

A NEW MODIFIED SLOTTED SIERPINKSI GASKET FRACTAL MICROSTRIP ANTENNA FOR WLAN AND RFID APPLICATIONS

P.Prabhu¹, R.Ranjith Kumar², S.Yogapriya³, R.Rajalakshmi⁴, N.Ahamedu Nisha⁵

PG scholar, Dept. of ECE, Bannari Amman Institute of Technology, Tamil Nadu, India¹

PG scholars, Dept. of ECE, K.Ramakrishana College Of Engineering, Tamil Nadu, India^{2,3,4,5}

Abstract: A sierpinski gasket fractal antenna for WLAN ,RFID ISM band applications proposed ,designed and simulated .The proposed modified sierpinski slotted fractal patch designed in order to achieve radiation characteristics. The simulated antenna has a total dimensions of 25*25 ,simulated results of an antenna is -18 dB return loss for 2.4 GHz to 2.256 GHz with 56% .This frequency bands cover the IEEE 802.11 (WLAN) and RFID ISM bands ,the simulated return loss ,radiation ,patterns and directivity ,gain of the antenna are presented .

Keywords: sierpinski Gasket fractal, WLAN applications, RFID application, ISM band, slotted fractal

I. INTRODUCTION

Recent years different fractal antennas have been developed for various wireless applications ,such as miniature and multiband .Geometry of design [2] of a sierpinski gasket fractal design ensures a successful geometry of a broadband applications antenna.sierpinski mounted on the rectangular patch explained in [1].A single broad band sierpinski fractal antenna fed by 50 Ω microstrip feed line [3]In fractal antenna microstrip feed is most efficient fed method in order to achieve broad band width ,small size ,better impedance matching ,easy to integrate with MIC circuits , low loss and and achieve perfect radiation characteristics [3][5].Many fractal antennas implemented using carpet or sierpinski fractal [6][7][8][9] in this antennas are increase the band width and also increase the thickness of the antenna [10].

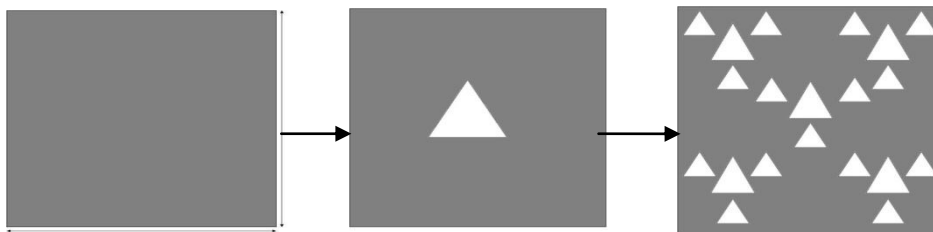


Fig .1 Iterations of the New modified triangular slotted sierinski gasket fractal antenna.

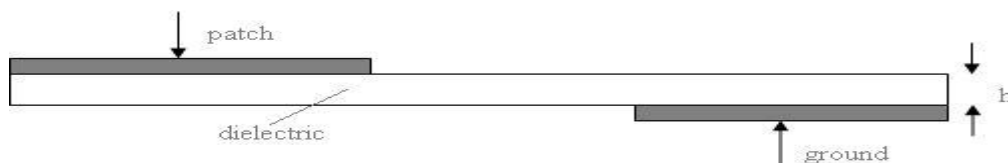


Fig.2 configuration of the patch and ground plane of New modified triangular slotted sierinski gasket fractal antenna.

In this paper we introduce the new modified triangular sierpinski gasket fractal antenna method of momentum (MOM) using iterated function system (IFS) geometrical properties [2] with modification. In this proposed modified triangular slotted sierpinski for single band operations. The proposed antenna covers the RFID ,WLAN ISM band (2.4 -2.456 GHz) band with -18 dB return loss .The design and simulation was performed using method of momentum (MOM) simulation software .This paper also describe design and simulated performance of the proposed antenna .

II. ANTENNA CONFIGURATION

The proposed sierpinski antenna geometry shown in fig.3. A sierpinski fractal patch is printed on the one side of the substrate and ground plane is printed on the other side of substrate with 30mil thickness and the dielectric constant $\epsilon_r=3.38$. The microstrip fed is used for the sierpinski fractal patch which fed out edge of the rectangular patch. Microstrip fed line have 50 Ω impedance can be used to excite sierpinski fractal patch shown in fig.2. It has the vertex angle A and Resonant frequency controlled by the each iteration. The proposed sierpinski fractal antenna printed on the Rogers Ro4003 dielectric substrate ($\epsilon_r=3.38$ and 30 mil).

This can be calculated by using formula given by

$$f_n = [0.18 + .2479 \cos(\alpha) \rho_n x_n] \frac{c}{\rho_n} (\delta_n)^{x_n} \dots\dots\dots(1)$$

The antenna matched at frequencies calculate approximately for fractal antenna given below

$$f_{rn} = 0.3 \cos\left(\frac{\alpha}{2}\right) \sqrt{\frac{2.5}{\epsilon_r} \frac{c}{n}} s^n \dots\dots\dots(2)$$

The iterated function can be represent by,

$$w(x, y) = (ax + by + e, cx + dy + f) \dots\dots\dots(3)$$

Where,

a,b,c,d ,e and f are real numbers

Thus our scaling factor can calculate approximately by

$$d = \frac{\log p}{\log s} = \frac{\log 3}{\log 2} = 1.5496 \dots\dots\dots(4)$$

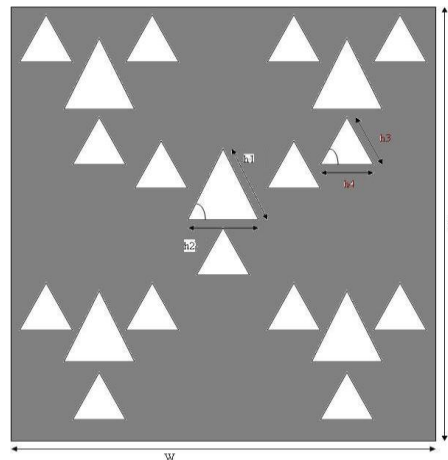


Fig.3 Proposed Configuration Of The New Modified Triangular Slotted Sierpinski Gasket Fractal Antenna.

Height of the modified triangular is determined by using the following equations

$$h_1 = \frac{h}{s} \dots\dots\dots (5)$$

$$h_2 = \frac{h_1}{s} \dots\dots\dots (6)$$

$$h_3 = \frac{h_2}{s} \dots\dots\dots (7)$$

$$h_4 = \frac{h_3}{s} \dots\dots\dots (8)$$

Length of the seirpinski gasket calculate by given below

$$3 + \sum_{i=1}^{\infty} \left(\frac{3}{2}\right)^i \dots\dots\dots (9)$$

Fig illustrates the proposed antenna configuration of a sierpinski fractal antenna for IEEE 802.11 b/g and RFID ISM frequency (2.4-2.456) band.

The geometry design parameters are L=25mm,W=25 mm,h1=6 mm,h2=6 mm , h3=4 mm,h4= 4 mm,The proposed antenna using microstrip fed to excite the proposed antenna ,simulation of the proposed antenna using ADS method of momentum simulation tool.

III. RESULTS

Simulated return loss of the proposed antenna shown in fig.4 for $\epsilon_r=3.38$ and $h=30$ mil $L*W$ is $25 * 25$. In this geometry proposed new modified triangular slotted siernski gasket fractal antenna reduce the thickness of the antenna compare to other siernski gasket fractal antenna which is 30 mil and increase the bandwidth. The return loss of the proposed antenna is -18dB at 2.42GHz. The simulated resonant frequency resonate around 2.4-2.45GHz. Bandwidth of the proposed antenna is suitable for the WLAN, RFID antenna communications. The resonant frequency of the antenna is shown in fig 1 . Simulated frequency good agreement with the frequency band of WLAN,RFID ISM band which is 2.45GHz and simulated by the ADS MOM technology. Microstrip line feed is excite the triangular slotted antenna, The simulated impedance bandwidth for -18db return loss 56 % at the 2.4GHz, Hence proposed new modified triangular slotted seirnski gasket fractal antenna can be cover the WLAN and RFID ISM band.

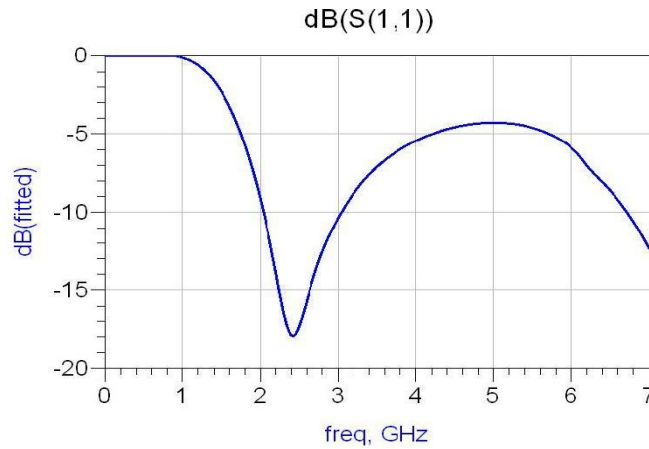
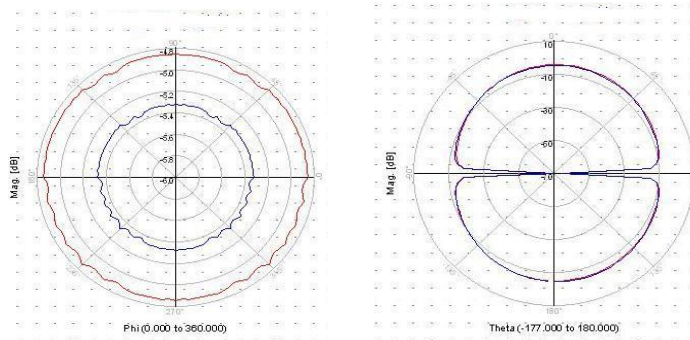


Fig.4 Return Of The New Modified Triangular Slotted Sierinski Gasket Fractal Antenna.

Radiation pattern of the proposed antenna is shown in fig.4 . In this radiation pattern shown $x-z$ planes and $y-z$ plane at 2.45GHz from the fig.4 . The proposed antenna radiated in omnidirectional pattern ,this radiation pattern combines both the E_ϕ and E_θ components .

Microstrip fed is excite the modified sierpinski gasket antenna this current distribution is shown in fig.5 .The simulated radiation pattern is similar to the standard triangular fractal dipole antenna .The simulated antenna gain 3.14 dBi for resonant frequency 2.4GHz .



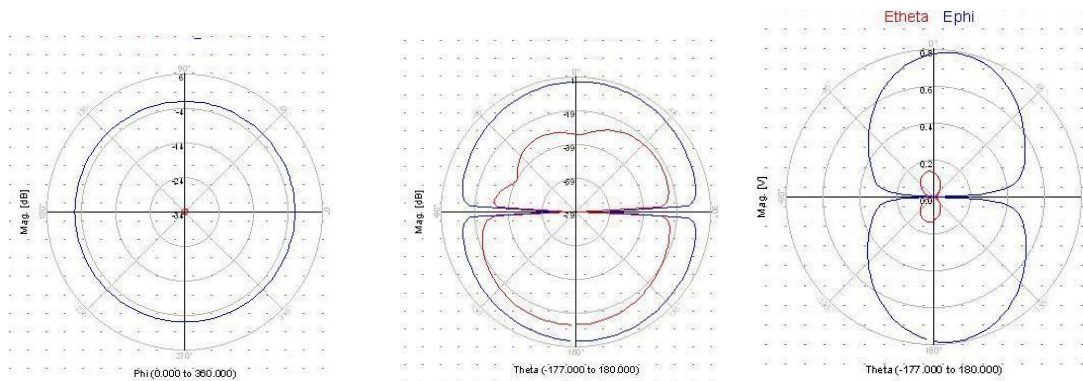


Fig .5 Radiation Pattern Of The New Modified Triangular Slotted Sierinski Gasket Fractal Antenna.

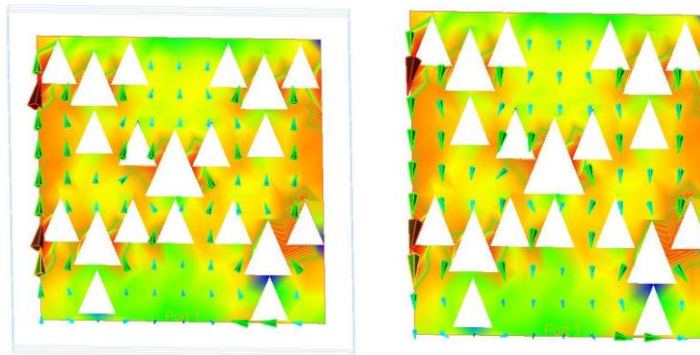


Fig .6 Current Distribution Of The New Modified Triangular Slotted Sierinski Gasket Fractal Antenna.

IV. CONCLUSION

Thus the proposed new modified sierpinski gasket slotted fractal for WLAN ,RFID ISM band antenna simulated and simulated with slotted triangular patch ,this proposed antenna used modified slotted triangular patch used to achieve broad bandwidth ,The simulated return loss shown proposed antenna has single operating frequency band (2.4-2.245GHz) which covers the WLAN ,RFID ISM bands .The radiation pattern of the modified sierpinski gasket fractal antenna is omnidirectional ,Hence proposed antenna suitable for WLAN ,RFID applicatons.

REFERENCE

- [1] Kuem C. Hwang,,"A Modified Sierpinski Fractal Antenna for Multiband Application" IEEE antennas and wireless propagation letters, vol. 6, 2007
- [2] H. O. Pietgen, H. Jurgerns, and D. Saupe, *Chaos and Fractals, New Frontiers in Science*. New York: Springer Verlag, 1992.
- [3] C. Puente, C. Borja, M. Navarro, and J. Romeu, "An iterative model for fractal antennas: Application to the Sierpinski gasket antenna," *IEEE Trans. Antennas Propag.*, vol. 45, no. 5, pp. 713–719, May 2000.
- [4] J. Soler, J. Romeu, and C. Puente, "Mod-p Sierpinski fractal multiband antenna," presented at the AP2000 Millennium Conf. Antennas Propag., Davos, Apr. 9–14, 2000.
- [5] D. H. Werner and S. Ganguly, "An overview of fractal antenna engineering research," *IEEE Antennas Propag. Mag.*, vol. 45, no. 1, pp.38–57, Feb. 2003.
- [6] C. Puente-Baliarda, J. Romeu, R. Pous, and A. Cardama, "On the behavior of the Sierpinski multiband fractal antenna," *IEEE Trans. Antennas Propag.*, vol. 46, no. 4, pp. 517–524, Apr. 1998.360

- [7] C. T. P. Song, P. S. Hall, and H. Ghafouri-Shiraz, "Perturbed Sierpinski multiband fractal antenna with improved feeding technique," *IEEE Trans. Antennas Propag.*, vol. 51, no. 5, pp. 1011–1017, May 2003.
- [8] P. W. Tang and P. F. Wahid, "Hexagonal fractal multiband antenna," *IEEE Antennas Wireless Propag. Lett.*, vol. 3, pp. 111–112, 2004.
- [9] C. T. P. Song, P. S. Hall, and H. Ghafouri-Shiraz, "Multiband multiple ring monopole antennas," *IEEE Trans. Antennas Propag.*, vol. 51, no.4, pp. 722–729, Apr. 2003.
- [10] G. J. Walker and J. R. James, "Fractal volume antennas," *Electron.Lett.*, vol. 34, no. 16, pp. 1536–1537, Aug. 1998.
- [11] C. T. P. Song, P. S. Hall, H. Ghafouri-Shiraz, and D. Wake, "Fractal stacked monopole with very wide bandwidth," *Electron. Lett.*, vol. 35, no. 12, pp. 945–946, Jun. 1999.
- [12] R. Hossa, A. Byndas, and M. E. Bialkowski, "Improvement of compact terminal antenna performance by incorporating open-end slots in ground plane," *IEEE Microw. Wireless Compon. Lett.*, vol. 14, no. 6, pp. 283–285, Jun. 2004.
- [13] B. Sanz-Izquierdo, J. Batchelor, and R. Langley, "Multiband printed PIFA antenna with ground plane capacitive resonator," *Electron. Lett.*, vol. 40, no. 22, pp. 1391–1392, Oct. 2004.
- [14] M. F. Abedin and M. Ali, "Modifying the ground plane and its effect on planar inverted-F antennas (PIFAs) for mobile phone handsets," *IEEE Antennas Wireless Propag. Lett.*, vol. 2, pp. 226–229, 2003.
- [15] K. C. Hwang, "A modified Sierpinski fractal antenna for multiband application," *IEEE Antennas Wireless Propag. Lett.*, vol. 6, pp. 357–Jun. 2007.

BIOGRAPHY



PRABHU P is a PG scholar doing his M.E communication system in Bannari Amman Institute of Technology. Earlier he has completed his undergraduate in the field of electronic and communication engineering in sudharsan engineering college India in 2010. he was worked as a service engineer from 2010-2011.



R.RANJITH KUMAR is a PG scholar doing his M.E communication system in K. Ramakrishan college of engineering. Earlier he has completed his undergraduate in the field of electronic and communication engineering in sudharsan engineering college India in 2010. he was worked as a service engineer from 2010-2011.



RAJA LAKSHMI.R is a PG scholar doing his M.E communication system in K. Ramakrishan college of engineering. Earlier he has completed his undergraduate in the field of electronic and communication engineering in kongunadu college of engineering and technology in 2011.



YOGAPRIYA S is a PG scholar doing his M.E communication system in K. Ramakrishan college of engineering. Earlier he has completed his undergraduate in the field of electronic and communication engineering in Shri Angalamman College of Engineering & Technology in 2011.



AHAMEDU NISHA .N is a PG scholar doing his M.E communication system in K. Ramakrishan college of engineering. Earlier he has completed his undergraduate in the field of electronic and communication engineering in M.I.E.T. Engineering College in 2011.