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Wide Band Microstrip Patch Antenna for S & C Band Applications

Abhinav Bhargava, Poonam Sinha

Abstract**: *A fractal is a repeated or similar structure having a fractional dimension. This type of shape having repetitive structure so the electrical length can be increased with introducing multiple slots. That we can get fine edge length structure. By recursive nature multiple objectives can be achieved. Size of the antenna is continuously decreasing with the development of patch antenna. In this paper a square shaped square slotted antenna is investigated, which is compact printed wide band antenna. A rectangular microstrip patch antenna chosen with three slots for wide band application. When ground is modified it is called defected ground structure by which bandwidth can be further increased, and overall a wideband antenna is simulated using HFSS simulation software. So this antenna is useful for many applications in S & C band, the size of the antenna is reduces. This paper represents the combination of rectangular antenna with rectangular slots. Proposed design has resonant frequency of 4.7GHz with the operating range from 3.2GHz to 14.3GHz with bandwidth of 11.1GHz. Using proposed antenna design and micro strip feeding at proper position acceptable resultant frequency, return loss, VSWR and bandwidth is achieved. For the design of the micro strip antenna we have used FR-4substrate which has permittivity of 4.4 and thickness 1.6, loss tangent is 0.02. HFSS simulation software is used for designing and analysis. We have observed that using slotted patch antenna and using micro strip at proper location we can get better return loss, VSWR, and wideband.***

Keywords**: *Wideband, fractal micro-strip patch-antenna, return loss, VSWR, radiation pattern***

I. INTRODUCTION

In fractal there is huge development in last 35 which can't be easily define i.e. a cone cannot truly define the shape of a mountain no more than an ellipsoid can describe a cloud. These structures are very complicated so the exact mathematical modeling is not possible. These structures are very complex in nature. Fractal represents a different type of geometry which are useful for the designer to improve the performance of the antenna [1]. Fractals are shapes which fill the space in contours, meaning electrically large features can be efficiently packed into small areas. Because the electrical lengths play a vital role in the designing of antenna, this efficient packing can be used as a viable miniaturization technique. Communication in the field of Wireless is the one of the most important part of our life. Many applications such as GPS, mobile phones, Bluetooth technology have shown tremendous development, and new applications such as wireless local area network, tagging, and wireless internet are emerging day by day life [2]. In today's scenario the range of the wireless communication is bigger problem which can be shorted out by small antennas with multi frequency application. In the telecommunication industry many devices for many applications for this we have to design different antenna for different application but this solution is expensive & complex, so we have to design antenna which can be operated on multiple operating frequencies. Now a day Modern telecommunication device should be small in size and be able to interact with other multiple devices and integral with circuits. Recenyly, chiral metamaterials (CMMs) have attracted increasing attention because of their unique properties such as high optical activity and negative refraction. In fact, CMMs are metamaterials (MTMs) made of unit cells without any mirror symmetry.[4] These antenna can be used for many wireless systems must hence possess multiband capabilities but yet remain compact in size. Antenna is a most important part for wireless communication and global positioning system (GPS) since it was first demonstrate in 1886 by Heinrich Hertz and its practical application by Guglielmo Marconi in 1901

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II. EXISTING GEOMETRIES

A. Submission of the paper

Since the electrical lengths ought to be high for the antenna design, this expansion the productive of pressing. This can be utilized as a reasonable scaling down method. Some previous fractal geometry is appeared in figure-1 in which five cycle appeared. This kind of geometry resonates at single recurrence. Because of this these antenna are helpful for single application so we have to design an antenna which can resound on numerous frequencies.

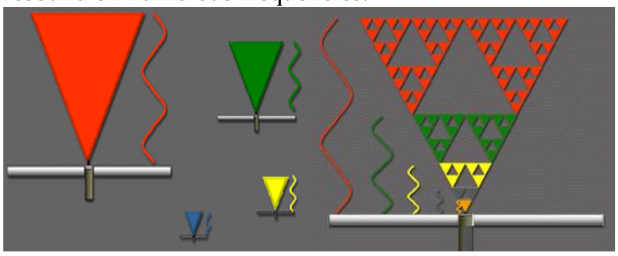

Fig.1: Five Cycle Geometry

Figure two shows octagon geometry with numerous cycles for the bandwidth improvement there likewise we can't utilize more than one application.

To improve this downside of fractal antenna we have designed an antenna for numerous applications. This can be helpful for numerous applications in the field of remote correspondence.

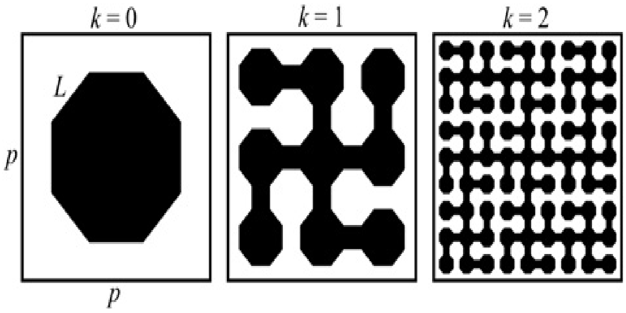

Fig.2: Octagon Geometry

III. Antenna Design

The proposed antenna design by presenting rectangular formed slots on straightforward rectangular patch as appeared in figure (3). Cutting of these slots in antenna expands the present way which builds current force therefore effectiveness is expanded. First altered dual triangular patch antenna is designed dependent on standard design method. In the subsequent cycle number of triangle increment with the goal that we can expands the radiations. In the subsequent stage the association of this geometry and roundabout geometry has been created. At that point further this roundabout fractal has been created inside the external roundabout ring. At that point the absolute electrical length further increments.

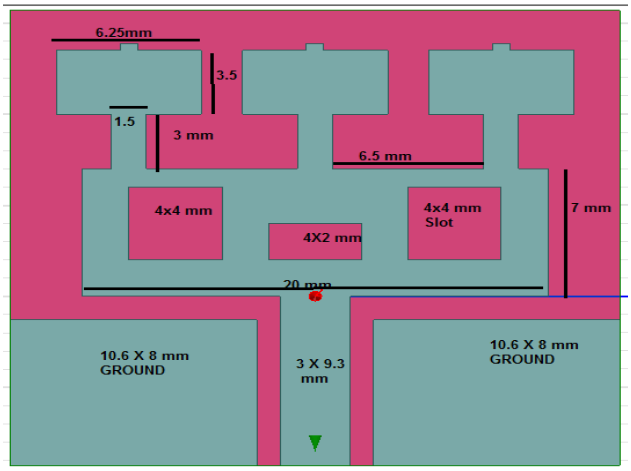

Figure 3: Front View of Rectangular Slotted patch-antenna

A modified rectangular fractal patch antenna shown in figure (3) in which two iterations had applied and a wide band micro strip patch antenna is designed. On this antenna we can use many applications as per the bandwidth requirement.

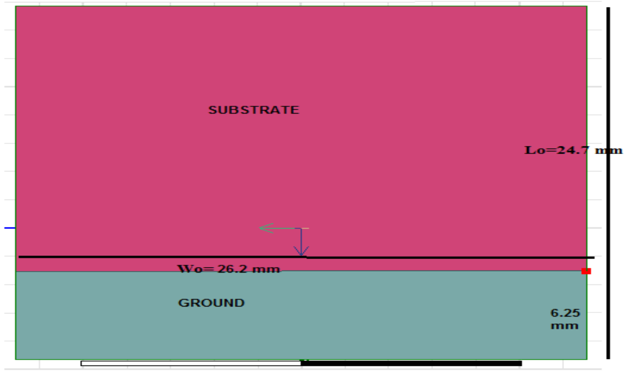

Figure 4: Back side view of patch

As shown in the figure the defected ground structure is shown which increase the bandwidth.

IV. Antenna Result

The simulation of micro-strip patch antenna is done by using HFSS simulation software. The variation of return loss with frequency of rectangular patch antenna with iteration shown in figure (5)

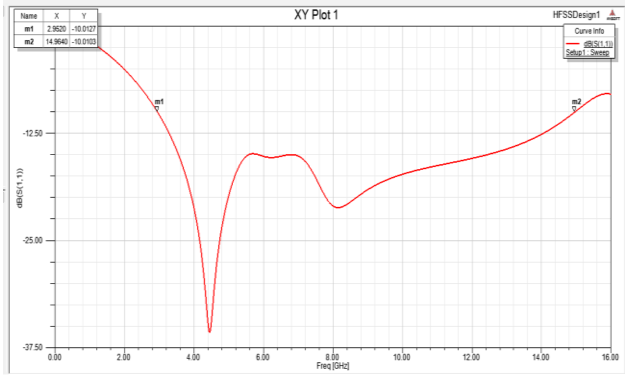

Figure 5: Return loss of the Proposed Rectangular Micro-strip Patch Antenna

The return loss is important parameter. The value of return loss can be defined as the ratio of the Fourier transform of the incident pulse and the reflected signal.. The value of return loss is -31db at resonance frequency of 4.7GHz.

In the figure 6 the value of VSWR for a rectangular shaped slotted patch antenna is shown. The VSWR indicates the reflection of energy due to mismatch between the antenna and the transmission line. For perfect matching the VSWR value should be close to unity. The values of VSWR are close to 1.5 on all the resonant frequencies shown in figure (6).

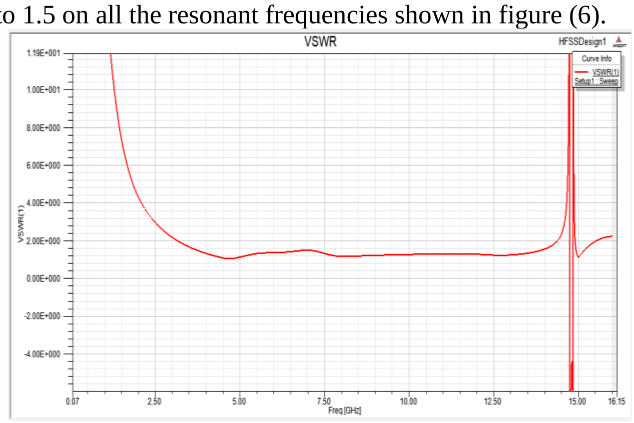

Figure 6; VSWR of the Proposed Rectangular Micro-strip Patch Antenna

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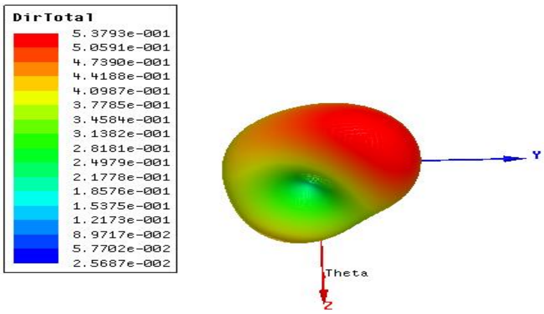


Figure 7: Radiation pattern in 3D of the Proposed Rectangular Micro-strip Patch Antenna

Figure 7 shows the three dimensional radiation pattern for slotted antenna in which the color legend is given which show the radiation intensity of patch antenna. Red color shows the maximum and blue is minimum radiation or signal strength.

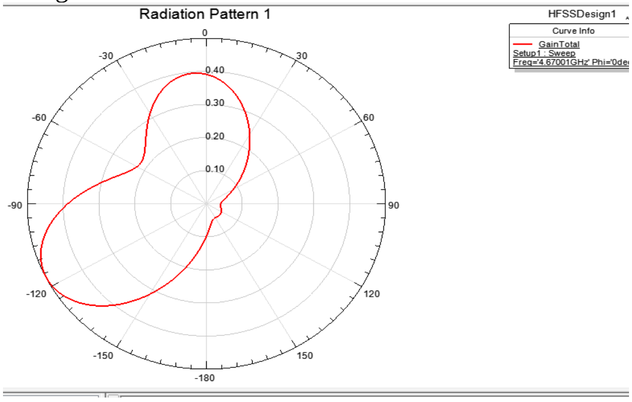


Figure 8: Radiation pattern in 3D of the Proposed Rectangular Micro-strip Patch Antenna

Figure eight shows the two dimensional radiation pattern for rectangular patch. In this the radiation intensity with respect to the angle is demonstrated.

The simulation impedance shown in figure nine in which the value of impedance is achieved close to fifty ohm, which is required for proper matching.

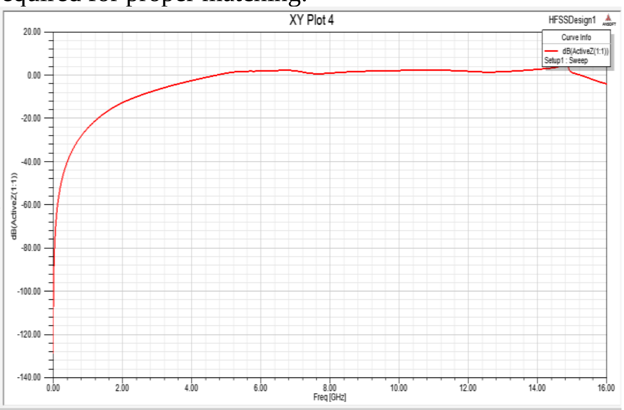
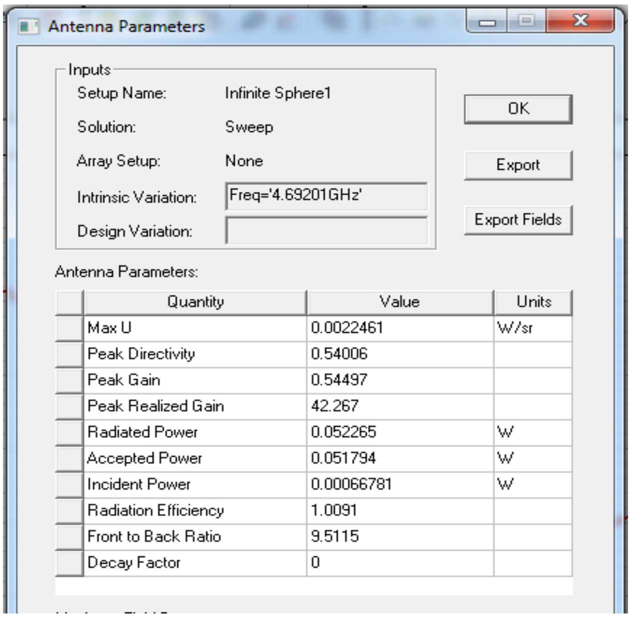


Figure 9: Radiation pattern in 3D of the Proposed Rectangular Micro-strip Patch Antenna



Quantity	Value	Units
Max U	0.0022461	W/sr
Peak Directivity	0.54006	
Peak Gain	0.54497	
Peak Realized Gain	42.267	
Radiated Power	0.052265	W
Accepted Power	0.051794	W
Incident Power	0.00066781	W
Radiation Efficiency	1.0091	
Front to Back Ratio	9.5115	
Decay Factor	0	

Figure 10: Parameter of Proposed Rectangular Micro-strip Patch Antenna

V. CONCLUSION

The rectangular patch of size 26.2*24.7 has been designed with dielectric material of FR-4 with relative permittivity of 4.4. It is observed that a rectangular fractal-antenna is simulated and achieved the bandwidth of 11.1GHz from 3.2GHz to 14.3GHz, covers the C & X band applications.

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