KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
Department of Electrical Engineering

EE577 Wireless and Personal Communications

Homework Assignment #3   Due Date: April 29, 2006

Question 1

A digital cellular system uses TDMA multiple access method. The frame consists of 6 time slots each having 324 bits and within each time slot there are 6 guard bits, 6 bits reserved for ramp-up, 28 synchronization bits, 12 control channel bits, 12 bits for supervisory control signals, and 260 data bits. Determine the frame efficiency.

Question 2

In a proposed TDMA cellular system, the one-way bandwidth of the system is 40 MHz. The channel spacing is 25 KHz, and out of total of 1600 channels, 30 channels are reserved for paging and access. The frame duration is 40 msec divided equally into 5 time slots. The system has an individual user data rate of 16.2 kbits/sec in which the speech with error protection has a rate of 11.6 kbits/sec. Calculate the efficiency of the TDMA system.

Question 3

(a) At a certain time there were 54 active users sharing a CDMA channel. Each user has a processing gain of 511. Find the probability of error when the modulation is BPSK. What assumptions have you made in determining your result?

(b) When the number of users in a busy hour increases to 67, what is the impact on the error probability.

(c) If the minimum acceptable signal to noise ratio at the detector is 6 dB, determine how many users can be accommodated by the system?

(d) If the processing gain is increased to 1023, how many additional users can be accommodated?

Question 4

(a) What is the required average received signal to noise ratio for a QPSK modem operating over a flat fading radio channel to have an outage rate of 10^{-2} relative to the threshold error rate of 10^{-4}?

(b) If we reduce the acceptable threshold level in part (a) to 10^{-2}, what improvement in the outage rate would we see?

(c) If we increase the transmitted power in part (a) four times, how much improvement would be seen in the outage rate?

(d) If we operate the modem over a fixed wireline channel, what would be the required signal to noise ratio to maintain an error rate of 10^{-2}? How much improvement in the error rate would occur if we increase the power by 6 dB?