

# ANALYSIS OF CIRCULAR FRACTAL ANTENNA

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**Abstract**-In high performance satellite and missile applications where performance, size, weight and ease of installation, low profile antenna are required. These types of antenna are low profile, simple and inexpensive to manufacture using modern PCB technology. In this, circular shaped fractal antenna is proposed for the use of satellite communication. Antenna is implemented and simulated by using FR4 Epoxy substrate with dielectric 4.4 and height 1.6, the design is fractal antenna with modified ground structure. The fractal antennas are used due to its reduced size in shape and its multiband characteristics. We have designed this using High Frequency Simulation Software (HFSS/ANSYS) at a frequency of 5 GHz...

**Keywords**- Fractal Antenna, Directivity, Feed line, VSWR, Return Loss

## I. INTRODUCTION

The fractal An antenna that uses a fractal, self-similar design. This increases to maximize the effective length or increase the perimeter of material and also referred to as multilevel and space filling curves. It is very compact, multiband or wideband. This type of antenna mainly use in cellular telephone and microwave [1].

The term fractal means broken or irregular fragments to describe a family of complex shapes that possess an inherent self-similarity or self affinity in their geometrical structures.

In this paper we using Circular shape fractal antenna using HFSS. To excite the antennas microstrip line feed technique(Direct Contact Method) is used. Directivity of antenna is an antenna parameter which measures to what extent the antenna is able to concentrate its radiation pattern in a particular direction. The basic structure of Circular fractal antenna is as shown below.

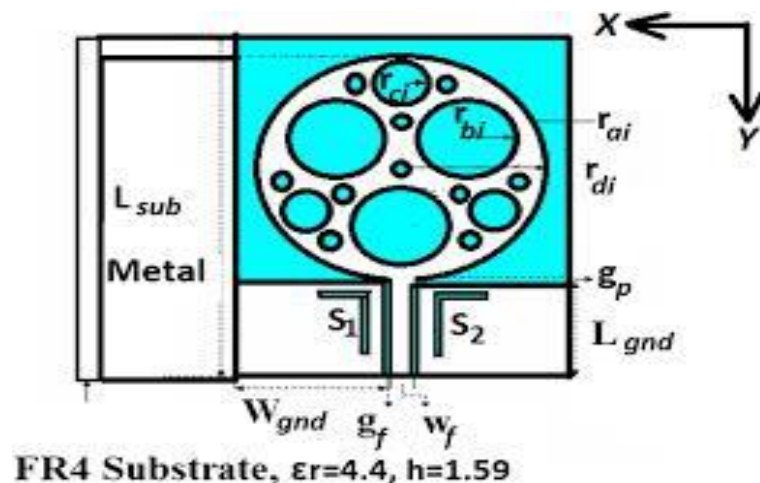


Fig. 1 Circular Fractal Antenna structure

## II. DESIGNING FORMULAS USED

For designing the Circular Fractal Antenna, formulas are listed as follows[2][3]:

The Effective Dielectric Constant of substrate is given by,

$$\epsilon_{\text{reff}} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left(1 + 12 \frac{h}{W}\right)^{-1/2}$$

Firstly define the radius of circular fractal antenna by using this formula,

$$a = \frac{8.791}{f_o \sqrt{\epsilon_o}} - \frac{h}{\sqrt{\epsilon_r}}$$

The frequency of resonant is find through this formula,

$$f_r = \frac{1.8412c}{2\pi a_e \sqrt{\epsilon_r}}$$

Where,

C=light Velocity in free space

F<sub>r</sub>=frequency of resonant

h=Height of Substrate

Effective Radius of circular Fractal where,

$$a_e = a \left\{ 1 - \frac{2h}{\pi a \epsilon_r} \left( \ln \frac{\pi a}{2h} + 1.7726 \right) \right\}^{0.5}$$

a= Actual radius of this antenna

h= height of substrate

ε<sub>r</sub> = relative permittivity

Length of Ground Plane=4\*a

Width of Ground Plane=4\*a

Specification for feedline,

$$w = \frac{7.48 \times h}{e^{\left( \frac{Z_0 \sqrt{\epsilon_r + 1.41}}{87} \right)}} - 1.25 \times t$$

### III ANTENNA GEOMETRY

a). *Circular Fractal Antenna:*

The antenna design of this Fractal antenna shown below.

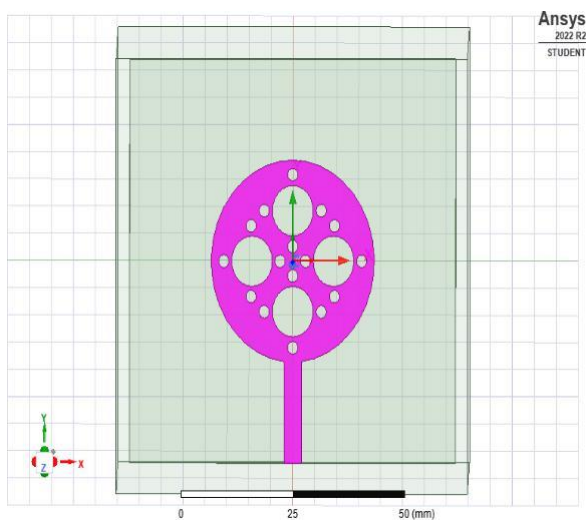


Fig.2 Geometry of Circular Fractal antenna in HFSS

The dimensions of all components of Circular Fractal Antenna given in table1 below.

Parameter	DESCRIPTION	Value(in mm)
$L_s$	Length of Substrate	33.52
$W_s$	Width of Substrate	33.52
$h$	Height of Substrate	1.6
$a$	Radius of Patch	8.38
$L_f$	Length of Feed Line	8.38
$W_f$	Width of Feed Line	2.9995
$L_g$	Length of Ground Plane	33.52
$W_g$	Width of Ground Plane	33.52

Table 1 Parameters of this Circular Fractal Antenna

Fig. 3 show the VSWR, Far field and s-parameter characteristics of this Antenna

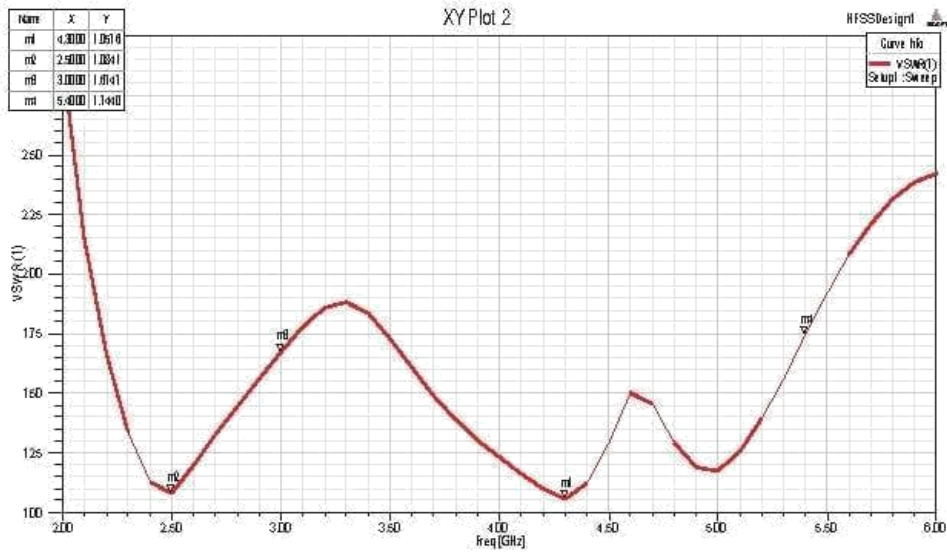


Fig.3 (a) VSWR of Circular Fractal Antenna

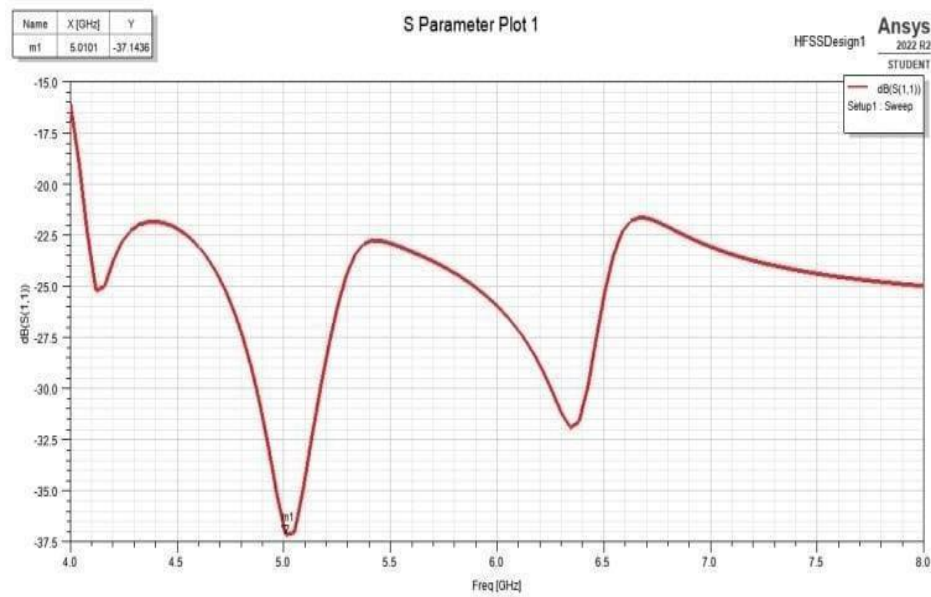


Fig. 3(b) S parameter Curve for Circular Fractal Antenna

#### IV CONCLUSION

This type of fractal antenna is suitable for satellite communication. The fractal antenna gives the good response with low frequency and used for several types of application due to their wide range. this type of antenna small size so their cost is also less.so,this type of suitable antenna used for large range and it's also gives the stable radiation pattern. This antenna simulation done by HFSS Software and this type of antenna suitable for multiband wireless communication.

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