

INFSCI 1072/TELCOM 2700: Introduction to Wireless Networks

Homework 5

Read the material on radio propagation posted on the web page. Answer the following questions.

1. Consider a mobile phone system cell using a frequency of 900 MHz providing coverage to a urban environment like the Oakland area of Pittsburgh. The height of the receiver is 2 meters and the cell site antenna is 34 meters tall. The mobile terminal receivers have a sensitivity of -90 dBm. Using the Okumura-Hata propagation model determine what power level the base station must operate at to have a cell coverage radius of 1.6 km.
2. What is the fading margin if the shadow fading component has a standard deviation $\sigma = 8$ dB and you want to design a system that has 95% coverage at the edge of the cell?
3. If you apply that fading margin to the mobile phone system in Problem 1, at what power level must the base station operate?
4. Of the following, what values are possible for a cluster size in a cellular topology? Why? Assume a hexagonal geometry: 8, 21, 23.
5. Consider a digital cellular system that can tolerate a carrier to co-channel interference ratio (C/I) of 14 dB in the worst case. Assuming that the path loss coefficient is 3.5, determine the cluster size N_c for frequency reuse.
6. Generate the following plot using R or Matlab: Plot the path-loss assuming the free space loss model for frequencies of 700 MHz, 900 MHz, 2.4 GHz, 5 GHz, and 28 GHz. The distance between the transmitter and receiver varies from 500m to 10km. Identify the curves for the various frequencies. In the same plot, show what happens at 700 MHz if the path-loss gradient changes from $\alpha = 2$ to 4. The x-axis should be in meters and the y-axis should be the path-loss in dB.