Design of Circular Patch Fractal Antenna by using Sierpinski Carpet Geometry

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Abstract- Remote Communication Technology is the best exposure in the recorded setting of mankind in the scopes of cutting edge bleeding edge correspondence structures. Fractal arranges methodology is used in perspective of its self-near and space filling property. The scope of the proposed receiving wire is to be diminished by using the round fix gathering contraption. In the Proposed work, we execute the Rogers RT/duroid 5880(tm) substrate and the dielectric relentless is 2.2 for enhance the repeat of the receiving wire. In continuation repeat the execute of one more cycle in the radio wire handle. Fractal arranges methodology is used in perspective of its self-tantamount and space filling property. The domain of the proposed gathering mechanical assembly is to be lessened by using the circuitous fix receiving wire antenna and following the parameters are radiation pattern, directivity, return loss, VSWR and Bandwidth of the proposed receiving wire antenna figured by using the HFSS.13 programming pack

Index Terms— Sierpinski carpet geometry, fractal Antenna, MSA, Return Loss, microstrip feed line.

I.INTRODUCTION

A little scale strip receiving wire is on a very basic level formed with the end goal that a joining of two parallel coordinating layers which is disconnected by a dielectric material is engraved on to a singular board. The lower layer and upper layers go about as a ground plane and radiator independently. A direct fix receiving wire uses a fix of half wavelength long and having a greater ground plane which may manufacture the gathering device measure in spite of what may be normal gives better execution. We can diagram particular conditions of little scale strip settle segments, for instance, dipole, triangular, rectangular, bended, round and square. Nevertheless, we use rectangular micro strip for better radiation qualities. Little scale strip radio wires are the successors of the printed receiving wires which are the present stock for a remote application with its repeat fragments sparing to different applications in shield, GPS, rocket structures and satellite correspondences [2, 4]. Scaled down scale strip radio wires have extraordinary execution in gathering contraption propels when appeared differently in relation to other metallic receiving wires obliging almost no exertion. We can execute unmistakable systems and advances to achieve radio wire blend inside a fascinating chip using this sort of receiving wire. In reference to this in our paper we have formed a serrated rectangular scaled down scale strip settle gathering contraption on Rogers RT/duroid 5880(tm) substrate. The principal thought behind arranging a serrated fix gathering device is that it has multiband qualities, since we have obtained twofold band for this circumstance, it will be fruitful that it will have high information transmission and high get with only a single exuding part and Omni directional radiation configuration like those of general printed recieving wires, however these are more positive as a result of its applications. In serrated gathering contraption diagram we have used Rogers RT/duroid 5880(tm) substrate since all the printed circuited sheets are generally made of this material it is definitely not hard to make serrated openings with this material. Serrated gathering contraptions have multiband traits since serrated openings are used for optical correspondence where quick is fundamental, this would be valuable for quick long range data transmission to satellite in microwave repeat amplify. Additionally, multiband frequencies are really basic in military applications composed with satellite achieves, we can have relationship with high secure, fast and insignificant exertion using the proposed the radio wire particulars. HFSS writing computer programs is used to blueprint and copy Patch.Edge Patch receiving wire. The composed round fix reception apparatus with edge.

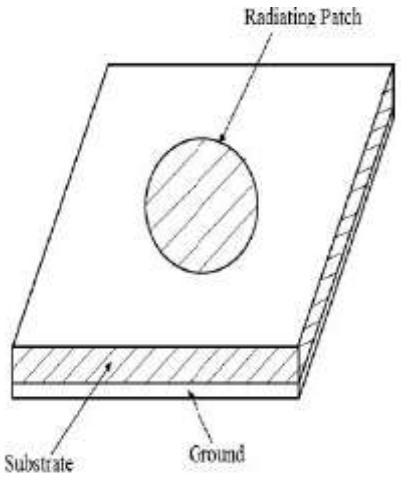

Figure 1: Designed Circular Patch Antenna

Return hardship appears at what however for the better banner quality the entry hardship should be as higher as possible than that Multi-band serrated gathering mechanical assembly infers it transmits impact at two one of a kind frequencies. The operational downside with these scaled down scale strip radio wires is having low get. So get is the noteworthy necessity to be take mind as it depends on upon shape, size and dielectric material used. As showed up in the Figure11 the illustrated serrated gathering device has a 6.8dB which is best sensible for steady applications.

Radiation Characteristics describes the relative field nature of the gathering contraption from different headings. 2d-radiation illustration is just the graphical depiction of radio wire outline in two estimations, however 3d-radiation case is the graphical depiction of gathering mechanical assembly plan in three estimations. The proposed printed-sort recieving wire depends on upon a 1.6 mm-thick Rogers RT/duroid 5880(tm substrate with estimations 25mm and 38mm. It has a rectangular part ring opening encased inside a rectangular fix. The circuit of the split-ring opening and the U-molded space in the halfway ground plane gives reverberation at two extra frequencies. The estimations of the fix, the ground, and the two openings are improved to get these coveted sensible rehash range. A novel triple-band recieving wire legitimate for WLAN/WiMAX applications is proposed in this paper. Utilizing a split-ring space embedded in the rectangular fix and a U-formed opening cut halfway ground plane, three resounding modes with magnificent impedance execution are refined. The preservationist measure, triple-band rehash, mind boggling radiation arranges, remarkable get and a basic structure makes this recieving wire sensible for useful remote correspondence frameworks, overseeing WLAN and WiMAX systems, in three different rehash social affairs. In this paper, utilizing a split-ring opening encased inside a rectangular fix and scratching a U-formed space in the fragmentary ground plane are the two frameworks used to satisfy triple-band operation execution, and likewise littler size and less unpredictable structure. By utilizing the three di®erent reverberating frequencies, the proposed recieving wire a deliver three booming modes to cover three looked for groups for WLAN and WiMAX applications. The geometry and the outline rules of the proposed Progress In Electromagnetics Research Symposium Proceedings, Moscow, Russia, August 19{23, 2012 609 recieving wire structures are presente.

II. EXISTING METHOD

Fix reception apparatus experienced vast development as of late in the field of remote correspondence and turn into the primary subject of many explores. Benoit Mandelbrot in 1975 acquaints the fractal geometries with accomplish the multiband and wideband qualities. These attributes are started by the fractal geometrical properties, for example, self-similitude and space-filling.The piece outline as shown in underneath. Fractal geometries rehash their geometries by a scale at specific measurements in progressive emphases the geometry for the fix of fractal radio wire is the comparable example of the entire geometry at various scales to make distinctive cycles and to get the better outcomes.

Self-similitude property of radio wire is utilized to acquire the multiband conduct and the space-filling property is utilized to accomplish scaling down of receiving wire. Fractal receiving wire likewise has many elements like little size, less weight and better execution over various remote applications [6] in the recurrence groups, for example, L-band (1-2GHz), S-band (2-4GHz), C-band (4-8GHz), X-band (8-12GHz), Ku-band (12-18GHz). In this paper two unique cycles of proposed reception apparatus has been planned and diverse parameters are dissected for both the emphases. The definite plans, graphical and hypothetical estimation of results are talked about in the further segments of this composition. In this work, to plan the round fix receiving wire for multiband applications.By utilizing the Microstripline nourishing, this accomplishes the most noteworthy execution for the composed antenna. Fractal radio wire is one of those procedures to enhance reception apparatus attributes utilizing .Fractal antenna is one of those techniques to improve antenna characteristics using fractal geometry.The substrate with dielectric constant 2.2 that is Rogers RT Duroid5880 substrate material.Finally, to find the return loss, radiation pattern, VSWR and bandwidth.Simulation is done by using HFSS.13(High Frequency Structure Simulator).

III.ANTENNA DESIGN CALCULATION

Step 1: Calculation of the width W:

$$W = \frac{c}{2fo\sqrt{\frac{(\epsilon r+1)}{2}}} = 1.22\text{mm} \quad \text{---------- (1)}$$

Step2: Calculation of the Effective Dielectric Constant. This is based on the height, dielectric constant of the dielectric and the calculated width of the patch antenna

$$\epsilon_{eff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2}\left[1 + 12\frac{h}{w}\right]^{\frac{-1}{2}} = 8.89 \text{ ---- (2)}$$

Step 3: Calculation of the Effective length

$$L_{eff} = \frac{c}{2f_o\sqrt{\epsilon_{eff}}} = 5.6 \text{ ---------- (3)}$$

Step 4: Calculation of the length extension

$$\Delta L = 0.412h\frac{(\epsilon_{eff}+0.3)(\frac{W}{h}+0.264)}{(\epsilon_{eff}-0.250)(\frac{W}{h}+0.8)} = 0.6 \text{---------- (4)}$$

Step 5: Calculation of actual length of the patch $L = L_{eff} - 2\Delta L = 4.4\text{mm}$ ---------- (5)

Circular radius (a)=5.255mm

$$a = \frac{F}{\left\{1 + \frac{2h}{\pi\epsilon_r F}\left[\ln\left(\frac{\pi F}{2h}\right) + 1.7726\right]\right\}^{1/2}}$$

Table: Frequency Vs Radius of circular patch antenna

Frequency(GHZ)	Radius(cm)
10.7	0.0735
16.7	0.1830
21.7	0.2041
25.6	0.1375
43.3	0.1555
49.3	-0.1991

IV.PROPOSED METHOD

Transmission line model is used to design patch antenna.The parameters used to calculate patch dimensions are given Antenna shown in the figure 1 & 2 was fabricated using a software HFSS. Because of low

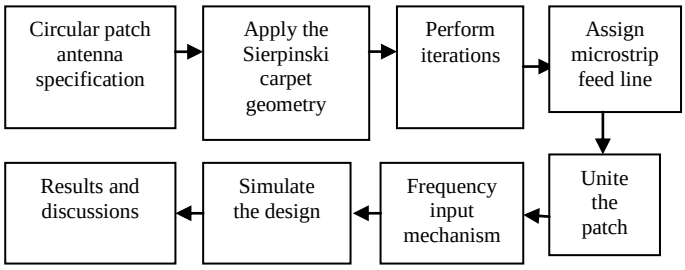

Fig 2.Block diagram

Spurious radiations and ease of fabrication the coaxial feeds are present. HFSS is a commercially available finite element method solver for electromagnetic structures Rogers RT/duroid 5880(tm) and printed circuit sheets (PCB). Rogers RT/duroid 5880(tm) is a composite material made out of woven fiber glass fabric with an epoxy tar cover that is fire safe (self-smothering). Rogers RT/duroid 5880(tm) is a well known and flexible high-weight thermo set plastic overlay review with great quality to weight proportions. With almost zero water assimilation, Rogers RT/duroid 5880 is most usually utilized as an electrical encasing having impressive mechanical quality.

I. Meshing the Dielectric Substrate

The going with is the work used to display the social event gadget? The triangles are utilized to criticized the metal scopes of the settle, and tetrahedral are utilized to discrertize the volume of the dielectric substrate in the settle. These are appeared by the tones yellow and green freely. The aggregate number of request is the whole of the request for the metal despite the request utilized for the dielectric. In this way, just a particular layer of tetrahedral are utilized to demonstrate the dielectric substrate. This gives exceptional outcomes when the substrate thickness is little regarding this situation. However for thicker substrates this may be a internment. Manual cross portion might be required to allude to change exactness. This is clarified in the running with region. Demonstrating. Thin versus thick Dielectric Substrates.

II.ITERATIONS

The Radius of the circular patch is 5.25mm,L_f =4.4mm and W_f=1.2mm by using these values we can design the circular patch antenna and then making the iterations by using the sierpinski carpet geometry as showen in below figures

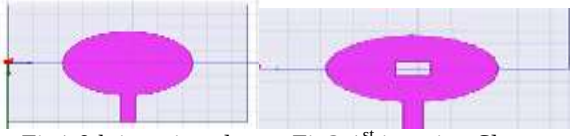

Fig1:0th iteration slot Fig2:1st iteration Slot =2.1*2.1mm

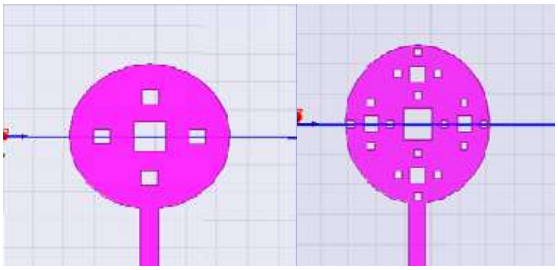

Fig3:2nd iteration= 2.1/2mm Fig4: 3rd iteration=1.05/2mm

In this section the Figure1 shows the circular patch antenna and Figure2 shows the 1st iteration it is made by Sierpinski carpet geometry (i.e. half of the circular radius value).In Figure3 the iterations is formed by half of the first iterations and Figure4 is formed by the half of the second iterations

V.RESULTS AND DISCUSSIONS

In this section the simulation of the proposed antenna is performed and the respective results are presented and discussed. The simulation is carried out in HFSS and the different antenna parameters like s-parameters, VSWR and gain in dB are observed, the relevant figures are shown below. The table2 shows the characteristics of the circular patch fractal antenna by using Sierpinski carpet geometry.

Different VSWR's are obtain at different frequency of operation by the CPFA .Their respective results are shown as follows.

(i) At Frequency 16.7GHz

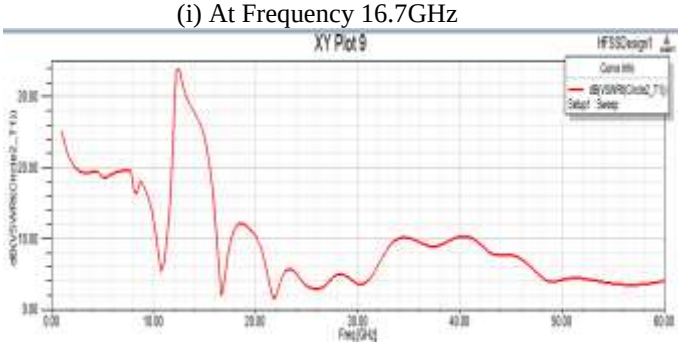

Fig5: VSWR =1.22

(ii) At Frequency 21.65GHz

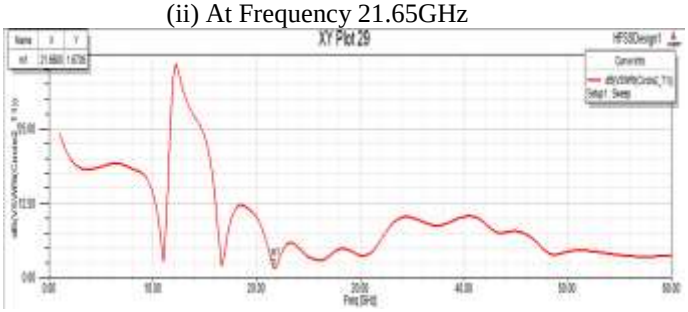

Fig6: VSWR = 1.67

Different Return losses are obtained at different frequency of operation by the CPFA .Their respective results are shown as follows.

Return losses:

(i) At Frequency 16.7GHz

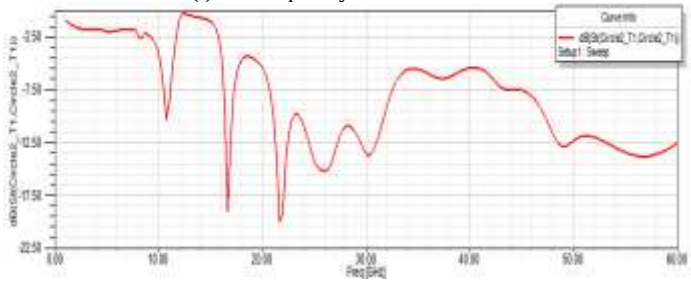

Fig7: S-parameters Return loss = -20.52dB

(ii) At Frequency 21.65GHz

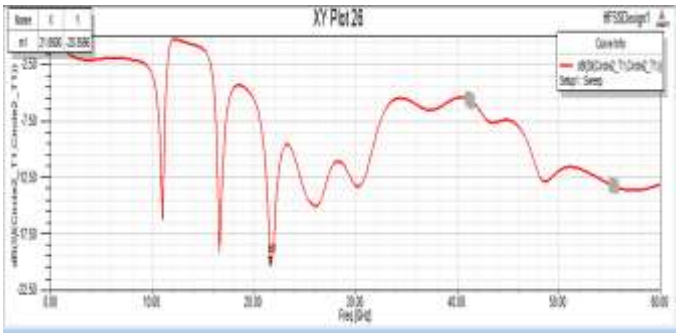

Fig8**:** S-parameters Return loss =-21.36

Radiation pattern :

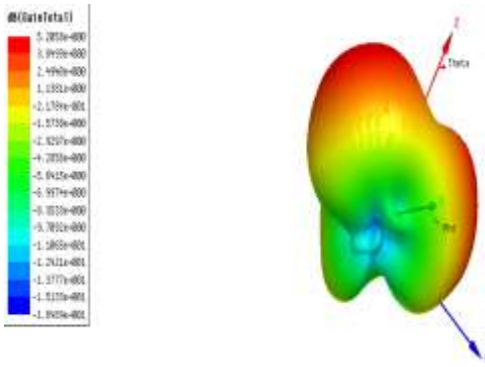

Fig10: Frequency 16.7GHz

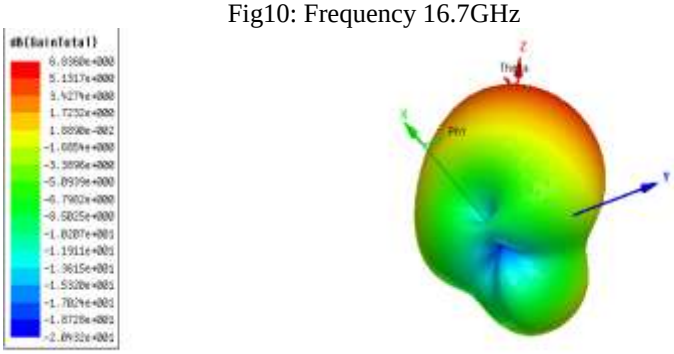

Fig11: Frequency 21.65GHz

Table2: Characteristics of the CPFA by using SC geometry

In the above section the simulated results are presented and discused, specifically different resonant frequencys, their respectieve s-parametrs, Return loss and gain.The Figure6 shows the about VSWR charecterstics is 1.22 at 16.7GHz resonant frequency and Figure7 shows the about s-parameters respected their return losses -20.52 at 16.7GHz resonant frequency.The Figure8 shows the s-parameters their return losses -21.36 at 21.65GHz resonan frequncy and Figur9 shows the VSWR charecterstics is 1.67.The fig 10 shows the antenna gain is 5.2dB at 16.7GHz and Figure11 shows the antenna gain is 6.88 at 21.65GHzThe Figure4 circular patch fractal antenna is having good return losses at two resonant frequncy's those are 16.7GHz&21.65GHz as well as VSWR and gain.

VI. CONCLUSION

Circular patch fractal antenna is intended and simulated using HFSS software and different parameters like return loss, and radiation pattern are determined at different resonant frequency's. The fractal antenna has achieved improved return losses, Gain and pattern and VSWR is also reduced. This antenna can be good at satellite communications, space ,radar communications. Designing of unlike shaped slot may raise the parameters like gain, VSWR, Return loss. In present work, circular Patch fractal antenna is designed by using Rogers RT/duroid 5880(tm) substrate it is having dielectric constant is 2.2.

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Resonant frequency(GHz)	Return loss(db)	VSWR	Antenna gain(dB)
16.7	-20.52	1.22	5.2
21.65	-21.36	1.67	6.88

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