UNIVERSITY OF TEXAS AT DALLAS
Department of Electrical Engineering

EE/TE 4367 - Telecommunications Switching & Transmission
Assignment #8

Date assigned: 4/10/2008
Date due: 4/17/2008

8.1 For BPSK signaling over an AWGN channel in which the two binary signals are transmitted with equal likelihood, the probability of bit error is given by

$$P_b = Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$$

where E_b is the signal bit energy and $N_0/2$ is the two-sided noise PSD. Suppose that the ratio E_b/N_0 is 10 dB.

(a) Calculate the probability of bit error for BPSK signaling in the AWGN channel.

(b) Suppose $N_0/2 = 0.5\times10^{-10}$ watts/Hz, $E_b/N_0 = 10$ dB, and the data rate is $R_b = 100$ kbps. Calculate the amplitude of the low-pass rectangular envelope. (Hint: $A^2 = E_b/T_b$)

8.2 Determine the system gain of a 10-Mbps, 2-GHz digital microwave repeater using 4 - PSK modulation and an output power of 2.5 W. Assume the excess bandwidth of the receiver is 30% and that other departures from ideal performance amount to 3 dB degradation. Assume a noise figure of 7 dB for the receiver, and the desired maximum error rate is 10^{-6}. Also determine the fade margin assuming antenna gains of 30 dB each and a path length of 50 km. The branching and coupling losses are 5 dB. (Hint: $P_b = Q\left(\frac{\sqrt{2E_b}}{N_0}\right)$ for 4-PSK signals)

8.3 If the received power at a distance of 2 km is equal to 2 μW , find the received powers at 3 km, 6 km, and 15 km for a path loss exponent γ of 3.8.