

CARLETON UNIVERSITY

Department of Systems and Computer Engineering

SYSC 4700 Telecommunications Engineering Winter 2008

Assignment 2

Posting date: Thursday, February 7, 2008

Due date: 12:00 noon, Wednesday, February 13, 2008 (in box outside ME 4438)

Late submission: no late submissions are allowed

The assignment solutions will be posted at 1:00 pm on Feb 13

Question 1 [20 marks] Link Budget

You are supposed to find the minimum required transmit power, P_t (dBW), in a mobile communication system through link budget analysis.

The path-loss is worse than that in free-space propagation due to the attenuation caused by objects:

- Path-loss (in linear scale): $PL = (4\pi f/c)^2 d^{3.5}$, where $c=3 \times 10^8$ m/sec.

From the temperature ($T=290^\circ\text{K}$) and the noise figure ($F=6$ dB), the noise power can be calculated:

- Noise power (in dBW): $P_n = -228.6 + 10 \log_{10} T[^\circ\text{K}] + 10 \log_{10} B[\text{Hz}] + F$.

The total antenna gain of transmitter and receiver is 25 dB. For satisfactory performance, the minimum required signal-to-noise ratio at the receiver is 10 dB. The carrier frequency is $f=2$ GHz, and the transmission bandwidth is 5 MHz.

- (a) Sketch a graph of the required transmitter power in dBW as a function of distance between the transmitter and receiver from 0.1 km. to 10 km. (Plot distance on a logarithmic scale; that is, put the ticks of your horizontal axis at 0.1 km, 1 km, and 10 km.)
- (b) Discuss the advantages and disadvantages of using a carrier frequency of 700 MHz, instead of 2 GHz, for the radio transmission of this type of signal in the context of providing coverage.