# ANTENNA OVERVIEW

**dB Gain Reference points:**

1 dB = barely noticeable change
3 dB = 2 times the power
6 dB = 4 times the power
10 dB = 10 times the power
20 dB = 100 times the power

**To get the total gain or loss, add the dB numbers:**

23dB =20 +3 or 100X2=200 times the power

**Typical references:**

**dBm:** The reference is 1 milliwatt
**dBi:** The reference is an isotropic radiator in free space (i.e. Omni directional antenna)
**dBd:** The reference is a dipole in free space. Gain is approximately 2 dBi
**Front to back ratio:** This is the ratio of the power in the main lobe to the power in the opposite direction. (It may or may not include the side lobes in the back side)
Power into an Antenna

**The power applied to an antenna is either radiated as a signal or lost as heat**

Typical heat losses are in coils, antenna tuners, feed lines, traps, and resistance in short antennas.
Ground can be a major heat loss in vertical antenna systems

**Gain**

The only way to achieve gain from an antenna is by focusing the power

**Perfect Ground**

A perfect ground acts like a mirror
A perfect ground will add 3 to 6 dB gain to an antenna
The ground can be modeled by placing an identical antenna beneath the ground plane and fed 180 degrees out of phase.
The pattern is determined by the antenna height in wave lengths

**Real Ground**

Real ground has resistance that dissipates power due to the induced currents.
Real ground has a dielectric constant that slows the electric field. There are also dielectric losses
The best real ground is salt water
The worst ground is rocky mountain soil

**Pseudo Brewster Angle (**PBA)

PBA is generally not a significant factor for horizontal antennas
PBA is a major factor for vertical antennas
The dielectric constant slows the reflected electric field causing it to be out of phase with the main field. There are also significant dielectric losses
There are significant resistive losses due to induced currents

**Antenna Modeling**

4NEC2 is a free and very powerful software package
Use modeling to:
Understand what is happening in an antenna
Compare antennas
Optimize designs