A Survey on Comparative Study of Different Types of Fractal Antennas for WLAN Applications

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ABSTRACT: A comparative study of different shapes of fractal antenna and their parameters for better implementation has been presented in this paper. The basis of comparison VSWR, return loss on resonating frequency for IEEE 802.11b band.

Keywords— IEEE 802.11b, fractal antenna, VSWR.

INTRODUCTION: The term ***fractal,*** which means broken or irregular fragments, was originally coined by Mandelbrot to describe a family of complex shapes that possess an inherent self-similarity in their geometrical structure. Since the pioneering work of Mandelbrot and others, a wide variety of applications for fractals has been found in many branches of science and engineering. One such area is ***fractal electrodynamics***, in which fractal geometry is combined with electromagnetic theory for the purpose of investigating a new class of radiation, propagation, and scattering problems. One of the most promising areas of fractal electrodynamics research is in its application to antenna theory and design. As we know the IEEE 802.11b band of frequency is for the usage of Bluetooth connection (wireless), so designing an antenna for this range will be quiet beneficial for such areas where larger band with is required.

Here the comparison is between five designed structure of fractal antennas:-

1. Modified Sierpinski Carpet Fractal Antenna

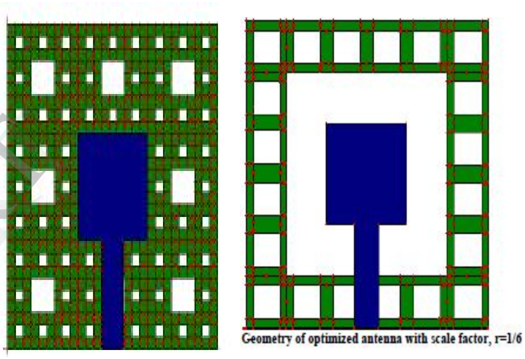

Fig. 1 Modified Sierpinski Carpet Fractal Antenna

In order to enable the operability in the frequency bands {2.41 GHz, 4.95 GHz}, while miniaturizing the radiating structure, the antenna has been required to exhibit a good impedance matching over the working frequencies .The PSO-based optimization procedure has been applied to identify the geometrical descriptors of DGS for required frequencies. To obtain a database from simulator for obtaining fitness function, the scaling factor of the DGS fractal has been varied.

2. Circular Fractal Antenna

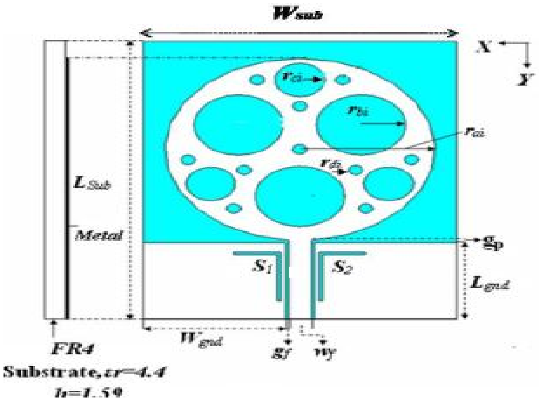

Fig.2 Circular Fractal Antenna

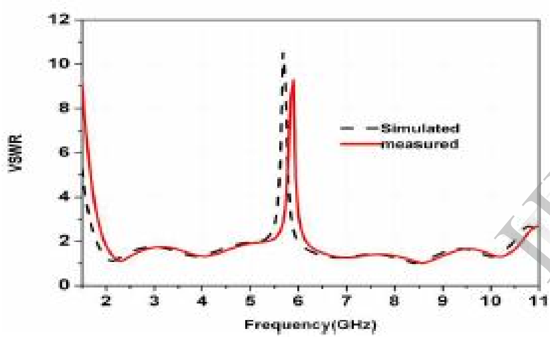

Fig. 3 Plot between VSWR and Frequency for Circular Fractal Antenna

3. Pentagonal Fractal Antenna

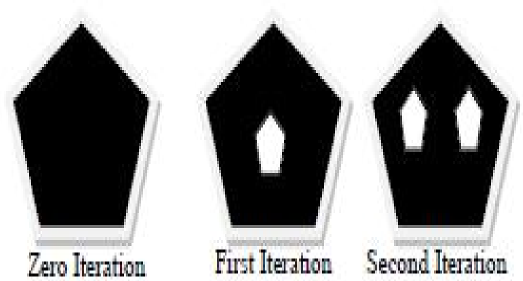

Fig.4 Pentagonal Fractal Antenna

Fig. 5 Plot between return loss and frequency for Pentagonal Fractal Antenna

4. Minikowski-Koch Fractal Antenna

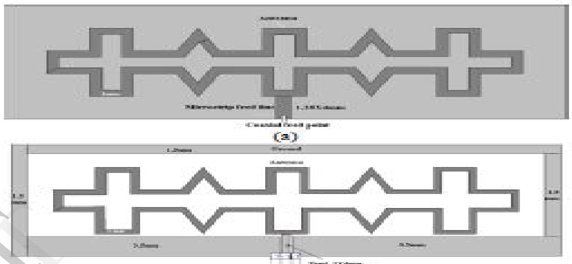

Fig. 6 Minikowski-Koch Fractal Antenna

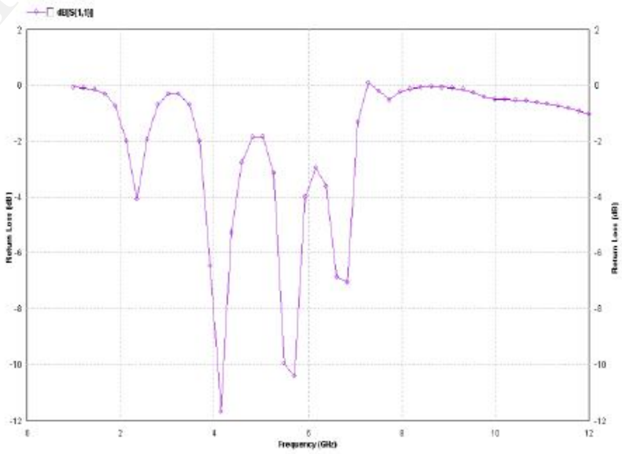

Fig. 7 Plot between return loss and frequency for Minikowski-Koch Fractal Antenna

5. Hexagonal Fractal Antenna

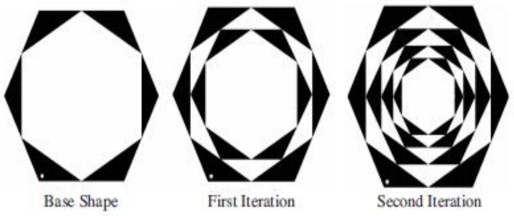

Fig.8 Pentagonal Fractal Antenna

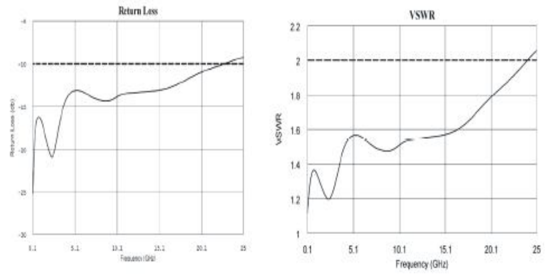

Fig. 9 Plot between return loss, VSWR and frequency for Pentagonal Fractal Antenna

The pattern of iterations here decide the radiation pattern of the antenna, generally these are kept in same structures of the parent design so as to get the same phase from the smaller structures also. The degree of the iterations also decide the characteristics of the pattern as the se antenna iterations can be varied from 1st , 2nd ,3rd and so on. Thus from this study it is analyzed that Fractal antennas are multi-resonant and smaller in size. Qualitatively, multi-band characteristics have been associated with the self-similarity of the geometry and Hausdorff dimensions are associated with size.

TABLE 1

Comparison Table

Antenna/ characteristics	**Modified Sierpinski antenna**	**Circular shaped antenna**	**Pentagonal shaped antenna**
VSWR (dB)	1.132	1.000009	1.2
Return Loss dB	-24.136	48.92	17.828

TABLE 2

Comparison Table

Antenna/ characteristics	**Minikowski-koch fractal antenna**	**Hexagonal antenna**
VSWR (dB)	1.6667	1.2
Return Loss dB	-29.04	-22.02

CONCLUSION

On the basis of the above comparison we can conclude that circular shape of antenna is best used for the particular band of frequency (2.4 GHz) as this shape has the high Gain, better results for VSWR which should be less than 2, better results for Return loss (<10) and also has high efficiency because of the shape from where radiations are coming out from the smallest element also (continuous change/ discontinuity), whereas for other antennas there were lesser discontinuities. Also the iterations make the radiations in same phase.

REFERENCES

[1] Sushil Kakkar* Priyadarshini Shweta Rani Deptt., Bgiet, Sangrur Ece Deptt., Lcet, Ludhiana Ece, Dept., Sliet, Longowal India. " New Antenna With Fractal Shaped Dgs For Emergency Management Applications"

[2] A. Azari-Member of Young Researchers Club Iran J. Rowhani Faculty Member Of Iau-Gonabad Branch Iran "Ultra Wideband Fractal Microstrip Antenna Design"

[3] Ravindra Kumar Yadav1, Jugul Kishor2, R. L. Yadava3 "Dielectric Loading on Multi-Band Behaviors of Pentagonal Fractal Patch Antennas"

[4] Rowdra Ghatak1, Balaka Biswas2, Anirban Karmakar3, and Dipak R. Poddar2 "A Circular Fractal Uwb Antenna Based On Descartes Circle Theorem With Band Rejection Capability"

[5] S. Suganthi, Member IACSIT, D. Kumar, and S. Raghavan "Design and Simulation of Miniaturized Multiband Fractal Antennas for Microwave Applications"

[6] Nemanja Popržen[1], Mićo Gaćanović[2] "Fractal Antennas: Design, Characteristics And Application"

[7] Douglas H. Werner', Randy L. Haup, and Pingjuan L. WerneJ' Communications and Space Sciences Laboratory The Pennsylvania State University, Department of Electrical Engineering "Fractal Antenna Engineering: The Theory andDesign of Fractal Antenna Arrays"