Antennas, Fields and Transmission

Path Loss (Friis equation)	$\frac{P_r}{P_t} = G_t \cdot G_r \cdot \left(\frac{\lambda}{4\pi d}\right)^2$
Radiation intensity [W/m²]	$S = G_t \cdot \frac{P_t}{4\pi d^2} = \frac{E^2}{Z_0}$
Electric Field strength at distance d from TX antenna	$E = \sqrt{\frac{P_t \cdot G_t \cdot Z_0}{4\pi \cdot d^2}}$
Electric Field vs received power	$E = \sqrt{\frac{P_r \cdot 4\pi \cdot Z_0}{G_r \cdot \lambda^2}}$
Superposition of N electromagnetic waves	Power density: $S_{total} = S_1 + S_2 + \cdots + S_N$ E-Field: $E_{total} = \sqrt{E_1^2 + E_2^2 + \cdots + E_N^2}$
Antenna Efficiency	$\eta = \frac{total\ radiated\ power}{input\ power}$
Antenna directivity	$D = \frac{maximum\ \ S}{average\ \ S}$
Antenna gain	$G = \frac{maximum\ \ S}{equivalent\ isotropic\ \ S} = \eta \cdot D$
Free-space wave impedance	$Z_0 \cong 377\ \Omega$
Speed of light (vacuum)	$c = 299'792'458\ m/s$

P_t: Transmitted power

P_r: Received power

λ: free-space wavelength

G_t: Gain of transmitting antenna

G_r: Gain of receiving antenna

d: Distance between the antennas