

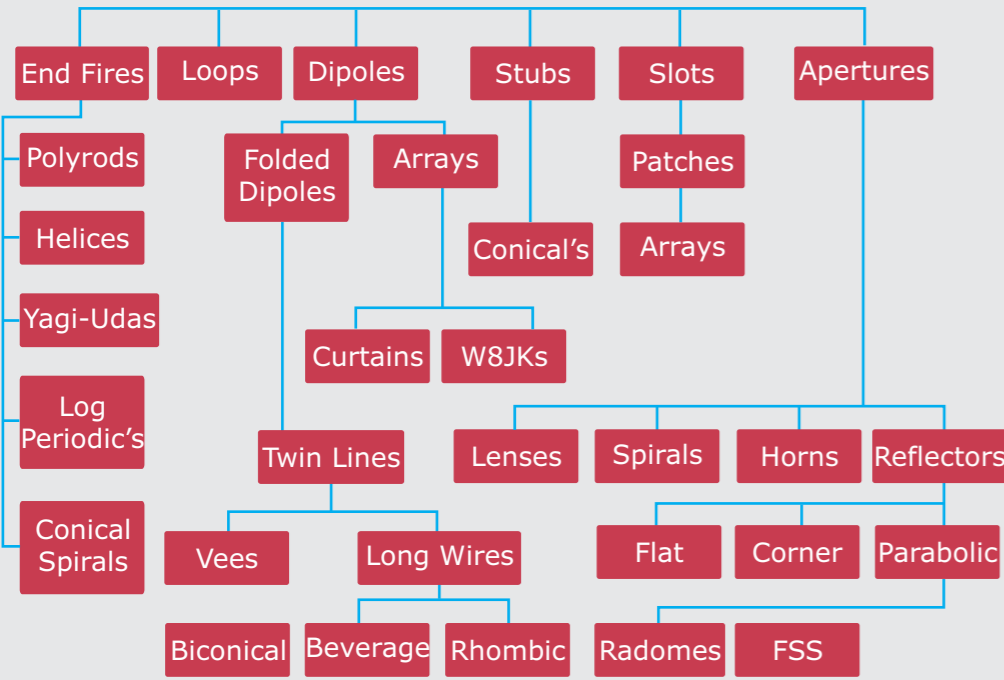
## What is Antenna ?

An antenna is a transducer that converts radio frequency electric current to electromagnetic waves that are then radiated into space.

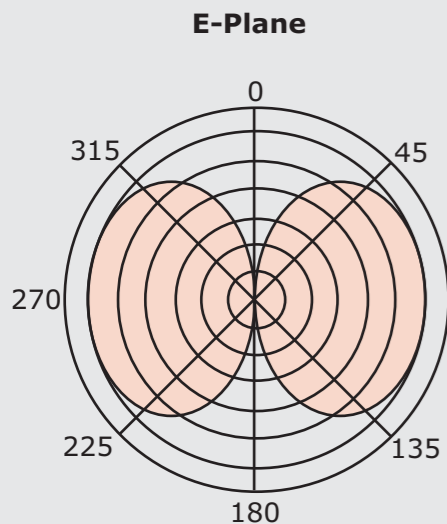
An arrangement of conductors designed to radiate (transmit) an electromagnetic field.

## Types of Antennas

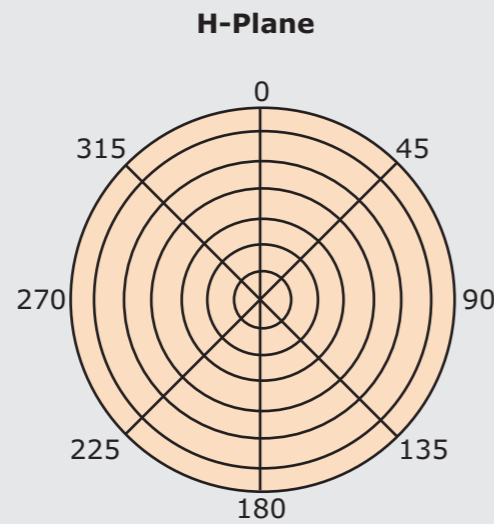
- 1) Omnidirectional (radiates equally in plane)
- 2) Directional (radiates more in one direction than other):



### Single Antennas (Single Feed)



### Arrays (Multiple Feed)



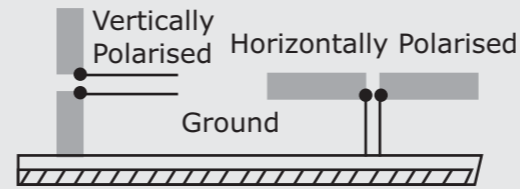
## Antenna Properties

**Reciprocity:** An antenna can receive and transmit equally.

**Polarization:** The orientation of the electric field (E-Plane) of the radio wave with respect to the Earth's Surface.

**Linear:** Radiates in one plane

**Circular:** Rotates making one complete revolution during one period of the wave, used in satellite communication.



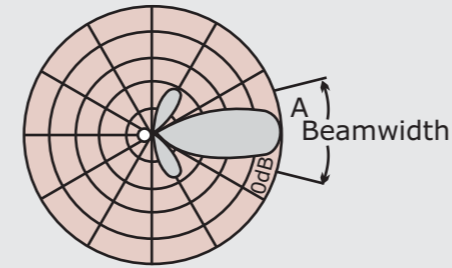
**Horizontal:** Used for long distance transmission e.g. TV

**Vertical:** used for short to medium waves e.g. Tower for A radio of the antenna on an automobile

**Gain:** The logarithm of the ratio of the intensity of an antenna's radiation pattern in the direction of strongest radiation to that of a reference antenna.

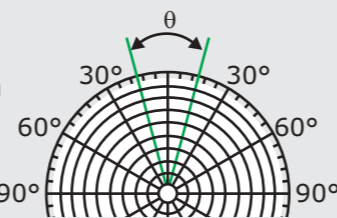
$G = \frac{\text{Maximum radiation intensity}}{\text{Maximum radiation intensity from a ref antenna (isotropic antenna) with same power input}}$

$$G = \frac{AA' \text{ dB}}{1}$$



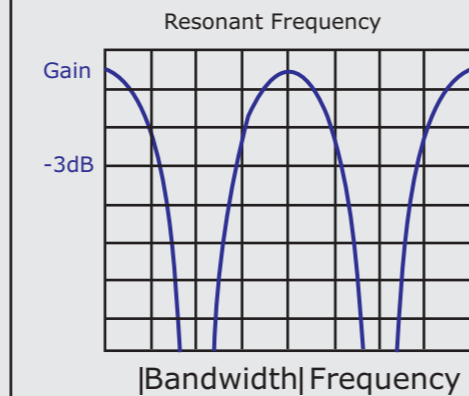
### Beam Width

Degree of concentration of antenna radiation



### Band width:

Range of frequency over which antenna is effective.

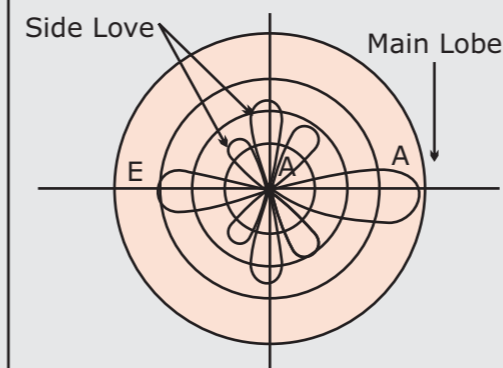


**Front to Back ratio:** The gain in direction of maximum gain, compared to the gain in a direction 180° from the specified direction. Usually expressed in dB.

$$\text{Front to back ratio} = \frac{AA' \text{ dB}}{1}$$

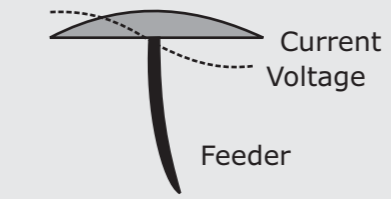
IF back lobe is present then, measure AE, where E is the maximum of back lobe.

$$\text{Then front to back ratio} = \frac{AA' \text{ dB}}{1}$$

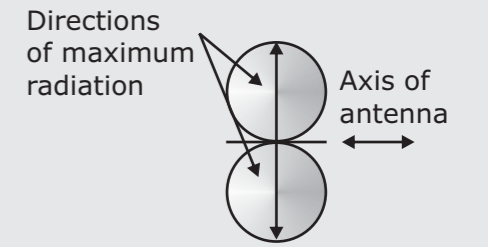


## Basic Models of Antenna

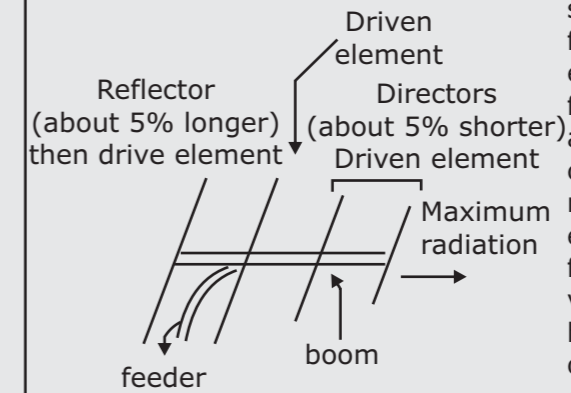
### Dipole Antenna



### Radiation Pattern



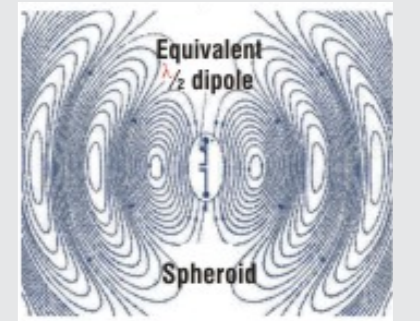
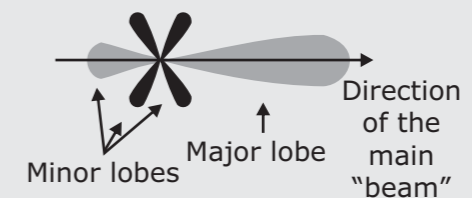
## Yagi UDA



A "director" is metallic conductive structure which reradiates into free space impinging electromagnetic radiation coming from or going to the active antenna. A "reflector" is a metallic conductive structure (e.g. Screen, rod or plate) which impinging electromagnetic radiation coming from or going to the active. The velocity of the returned wave having a component in a direction opposite to the direction of velocity of the impinging wave.

Electric field lines of the radiation moving out from /2 dipole antenna

## Radiation Pattern



The parameters of terminology of antennas illustrating their duality as a circuit device (with resistance and temperature) on one hand and a space device (with patterns, polarization, beam area, directivity, gain, aperture and radar cross-section) on the other. Other antenna qualities are its physical size and bandwidth (involving impedance, Q and pattern.)

Circuit Quantities	Physical Quantities	Space Quantities
Antenna impedance, $Z_A$	Size	* Field Patterns $\begin{cases} E_\phi(\theta, \phi) \\ E_\theta(\theta, \phi) \\ \phi(\theta, \phi) \end{cases}$
Radiation resistance, $R_T$	Weight	* Polarization, LP, CP, EP
Antenna temperature, $T_A$		* Beam area W
		* Gain, G
		* Power patterns, $P(\theta, \phi)$
		* Directivity, D
		* Effective aperture, A
		* Radar cross-section, $\sigma$



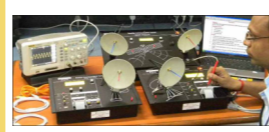
10006  
PC Based Motorised  
Antenna Trainer



10020  
Antenna Trainer



10020M  
Motorised Antenna Trainer



10203  
Satellite Communication  
Trainer



10204  
Radar Trainer



10212  
GPS Trainer



10944  
LED TV Trainer



10948  
Digital Satellite Receiver  
Trainer