

Problem 1: If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone 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.

Problem 2: If a signal to interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is (a) $n = 4$, (b) $n = 3$? Assume that there are 6 co-channels cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations.

Problem 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.

Problem 4: An urban area has a population of 2 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 2 calls per hour at an average call duration of 3 minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider.

Problem 5: Find the far-field distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz. Also Calculate path loss.

Problem 6: Consider a transmitter which radiates a sinusoidal carrier frequency of 900 MHz. For a vehicle moving 70 km/h, compute the received carrier frequency if the mobile is moving (a) directly towards the transmitter, (b) directly away from the transmitter, (c) in a direction which is perpendicular to the direction of arrival of the transmitted signal.

Problem 7: Assume a discrete channel impulse response is used to model urban radio channels with excess delays as large as 150 μs and microcellular channels with excess delays no larger than 4 μs . If the number of multipath bins is fixed at 70, find (a) Δt , and (b) the maximum bandwidth which the two models can accurately represent. Repeat the exercise for an indoor channel model with excess delays as large as 500 ns. As described in section 4.7.6, SIRCIM and SMRCIM are statistical channel models based on equation (4.12) that use parameters in this example.

Problem 8: A zero mean sinusoidal message is applied to a transmitter that radiates an AM signal with 400 kW power. Compute the carrier power if the modulation index is 0.75. What percentage of the total power is in the carrier? Calculate the power in each sideband.

Problem 9: A sinusoidal modulating signal, $m(t) = 8\cos(2\pi \times 4 \times 10^3 t + 10)$, is applied to an FM modulator that has a frequency deviation constant gain of 10 kHz/V. Compute (a) the peak frequency deviation, and (b) the modulation index (c) Phase Modulation Index.