

Antenna Lab Assignment

OBJECTIVE:

When you have completed this exercise, you will be familiar with antenna propagation loss , and be able to measure the gain and the directivity of an antenna .you will also be able to plot the radiation pattern of an antenna.

EQUIPMENT:

- 1- SWR Meter
- 2- Gunn oscillator
- 3- Crystal Detector
- 4- Variable Attenuator
- 5- (2) Horn Antenna
- 6- Microwave Accessories
- 7- Connections leads and Accessories
- 8- (2) Waveguide support
- 9- Antenna Azimuth Indicator

PROCEDURE SUMMARY:

In first part of this exercise you will determine the relationship between the power of the received signal and distance between two horn antennas. You will transmit a signal from one horn and use the SWR meter to measure the strength of the signal received by by other horns for various antenna separations. Relative signal powers will be determined by subtracting the received signal strength (dB) from a reference measurement.

Then, you will determine the gain of two identical horn antennas using identical antenna gain measurements technique. First you will put the variable Attenuator between the Gunn Oscillator and the Crystal Detector connected to the SWR Meter, and adjust the Variable Attenuator to set the transmitted power reference level. You will then insert the transmitting and receiving horns in the set-up and SWR meter reading will now represent the received signal level. Subtracting the received signal level from the reference level you will give the

ratio of the received power to the transmitted power in dB from this ratio and following equation the gain of horn will be determined

$$G = \frac{4\pi r}{\lambda} \sqrt{\frac{P_R}{P_T}}$$

Finally, in the last part of exercise, you will plot the radiation pattern of horn antenna and of a long triangular lens .The Antenna Azimuth indicator will be used to vary the orientation of the receiving under study. You will set a reference level on the SWR Meter with the receiving antenna aligned with the transmitting antenna. This value will be used to determine the relative power of the received signal as the receiving antenna is turned through 360° .each relative power will be plotted to produce the radiation pattern.

REQUIREMENTS:

- A. Based on Lab measurements ;Plot the curve of the propagation loss as a function of Antenna separation the plot the theoretical curve of propagation loss as a function of Antenna separation .(make your conclusion)
- B. Based on Lab measurements; calculate the gain of antenna in dB. Given $f = 10.5 \text{ GHz}$.
- C. Plot the horn antenna pattern (if MATLAB is used then report must include the code).
- D. Answer the following questions:
 - 1- What is free space propagation loss? What is far-field?
 - 2- Some one moves away from a transmitting antenna and records the distance each time that the received signal decreased by 1 dB .what should be the distance ratio between any two successive measurements.
 - 3- Why is it important to conduct the experiment in an empty environment? What would happen if the experiment were repeated with a lot of objects in the vicinity?
 - 4- Briefly describe the reference antenna method of antenna gain measurements. Then Derive the expression used to calculate the antenna gain.
 - 5- In part (2) of the experiment, would the same scheme work in the determination of the TX gain if only the Rx antenna was replaced by a dipole antenna? Explain

6- In part (3) of the experiment, why was it important to turn the receiver antenna in a direction away from the observer instead of turning it in the direction of observer?

7- If we remove the transmitter horn and measure received power, then what is the type of antenna used to transmit signal in that case.

8- How does the SWR meter report power measurements? And what is the difference between it and power Meter.

SUBMISSION:

- Every 3 students should turn in one report.
- Your report must be neat and include the LAB measurements, calculations (if needed) and requirements.