

Wireless Fundamentals

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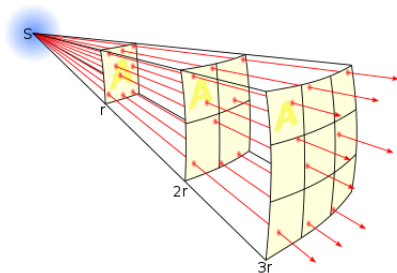
RF Fundamentals

- ▶ Wireless Signal Characteristics
- ▶ Antenna Design and Choice
- ▶ The Shannon-Hartley law
- ▶ System Gain
- ▶ Reflection and Refraction

Wireless Signal Characteristics

- ▶ Power vs distance
- ▶ Power vs Frequency
- ▶ Noise and interference

Power vs distance



The power of an electromagnetic signal reduces over distance.

$$P_d = \frac{1}{d^2} P_1, \quad (1)$$

Power vs Frequency

The atmosphere is not transparent. Some frequencies are absorbed more than others.

Higher frequencies are more likely to be absorbed.

This introduces additional loss.

This additional “gain” will be d^{-a} for some $a > 0$ (a gain less than 1 is really a loss).

Noise and interference

Supposing the noise has power level N , and the signal has power S . The formula of Hartley and Shannon gives the maximum capacity, C , as:

$$C \leq B \log_2(1 + S/N).$$

where B is the bandwidth, in Hz.

Antenna Design and Choice

The Shannon-Hartley law

System Gain

Reflection and Refraction