

EE 6950 – Homework #1
Assigned: 09/22/03; Due: 09/29/03 before class
Email or hard copy to TA: sbe2001@columbia.edu

1. If a transmitter produces 40W of power, express the transmit power in units of (a) dBm and (b) dbW. If 40W is applied to a 900MHz system with unity gain in the transmitter and receiver antennae, find the received power in dBm at a free space distance of (a) 100m and (b) 10Km. (20pts)

2. If 20MHz of total spectrum is allocated for a duplex wireless system and each simplex channel uses 25KHz RF bandwidth, what is the total number of duplex channels? If the provider decides that a minimum signal to interference ratio of 16dB is necessary for adequate voice quality, what is the number of duplex channels available per each cell? Assume a path loss exponent of 3.8 and nearest six equidistant co-channel cells interfere. (10 pts)

3. Consider the following system: system bandwidth of 1.2 MHz, carrier frequency of 15 KHz. Each carrier can support 3 simplex voice channels using TDMA. If the frequency re-use factor in the network is 4, and the network covers 1,000 square miles, determine the blocking probability on the air interface for cell sizes of 1 sq. mile, 5 sq. miles, 10 sq. miles assuming users make/receive a combined 3 calls/hour, calls last an average of 2.5 minutes, and there are 20 users/sq. mile. If the operator does not want the blocking probability on the air interface to exceed 1%, what is the maximum number of users the network can support for cell sizes of 1 sq. mile, 5 sq. miles, and 10 sq. miles? (50pts)

4. Consider a GSM system in which there are 8 carriers making up a logical cell. On each carrier, 1 channel is dedicated for CCCH, i.e., one uplink RACH and one set of downlink channels. Using the time slot structure covered in the notes, and assuming an additional 25% overhead for channel coding (forward error correction, etc.), what is the effective bandwidth of each control channel (FCCH, SCH, BCCH, PAGCH, RACH) in Kbps. (20 pts)