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Size Reduction of Planer Dipole Antenna withUsing New Hybrid Koch Fractal

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***Abstract*— this paper presented a new hybrid Koch dipole fractal antenna that contributes to a 20% antenna size reduction. There is analyze the third iterative application of a new hybrid dipole fractal that leads to to10% extra shrinkage. The simulation result shows that the proposed antenna is useful for GSM900 application.**

Keywords—fractal; reduction antenna size; microstrip antenna; GSM900

I. INTRODUCTION

Designers are usually looking for a new idea for reducing antenna size. Fractal geometry is a suitable method for increase bandwidth or reduction size. Fractal has attractive construction. If the fractal shape zooms in or zooms out, their construction will be without any change. Step by step iteration creates upper fractal construction. The basic structure is created by a combination of two famous fractals called Koch and Minkowski[1]. The length of the new hybrid Koch dipole fractal antenna is 11 cm. In this paper can be seen the 3 iterations of a new hybrid Koch dipole fractal antenna is created 10% extra shrinkage [2, 3, and 10]. Figures 1 review the geometry of the antenna of the standard Koch curve and their lengths that are designed in different papers. According to the simulation was done with the standard Koch curve planar dipole antenna, the total length is 20 cm in order length[11]. Also, this new structure has a suitable size in comparison to the standard Koch curve. Because the length of the Minkowski generator is shorter than Koch generator .with regard to this discussion novel configuration, it has half-size lengths [11].In this paper, we concentrate on the Size Reduction of Planar Dipole Antenna Using New Hybrid Koch Fractal.

II. ANTENNA DESIGN

Figures 1, 2 project the geometric structure of the standard Koch curve for each order. In this paper according to the structure of the standard Koch and our new idea is used substrate Rogers 4003 with a dielectric constant of 3.38 and thickness 0.508 mm. The length of the simple planer dipole antenna is 140mm. The top of the substrate is grounded by the dipole slot and is fed by the prob. The antenna has been evaluated using Ansoft HFSS software. The resonance frequency of antenna is simulated for 900GSM. According to the novel hybrid fractal antenna designed, antenna length declines to110mm.With Appling 3 iteration to novel hybrid fractal antenna, antenna size reached by 100mm. The idea of antenna construction and geometries and simulated antenna are shown in Figures 1, 2, and3 [2, 3, and 9].

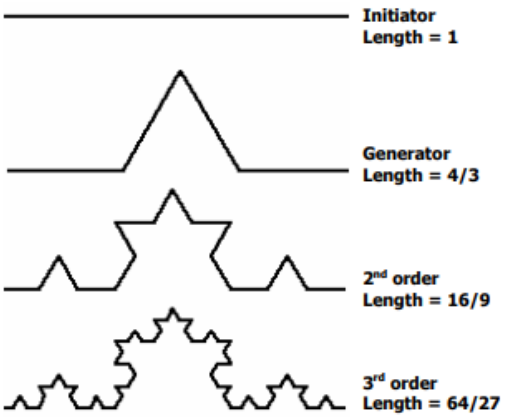


Figure 1. The geometric structure of the standard Koch curve for each order

The total length of the standard Koch curve is given by[11]:

$$L_{koch} = L_o\left(\frac{4}{3}\right)^n \qquad (1)$$

Where:

L_{koch}= total Length of koch curve

L_o = length of initiator

n = iteration

According equation (1) in we can derive the length of the Koch curve dimension which is shown in equation (2).

$$L_k = \frac{L_o}{\left(\frac{4}{3}\right)^n} \qquad (2)$$

Where:

L_k = total Length of Koch curve dimension

L_o = length of initiator

n = iteration

Miniaturization means that the structure can have the same frequency response as a straight wire with a longer length. This property can be used to reduce the size use of a simple wire monopole or dipole antenna.

The line width of the radials is 2 mm. Each dipole side has a length of 10 cm therefore the total length is 20 cm as can be seen in Figure 2.

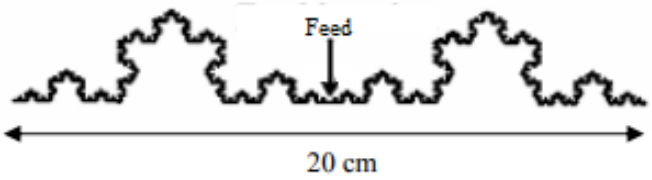


Figure 2 . Center fed Koch curve planar dipole antenna.

With set the new idea, our design is created. Figure 3 represents a new hybrid fractal and figure 4 shows the geometry for each order.

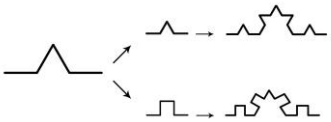


Figure 3 . principle of manufacturing of a new Koch fractal.

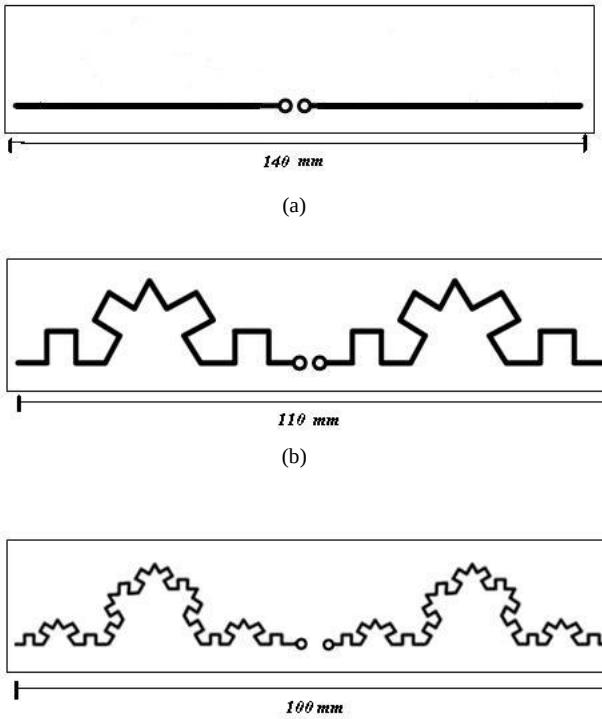


Figure 4 . Iteration of new hybrid kock fractal antenna applied on dipole antenna.

III. SIMULATED RESULT

Simulated results of antenna consist of Return Loss, current distribution, Radiation patterns and VSWR presented with a different graph.

A. Return Loss

The below chart illustrates S11 and compares the amount of B.W and level for planer dipole, first iteration and second and third iteration of a simulated antenna. As can be seen that simulated results are matched with each other. Table I shows a simulated result [5].

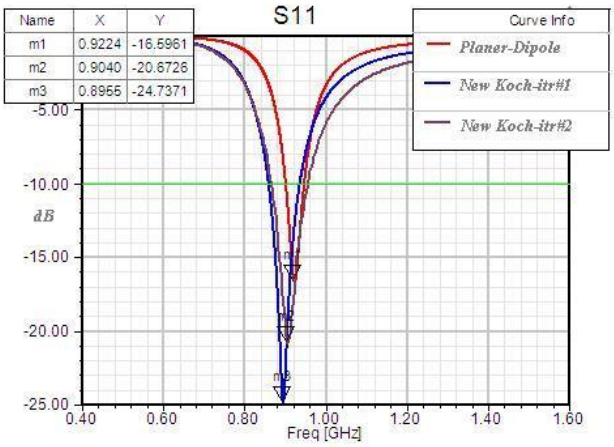


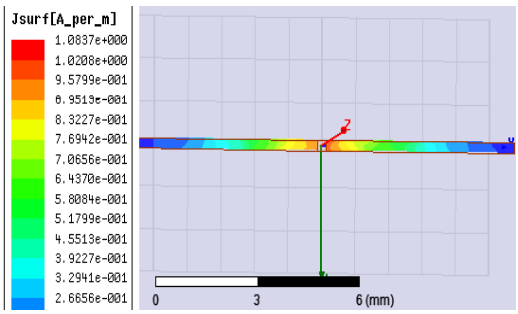
Figure 5 . Retern Loss of proposed fractl antenna.

TABLE .I. SIMULATED RESULT OF PROPOSED ANTENNA

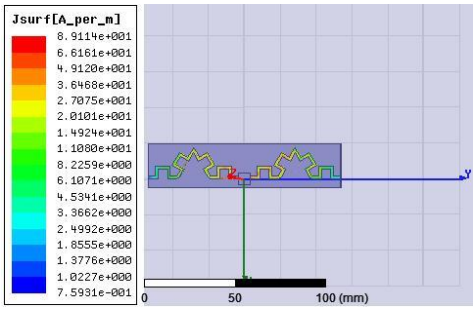
Antenna Type	**Substrate: Rogers 4003,h=0.508mm**		
	Length(cm)	***Return Loss***	***B.W***
Planer Dipole	14	-21	854-945 (90MHz - 10%)
Dipole New Hybrid Koch 2nd Iter.	11	-25	850-947 (97MHz - 9.2%)
Dipole New Hybrid Koch 3rd Iter.	10	-16.5	900-950 (50MHz - 5.6%)
Dipole standard Koch 3rd Iter	20	-22	520-600 (80MHz - 9%)[11]

B. current distribution

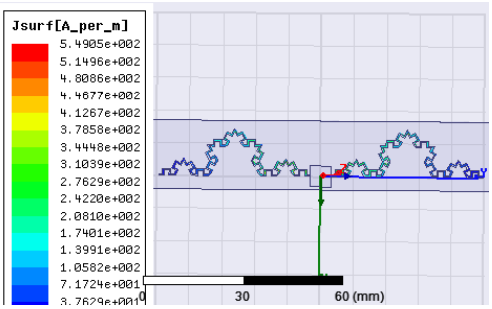
Simulations of the current distribution on the fractal antenna with iteration#1 and iteration#2 only using the commercial software package HFSS is provided in figure 6. The resonances of the fractal antenna are clearly observed from the current distributions. The surface current distribution on the fractal antenna is operating at a frequency of 900 MHz. It can be seen that the surface current is concentrated mainly on the notched that are responsible for band rejection at that frequency..



(a)



(b)



(c)

Figure 6 . Geometries of simulated antenna and current distribution on the fractal antenna.

C. Radiation Pattern

Figure 7 presents the simulated far-field radiation patterns for the first and second iteration. Radiation patterns are bidirectional in the E-plane and nearly Omni-directional in the H-plane for both, second and third iteration [4].

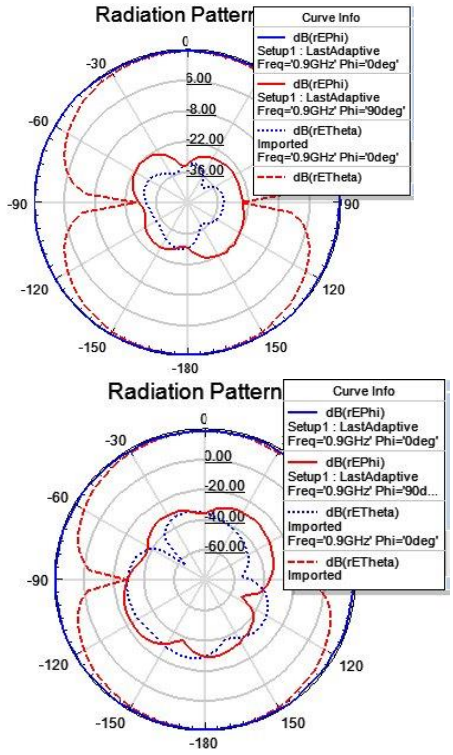
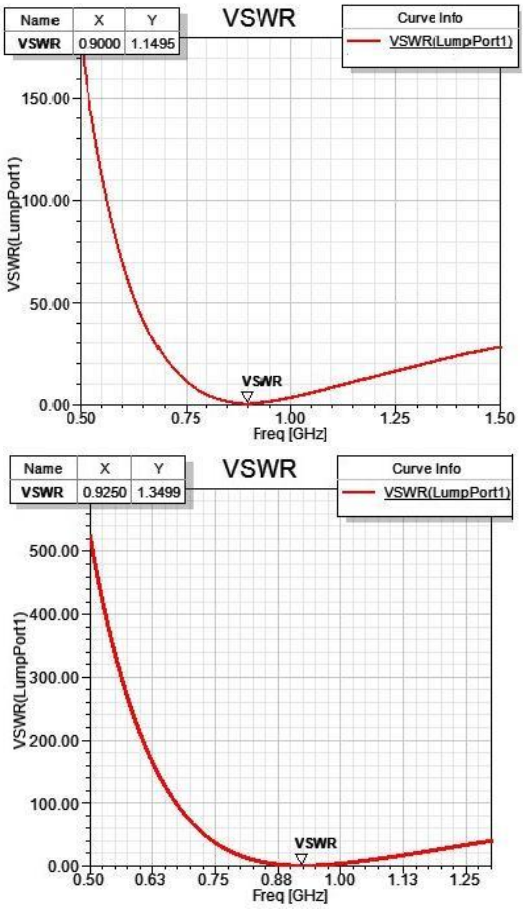


Figure7 . Radiatio patern of proposed antennaa for first and second iteration.

a. VSWR

According to simulation (figure 8), first iteration and second iteration have VSWR≤2, which means, these antennas easily matched with 50Ω coaxial cable [2, 3, 4, 6 and 9].



(a) (b)

Figure 8 . VSWR of a New Koch Fractal, (a)iteration#2,(b)iteration#3

IV. CONCLUSION

In this paper, the planer dipole antenna is based on the novel Koch fractal antenna. The novel structure of Koch and microstrip dipole antennas for 900 MHz band is provided in order to reduce its size. The new fractal structure is composed of two famous fractal structures called Minkowski and Koch. The suggested antenna has sufficient bandwidth as well as proper value of return loss in GSM900. Size reduction of the new fractal antenna by 20% in collation with dipole antenna and 10%extra reduction size in collation with 1st iteration new fractal will be achieved.

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