# Radiation Pattern of Antenna

## Team Higgs (G5)

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# Antenna Trainer Kit

**Aim-** To study the process of transmission and receiver processes and the radiation pattern of various antennas.

**Apparatus-** Various types of Antennas, 668Mhz RF oscillator, Adjustable Stands, receiver and multimeter

**Procedure-**

1. The antenna was connected to a RF Oscillator at the frequency of 668 MHz. This was the transmitter.
2. Another antenna was mounted on the stand and placed at a distance such that the transmitter and receiver signals don't interfere.
3. The receiving antenna was connected to receiver that has a microammeter to display the current proportional to the received power.
4. The oscillator was turned on. The current output at different relative angular positions was noted by rotating the transmitter in steps of 10 degrees.

# What we did

- We performed the prescribed procedure for 3 different types of transmitters-
    1. Folded dipole antenna
    2. Folded 5 element Yagi-Uda antenna
    3. Simple dipole with parabolic reflector

- The receiver was Folded dipole antenna.

- The distance between transmitter and receiver was 120 cm which was about 3 times the wavelength of the transmitted signal to avoid interference.

- We stood as far away as possible from the assembly to reduce the interference of radio waves emitted from human body.

# Theory and Analysis

- The received power was calculated from current readings using the formula:-

$$P \text{ (in decibels)} = 20 \log (i/io)$$

This power was plotted against the angular position in a polar graph to find out the radiation pattern.

- Using the principle of reversibility of path of light(EM waves), we can study the receiving pattern of an antenna by studying the transmission pattern of the same.

Hence we studied the transmitters using above assembly.

- We compared the standard radiation patterns (2D) with our obtained graphs to detect errors in our measurement.

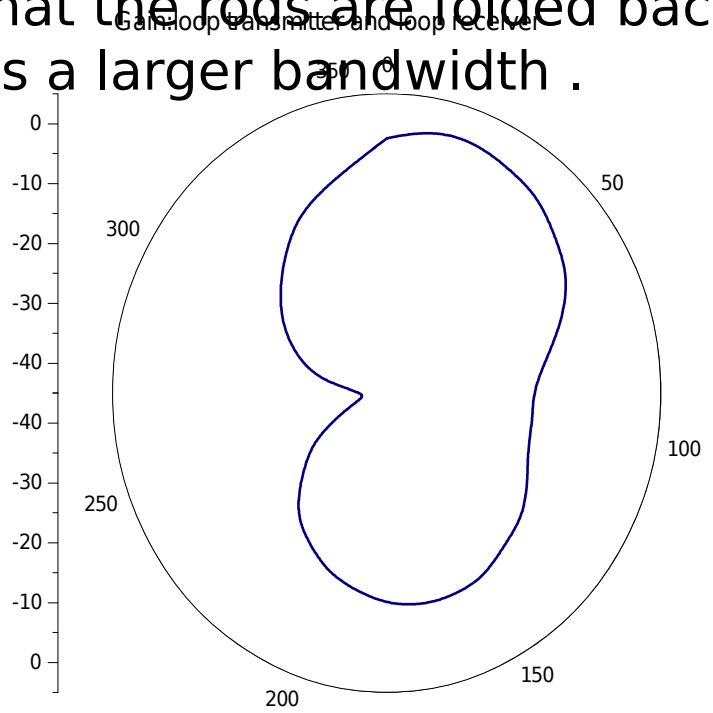
# 1. Folded dipole

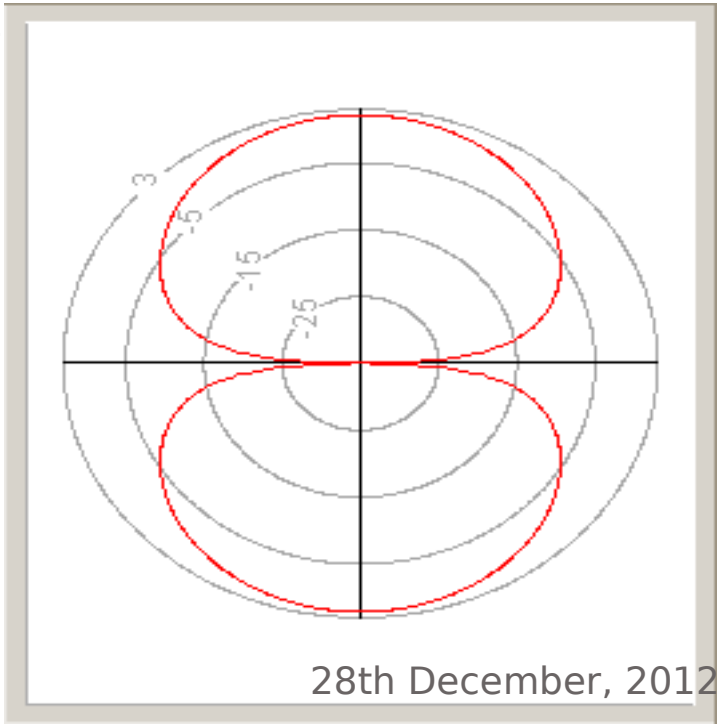
This is the plot of power pattern for folded dipole transmitter and folded dipole receiver.

Simple dipole is antenna that consists of two metal rods of length equal to 1/4th of the wavelength each, separated by a small gap. The total  length of our antenna was 20 cm.

Simple dipoles  have a peak gain at right angle to its axis. While their power pattern is are symmetrical around  z- axis.

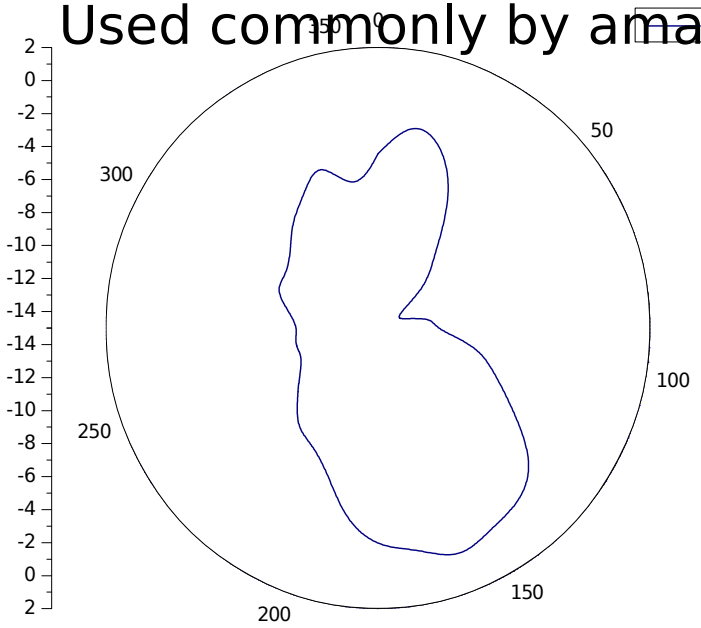
Folded dipoles are very similar to simple dipoles in a way that the rods are folded back to me
us a larger bandwidth .

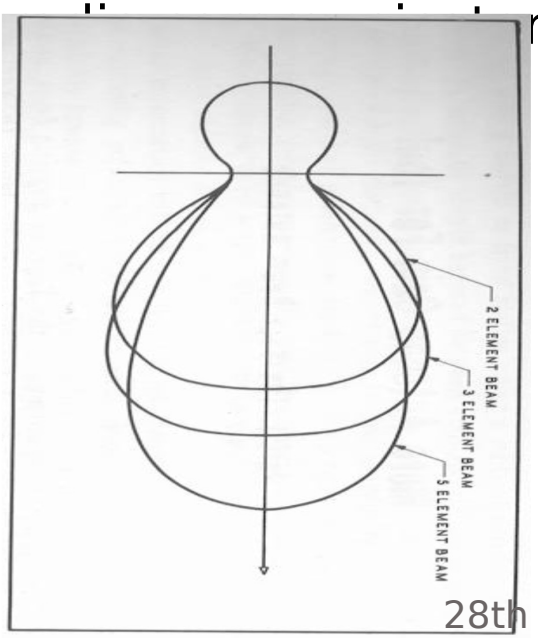


# 2. 5 element Yagi-Uda transmitter

- This is the plotted power pattern for 5 element Yagi-Uda transmitter and folded dipole receiver. Yagi- Uda is a directional antenna. It consists of 5 metal rods of different lengths. One of them is active element which actually radiates the signal while a longer element known as reflector reflects the emitted wavefront. There 3 smaller elements called directors which actually direct the wavefront. This gives the antenna high directionality. Used commonly by amateur [illegible]rs.

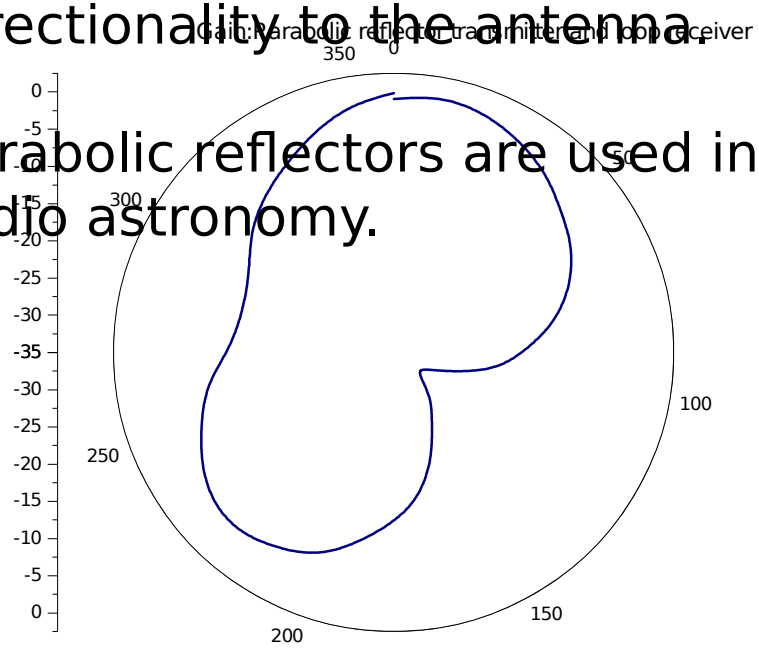


# 3. Simple dipole with parabolic reflector

This is the plotted power pattern for simple dipole transmitter with parabolic reflector and folded dipole receiver.

It has a simple dipole with the a cylindrical parabolic reflector. The parabolic reflector is cylindrical in shape and reflects the emitted wavefront and converts it into parallel wavefront so that the signal is transmitted over long distances with parallel waves. This gives higher directionality to the antenna.




Parabolic reflectors are used in satellite communication and radio astronomy.

# Sources of Error

We got some errors in our graphs. When we tried to find out the sources of this error, we found this-

1. Though we were standing at a distance from assembly, we could not isolate it completely because of our limitations. This evidently affected the readings as even at our slightest movements, we could see a deflection in the ammeter reading.
2. There were some immovable metal objects which must have reflected radio waves causing interference leading to error in the reading.

# Precautions

To avoid interference from all possible radio sources-

1. Keep all the metal objects away from the antennas as metals reflect radio frequencies.
2. Stand away from the assembly as human body also emits radio waves.
3. Perform the experiment in radio shielded room, if possible.
4. Keep the mobile phones and other electronic devices away from the assembly.

# Acknowledgements

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