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Microstrip Decagon Carpet Fractal Antenna For Wireless Applications

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ABSTRACT

Microstrip Fractal antennas are the most suited for aerospace and mobile applications because of their low profile, light weight and low power handling capacity. They can be designed in a variety of shapes in order to obtain enhanced gain and bandwidth, dual band and circular polarization to even ultra wideband operation.. The paper provides a study of the design of a microstrip decagon carpet fractal antenna. The design parameters of the antenna have studied. For the simulation process ANSOFT HFSS (high frequency structure simulator) has been used. The effect of antenna dimensions and substrate parameters on the performance of antenna have been discussed. The antenna has been designed using the Arlon substrate with relative permittivity of 2.7 and a patch of decagon shaped designed up to 3rd iteration placed on it. Feed used is the microstrip line feed. The designed antenna is a low profile, small size and multiband antenna since it can be operated at different frequencies within the frequency range of 1 to 12GHz. It can be used for applications like wireless and mobile communication.

Keywords -Multiband, self-similarity, fractal

I. INTRODUCTION

In our modern society people need to be in touch with the world, for that technology is beingdeveloped in such way that anyone can communicate or be informed about everything just by usinga small handset cellular device. This equipment needs to operate in a wide range of frequencies,allowing people to connect to the WEB (standards 802.11a, 802.11b or 802.11g), make phone calls(GSM), video conferences (UMTS) and other utilities. All these technologies operate in differentfrequencies demanding a high efficient multi-band antenna with a very compact size. Fractal geometry antennas may help answer these requirements.

Nowadays, wireless communication systems are becoming increasinglypopular. There have been ever growing demands for antenna designsthat possess the following highly desirable attributes: compact size, low profile, multi-band, wide bandwidth, etc. There are varieties of approaches that have been developed over the years, whichcan be utilizedto achieve one or more of these design objectives.Recently, the possibility of developing antenna design objective hasbeen improved due to the use of fractal concept. The term of the fractal geometries was originally coined by Mandelbrot to describea family of complex shapes that have self-similarity or self-affinity intheir geometrical structures.

The main problem of common antennas is that they only operate at one or two frequencies,restricting the number of bands that equipment is capable of supporting. Another issue is thesize of a common antenna. Due to the very strict space that a handset has, setting up more thanone antenna is very difficult. To help these problems, the use of fractal shaped antennas is being studied.

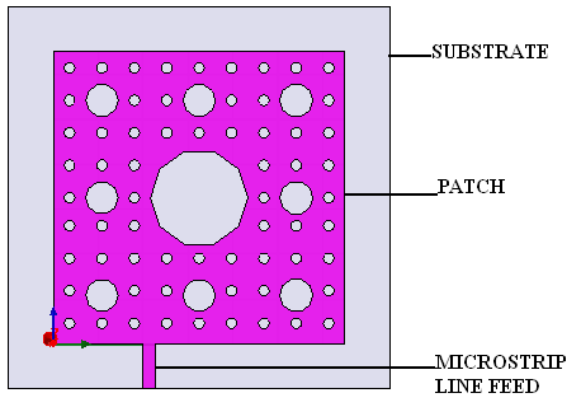

Figure 1: Geometry of the third iteration of decagon microstrip patch antenna

II. ANTENNA CONFIGURATION AND SIMULATION RESULTS

In the proposed geometry the concept of fractal has been applied to the geometry of a decagon carpet microstrip patch antenna to obtain multi band frequency operation. It is similar to the Sierpinski carpet iterative construction except the basic shape used in it that is decagon in place of triangle or square.A scaling factor of 1/3 was chosen so as to maintain the perfect geometry symmetry of fractal structure. To establish the multi band frequency operation, initially the order n of the antenna was limited to three (n=3), which enabled the antenna to operate in three different frequency

bands with corresponding renonant frequencies f_1, $3f_1$,$9f_1$(where f_1 is the resonance frequency of the driven element i.e n=1).

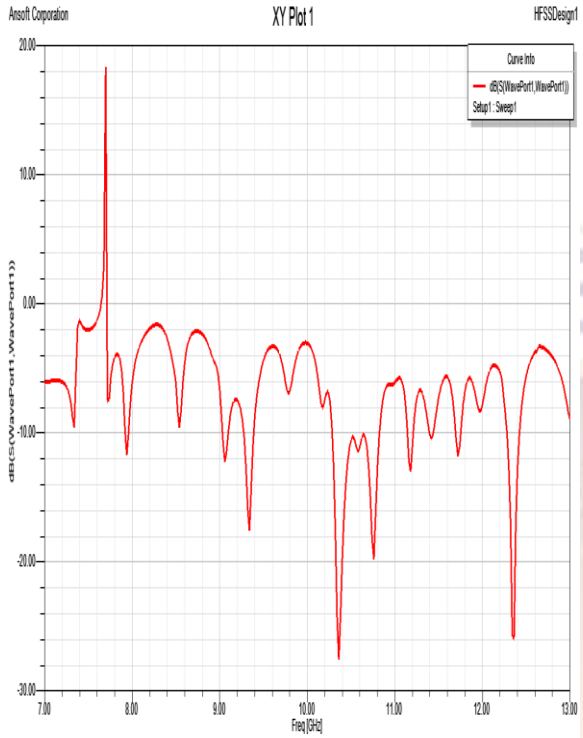

Figure 2: s parameters

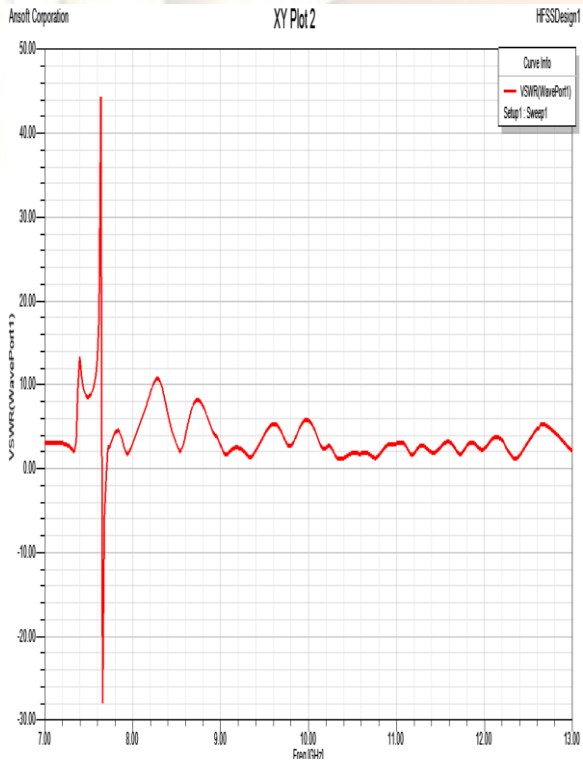

Figure 3: VSWR graph

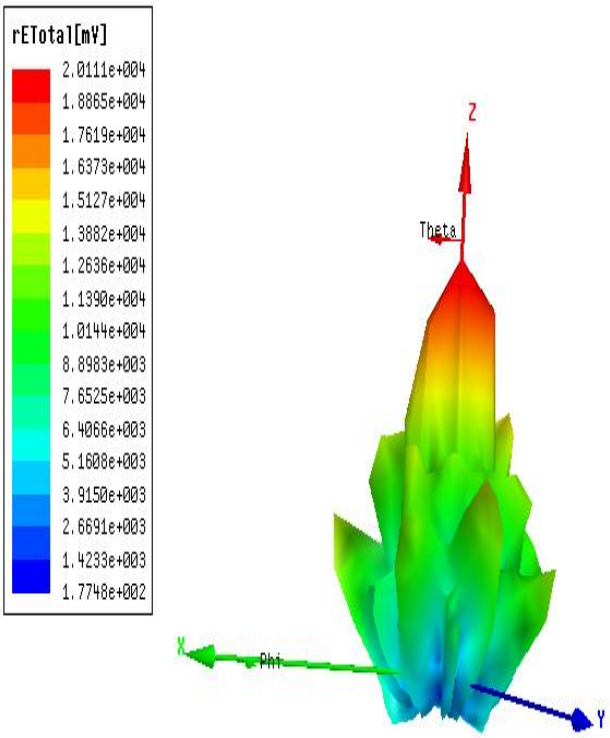

Figure 4: Radiation pattern graph

CONCLUSION

The main goal behind this work is to design an antenna capable of working at different frequencies which categorized it under multiband antennas. The range of the operating frequencies is between 1to 12GHz range, therefore it can be used for wireless and mobile communication. Return loss is bellow -10dB which is our margin, consequently the VSWR is always under 2, the radiation patterns show that these antennas have good gain. From the results we can conclude that with the increase in iteration there is a increase in bandwidth and decrease in the return loss. the proposed antenna can radiate at all of the operating frequency bands suitable for using in wireless communication applications.

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