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|  | ***Department of Electronics and Telecommunication Engineering***  ***(NBA ACCREDIATED)***  ***Antenna and Radio Wave Propagation Laboratory***  ***Academic Year 2020-2021***  ***Odd Semester*** |

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| **Course Code** | ECC603 |
| **Subject Professor In-charge** | Prof. Santosh Jagtap |
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| **Roll Number** | 18104B0024 |
| **Class** | TE EXTC |
| **Division** | B |
| **Date of Performance** | 28th April 2021 |
| **Date of Submission** |  |

**EXPERIMENT NO.10**

**Design Log Periodic antenna and Plot its radiation pattern.**

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| **Total**  **(10 Marks)** | **Sign** |
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**EXPERIMENT No.10**

**Title:** Design Log Periodic antenna and Plot its radiation pattern

**Estimated time to complete this experiment:** 02 hours

**Objective:** Design of frequency independent antennas

**CO to be achieved:** CO1, CO2.

**Expected Outcome of Experiment:** Design andPerformance analysis of log periodic antenna.

**Pre Lab/ Prior Concepts:** Wire antenna**,** Radiation pattern, HPBW, Gain, Impedance

**Theory**

Principle of Log periodic, Design parameters, Advantages, and applications

Principle

A log-periodic antenna (LP), also known as a log-periodic array or aerial, is a multi-element, directional antenna designed to operate over a wide band of frequencies. It was invented by John Dunlavy in 1952.

Every element in the LDPA (log periodic dipole array) is a driven element, that is, connected electrically to the feedline. A parallel wire transmission line usually runs along the central boom, and each successive element is connected in opposite phase to it. The feedline can often be seen zig-zagging across the support boom holding the elements. Another common destruction method is to use two parallel central support beams that also acts as the transmission line, mounting the dipoles on the alternate booms. Other forms of the log-periodic design replace the dipoles with the transmission line itself, forming the log-periodic zig-zag antenna. Many other forms using the transmission wire as the active element also exist.

Design parameters

The LDPA normally consists of a series of half wave dipole “elements” each consisting of a pair of metal rods, positioned along a support boom lying along the antenna axis. The elements are spaced at intervals following a logarithmic function of frequency, known as or . The successive elements gradually decrease in length along the boom. The relationship between the lengths is a function known as . and are the key design elements of the LDPA design. The radiation pattern of the antenna is unidirectional, with the main lobe along the axis of the boom, off the end with the shortest gain. Each dipole element is resonant at wavelength approximately equal to twice its length. The bandwidth of the antenna, the frequency range over which it has maximum gain, is approximately between the resonant frequencies of the longest and shortest element.

Advantages

* It has a broad bandwidth, allowing a single antenna to transmit on frequencies in multiple bands.
* Being log-periodic, the antenna’s main characteristics (radiation, pattern, gain, driving point impedance) are almost constant over its entire frequency range, with the match to a 300Ω feedline achieving a standing wave ratio of better than 2:1 over that range.

Applications

One large application for LDPAs is in rooftop terrestrial television antennas, since they must have large bandwidth to cover the wide television bands of roughly 54-88 and 174-216 MHz in the VHF, and 470-890 MHz in the UHF while also having high gain for adequate fringe reception. One widely used design for television reception combined a Yagi for UHF reception in front of a larger LDPA for VHF.

The log periodic is commonly used as a transmitting antenna in high power shortwave broadcasting stations.

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| **Log Periodic Design** |
| **Design Specification:**  Frequency (f) : 80 MHz to 120 MHz  Wire Diameter (d) = 0.001  Scale factor (τ)= 1.2       |  |  |  | | --- | --- | --- | | **Sr. No.** | **Parameter** | **Length** | | 1 | Wavelength at Highest frequency ( | 2.5 m | | 2 | Wavelength at Lowest frequency ( | 3.75 m | | 3 | Length of first Element ( | 1.25 m | | 4 | Length of second Element ( | 1.5 m | | 5 | Length of third Element ( | 1.8 m | | 6 | Length of fourth Element ( | 2.16 m | | 7 | First element position ( | 2.33 m | | 8 | Second element position ) | 2.8 m | | 9 | Third element position ( ) | 3.4 m | | 10 | Fourth element position | 4.1 m | |

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| **Log periodic geometry**      **Parameter Setting** |
| **Results** |
| 1. **Radiation Pattern** |
| f=80 MHz    **HPBW=70 Gain=6.29 dB** |
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| **Impedance Plot** |
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| **Observations:**   |  |  |  | | --- | --- | --- | | **Parameter** | **f=80 MHz** | **f=120 MHz** | | HBPW | 70 degree | 50 degree | | Gain | 6.92 dB | 8.04 dB | |

**Conclusion:**

* The HPBW decreases as the frequency increases.
* The gain increases as the frequency increases.