

Homework 1
CS356R: Introduction to Wireless Networks (Spring 2026)
Assigned: Jan. 14, 2026
Due: Jan. 26, 2026

Please show the intermediate steps, not just the final answers.

1. Convert 10 W (i) into dBm, and (ii) into dBW. Convert 0.01 mW to (i) dBm, and (ii) into dBW (5 points each).

2. Suppose a transmitter produces 1 mW power, what's the received power (in dBm) at distance 100 meters away from the transmitter under free-space propagation model? What's the received power under two-ray ground reflection model? (Both transmitter and receiver antenna gain is 1, the transmitter's height is 10m and the receiver's height is 1m. Carrier frequency is 2.4 GHz.) (30 points)

3. What's the minimum signal-to-noise ratio in order to reliably support 20 Mbps using a channel spanning from 5 GHz to 5.05 GHz? What is the minimum received signal strength if the background noise is -100 dBm? (26 points)

4. You are designing two wireless systems:
 1. A high-throughput Wi-Fi link
 2. A satellite communication system
 - (a) Choose one digital modulation scheme for each system.
 - (b) Justify your choice.
 - (c) Give one advantage and one disadvantage of each scheme.

5. Suppose a nearby microwave device produces strong narrowband interference at an unknown frequency that overlaps with your operating band. [12 points]
 - (a) Propose two different strategies support reliable communication despite this interference.
 - (b) Which strategy would you choose for an IoT device? Why?