A Novel Hybrid Fractal Loop Antenna For GSM900

Ali Gashtasbi
Non-Profit Institute
Hyrcania,Bandar Gaz
Golestan-Iran
gashtasbi_ali@yahoo.com

Omid Kaboli
Iran Telecommunication Company
TCGolestan
Gorgan-Iran
okaboli@gmail.com

Dr.Alireza Monajati
Islamic Azad University
Shahr-e-Rey
Tehran-Iran
Alireza_monajati@iausr.ir

***Abstract*—A novel hybrid fractal loop microstrip antenna with size of 62*62 mm ^{2} is proposed for GSM900MHz application. The proposed antenna is designed by composition of Koch and Minkowski fractal antennas in loop construction and coaxial feeding is used. This antenna has appropriate radiation pattern as well as adequate return loss along with 60MHz BW.**

***Keywords*—fractal antenna; micro strip antenna; GSM900**

I. INTRODUCTION

The fractal micro strip antennas are used for a variety of purposes, including mobile communication, satellite communication and wireless applications. The geometry of fractal antennas has been always charming for the designers. Complex and repeatable structures contribute to increasing electrical length of the antennas while having fixed surface and bandwidth; therefore, this is the basic reason to reduce the antenna size. Some applications of different fractal antenna have been proposed.

In this paper, a mixed shape of fractal has been designed. The new structure is composed of a combination of two famous fractals called Koch and Minkowski[1]. In this algorithm, Minkowski's generator (square pulse, Fig.1) is applied to Koch's fractal antenna in each level. When the generator is applied to each line, it is divided to three identical parts called the width of dip, varying between zero and one. If the width of dip is 0.5, it means that the width of dip is half of the size of direct parts [1, 2, 3, 4, and 5].

Fig.1. Minkowski's generator

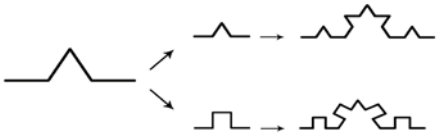

Fig.2. generating new fractal from Koch's fractal using square pulse with $\omega = 1$

II. ANTENNA DESIGN

In This article, a new structure is loaded by 4 novel fractals in the loop shape antenna [2, 3]. Coaxial feeding is used at the end of an angle. The geometry of the antenna is presented in Fig. 3. The characteristics of the antenna are as follows: a substrate from Rogers 4003 with dielectric substrate ε_r =3.38 and thickness h=20 mil. The size of the antenna is 60*60 mm ^{2} . Ansoft HFSS is used for simulations .The resonance frequency is simulated in GSM900. Some applicable antenna parameters are demonstrated (table I).

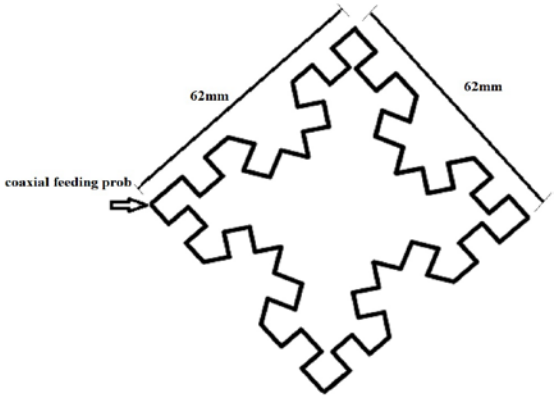

Fig.3.Geometry of proposed antenna

TABLE I. ANTENNA DESIGN DETAILS

Material	***Rogers***
Dielectric constant	ε_r = 3.38
Los tangent	***δ=0.02***
Substrate thickness	***h=20 mil***
Centre frequency	***900MHz***

A. *Return Loss*

The simulated S11 Parameter is illustrated in Fig. 4. The level of return loss is -43db for band width (862-922,60mhz), according to the simulations.

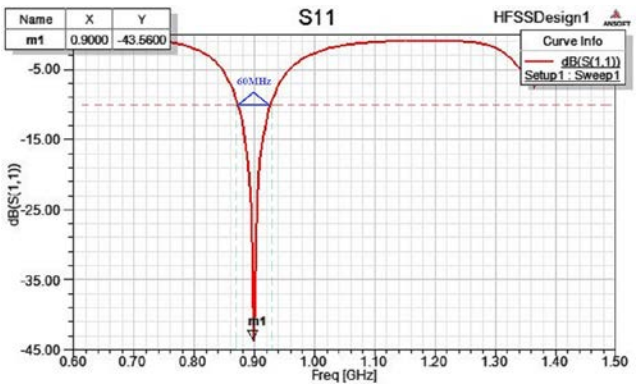

Fig.4. S11, simulated antenna

TABLE II. FREQUENCY AND BANDWIDTH

	Frequency Range	***Bandwidth MHz***	***%***
GSM900	862-922	60	7.5

B. *Radiation Pattern*

By studying Radiation pattern simulations, it can be seen that directivity and radiation levels are reasonable.

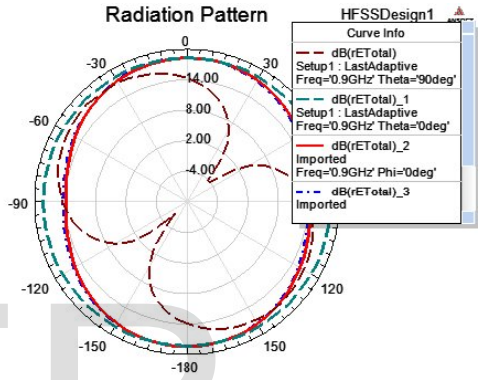

Fig.5. Radiation pattern (E-Plane, H-Plane) antenna

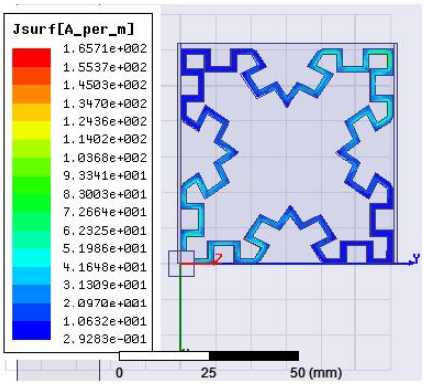

Fig.6. J Surface of proposed antenna

C. *VSWR*

According to the simulated VSWR, this antenna is matched to 50Ω in 900 MHz frequency (VSWR<2).

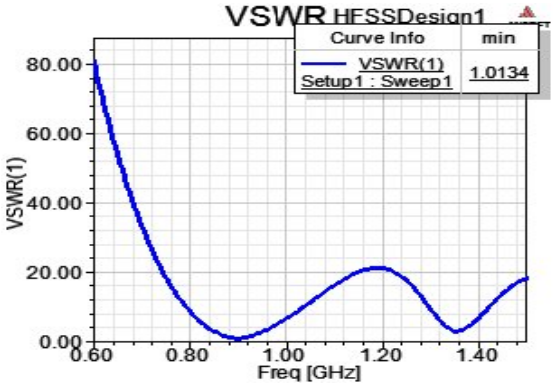

Fig.7. VSWR for proposed antenna

III. CONCLUSION

A hybrid fractal loop antenna has been investigated. According to the fractal theory, this antenna has appropriate size and it is capable of operating in 1350 MHz frequency [5]. The simulated antenna is composed of four new Kock fractal antennas applied to a loop microstrip antenna. The results obtained from HFSS simulations show that the proposed antenna is suitable for GSM900 in 60MHz BW.

REFERENCES

[1] O. Kaboli, A. Gahtasbi, and A. R. Monajatineddon, "Design Simulation ,Fabrication and Measurement of 900MHZ Newhybrid Fractal Dipole ," IJECCE. India, vol. 6, pp. 2278–4209, January 2015.

[2] A. Azari, "A New Fractal Monopole Antenna For Super Wideband Applications," IEEE. K. L. Malaysia, vol. 9, pp. 5532-4, December 2009.

[3] A. Azari, "A New Fractal Antenna For Ultra Wide- And Multi- Band Applications," APCC. H. R. K. L. Malaysia, vol. 17, pp. 390-4, October 2011.

[4] Dong Li, Fu-Shun Zhang , Zong-Ning Zhao, Liu-Tao Ma, Xu-Nan LiL. Dong,Zhang. F. S,Zhao. Z. N " UWB Antenna Design Using Patch Antenna with Koch Boundary," IEEE, National Key Laboratory of Antennas and Fractal Microwave Technology, Xidian University, Xi'an, Shaanxi 710071,China2012.

[5] Dilara khatun , Md. Shahjahan, "Multiband Fractal Square Koch Antenna Design for UHF/SHF Applications," IEEE, 2012.