

2-1. Under the free-space path-loss model, find the transmit power required to obtain a received power of 1 dBm for a wireless system with isotropic antennas ($G_t = 1$) and a carrier frequency $f = 5$ GHz, assuming a distance $d = 10$ m. Repeat for $d = 100$ m.

$$\lambda = \frac{c}{f_c} = \frac{3 \times 10^8}{5 \times 10^9} = 0.06 \text{ m} \quad P_r = 1 \text{ dBm} \quad G_t = 1 \quad d = 10 \text{ m}$$
$$= 10^{-6} \text{ mW}$$

$$\therefore P_t = P_r \left[\frac{4\pi d}{\sqrt{G_r} \lambda} \right]^2 = 5.53 \times 10^6 \text{ mW}$$

$$\text{when } d = 100 \text{ m. } P_t' = 5.53 \times 10^8 \text{ mW}$$