

AMATEUR RADIO FACT SHEET / DISCUSSION POINTS

TOPIC: Antenna Efficiency Compared to Dipole

Purpose of Antenna

- transfer electrical energy into an electromagnetic field. The purpose of a
- receiving antenna is to capture as much energy from arriving electromagnetic fields
- antennas considered “reciprocal”

LOSSES: energy wasted rather than transferred in the desired direction.

APERTURE: “capture area” of the incoming electrical field converted to electrical energy.

Comparison Standards

- ◆ ISOTROPIC theoretical perfect spherical radiation, lossless and equal in all directions
- ◆ DIPOLE reference of a normal (usually half-wavelength long) two part wire antenna
 - slightly directional pattern stronger in the “broadside” direction by about 2 dB
 - null in the “end-on” direction.
- ◆ dBd refers to the gain (positive) or loss (negative) of the best output of an antenna as compared to a dipole.

DIRECTIONAL antennas

- ◆ “yagi”, “corner” and “parabolic” designs
- ◆ Concentrate response in one direction at the expense of others
- ◆ Typical gains may be from 6 dBd to 20 dBd and typical front-to-back ratios may be 20 dB or more

Antennas which have “lossy” elements such as tuning networks or transformers may appear to present a better “load” to a transmitter, but at the expense of dissipating energy as heat instead of radiating it as real transmitted signal. The same losses apply on received signals as well. There is a tradeoff here --- for ease of use one prefers to have a lower “standing wave ratio” (a measure of how accurately the antenna presents the desired impedance toward the transmitter) but if this occurs at the expense of very significant losses, the tradeoff may be unfavorable.

One tries to create a SYSTEM of tuning networks and antenna elements that creates an acceptable impedance for the transmitter (often a standing wave ratio of 2.5:1 or less) while minimizing heating losses in the system.

The efficiency of a resonant half-wave antenna is nearly 100%. The efficiency of some commercially manufactured antennas can be as low as 10% at some of their rated frequencies.