# Fractal Ultra Wide Band Antenna for 5G Applications

**Ramesh. Avula, M.Rangarao, Y.Kumari**

***ABSTRACT--- Abstract —a reduced fractal UWB Microstrip antenna is displayed in this paper for future versatile advancements. It is used for wide band applications like WIMAX, WILAN. The proposed prototype is extremely reduced in size having the dimensions 18×25 mm and is enhanced to be worked in the band from 20 to 50GHz with a partial transmission capacity of over 89%. Rogers RO 4232 material of 1.5209mm height with a ε_r= 3.2 and impedance matching of 0.0018 is utilized as a substrate for the proposed prototype. The realized gain of 6.6dB at 38GHz is proficient and normal gain of 5.4dB is kept up all through the impedance transfer speed of the proposed antenna prototype. Different outcome bends as return losses, gain and the radiation pattern of the proposed prototype have been dissected in the paper.***

***Key words— Fractal , 5G, Ultra Wide band (UWB), microstrip.***

## I. INTRODUCTION

5G remote correspondence framework is normal to the current frameworks because of its extension from the customary microwave groups to the wave of millimeter. It would give exceptionally large information rates and top notch interactive media applications to the portable clients. Likewise 5G frameworks will have a lot more prominent data transmission than the current correspondence framework. This attracted the engineers towards the ultra wide band.

UWB structures, characterized by FCC in 2001 are those covering 3.1GHz to 10.6GHz band. To accomplish more extensive transfer speed and to lessen the extent of ordinary radio wires Microstrip antenna of fractal structures are better choices. Fractal structure are considered mostly for comparable structures repeating the same structure by recurrence logically that permit the antenna to resound at in excess of one recurrence and henceforth gives minimal size, higher data transfer capacity and numerous recurrence groups.

As of late numerous structures have been accounted for covering UWB band and numerous procedures have been utilized for expanding the data transmission as, utilized Penta Gasket Koch strategy to accomplish recurrence scope of 1.51GHz-20.0GHz and gain of 4dB, delineated a patch radio wire working in a scope of 1.456 to 18.88 GHz by stacking a fractal corresponding opening into its ground plane and gotten great reduced attributes and furthermore got another BDR record term to distinguish the minimization of that antenna, structured a nourished the fractal monopole antenna covering the recurrence scope of 2.66 to 11.66 GHz. It gives omnidirectional radiation example and great impedance coordinating from 1GHz to 15GHz, changed tie with a Fractal bend and sided fractal tie dipole antenna, accomplished the UWB recurrence band by utilizing log-occasional quadrature fractal structure, exhibited a UWB end fire dipole radio wire with band score qualities utilizing log intermittent fractal structure. As microwave band beneath 10GHz is completely involved the opportunity has already come and gone to use microwave recurrence the band above 10GHz because of its wide assortment of uses. Numerous fractal structure like Sierpinski gasket, koch, tree molded, star molded and so forth can be utilized for scaling down among them fractal structure is all the more generally utilized in circle reception apparatuses.

In this article a Microstrip antenna apparatus is planned by rehashing a basic quardrature shape while keeping up the symmetry all through the fix in a route like that of the Fractal structure. The conveyed reception apparatus is intended to be worked in the recurrence extend from 23.2 to 50 GHz with a partial band width of 89.154%. Radio wire structure arrangement and mimicked consequences of variety of the compelling parameters of reflection coefficient, VSWR, gain and radiation design bends are examined in the up and coming segments.

## II. ANTENNA DESIGN

The structure of the prototype is an aftereffect of three noteworthy movements in this basic rectangular Microstrip antennas. The first figure is along these lines demonstrates a basic square molded over a substrate which is shown in below Fig. 1(a) and is named as the beginning most movement i.e. the zeroth cycle. First emphasis is accomplished by recursion of squares on each side of the parent square of the zeroth cycle. The length of the squares of this movement is abbreviated by a proportion called iterative proportion s, in contrast with the Parent Square as appeared in Fig. 1(b).

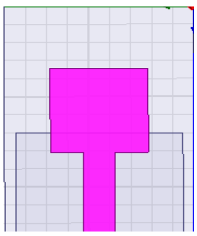

**Fig.1 (a): zeroth cycle**

Revised Manuscript Received on February 11, 2019.

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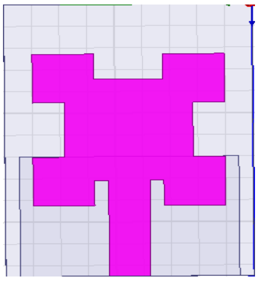

**Fig. 1(b): first cycle**

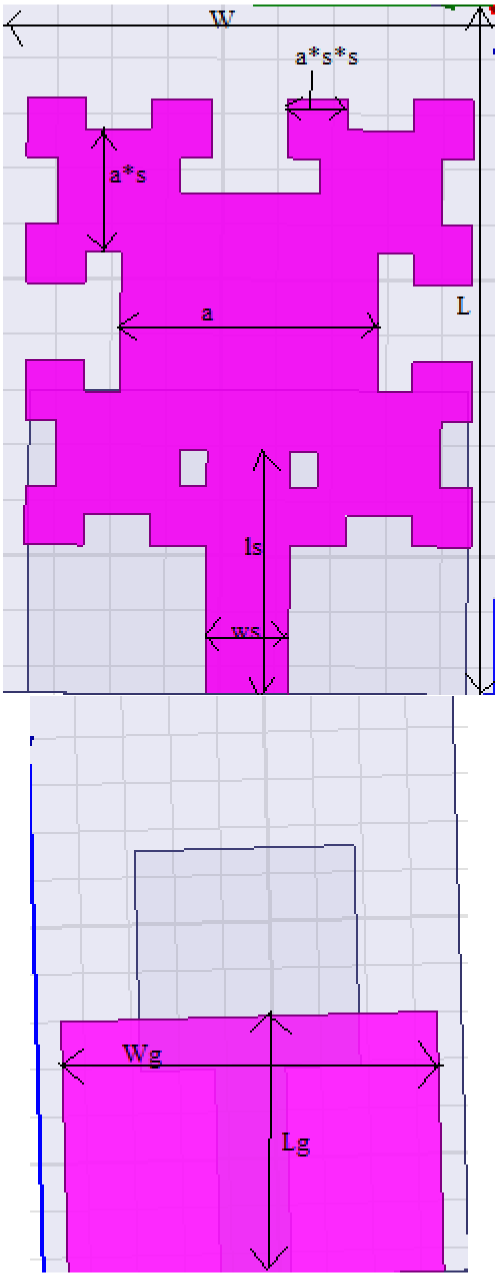


**Fig.1(c): second cycle**

The last structure ,that is proposed fractal antenna is accomplished by rehashing the squares on every one of the quadrature mounted on the parent square. Length of the squares utilized in this second and last movement is once more abbreviated with a similar proportion which was utilized to reach to first emphasis from the zeroth. The last emphasis is appeared in the Fig. 1(c).

Proposed antenna is recreated and enhanced utilizing Hfss software, and the last components of this design is accomplished as appeared in above Fig. 1 and furthermore portrayed underneath in the Table-I. RO 4232 having dielectric steady 3.2, misfortune digression 0.0018 and height 1.520mm is utilized to recreate the structure. By and large elements of the antenna WXL are 18mm×25mm.

The reflection coefficient attributes for every one of the three cycles and their outcomes are appeared in the Fig. 2. The graph demonstrates that the entire recurrence band is moving towards lower recurrence and the quantity of resounding groups is likewise expanding as number of emphases is expanded. In the zeroth cycle, there are just four full groups, in the following cycle the quantity of resounding groups has been expanded to 6. In the last cycle, there are adding up to 8 resounding groups. The base reflection coefficient for the main emphasis is – 23.45dB which gets additionally brought down to – 26.9dB for the second emphasis. It is additionally seen that the z-parameters coordinating has absolutely enhanced from the zeroth to the second emphasis. Additionally, great Z_parameters coordinating is seen over 50 GHz recurrences. In this manner, fractal movements improved the general data transfer capacity as well as expanded the quantity of reverberating groups.

| Parameter | Value in mm |
|---|---|
| a | 9.3 |
| s | 0.48 |
| l | 25 |
| w | 18 |
| Ls | 8.8 |
| Ws | 3 |
| Lg | 11 |
| Wg | 15.9 |

Every one of the elements of the antenna are dissected and differed inside their normal scope of qualities and the best one is selected out of these proposed antnnas after reenactment is refreshed in the proposed radio wire structure. In the up and coming subsections impact of four important parameters out of the considerable number of parameters, which significantly affect the return losses of the antenna, has been talked about by looking at their particular return losses bends.

## III. RESULTS AND DISCUSSION

The proposed antenna configuration has been recreated for the recurrence run from 20GHz to 50GHz. From Fig.2 return losses bend can be examined and it tends to be seen that the resonant frequencies of the proposed prototype are 25GHz, 24.6GHz, 31.6GHz, 38GHz, 46.8GHz, 50.2GHz and reflection coefficient at their particular full frequencies are – 12.10dB, - 14.86dB, - 19.68dB, - 16.66dB, - 20.53dB, - 26.9dB separately . The lower cut-off recurrence for -10dB is 23GHz.


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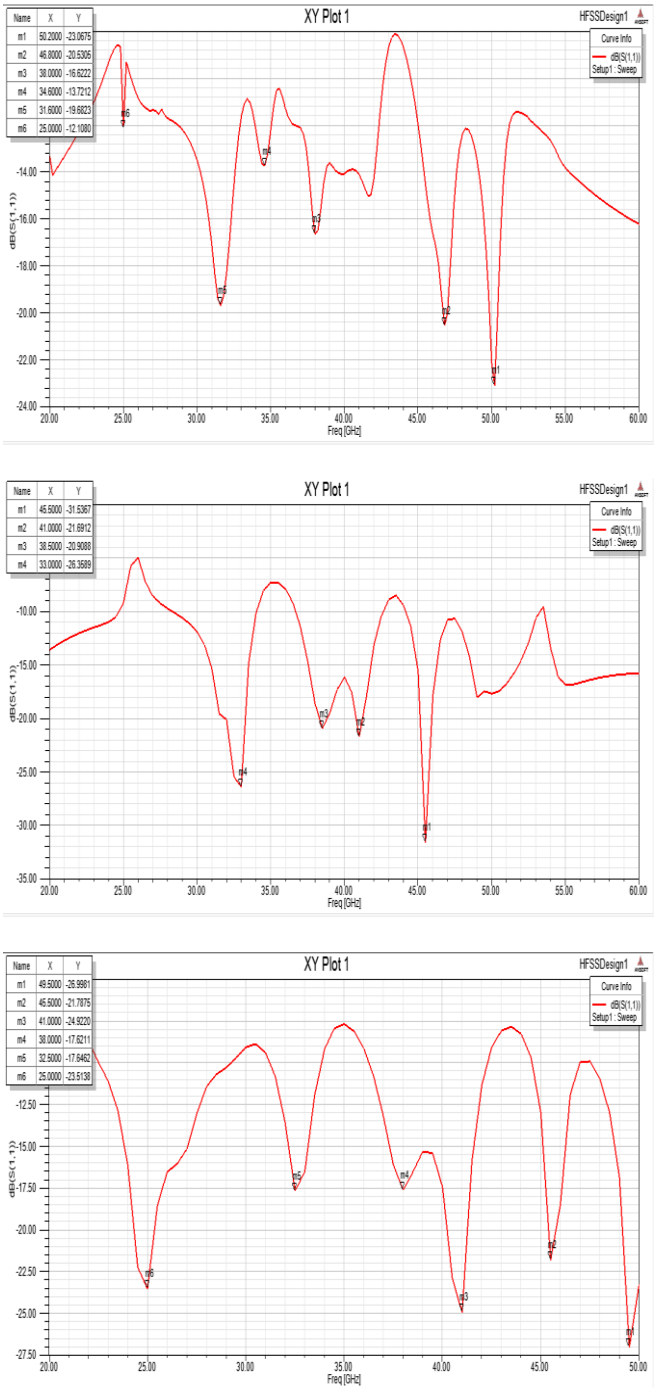



**Fig.2: return losses of zero, first and second cycles.**

The radiation patterns of the proposed prototypes are shown in the Fig. 3. The realized gain of the zeroth cycle is 6.54dB at the frequency point 36.5GHz. The realized gain of the first cycle is 6.67dB at a frequency point of 38GHz and for the second cycle the realized gain is obtained to be 12.5dB at a frequency of 25.5GHz. The realized gain of the prototypes is shown in the Fig. 4.

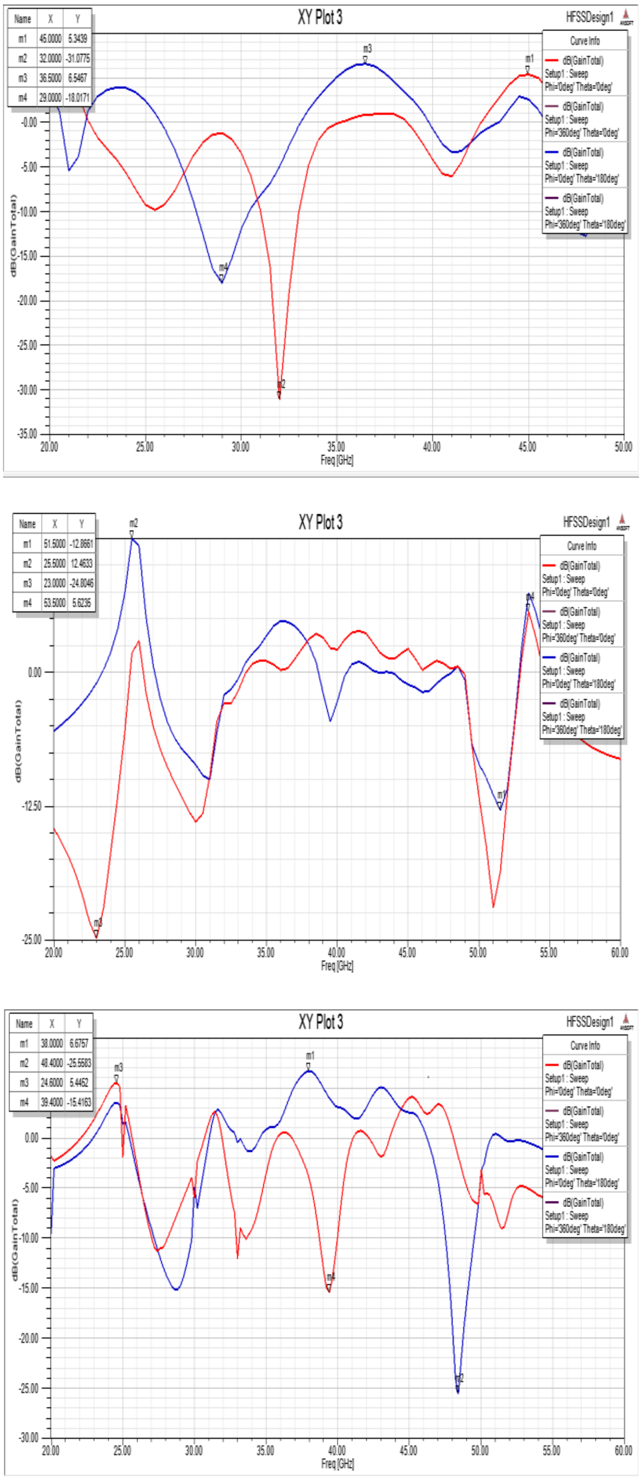
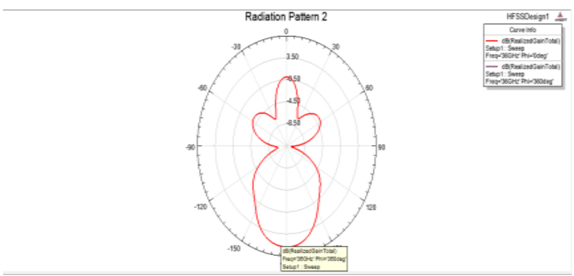



**Fig.3: Realized gain of zero, first and second cycles.**



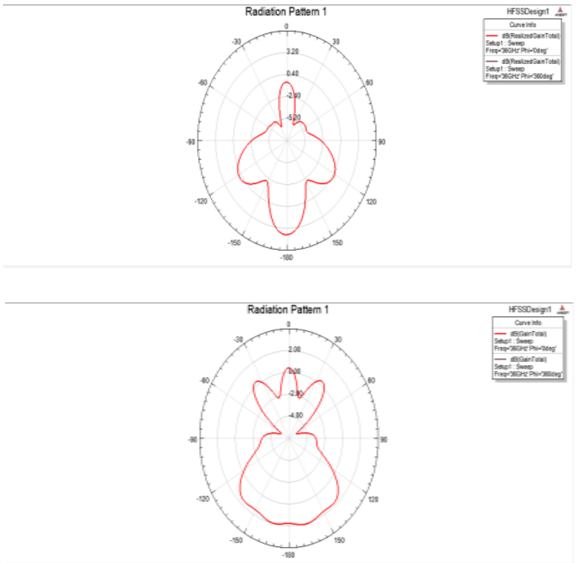



**Fig.4: radiation patterns of zero, first and second cycles.**

## IV. CONCLUSION

A fractal antenna of dimensions 18X25X1.52 is designed with a fractal structure. The band of frequencies runs from 20GHz to 50GHz. The substrate used for this prototype is Roger RO4232 with a $\varepsilon r$ =3.2, loss tangent of 0.0018 and a thickness of 1.52mm. The gain has enhanced upto 12.5dB and the return losses are less than -10dB throughout the band. Three cycles of designs are proposed out of which the third cycle is the best one. The designing is done using the high frequency simulation software and the ressults are observed.

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