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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 |
| **Student Name** | Anuj Shah |
| **Roll Number** | 18104B0024 |
| **Class** | TE EXTC |
| **Division** | B |
| **Date of Performance** | 17th April 2021 |
| **Date of Submission** |  |

**EXPERIMENT NO.5**

**Design Monopole antenna and Plot far field radiation pattern and measure its performance parameters**

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| **Total**  **(10 Marks)** | **Sign** |
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**EXPERIMENT No.5**

**Title:** Design monopole antenna and plot far field radiation pattern and measure its

performance parameters by using 4NEC simulation tool.

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

**Objective:** Measurement of circuit, far field and network parameters of antenna

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

**Expected Outcome of Experiment:** Design andPerformance analysis of Monopole antenna.

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

**Theory (2 Marks)**

Field expression, Radiation resistance

Field expression:

In physics, a field is a physical quantity, represented by a number of another tensor, that has a value for each point in space and time. For example, on a weather map, the surface temperature is described by assigning a number to each point on the map; the temperature can be considered at a certain point in time or over some interval of time, to study the dynamics of temperature change. A surface wind map assigning an arrow to each point on a map that describes wind speed and direction at that point, would be an example of a vector field, ie. A 1-dimensional tensor field. Field theories, mathematical descriptions of how field values change in space and time, are ubiquitous in physics. For instance, the electric field is another rank-1 tensor field, and the full description of electrodynamics can be formulated in terms of two interacting vector fields at each point in spacetime, or as a single-rank 2-tensor field theory.

Radiation resistance:

Radiation resistance is that part of an antenna’s feedpoint electrical resistance that is caused by the radiation of electromagnetic waves from the antenna. In radio transmission, a radio transmitter is connected to an antenna. The transmitter generates a radio frequency alternating current which is applied to the antenna, and the antenna radiates the energy in the alternating current as radio waves. Because the antenna is absorbing the energy it is radiating from the transmitter, the antenna’s input terminals present a resistance to the current from the transmitter. Unlike other resitances found in electrical circuits, the radiation resistance is not due to the opposition (resistivity) of the material of the antenna conductors to electric current; it is a virtual resistance due to the antenna’s loss of energy as radio waves.

The radiation resistance is equal to the total power radiated as radio waves by the antenna, divided by the square of the rms current into the antenna terminals

The radiation resistance is determined by the geometry of the antenna and the operating frequency.

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| **Monopole Design** |
| **Design Specification:**   1. **Frequency (f) :** 750 MHz 2. **Length of Wire (l) :** 0.25λ   Monopole – MicrowaveTools  **Calculation of Length of Monopole (l):**  Velocity factor=0.92     |  | | --- | | **λ =c/f**  **l=0.92\*0.25\* λ** |     Where,  c=Speed of light  L= Length of dipole  **Diameter of Wire (d):**  **d= λ/100** |

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| **Monopole Geometry**      **Parameter Setting** |

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| **Results** |
| 1. **Radiation Pattern** |
| **HPBW=40 Gain=5.13 dBi** |
| 1. **Impedance Plot** |
| 1. **SWR and Return Loss** |
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| **SWR=1.37533 Return loss = -16.026 dB**   1. **Gain Plot** |
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| **Gain=5.15 dBi** |
| **Observations:**   |  |  |  | | --- | --- | --- | | **Sr.No** | **Parameters** | **Observed Values** | | 1 | HBPW | 40 degree | | 2 | Gain | 5.15 dBi | | 3 | SWR | 1.3753 | | 4 | Return Loss | -16.026 dB | | **5** | Impedance | 36.38+j0.9417 Ω | |

**Conclusion:**

* The gain of the monopole antenna is almost twice that of the half-dipole antenna.
* The HBPW (half power beam width) of the monopole antenna is half that of the half-dipole antenna.
* The VSWR of the monopole antenna is almost 1.38, which is good because it is less than 1.86.
* The reactive part of the impedance of the monopole antenna is close to zero, near the operating frequency of 750Mhz.
* Thus, we conclude that the monopole antenna is superior to the half-dipole antenna.