

Hexagonal Fractal Geometry Antenna Using Ultra Wide Band Applications

¹K.Kavitha, ²R.Maniarasi, ³J.Jayapriya, ⁴M.Meena

UG Student, Department of ECE, IFET College of Engineering, Villupuram, Tamil Nadu, India

ABSTRACT: Antenna with hexagonal fractal geometry using ultra wide band pattern is been discussed in this paper. The proposed antenna is fed with co-axial line and its structure depends on hexagonal fractal geometry wherever resonance frequency of antenna is a lowered using iteration technique, which is the repetition of motif over two or more scale sizes. CST microwave studio suite has completed the analysis of this ultra wide band (UWB) pattern. This fractal antenna is low height and width, light weight and simple to fabricate. Proposed antenna possesses multiband and broadband characteristics. This paper explains that the planned antenna has superb performance in radiation pattern and bandwidth.

KEYWORDS: Fractal geometry, Iteration technique, wideband, multiband.

I.INTRODUCTION

The most multiband antenna development is the incorporation of fractal geometry into radiators. Fractal antenna's response differs obviously from traditional antenna design. It is capable of operating optimally at many different frequency ranges simultaneously. This makes fractal antenna an excellent design for broadband applications. Due to self-similar property of fractal antennamicrostrip fractal antennas demonstrate higher bandwidth than conventional microstrip antennas. They are also considered in multi-frequency antenna designs. By connecting fractal shaped antennas, wideband coverage can be achieved. Further fractal antennas allow controlling of characteristics such as location of frequency bands, radiation pattern and antenna geometry variations. Due to the concept of self-similarity and infinite complexities, the proposed geometry of antenna is very versatile in terms of polarization, radiation pattern, gain and bandwidth.

II.PAST WORKS

Popularity of fractal geometry and great demand for ultra wide band characteristics resulted many researches Contribute towards the development of these fractal antennas. JavadRohani and AbolfazlAzari[2] have achieved an ultra-wide band antenna by applying a Koch fractal geometry to a wire square loop antenna. Modelling is performed through superNEC electro-magnetic simulator. Optimization is done through GAO (genetic algorithm optimizer). The researchers concluded that it is an ultra-wide band antenna and operates in frequency between 100MHz to 10GHz.N.A.Saidatul, A.A.H.Azremi, R.B.Ahmed, P.J Soh, F. Malek[3] proposed the fractal PIFA (Planar Inverted f Antenna) with bandwidth enhancement for mobile phone applications. The antenna achieved the GSM, UMTS and Hiperlan frequency with -6db return loss and almost Omni directional radiation pattern. Another popular fractal was implemented by A. Azari and J.Rowhani[4]. They used the hexagon as base geometry. They analyzed the antenna using Microwave Office Software. This antenna was capable of achieving much more wideband and multiband characteristics. The proposed antenna was found to be broadband and applied in all frequencies (0.1 GHz-24 GHz).

III.PROPOSED ANTENNA DESIGN

Fractal design consists of two components (1) Initiator (0thstage): the basic shape of the geometry. (2)Generator: the shape that gets repeated in a pattern in subsequent stages of different dimensions. In proposed design, the hexagon is

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 4, Special Issue 11, September 2015

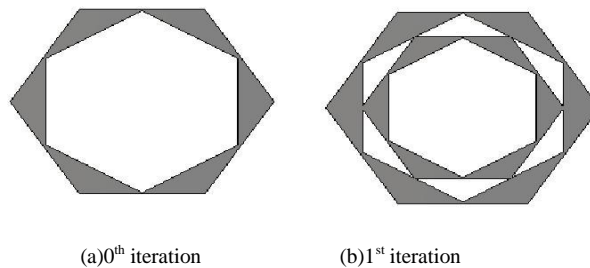
National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

On 4th September, 2015

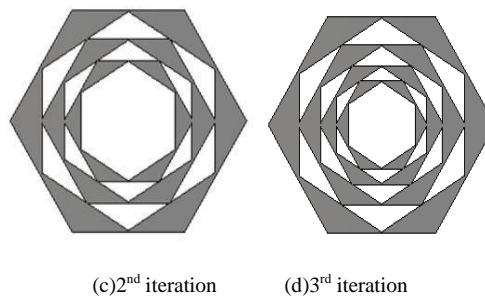
Organized by

Department of CSE, ECE & EEE, Magna College of Engineering, Chennai-600055, India.

chosen as basic shape or initiator shape. The generator shape is the different scaled versions of base shape. Each side of base hexagon is 30mm. The substrate chosen is Rogers RT 5870 with dielectric constant $\epsilon_r = 2.33$ with dimensions 70×70mm and substrate height 2mm. with proper scaling factor, two more iterations were shown in figure.



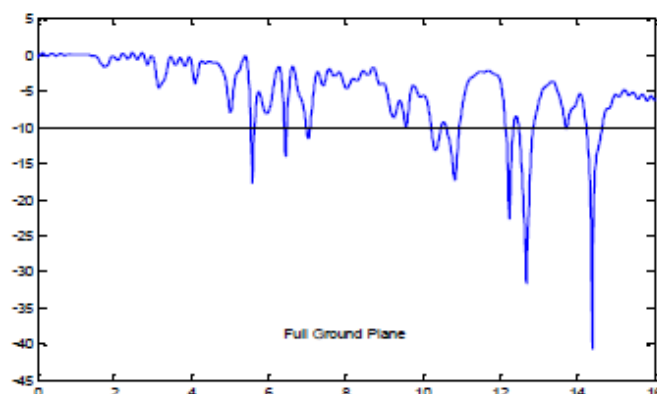
Higher iterations were avoided because they do not contribute any change in antenna behavior and radiation pattern.



The ground level was originally in use towards 70mmx70mm however the S11 outcomes study were extremely poor. The process of providing things was particularly next to a distance of 28mm lengthwise x-axes as well as breadth of 12mm lengthwise y-axes starting from most left to the down verge on outside hexagon. The ground level was breadth and properly brought down to attain the improved outcome as well as performance. The distance of the ground level was in use to be similar 70mm. The decrease in the ground level leads to reduction in the copper misplace related with the directing ground level.

IV. RESULTS AND DISCUSSIONS

The results obtained while comparing the full ground level with the reduced ground level is in fig 2



International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 4, Special Issue 11, September 2015

National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

On 4th September, 2015

Organized by

Department of CSE, ECE & EEE, Magna College of Engineering, Chennai-600055, India.

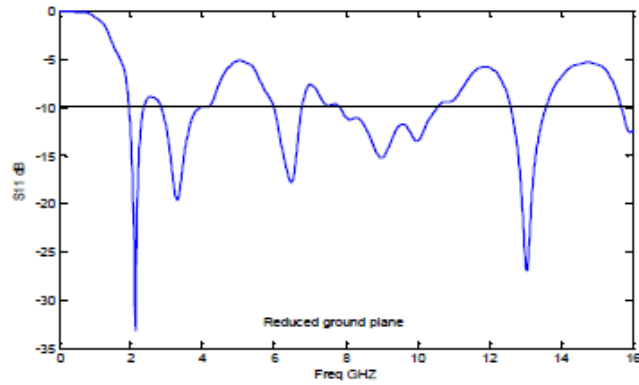
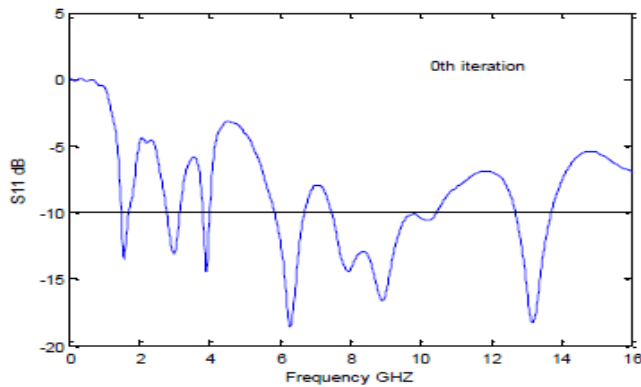
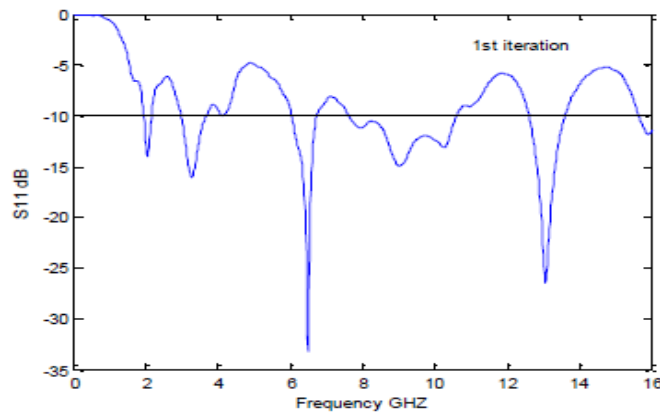


Figure 2.



(a)0th iteration outcomes



(b)2nd iteration outcomes

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

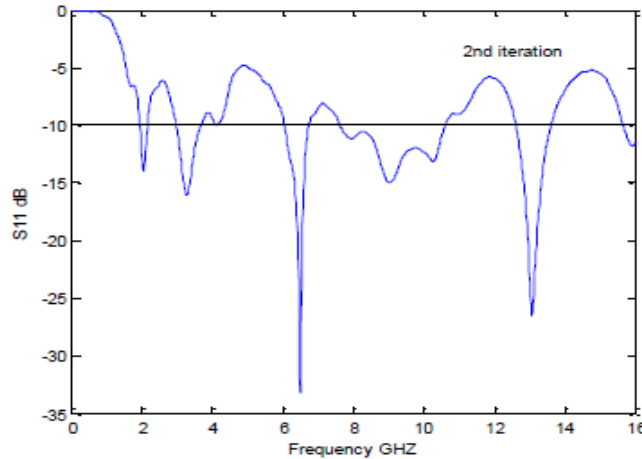
Volume 4, Special Issue 11, September 2015

National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

On 4th September, 2015

Organized by

Department of CSE, ECE & EEE, Magna College of Engineering, Chennai-600055, India.



(c) 3rd iteration outcomes

From the fig (a), (b), (c), (d), it shows that S11 is outcome for all the iterations. Now lesser frequency outcomes ought to be in progress to increase the developed iterations by means of fractional bandwidth. The proportional analysis shows iterations using extreme bandwidth as well as fractional bandwidth attained is in table

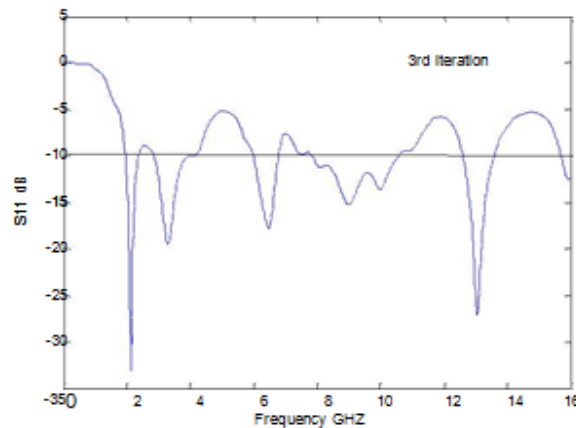


Figure: 23rd Iteration response

Iteration	Max bandwidth	Fractional bandwidth
0 th iteration	2.93GHz	23.23%
1 st iteration	2.96GHz	32.79%
2 nd iteration	2.96GHz	32.95%
3 rd iteration	2.73GHz	29.59%

Table: Comparison of various iterations

The 3rd iteration frequency bands have improved here. However, it is lower than the previous iteration. Fractional bandwidth is the measure of value of the ultra-wide band of the antenna. The high fractional bandwidth is preferred and so rectangular slots were added in the existing antenna. A midslot and two small slots were added at equidistant from the midslot. The better result is obtained here by taking length along x-axis and width along y-axis. The wideband and multiband characteristics obtained from resulting antenna shows excellent result. The final result obtained from the antenna was mentioned as S11. The various bands obtained were (i) 1.90-4.2GHz, (ii) 5.88-11.07GHz, (iii) 12.72-15.2GHz. Therefore, in addition to satellite applications bands at higher frequencies, GSM 1800 MHz band, 2.4GHz Bluetooth, 3000 MHz 3G, and Wi-Fi Max band are the bands covered by this antenna. About 75.40% of fractional bandwidth came out of it. The 3dB bandwidth came out to be 59.8 degrees. At frequency 8.5GHz, The radiation pattern clearly indicated that this antenna was working as an omnidirectional antenna. With theta at 91 degrees, its main lobe magnitude is 6.9 dBi in y-direction.

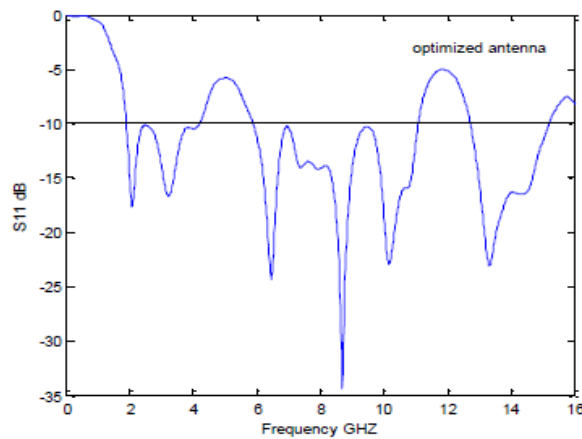
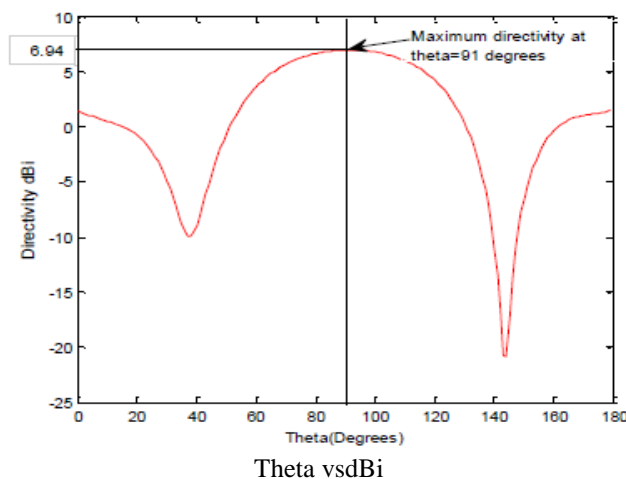


Figure: 3 S11 response of optimized antenna



V. CONCLUSION

A hexagonal fractal geometry antenna with wideband and multiband characteristics has been studied. The improvement in gain is significant and it is achieved with iteration. Numerous iteration was also discussed and corresponding results were analyzed. The overall bandwidth for both antennas is increased and more of the lower frequencies can be brought into the bandwidth. In the single slot antenna, fractional bandwidth is increased to 144.8% and to 152.7% in the 3-slot

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 4, Special Issue 11, September 2015

National Conference on Emerging Trends in Computing, Communication & Control Engineering [NCET 2K15]

On 4th September, 2015

Organized by

Department of CSE, ECE & EEE, Magna College of Engineering, Chennai-600055, India.

antenna. By scaling it to optimum configuration, we intend to try to increase the size of base geometry and number of iterations.

REFERNCES

- [1] Constantine A Balanis, "Antenna Theory: analysis and design", 3rd Edition.
- [2] JavadRohani, and AbolfazlAzari, "Koch Fractal Antenna for Ultra WideBand Applications", Cambridge, USA, July 5(8,2010).
- [3] N.A.Saidatul, A.A.H Azremi, R.B Ahmad, P.J Soh, F. Malek, "A Development of fractal PIFA(Planar Inverted Fractal Antenna) with band width enhancement for mobile phone applications"2009,Loughborough Antennas and propagation constant.
- [4] A.Azari and J.Rowhani, "Ultra Wide Band Fractal Microstrip Antenna Design",progress in electromagnetic research C, vol.2(7-12-2008).
- [5] A. Azari, "Super WideBand Fractal Antenna Design",IEEE MAPE,Beijing,China,2009
- [6] J. Gutrman, A. A. Moreira, and C. Peixeiro, "Microstrip fractal antenna formultistandard terminals," IEEE Antennas Wireless Propagation Lett., vol. 3, pp. 351–2004
- [7] Anshul Kumar, "Design Of Fractal Antenna For Ultra WideBand Applications",vol.4,July (7.2015)