

ELP 725

Wireless Communication Lab

Experiment 2

**POLARISATION OF ANTENNAS, CROSS POLAR
DISCRIMINATION AND POLARISATION DIVERSITY**



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1 OBJECTIVES

1. To study the phenomenon of Linear and Circular polarization of antennas.
2. To determine the Cross Polar Discrimination(XPD) for the antenna systems in the lab.
3. To study polarization diversity.

2 EQUIPMENTS REQUIRED

1. Antenna Digital RF transmitter, MADL 2.4.
2. Antenna Digital RF receiver MADL 2.4.
3. Pair of Dipole antennas, RHCP & LHCP crossed dipole antennas and RHCP & LHCP axial mode helix antennas.
4. Antenna Tripod and stepper pod with connecting cables, Polarization connectors.
5. LHCP crossed dipole, RHCP crossed dipole, helix and dipole antennas.

3 OBSERVATIONS

3.1 Observation Table

3.1.1 Observation Table for Dipole Antenna

S. No	Frequency	Position of Transmitter	Position of Receiver	Power Received (dB)
1	2.4 Ghz	Horizontal	Horizontal	30
2	2.4 Ghz	Horizontal	Vertical	24

Table 1: Dipole Antenna

3.1.2 Observation Table for Helix LHCP Antenna

S.No	Frequency	Position of Transmitter	Position of Receiver	Power Received (dB)
1	2.4 Ghz	Horizontal	Horizontal	34
2	2.4 Ghz	Horizontal	Vertical	31

Table 2: Helix LHCP Antenna

3.1.3 Observation Table for Helix RHCP Antenna

S.No	Frequency	Position of Transmitter	Position of Receiver	Power Received (dB)
1	2.4 Ghz	Horizontal	Horizontal	26
2	2.4 Ghz	Horizontal	Vertical	27

Table 3: Helix RHCP Antenna

4 ANALYSIS

1.	Axial ratio of circularly polarized antenna (A.R) in dB. (Difference of readings upon rotation of a test dipole in front of a circularly polarized wave front (crossed dipole) in horizontal and vertical planes.)	2 dB (Approx.)
2.	Cross polarization discrimination (C.P.D) for linear antenna (in dB). (Difference of readings upon rotation of a test dipole in front of a linearly polarized wave front (dipole) in horizontal and vertical planes)	6 dB (Approx.)

5 CONCLUSIONS

1. Type of polarization:
RHCP antenna: Circularly polarized
Dipole antenna: Linearly polarized
2. Axial ratio of Circularly polarized antenna (for main beam) : 2 dB(approx)
3. Cross polarization discrimination (XPD) for linear antenna(for main beam): 6dB(approx)

6 QUIZ

1 Compare entire antenna used in this experiment according to their diversity gain?

Ans. We have used dipole antenna and Helix antenna in this experiment. The diversity gain of dipole antenna is very high as compared with Helix antenna. The reason is that Helix antenna is circularly polarised hence signal strength is independent of antenna's position while dipole antenna is linearly polarised.

2 Find one application of each type of polarization?

Ans. Vertical polarization is most often used when it is desired to radiate a radio signal in all directions such as widely distributed mobile units. Vertical polarization also works well in the suburbs or out in the country, especially where hills are present. As a result, nowadays most two-way Earth to Earth communications in the frequency range above 30 MHz use vertical polarization.

Horizontal polarization is used to broadcast television in the USA. Some say that horizontal polarization was originally chosen because there was an advantage to not have TV reception interfered with by vertically polarized stations such as mobile radio. Also, man-made radio noise is predominantly vertically polarized and the use of horizontal polarization would provide some discrimination against interference from noise.

3 The larger the XPD, the less is the energy coupled b/w the cross polarized channel. Justify this statement?

Ans. The microwave antenna's ability to maintain radiated or received polarization purity between horizontally and vertically polarized signals is called cross-polar discrimination, or XPD. XPD is the ratio of the co-polarized average received power to the cross polarized average received power.

As we know that co-polarization XPD is very less compared to as in cross polarization. Here from observation table we can see that we get more energy strength for co-polarized position compared to cross polarized position.

4 What is the recommended value (min) of polarization discrimination for BTS?

Ans. The recommended value should be 30dB.