Lab 1: Impulse Response and Multipath

EE432: RF Engineering for Telecommunications

By: Scott Hudson
Washington State University
USA

Objectives

- To observe multipath in a real radio propagation environment.
- To gain understanding of the relation between time and frequency domain response of a radio channel.
- To characterize a radio channel using the statistical measures we have developed in class.

Equipment Needed

- Agilent 8510 Network Analyzer.
- Two magnetic mount cell phone antennas.

Procedure

1. The network analyzer will be running and calibrated when you come to lab. Hook up a cell phone antenna to each port. (Put the one with the longer cable on port 2.) The network analyzer will be set for a frequency range of 700 to 1000MHz. Channel 1 will operate in the time domain (measuring the impulse response) and channel 2 will operate in the frequency domain (measuring the transfer function). All measurements will be of the S21 parameter, i.e., transmit from port 1 and receive at port 2.

2. Place the antennas next to each other on a metal surface and measure the time delay to the first returned peak. Enter this value as an electrical offset so that future measurements are referenced to this value. This compensates for the time delay through the coax cables and results in measurements that are directly related to propagation delays. In this configuration save the transfer function to the 8510's disk (as formatted data). Make a note of the file name and what it contains.

3. Move the receiving antenna to somewhere near the middle of the room where it will have good line of sight. Measure and save to disk both the impulse response and transfer function. Use a tape measure to figure out the physical distance between the antennas and relate this to the impulse response.

4. Find a spot for the receiving antenna where you do not have line of sight and have two or more nearly equal-amplitude multipaths. Measure and save both the impulse response and transfer functions.

5. The 8510 saves data to a non-DOS format and you need to convert it. Take the disk over to a PC and run LIFUTIL. This will allow you to save the files in DOS format on the PC's hard drive. Then you can copy them to a standard DOS formatted disk. Be sure and specify that the format as DOS TEXT.

Analysis

1. Apply the theory that we have developed to calculate the mean delay, delay spread, and channel bandwidth of your measurements.