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CPW FED COMPACT UWB FRACTAL ANTENNA DESIGN

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ABSTRACT

This paper presents fractal monopole antenna for Ultra Wide Band communication applications. Fractal antenna is energized through Co-planar waveguide (CPW) feed structure. The stepping feed configuration is used to improve the antenna electrical characteristics at the center and higher frequencies in the FCC designed UWB frequency range from 3.1 to 11.2 GHz. The proposed antenna uses a fractal technique to analyze its UWB characterization for S11 ≤ -10dB. The fractal antenna is designed and simulated using Advanced Design System (ADS) and HFSS.

KEYWORDS — *Fractal Antenna, CPW feed, UWB*

I.INTRODUCTION

The multimedia applications require a large bandwidth much higher than what can be achieved through currently existing conventional wireless technologies. To address to this preoccupation , in February 2002, the federal communications commission FCC adopted the use of the Ultra-Wideband from 3.1GHz to 10.6GHz for commercial uses. Since the date, scientists and engineers have focused their research towards the development of UWB devices. The UWB antennas require smaller size, low power, high data transmission capacity, low cost, high gain and stable radiation pattern across the operating frequency band. These are essential and present challenging designs. These problems are answered up to some extent by introducing fractal geometry concept in UWB designs without hampering the antenna performance. Several fractal geometries have been contemplated to design and develop UWB antennas. With the growth of wireless communication systems and applications, the requirement of low profile and wideband antennas increased, in order to satisfy this progress, the fractal antenna with CPW feed supposed to be the appreciated candidate. Another advantage of CPW is that the characteristic impedance can be evaluated by the ratio of the feed line width and the width of the gap between the ground plane and feed line.In this paper, a CPW-fed UWB fractal monopole antenna is designed and simulated using Advanced Design

System (ADS). The simulated reflection, radiation pattern and gain of the proposed antenna are presented in the following section.

II.ANTENNA DESIGN

In the proposed antenna, the self similar fractal concept is utilized in the conventional monopole patch antenna to enhance bandwidth without reducing antenna size. The final structure of the monopole fractal antenna is shown in Fig.1. The antenna is fed with CPW feed. The advantages of CPW feed over conventional microstrip feed lines are low dispersion characteristics at higher frequencies, broader impedance bandwidth, unipolar configuration and ease of incorporation with active devices as it does not require backing ground plane. In the coplanar technology, no via is needed for ground purpose. So, this technique is less costly than microstrip feed. In CPW feed , 50Ω impedance is achieved by adjusting the width of inner conductor and the gap width between the ground plane and the inner conductor. It is also equivalent to the relative permittivity and the thickness of the substrate. In this paper, the FR4 substrate with thickness of 1.6mm and relative permittivity, ε_r of 4.4 is used.

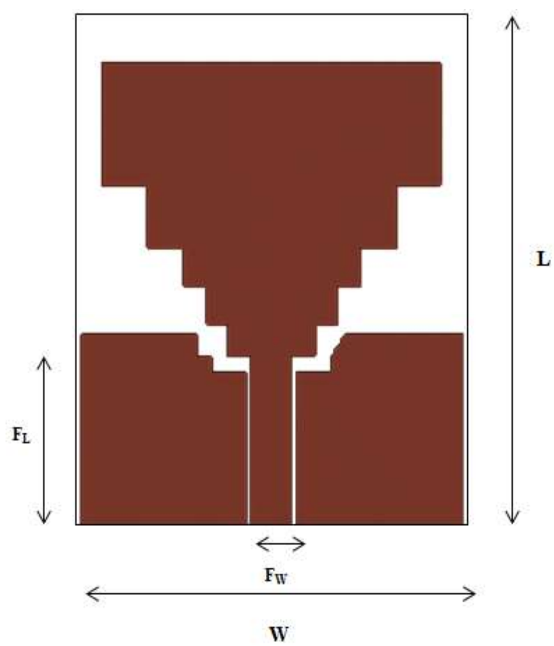


Fig.1.Proposed Antenna

The complete dimensions of the fractal antenna and the CPW feed are shown in Table.1.

Table.1.

Parameter	Dimensions(mm)
L	32
W	26
F_W	2.8
F_L	11
F_G	0.3

The monopole fractal antenna without feed is shown in Fig.2.

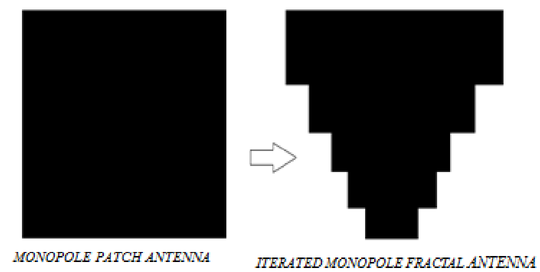


Fig.2.Monopole fractal antenna without feed

The Coplanar waveguide is a planar transmission line. In coplanar waveguide, Electro Magnetic energy is concentrated within the dielectric. The leakage of the electro magnetic energy in the air can be controlled by having the substrate height twice that of width. The coplanar waveguide supports quasi TEM mode at lower frequencies while it supports TE mode at higher frequencies. The potent dielectric constant of CPW is same as that of slot line. The characteristic impedance of a CPW is not affected by thickness and it depends on the width (w) and space (s). The structure of CPW is shown in Fig.3.

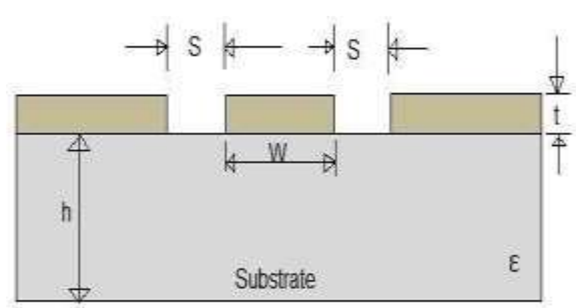


Fig.3.Coplanar waveguide structure

After applying CPW feed to monopole fractal antenna, it provides better characteristics for bandwidth enhancement in UWB applications. The fractal antenna with CPW feed structure is shown in Fig.4.

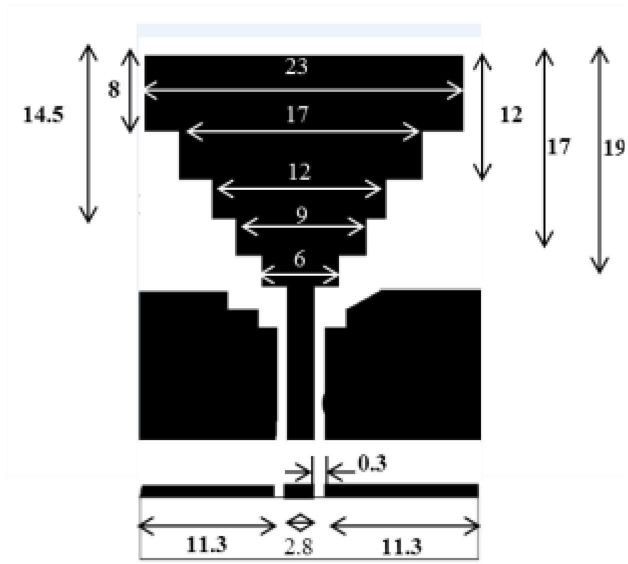


Fig.4.Monopole fractal antenna with CPW feed(all dimensions are in mm).

3D model of the proposed antenna obtained by simulation using ADS is shown in Fig.5.

Fig.5.3D view of proposed antenna

IV. SIMULATION

The antenna properties can be known from its return loss, resonant frequency, bandwidth, radiation pattern, gain and efficiency. The antenna is designed and simulated using ADS.The return loss, VSWR characteristics are shown in Fig.6 and Fig.7.

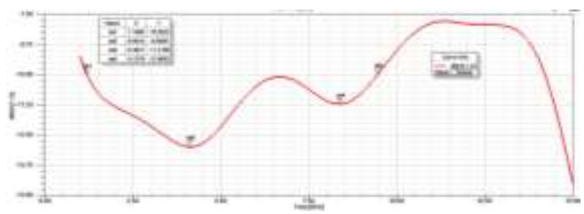


Fig.6.Return loss plot

The resonant frequencies and their corresponding return loss obtained for the design during simulation in the frequency band of (1.196 – 9.461) GHz is detailed in Table.2.

Table.2.Resonant Frequencies and their Return loss

Frequency(GHz)	Return Loss (dB)
4.1279	-12.9882
8.3927	-11.2198

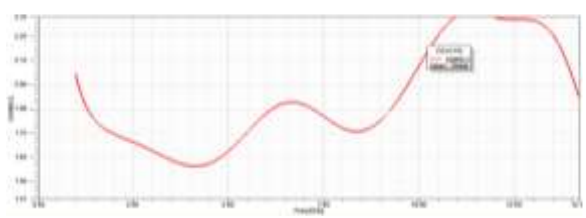


Fig.7.VSWR plot

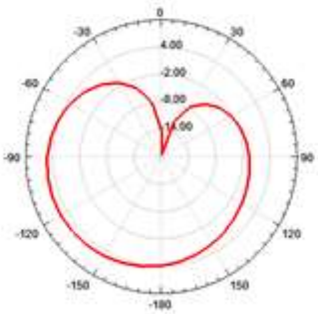
This figure shows that the antenna has good VSWR performance(less than 2.0) for UWB antenna.

V.RESULTS AND DISCUSSION

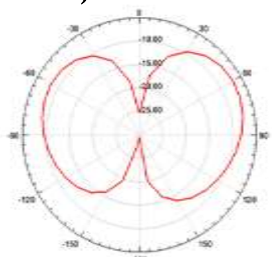
From the return loss plot obtained by the simulation using Advanced Design System (ADS), it is clear that proposed antenna perfectly operates from the frequency range of 1.196 to 9.461 GHz which covers the bandwidth of 8.265 GHz. From the results, it clearly indicates that designed antenna has good gain, directivity and radiation characteristics for the operation in UWB.

VI.RADIATION PATTERN

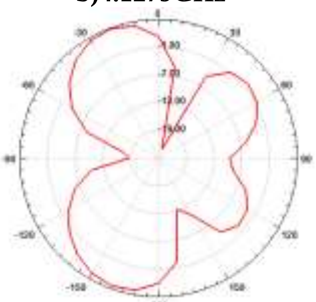
Radiation pattern determines how an antenna radiates. If an antenna is said to be omnidirectional then the antenna should radiate in all directions. The radiation patterns of the proposed UWB antenna are simulated in E-plane. The detailed analysis of the 2D radiation patterns have been plotted within the operating frequency range as shown in the following figures.



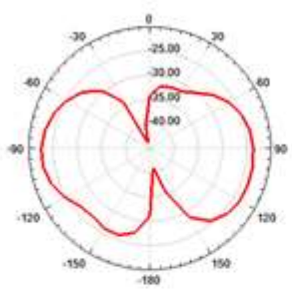
a)1.196GHz



b)4.1279GHz



c) 8.3927GHz



d) 9.461GHz

Fig.8.Simulated E-plane radiation pattern of the proposed antenna at 1.196, 4.1279, 8.3927 and 9.461GHz

It can be seen that stable radiation characteristics have been observed throughout its operating band. The measured radiation patterns associated with the y-z plane (E-plane) are omni-directional except at 1.196GHz.

VII. CONCLUSION

A CPW fed monopole compact fractal antenna for UWB applications has been designed and simulated using ADS software.The propose antenna exhibits wide bandwidth of 8.265GHz from frequency of 1.196GHz to 9.461GHz with high efficient data rate. The proposed antenna fulfills all the requirements of an UWB antenna in perspective of Return Loss, VSWR and Gain which is verified from respective simulation results. The use of Coplanar waveguide makes the design conformal and more suitable for UWB applications.

REFERENCES

1. *Elizabeth Rufus, Zachariah C Alex, Lokesh B J, "Design of fractal antenna for UWB applications" , Journal of Theoretical and Applied Information Technology., Vol .64, No.2, 20th June 2014.*
2. *HojjatollahFallahi, Zahra Atlasbaf, "Bandwidth Enhancement of a CPW-fed monopole antenna with small fractal elements", International Journal of Electronics and Communications, vol .69,pp. 590-595,2015.*
3. *P.Prabhu,C.Poongodi,R.Ranjith Kumar, K.Prabhakaran,"Design and Simulation of CPW – FED Printed Antenna for Ultra Wide Band and Wireless LAN Applications", International Journal of Electronics and Computer Science Engineering.,vol.2,No.2,pp.434-442,2012.*
4. *Raj Kumar,Pritam B.Nikam ,"A Modified Ground Apollonian Ultra Wide Fractal Antenna and its Backscattering",International Journal of Electronics and Communications.,vol.66,pp.647-654,2012.*
5. *Rajkumar,K.K.Sawant, "Design of CPW-Fed Fourth Iterative UWB Fractal Antenna, International Journal of Microwave and Optical Technology.,vol.5,No.6,pp.320-327,2010.*
6. *Rowdra Ghatak,Anirban Karmakar, D.R.Poddar , "Hexagonal Boundary Sierpinski carpet fractal shaped compact ultra wide band Antenna with band rejection functionality", International Journal of Electronics and Communication.,vol.67, pp.250-257,2013.*
7. *Raj kumar, Dhananjay Magar, K Kalidas Sawant,"On the design of inscribed triangle circular fractal antenna for UWB applications", International Journal of Electronics and Communications.,vol.66,pp.68-75,2012.*
8. *Kailas Kantilal Sawant, Dr.C.R.Suthikshn Kumar,"CPW fed Hexagonal microstrip fractal antenna for UWB wireless communications",International Journal of Electronics and Communications.,vol.69,pp.31-38,2015.*

9. *Yang and G.B.Giamalkis, "Ultra wide band Communications", IEEE signal processing magazine.,pp.26-28,Nov 2004*
10. *Aiello G R,Rogerson GD, "Ultra-wideband wireless systems", IEEE Microwave Magazine.,pp.36-47,June 2013.*
11. *S.De,P.P.Sarkar,"A high gain Ultra-wideband monopole antenna", International Journal of Electronics and Communications.,vol.69,pp.1113-1117,2015.*
12. *Raj Kumar,P.Malathi,"Design of CPW-Fed Ultra wideband Fractal Antenna and Backscattering Reduction",Journal of Microwaves, Optoelectronics and Electromagnetic Applications,vol.9,pp.10-19,June 2010.*
13. *Djelloul Aissaoui , Noureddine B.Hacen ,Tayeb A. Denidni,"UWB Hexagonal Monopole Fractal Antenna with Additional Trapezoidal Elements",IEEE NCC, vol.15, pp.1-5, 2013.*
14. *A.El Hamdouni,J.Zbitou,L.El Abdellaoui, A.Errkik,A.Tribak,M.Latrach, "Design of a Novel CPW Fractal Antenna for UWB", International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering,vol.9,No.1,2015*
15. *Anirban Karmakar,Utsab Banerjee, Rowdra Ghatak,D R Poddar,"Design and analysis of Fractal Based UWB Monopole Antenna", IEEE International Conference, vol.13, pp.1-4, 2015*