Design and Analysis of Planar Toothed Log Periodic Antenna

Rakhi Dua

PhD Student, JJTU Jhunjhunu
E-mail: rakhi900@gmail.com

Abstract: *This paper describes the development of Log Periodic Toothed Planar Antenna using HFSS. Log periodic antennas are the antennas with high gain, high front to back ratio and low cost. These antennas can be used for long distance communication. The antenna has a simple structure. The simulation results shows that the proposed antenna has stable radiation pattern in the frequency range from 1 to 5 Ghz.*

1. INTRODUCTION

Log Periodic Antenna was the first frequency independent antenna that immediately after conception made a huge impact on commercial and building applications throughout the world. A log-periodic antenna is defined as an antenna whose electrical properties changes with the logarithm of frequency. A multi decade operation can be obtained if the antenna is defined as a structure whose electrical properties vary periodically with the logarithm of frequency. To produce required performance similar mathematical relationships need to be applied to antenna's structural parameters. The Antenna has reasonable gain, narrow beam and constant input resistance over a wide impedance bandwidth. This type of antenna can be used in variety of applications such as feed for reflector antennas, lens and signal detection.

2. LPDA GEOMETRY

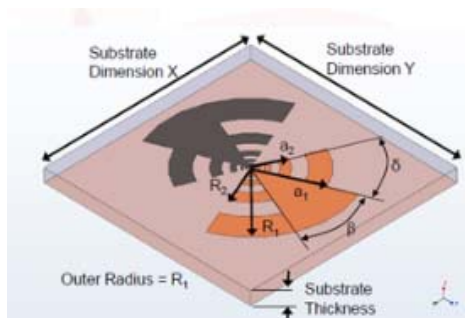A typical example of planar toothed log periodic antenna is shown in figure.1.(a).

Fig.1 (a) Geometry of Planar Toothed Log Periodic Antenna using substrate.

The ultimate objective of this design antenna is to meet certain design specifications. Geometry of Planar Toothed Log Periodic Antenna without substrate is shown in fig.1.(b).
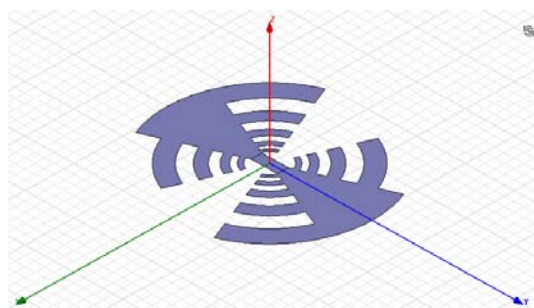

Fig.1 (b) Design of Planar Toothed Log Periodic Antenna without substrate

Fig.2. Port Gap Width of Planar Toothed Log Periodic Antenna

The proposed antenna is designed for:

Solution frequency	5 Ghz
Port Impedance	50 Ω
Substrate	εr = 2.2
Thickness	0.16 cm

If design ratio is denoted by τ and mean spacing factor is denoted by σ then these factors can be written as:

$$\tau = \frac{R_{n+1}}{R_n} < 1$$

$$\sigma = \frac{\alpha_n}{R_n} < 1$$

The configuration of log periodic antenna can be described by its specifications.

Parameters	Dimensions
Substrate Width (W)	12 cm
Substrate Length (L)	12 cm
Outer Radius (R1)	5.239 cm
Tau (τ)	0.65
Sigma (σ)	0.81
Port Gap Width	1.31 cm
β angle	45 deg
δ angle	45 deg

3. SIMULATION RESULTS AND DISCUSSIONS

Radiation pattern of Planar Toothed Log Periodic Antenna

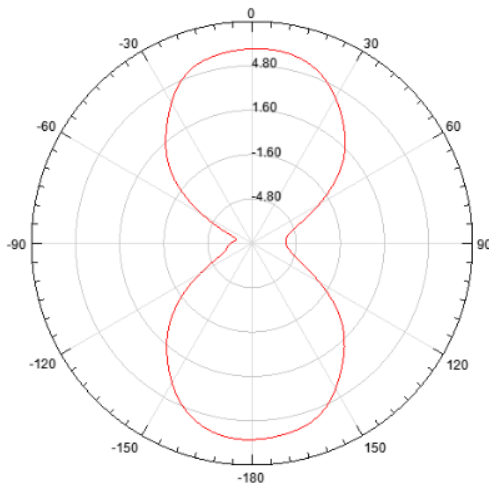Radiation pattern of Log Periodic Antenna is shown in fig.3. for $\phi = 90°$

Fig. 3: Radiation Pattern for $\phi = 90°$

4. CONCLUSION

Radiation pattern of planar toothed log periodic antenna is shown in fig.3.Such type of antenna when properly optimized can find potential applications in communication, navigation, surveillance, broadcast and EM field measurements.

REFERENCES

[1]. R. H. DuHamel, "Broadband Logarithmically Periodic Antenna Structure," IRE National Convection Record, Part I pp. 119-128, 1957.

[2]. R. H. DuHamel, "Logarithmically Periodic Antenna Designs," IRE Convection Record, Part I, pp. 139-157, 1958.

[3]. J.D Dyson, "The equiangular spiral antenna, "University of Illinios, Antenna laboratory, September 15,1957.

[4]. V. B. Romodin, V. I. Oznobikhin, V.V. Kopylov, "Log periodic microstrip array," IEEE, 2000, in press.

[5]. S. Bruni, A Neto, and Marliani, "The ultrawideband leaky lens antenna, "IEEE Trans. Antenna Propg.,vol.55,no.10, pp. 2642-2653,Oct-2007.

[6]. C.A Balanis, Antenna theory "Analysis and Design," John Wiley & Sons, Inc, Publication, New York, 2008.