rf_bjt.doc

print name (first last): ______________________

course: EET 257 Lab 11/24/2001

lab date (mo/day/yr):______________________

lab section (day time):____________________

instructor: _____________________

RF Bipolar Transistor
Common Emitter Amplifier Performance

Performance Checks

_____ 1 Actual simple common emitter amplifier frequency response f_H

_____ 2 Actual voltage divider common emitter amplifier frequency response f_H

_____ 3 MAR amplifier frequency response f_H

Prelab Activities

There are no prelab calculations. Build the two amplifiers in Figure 1 and Figure 2 on your ground plane board. Only one board is required for each lab station.

- Be sure to keep the configuration tight.
- Trim all component leads as short as practical.
- Avoid bending leads, using jumpers or *any* long leads.
- To connect to a bnc cable in lab, use the bnc connector with a 51 Ω resistor between the input and the shield. Keep the leads from the bnc connector to your circuit as short as possible.

Show your circuits to the lab instructor. ______________

Instructor initials

Objectives

Evaluate the actual frequency response from 100kHz to 100MHz for three different common emitter configurations.

Approach and Results

1. Simple Common Emitter Amplifier's Frequency Response

a. Apply power to your circuit from Figure 1 and measure the dc voltages. Complete all of Table 1. Do not go on until your amplifier is properly biased.

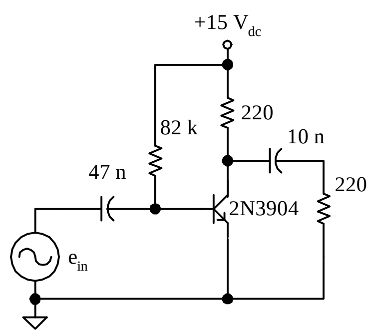


Figure 1 Simple common emitter amplifier

	Theory volts	Measured volts	Error %
$V_{collector}$			
V_{base}			
$V_{emitter}$			

Table 1 Common emitter amplifier bias

b. Set the signal generator to $25mV_{rms}$, 1MHz. You will have to use the Fluke 6061 Synthesizer, not the Philips generator you have used in all previous experiments.

c. Display the input voltage across the load and its rms value in the center of your oscilloscope display. Be sure to use an rf x10 oscilloscope probe to isolate the probe's capacitance from the amplifier. Assure that the attenuation is properly accounted for. Also be sure that the probe is properly adjusted.

d. Once the input is displayed correctly, move the probe to the output. Do *not* try to make a dual trace measurement. Use one channel and one probe.

If the circuit's gain is less than -120 or greater than -60, stop and resolve the problem before continuing.

$V_{load\ @\ 1\ MHz}$ = ____________ $gain_{measured\ @\ 1MHz}$ = ____________

e. Sweep the frequency as indicated in the table below. Measure and record the input, then move the probe to the output and measure and record it. Record all of the data at one frequency before moving to the next frequency.

frequency MHz	input V_{rms}	output V_{rms}	gain dB	comment
0.1				
1.0				
2.0				
4.0				
8.0				
10.0				
20.0				
40.0				
60.0				
80.0				
100.0				
f_{low}				
f_H				

Table 2 Simple common emitter amplifier frequency response

f. In the comment column of Table 2, indicate the following:

1) any significant input or output distortion

2) the frequency at which the gain peaks to its largest value.

h. Accurately locate f_{low} and f_H. Record each in Table 2.

Demonstrate your circuit's performance at f_H, and the table to your lab instructor.

2. Voltage Divider Common Emitter Amplifier's Frequency Response

a. Apply power to your circuit from Figure 2 and measure the dc voltages. Complete all of Table 3. Do not go on until your amplifier is properly biased.

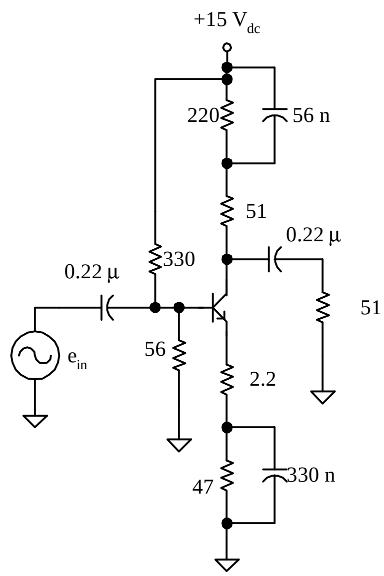


Figure 2 Voltage divider common emitter amplifier

	Theory volts	Measured volts	Error %
$V_{collector}$			
V_{base}			
$V_{emitter}$			

Table 3 Common emitter amplifier bias

b. Set the signal generator to $25mV_{rms}$, 1MHz.

c. Display the input voltage across the load and its rms value in the center of your oscilloscope display. Be sure to use an rf x10 oscilloscope probe to isolate the probe's capacitance from the amplifier. Assure that the attenuation is properly accounted for. Also be sure that the probe is properly adjusted.

d. Once the input is displayed correctly, move the probe to the output. Do *not* try to make a dual trace measurement. Use one channel and one probe.

If the circuit's gain is less than -12 or greater than -8, stop and resolve the problem before continuing.

$V_{load\ @\ 1\ MHz}$ = ____________ $gain_{measured\ @\ 1MHz}$ = ____________

e. Sweep the frequency as indicated in the table below. Measure and record the input, then move the probe to the output and measure and record it. Record all of the data at one frequency before moving to the next frequency.

frequency MHz	input V_{rms}	output V_{rms}	gain dB	comment
0.1				
1.0				
2.0				
4.0				
8.0				
10.0				
20.0				
40.0				
60.0				
80.0				
100.0				
f_{low}				
f_H				

Table 4 Voltage divider common emitter amplifier frequency response

f. In the comment column of Table 4, indicate the following:

1) any significant input or output distortion

2) the frequency at which the gain peaks to its largest value.

g. Accurately locate f_{low} and f_H. Record each in Table 1.

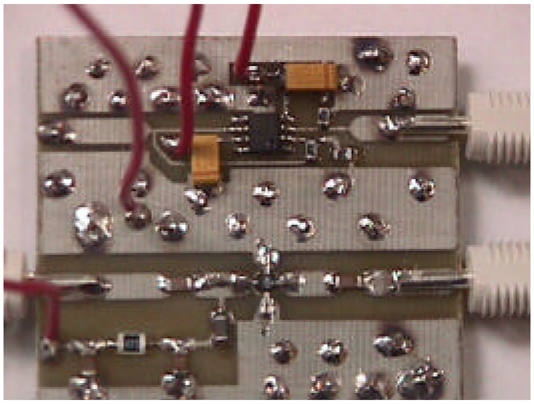
Demonstrate your circuit's performance at f_H, and the table to your lab instructor.

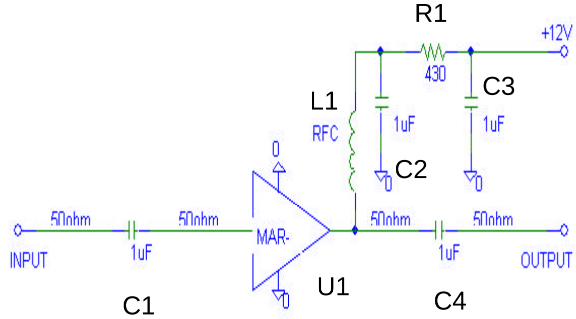
C. MAR-1 Amplifier

Completing this section exempts you from writing a *formal* report. Refer to the Analysis and Conclusions section.

1. In the photo below, identify and label each of the following. (warning: the board may be oriented on the bench differently than it is in the photograph.)

common +12V input output C1 C2 C3 C4 L1 R1





2. Verify that the power supply is correctly set to +12V

3. Apply power to the surface mount board. Measure to following dc voltages.

   V+ on the board = _____ junctioin of R1 & L1 = _____ MAR output = _______

Do not continue until you are sure the bias is correct.

4. Add a 50 Ω terminator on the channel 1 input of the oscilloscope. Connect between the MAR amplifier output and the oscilloscope with a bnc cable, *not* a x 10 probe.

5. Set the synthesizer to $10mV_{rms}$, 50 MHz.

6. Measure the rms of the output on the oscilloscope.

7. When the amplifier is working correctly, complete the following frequency response measurements.

Frequency (MHz)	V_{out} (mV_{rms})	Gain (dB)
50		
100		
200		
300		
400		

8. Find the high frequency cut-off. f_H = ________ Instructor's checkoff

9. What is the oscilloscope's maximum frequency? Is your measurements in step 8 a valid measurement of the *amplifier's* cut-off?

Analysis and Conclusions

Report Exemption: If you completed all three sections, then, submit the signed front page, and the five manually completed data tables.

If you only completed the first two sections, you may still receive a 100% by writing a formal report. Include the following.

1. Simple Common Emitter Amplifier Frequency Response
   a. Include Tables 1 & 2 and all the data properly displayed and Table 2's associated graph in the appropriate place in the procedures section.
   b. Create another table to compare the measured and the theoretical values of $A_{midband}$, f_{low}, and f_H. Include a % error for each. Explain any errors greater than 5%.
2. Voltage Divider Common Emitter Amplifier Frequency Response
   a. Include Tables 3 & 4 and all the data properly displayed and Table 4's associated graph in the appropriate place in the procedures section.
   b. Create another table to compare the measured and the theoretical values of $A_{midband}$, f_{low}, and f_H. Include a % error for each. Explain any errors greater than 5%.