

Exercise 2

Task 1. Assume that the transmitted power of an isotropic radiator is 5 kW and the operating frequency is $f = 2.5$ GHz.

- (a) What is the power density at the receiver 10 km away?
- (b) If the receiver antenna is isotropic, what is the total received power?
- (c) What is the transmission loss?

Task 2. Derive the formula for the transmission loss in free space:

$$L_{\text{dB}} = 32.4 + 20 \log_{10} d_{\text{km}} + 20 \log_{10} f_{\text{MHz}}$$

Task 3. Considering a line-of-sight wireless communication link:

- (a) Calculate the free space loss at 30 km distance when operating at 7.5 GHz
- (b) Double the original frequency and re-calculate the free space loss
- (c) Halve the original distance and re-calculate the free space loss

Task 4. A satellite communication system employs large parabolic dish antennas with 20 m diameter and 60% efficiency to receive a signal at 4 GHz. What is the dB gain of such dish?