RESEARCH ARTICLE OPEN ACCESS

Compact Cantor Square Fractal Antenna with Low Cross-Polarization

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ABSTRACT
A miniaturized Cantor Square fractal antenna is presented in this letter. It has a size $30mm \times 20mm \times 1.6mm$ in the 2nd iteration. Also, the antenna has a return loss of -35dB with 170MHz bandwidth. To reduce cross-polarization two stubs are introduced in the feed line. The gain of 4dB along with low cross-polarization level is achieved in this antenna. It can be used for WLAN Application in 5GHz band.

Keywords: Miniaturization, Cantor Square fractal, WLAN, Cross Polarization.

I. INTRODUCTION

Miniaturization is one of the key factors in designing modern communication devices. Therefore the antennas inside the devices are also expected to be compact. Fractal geometry is one candidate to get miniaturized antennas. Many researchers contributed their effort to miniaturize antennas using a fractal system. A detailed analysis of fractal geometry has been done by many researchers [1] where we could find the design considerations of geometries like Koch, Sierpinski, and also fractal arrays.

Fractals also have the property of enclosing an infinitely long curve in a finite area[2]Space-filling can also be achieved through Hilbert geometry Another important characteristic of a fractal antenna is the multiband nature [3][4][5]which are very essential for the modern multiple application devices. A cantor square fractal based slot can be used for dual band application [6]

II. ANTENNA DESIGN

Here the proposed antenna is fabricated on FR4 Epoxy with a height 1.6mm & Dielectric constant 4.4. The initiator chosen was a Cross-type and from there 3 iterations were generated. To get 1st iteration the initiator is scaled down with factor 0.4 and is added in all the 4 quadrants of the initiator. Likewise, the 2nd iteration was also generated. These antennas are shown good radiation performances in terms of return loss, VSWR, Cross-Polarization, etc. The 2nd iteration of the cantor square antenna has a dimension of 30x20x1.6 mm.

Fig 1.a is the initiator and 1.b & 1.c shows the 1st & 2nd iterations respectively. The Optimum dimensions of the antenna fabricated are given in the TABLE I. Stripline is used to feed the antenna with a quarter-wave matching network to match the antenna impedance with the cable impedance of 50Ω. The width of the feed line is chosen to be 3mm. The cross-polarization can be reduced by adding stubs in the feed line. By adding two stubs in the feed line the cross-polarization could be reduced up to-37dB.

The fabricated antenna is then tested and confirmed that it can be used for WLAN application in 5GHz Band. The antenna fabricated with dimensions is shown in Fig.2

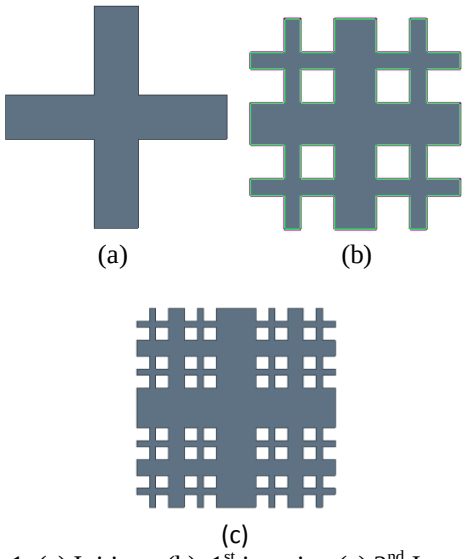

Fig.1. (a) Initiator (b). 1st iteration (c) 2nd Iteration of Cantor Square fractal antenna.

TABLE I

Component	Dimension in mm
L	30
W	20
W2=L2	12.5
W3	3
L3	5
L4	7.75

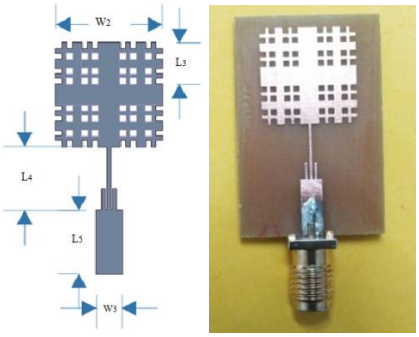

Fig.2. (a) dimensions of the antenna (b) Fabricated antenna

III. EXPERIMENTAL RESULTS AND DISCUSSION

The proposed structure was fabricated and tested using Vector network analyzer. The measured results show it can be used for WLAN application. The Measured return loss has a value of -35dB at 5.32GHz & an impedance bandwidth of 170MHz.The VSWR at 5.32GHz is 1.01dB.The Radiation properties like Gain & Cross polarizations were also studied for the antenna. The maximum gain obtained is 4dB. In order to improve Cross polarization level two stubs of size 2.5x0.3mm is added on both sides of the feed line. The cross-polarization level obtained at 5.32GHz is -37dB.Fig 3-7 shows the Experimental results of the proposed antenna

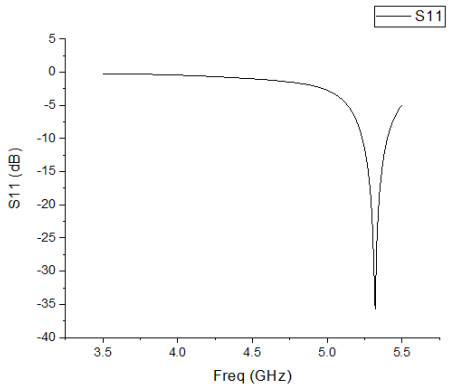

Fig.3 Measured return loss of the antenna at its 2nd iteration

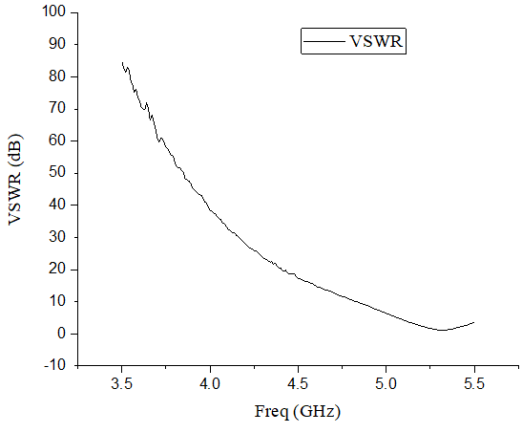

Fig 4.Measured VSWR of Cantor Square fractal at its 2nd iteration.

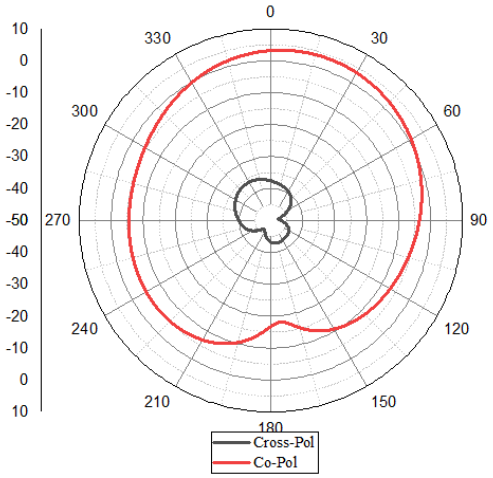

Fig 5. Co & Cross polarization levels at phi=0

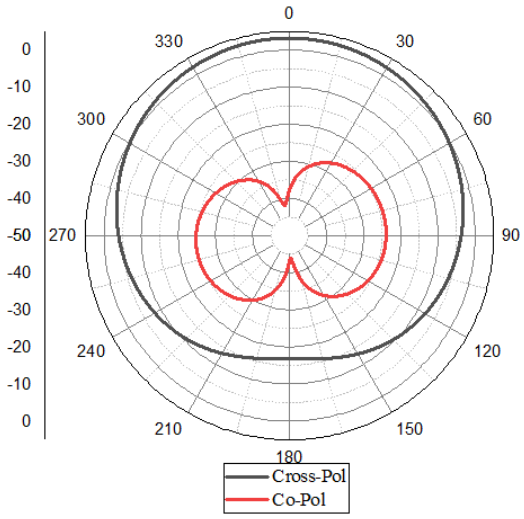

Fig 6. Co & Cross polarization levels at phi=90

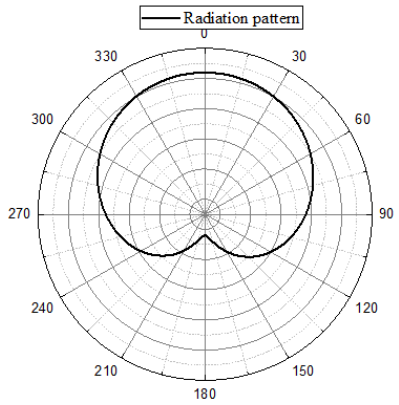

Fig 6. Radiation pattern at phi=90

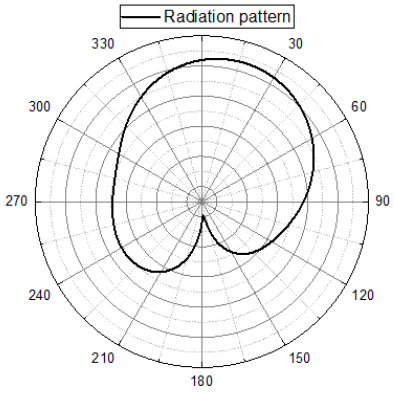

Fig 7. Radiation pattern at phi=0

IV. CONCLUSION

A cantor square fractal antenna for WLAN application with very low cross-polarization is presented here. It has a miniaturized dimension at its 2nd iteration with very good radiation characteristics. Cross polarization level could also reduce in this antenna and thus is a good candidate for WLAN application.

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