Performance Analysis of Corner Reflector Antenna Using Antenna Magus

[1]Ujwala Patil, [2]Namrata Mangalgi, [3]Pooja Kamat, [4]Shraddha Melinmani

[1,2,3,4] UG Student, Department of Electronics and Communication Engineering, BLDEA's V. P Dr. P.G.H College of

Engineering and Technology, Bijapur, India

ABSTRACT: The Corner reflector antenna is designed using antenna magus tool. The system efficiency depends on the spacing between the vertex of the corner reflector and the feed element that is S. The spacing affects gain and bandwidth. Spacing S is thus selected as a compromise between gain and bandwidth. The antenna is designed varying i) spacing between source and reflector to obtain maximum gain of 16.5dB ii) reflector angle to obtain maximum gain of 16.99dB iii) reflector length for maximum gain of 15.36dB.

KEYWORDS: Antenna Magus, Bandwidth, Corner reflector antenna, Dipole, Frequency, Gain, Reflector angle, Reflector length, Spacing.

I. INTRODUCTION

The corner-reflector antenna is made up of two plane reflector panels and a dipole element. This arrangement prohibits radiation in the back and side directions and hence makes the antenna more directional. The feed element for the corner reflector is almost always a dipole or an array of collinear dipoles placed parallel to the vertex a distance *s* away, as shown in Fig1. To obtain a greater bandwidth the feed elements are thick cylindrical or biconical dipoles instead of thin wires. The aperture of the corner reflector (D) is usually made between one and two wavelengths ($\lambda < D < 2\lambda$). The feed-to-vertex distance (s) is usually taken to be between a third and two-thirds of the wavelength ($\lambda / 3 < s < 2\lambda / 3$). The corner reflector antenna is designed using antenna magus tool.

"Antenna Magus is the first antenna design tool of its kind. Its huge searchable collection of antennas can be explored to find, design and export models of designed antennas to CST MICROWAVE STUDIO and FEKO."
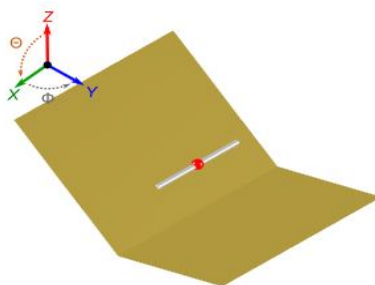

Fig.1: Dipole fed corner reflector antenna

Fig.1 describes the geometry of typical dipole fed corner reflector antenna. The dipole feed element is fed at the centre point between the two arms.

II. RELATED WORK

In [1] authors made Impedance measurements for a monopole in a corner reflector over an image plane as a function of monopole length, diameter and position within the corner reflector structure. In [2] authors designed a new type of

corner reflector antenna and experimentally investigated its radiation characteristics. The design involves the addition of planar parallel periodic strips to the two sides of corner reflector antenna.

III. PROPOSED ALGORITHM

Corner reflector is designed and different parameters are varied such as spacing between dipole and reflector, length of reflector and reflector angle. The gain is been observed. Different cases have been discussed in section V.

Design

- For each combination of reflector width and length, there is an optimum reflector angle and reflector-dipole spacing to maximize the gain. This design performed by Magus provides a compact antenna for a specified gain.
- To increase the resonant frequency, decrease the dipole length.
- To increase the bandwidth, increase the dipole diameter.
- To increase the gain, increase the reflector length and width, and the reflector-dipole spacing, and reduce the reflector angle.
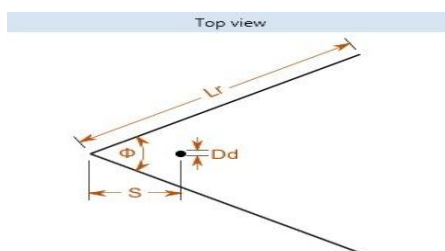

Fig.2: Top view of dipole fed corner reflector antenna

Fig.2 describes top view of dipole fed corner reflector antenna. The following parameters are considered for design:

Φ-Reflector angle	Wr-Width of reflector
Lr-length of reflector	Ld-length of dipole
S-spacing between reflector and dipole	Dd-Width of dipole

IV. PSEUDO CODE

Step 1: Double click on the Icon, tool named Antenna Magus.

Step 2: When the folder opens, go to Home menu. Click on design tool bar by selecting the desired antenna.

Step 3: Set the operating frequency to 1GHz.

Step 4: click on design in 'Design and Tweaks' tool bar to design an antenna.

Step 5: All the parameters are set to desired value.

Step 6: Case1 is studied by varying spacing between dipole and corner reflector using the scroll and set to desired value in order to increase the gain.

Step 7: Case2 is studied by varying the reflector angle using the scroll.

Step 8: Case3 is studied by varying the reflector length using the scroll

Step 9: In all the three cases, gain is observed.

V. SIMULATION RESULTS

Case1: Effect of spacing between dipole (source) and corner reflector on gain.

F- Frequency in GHz, B.W-Beam width, A-Angle in degree, G- Gain in dB.

In case1 all the parameters are kept constant and spacing between dipole and corner reflector is varied and gain is observed and shown in below table1.

TABLE 1: Dimensions of Corner reflector

F	A	Lr m	Wr mm	S Mm	Ld mm	Dd mm	G dB	B.W 0°	B.W 90°
1	60	1.47	671.7	178.	139.2	2.9	15.9	28.02	19.34
1	60	1.47	671.7	110	139.7	2.9	16.4	27.34	19.53
1	60	1.47	671.7	70	139.7	2.9	16.5	27.16	19.55
1	60	1.47	671.7	60	139.7	2.9	16.4	27.33	19.3

Table 1 describes that gain observed is maximum when the spacing between dipole and antenna ranges between 50mm to 70mm.

Case2: Effect of reflector angle on gain.

In case2 all the parameters are kept constant and reflector angle is varied and gain is observed and shown in above table2.

TABLE 2: Dimensions of Corner reflector

F	A	Lr m	Wr mm	S mm	Ld Mm	Dd Mm	G dB	B.W 0°	B.W 90°
1	50	1.47	671.7	80	139.2	2.9	16.99	26	18.5
1	65	1.47	671.7	80	139.7	2.9	15.94	28.7	22.29
1	70	1.47	671.7	80	139.7	2.9	15.28	31.28	26.01
1	75	1.47	671.7	80	139.7	2.9	14.75	34.70	29.68

Table 2 describes gain observed is maximum when the reflector angle ranges between 50° to 65°.

Case3: Effect of reflector length on gain.

In case3 all the parameters are kept constant and reflector length is varied and gain is observed and shown in above table3.

TABLE 3: Dimensions of Corner reflector

F	A	Lr m	Wr mm	S mm	Ld Mm	Dd mm	Gain dB	B.W 0°	B.W 90°
1	50	1	671.7	80	139.7	2.9	15.36	28.7	22.29
1	50	0.8	671.7	80	139.7	2.9	15.28	31.28	26.01
1	50	0.74	671.7	80	139.7	2.9	14.75	34.70	29.68

Table 3 describes that observed gain is maximum when length ranges between 0.8 to 1m.

Radiation patterns are obtained by varying spacing between dipole (source) and corner reflector and are shown in Fig 3a &3b for 2D and 3D views respectively.
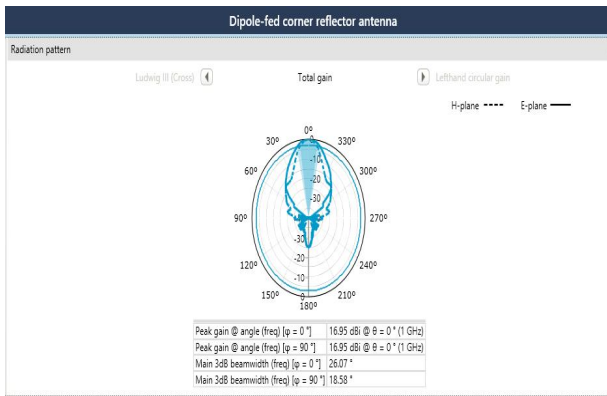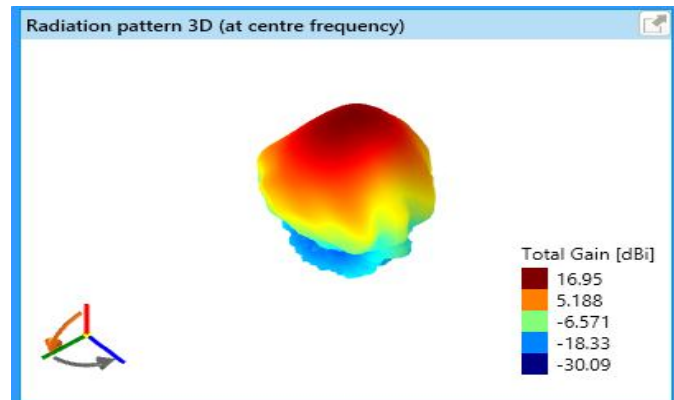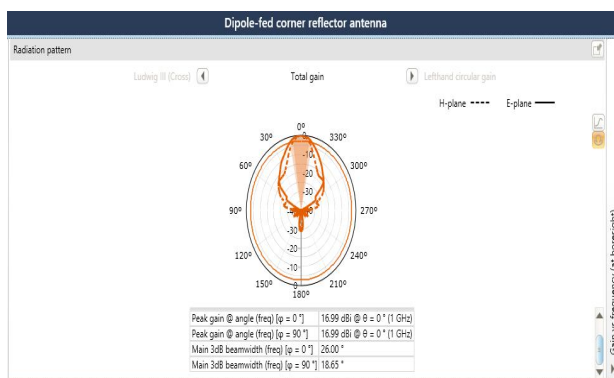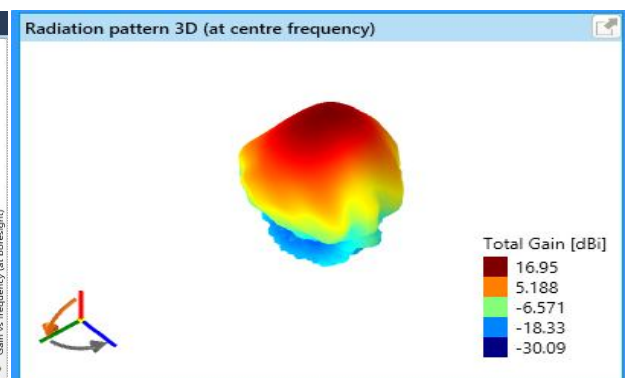
Fig 3a: Radiation pattern in 2D view.

Fig 3b: Radiation pattern in 3D view.

Fig 3a and fig 3b describes that the observed gain is 16.5dB for the variation of following parameters as follows:

Frequency: 1GHz,
Angle: 60°,
Reflector length: 1.47m,
Reflector width: 671.7mm,
Spacing between dipole and corner reflector: 70mm,
Dipole length: 139.7 mm,
Dipole width: 2.9mm,
Beam width at 0°: 27.16,
Beam width at 90°: 19.55.

Radiation patterns obtained by varying reflector angle are shown in below Fig 4a and Fig 4b for 2D and 3D views respectively.

Fig 4a: Radiation pattern in 2D view

Fig 4b: Radiation pattern in 3D view

Fig 4a and 4b describes that the observed gain is 16.99dB for the variation of following parameters as follows:
Frequency: 1GHz,
Angle: 50°,
Reflector length: 1.47m,
Reflector width: 671.7mm,
Spacing between dipole and corner reflector: 80mm,
Dipole length: 139.7 mm,
Dipole width: 2.9mm,

Beam width at 0°: 26,
Beam width at 90°: 18.5.

Radiations patterns are obtained by varying reflector length are shown in fig 5a and fig 5b for 2D and 3D views respectively.
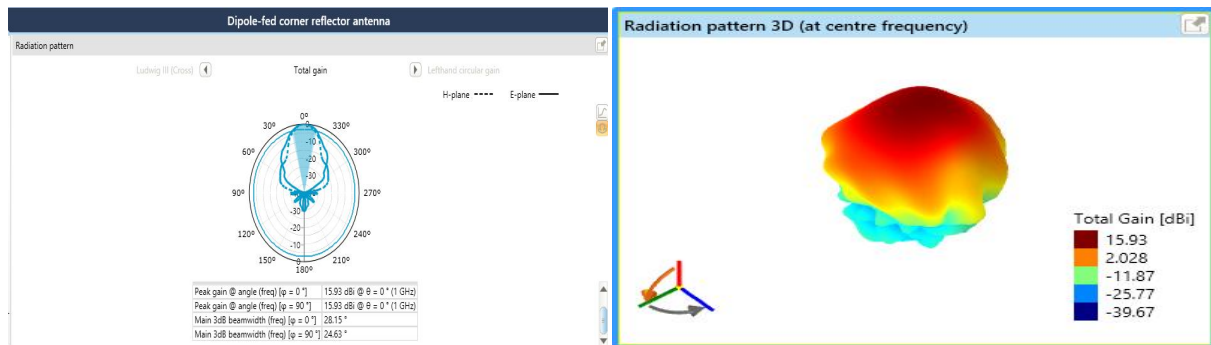

Fig 5a: Radiation pattern in 2D view   Fig 5b: Radiation pattern in 3D view

Fig 5a and 5b describes that the observed gain is 15.36dB for the variation of following parameters as follows:
Frequency: 1GHz,
Angle: 50°,
Reflector length: 1m,
Reflector width: 671.7mm,
Spacing between dipole and corner reflector: 80mm,
Dipole length: 139.7 mm,
Dipole width: 2.9mm,
Beam width at 0°: 28.7,
Beam width at 90°: 22.09.

Effects of antenna parameters on Gain

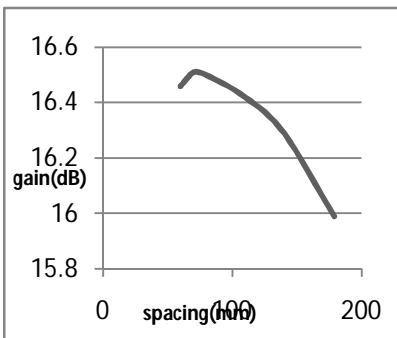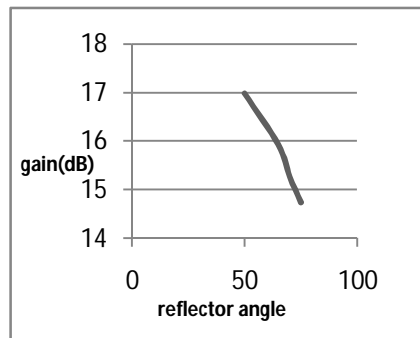Fig6a: Graph of spacing v/s gain   Fig6b: Graph of reflector angle v/s gain   Fig6c: Graph of reflector length v/s gain
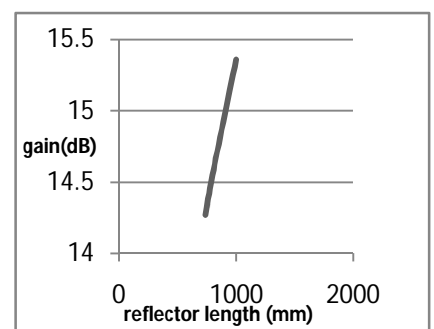

Fig 6a describes the variation of Gain with change in spacing between dipole (source) and corner reflector. From graph at spacing of 70mm, Gain is maximum having 16.5dB.
Fig 6b describes the variation of Gain with change in reflector angle. From graph, at 30° Gain is maximum having 16.99dB.
Fig 6c describes the variation of Gain with change in reflector length. From graph, at 1000mm Gain is maximum having 15.36dB.

VI. APPLICATIONS

1. Corner reflectors can be used in TV system.
2. For point to point communication, corner reflectors are more convenient.
3. Corner reflectors are used in radio astronomy.
4. Corner reflectors are used in Wi-Fi applications.

VII. CONCLUSION

The Corner reflector antenna is designed using Antenna Magus. Antenna is designed by varying parameters such as reflector angle, Spacing between source and reflector and reflector length, Gain is observed for all the cases and can be concluded that antenna with spacing 70mm, reflector angle of 50° and reflector length of 1m gives gain of 16.5dB, 16.99dB and 15.36dB.

REFERENCES

[1] A.C. Wilson, 'Impedance of a corner reflector antenna as a function of diameter and length of the driven element', JOURNAL OF RESEARCH of the National Bureau of Standards-D. Radio Propagation, Vol.64.D, No 2, March-April, 1960.
[2] Sebastian Mathew, Joe Jacob, V.P. Joseph, S. Bijukumar, U. Raveendranath and K.P. Mathew 'A New Corner Reflector Antenna with periodic strips sub reflectors', Microwave and Optical technology letters, Vol.20, No 5, March 5, 1999.
[3] John D Krauss, *Antennas and Wave Propagation, 4*th ed.McGraw-Hill International edition, 2010.
[4] C. A. Balanis, *Antenna Theory: Analysis and Design,* 3rd ed., John Wiley India Pvt. Ltd, 2008.
[5] Prof K.Giridhar, *Antennas and Propagation,* 1st ed., Pooja Publications, Bangalore.

ACKNOWLEDGEMENT

BIOGRAPHY

Ujwala Patil is pursuing BE in Electronics and Communication at BLDEACET, Bijapur. Her research interests are Antenna Theory and Propagation, Digital Image Processing, etc.

Namrata Mangalgi is pursuing BE in Electronics and Communication at BLDEACET, Bijapur. Her research interests are Antenna Theory and Propagation, Computer networking, etc.

Pooja Kamat is pursuing BE in Electronics and Communication at BLDEACET, Bijapur. Her research interests are Antenna Theory and Propagation, Digital communication, etc.

Shraddha Melinmani is pursuing BE in Electronics and Communication at BLDEACET, Bijapur. Her research interests are Antenna Theory and Propagation, Embedded Systems, etc.