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Design of T Shaped Patch Antenna for Cognitive Radio Application

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Abstract

Objectives: To design an antenna for cognitive radio application. **Methods/Statistical Analysis:** With the advancements in the technology the demand for the radiating elements which are less in weight and size with increased efficiency has increased. T Shaped patch is designed to operate in different frequencies. **Findings:** The paper explains the outline of T molded fix. The T formed fix receiving wire is contrived for the subjective radio application. The working recurrence is 3.45 GHZ. The receiving wire is outlined and simulation by utilizing ADS software. The Simulated outline offers return loss of - 16 DB at the planned recurrence. **Applications/Improvements:** As the users increase, the spectrum is now becoming a scarce resource and demands for the efficient utilization. Thus, the cognitive radio came into the field and necessitates the antenna to be flexible for multi operating environment and compact.

Keywords: Cognitive Radio, Dual Band, Micro strips Patch, Reconfigurable Element, T Shape

1. Introduction

The developments in the fields of science necessitate rapid development of radiating elements with the multi operating capabilities, less weight and size[1-8]. These techno traits lead to the introduction of compact patch antennas which serves the above mentioned requirement well. This work is about the design of a patch antenna which is T in shape. The design is targeted for the CR environment. Cognitive Radio (CR) has developed as a promising innovation to use the unused spectrum in a pioneering way[1,2]. The unoccupied spectrum by the primary users is termed as the "Spectrum hole" or "white spaces". The innovation in CR defeats the issue and permits gadgets to detect the range for unused spectrum available and utilize the most reasonable ones.

2. Antenna Design

The antenna that is modeled for the use in cognitive radio applications is T in shape. The infinite ground is used in the antenna and the T Shaped patch is intruded into the substrate. The substrate material is placed over the ground plane. The initial view of layers of the designed element is displayed in Figure 1.

Figure 1. Proposed Antenna Structure.

When designing a patch antenna, one should focus on the following i) the frequency for which the antenna is intended for ii) use of appropriate substrate material which coincides well with the desired operating frequency iii) the relative permittivity value of the chosen dielectric.

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The default design formulas are used for the estimation of width and length of the patch depending up on the operating frequency refer Table 1 for estimated values. The antenna design which is taken into consideration is for 3.4 GHZ band.

Table 1. Design Specifications

Symbol	**Quantity**	**Value for the proposed antenna design**
L	Length	23.4 mm
W	Width	30.4 mm
h	Height	1.6 mm
εr	Relative permittivity	4.4
H	Thickness of ground plane	35 Micron

The dimensions of the antenna are estimated from the above mentioned formulas are 23.4 mm and 30.4mm. The substrate material that is selected for the design is FR4 (Lossy). The relative permittivity is about 4.4 and the thickness chosen for the proposed design is 1.6 mm. The antenna is designed with the infinite ground plane with copper of about 35-micron thickness.

The T shaped antenna displayed in Figure 2 is fed with the help of edge feeding and the line impedance value for the patch is 50ohms.

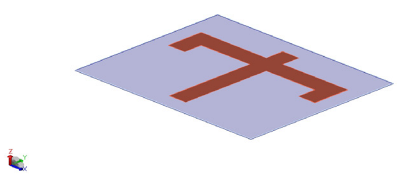

Figure 2. T Shaped Patch Antenna Structure.

3. Results and Discussions

The radio wire for CR condition is outlined and reenacted utilizing propelled plan framework programming. The recreated comes about are return loss, radiation design, straight and cross polarization displayed Figure 3,4. The Return loss is estimated as it is utilized to quantify the measure of influence that is transmitted out from the measure of the influence gave as the info. The arrival misfortune is utilized to quantify how compelling the reception apparatus emanates the influence. The arrival

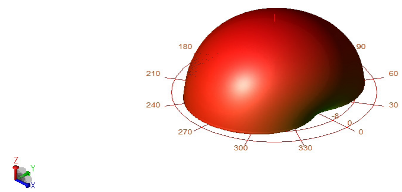

Figure 3. Three Dimensional View of Pattern.

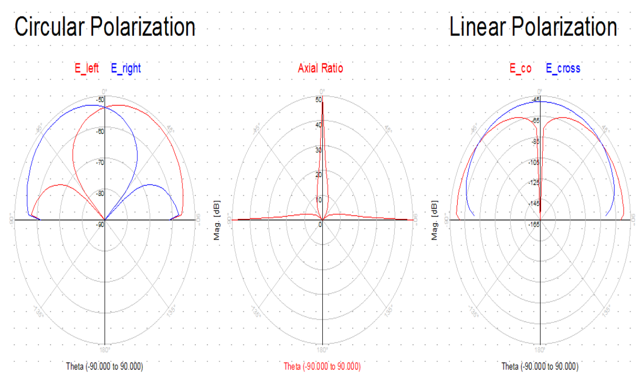

Figure 4. 2D View of Circular and Linear Polarized.

loss of any receiving wire when all is said in done ought to be not exactly -10 DB. The results obtained for proposed design is -16 DB. The plots of magnitude and phase return loss against the frequency are displayed in Figure 5,6.

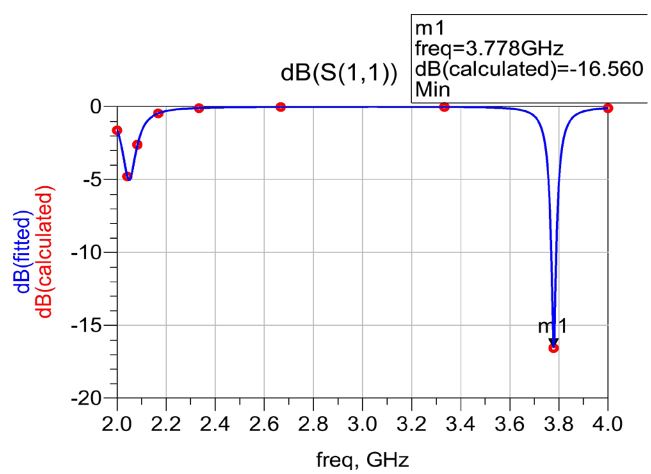

Figure 5. S11 Parameter Magnitude Plot.

The pattern of the simulated T structure radiates in all directions and it is an omnidirectional antenna. Along with current distribution the radiation is displayed in Figure 7.

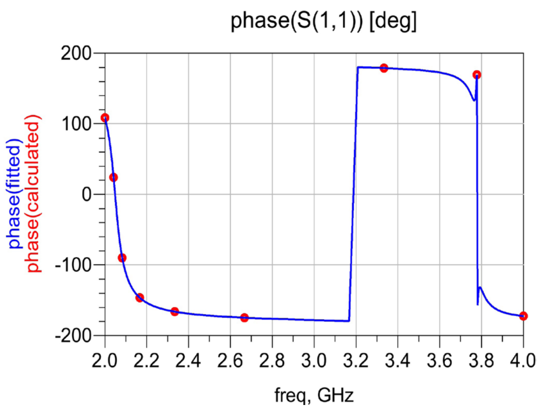

Figure 6. S11 Parameter Phase Plot.

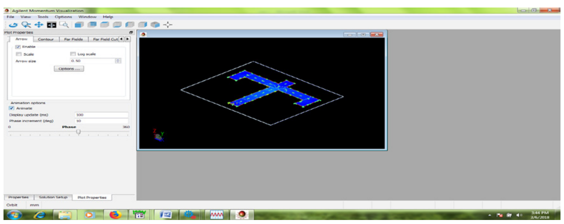

Figure 7. Current and Maximum Radiation.

The gain of radiating element about -21 dB and the Directivity is 6.89547 which are displayed in Figure 8.

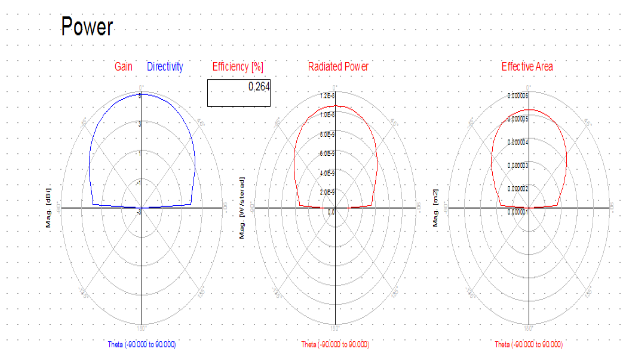

Figure 8. Gain.

4. Conclusion

Cognitive Radio is the promising technology which offers solution for the utilization of the spectrum in an effective manner. The proposed element suits well for the CR environment. The antenna offers the efficiency of about 82.2 %. The introduction of reconfigurable elements for reconfiguration of frequency, polarization and radiation pattern can be added along with the proposed antenna design and the slots can be incorporated over the patch structures can increase the bandwidth is the future scope of this work.

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