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Wideband Monopole Antenna for WLAN/WIMAX Applications

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ABSTRACT

In this paper we have design the multiband monopole antenna with sector nested fractal having operating range of 2.44Ghz/3.5Ghz/5.2Ghz and 508Ghz.Also the calculate following parameter like Gain, VSWR, Directivity, Reflection coefficient. In design of antenna cpw(coplanar wave guide)feed is used antenna with trapezoidal shape. The impedance and pattern measurement of antenna show the good performance over the WLAN/WIMAX band. The designed proposed antenna have a promising application in other fields like computer graphics and for used broadcasting.

Keywords : Sector nested, Fractal antenna, Trapeziform ground plane, Multi-frequency

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I. INTRODUCTION

Growth of a high data rates wireless communication system and the rise in the communication frequency bands puts forward the demand for multi-band antennas. In a particular fixed space, there usually exists several different communication systems, such as mobile communication syatem, wireless local area network system, etc. These wireless systems require the antennas which could work on different frequencies and modes. For example the working frequencies for the wireless local area network are 2.4 GHz and 5.2 GHz, and those for the GSM wireless mobile terminal are 900 MHz and 1800 MHZ. So we really need an antenna, it can meet the necessities of different application. The own similarities of fractals is the cause of multi-band property and their complicated shapes adds to the design of antennas with minor size. Fractals have jagged and convoluted shapes, and these discontinuities will growth the bandwidth and weaken the effective radiation of antennas. The filling of space property of fractal makes curves which have ex electrical length be fitted into a compact physical extended volume.

The various fractal antennas in recent years include Koch fractal, Sierpinski fractal, and Minkowski antennas. A novel sector-nested fractal antenna is studied, which a single-plane printed monopole antenna having feeding as a trapezi form ground plane with CPW. The antenna can synchronously operate in three frequencies, covering the working frequency bands of WLAN/WiMAX (2.44 GHz/3.5 GHz/5.2 GHz - 5.8 GHz).

II. LITERATURE SURVEY

The creation of multiband monopole antennas has been accredited to a number of researchers, but it certainly dates back to the 1960s when the first works was published by Deschamps, Greig and Engleman,and Lewin, among others. Since 1970,severe research came into picture with the first design equations. Since then different authors started research on Multiband monopole antennas like James Hall and David M. Pozar and many more who contributed a lot. Fractal is a concept extension to the microstrip antenna. The word “fractal” was termed by Benoit Mandelbrot in 1961. Sometimes he is referred to as the predecessor of fractal geometry. He said, “I coined fractal from the Latin adjective”. In many fractal antennas, the self-affinity and space-filling nature of fractal geometries are often quantitatively linked to its frequency characteristics. Fractals are geometrical structures, which are self-similar, repeating at regular intervals of time. The geometry of fractals is significant because the physical length of the fractal antennas can be enlarged while keeping the total area same. Final fractal geometry can be formed by an iterative mathematical procedure called, Iterative function(IFS).

In this paper, author namely Jie Zhang and Wei Zhang designed a multiband monopole antenna in july 2015.A kind of novel multi-frequency monopole antenna with sector-nested fractal is proposed and designed, which is nested with a series of similar circular sector elements. By means of the trapeziform ground plane with the tapered CPW (coplanar waveguide) feeder in the middle, the antenna"s radiation performance is greatly improved.

The author Best .S.R designed Koch fractal monopole antenna in feb.2002 which tells us about the Koch fractal monopole antenna which has been shown exhibit a lower resonant frequency than simple Euclidean monopole having the same overall height. The performance properties of the Koch fractal monopole have primarily been attributed to its fractal geometry. Here, the performance properties of the Koch fractal monopole, normal mode helix, and two meander line configurations are considered. While the resonant frequency of these antennas is a function of both the antenna's geometry and total wire length, it is demonstrated that when these antennas are made to be resonant at the same frequency, they essentially exhibit the same performance characteristics independent of the differences in their geometry and total wire length. It is demonstrated that the electromagnetic behavior of the Koch fractal monopole is not uniquely defined by its geometry alone.

Similarly, authors namely Mirzapour .B and Hassani designed the size reduction and bandwidth enhancement of snowflake fractal antenna in aug.2007. which is a new small-size and wideband fractal antenna in the shape of a snowflake is proposed. Various iterations of this fractal antenna with probe feed and capacitively coupled feed are compared and an optimised design is presented. It is shown that, with an air-filled substrate and capacitive feed, an impedance bandwidth >49% and, with a slot-loading technique, a reduction of about 70% in patch surface size compared with an ordinary wideband Koch fractal antenna are achievable. The simulation via a finite-element programme, and measured results on the return loss and the E and H-plane radiation patterns of the proposed antennas are presented and shown to be in good agreement.

III.THEORETICAL ANALYSIS OF ANTENNA

ANTENNA DEFINATION:-

Antenna is an electrical device which converts electrical power into radio wave , and vice versa .It is usually use with a radio transmitter or radio receiver. Antennas are essential components of all equipment that uses radio. Typically an antenna consists of an arrangement of metallic conductance electrically connected to the receiver or transmitter. An oscillating current of electrons force through an antenna that transmitter will create an oscillating magnetic field around the antenna elements. In computer and Internet wireless applications, the most common type of antenna is the dish antenna ,used for communications. Dish antennas are generally practical only at microwave frequencies (above approximately 3 GHz). The dish consists of a paraboloidal or spherical reflector with an active element at its focus. When used for receiving, the dish collects RF from a distant source and focuses it at the active element. When used for transmitting, the active element radiates RF that is collimated by the reflector for delivery in a specific direction At frequencies below 3 GHz, many different types of antennas are used. The simplest is a length of wire, connected at one end to a transmitter or receiver. More often, the radiating/receiving element is placed at a distance from the transmitter or receiver, and AC is delivered to or from the antenna by means of an RF transmission line, also called a feed lineor feeder. Every structure carrying RF current generates an electromagnetic field and can radiate RF power to some extent. A transmitting antenna transforms the Radio Frequency (RF) energy produced by a radio transmitter into an electromagnetic field that is radiated through space. A receiving antenna it transforms the electromagnetic field into RF energy that is delivered to a radio receiver.

Types of Antenna:

Monopole Antenna: A Monopole antenna is one half of a dipole antenna, almost always mounted above some sort of ground plane. The case of a Monopole antenna of length L mounted above an infinite ground plane is shown in fig.1.

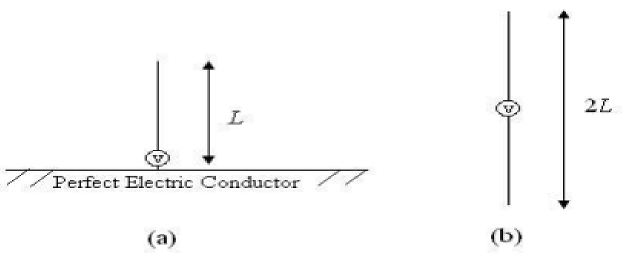

Fig 1. Monopole antenna above a PEC (a), and the equivalent source in free space (b)

Reflector Antenna: The parabolic reflector antenna or dish antenna is widely used in many areas where high gain and narrow beam width are required. The parabolic reflector antenna or dish antenna has been used far more widely in recent years with advent of satellite television. however the dish antenna field uses in many radio and wireless applications at frequencies usually above about 1Ghz where very high levels of RF antenna gain are required along with narrow beam widths.

Fig 2. Parabolic reflector antenna

Yagi-Uda Antenna:- It is simple to construct and has a high gain, Typically grater than 10dB.The Yagi-Uda antennas typically operate in the HF to UHF bands(About 3Mhz to 3Ghz),although their bandwidth is typically small ,on the order of a few % of the center frequency. Another antenna design that uses passive elements is the Yagi-uda antenna.This antenna is inexpensive and effective.

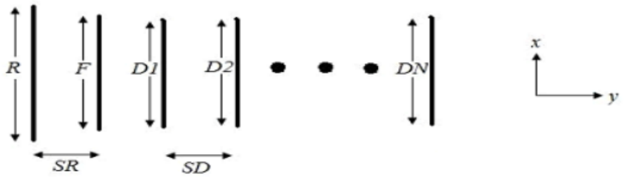

Fig 3. Geometry of yagi uda antenna

IV. DESIGN OF ANTENNA

The sector-nested fractal antenna is evolved from multiple-ring fractal antenna and the evolution process is presented in Figure 4. Antenna radiator is nested by multiple sector loops and the novel sector-nested antenna can be obtained. The two antennas in Figure 4 can be considered that the sector or circle metal-patches are caverned out and orderly nested from larger to smaller. The dark part is metal and the white part is the substrate. The number of nested fan is set to n =4, and at the same time the segment heights are h1,h2,h3,h4. The vertex angles for the antenna are θ1,θ2,θ3 ,θ4 , and metal thickness is 2 mm. As we can see, the antenna has two main parts metal radiator and trapeziform ground plane. Here the trapeziform ground plane has three functions: the first is acting as a ground plane for the monopole and the CPW, the second is acting as a radiating element, and the third is acting as a component to form the distributed matching network with the monopole together.

V. RESULT AND ANALYSIS

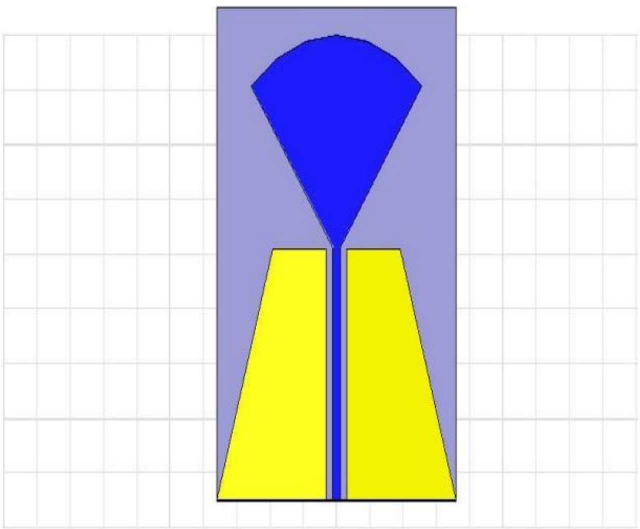

Fig 5. Top view of Antenna

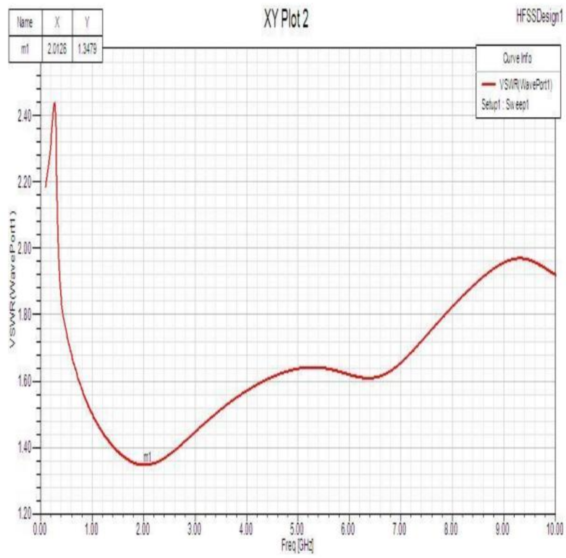

Fig 6. Plot of VSWR vs Frequency

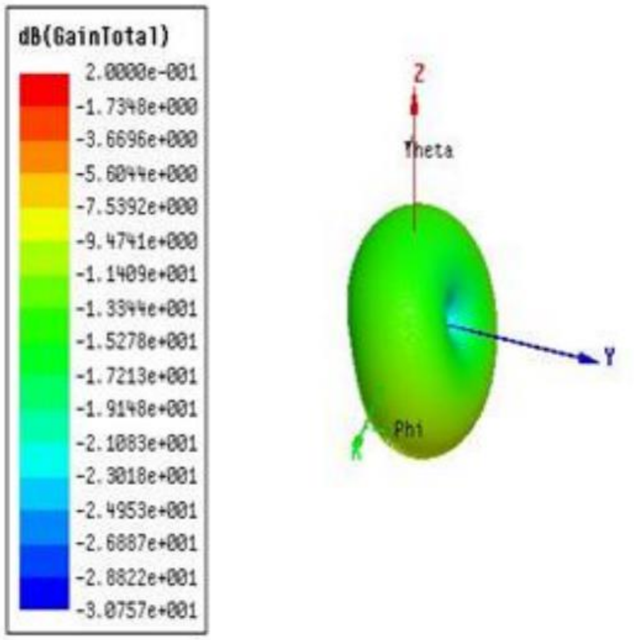

Fig 7. 3D gain

VI. ADVANTAGES AND APPLICATION

ADVANTAGES:-

- Small in size.
- High Efficiency.
- Low cost.
- Good performance over WLAN.

APPLICATION:-

- Computer Graphics.
- It is used in broadcasting.
- WLAN

VII. CONCLUSION

A novel sector-nested fractal antenna has been studied in this project. When we combine two techniques: the sector-nested fractal structure and the trapezi form ground plane, the monopole multiband antenna can operate to cover three bands at 2.44 GHz/3.5 GHz/5.2 GHz - 5.8 GHz, which are required by WLAN/WiMAX systems. It is observe from study that, the antenna has simple structure, thin profile, low cost and significant gain; therefore it can be applied for the electronic protection systems, etc., and will be an attractive candidate for various WLAN/WiMAX applications. In this seminar a antenna with trapezoidal shape & CPW feed can be designed & results are obtained in the form of various antenna performance parameter. The material used for said antenna is FR4, with thickness of 1.5mm. The antenna is operating at a frequency of 1.34 GHz & having total value of gain is 0.2 dB. The gain of antenna may be increases when we use fractal shape antenna.

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