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Fractal Antenna by Repeated Rectangular Block for Bandwidth Enhancement

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Abstract: ***Fractal antenna is basically used for multiband operations but here a new approach is developed for enhancement of bandwidth by fractal antenna. The proposed fractal antenna has frequency band in the frequency range of 2.65 GHz to 4.82 GHz. The proposed antenna has a fractional bandwidth of 58.1%. It is operated in C band hence it covers the application of C band. The proposed antenna has gain of 2.62 db and directivity 3.67db.The proposed antenna has efficiency of 79%. Here a line feed is used to energize the antenna and IE3D Zealand simulation software is used for simulation work.***

Keywords: fractal, enhance bandwidth, gain, line feed, C band.

I. INTRODUCTION

The current upsurge in wireless communication systems has forced antenna engineering to face new challenges, which include the need for small-size, high performance, low cost antennas. There are many approaches to reduce the size of the antenna without much affecting the antenna performance. The application of the fractal geometry is one of the techniques. Fractal antenna is the antenna that uses a fractal, self –similar design to maximize the length or increase the parameter on inside sections or the outer structure of material that can receive or transmit electromagnetic radiation within a given total surface area or volume [1]. Fractal antennas have performance parameters that repeat periodically with an arbitrary fitness dependent on the iteration depth. Iteration depth refers to the number of iterations that should be carried out to get higher order structure [2-3]. Here the rectangular block of size 4×2 mm is used for making the given fractal antenna and also its different size is used as shown in figure 2. To energize the given antenna a line feed is used. The length and width of strip line feed is 4mm and 14 mm respectively. The probe feed position on strip line is shown in figure 2. The ground plane size is 35×45 mm^2. The proposed antenna is operated in C band hence it covers the applications of C band. The gain and directivity of proposed antenna is 2.62 and 3.67 dB. The efficiency of proposed antenna is 79%. Such type of antenna covered the application of telecommunication, satellite communication, Wi-Fi, Radar, commercial and military.

II. ANTENNA DESIGN SPECIFICATIONS

Table1: Antenna design specifications -1

Ref.Block width	Length	Wg	Lg	ε_r
2	4	45	35	4.4

Table-2 Antenna design specifications -2

Strip line length	Strip line width	Feed coordinate
4	14	X=23.174,y=3.25

III. ANTENNA DESIGN PROCEDURE

The proposed fractal antenna is designed by the repetition of rectangular block of size 4×2 mm^2 for making the proposed antenna material of glass epoxy material is used ϵ_r=4.4 [4] and substrate height is 1.6 and loss tangent ratio is 0.0013.The block size is varied during the designing of antenna for the enhancement of the bandwidth.

A modified line feed is used to enhance the bandwidth of proposed fractal antenna. The probe feed is placed at point (X = 23.175, Y = 3.25). During the designing of proposed antenna on IE3D ground plane is starting from (0, 0) at lower left corner. The geometry of proposed antenna is shown in figure 2

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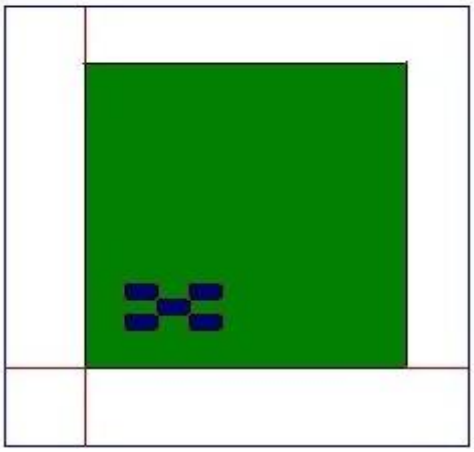

Fig 1.Rectangular block of size 4×2 mm

IV. SIMULATION RESULT AND DISCUSSION

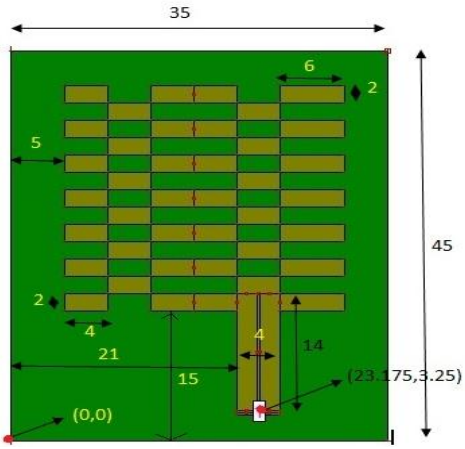

Fig.2. Proposed antenna.

The design of proposed antenna is shown in figure. The length and width of rectangular block is 2×4mm is clearly mentioned in the figure. The probe is placed at (23.175, 3.25) on strip line. The ground plane size is 35×45mm^2.The block is repeated accordingly for the enhancement of the bandwidth of different sizes.

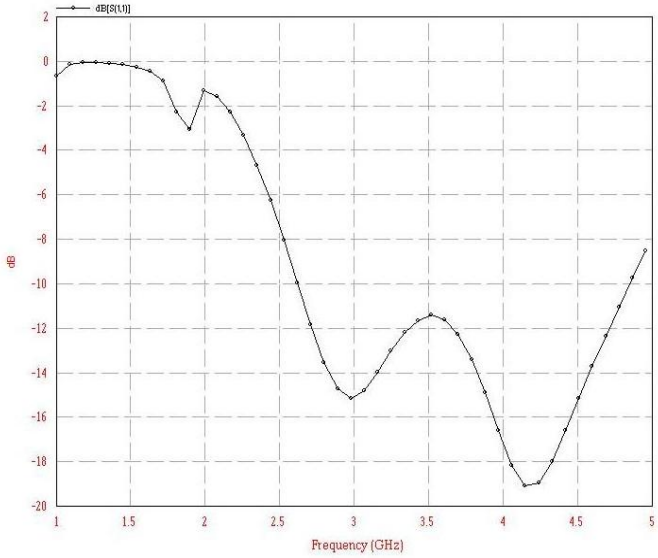

Fig.3. Return loss v/s frequency graph.

The frequency band of proposed antenna is from 2.65 GHz to 4.82 GHz. The fractional bandwidth is around 58.1%.The return loss is -19 db .The resonant frequency is 4.2GHZ. The proposed antenna covers the application of C band.
This is the best and convenient method to calculate the input and output of the signal source. It can be said that when the load is mismatched the whole power is not delivered to the load there is a return of the power and that is called loss, and this loss that is returned is called the "Return loss". This Return loss determined in dB.

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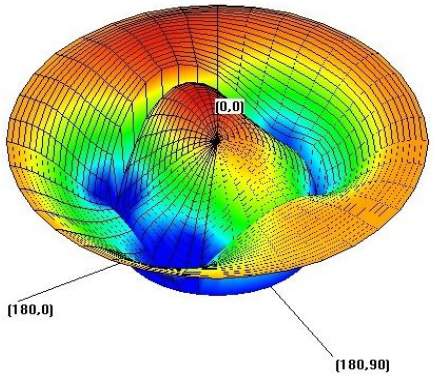

Fig.4. 3D Radiation pattern of proposed antenna..

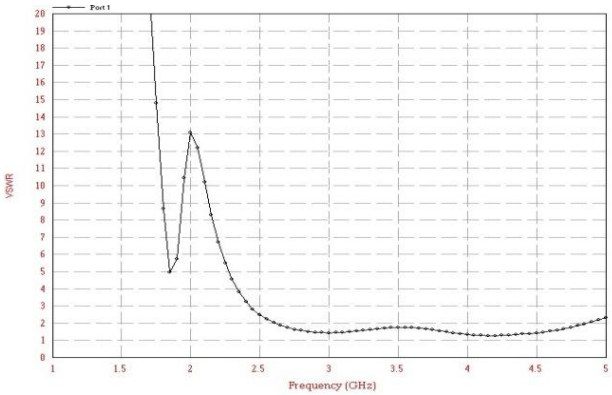

Fig.5. VSWR of proposed antenna.

The VSWR of proposed antenna is between 1 and 2 which shows that antenna is efficiently radiates.
There should be a maximum power transfer between the transmitter and the antenna for the antenna to perform efficiently. This happens only when the impedance is matched to the transmitter impedance,

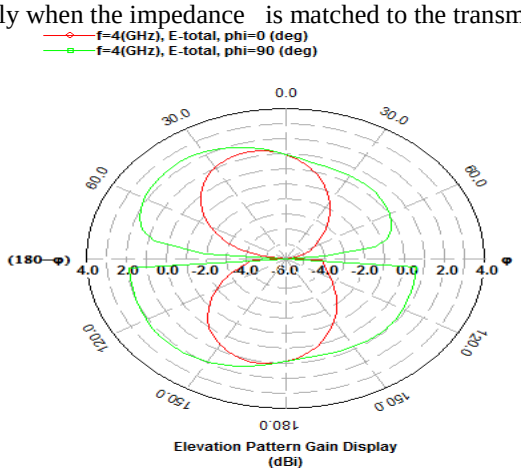

Fig.6. 2D pattern of proposed antenna

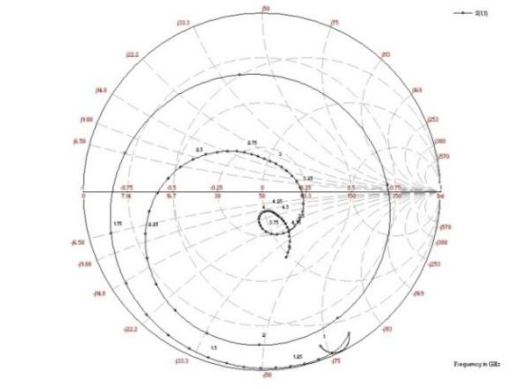

Fig.7. Smith chart

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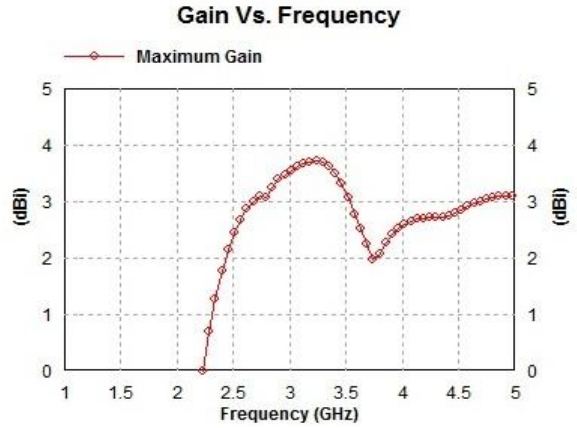

Fig.8. Gain vs. frequency

Gain of an antenna (in a given direction) is defined as "the ratio of the intensity, in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna were radiated isotropic ally". This is expressed in dB, in a simple way we can say that this refers to the direction of the maximum radiation.

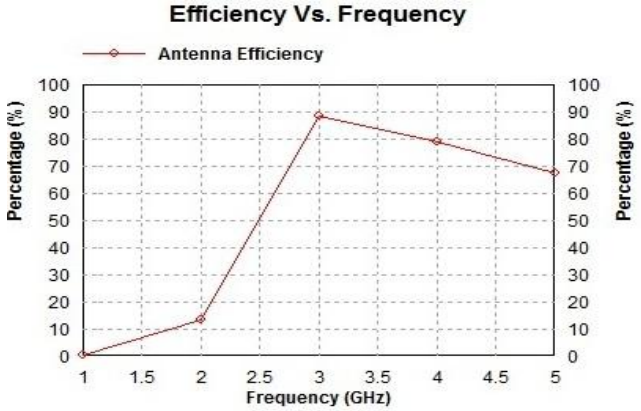

Fig.9 Antenna efficiency

V. CONCLUSION

The characteristics of proposed repeated fractal structured antenna are studied. In general, the impedance bandwidth of the traditional Micro strip antenna is only a few percent (2%-5%) [5]. Therefore, it becomes very important to develop a technique to enhance the bandwidth of the Micro strip antenna. Proposed antenna improved the fractional bandwidth upto58.1%. The proposed antenna has been designed on glass epoxy substrate to give a maximum radiating efficiency of about 79.59% and gain of about 2.62 db

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