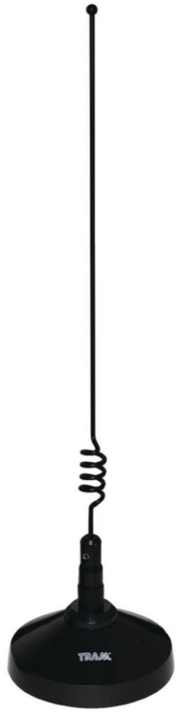
Technician License Course

Chapter 4

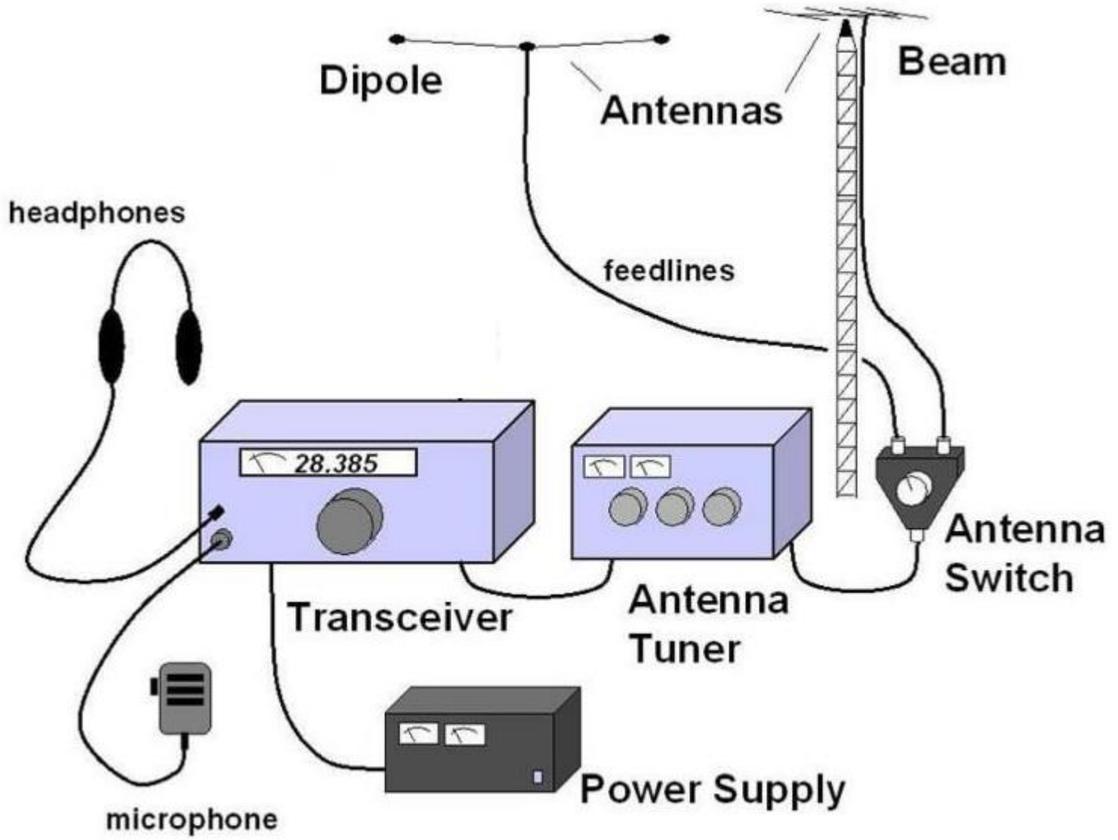
Section 4.2 Antenna & Radio Wave Basics

The Antenna System



The Antenna System

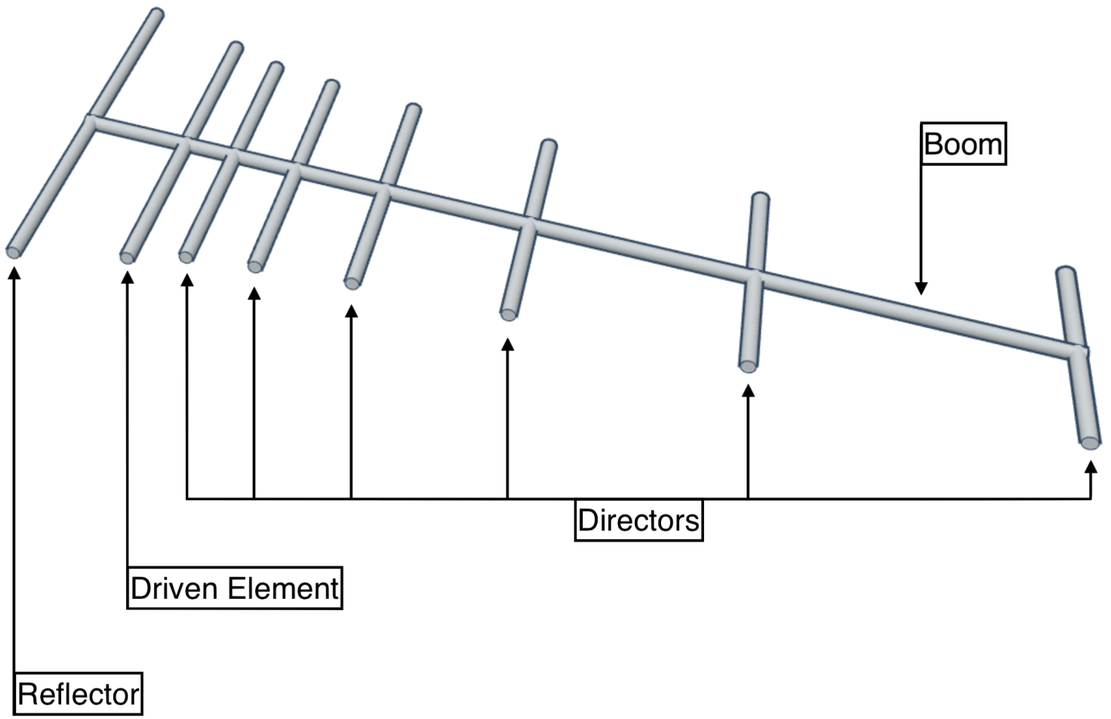
- **Antenna**
- **Feed line**
- **Connectors & Switches**
- **Test and matching equipment**
- **Transceiver**



The Antenna (Some Vocabulary)

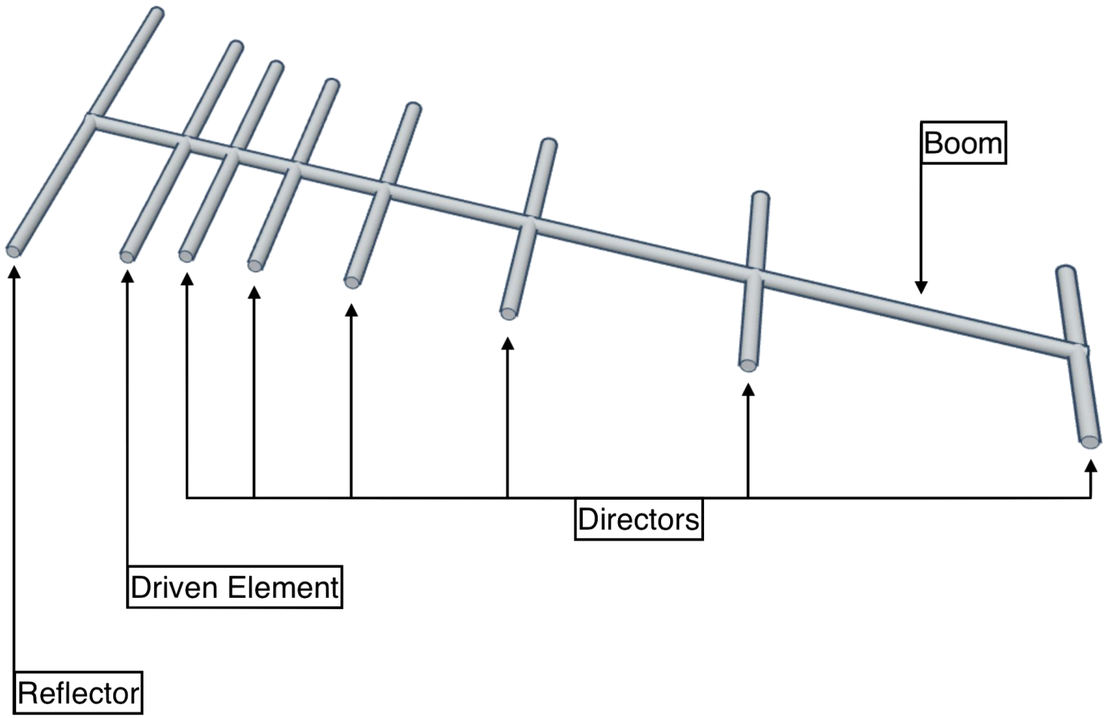
The Antenna (Some Vocabulary)

- **Element**: The conducting part or parts of an antenna designed to radiate or receive radio waves.
- **Array**: An antenna with more than one element.



The Antenna (Some Vocabulary)

- **Active element (driven)**: Elements that are connected to the feedline and emit electromagnet energy
- **Parasitic/Passive element**: Elements not connected directly to a feed line.



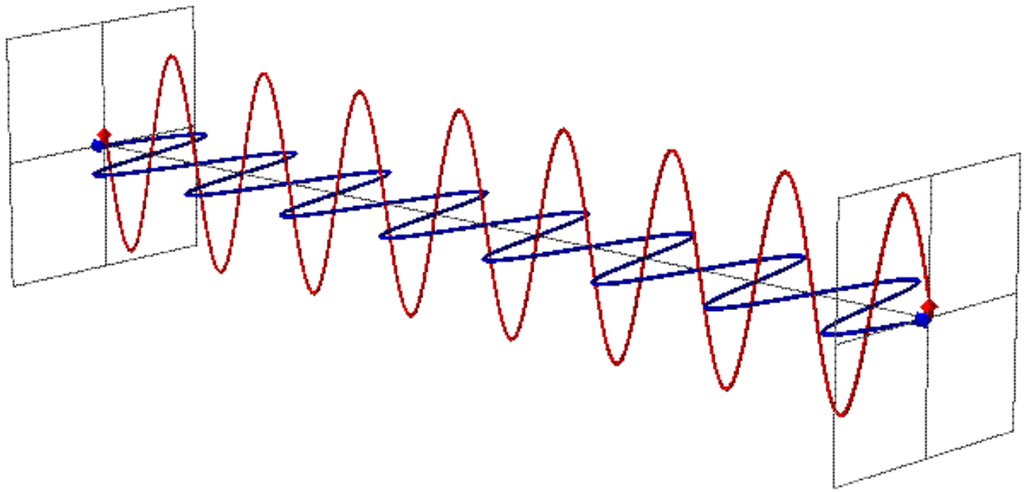
The Antenna (Some Vocabulary)

- **Resonant**: An antenna is resonant when its feed point impedance has zero reactance.
- **Feed point**: Where the transmitted energy enters the antenna.
- **Radiation**: An antenna radiates electromagnetic waves. *NOT* radioactivity!

Electromagnetic Waves

Electromagnetic Waves

- Radio waves are **electromagnetic** waves
  - Electric and magnetic fields at **right angles** to each other, oscillating at the wave's frequency



Wave Polarization

Wave Polarization

- Orientation of the wave's **electric** field component with respect to the surface of the Earth
  - *Vertical or horizontal* – determined by elements
  - Combinations of polarization are called *elliptical* or *circular* polarization
  - Refracted signals become elliptically polarized

Cross-Polarization

Cross-Polarization

- Antenna and wave polarization must match for maximum reception.
  - **Cross-polarized**: antenna elements and the wave's electric field at right angles
  - Can **reduce reception** by a factor of 100

- For elliptically polarized waves (such as HF sky-wave) any antenna will respond at least partially.

The Decibel (dB)

The Decibel (dB)

- A ratio expr ge numbers easier to w

  dB= 10 log
  dB = 20 lo
- Positive val
  Negative va
- Antenna ga

What you need to know

Power ratios:

3dB = double	-3dB = half
6dB = 4 times	-6dB = 1/4th
10dB = 10 times	-10dB = 1/10th

The Antenna (Some Vocabulary)

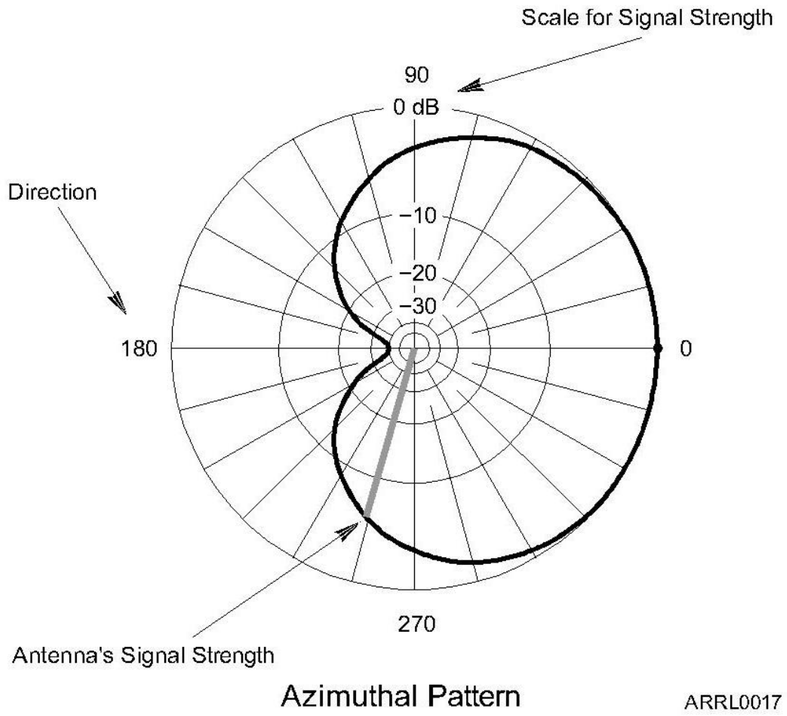
The Antenna (Some Vocabulary)

- **Gain:** Apparent increase in power in a particular direction by focusing radiation in that direction. Measured in decibels (dB).
- **Isotropic:** Equal radiation in all directions.
- **Omnidirectional:** No preferred horizontal direction.
- **Directional:** Antenna that focuses radiation in specific directions.

Antenna Radiation Patterns

Antenna Radiation Patterns

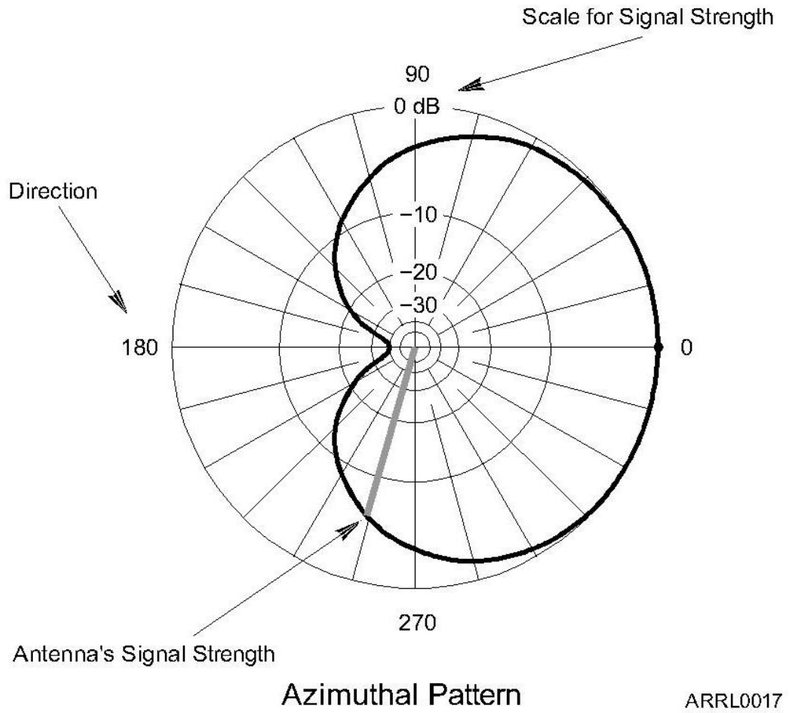
- Radiation patterns are a way of visualizing antenna performance.
- The further the line is from the cent of the graph, the stronger the signa at that point.
- Graph calibrated in dB.



Radiation Pattern Vocabulary

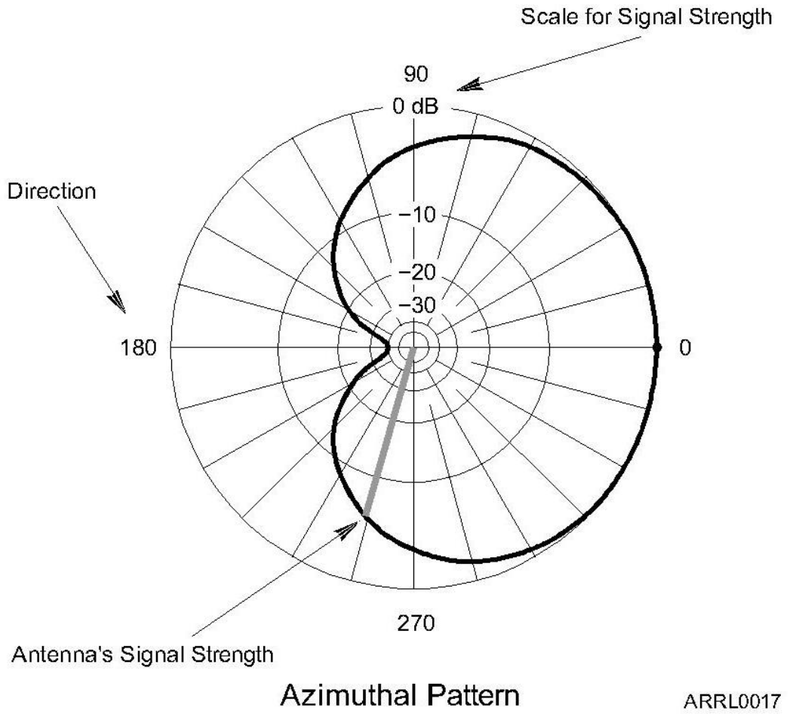
Radiation Pattern Vocabulary

- **Nulls:** Directions of minimum gain
- **Lobes:** Regions between nulls
- **Main lobe:** Lobe with highest gain
- **Side lobe**: Any lobe other than the main lobe
- **Forward gain:** Gain in the direction assigned as forward



Radiation Pattern Vocabulary

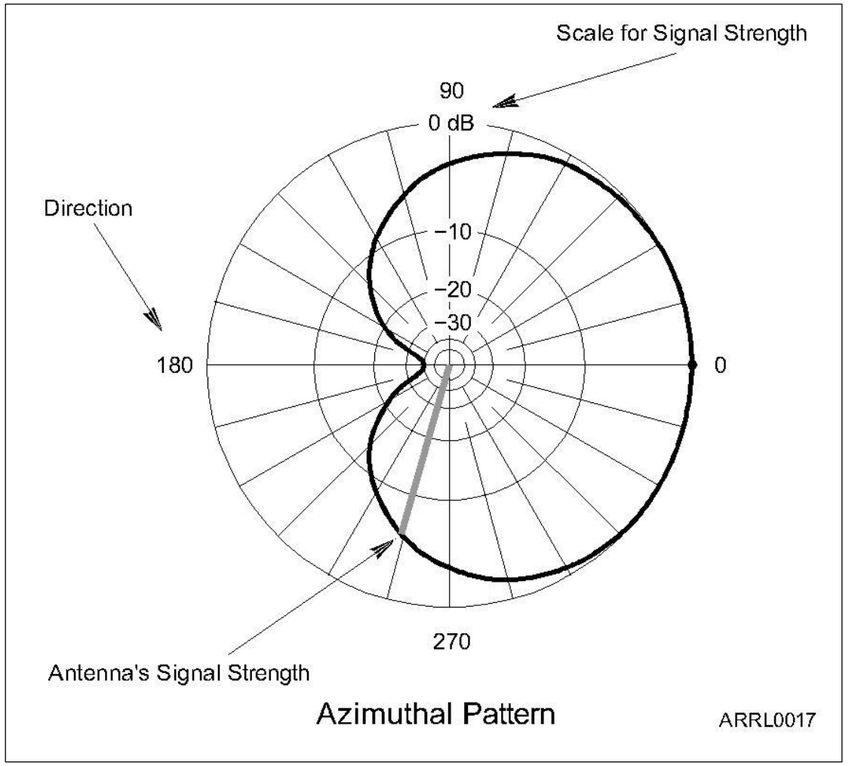
- **Front-to-back ratio**: Ratio of forward gain to gain in the opposite direction.
- **Front-to-side ratio**: Ratio of forward gain to gain at right angles to the forward direction.



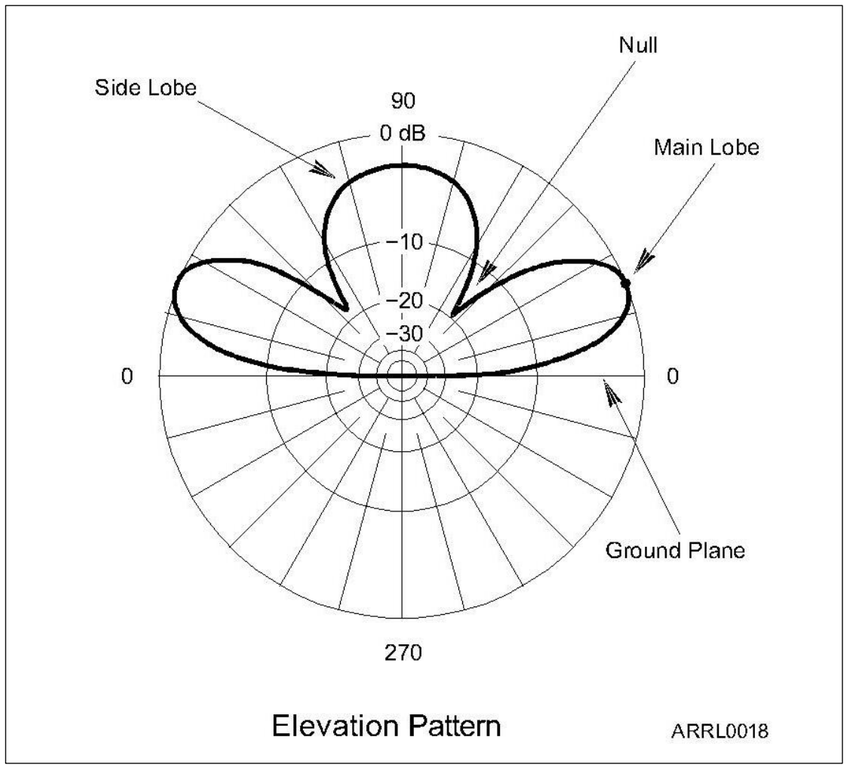
Radiation Pattern Vocabulary

- **Azimuth pattern**: Radiation pattern showing gain in all horizontal directions around the antenna.
- **Elevation pattern**: Radiation pattern showing gain at all vertical angles from the antenna.
  - Often restricted to angles above horizontal

Azimuth Pattern



Elevation Pattern



Any Questions?