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

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

**EXPERIMENT NO.8**

**Design array of N elements and plot its radiation pattern**

|  |  |
| --- | --- |
| **Total**  **(10 Marks)** | **Sign** |
|  |  |

**EXPERIMENT No.8**

**Title:** Design array of N elements and plot its radiation pattern

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

**Objective:** To measure gain and bandwidth of array of N elements

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

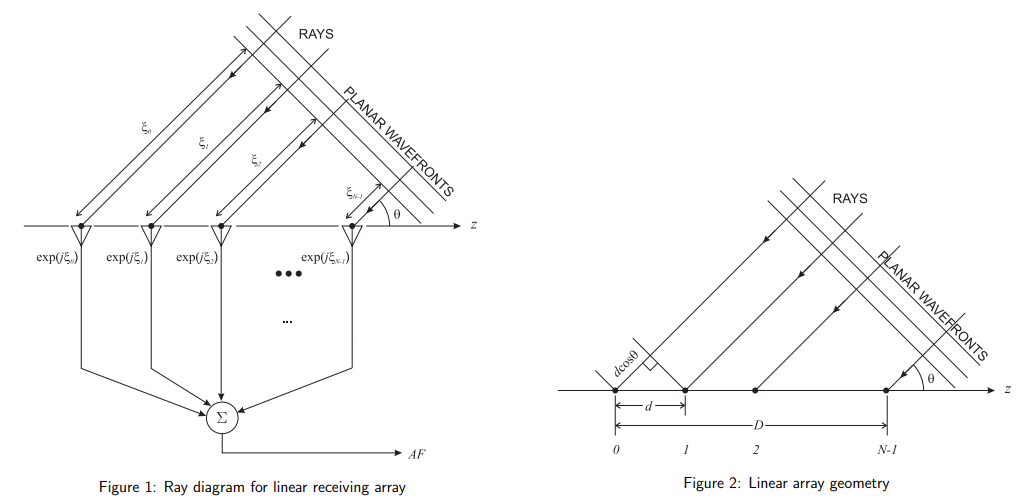
**Expected Outcome of Experiment:** Design of high gain antenna

**Pre Lab/ Prior Concepts:** Radiation pattern, Impedance, SWR

**Theory (2 Marks)**

Array factor of N elements array and its properties.

Array factor:

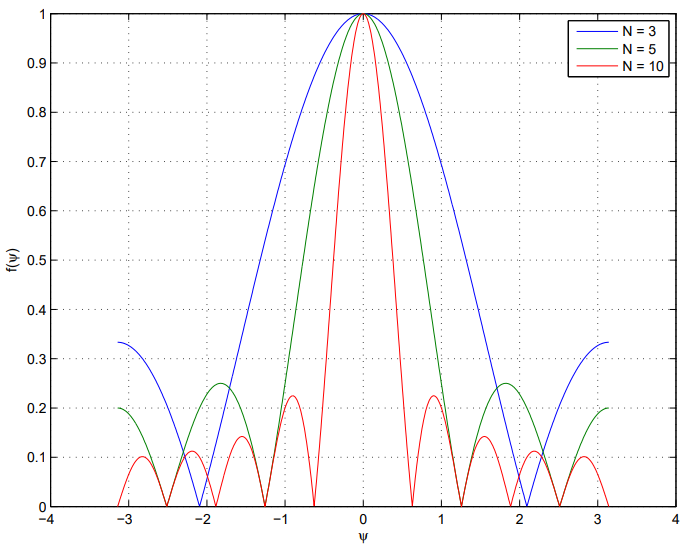


An ESLA (eqally space linear array) consists of equally spaced array elements, separated by the same distanced . The phase of an array element leads the phase of the previous element by .

The array factor for an ESLA is:

Here are the properties of the array factor:

* Array factor represents the response of an array of isotropic elements, allowing us to treat the element and the array separately.
* The total field pattern from an array can be found by multiplying the element factor (the pattern produced by a single element) by the array factor.
* There is always a maximum at , corresponding to , which is called the broadside direction as it is normal to the plane of the array.



* As increases, the width of the main lobe decreases.
* The number of sidelobes increases as increased.
* The width of these minor lobes (in terms of ) is . The width of the major lobe is twice that.
* The SLL (sidelobe level) decreases with .

|  |
| --- |
| **Dipole Design** |
| **Design Specification:**   1. **Frequency (f) :** 300 MHz 2. **Length of Wire (l) :** 0.5λ   UNIT-3       |  | | --- | | **λ =c/f=1 m l=0.5\* λ=0.5 m** |     Where,  c=Speed of light  L= Length of dipole  **Diameter of Wire (d):**  **d= λ/100** |

|  |
| --- |
| **Array Geometry**      **Parameter Setting** |

|  |
| --- |
| **Results** |
| 1. **Array of 4 Elements** |
| **HBPW=80 degree Gain=9.25 dB**     1. **Array of 7 Elements** |
| **HPBW= 80 Gain= 9.57 dB** |
|  |

|  |
| --- |
| 1. **Array of 15 Elements** |
|  |
|  |
| **Observations:**  Gain=10 Log [4N (d/, d=0.5 λ,  Hence,  Gain=10 Log [4N (0.5   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Sr.No** | **Array Elements(N)** | **HPBW** | **Gain (Measured)** | **Gain (Calculated)** | | 1 | 4 | 80° | 9.25 dB | 9.03 dB | | 2 | 7 | 80° | 9.57 dB | 11.46 dB | | 3 | 15 | 80° | 12.1 dB | 14.77 dB | |

**Conclusion:**

1. The gain increases as the number of elements in the array increases.
2. The HPBW remains the same as the number of array elements increases.