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1. A spectrum of 30 MHz is allocated to a wireless FDD cellular system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses

   (a) 4-cell reuse, (b) 7-cell reuse (c) 12-cell reuse.

   If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems.

2. For given path loss exponent (a) n=4 and (b) n=3,
   Find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal to interference ratio of 15 dB is minimum required for satisfactory forward channel performance of a cellular system. There are six co-channels cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations.

3. How many users can be supported for 0.5% blocking probability for the following number of trunked channels in a blocked calls cleared system?

   (a) 1, (b) 5, (c) 10, (d) 20, (e) 100.

   Assume each user generates 0.1 erlangs of traffic.

4. An urban area has a population of two million residents. Three competing trunked mobile networks (systems A, B, and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each, and system C has 49 cells, each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages two calls per hour at an average call duration of three minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider.

5. Find the Fraunhofer distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz if antennas have unity gain, calculate the path loss.

6. In the U.S digital cellular system if Fc = 900 MHz and the mobile velocity is 70 km/hr., calculate the received carrier frequency if the mobile
   a) directly toward the transmitter,
   b) directly away from the transmitter,
   c) in a direction perpendicular to the direction of the arrival of the transmitted signal.

7. An urban RF radio channels are modelled on SIRCIM and SMRCIM statistical channel models with excess delays as large as 150μs and microcellular channels with excess delays no larger than 4μs. If the multiple path bin is selected at 70, calculate (a) ΔT and (b) the maximum bandwidth which two models can accurately represent. And (c) if the indoor

channel model with excess delays as large as 500 ns exists, calculate the values of (a) and (b).

8. A zero mean sinusoidal message is applied to a transmitter that radiates an AM signal with 400KW power. Compute the carrier power if the signal is modulated on a depth of 0.75.
    a) What percentage of the total power is in the carrier?
    b) Calculate the power in each sideband?
    c) What will be the total power saving if the carrier and one of the sidebands are now suppressed?

9. A sinusoidal modulating signal, m (t) = 8cos (2pi4*103 t +10) is applied to a modulator that has a frequency deviation constant gain of 10 kHz/V. Compute-
    a) The peak frequency deviation.
    b) The modulation index.
    c) The phase modulation index.

10. If GSM uses a frame structure where each frame consists of eight time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find
    a) The time duration of a bit,
    b) The time duration of a slot,
    c) The time duration of a frame, and
    d) How long must a user occupying a single time slot wait between two successive transmissions.

11. A normal GSM has 3 start bits, 3 stop bits, 26 training bits for allowing adaptive equalization, 8.25 guard bits, and 2 bursts of 58 bits of encrypted data which is transmitted at 270.833 kbps in the channel. Find
    a) Number of overhead bits per frame, b_{oh};
    b) Total number of bits/frame;
    c) Frame rate;
    d) Time duration of a slot;
    e) Frame efficiency.