QUADRANGLE FRACTAL ANTENNA DESIGN FOR MULTIPLE RESONATING FREQUENCIES

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ABSTRACT

This paper presents the Quadrangle fractal micro strip fractal antenna for multiple resonating frequencies operation. The fractal antenna has been designed on substrate with dielectric constant ε_r=2.2 and substrate thickness h=1.5mm. This fractal antenna offers operation at five cutoff frequencies 5.5GHz, 7.9GHz, 8.8GHz, 12.5GHz and 15GHz.

Index Terms — Coaxial Feed, Fractal Antenna, Impedance Matching, Multi Frequency, Radiation Pattern, Resonant Frequency, Return Loss

I. INTRODUCTION

In modern wireless communication systems, multiband and low profile antennas are in great demand for both commercial and military applications. This has led to antenna research in various directions; one of them is using fractal shaped antenna elements. Traditionally, every antenna operates at a single or dual frequency bands, where different antennas are needed for different applications. Fractal shaped antennas have already been proved to have some unique characteristics that are linked to the various geometry and properties of fractals. Fractals were first defined by Benoit Mandelbrot in 1975 as a way of classifying structures whose dimensions were not whole numbers. Fractals have unique geometrical features occurring in nature. It can be used to describe the rough terrain, jaggedness of coastline, branching of tree leaves and plants, and many more examples in nature [1]. Fractal geometries have two common properties, space filling and self similarity. It has been shown that the self similarity property of fractal shapes can be applied to the design of multiband fractal antennas and the space filling property of fractals can be utilized to reduce antenna size. In this paper quadrangle fractal antenna is simulated. In section II detailed information of antenna geometry is discussed, while in section III simulation results with return loss and radiation pattern characteristics are discussed.

II. ANTENNA GEOMETRY DESIGN

The proposed multifrequency fractal patch antenna designed up to five iteration. At initial stage antenna geometry looks like simple square patch designed on FR-4 substrate with ε_r=2.2, and substrate thickness of 1.5mm. The square patch has dimension of 30mm× 30mm.

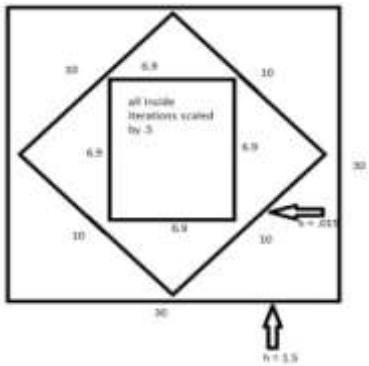

Figure2.1Dimensions of Quadrangle Geometry

The first iteration of fractal antenna has been constructed by inscribing the Quad patch of 10mm×10mm and subtracted it from square. The second iteration has been constructed by making the square of dimension 6.9mm×6.9mm.Likewise the third iteration is constructed and so on. All the iterations of antenna along with patch dimension is shown in Fig.2.1This fractal antenna has been fed with Coaxial Probe Feed having inner diameter 1mm and outer diameter 4mm as shown in Fig2.3. An impedance transformer is used in between antenna. Patch and feed to achieve better impedance match.

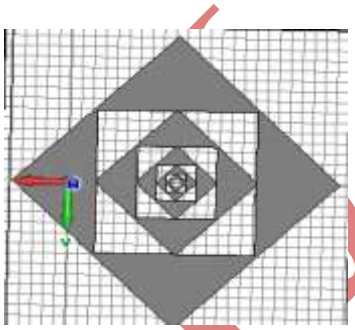

Fig. 2.2 Quadrangle Antenna Geometry

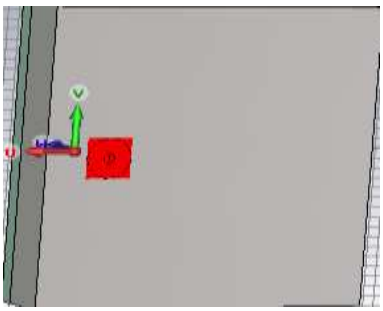

Fig.2.3 Coaxial Probe Feed point

III. SIMULATION RESULT

After simulating this fractal antenna, it is noticed that the operating resonant frequency of antenna is depends on patch size, width of impedance transformer, Feed which is used and substrate thickness of proposed antenna. So, these parameters should be optimized for better performance of antenna. Quadrangle Antenna will resonate at five different Frequencies as

shown in Fig. 3.1 shows the S11 vs. frequency plot for Quadrangle, which indicates at 5.5 GHz frequency, return loss is minimum .

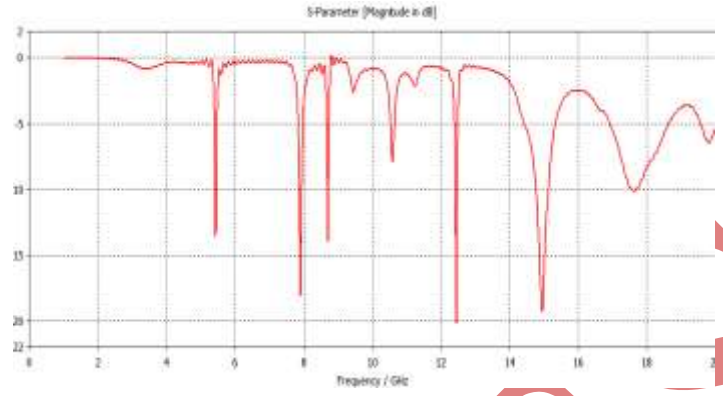

Fig. 3.1 Frequency Response plot for quadrangle antenna

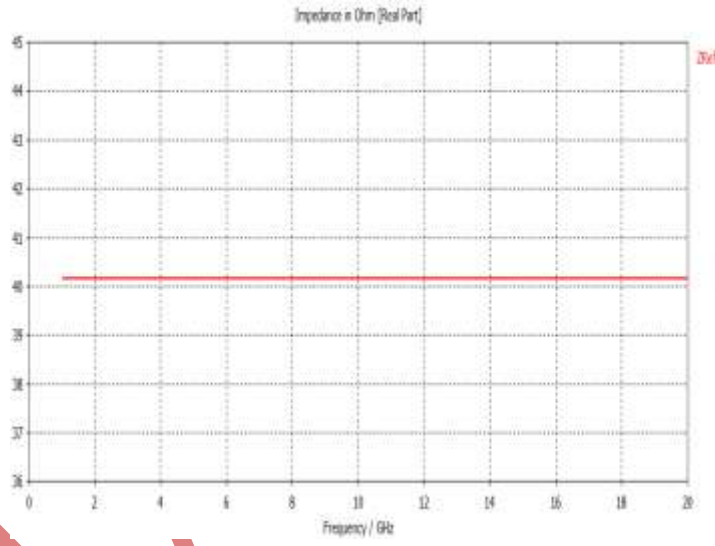

Fig.3.2ImpedanceInOhm

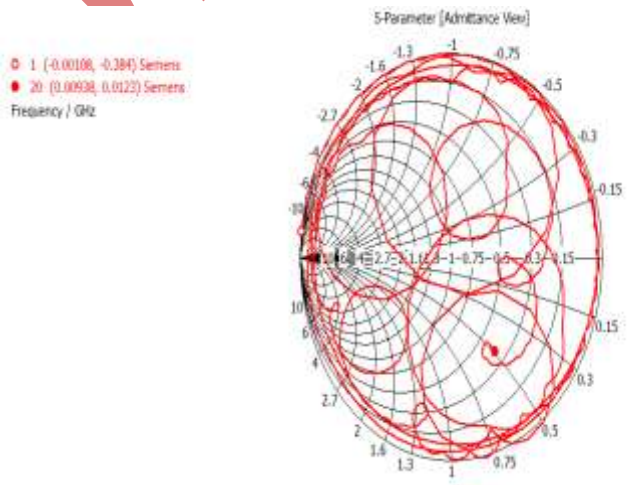

Fig. 3.3 Admittance View

IV. CONCLUSIONS

This paper describes the design of a multiband Quadrangle fractal antenna for multi band operation. The proposed antenna is built on full ground plane and fed through a Coaxial probe Feed. It is shown that the proposed antenna has operational corner frequency-cy at 5.5GHz, 7.9GHz, 8.8GHz, 12.5GHz, and 15GHz normalized to 10dB return loss value, which is covered in WLAN and Wi-Max, Satellite and RADAR bands for communication.

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