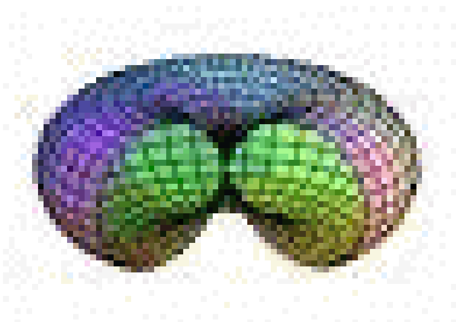
Isotropic Antenna

- The isotropic antenna is a hypothetical point source.

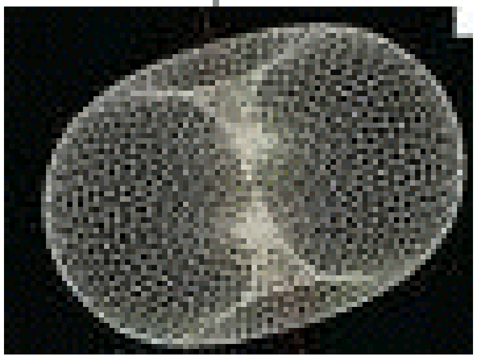
- It does not exist in reality but is considered as an important starting point considering different

- antennas from the theoretical to the practical

- The pattern is a Cardioid - a donut shape or a sphere

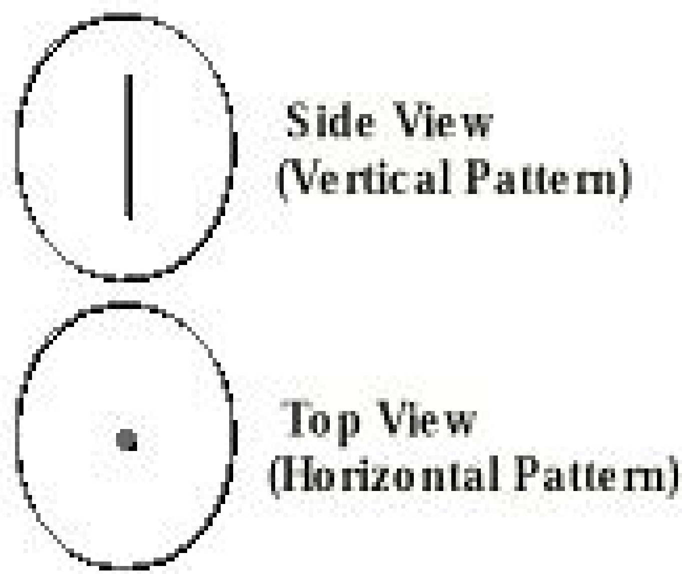


Dipole Radiation Pattern



Antenna Theory

- A theoretical antenna (Isotropic) has a perfect 360 degree vertical and horizontal beamwidth
- This is a reference for all antennas

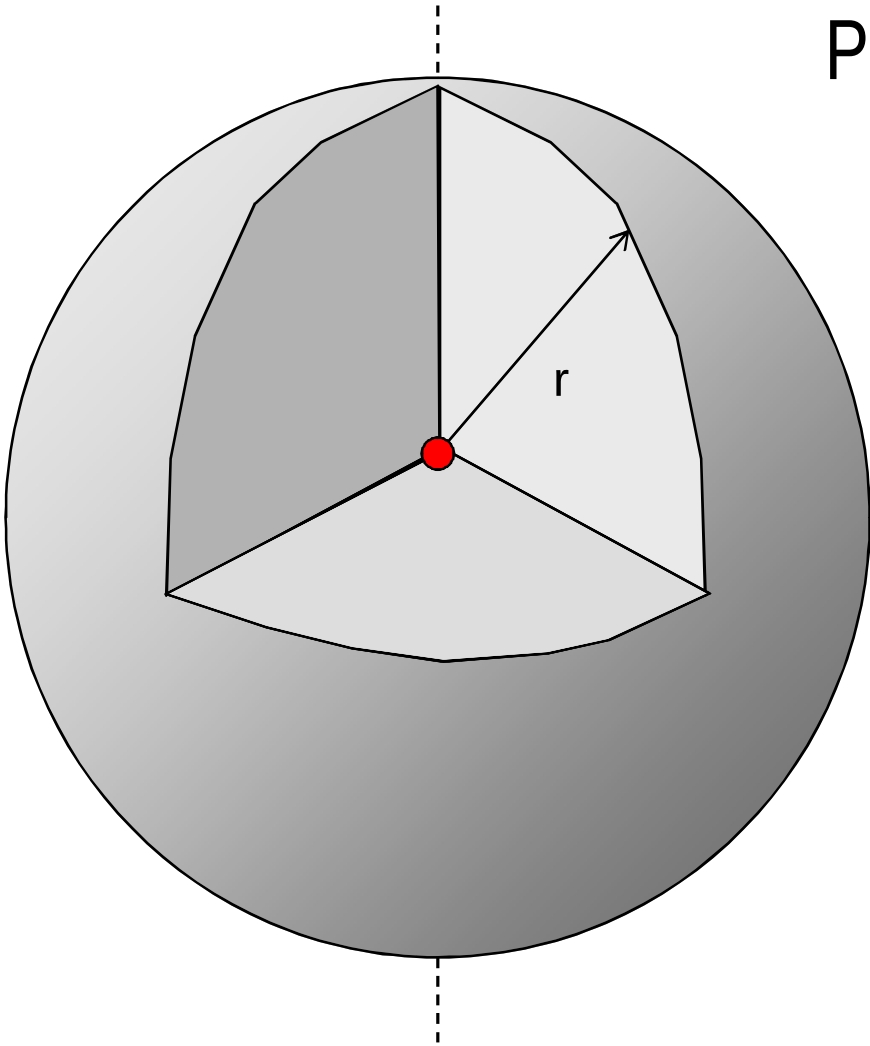


Isotropic Radiators

- An isotropic antenna is one which radiates equally in all directions.
- If the total power radiated by the isotropic antenna is *P* , then the power is spread over a sphere of radius *r* ,so that the power density *S* at this distance in any direction is given as:

$$S = \frac{P}{area} = \frac{P}{4\pi r^2}$$

PFD: Isotropic Radiator



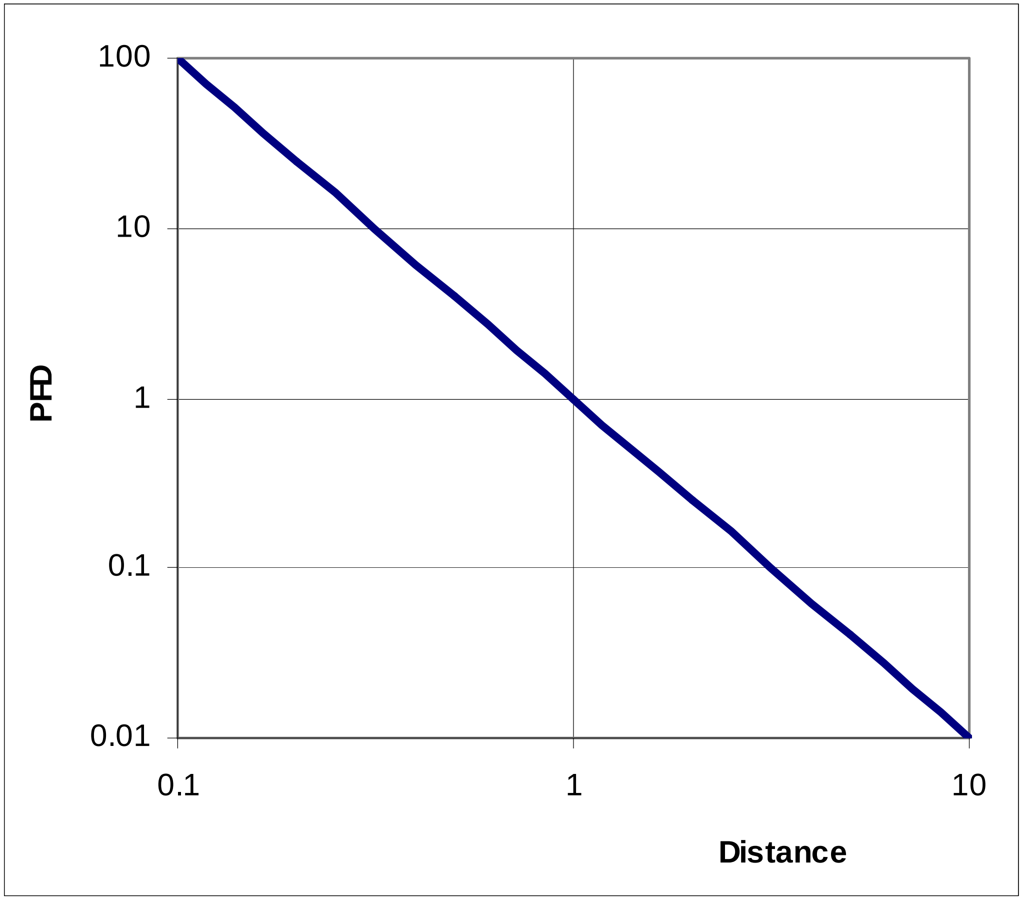
Power Flux Density (PFD)

$$PFD = \frac{P_T}{4\pi r^2}$$

Notes

- Loss-less propagation medium assumed
- Isotropic radiator cannot be physically realized
- PFD does not depend on frequency/ wavelength

PFD: Distance Dependence

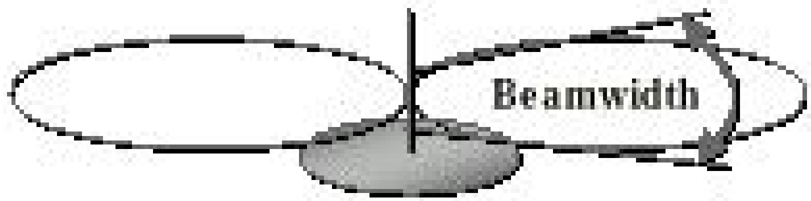


PFD: Real Antenna

- PFD produced by physically realizable antennas depends on
  - power and distance (as isotropic source)
  - horizontal direction angle (θ)
  - vertical direction angle (φ)

High Gain Omnidirectionals

- High gain omnidirectional antennas will create more coverage area in far distances, but the energy level directly below the antenna will become lower, and coverage here may be poor



Area of Poor Coverage Directly Under the Antenna

Half-wave Dipole (Hertz) Antenna

- An antenna having a physical length that is one-half wavelength of the applied frequency is called a ***Hertz antenna*** or a **half-wave dipole antenna.**
- Hertz antennas are not found at frequencies below **2MHz** because of the physical size needed of the antenna to represent a half-wave

The Antenna Formula

$$\lambda = c/f = \frac{186{,}000\ mi/sec}{frequency\ of\ the\ signal}$$

- *c is the speed of light*

λ is the wavelength of the signal

λ use 3 x 10^{8} *when dealing in meters for the speed of light*

The Antenna Formula - applied

- If a half-wave dipole antenna needed to be constructed for a 60 Hz signal, how large would it need to be?

$$\lambda = c/f = \frac{186{,}000\ mi/sec}{60} = 3100\ \mathrm{mi}$$

$$\lambda/2 = 1550\ \text{miles!}$$