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Design and Performance Evaluation of Reflector Antenna for Microwave Applications

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Abstract
Reflector antenna can be considered as the backbone of all modern communication. This research presents design and performance analysis of reflector antenna for microwave applications. Reflector antenna here is designed and simulated at 2 GHz. Performance parameters like Gain, Voltage standing wave ratio, bandwidth of antenna is extracted using High frequency structure simulator.
Index Terms— Reflector Antenna**,** VSWR, Bandwidth, Return loss.

1. Introduction

Reflector antennas are extensively used in point-to-point communication, remote sensing, satellite communication, deep-space telemetry, TV signal broadcasting, radio astronomy, weather radar & in spacecraft systems. Reflector antennas are basically used to reflect electromagnetic signals originating from different sources. By adjusting the geometry of reflector antenna system, a desired radiation pattern can be achieved. Reflector antenna can be considered as the system consisting of active and passive elements. Active element is antenna which is used to feed or receive electromagnetic signal. Passive element is the structure of antenna which is used to collect or transmit electromagnetic signals. Based on the geometry of reflecting system reflector antennas are classified as rod, plane, corner, spherical and parabolic antennas. The structure of plane reflector antenna is as shown in Fig (1)

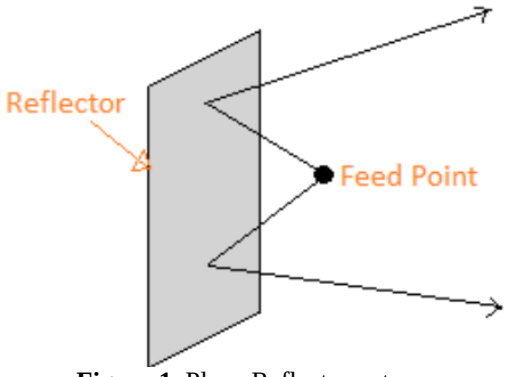

Figure 1. Plane Reflector antenna

The structure of corner reflector antenna is as shown in Fig (2)

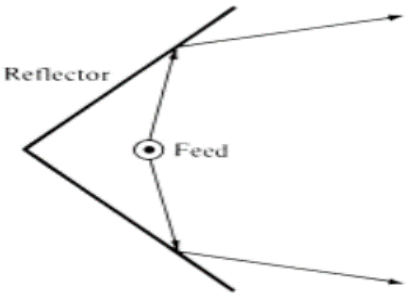

Figure 2. Corner Reflector antenna

The structure of spherical reflector antenna is as shown in Fig (3)

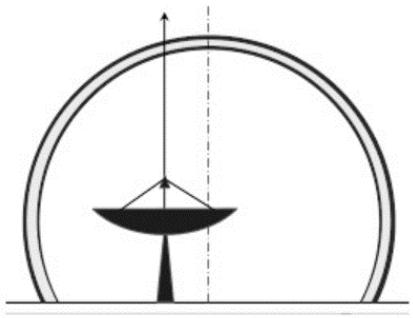

Figure 3. Spherical Reflector antenna

The structure of Parabolic reflector antenna is as shown in Fig (4)

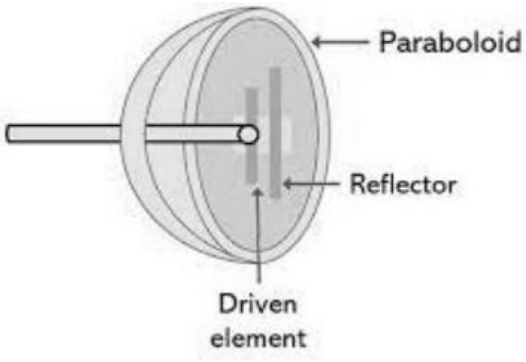

Figure 4. Parabolic Reflector antenna

Parabolic antennas are further classified as

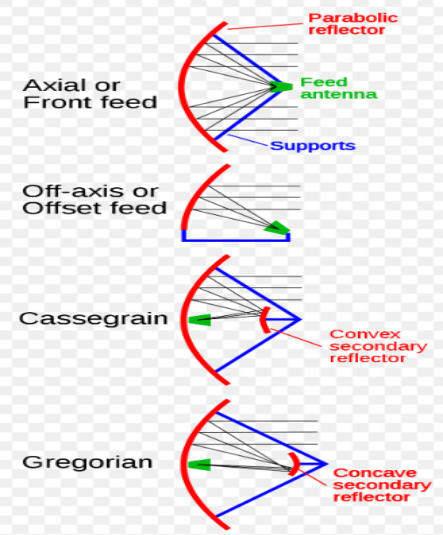

Figure 5. Parabolic Reflector antenna types

References [1-5] proposed to analyses reflector antennas.
In this research we will be concerned to design and evaluate the performance of Parabolic reflector antenna at 10 GHz.
The parabolic antenna is described completely by two parameters which are Diameter D and Focal length F of reflector antenna. Two auxiliary parameters involved in design of reflector antenna included Vertical height of reflector(H) and maximum angle between the focal point and edge of the dish (θ_o).

These are illustrated in Fig ()

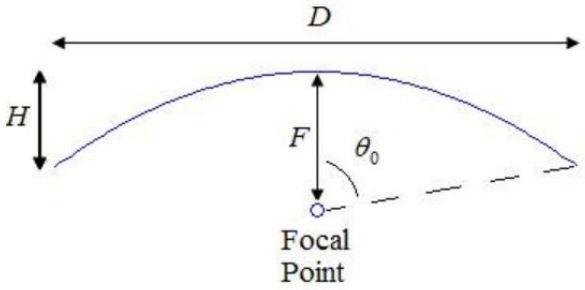

Figure 6. Reflector antenna design parameters

These parameters are related by

$$F = \frac{D^2}{16\,H}$$

The efficiency of Parabolic reflector is

$$\eta = \frac{Focal\ Length\ F}{Diameter\ D}$$

The Beam width of Parabolic reflector can be approximated by

$$Beam\ Width = \frac{70\lambda}{D}$$

The gain of reflector antenna is given by

$$G = 10\ \log_{10} k \left(\frac{\pi\, D}{\lambda}\right)^2$$

From the expression it is clear that higher the diameter of reflector antenna higher will be the gain of antenna.
The design parameters of Parabolic reflector antenna used in this research are mentioned below

Table 1

S.No.	Name of Parameter	Value
1	Operative frequency	10 GHz
2	Diameter	50 cm
3	Focal length	50 cm

2. Results and Discussion

The Structure of reflector antenna designed using HFSS is shown in Fig (7).

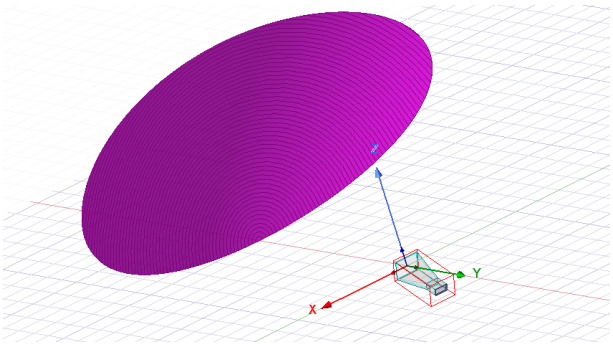

Figure 7. Reflector antenna design parameters

The radiation pattern of designed Parabolic reflector antenna is as shown in Fig (8). The maximum achieved directive gain of this antenna is 13.10 dB

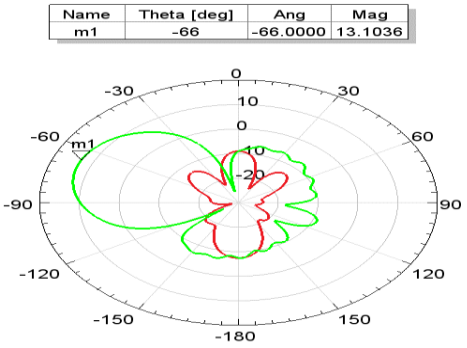

Figure 8. Reflector antenna design parameters

Conclusion

A Reflector Antenna for operative frequency of
10 GHz is designed and simulate in this research. High frequency structure simulator is used to simulate this antenna. A high vale of directive gains up to 13.1 dB is achievable by using this antenna. Antenna with this high value of directive gain will find applications in Radars and Satellite communication.

References

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