

# ECE 435

## INTRODUCTION TO CAD WIRE ANTENNAS

Latest revision: October 2000

This lab will introduce you to computer-aided microwave circuit design using the program NEC-2

### Pre-Lab Exercises

You must perform the following tasks prior to the lab session:

1. Review the on-line documentation for NEC paying particular attention to the following commands: GW, GE, EX, FR, GH, and RP.
2. Familiarize yourself with the input file format and the output file format.

### Whip Antenna Analysis

Download a copy of NEC-2 from the class web page for your use.

1. Model the 2m/440 whip antenna provided by the instructor for the following two configurations (remember to include the ground plane):
  - 1.1. "As is" with the helix ( $D=0.5''$ , 4 turns,  $L=1.125''$ ) where the top of the helix is 9.5 inches from the top of the 19.5 inch antenna.
  - 1.2. Without the helix (but with the same over-all length).
2. Compare the results for these two configurations. Plot the pattern and the impedance spectrum.
3. Measure the antenna using the vector voltmeter from 100 MHz to 800 MHz every 10 MHz and plot the impedance and  $S_{11}$  spectrums.
4. Measure the "rubber ducky" antenna with the vector voltmeter. Plot the impedance and  $S_{11}$  spectrums.

### Patch Antenna

1. Measure the patch antenna's impedance spectrum (using the Vector Network Analyzer) and measure the patterns in the chamber at the L1 link frequency.

### Report

Compare the performance of the whip antenna with and without the helix. What does the helix do? What is the function of the dielectric ball at the end of the whip antenna? What is the VSWR at the best match point in the 144 MHz and 440 MHz bands? Discuss the patch antenna's performance.