Experiment -2: Radiation Pattern of a Dipole Antenna

1. Aim : A) To plot the radiation pattern of dipole antenna in E &H planes.

B) To measure the beam width (-3dB) ratio from the radiation pattern.

C) To study infinitesimal antenna, monopole antenna and folded dipole antenna

2. Requirements

- Antenna transmitter, receiver and stepper motor controller.
- Pair of dipole antennas.
- Antenna tripod and stepper pod with connecting cables, BNC Tee connector.

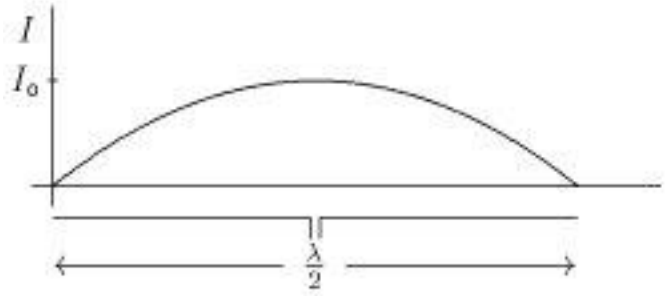
3.Pre-experiment Exercise

Brief Theory

A dipole antenna is a straight electrical conductor half wavelength long and connected at the center to a radio-frequency feed line. This antenna, also called a doublet, is one of the simplest types of antenna. The dipole is inherently a balanced antenna, because it is bilaterally symmetrical.

Ideally a dipole antenna is fed with a balanced, parallel-wire RF transmission line. However, this type of line is not common. An unbalanced feed line, such as coaxial cable can be used, but to ensure optimum RF current distribution on the antenna element and in the feed line, an RF transformer called a balun should be inserted in the system at the point where the feed line joins the antenna.

In the case of a λ/2 dipole, current is assumed to have a sinusoidal distribution with a maximum at the center and zero at the two ends.



4.Laboratory Exercise

A. Procedure :

1. Connect an arbitrary antenna to the transmitter unit. Switch on the transmitter and set the frequency to 800 MHz. Keep the antenna in horizontal direction.

2. Connect a half wavelength dipole antenna to the stepper motor controller and turn the receiver ON. Keep the antenna in horizontal direction. Verify that the received signal is of the same frequency as the transmitted frequency. Avoid any parallax between the transmitting and receiving antennas.

3. Set the distance between the antennas to be around 1.5m. Remove any stray object from around the antennas especially in the line of sight.

4. In case the stepper motor is not ON, press the stepper motor switch on the receiver front panel. The message ‘stp’ appears on the display on the bottom right corner.

5. Press the capture antenna data array switch. Press Enter when prompted by message on the display.

6. Enter the array number as 1 or 2 and press ENTER. Input the step size for stepper motor as either 1 or 5 degrees. Move away from the set-up to avoid interference.

7. Once the stepper motor has stopped, press FUNC switch and select ‘6’ for switching to RS-232 communication. Once ENTER is presses. ‘SERIAL ENABLED’ message appears on the display.

8. Navigate to the PLOT-ITR software on the computer and ignore the warning message. Select COM PORT 1 for RS232 communication. A pop-up with the message ‘Connected Sucessfully’ appears. Click OK.

9. Go to the Display/Capture tab and collect data stored within the selected array. Save the file.

10. Use the display tab to view the radiation pattern as a polar plot on the screen. The radiation pattern corresponds to the E plane pattern for receiving antenna.

11. Determine the half power beamwidth from the E plane pattern by positioning the red and green cursors at the points where the power reduces by 3 dB from the maximum value.

12. Press ENTER once to reset the display at the receiver. Without disturbing the set up, rotate the dipole antenna at the receiver from horizontal to vertical plane and repeat the above procedure to view the pattern in the H plane.

4. Post Experiment Exercise :

A. Results :

Parameter	Theoretical Result	Measured Result
Half Power Beam Width	--	

B. Conclusion/Comments

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C. Questions:

1. Explain the radiation pattern of Dipole Antenna.
2. Explain the current distribution in a dipole antenna.
3. Define directional, omnidirectional, and isotropic radiators.
4. Derive the fields for the infinitesimal dipole antenna.
5. What are the effects of ground planes on monopole antenna?