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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.6**

**Design Helix antenna and plot normal and axial mode radiation pattern and measure its performance parameters.**

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| **Total**  **(10 Marks)** | **Sign** |
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**EXPERIMENT No.6**

**Title:** Design Helix antenna and plot its normal and axial mode pattern

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

**Objective:** To study radiation properties of helix antenna

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

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

**Pre Lab/ Prior Concepts:** Radiation pattern, Impedance, Ground effects

**Theory (2 Marks)**

Modes of operation, advantages and applications

Modes of operation:

Helical antennas can operate in one of two principal modes- normal mode or axial mode.

In the normal mode or broadside helical antenna, the diameter and the pitch of the aerial are small compared with the wavelength. The antenna acts similarly to an electrically short dipole or monopole, equivalent to a ¼ wave vertical and the radiation pattern similar to these antennas is omnidirectional, with maximum radiation at right angles to the helix axis. For monofilar designs, the radiation is linearly polarized parallel to the helix axis. In bifilar or quadrifilar implementations, broadside circularly polarized radiation can be realized.

In the axial mode or end-fire helical antenna, the diameter and pitch of the helix are comparable to a wavelength. The antenna functions as a directional antenna radiating a beam off the ends of the helix, along the antenna’s axis. It radiates circularly polarized radio waves. Axial mode operation was discovered by physicist John D. Kraus.

Advantages:  
Following are the benefits of helical antenna:

* It is simple in design
* As it uses circularly polarized pattern, it is acceptable by both horizontal and vertical polarized antenna types.
* It can be used for broadband applications due to wider bandwidth.
* It can be used at HF/VHF frequencies for transmission and reception.
* It offers higher directivity.
* It is very robust in construction.

Applications:

* Monofilar antennas are used as compact antennas for portable hand held as well as mobile vehicle mount two-way radios, and in larger scale for UHF television broadcasting antennas.
* Bifilar or quadrifilar antennas can be used to realize broadside circularly polarized radiation.
* In the axial mode, helical antennas can be used to realize end-fire circularly polarized radio waves. These are used for satellite communication.

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| **Helix Design** |
| **Design Specification:**   1. **Frequency (f) :** 1600 MHz 2. **No. of turns (N) =**5   A sketch of a helical antenna | Download Scientific Diagram    **λ =c/f=(3X10^8)/(1600X10^6) =0.1873 meter**    **C= Circumference of Helix**  **N= no of turns**  **S= separation between turns**  **L= Length of Helix=NS**  **D= Diameter of Helix=**   1. **Axial Mode:**  |  |  |  |  | | --- | --- | --- | --- | | **Sr.No.** | **Parameter** | **Formula** | **Calculated Value (meter)** | | 1 | Circumference | C= λ | 0.1873 | | 2 | Diameter | D= | 0.05967 | | 3 | Separation between turns | S=0.25λ | 0.04684 | | 4 | Total Length | L=NS | 0.2342 |   **(ii)Normal Mode:**   |  |  |  |  | | --- | --- | --- | --- | | **Sr.No.** | **Parameter** | **Formula** | **Calculated Value (meter)** | | 1 | Circumference | C=0.2 λ | 0.03747 | | 2 | Diameter | D= | 0.01193 | | 3 | Separation between turns | S=0.02λ | 0.003747 | | 4 | Total Length | L=NS | 0.01873 | |

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| **Helix Geometry**      **Parameter Setting** |

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| **Radiation Pattern-Axial Mode** |
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| **Radiation pattern -Normal Mode** |
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| **Observations:** |
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**Conclusion:**

* If the helical antenna is grounded, then it will radiate in one direction. If it is not grounded, then it will radiate in two directions. Grounding increases the gain of the helical antenna.
* In axial mode, the helical antenna functions as a directional antenna radiating a beam off the ends of the helix, along the antenna’s axis.
* In normal mode, the helical antenna acts similarly to an electrically short dipole or monopole, with an omnidirectional radiation pattern, with maximum radiation at right angles to the helix axis