

Antenna Fundamentals

Electrical Engineering

Gain, directivity, beamwidth and polarisation, and how the four constrain each other.

An antenna trades a guided wave for a radiated one; gain describes how sharply it concentrates power.

HALF-WAVE DIPOLE
2.15 dBi

ISOTROPIC RADIATOR
0 dBi by definition

20 DBI ANTENNA
Beamwidth near 18°

- Gain is directivity reduced by efficiency
- Effective aperture and gain rise together
- Beamwidth narrows as gain increases
- Reciprocity: the pattern is the same either way
- Polarisation mismatch loses signal outright
- Wide bandwidth usually costs gain

LOOK FOR IT

A dish's gain rises with the square of its diameter and with the square of frequency.

dBi is referenced to an isotropic radiator, dBd to a half-wave dipole. They differ by 2.15 dB and are often quietly mixed up.