KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
Department of Electrical Engineering

EE577 Wireless and Personal Communications

Homework Assignment #4   Due Date: May 23, 2006

Question 1

(a) Explain how more than one independently fading channels can be created for a receiver housed in a vehicle traveling at a speed of 80 km/hr and receiving signals at 930 MHz.

(b) In time diversity, a signal is transmitted with a certain delay over which the channel is assumed to have changed sufficiently to create two uncorrelated copies of the signal. Find time delays between transmissions for vehicular speeds of 100, 60, 30 and 0 km/hr. Assume operating frequency of 890 MHz. (Hint: use time correlation of the signal envelope.)

(c) State the condition under which time diversity does not work.

Question 2

(a) In a 4-branch selection diversity, the mean signal to noise in each branch is randomly varying with a uniform distribution over 6 dB. Derive an expression for the outage probability.

(b) How the diversity gain obtained in (a) differs from that when the envelope fading is characterized by Rayleigh distribution.

(c) Draw conclusions on the diversity gain from the results obtained in parts (a) and (b).

Question 3

(a) The probability of fading 10 dB below the mean signal to noise ratio of a Rayleigh faded signal has been found to be 0.12. Determine the mean SNR in dB relative to the threshold.

(b) What will be the probability of signal fading to 10 dB below the mean SNR when a two branch selection diversity is used?

(c) Repeat (b) when the cross-correlation coefficient between the branch signals is 0.6.

Question 4

Consider a single branch Rayleigh faded signal has a 15% chance of being faded 10dB below some mean SNR threshold.

(a) Determine the mean SNR in dB of the Rayleigh faded signal as reference to the SNR threshold.

(b) Find the probability that a two branch selection diversity receiver will be 10 dB below the mean SNR threshold.

(c) Find the probability that a four branch equal gain combining diversity receiver will be 10 dB below the mean SNR threshold.

(d) Compare the results in (a,b,c) with MRC diversity.