Homework 2

Due Thursday, January 31 at 6:00

1) Transmission Lines

A real load impedance includes a complex portion due to some capacitance and inductance. These values are frequently a factor in the performnace of the design. Given a 75 Ω load with a parasitic capacitance of 2.0 pF and inductance of 0.15 pH. You can consider a model of this circuit to be a capacitor in parallel with an inductor and resistor in series.

For a 75 Ω lossless transmission line with a propagation velocity of 0.86c, determine the magnitude of the reflection coeficient as a function of frequency.

At what frequency is the 3dB point for the load power relative to the incident power? Are any of the load components negligible at this frequency?

For the frequency 1080 MHz, where is the location of the first maximum and minimum.

A real line is lossy, with a resistance of .001 ohm/m and an admittance of .00005 mho/m. If the load has a minimum threshold voltage of 1 Vpp and a 10 Vpp source is used, how long can the transmission line be when operating at 100MHz? Use the same impedance and propagation velocity as above.

2) Stubs

Being good engineers, you decided to crack open the cable box and see what was inside. Unfortunately, you are curious but also careless and you manage to introduce some capacitance giving your box an effective load 75-j30 Ω. Now the only cable channel you really care about is 33 which shows old episodes of Giligan's Island. The good thing is that you are an excellent student in Fields and Waves, so you quickly

note that you can add a short circuit stub to tune out the imaginary component of the box. Do that now. Assume the transmission line is 75 Ω and lossless.

Sadly all this happened prior to the AOL-Time Warner merger. You have received an undamaged cable box that now has the standard 75 Ω load. In your early enthusiasm, you soldered the stub to the circuit and can't remove it. You swap in the new box, but now need to add another stub (open circuit) to get rid of the effects of the first one. Do that now.

Note: Look up the frequency of the cable channel yourself. There are several ways to find it. Anyone who asks a TA or Instructor will take a two point penalty.