WIRELESS COMMUNICATION (WLC-234)

Assignment 2

Submission Deadline: 1st September 2025

1) If 0 dBm is equal to 1 mW (10^{-3} W) over a 50 n load; express 10 W in units of dBm.
2) A total of 24 MHz of bandwidth is allocated to a particular FDD cellular telephone system that uses two 30kHz simplex channels to provide full duplex voice and control channels. Assume each cell phone user generates 0.1 Erlangs of traffic. Assume Erlang B is used.
    a) Find the number of channels in each cell for a four-cell reuse system.
    b) If each cell is to offer capacity that is 90% of perfect scheduling, find the maximum number of users that can be supported per cell where omnidirectional antennas are used at each base station.
    c) What is the blocking probability of the system in (b) when the maximum number of users are available in the user pool?
    d) If each new cell now uses 120° sectoring instead of omnidirectional for each base station, what is the new total number of users that can be supported per cell for the same blocking probability as in (c)?
    e) If each cell covers five square kilometers, then how many subscribers could be supported in an urban market that is 50 km x 50 km for the case of omnidirectional base station antennas?
    f) If each cell covers five square kilometers, then how many subscribers could be supported in an urban market that is 50 km x 50 km for the case of 120° sectored antennas?
3) If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 kHz RF bandwidth, find: (a) the number of duplex channels. (b) the total number of channels per cell site, if N = 4 cell reuse is used.
4) A certain area is covered by a cellular radio system with 84 cells and a cluster size N. 300 voice channels are available for the system. Users are uniformly distributed over the area covered by the cellular system, and the offered traffic per user is 0.04 Erlang. Assume that blocked calls are cleared and the designated blocking probability is P_b= 1%.
    a) Determine the maximum carried traffic per cell if cluster size N = 4 is used. Repeat for cluster sizes N = 7 and 12.
    b) Determine the maximum number of users that can be served by the system for a blocking probability of 1% and cluster size N = 4. Repeat for cluster sizes N = 7 and 12.
5) The GSM TDMA system uses a 270.833 kbps data rate to support eight users per frame.
    a) What is the raw data rate provided for each user?
    b) If guard time, ramp-up time, and synchronization bits occupy 10.1 kbps, determine the traffic efficiency for each user.

6) Consider a cellular network with 12 cells arranged in a hexagonal pattern .Each cell needs to be assigned a frequency channel to support communication for mobile devices. The available frequency channels are numbered from 1 to 20.
    a) Determine the total number of channels available.
    b) Assign the channel using channel assignment strategies.
7) Features collectively make DECT a reliable and versatile wireless communication solution, well-suited for both residential and business environments. Emphasize on features, frequency of DECT.
8) Assume a system of 32 cells with a cell radius of 1.6 km, a total of 32 cells, a total frequency bandwidth that supports 336 traffic channels and a reuse factor of N = 7. If there are 32 total cells, what geographic area is covered, how many channels are there per cell, and what is the total number of concurrent calls that can be handled?
9) ISDN has been more widely accepted as a network solution, there are various types of ISDN; clarify it, include speed, uses.
10) Consider GSM which is a TDMA/FDD system that uses 20MHZ for the forward link, which is broken into radio channels of 20KHZ. If 6 speech channels are supported on a single radio channel, and if no guard band is assumed. Find the number of simultaneous users that can accommodate in GSM.
11) Describe the key features and functions of Signaling System No. 7 (SS7) in telecommunications networks. Explain how SS7 facilitates call setup, routing, and termination processes. Discuss the advantages of using SS7 in comparison to in-band signaling techniques.
12) On average, there are 1800 new calls in an hour, and the average holding time is 3 minutes. Calculate the traffic intensity.
13) If a particular FDD cellular telephone system has a total bandwidth of 33 MHz, and if the phone system uses two 25 KHz simplex channels to provide full duplex voice and control channels. Compute the number of channels per cell if N = 4, 7, 12.
14) The US Digital Cellular TDMA system uses a 48.6 kbps data rate to support three users per frame. Each user occupies two of the six time slots per frame. What is the raw data rate provided for each user?