King Fahd University of Petroleum and Minerals
Department of Electrical Engineering

EE577 Wireless and Personal Communications

Homework Assignment #2   Due Date: April 10, 2006

Problem 1: (Assigned to 201705, 250543, 250153)

(a) Show that a channel whose magnitude response is uniform but the phase response is not linear produces ISI.

(b) Show that the channel impulse response is given by

$$H(f) = (1 + \cos 2\pi fT)e^{-j\sin\pi(f/T)} \tag{1}$$

Problem 2: (Assigned to 213415, 250545, 250317)

(a) Define mean excess delay, rms delay spread, and maximum excess delay of a mobile radio channel.

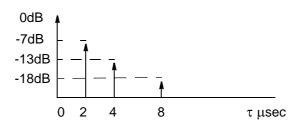(b) A power delay profile is shown in Figure P-2. Determine the channel parameters as defined in (a).

      Figure P-2   **Channel power delay profile**

Problem 3: (Assigned to 240128, 250567, 250321)

The power delay profile shown in Figure P-2 is obtained after averaging 1000 profiles. All four paths have been shown to fade with exponential distribution with the path averages shown. Determine the probability that all four paths have powers within 1 dB.

Problem 4: (Assigned to 250153, 201705, 250543)

During its travel from a sub-urban area towards the city core over a distance of 3 km. The measured channel delay spread changes linearly over this distance from 2.1 μseconds to 6.7 μseconds. How does the coherence bandwidth and supportable data rate changes over this distance?

Problem 5: (Assigned to 250317, 213415, 250545)

The envelope of *E* field at a frequency of 834 MHz is received by a mobile unit travelling at 47 km/hr. Assume that the reception threshold of receiver is set at -13 dB relative to the envelope rms power. (a) Find relative frequency of error bursts. (b) Estimate the average length of error free packet. (c) Repeat (a) if the mobile speed has changed to 100 Km/hr. (d) Estimate the length of the packet when a better receiver with a reception threshold of - 20 dB relative to rms is used.

Problem 6: (Assigned to 250321, 240128, 250567)

The envelope of an *E* field signal at a frequency of 870 MHz is received by a mobile unit travelling at 70 Km/hr. The mean signal strength at the receiver is measured to be -9 dBm. If the envelope of the fading signal is Rayleigh distributed, find the average fade duration and cross rates for threshold level of -13 dBm.