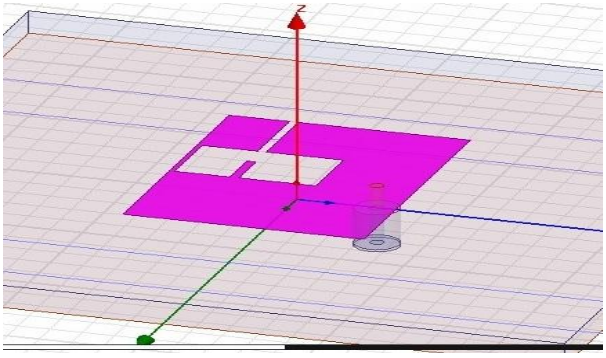

Fig. 1. Geometry of Y-Shaped Patch antenna with co-axial feed

The co-axial probe feed that can be inserted into micro-strip patch that considered through ground plane. The ease of insetting and low radiations is advantages of probe feeding as compared to micro-strip line feeding. The dimensions of shaped patch shown in Figure 1 are L=9.92cm, W=7.5cm which are designed at operating frequency 1.2 GHz.

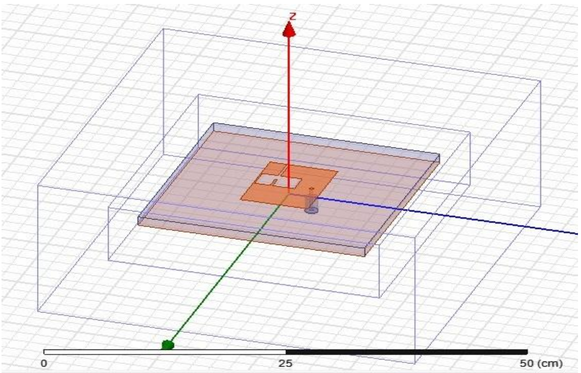

Fig. 2. Ansoft HFSS generated model.

This figure 2 that can be substrate with Rogers RT/duroid 5880(tm) material using An soft HFSS model.

III. SIMULATION RESULTS

A. Return loss

This can be defined as difference in dB between the forward and reflected power measured at a given point in an RF system.

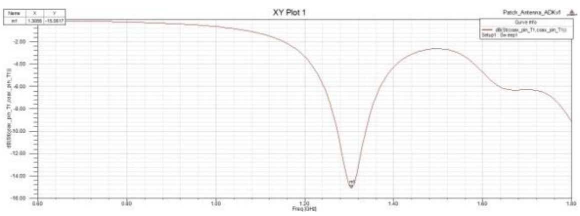

Fig. 3. Return Loss

Figure 3 shows the return loss plotted at 1.2GHz. the return loss that obtains -15.0617dB at 1.3GHz.

B. 3D Gain and 2D Gain

It is defined as the ratio of the intensity (power per unit surface) radiated by the antenna in a given direction at an arbitrary distance divided by the intensity radiated at the same distance by an hypothetical isotropic antenna. Gain is a key performance figure which combines the antenna's directivity and electrical efficiency.

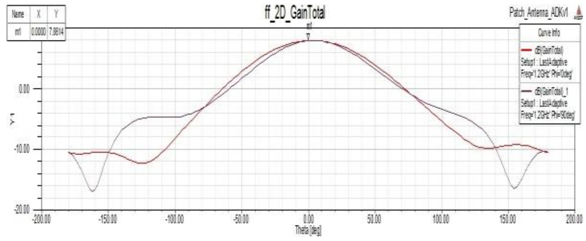

Fig.4. 2D Gain total

Figure 4 shows the 2D gain total plotted at 1.2GHz. The gain that obtains 7.8614dB at 0 degrees.

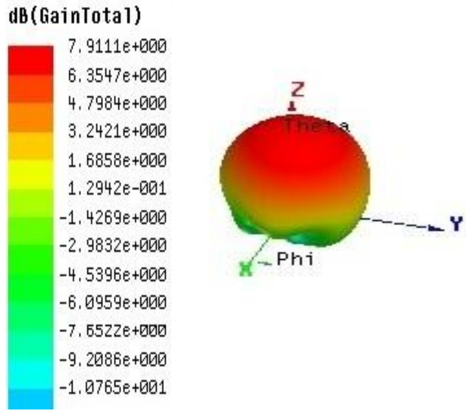

Fig.5. 3D Gain total

Figure 5 shows the 3D gain plotted at 1.2 GHz. The gain that obtains 7.9111e.

C. Radiation Patterns

Radiation pattern of an antenna can be defined as the locus of all points where the emitted power per unit surface is the same.

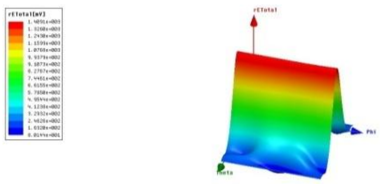

Fig.6. Radiation pattern Total

Figure 6 shows the radiation pattern total(E total) plotted at 1.2GHz. The E total obtains 1.4091e+003.

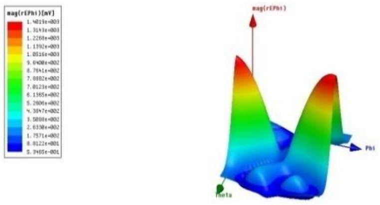

Fig.7. Radiation Pattern Phi

Figure 7 shows the radiation pattern phi(E Phi) plotted at 1.2GHz. The E Phi obtains is 1.4019e+003.

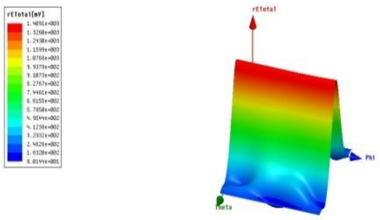

Fig.8. Radiation pattern Theta

Figure 8 shows the radiation pattern theta (E Theta) plotted at 1.2GHz. The E Theta obtains 1.4064e+003.

D. E-Field distribution

It can be defined as the vector quantity which means at every point in space it has a magnitude and a direction.

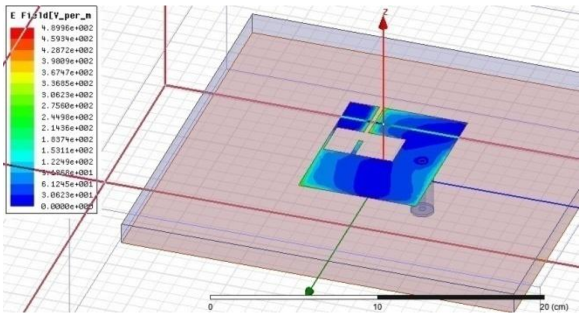

Fig.9. Electric Field

Figure 9 shows the electric field distribution(mag E) plotted at 1.2GHz. The mag E obtains 4.8996e+002.

E. H-Field distribution

It is defined as the H-field is a vector quantity (has a magnitude and direction) and is measured in Amps/Meter [A/m].

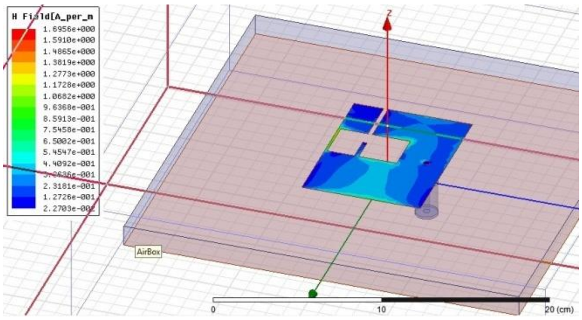

Fig.10. Magnetic Field

Figure 10 shows the magnetic field distribution(mag H) plotted at 1.2GHz. The magH obtains 1.6956e+000.

F. Current distribution

The 3D current distribution plot gives the relationship between the co-polarization and cross-polarization components.

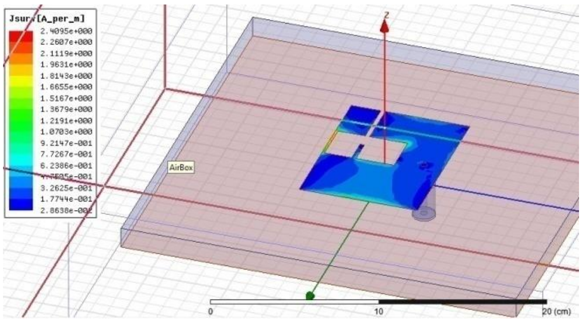

Fig.11. Current distribution

Figure 11 shows the current distribution(mag Jsurf) plotted at 1.2GHz. The mag Jsurf obtains 2.4095e+000.

G. Mesh Plot

This the mesh plot that can be said by the rectangles which defines the current distribution.

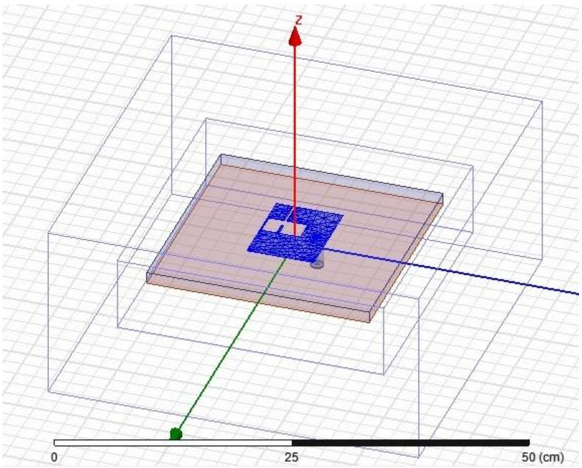

Fig.12. Mesh Plot

Figure 12 shows the mesh plot obtained at 1.2GHz.

IV. CONCLUSION

Finally, the measurements of Y-shaped patch antenna on Rogers RT/duroid 5880(tm) substrate for mobile and wireless applications has been investigated. The performance properties are analyzed for the optimized dimensions and the proposed antenna works well at the required frequency L-band.

V. ACKNOWLEDGMENT

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