INFSCI 1072/TELCOM 2700: Wireless Networks
Homework 7

Answer the following questions.

1. Differentiate between fade rate and fade duration.
2. Compute the fade rate in a WLAN environment where the carrier frequency is 2.4 GHz and the speed of changes in the environment is at 2 m/s. Assume that you are looking at the level crossings of the signal at 10 dB below the RMS value.
3. When is a radio channel "narrowband" or "wideband"?
4. Sketch the power-delay profile of the following wideband channel. Calculate the RMS delay spread of the following multipath channel. Would the channel be considered a wideband channel for a binary data system at 25 kbps? Why?

Relative delay in microseconds	Average relative power in dB
0.0	-3.0
0.2	0.0
0.5	-2.0
1.75	-6.0
2.3	-8.0
5.5	-10.0

5. Find the SNR per bit (γ_b or E_b/N_0) required to obtain an error rate of 10^{-5} for BPSK in flat Rayleigh fading channels. Compare your results with those for an AWGN channel (without fading) and comment on the results.
6. Consider a (48, 36) block error correcting code used in the downlink control channel of a cellular system. This code can correct up to 5 bit errors in a block of 48 bits.
   a. What is the code rate?
   b. What is the maximum error burst size (in bits) that can be tolerated and still have correct reception of the data?
   c. An error burst is usually caused by time variation of the channel in cellular networks. If the control channel operates at 48 kbps, what is the maximum fade duration (in seconds) that can be tolerated?
   d. If the 48 bit blocks are buffered until 10 blocks are collected and then they are interleaved and transmitted, what is the maximum error burst size that can be tolerated and still have correct reception of the data?
   e. What is the delay incurred in buffering the data for interleaving and de-interleaving at a 48 kbps rate?
7. How does a space-time block code work?
8. Differentiate between the training and tracking modes of an equalizer.