Study on Fractal Circular Shaped Microstrip Antenna at 6.48 GHZ

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***Abstract*— In this paper, a circular shaped microstrip fractal antenna is studied. Copper annealed is taken as ground plane with 0.1mm and dielectric substrate of FR-4 lossy material with dimensions 38x29x2mm.Excitation is given to three fractal patches using a common feed. The return loss of this proposed antenna as shown a value of -41.79 dB. It can be used in satellite communication and electronic warfare applications.**

***Index Terms*— Antenna ,Circular Microstrip antenna, Return loss , VSWR, directivity ,Farfiled.**

I. INTRODUCTION

Antenna is a radiator and sensor of electromagnetic waves i.e., it transmits EM waves during transmission and acts as a radiator and during reception it receives EM waves and acts as a sensor. The antennas are divided mainly into two types. They are: The receiving antenna- that receives the RF energy and transfers the AC to an electronic equipment, and transmitting antenna- that fed with AC from electronic equipment and produces an RF field. Normally the size of the antenna is large, such that it cannot be used in the applications such as satellites, mobiles. So, for that purpose the microstrip patch antenna is preferred because of the following advantages like low cost, small size, low weight, easy to feed, easy to use in array and easy to fabricate. A patch antenna is nothing but a radio antenna that is mounted on a flat surface. There is different shapes use for the patches like rectangle, circle, and triangle, square,etc. This shape is mounted on a large sheet of metal called substrate .Thus the substrate is placed on the same dimension sheet of metal called ground plane. The patch used here works as a radiator that radiates the electromagnetic waves. In this paper a microstrip patch antenna is presented which has less return loss and high directivity when compared to the normal microstrip patch antenna.

II. PROPOSED ANTENNA DESIGN

In this antenna, copper (annealed) is used for ground plane and FR-lossy is used as substrate that has the dielectric constant of 4.3.The circular shape is used as a patch to the antenna which is made up of copper (annealed) .The feed line is attached to the patch by cutting the empty space using brick tool and by insert fed method the feed line is attached using Boolean operation tool. Two parallel lines and a square shapes are used to the patch to get the required structure. Totally there are three antennas that are connected with the parallel line (copper annealed).The port creation is done to the center antenna that which acts as a feed to these three antennas. The three antennas are arranged such that the space must be equal between the antennas from the centered antenna. The design of the antenna discussed above and represented in the below figure 1:

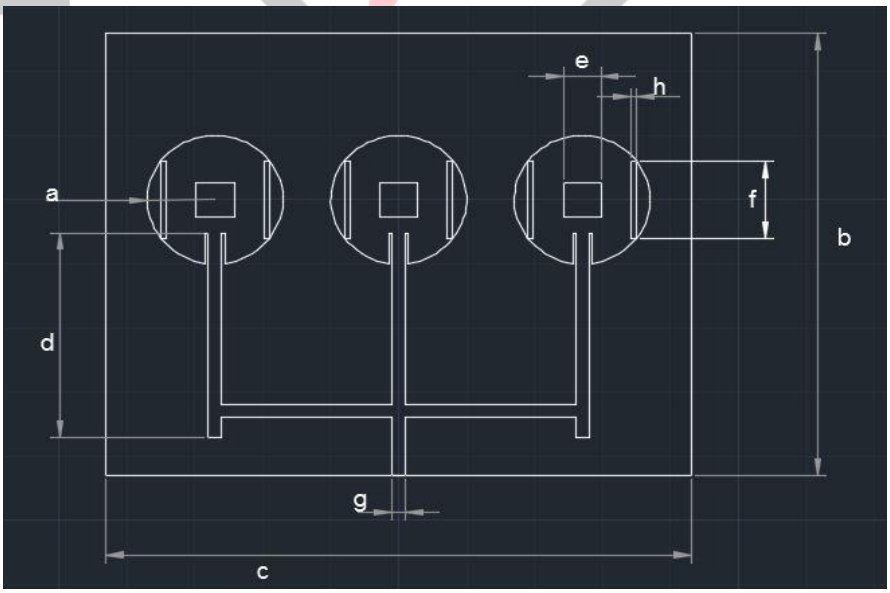

Figure1: Proposed antenna design (Top view)

The thickness of the substrate is 2.01mm and the dimensions of the design are listed in table below:

Parameters	Corresponding lengths in mm
a	9.36
b	38
c	29
d	18.32
e	2.337
f	10.46
g	1.44
h	1.02
Substrate thickness(FR-4)	2
Ground thickness(Copper annealed)	0.1
Patch(copper annealed)	0.04

Table 1: Proposed antenna dimensions

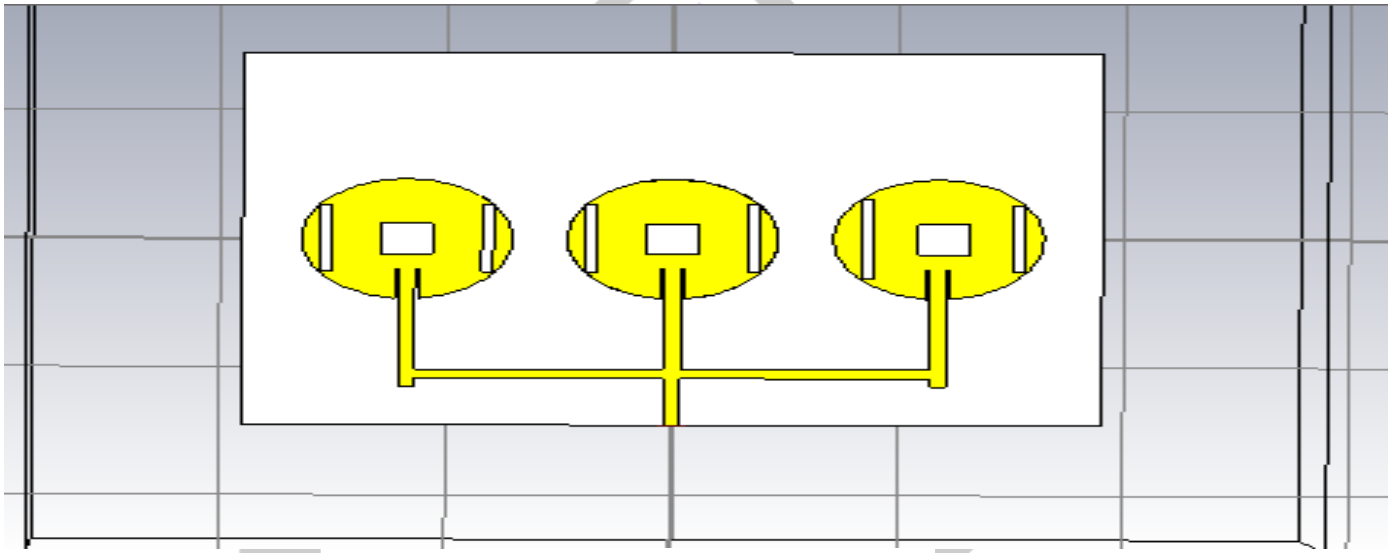

Figure 2: Layout of proposed antenna design

III. RETURN LOSS

It is a parameter that is used to measure the power reflected by the antenna due to the mismatch of the transmission line and antenna. Let us consider an example, if the return loss is 0dB there is nothing to radiate by the antenna because the power provided to the antenna is completely reflects by the antenna. Lower value of the return loss provides the high efficiency of antenna. The return loss of the antenna performed is shown in the figure:

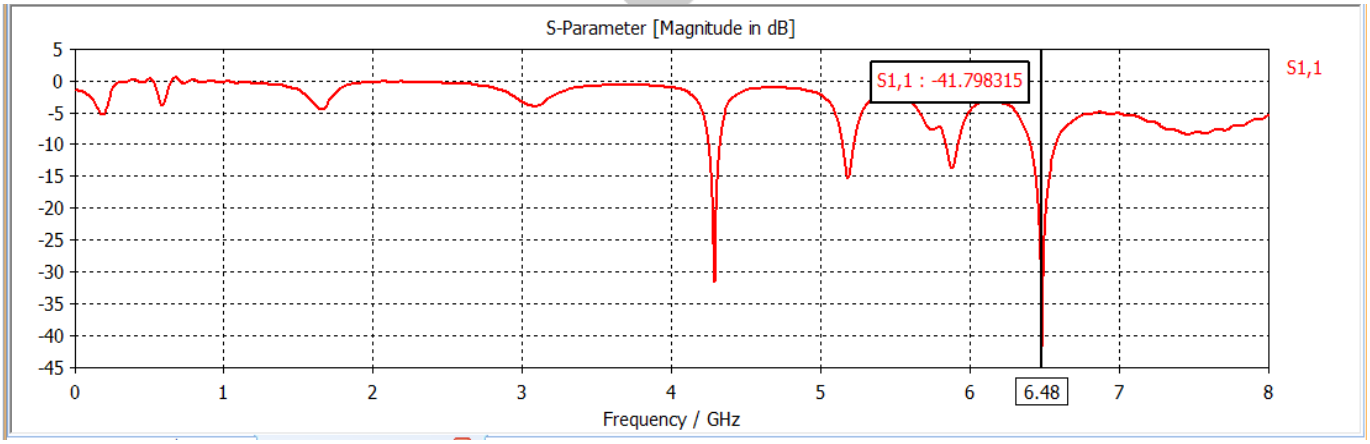

Figure 3:The return loss of the proposed antenna of frequency at 6.48GHZ

IV. VSWR

VSWR stands for voltage standing wave ratio. It is defined as the ratio between the maximum value of standing wave voltage to its minimum value. The minimum VSWR for an antenna would be 1. The antenna with less VSWR has the better return loss compared to the other antenna. The VSWR of the microstrip patch antenna is shown in the below figure:

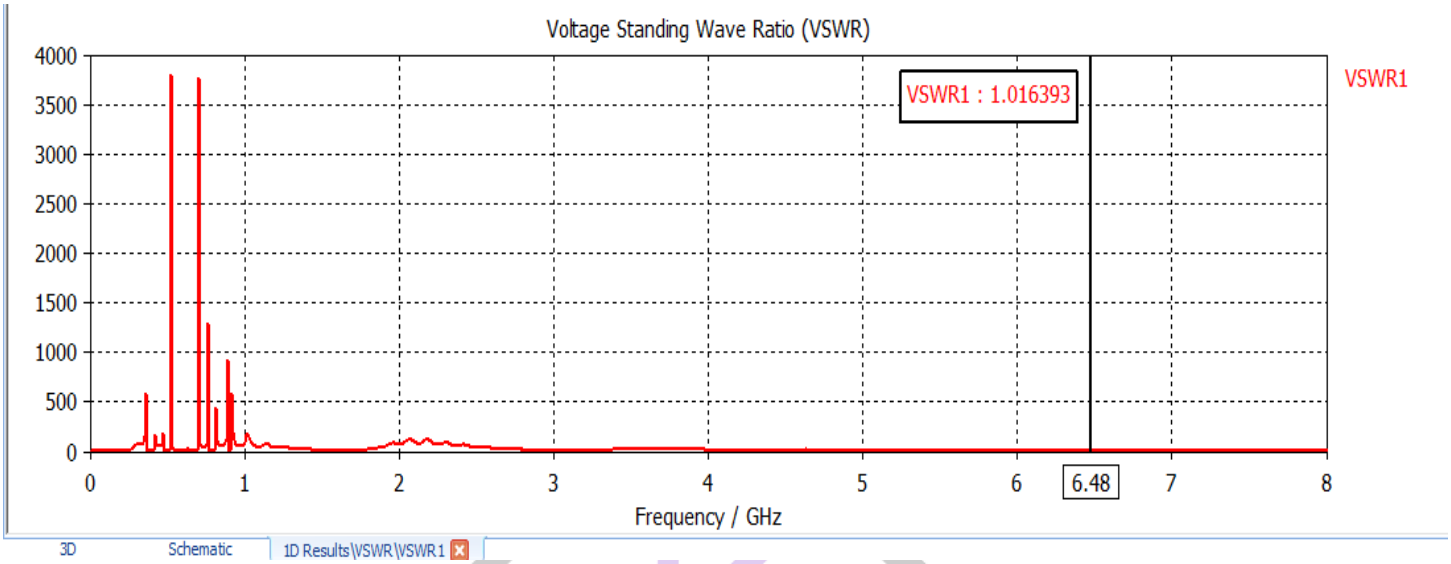

Figure 4: The VSWR of proposed antenna at frequency of 6.48 GHZ

V. FARFIELD PATTERN

The three dimensional view of the microstrip patch antenna is shown here:

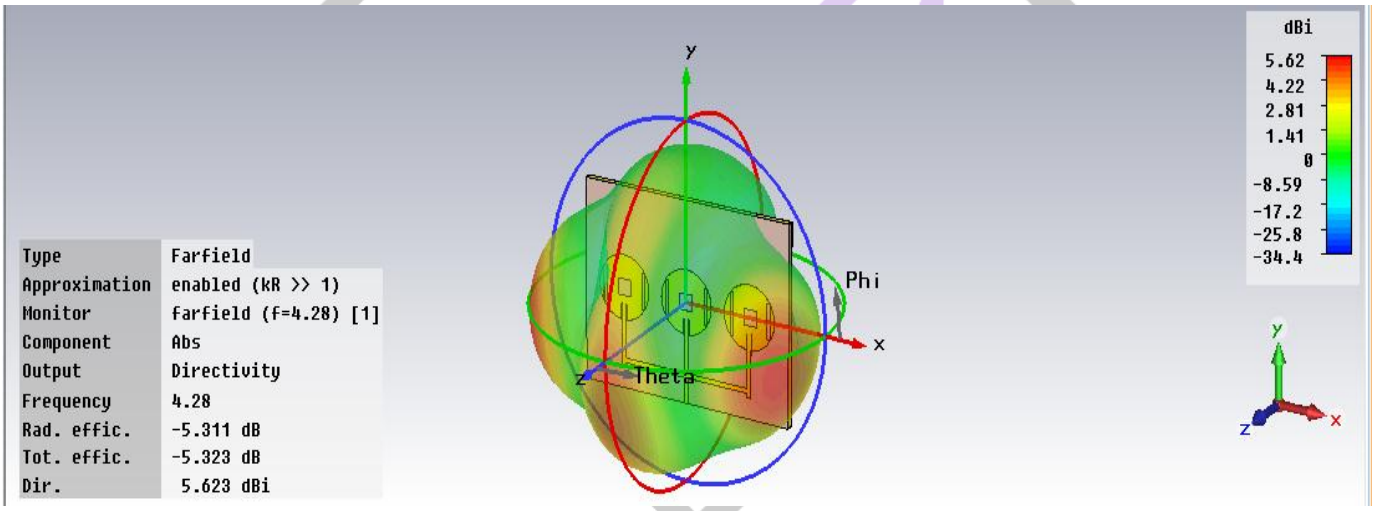

Figure 5: The 3d view of the proposed antenna at frequency of 4.28 GHZ

POLAR PLOT:

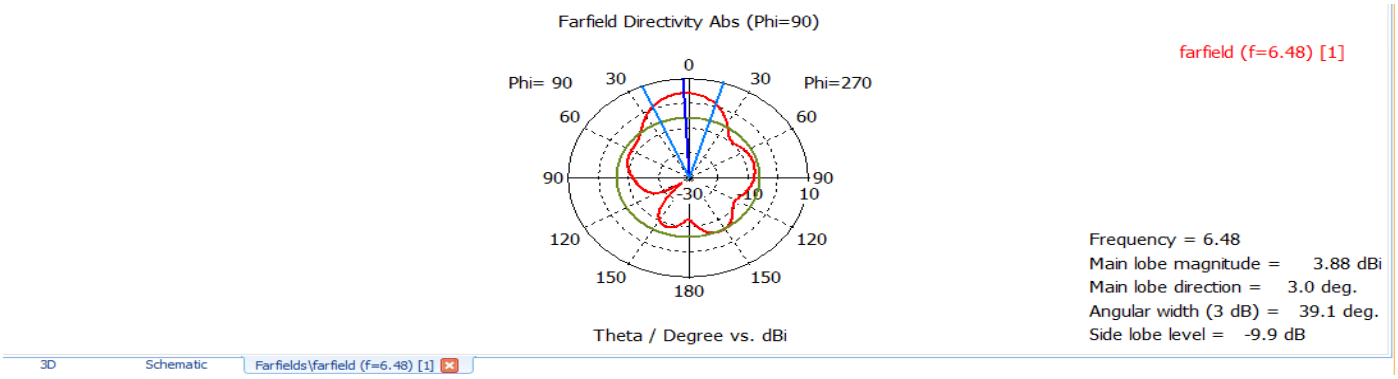

Figure 6: The polar plot of the proposed antenna at frequency of 6.48GHZ

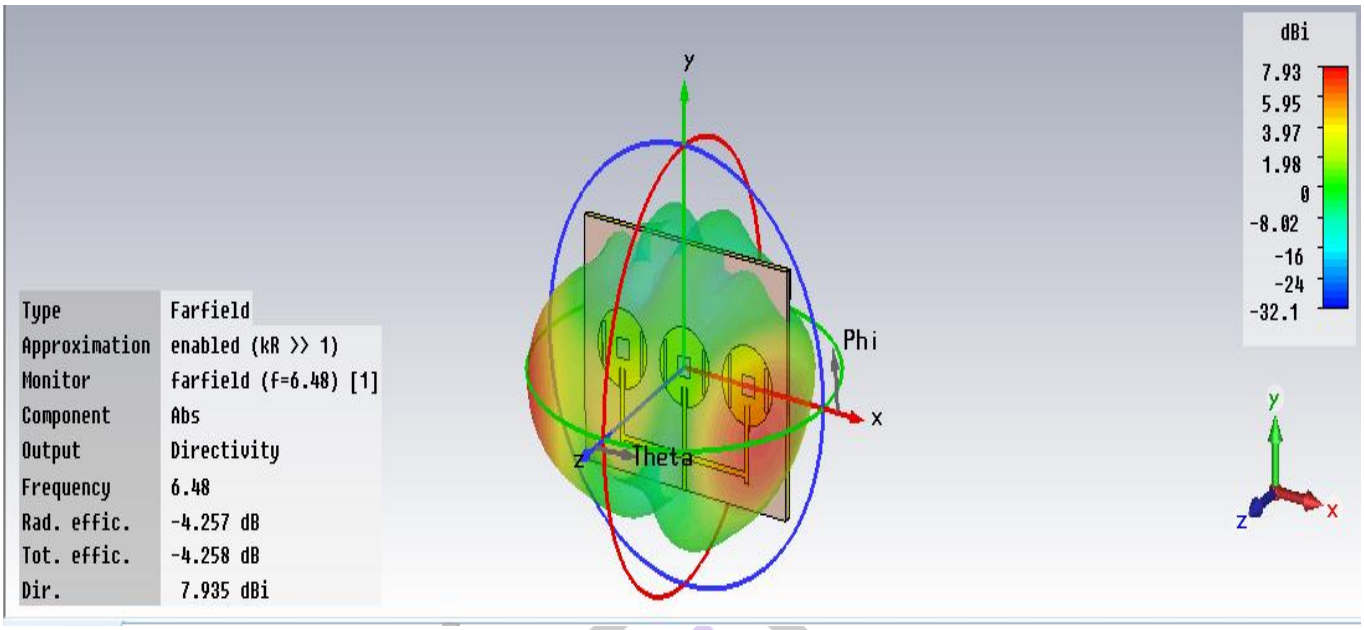

Figure 7: The 3d view of the antenna structure of frequency 6.48 GHZ

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