Scientific Journal of Impact Factor(SJIF): 3.134

e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2,Issue 3, March -2015

Koch Fractal Microstrip patch Antenna for Triband Wireless Applications

Nitin.M.Gaikwad[1],Prof.M.M.Jadhav[2]

[1]*Department of Electronics, VPCOE Baramati, Pune Maharashtra*
[2]*Department of Electronics Engg. VPCOE Baramati, Pune Maharashtra, India.*

Abstract —*A Koch fractal microstrip Rectangular patch antenna fortriband wireless Applicationsis presented. Significant reduction of antenna size can be realized when the Koch fractal microstrip antenna used instead of conventional rectangular microstrip patch antenna. In this paper side of the rectangular patch replace by Koch curve and Rotating koch fractal rectangular slot is added at the centre of the rectangular patch for the good circular polarazation . The Axial ratio is 3 dB down for triple band also return loss values below -10 dB for frequency 1.52GHz,2.04GHz2.43GHz respectively. The antenna printed on a dielectric substrate FR4, dimension of patch is (45mmx58mm), relative permittivity εr =4.4 and h=1.6mm. This antenna simulated using HFSS software.*

Keywords*-Koch fractal antenna, microstrip antenna, Bandwidth, radiation patterns, VSWR, returns loss.*

I. INTRODUCTION

Nowadays wireless communications systems require compact antennas which are capable of operating at different frequency bands. Fractal geometry antennas are being studied in order to answer those requirements.The term 'fractal' was developed by the French scientists B.B. Mandelbrot in 1970. A "fractal" is a geometrical shape which can be split into parts, each of this is a reduced size copy of the whole design infinitely. Fractals are a class of shapes which have not characteristic size. Fractal concept is based on compression of length. There are different fractal geometries like Sierpinski gasket,Sierpinski carpet, Hilbert curve, Tree structure, Koch curve. It has different mathematical calculation. In this paper Koch curve geometry is used. Fractal shapes have the following features:

1. Self similarity
2. Space filling
3. Compact size by iteration, essay replaces.
4. It forms irregular and different shape.

Some patch antennas uses a dielectric substrate and suspend a metal patch in air above a ground plane using dielectric spacers; the resulting structure is less robust but provides better performance. Because such antennas have a very low profile, are mechanically rugged and can be conformable, they are often mounted on the exterior of aircraft and spacecraft .Koch curve geometry is the triband application with impedance matching probe feeding along diagonal axis[3-4],Koch curve contain triangular shaped geometry as well as compression and expansion is carried out length reduces. koch curve size reduces 20% of hole design and support multiband operation. The Koch fractal antennas are required to be compact, low-profile, directive with high transmission efficiency and designed to be discreet. Due to these well met requirements coupled with the ease of manufacture and repeatability makes the Koch fractal antennas very well suited for triband application.

The inserting dual pentagonal slots on the patch and proper asymmetry along the feedline, a dual- band CP antenna is proposed [1]. The replacing the patch side with four T-shaped slits and corners with four Y- shaped slits and slot in the patch center, dual-band CP is obtained [2]. Triband antennas based on circular -arc-shaped strips [3] . Triple-band antennas using H -shape [4]. The Single layer single patch dual band and triple band patch[5]. The multiband behavior of a Sierpinski mass fractal patch is thoroughly shown [6]. Size miniaturization capability of fractal curves is made to be used in wire antennas [7], [8] as the boundaries of patch for designing compact and multiband antennas [9]. Several coplanar waveguide (CPW)-fed Koch fractal boundary slot antennas [11] are proposed for broadband operation covering WLAN and WiMAX applications. Most of the an-tennas designed for multiband operation using fractal boundary curves are of CPW-fed slot or probe-fed wire antenna types. Compact circularly polarized asymmetrical fractal boundary microstrip antenna for wireless applications in this paper side of square patch replace by half circle and feeding point on the diagonal axies antenna axial ratio is increased by the asymmetrical boundary fractal[13].

In this paper, a Koch fractal boundary micristrip patch with an rotated fractal slot is implemented for triband CP radiation. This will discuss the design procedure of a triband fractal slot antenna; simulations and antenna is used for blutooth ,GPS applications.

II. DESIGN CONSIDERATION

The proposed antenna can be design for three layer patch layer,substrate layer,ground layer. Firstly calculate width(W) and length(L) of the patch . next step is calculation of the ground plane then gruond plane and substrate plane dimention are same . Calcultion of the feeding point on the diagonalaxies because of the impedence matching purpose. For the design purpose dielectic material is used FR4 material of dielectric constant 4.4 its height is 1.6 mm

In this design, iteration method is used. In first iteration simple microstrip patch antenna is design there is only one band of frequency occures ,second iteration fractal at the boundary of microstrip patch antenna threre dual band of frequency obtained,In third iteration koch fractal slot is inserted at the centre of the patch there is triple band of frequency shown.

To achieve the triple band of frequency and good circular polarazation rotate the inserted koch fractal slot some angle. The performance of the antenna is incresed by variation in the length of the koch curves. Thus, the ground-plane dimensions should also be taken into account in determining the proper parameters for the proposed design to achieve the desired band operation.

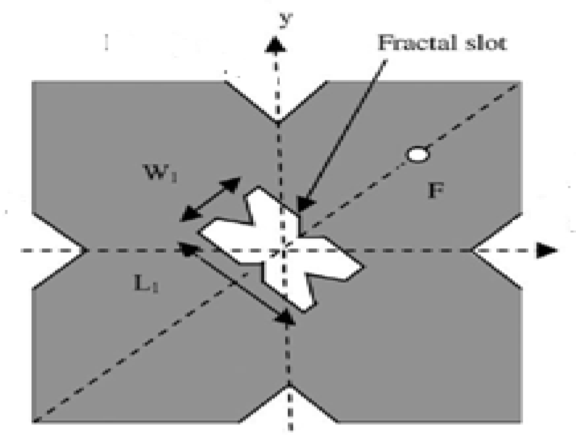

figure1.Geometry of koch fractal Antenna

III. SIMULATED RESULT AND DISCUSSION

The simulation of the koch fractal microstrip patch antenna is depends on the length ,width ,feeding point which is calculated using different formulea . calculated L and W used for designing microstip patch in HFSS software and result is achieves by the optimazation in design. The simulated result for Koch fractal Antenna is discussed as below.

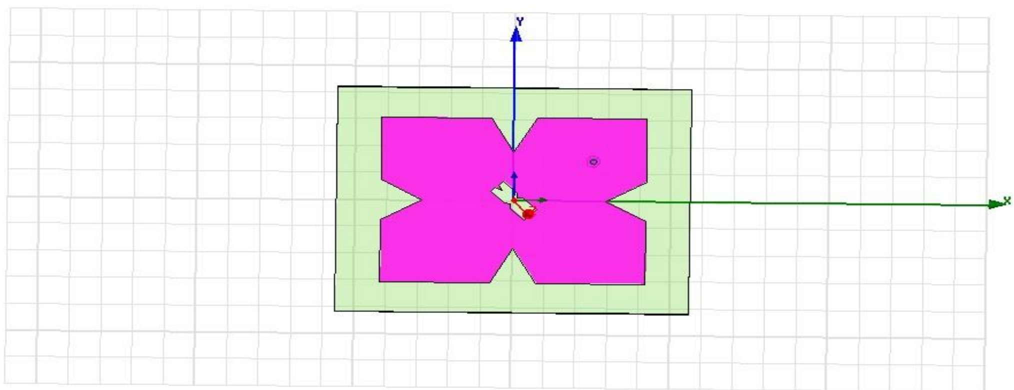

figure2. Simulation of Koch fractal Antenna

3.1. Return Loss

The return loss is a variable in which the power does not return in the form of reflection and is lost to the load. The designed antenna resonates at 1.52,2.04 and 2.43 GHz frequency. The return loss values is -11 dB,-14 dB,-28 dB respectively. The plot for Return Loss is shown in below Figure 3.

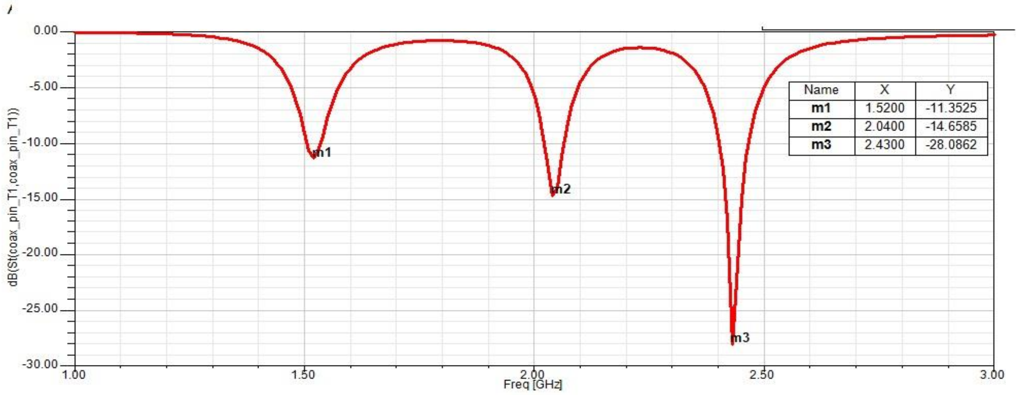

figure3. Return Loss of Koch fractal Antenna

3.2. VSWR

The VSWR (voltage standing wave ratio) plot for the design antenna (coaxial feed) is shown in Figure 4. The value of VSWR is 1.74, 1.45 1.08 at resonating frequency 1.52, 2.04 and 2.43 GHz respectively. A VSWR values is 1 means there is no loss in the transmission. The VSWR values is 2, 90% of the power is transmitted.

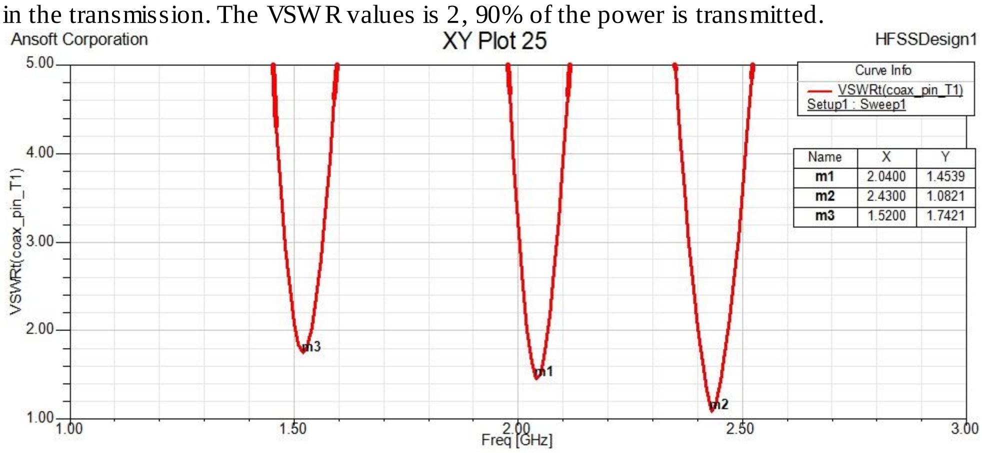

figure4.VSWR

3.3. Current distribution

The Current distribution represents that how the current is distributed on the patch .The maximum current on the patch on the edeges of the patch. Red colour shows maximum current ditribution. We have to varing length current distribution changes.

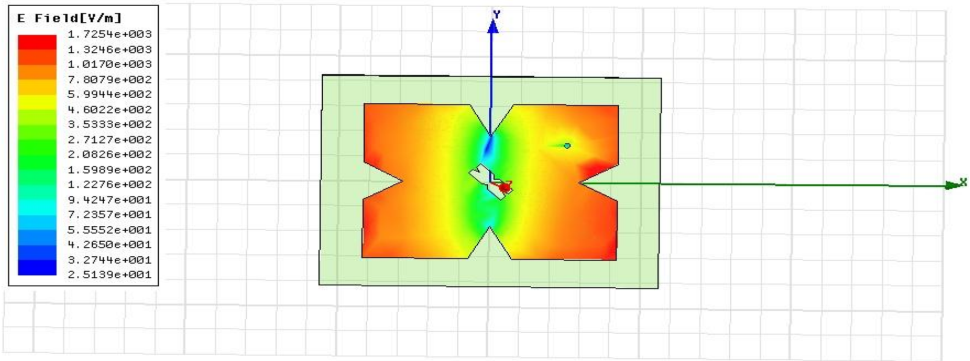

figure5.current distribution

3.4. Radiation Pattern

The antenna radiates more in a particular direction as shown in polar plot, as compared to the isotropic antenna which radiates equally in all directions.

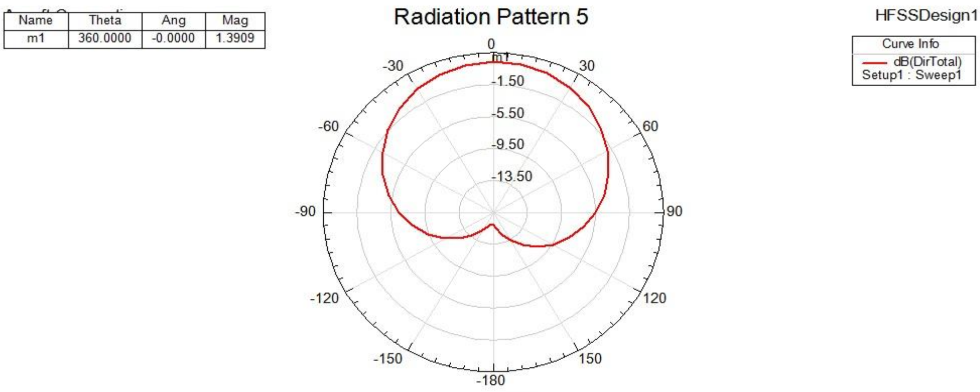

figure6.Radiation Pattern

IV. EFFECT OF DIFFERENT STUCTURE

The variation on the width and lenght of antenna corresponds to different types of MSA return loss and VSWR with different resonant frequency. The following table gives description of effect of antenna.

Sr no	Type of MSA	Frequency(GHz)	Return Loss (dB)	VSWR
1	Microstrip Antenna	2.41	-13.10	1.62
2	Fractal Antenna	1.41 1.66	-25.98 -18.08	1.10 1.47
3	Fractal Boundary Antenna	1.52 2.04 2.43	-11.35 -14.65 -28.06	1.74 1.45 1.08

IV. CONCLUSION

A koch fractal microstrip patch antenna has been designed and simulated. The simulation result obtained by HFSS shows at resonating frequency. It is shown that the proposed antenna have return loss -11.35,-14.65 and-28.06 dB for 1.52,2.04,2.43GHz respectively. The VSWR are 1.74,1.45,1.08 for 1.52,2.04 and 2.43 GHz resp.

REFERENCES

[1] Y. Sung, "Dual-band circularly polarized pentagonal slot antenna," *IEEE Antennas Wireless Propag. Lett.*, vol. 10, pp. 259–261, 2011.
[2] K. P. Yang and K. L. Wong, "Dual-band circularly-polarized square microstrip antenna," *IEEE Trans. Antennas Propag.*, vol. 49, no. 3, pp. 377–382, 2001.
[3] H. Zhai, Z. Ma, Y. Han, and C. Liang, "A compact printed antenna for triple-band WLAN/WiMAX applications," *IEEE Antennas Wire-less Propag. Lett.*, vol. 12, pp. 65–68, 2013.
[4] T.-H. Chang and J.-F. Kiang, "Compact multi-band H-shaped slot an-tenna," *IEEE Trans. Antennas Propag.*, vol. 61, no. 8, pp. 4345–4349, Aug. 2013.
[5] W. C. Mok, S. H. Wong, K. M. Luk, and K. F. Lee, "Single layer single patch dual band and triple band patch antennas," *IEEE Trans. AntennasPropag.*, vol. 61, no. 8, pp. 4341–4345, Aug. 2013.
[6] C. Puente, J. Romeu, R. Pous, and A. Cardama, "On the behavior of the Sierpinski multiband antenna," *IEEE Trans. Antennas Propag.*, vol. 46, no. 4, pp. 517–524, Apr. 1998.
[7] K. J. Vinoy, J. K. Abraham, and V. K. Varadan, "On the relationship be-tween fractal dimension and the performance of multi-resonant dipole antennas using Koch curves," *IEEE Trans. Antennas Propag.*, vol. 51, no. 9, pp. 2296–2303, Sep. 2003.
[8] C. Puente, J. Romeu, and A. Cardama, "The Koch monopole: A small fractal antenna," *IEEE Trans. Antennas Propag.*, vol. 48, no. 11, pp. 1773–1781, Nov. 2000.
[9] X. D. Song, J. M. Fu, and W. Wang, "Design of a miniaturized dual band Koch fractal boundary micro strip antenna," in *Proc. IEEE Mi-crow. Conf.*, 2008, pp. 282–284.
[10]P. H. Rao, "Broadband CPW-fed planar Koch fractal loop antenna," *IEEE Antennas Wireless Propag. Lett.*, vol. 7, pp. 429–431, 2008.
[11]D. D. Krishna, M. Gopikrishna, C. K. Aanandan, P. Mohanan, and K. Vasudevan, "CPW-fed Koch fractal slot antenna for WLAN/WiMAX applications," *IEEE Antennas Wireless Propag. Lett.*, vol. 7, pp. 389–392, 2008.
[12]D. D. Krishna, M. Gopikrishna, C. K. Aanandan, P. Mohanan, and K. Vasudevan, "Compact wide band Koch fractal printed slot antenna," *Microw., Antennas Propag.*, vol. 3, no. 5, pp. 782–789, 2009.
[13]V. V. Reddy and N. V. S. N. Sarma, "Compact circularly polarized asymmetrical fractal boundary microstrip antenna for wireless appli-cations," *IEEE Antennas Wireless Propag. Lett.*, vol. 13, pp. 118–121, 2014.

