COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electronics & Communication Engineering

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Course Title : Telecommunication Systems Engineering

Course Code : EC 551

Sheet (2)

Wireless Channel Characteristics

1. Consider the Okumura and Hata model for a suburban area of a medium city. Assume a BS antenna height of 50 m, an MS antenna height of 1 m and a carrier frequency of 900 MHZ. Also assume antenna gains 4 and 1.5 at the BS and MS, respectively. Use Matlab to plot the medium link gain G(d) [dB] as a function of d ranging from 1Km to 10 Km, using a sample spacing of 1 Km.

2. Consider a mobile phone system cell using a frequency of 900 MHz providing coverage to an 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.

3. The measured path loss at a distance 10 Km in a large metropolition area is 160 dB. The test parameters used in the experiment were the following: base station antenna height h_b=30 m, Mobile station antenna height h_m=3 m, Carrier frequency = 1000 MHz, Isotropic BS and MS antennas. If any model parameters are undefined, then use the default values.

    a. Compute the estimated path loss using Okumura's model.
    b. Compute the estimated path loss using Hata's model.
    c. Compare and Contrast the two models.

4. A base station radiates at a transmit power of 50W. Let the carrier frequency, f_c, be 900 MHz. Let d_o be 100 m. Assume free space path loss model between transmitter and d_o, and log-normal shadowing loss model for distances greater than d_o. Assume path loss exponent, n, of 3 and σ of 5 dB for log-normal shadowing model.
   Find out:
    a. The received power (in dBm) at 100 m.
    b. The mean path loss (in dB) from transmitter at 500m.
    c. The mean received power (in dBm) at 500m
    d. The probability that $P_r(500m) \geq 0.01$ mW.