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A Multiband Fractal Body Antenna for Body Wireless Communication System

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***Abstract*— A rapid progress in Body wireless communication has to deal with a great variety of communications systems like wireless personal area network, Bluetooth, Zigbee, ultra wideband technology .Each of these systems operate at several band frequencies. To give specific service to the users, each of these systems has to have an antenna that has to work in the frequency band for the specific system. The concept during last years has been to use single antenna for each system, but this concept is not used in terms of space usage and cost. The varieties of body communication systems suggest that there is a need for multiband body antennas. Nowadays, the design of multiband and small size antennas is still of major importance in body area network.**

This paper gives the design and simulation of a body antenna through the use of fractals. This paper present a multi-band body antenna based on fractal geometry. The performance of the proposed antenna design is analyzed with the simulations tool. The relevant antenna performance parameters of the proposed design viz. resonant bands, return loss are reported and discussed. The simulation results depicts that the antenna has a less than -10 dB return loss for six resonant bands upto 6 GHz in the vicinity of 1.00 GHz, 1.90 GHz, 3.12 GHz ,4.12 GHz, 5.04 GHz and 5.99 GHz. The VSWR of the antenna is less than 1.5 for six resonant bands up to 6 GHz in the vicinity of 1.00 GHz, 1.90 GHz, 3.12 GHz ,4.12 GHz, 5.04 GHz and 5.99 GHz. The performance results exhibited by the proposed body antenna make it extremely useful for the future generation of body wireless communication systems.

Key Words: Body Fractal Antenna, Body Area Network, Return Loss, Body wireless communication.

I INTRODUCTION

In present age of body communications, there is a dramatic development of a variety of body wireless applications. Hence the demands for multiband body antennas have remarkably increased. Different antennas are used for different frequency bands, recent studies have suggested that the antennas of certain configurations may operate in several frequency bands at the same time. Multi-band and wideband body antennas are desirable in personal body communication systems. Fractal antenna is one which serves this purpose.

Fractals is first defined by Mandelbrot [1] as a way of classifying complex geometric structures that have non-integer dimensionality and which posses' inherent self-similarity or self- affinity with-in their geometrical structure. While Euclidean geometries are limited to points, lines, sheets and volumes of integer dimensionality, fractal structures fall between these Euclidean classifications having non-integer dimensionality. Fractal geometries accurately characterize many non-Euclidean features of the natural including the length of coastline, density of clouds, and the branching of trees [2] and find application in many areas of science and engineering including body antenna design. Body Antenna design using Fractal geometry is called Body Fractal Antenna. It have been demonstrated that these antenna are multiband body antenna with enhance antenna properties due to their self-similarity behaviour. Using the property of fractal geometry, we may increase the electrical length of an antenna, keeping the volume of antenna same. [3][4][5] The necessary features of the fractal body antennas are

- Small size for a particular frequency band.
- Should possess multiband features.

The design considerations of fractal body antenna involves

- Dimensions of the basic structure or the starting topology
- Number of bands wanted.

.II. PROPOSED BODY ANTENNA DESIGN

The Proposed body antenna is designed by taking straight wire of A= 23.8 mm. This straight wire monopole is depicted in Fig. 1(a). The geometric construction has two levels of transformations. In the first level, straight wire is divided into four equal portions of length C= 5.95 mm . In the next level the Koch Fractal pattern is applied in middle two section of length B= 11.9 mm shown in fig 1 (b). Then koch fractal pattern is applied in the middle two section . This pattern is depicted in Fig. 1(c).

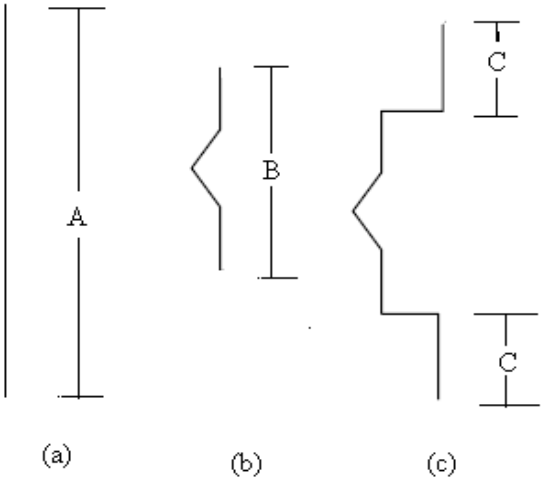

Fig. 1.(a) Straight Line (b) Koch Fractal Pattern (c) Proposed Design

Then Loop is made by the pattern shown in fig 2 which is our proposed antenna design of total length A=23.8 mm. The antenna is fed by a 2.2 mm wide transmission line, with an input impedance of 50 Ω.

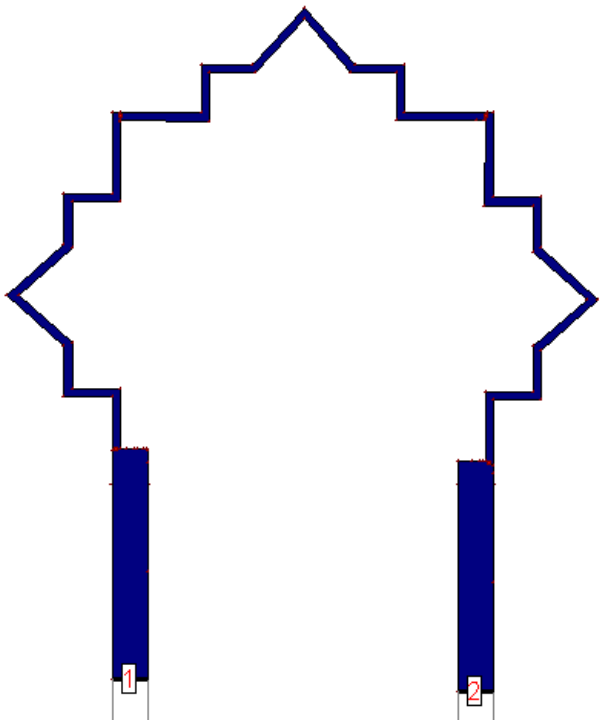

Fig 2: Proposed Fractal Body Antenna

III. RESULTS AND DISCUSSIONS

Body Antenna characteristics are measured using Simulation software. Simulated results of the designed fractal antenna shiown in table I.

TABLE I

RETURN LOSS AND VSWR OF PROPOSED FRACTAL ANTENNA

Freq. Band	Freq. in GHz.	S11 in dB	VSWR
I	1.00	-15.38	1.46
II	1.90	-31.03	1.05
III	3.12	-33.93	1.04
IV	4.12	-30.27	1.07
V	5.04	-24.88	1.12
VI	5.99	-14.94	1.44

Return loss obtained using simulation tool for proposed fractal body antenna are shown in Fig 3 and VSWR obtained using simulation tool for proposed fractal antenna are shown in Fig 4. Results of this body antenna resonate at 6 frequencies as shown in the table I.

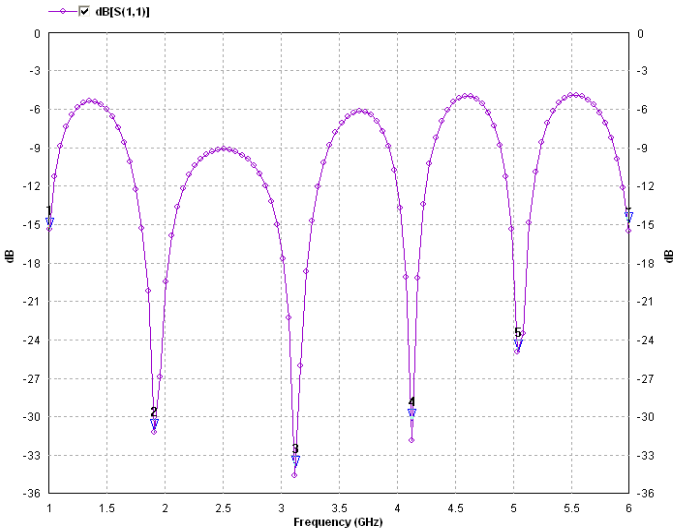

Fig.3: Return loss of proposed body fractal antenna

The return loss profile is as shown in Fig 3 showing 6 bands upto 6 GHz Frequency with return loss well below 10 dB and VSWR is as shown in Fig 4 showing 6 bands upto 6 GHz Frequency less than 1.2.

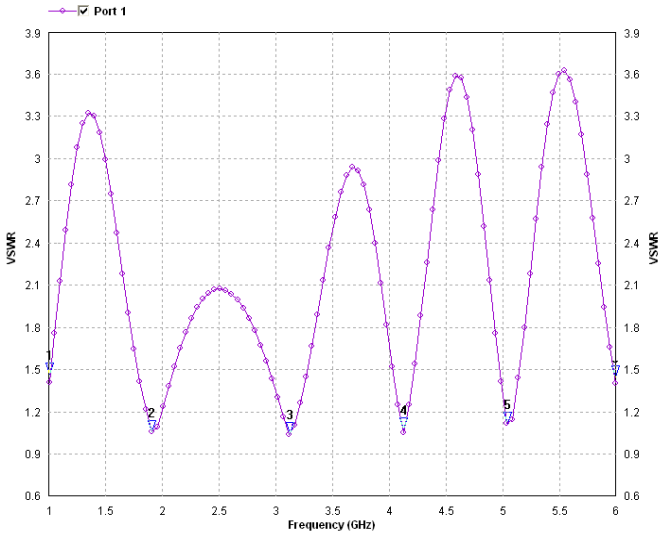

Fig.4: VSWR of proposed body fractal antenna

IV. CONCLUSION

Body antenna exhibits multiple frequency bands due to the self similarity between the different parts of the body antenna.We have obtained multiband with small bandwidth in the frequency band obtained. The proposed body antenna has also shown some good performance characteristics such as good radiation patterns and gain at higher frequency range. Due to the small size, the proposed multiband antenna depicts an overall fair performance and it could be a used in wireless body communications and body personal area network applications.

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