Wireless Local Area Network Lab 6 -- Amplifier Lab

Objective: Design the configuration for an amplifier with at least 10 dB of gain. Instructions and descriptions are attached.

Equipment:

Signal Generator at 2.4 and 2.6 GHz (or 5.4 and 5.6 GHz)
Spectrum Analyzer at 2.4 and 2.6 GHz (or 5.4 and 5.6 GHz)
Circuit board holder

Parts:

ERA-3SM amplifier from Minicircuits
App Note: http://www.minicircuits.com/appnote/an60010.htm
Two 100 pF ceramic capacitors with low ESR and parallel self resonance above 2.6 GHz
Thin-film Resistor: 240 ohm
RF Choke from Minicircuits http://www.minicircuits.com/dg03-242.pdf

Prelab:

1. Read the application note on the amplifier and determine the reason for the choice of the values of all components.
2. Find the physical size of all components from the data sheets.

Design / Week 1:

1. Lay out the amplifier circuit. Remember to add the length of THRU/2 to the input and output lines. Remember to show where holes should be drilled for the ground pins in the picture given with the layout.
2. ADS notes: There is no standard library part for the amplifier. Use any standard BJT out of the library that has the same dimensions as the amplifier you will be using (which is almost all of them -- place the part on your layout, and then use the "measure" tool to check the measurement).

Note: sample layout may be for different sized capacitors, etc. that were used in different years.

Testing / Week 2:

Soldering: When you solder the amplifier on to your circuit board, you can tell which direction to place it by looking at the pin that has a triangular end and a dot on the chip. (See the data sheet) Prepare the (many) ground pins with the regular (hand) soldering iron. Other parts can be paste soldered. The resistor is one of the larger parts. It is black. The inductor is a small green/striped cylinder. The caps are gray with silver ends, the smallest of the parts.

Testing: Do NOT connect the amplifier to the network analyzer!

1. Test the circuit with DC biasing
   a. Check the continuity of your solder connections with a digital voltmeter (you should be able to read the value of the resistor, and the capacitors should appear to be open circuits).
   b. Solder a short piece of wire (1 cm) onto the place where Vcc should be connected.
   c. Check the voltage supply for +12 V.
   d. Connect Vcc to the wire you just soldered to your amplifier and connect ground to the ground plane of your circuit board the same way you did in the diode detector lab (alligator clip).
   e. Measure the input to the amplifier, which should be +3.5 V.
2. Learn to use the signal generator and spectrum analyzer
   a. Set the ESG-3000A Signal Generator for a frequency of 2.4 GHz and a magnitude of -30 dBm. Connect it to the spectrum analyzer.
   b. Set the frequency range of the spectrum analyzer from 2.0 to 3.0 GHz. Do this by pressing the "Frequency" Button. This will bring up a menu of "start" "stop" etc. … Set the start and stop frequencies.

c. Turn the RF power on the signal generator (and modulation off). You should see a spike at 2.4 GHz on the spectrum analyzer. Place a marker on this spike (press MKR and move it with the thumb dial). The magnitude of the spike should be displayed in the upper right hand side of the spectrum analyzer window.
d. Experiment with frequencies and magnitudes until you feel comfortable using the signal generator and spectrum analyzer.

3. Test the circuit with AC signal:
   a. Disconnect the circuit board holder from the network analyzer. Connect one side to the signal generator and the other side to the spectrum analyzer.
   b. Place the input of the amplifier in the circuit board holder connected to the signal generator.
   c. Connect the output of the amplifier to the circuit board holder connected to the spectrum analyzer.
   d. Set the signal generator for -30dBm at the frequency of 2.4 GHz. You should have about 10-15 dB of amplification, so the signal observed on the spectrum analyzer should be about -20 to -15 dBm.
   e. Check the amplifier for 2.6 GHz also.