iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** VI **Month of publication:** June 2018

DOI: http://doi.org/10.22214/ijraset.2018.6128

Design & Performance Analysis of Symmetric & Asymmetric Fractal Boundary Microstrip Antenna for Wireless Application

Mr. Kiran R. Sapkal[1], Prof.Mahesh S Mathpati[2]
[1, 2]*Electronics and telecommunication Department,SVERI 's COE,Pandharpur, Solapur University*

Abstract*: In this paper the a effort has been taken to design & analyses of symmetric & asymmetric fractal boundary antenna for wireless communication. Compact high gain symmetric & Asymmetric fractal boundary Suspended microstrip antenna is proposed for circular polarization (CP). By replacing the sides of a square patch with symmetric circle curves & asymmetrical poly & circle curves, two orthogonal modes are excited for CP operation. Simulated results show that a good CP is achieved with a single probe feed and asymmetric fractal edge boundary antenna. Miniaturization techniques has been used to reduce the size of antenna. Higher Gain and bandwidth is achieved by air suspended techniques with adding parasitic element to edge of radiating patch. The suspended asymmetric & symmetric fractal boundary antenna is optimized to design wideband CP antenna. The antenna has been getting axial ratio bandwidth (< 3 dB) of 10.11%. The proposed antenna exhibits a much wider impedance bandwidth(2.31-2.61GHz) of about 12.5% (S11 < −10 dB) and also yields return loss better than −15 dB in the useful range of circular polarization. It has been found that asymmetric fractal boundary antenna offers higher gain & bandwidth with good radiation properties required for Wireless applications than symmetric fractal boundary microstrip antenna.

Keywords: Keywords: Microstrip antenna, fractal boundary, Koch, parasitic element, suspended antenna, Circular Polarization, Axial Ratio, Bandwidth.

I. INTRODUCTION

Recent developments in the field of wireless communication systems have accelerated the demand for compact circularly polarized microstrip antennas (CPMAs). In order to avoid the misalignment between transmitter and receiver, circularly polarized antennas have been used in a wide range of applications such as Wi-Fi, WiMAX, WLAN, and handheld devices.The conventional approach to achieve circular polarization (CP) involves feeding two orthogonal signals of equal amplitude and90 out of phase to the radiating and non-radiating edges of a square patch antenna [1]. CP can be obtained by feeding the CMSA at two orthogonal points with equal amplitude and 90° phase difference. Alternatively, a single-feed modified CMSA also yields CP. Some of examples include elliptical patch with an ellipticity ratio equal to 1.01 to 1.10, diametrically opposite peripheral slots, and a CMSA with a slot in the center [2]. Asymmetric cross slot provides the requisite perturbation to excite two orthogonal modes with 90 phase shift for CP radiation. By inserting four symmetrical slits along the diagonals of the corners truncated patch, CP is realized, and a considerable amount of size reduction is also reported [3]. Asymmetrical U-slot [4], Y-shaped monopole [5].Fractal concept has significantly affected the microstrip antenna field. Fractals are categorized into mass and boundary fractals. Mass fractals have been used to design antennas for multiband or wideband applications [6],[10]. In this paper Symmetric & Asymmetric circularly polarized, high gain, single feed and air gap antenna for WLAN applications was presented and compared. It has been found that asymmetric fractal boundary antenna shows improves results as compare to symmetric fractal boundary antenna.Applying the proposed construction, the antenna exhibits an effective bandwidth of 12.5% from 2.31-2.61 GHz for 10-dB return loss and AR<3 dB at 280 MHz. The simulated gain of the antenna is around 7.1 dB.

II. ANTENNA DESIGN

The geometry of the proposed antenna is shown in Figure 1&figure 2. This is basically symmetric & asymmetric fractal boundary Suspended with parasitic microstrip antenna. Both antenna patch and the feed strip are etched on the same dielectric substrate, which is placed at a height above the ground plane. The antenna is feeding by coaxial probe to the diagonal edge of radiating patch. The antenna was designed to operate with a center frequency of 2.45GHz

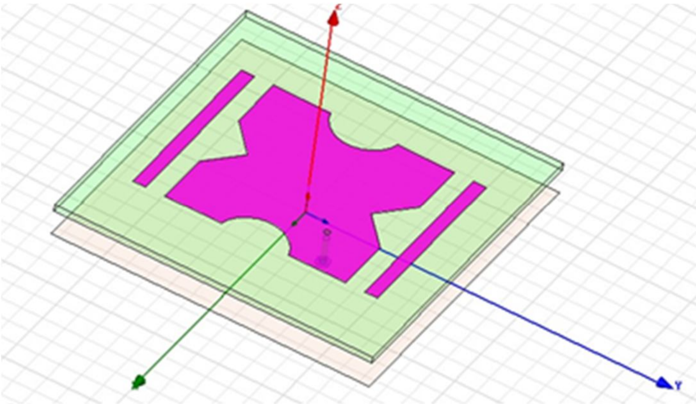


Fig. 1 symmetric fractal boundary antenna

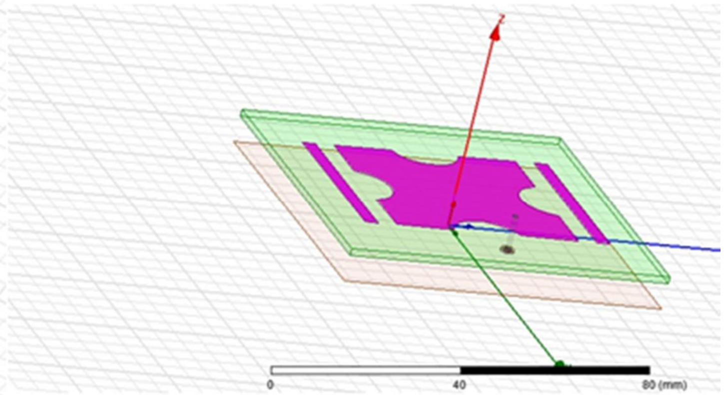


Fig. 2 Asymmetric fractal boundary antenna

Step 1: Calculation of Length of Patch (L)- The effective length due to fringing is given as

$$L_{eff} = \frac{c}{2f_o\sqrt{\varepsilon_{reff}}} \qquad \text{-(1)}$$

For c=3*10^11 mm/s, $\varepsilon reff$=3.99, $f\,o$=2.4GHz We get *Leff* =29.25 mm

$$\Delta L = 0.412h\frac{(\varepsilon_{reff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{reff}-0.258)\left(\frac{W}{h}+0.8\right)} \qquad \text{-(2)}$$

For W=28.4mm, h, =1.53mm, $\varepsilon reff$=3.99,We get ΔL=0.70mm Hence the length the of the patch is: L= Leff-2ΔL=28.4 mm

Step 2: Calculation of the width of Patch (W)-

For square patch we take L=W Therefore W=28.4 mm

III.RESULTS & ANAYLSIS

In this design we used an FR4 substrate (dielectric constant=4.4, tan delta = 0.0027 and thickness=1.6mm) placed above the ground plane at a 6mm height. These geometrical parameters are optimized with HFSS software

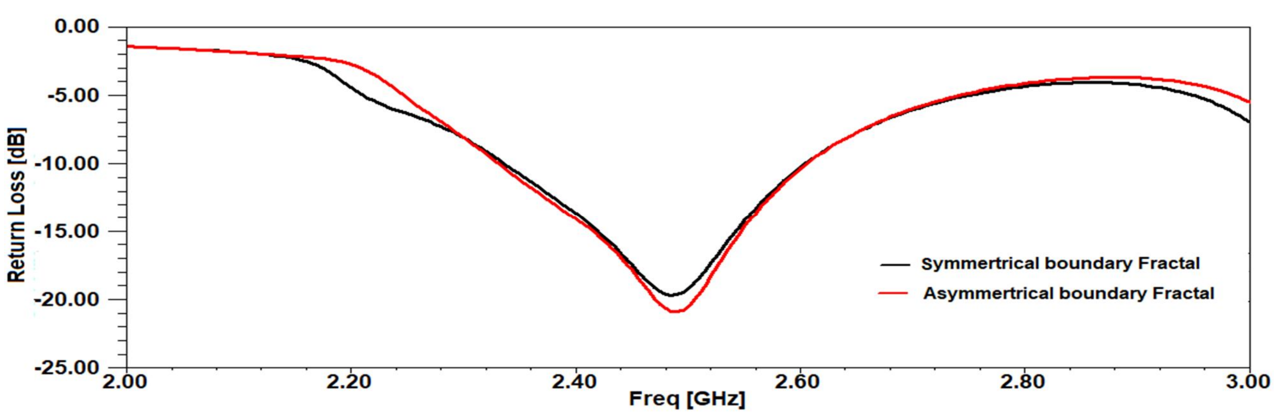


Fig. 3.Symmetric and Asymmetric boundary return loss

First, study of symmetric and asymmetric boundary fractal of microstrip patch have been investigated to understand their effects on gain and bandwidths. Return loss characteristics of the antennas are depicted in Figure 3. It can be noticed from Figure 3 that the return loss bandwidth also increasing with adding asymmetric boundary cross cut slits. With using asymmetric fractal boundary it helps to improving the bandwidth of suspended microstrip antenna with parasitic strip. The asymmetric fractal boundary we got excellent impedance bandwidth around 300MHz and symmetric fractal boundary patch bandwidth is 285MHz.

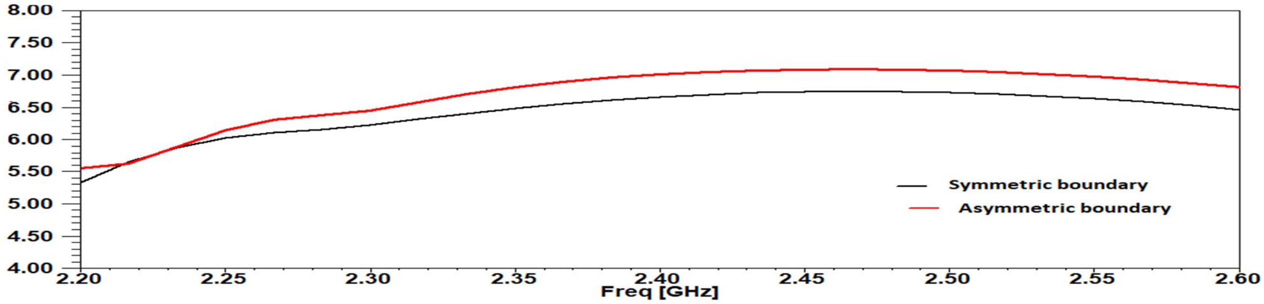


Fig. 4 Gain of symmetric and asymmetric boundary antenna

Fig.4 shows the simulated gain characteristics of the proposed symmetric and asymmetric boundary patch antenna.It can be shown the asymmetric fractal boundary we got excellent gain around 7.1dBi and symmetric fractal boundary patch gain is 6.8dBi . That means using asymmetric fractal boundary suspended patch antenna getting more efficiency as compared to symmetric boundary patch antenna.

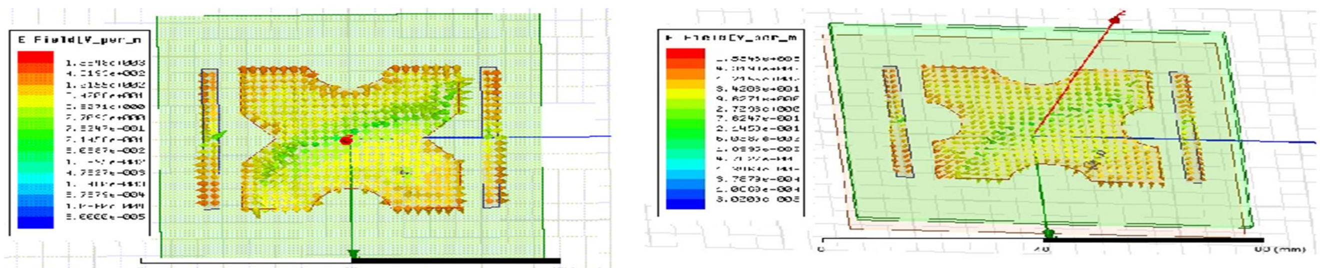


Fig. 6.Surface Current distribution of proposed Asymmetric & symmetrical fractal boundary antenna.

Regarding the simulated results, it can be concluded that the suspended Asymmetrical fractal boundary patch antenna using parasitic geometry provides wide bandwidth as compared to symmetric fractal boundary suspended patch. By asymmetrical fractal boundary it helps to reduce size of antenna. The effect of various parameters suspended fractal boundary patch antenna have been studied & investigated.

Table I. Comparisons table of symmetry Vs. Asymmetrical geometry

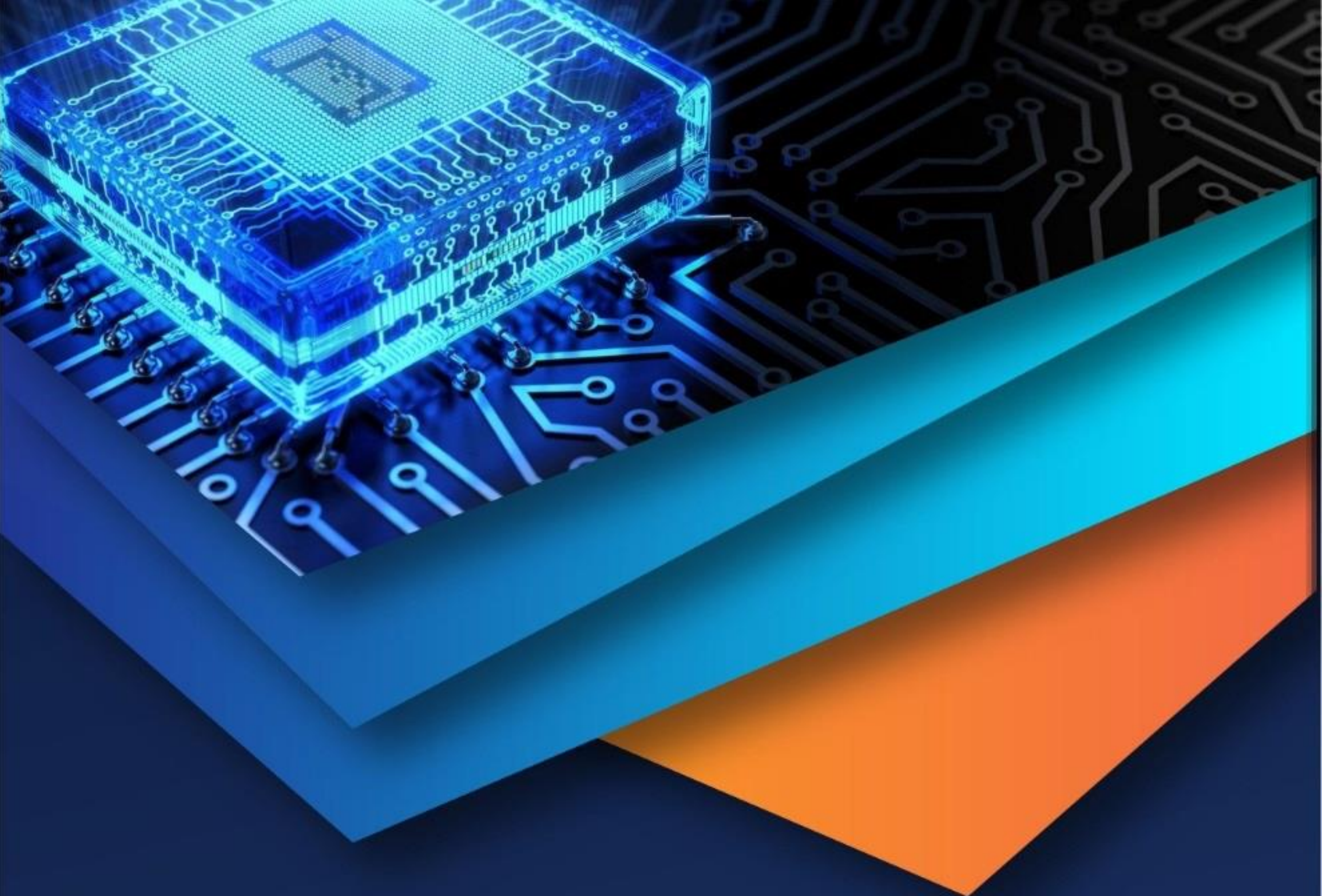
Sr. No.	Type of MSA	Frequency(Hz)	Return loss(dB)	VSWR	BW(Hz)	AR(dB)	Gain (dB)
1.	Suspended parasitic element fractal symmetric boundary	2.48	-19.60	1.23	285	0.73	6.8
2.	Suspended parasitic element fractal asymmetric boundary	2.47	-21.00	1.19	300	0.41	7.1

IV. CONCLUSION

The Asymmetric fractal boundary air gap microstrip antenna with parasitic strip was presented for circular polarization. This parasitic configuration has been shown previously to improve the antenna's impedance bandwidth & gain. The asymmetrical shape was used to getting better size reduction and more bandwidth. A corner circle & triangle slits was used to excite circular polarization and slot dimensions were optimized to maximum to better AR bandwidth. The proposed geometry exhibits the return loss less than −15 dB and a gain above 7 dB in the CP operating range. With optimum slot dimensions this proposed antenna offers an axial ratio bandwidth 240MHz of 10.6% (AR< 3 dB). It has also been established that the proposed approach can be employed to design antennas with similar performance for the desired circularly polarized antenna.

REFRENCES

[1] Balanis, c. A., antenna theory, john wiley & sons, inc., new york, 2004
[2] Sharma, p. C., and k. C. Gupta, ‘‘analysis and optimized design of single feed circularly polarized microstrip antennas,’’ ieee trans. Antennas propagation,vol. Ap-31, 1983, pp. 949–955c.
[3] Wen-shyang, k.-l. Chum-kum, and wong, “novel compact circularly polarized square microstrip antenna,” ieee trans. Antennas propag., vol. 49, no. 3, pp. 340–342, mar. 2001
[4] K.-f. Tong and t.-p. Wong, “circularly polarized u-slot antenna,”ieee trans. Antennas propag., vol. 55, no. 8, pp. 2382–2385, aug. 2007
[5] A. Ghobadi and m. Dehmollaian, “a printed circularly polarized y-shaped monopole antenna,” ieee antennas wireless propag. Lett.,vlog. 11, pp. 22–25, 2012
[6] J. Anguera, c. Puente, c. Borja, and j. Soler, “fractal-shaped antennas: a review,” encycl. Rf microw. Eng., vol. 2, pp. 1620–1635, 2005.
[7] V.v. Reddy & n.v.s.n sharma” single feed circularly polarized poly fractal antenna for wireless applications”, international scholarly and scientific research & innovation 8(11) 2014.
[8] Singh, vinit greval,rajiv saxena” fractal antennas: a novel miniaturization technique for wireless communication” international journal of recent trends in engineering, vol 2, no. 5, november 2009.
[9] Sharma, p. C. And k. C. Gupta, “analysis and optimized design of single feed circular polarized microstrip antenna," ieee transactions on antennas and propagation, vol. 29, 949{955, 1983.
[10] Nasimuddin, xianming qing, and zhi ning chen” compact asymmetric-slit microstrip antennas for circular polarization”, ieee transactions on antennas and propagation, vol. 59, no. 1, january 2011



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY