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Edge Chamfered Multi band Sierpinski Fractal Antenna

R. Gayathri Rajaraman
Assistant Professor, Department of Electronics & Communication Engineering, Annamalai University, Chidambaram, India

ABSTRACT

Wideband Antennas with multi resonances are designed generally using fractal concepts. A Sierpinski Fractal patch is created with two iterations and its edges are chamfered. This creates Penta band resonances at 12.28, 19.28, 21.26, 23.57, 27.52 GHz with adequate gain factors. The antenna has an Omni directional pattern. The chamfered antenna model with wide apart spectras is presented in this paper.

Keywords: Microstrip patch antenna, Fractal linear polarization, wireless applications, swastik, spiral slot, radar, SATCOM applications

I. INTRODUCTION

Todays advancement in printed antenna design [1-2] is metamaterial and fractal concept. The fractal antennas create multiresonances due to similar resonant structure on the patch[3-9]. There are many types of fractal antenna of which Sierpinski is one. In this paper, such antenna is taken and a new method (of chamfering) is done to induce more resonances and better papameter values.

DESIGN OF PENTA BAND KOCH ANTENNA

The Inset fed conventional patch using RT Duroid substrate with relative permittivity of 2.2 with a thickness of 1.524 mm is designed initially. [1,2]. The size of the Patch is 33 X 47mm. Square slots resembling Sierpinski slots are removed on the patch. Further two triangular cuts confining to left sides are created on both upper and lower side of the radiating width. The top view , Return loss are seen in Figures 1 and 2. The dimensional details are also shown in Table 1.

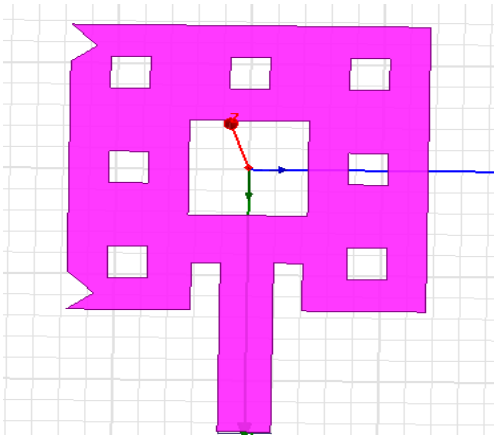

Figure 1. Proposed Antenna

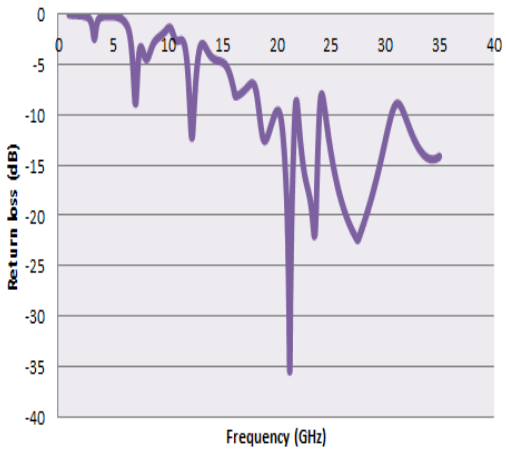

Figure 2. Reflection Coefficient of the Proposed Antenna.

Table 1. Dimension of the Proposed Antenna.

Parameters	Size
Substrate	1.524mm
Relative permittivity	2.2
Ground	60 x 60 mm
Patch	33.84 x 47 mm

ANALYSIS OF THE PROPOSED ANTENNA

The Inset fed antenna is optimized to resonate at 12.28, 19.28, 21.26, 23.57, 27.52 GHz and its return loss characteristics are shown in Figure 2. The value of S_{11} at the penta bands of resonances are -12, -21,-35,-21,-22dB.The Polar Plot of rE field, gain at the discrete resonant frequencies are shown in Figs.3-7. The simulated antenna parameters are seen in Tables 2-6.

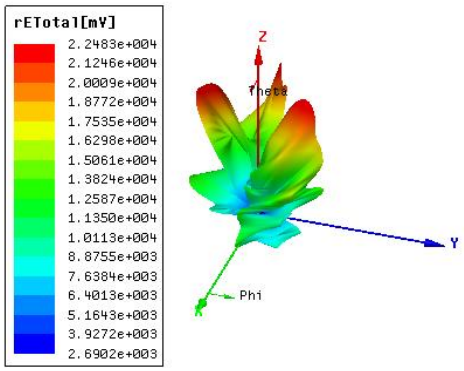

Figure 3. rE total of the Proposed Antenna

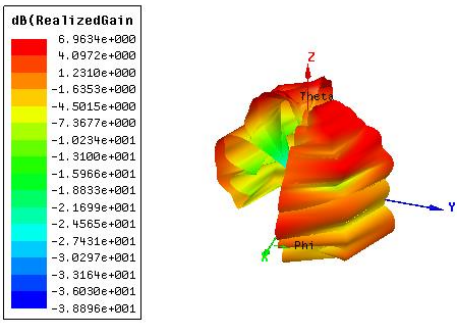

Figure 4. Gain of the Proposed Antenna

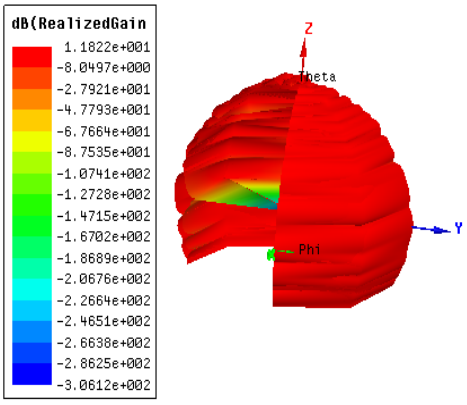

Figure 5. Gain of the Proposed Antenna

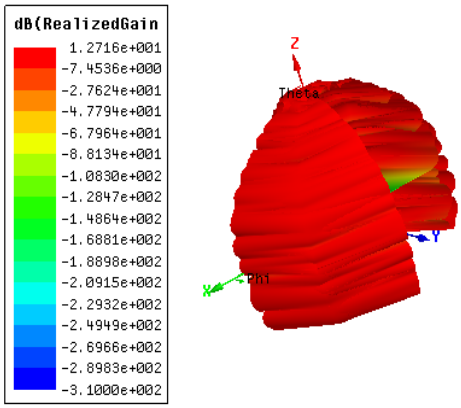

Figure 6. Gain of the Proposed Antenna

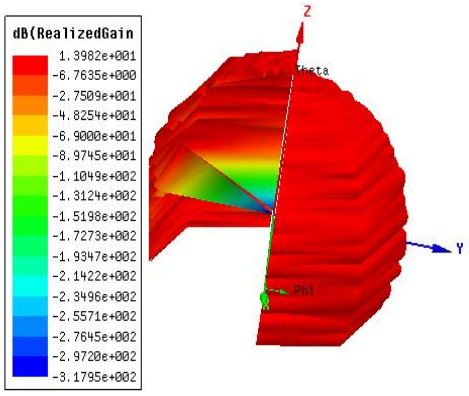

Figure 7. Gain of the Proposed Antenna

Table 2. Parameters of the Proposed Antenna

Antenna Parameters:

Quantity	Value	Units
Max U	0.67041	W/sr
Peak Directivity	8.4837	
Peak Gain	8.598	
Peak Realized Gain	8.4249	
Radiated Power	0.99307	W
Accepted Power	0.97987	W
Incident Power	1	W
Radiation Efficiency	1.0135	
Front to Back Ratio	-N/A-	
Decay Factor	0	

Table 3. Parameters of the Proposed Antenna

Antenna Parameters:

Quantity	Value	Units
Max U	0.99161	W/sr
Peak Directivity	17.31	
Peak Gain	13.175	
Peak Realized Gain	12.461	
Radiated Power	0.7199	W
Accepted Power	0.94583	W
Incident Power	1	W
Radiation Efficiency	0.76113	
Front to Back Ratio	-N/A-	
Decay Factor	0	

Table 4. Parameters of the Proposed Antenna

Antenna Parameters:

Quantity	Value	Units
Max U	1.3835	W/sr
Peak Directivity	24.682	
Peak Gain	17.425	
Peak Realized Gain	17.386	
Radiated Power	0.70442	W
Accepted Power	0.99779	W
Incident Power	1	W
Radiation Efficiency	0.70598	
Front to Back Ratio	4.3049	
Decay Factor	0	

Table 5. Parameters of the Proposed Antenna

Antenna Parameters:

Quantity	Value	Units
Max U	2.0378	W/sr
Peak Directivity	42.294	
Peak Gain	27.033	
Peak Realized Gain	25.608	
Radiated Power	0.60547	W
Accepted Power	0.94727	W
Incident Power	1	W
Radiation Efficiency	0.63918	
Front to Back Ratio	4.8637	
Decay Factor	0	

Table 6. Parameters of the Proposed Antenna

Antenna Parameters:

Quantity	Value	Units
Max U	2.0847	W/sr
Peak Directivity	49.042	
Peak Gain	26.335	
Peak Realized Gain	26.198	
Radiated Power	0.53419	W
Accepted Power	0.99481	W
Incident Power	1	W
Radiation Efficiency	0.53698	
Front to Back Ratio	-N/A-	
Decay Factor	0	

II. CONCLUSIONS

A penta band Fractal Antenna with chamfered ends is designed successfully. The antenna covers all direction uniformly which is confirmed by the directivity. The Co and cross pol levels of seperations are also adequate. The gain is found to be sufficient and the single antenna covers five resonances supporting five different wireless application. The antenna can be easily realized and has wider bandwidth supporting linear vertical polarization.

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