ELEC 2210 LABORATORY REPORT COVER PAGE
Complete and attach this page to the front of your lab report.

Meeting # 12 4R Bias Amplifiers
Title of Lab Experiment

Student Name: Gabriel Emerson
Name (Last, First, MI)

Student Email: gte0002
AU 7-character username

GTA: Paul Atilola
Name of your GTA

Section you are enrolled in: (Circle One): (1) 2 3 4 5 6 7 8

Date experiment performed (dd / mm / yy): 4/6/21

Date report submitted: (dd / mm / yy): 4/10/21

If you performed this experiment at a time other than your regularly scheduled section meeting:

Section # of the section you sat in on (Circle One): 1 2 3 4 5 6 7 8 Makeup

Name of the GTA who supervised your work: _____

I hereby certify that the contents of this report are true and complete to the best of my ability.
The lab work was performed by me exclusively, and this report was written by me exclusively.

DEmerson
Student signature

4/10/21
Date signed

Gabriel Emerson
ELEC 2210 – T 11:00
Experiment #12 Amplifiers
04/06/2021

Introduction:
The goal of this lab is to use transistors and understand how to use them as amplifiers. A ZVN4306 N-MOSFET will be used to construct a four resistor bias circuit. The student will gain experience using the NI Elvis board and Multisim.

Step 1: MOSFET Amplifier Biasing Network
Using the prelab schematic and the ZVN4306, a four resistor biasing network was constructed. Voltage measurements were taken at the source, drain, and gate and then compared to the measurements taken during the prelab.

	V_D	V_S	V_G	V_{GS}
Theoretical	8.48V	2.20V	4.15V	1.948V
Measured	8.36V	2.34V	4.33V	1.992V

Table 1: Measured and Theoretical Values

Step 2: MOSFET Amplifier
Three capacitors were added to the network from Step 1. One at the input, one at the output, and one at the source resistor. Measurements were taken at various frequencies and voltages and the oscilloscope shows the amplification of the waveform. Drain Voltage and Source Voltage were specifically measured for a 5kHz, 1.3 Vpp sine wave. The graph of Vd shows a square wave with loose transitions. The peaks of which stay above the sine wave and the valleys stay below the sine wave. The graph of Vs shows a flat, almost DC-like signal. This is most likely due to the capacitor across Rs partially grounding the signal.

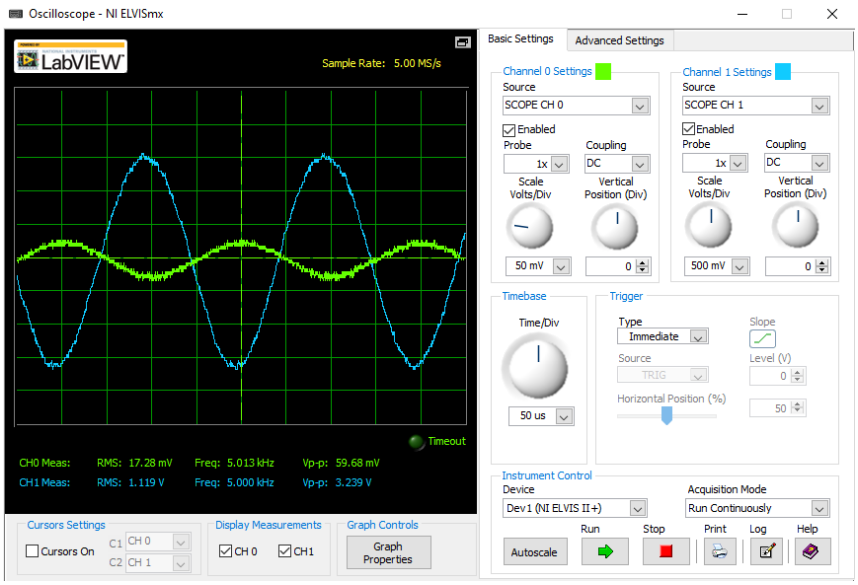


Figure 1: 5kHz; 0.05vpp; Gain: 54.27

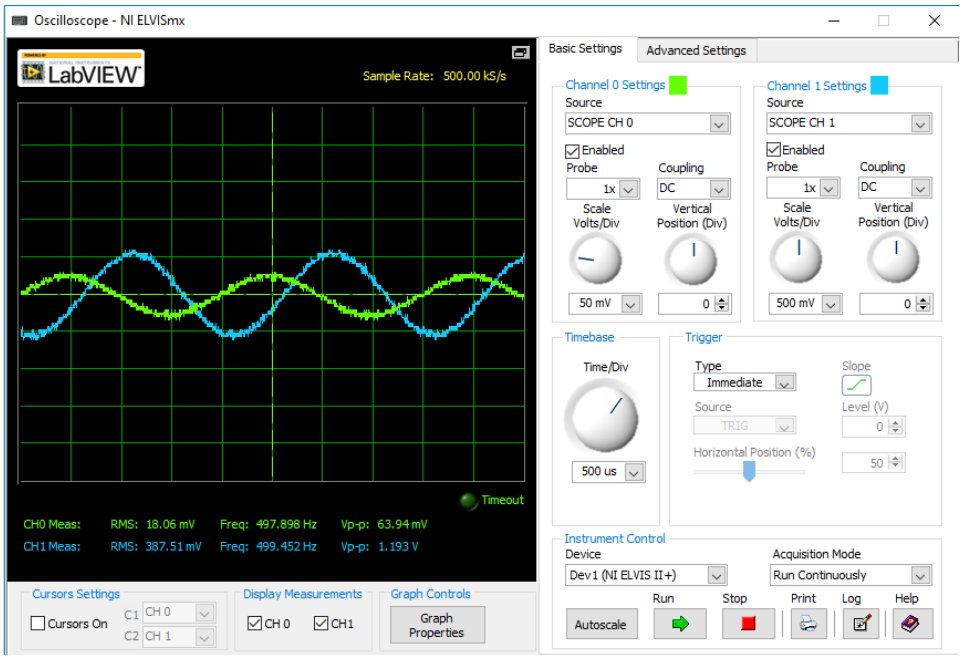


Figure 2: 500Hz; 0.05Vpp; Gain 18.66

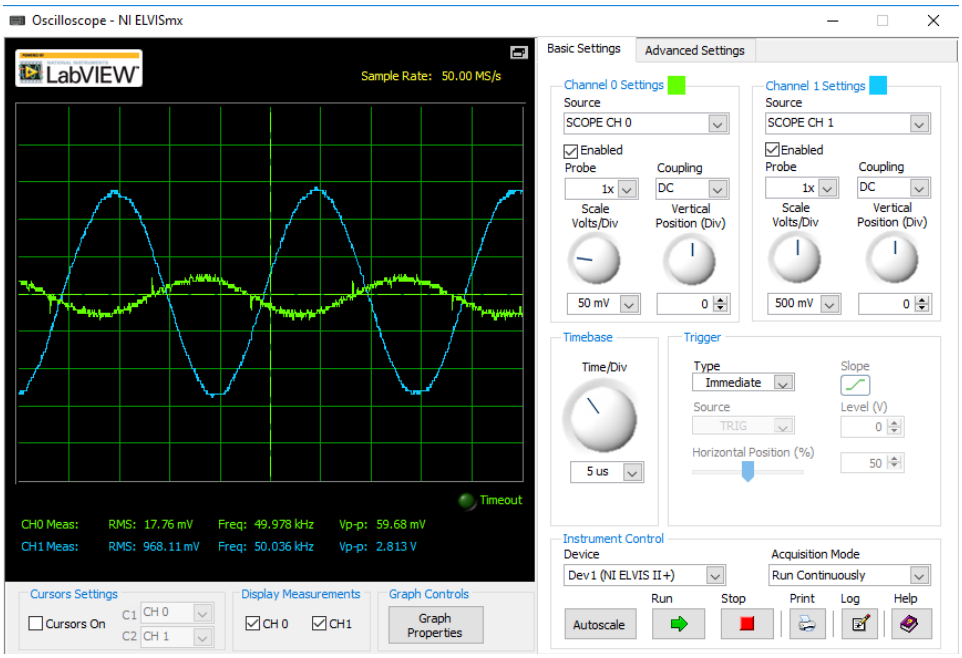


Figure 3: 50kHz; 0.05Vpp; Gain: 47.13

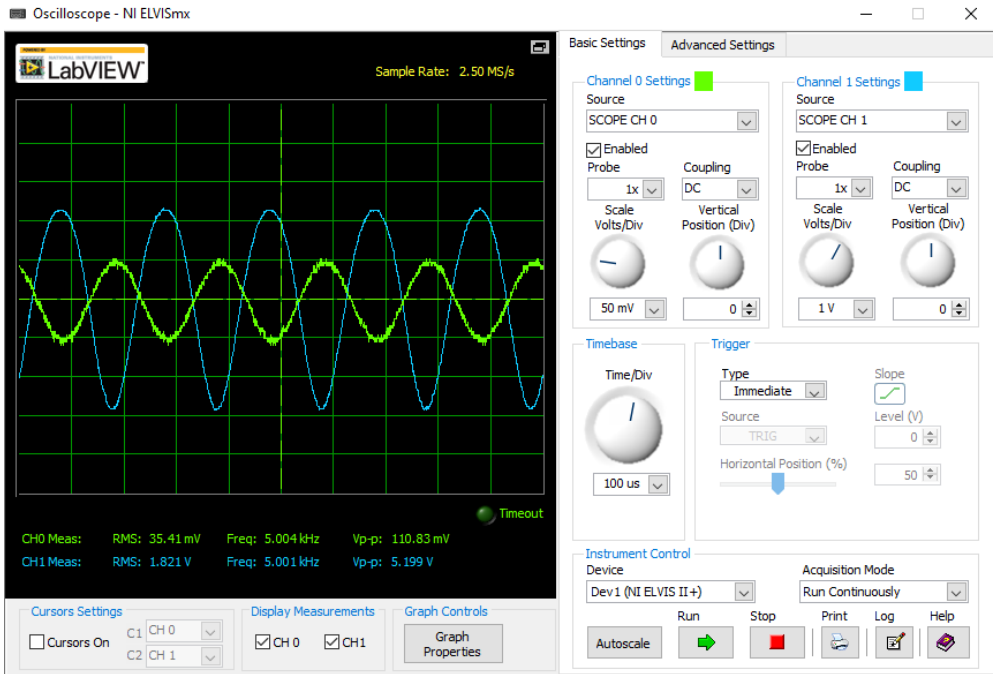


Figure 4: 5kHz; 0.1Vpp; Gain: 46.91

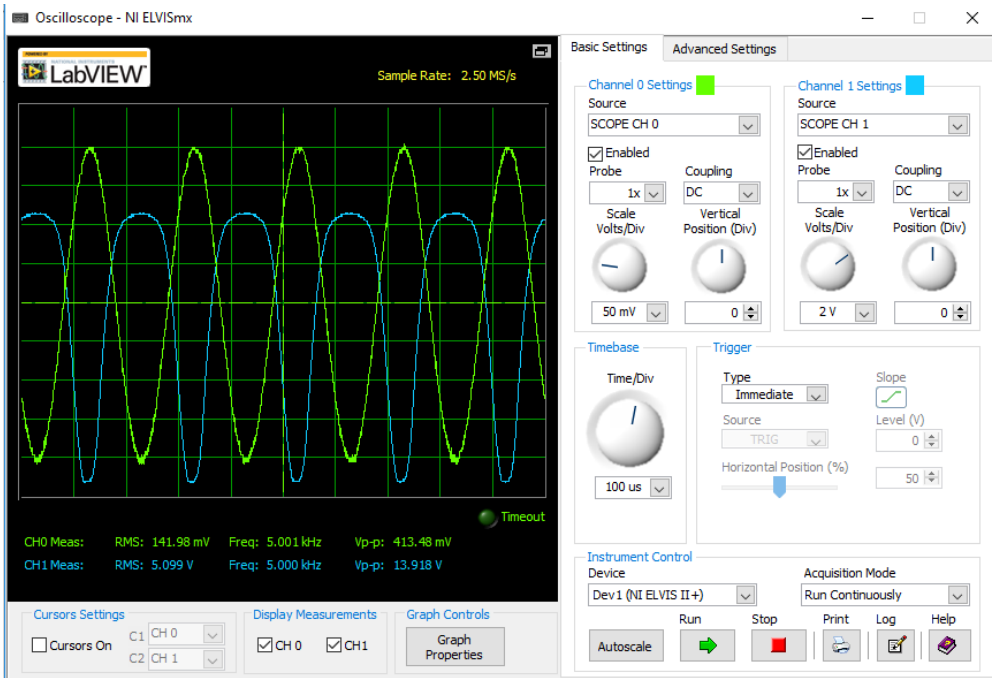


Figure 5: 5kHz 0.4Vpp; Gain: 33.66

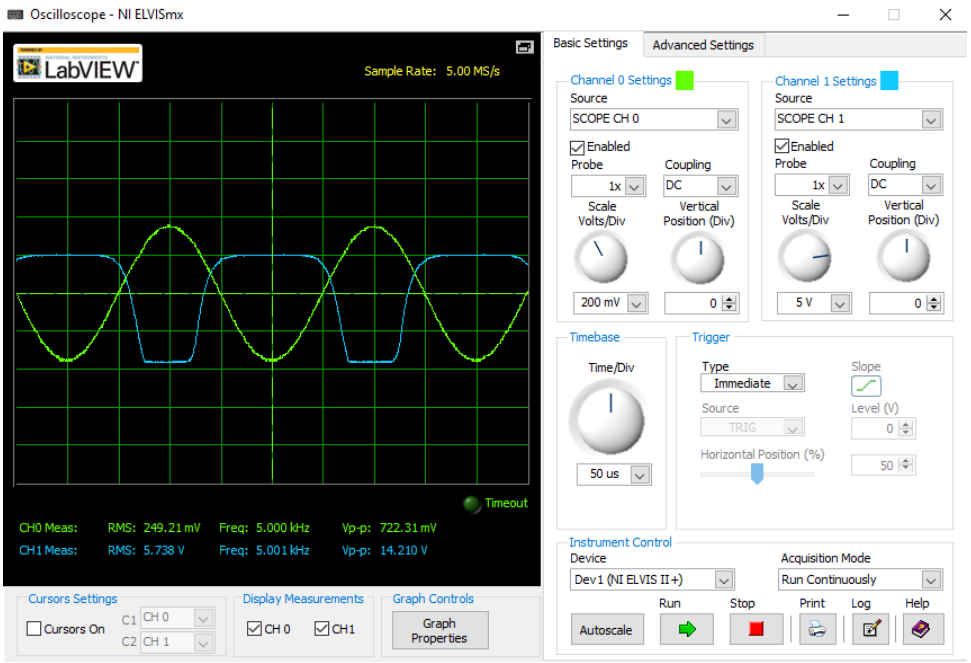


Figure 6: 5kHz; 0.7Vpp; Gain: 19.67

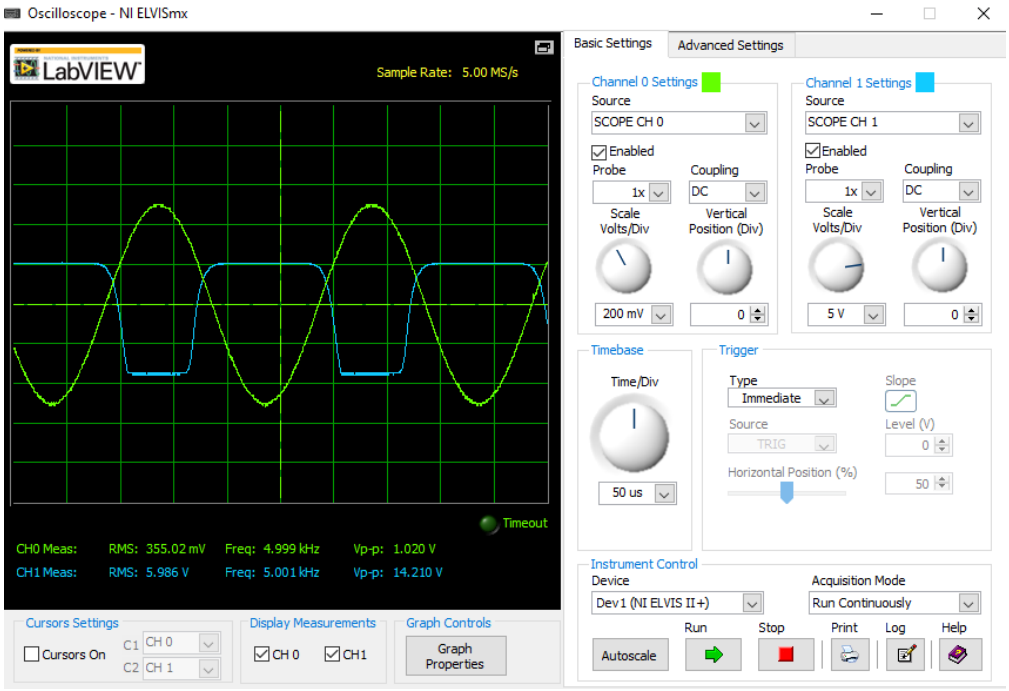


Figure 7: 5kHz 1.0Vpp; Gain: 13.93

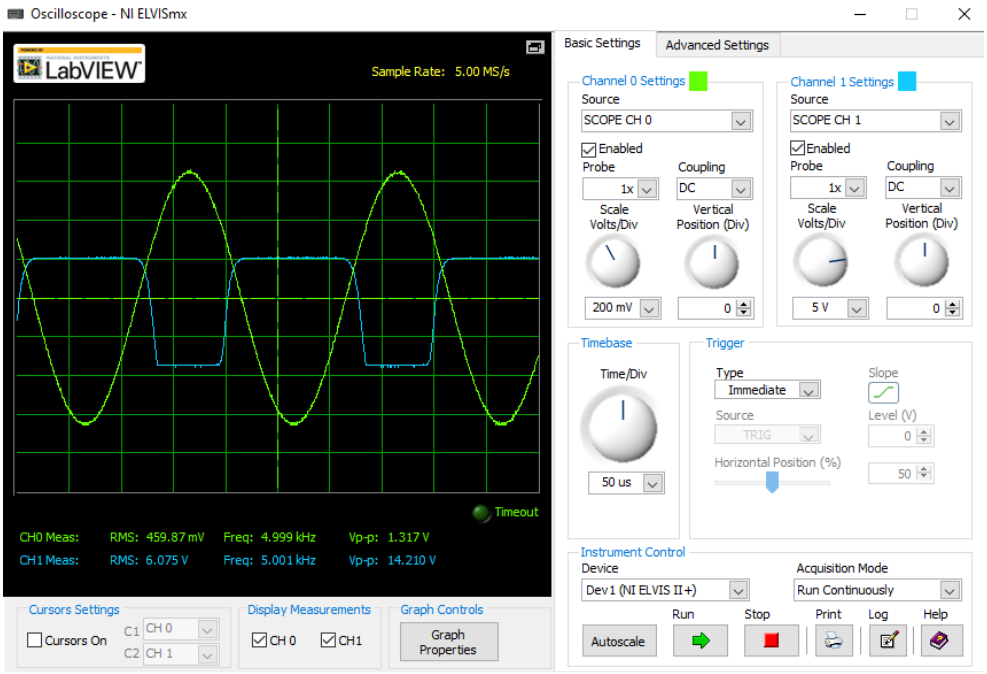


Figure 8: 5kHz; 1.3Vpp; Gain: 10.78

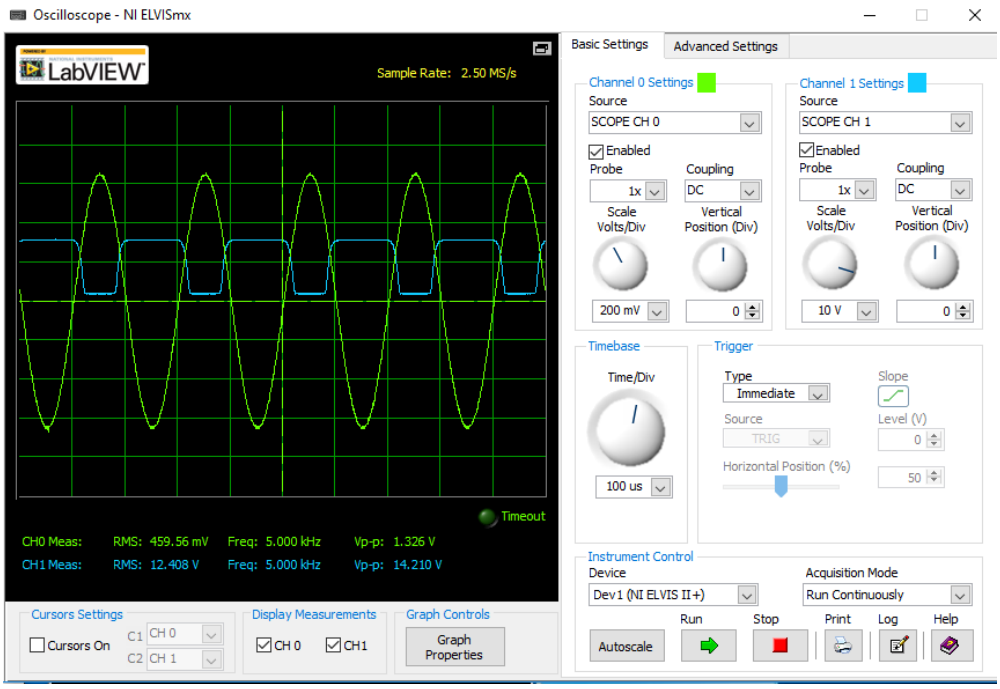


Figure 9: 5kHz 1.3 Vpp Drain Voltage

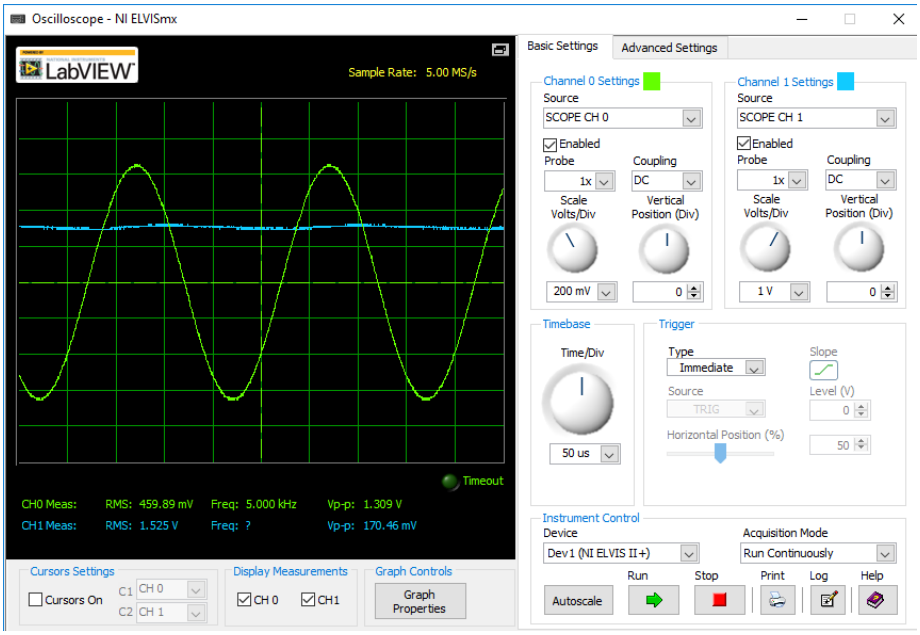


Figure 10: 5kHz 1.3 Vpp Source Voltage

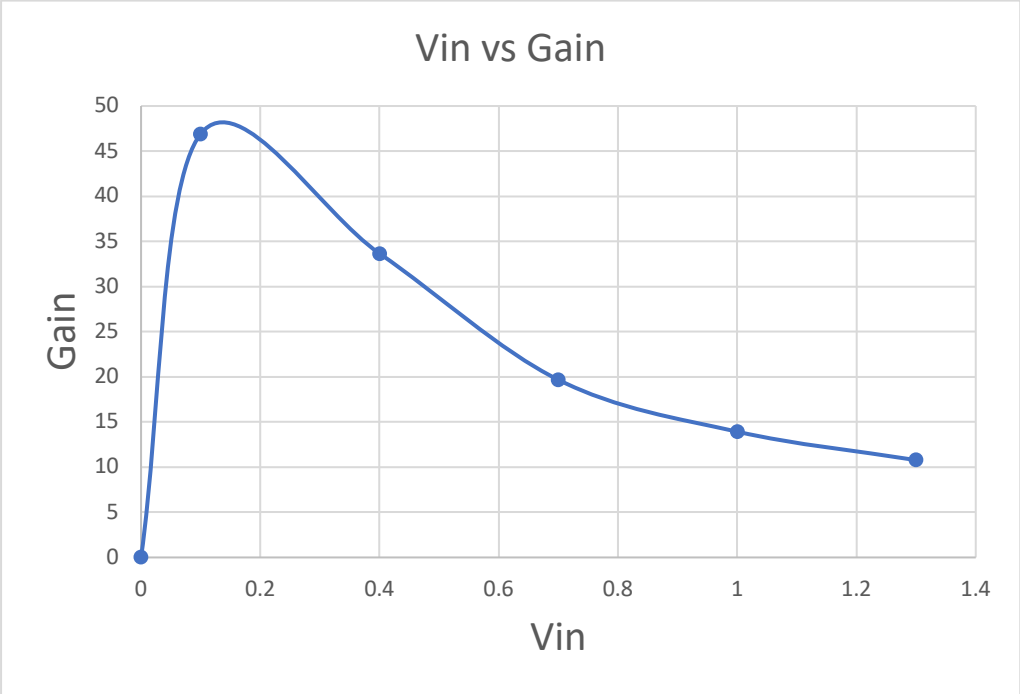


Figure 11: Vin vs Gain Plot

Step 3: Spectrum Analyzer

Using the previous circuit network, the output signal spectrum was measured using the Spectrum Analyzer. The amplitude was increased until the output was clipping neat the peak and the valley. By increasing this amplitude, the total harmonic distortion (THD) was increased from 4.85% to 60.09%. The distortions can be seen in the following figures below.

Figure 12: 5kHz 0.05Vpp Spectrum Analyzer

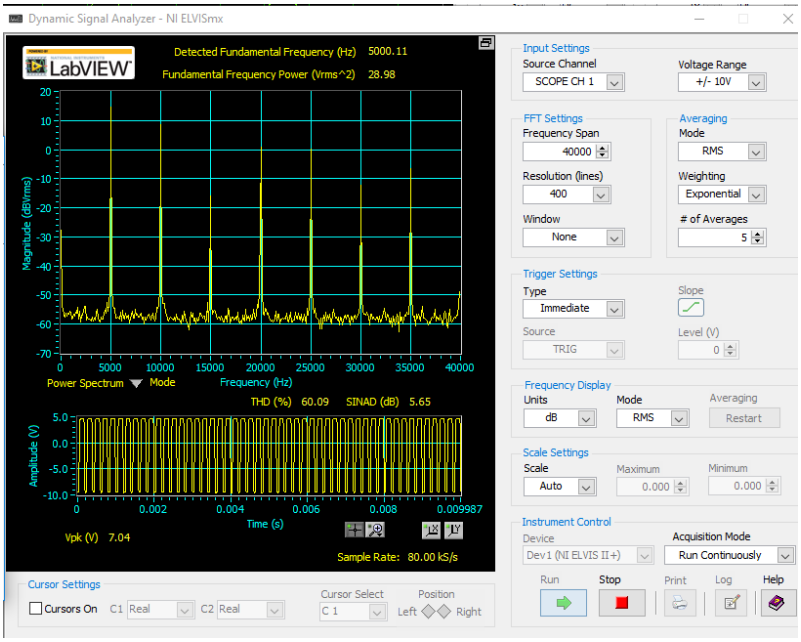


Figure 13: 5kHz 1.3Vpp

Step 4: Bode Plot

Using previous circuit network, the Bode Plot was used to capture the frequency response of the amplifier. The results from the plot were very similar to those simulated in the prelab.

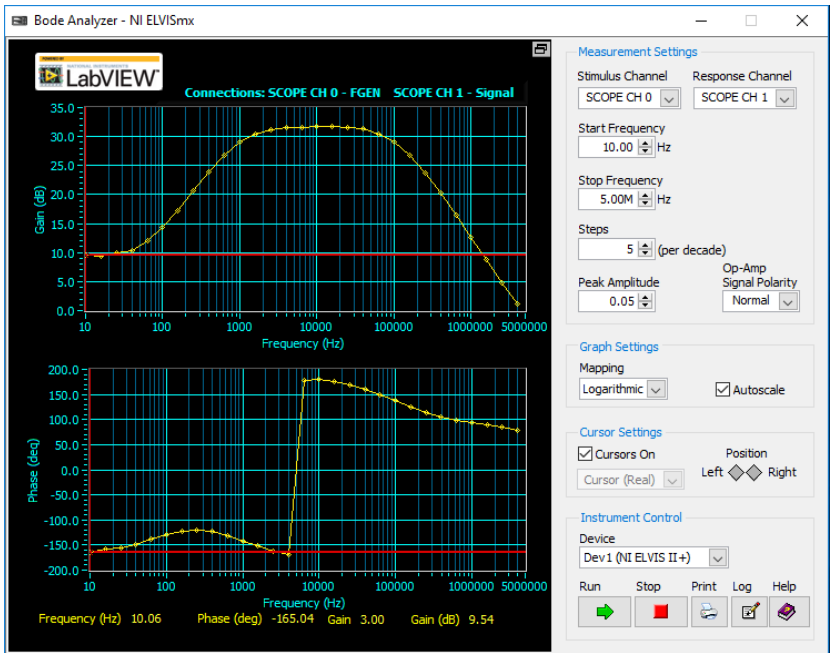


Figure 14: Bode Plot

Step 5: Radio

Using the previous circuit network, the input to the amplifier was replaced with a footlong wire that hung straight in the air, acting as a receiver. Another wire of similar length was attached to the function generator that acted as the radio signal generator. Using a 300kHz sine wave, the input signal of the function generator was sent through the wire and was picked up wirelessly by the receiver wire. This signal was then amplified as measured on the oscilloscope. The closer the wires were together, the larger the observed signal.

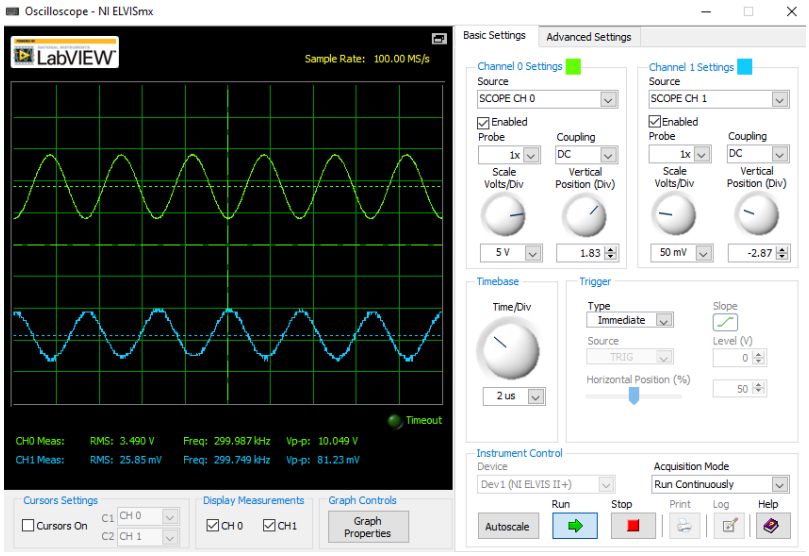


Figure 15: Amplified Radio Signal (Further Apart)

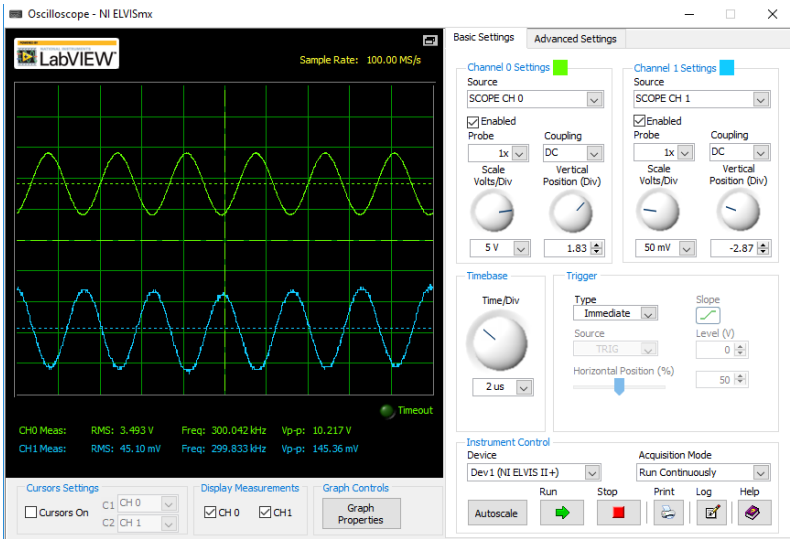


Figure 16: Amplified Radio Signal (Closer Together)

Step 6: BJT Amplifier

This step was rather simple. Instead of using the original transistor, replace it with a BJT and take measurements once again. This is done simply by removing the old transistor and putting the BJT in its place. The figures below are what I got from the BJT amplifier.

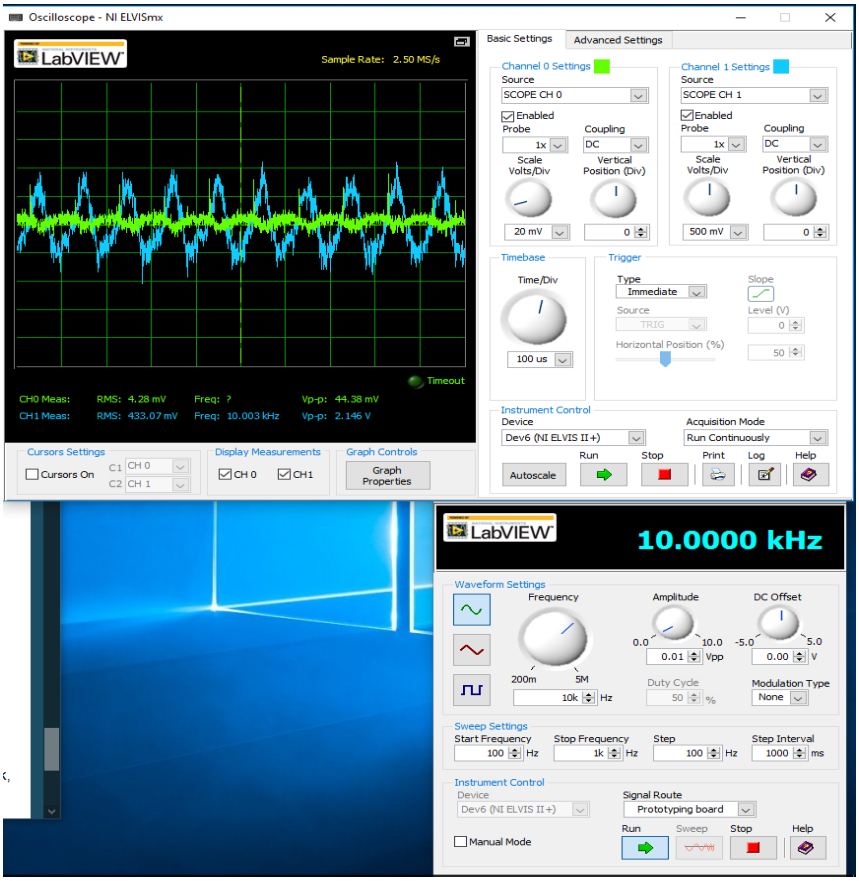


Figure 17: Amplifier with BJT

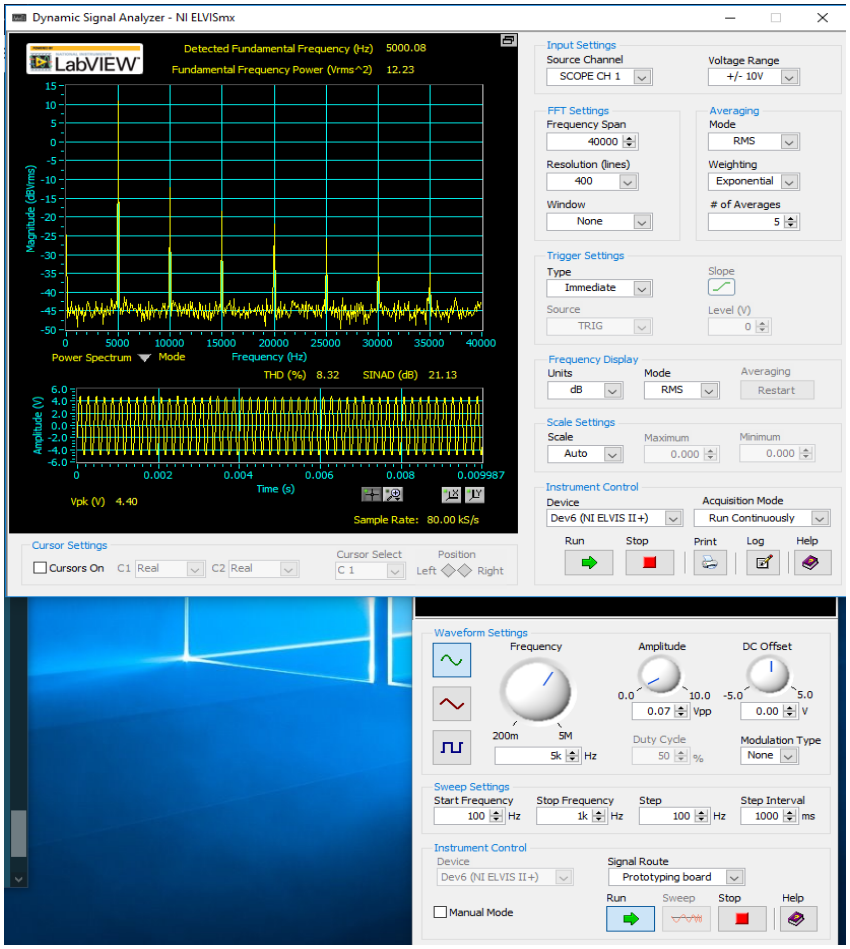


Figure 18: Spectrum Analyzer with BJT

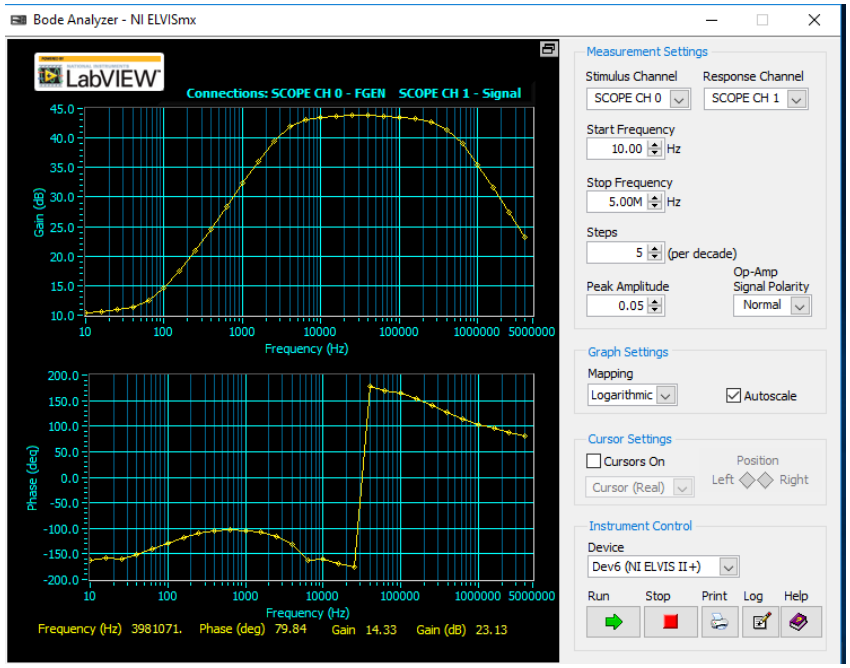
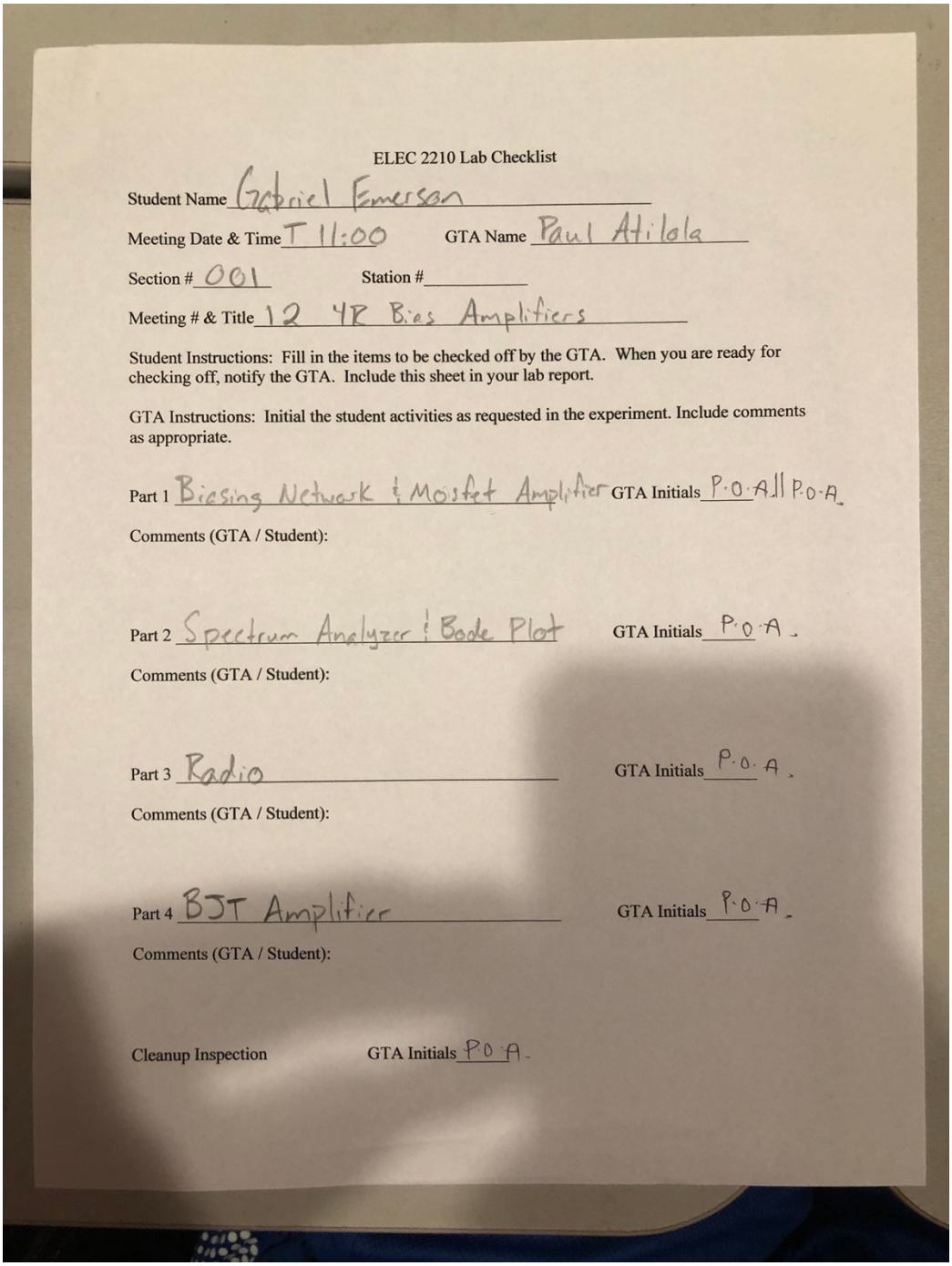


Figure 19: Bode Plot with BJT

Conclusion:
This lab allowed me to gain a better understanding of amplifier circuits. This seems like it is a very helpful tool to have in future labs. The only part of the lab that I struggled with was finding the appropriate scaling values to use in Step 2. I spent more time in the lab trying to get each waveform to fit properly in the oscilloscope than I did wiring circuits. Other than that, I had no problems with the lab. I really enjoyed the radio signal step and I think future student might enjoy doing an entire lab on radios.



ELEC 2210 Lab Checklist

Student Name Gabriel Emerson

Meeting Date & Time T 11:00 GTA Name Paul Atilola

Section # 001 Station #_____

Meeting # & Title 12 4R Bias Amplifiers

Student Instructions: Fill in the items to be checked off by the GTA. When you are ready for checking off, notify the GTA. Include this sheet in your lab report.

GTA Instructions: Initial the student activities as requested in the experiment. Include comments as appropriate.

Part 1 Biasing Network & Mosfet Amplifier GTA Initials P.O.A. || P.O.A.

Comments (GTA / Student):

Part 2 Spectrum Analyzer & Bode Plot GTA Initials P.O.A.

Comments (GTA / Student):

Part 3 Radio GTA Initials P.O.A.

Comments (GTA / Student):

Part 4 BJT Amplifier GTA Initials P.O.A.

Comments (GTA / Student):

Cleanup Inspection GTA Initials P.O.A.