FPGA APPLICATION USING COMPACT MICROSTRIP PATCH ANTENNA RT/ DUROID 5880 FOR WIRELESS COMMUNICATION

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Abstract

Accessibility and development in the improvement of minimal effort, less weight and exceptionally dependable receiving wires are essential for remote correspondence, as it presents new difficulties for radio wire plan in remote correspondence. The small scale strip fix reception apparatus utilized for these correspondences, since they will give high recurrence and less transfer speed. This report presents a plan and reproduction of a rectangular miniaturized scale strip fix radio wire in a 3 GHz recurrence extend for remote correspondence that gives an example of radiation over a wide shaft edge. The structure procedure utilizes Rogers RT/duriod 5880 material which is utilized as a substrate and the coaxial test taking care of technique is utilized to give the radio wire excitation esteem. The HFSS programming will be utilized to structure and execute the radio wire. The planned radio wire can be actualized in the FPGA controller to confirm applications continuously.

Keywords: Micro strip patch antenna, Radiation pattern, Ansoft HFSS (High Frequency Structural Simulator), FPGA controller.

1.Introduction

Around the world, correspondence needs start with the fundamental requirement for a reception apparatus. Lately there has been a requirement for progressively conservative radio wires in light of the fact that the size of specialized gadgets is quickly diminishing. In this manner, we need receiving wires of little measure and less weight. The receiving wire is commonly a metal gadget, (for example, a pole or link) that is utilized to transmit or get electromagnetic waves. The radio recurrence power created in the last period of a transmitter is conveyed through links or force supplies, without devouring vitality to the transmitting reception apparatus. This movements in free space as radio waves (electromagnetic waves). The getting receiving wire gathers radio waves and gives a valuable sign at the contribution of a recipient for signal gathering. The transmission and gathering radio wires are corresponding in the sense, any attribute of the reception apparatus

as a rule applies similarly to both. The smaller scale strip radio wire is one of the little reception apparatuses and is printed legitimately on the printed circuit board. The microstrip radio wire is a model of the thin band restricted band receiving wire component in a constrained metal follow on a dielectric substrate. These receiving wires are for the most part utilized for remote applications. They are little in size, ease, less taking care of weight, simple to produce, solid and are accessible in various shapes and ranges, for example, square, rectangular, dipole, round, triangular, roundabout, curved and some other shape. Receiving wire attributes, for example, radiation design increase, directivity and polarization are discovered utilizing the Ansoft HFSS recreation instrument.

2. Antenna Structure

The micro scale strip fix receiving wire comprises of a brilliant fix on one side of the dielectric substrate which has a ground plane on the opposite side and the fix is on the upper side. The micro scale strip fix radio wire is made out of three layers, these are the lower layer, which comprises the ground plane, the middle layer which shows the substrate lastly the upper layer which shows the fix. The fix is commonly made of conductive material, for example, copper or gold, and can take any conceivable shape that will be expressed previously. The structure of the micro scale strip fix radio wire was appeared in Figure 1

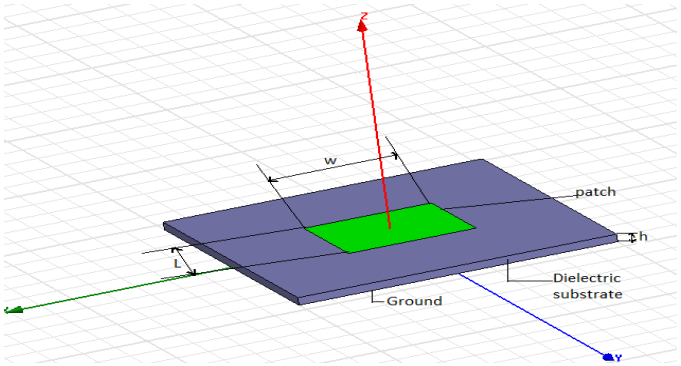

Figure 1. Structure of Micro scale strip fix patch antenna

3. Micro Strip Patch Antenna Design And Considerations

The Micro Strip radio wire was planned utilizing Ansoft HFSS. It is one of the radio wire configuration instruments. Ansoft HFSS is a straightforward and cheap instrument that has the basic strategies for structuring the reception apparatus in an exceptionally proficient manner. When utilizing this product, the recieving wire must be structured and reenacted. By recreating this reception apparatus we can acquire the recurrence reaction, the increase, the directivity and the radiation design.

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techniques for examination in the reception apparatus; of these we utilize the transmission line investigation strategy for the plan of the radio wire, which remembers numerous scientific counts for the structure of the receiving wire[1]. The structure stream of the small scale band receiving wire is appeared in figure 2. In light of this stream they ought to be structured.

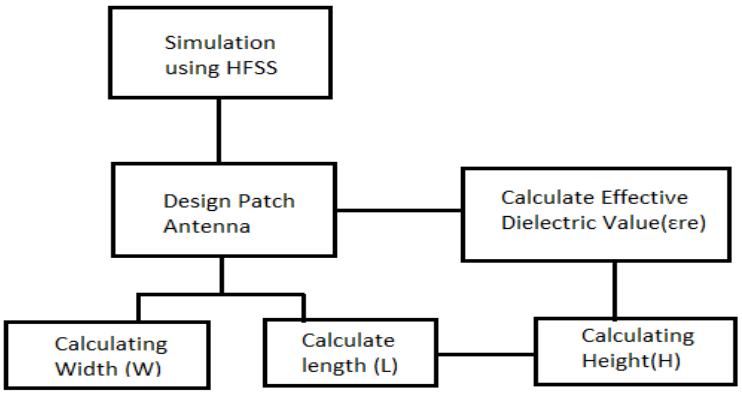

Figure 2. Design flow of Micro scale strip fix patch antenna

3.1. Calculation for the Antenna Width (W)

The Width of micro scale strip fix patch antenna is given by equation

$$W = \frac{C}{2 f_0 \sqrt{\frac{\varepsilon_r + 1}{2}}} \tag{1}$$

Where, C is speed of light, f_0 is a full recurrence and ε_r is a relative kick the bucket electric consistent. Different widths are likewise picked however for the higher widths the radiation effectiveness is lower in way and for the lower widths the radiation productivity is bigger in coming about qualities, right now [2]subbing C=3*10^11mm/s, ε_r =2.2 and f_0= 3GHz recurrence, at last by settling this condition we get the width esteem as 42mm for the 3 GHz.

3.2. Calculating the Height of the Antenna

The height (H) of the micro scale strip fix patch antenna is given by equation and is written as

$$H = \frac{0.3C}{2\pi f_0 \sqrt{\varepsilon_r}} \tag{2}$$

By subbing all the qualities and settling the condition we get the stature of the reception apparatus as 3.86mm for 2.8GHz or the standard tallness of the smaller scale strip fix receiving wire 3.2mm is utilized for the recreation.

3.3. Calculating the Antenna Length (L) with Effective Die Electric Constant

Before figuring the length of the reception apparatus we should ascertain the few different calculations, the principal we would locate the compelling pass on electric steady of the substrate which is a lot more prominent than the solidarity

esteem. The viable bite the dust electric steady worth is a lot nearer than the bite the dust electric consistent of the substrate. The compelling bite the dust electric consistent worth is given in equation

$$\varepsilon_{re} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{w}\right]^{\frac{-1}{2}} \quad (3)$$

4. Roger Rt/Duriod 5880(Tm)

The Roger material has the die-electric constant value as 2.2 which will be mostly recommended material for the designing of the micro strip patch antenna [1]. By using these materials the designing parameters values are get reduced and the size of the antenna was almost in small range and which will produce the maximum radiation pattern along its transmission side of the structure[4]. By using these materials the entire structure of the antenna gets minimized, cost of the designing procedure is getting reduced and the same time we get output of the micro strip patch antenna in a good and accurate manner.

4.1. Software Tool

The product utilized for the reenactment and demonstrating of the radio wire is HFSS (High Frequency Structural Simulator). It is one of the radio wire planning instruments and it is an elite full-wave electromagnetic (EM) field test system for the 3D volumetric detached gadget. It has straightforward methodology for the planning of the smaller scale strip fix radio wire structure and furthermore it is minimal effort, superior and effectively justifiable programming for everybody.

5. Results and Discussion

The structure and investigation of the rectangular micro scale strip fix radio wire was planned at a recurrence scope of 3GHz. The rectangular receiving wire has a greatest preferred position than different kinds since they have effortlessly planned structure and have positive emanated edges on the two sides of the reception apparatus. The three dimensional perspective on the reproduced smaller scale strip fix reception apparatus was appeared in figure.

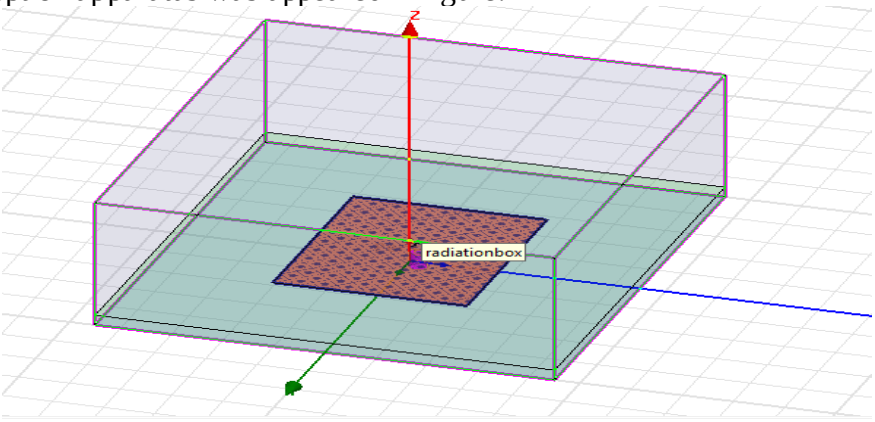

Figure 3. Three dimensional view of antenna

5.1 . Radiation Pattern

The radiation example of a radio wire has a typical radiation dissemination to its surface and it gives a picture nature of the worth and bearing of radiation, by which the receiving wire discharges or gets the electromagnetic waves[6]. The most ideal approach to speak to radiation design is by the three dimensional diagram. The radiation design is plotted to show the perception or give a perspective on the radiation. Its size relies upon the fix reception apparatus surface. Another approach to speak to it, is by the precise or polar directions.

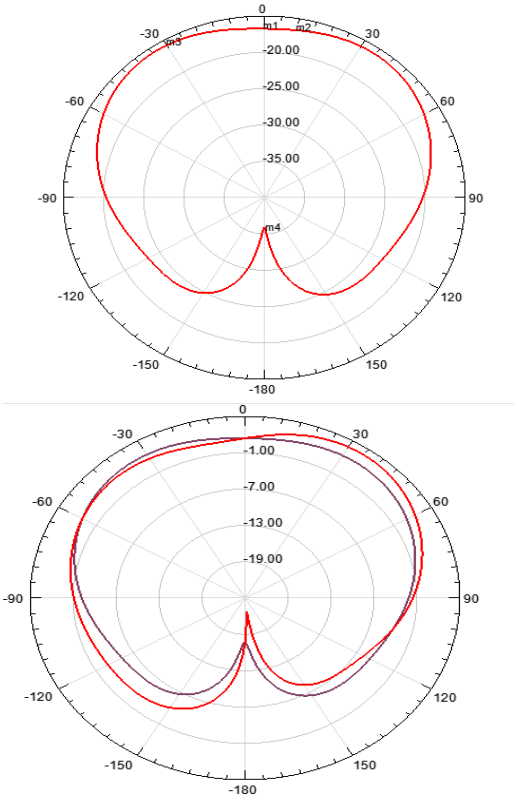

Figure 4. Radiation pattern for phi=90 and 0 deg For 3 GHz

5.2. Frequency response and Gain

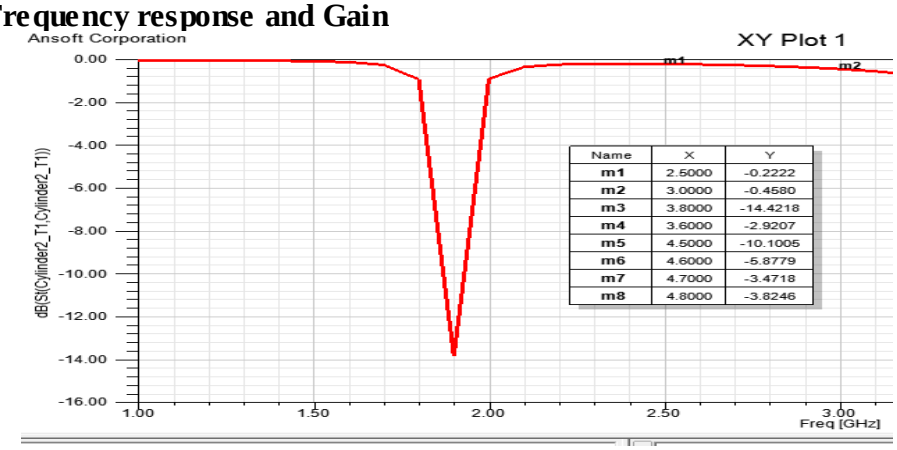

Figure 5. Frequency response for 3 GHz

The Frequency reaction of 3 GHz appear in the figure 5 to improve recurrence of significant distance correspondence. The increase of a receiving wire is characterized as the proportion between the most extreme radiation force in a provided guidance to the greatest radiation power from a reference reception apparatus a similar way, the accomplished addition of the miniaturized scale strip fix radio wire is 9.8475 dB for 3 GHz, where the figure 6 show the addition of the radio wire gain of the antenna.[5]

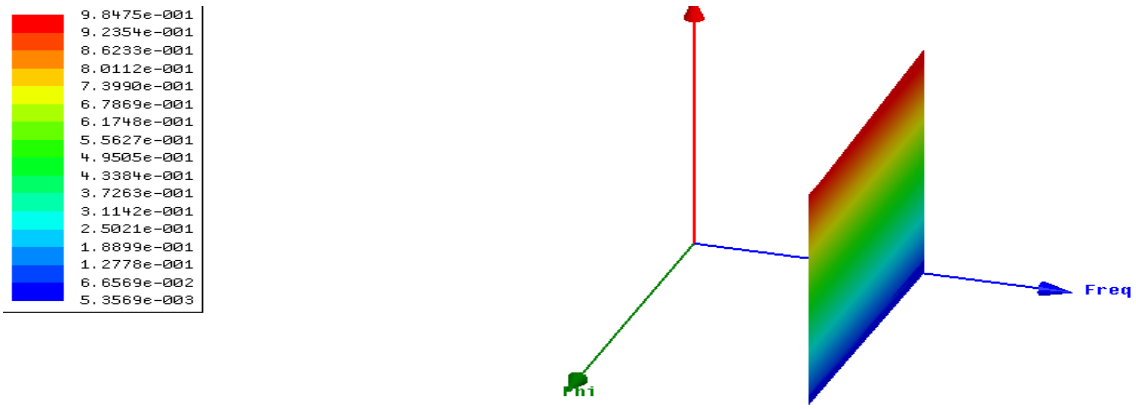

Figure 6. Gain for 3 GHz

5.3. Directivity of the micro scale fix patch antenna

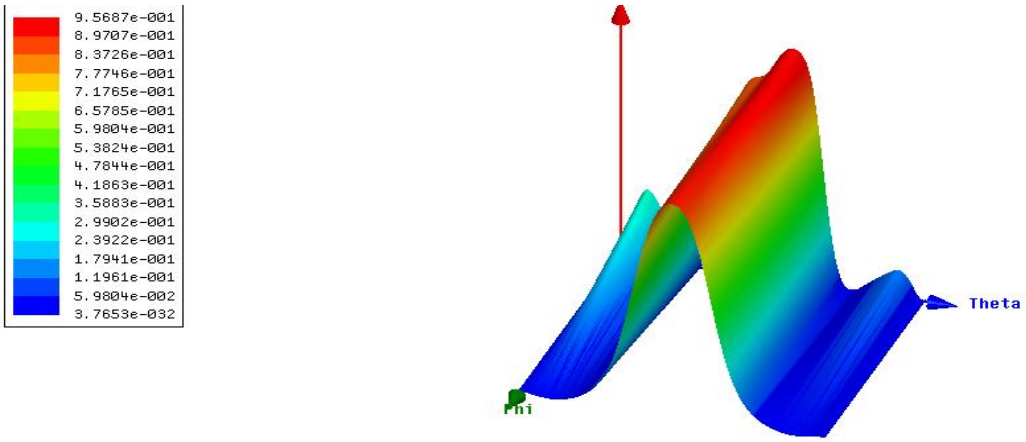

Figure 7. Directivity for 3 GHz

The figure 7 shows the directivity of the receiving wire it is characterized as the proportion between the greatest radiation power to the normal radiation force of the radio wire, the accomplished directivity of the small scale strip fix reception apparatus is 9.5687 dB for 3GHz.

5.4. VSWR of the micro scale fix patch antenna

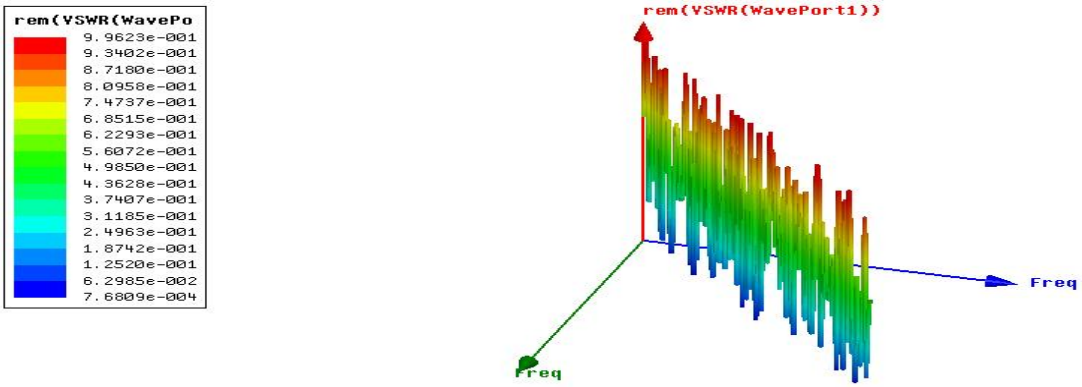

Figure 7. VSWR for 3 GHz

Another approach to perceive how mush may framework is coordinated, VSWR (Voltage Standing Wave Ratio) can be utilized. VSWR is the proportion between the most extreme voltage and least voltage in the transmission line,[7] can be characterized as follows: , where is the greatness of .When the framework is coordinated the reflection coefficient approaches 0, while VSWR ways to deal with 1.

5.4. Polarization of the micro scale fix patch antenna

The polarization of an electric field is characterized regarding the course of its electric field vector. On the off chance that the electric field vector is consistently in one plane, at that point it is said to be straightly polarized.[8]

Figure 8. Polarization for 3 GHz

Table 1. Micro strip patch antenna parameters for 3 GHz Frequency range Rogers RT/duriod 5880

Quantity	Rogers RT/duriod 5880
Gain (dB)	9.8475
Directivity(dB)	9.5687
VSWR	9.9998
Polarization	6.9951

5.5. **FPGA Implementation**

The activity of the FPGA – Cyclone II is represented through a Test Access Port (TAP) controller which is undetectable in the square chart, it is a straightforward limited state machine legitimately installed in the FPGA controller. First the reception apparatus signals are gone through the reconfigurable Low Noise Amplifier which will intensifies the low recurrence parts of the structure, after the enhancement the signs are gone through the IF change and ADC (Analog to Digital Controller) which will changes over the simple signs to the advanced signs equipped for working the FPGA in right way and we get the framework yield in

the FPGA controller dependent on the computerized signal applied on the framework.

Figure 9. Gain and Directivity for 3 GHz with FPGA

6. Conclusion

The rectangular small scale strip radio wire was structured and dissected with a recurrence scope of and 3 GHz is mimicked by utilizing the Ansoft HFSS programming. The recurrence reaction, radiation design are acquired, the structured recieving wire gain esteem is 9.8475dB, directivity esteem is 9.5687, the polarization of the radio wire is straightly spellbound reception apparatus for both the recurrence ranges by using the connectivity of FPGA.

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