Lab 7

Buffer – Assemble, Troubleshoot, Evaluate Performance, and Lab Equipment

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Objectives

The objectives of this lab is to solder the components on the Buffer amplifier, troubleshoot any problems, and validate that it meets the design specifications. You will be introduced to soldering and using lab equipment, such as the function generator and the oscilloscope. Also, how to connect to and take measurements on the stereo amplifier.

Procedure

Equipment and supplies

- Function Generator, oscilloscope, audio board, buffer PCBs, soldering station

Procedure

For this lab, we began doing a little research about potentiometers learning about the terminal wiper, taper, dual-gang port, linear and log tapers. We found that regardless of the shaft angle, the resistance between the outmost terminals of the potentiometer should be constant.

We then soldered the proper components onto our buffer PCBs. After learning a bit about how to solder and set up the microscope, we soldered everything together and could then test our buffer PCBs.

To test them, we used jumper to make the proper connections then applied an input signal from the function generator and measured using the oscilloscope the output of the function generator and the buffer out for both right and left channels at frequencies ranging from 20 to 20k Hz. These measurements can be found below as Figures 1-8 and the table with all the measured values and the calculated gain can be found in Table 1.

With our measurements complete we calculated the deviation in dB which should have been less than or equal to 3dB. Mine resulted in a deviation of 0.35dB for the right channel and 0.30dB for the left channel which were both well under the limit. This can be seen as Figure 9 below.

After this, we tested that our PCBs worked properly by playing music. It worked as expected, both right and left channels played and you could change the volume and balance between channels.

$V_{in} = 2V_{pp}$ from Function Generator	Frequency	$V_{in(pp)}$	$V_{out(pp)}$	Gain $\left(A = \frac{V_{out(pp)}}{V_{in(pp)}}\right)$
Right Channel	20 Hz	2.04V	6.04V	2.96
	200 Hz	2.04V	5.96V	2.92
	2k Hz	2.00V	5.88V	2.94
	20k Hz	2.04V	5.80V	2.84
Left Channel	20 Hz	2.04V	5.88V	2.88
	200 Hz	2.00V	5.92V	2.96
	2k Hz	2.04V	5.88V	2.88
	20k Hz	2.04V	5.72V	2.81

Table 1 – Frequency Response

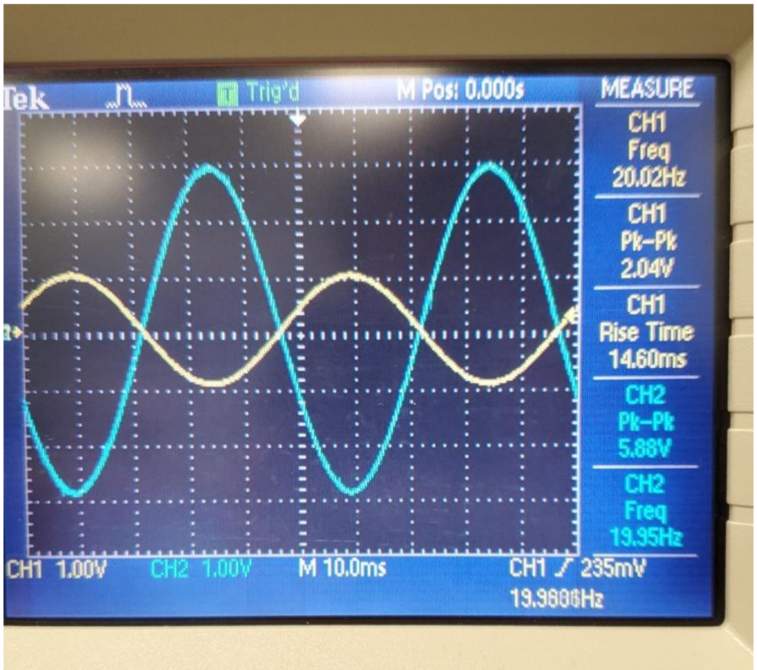

Figure 1, L 20 Hz

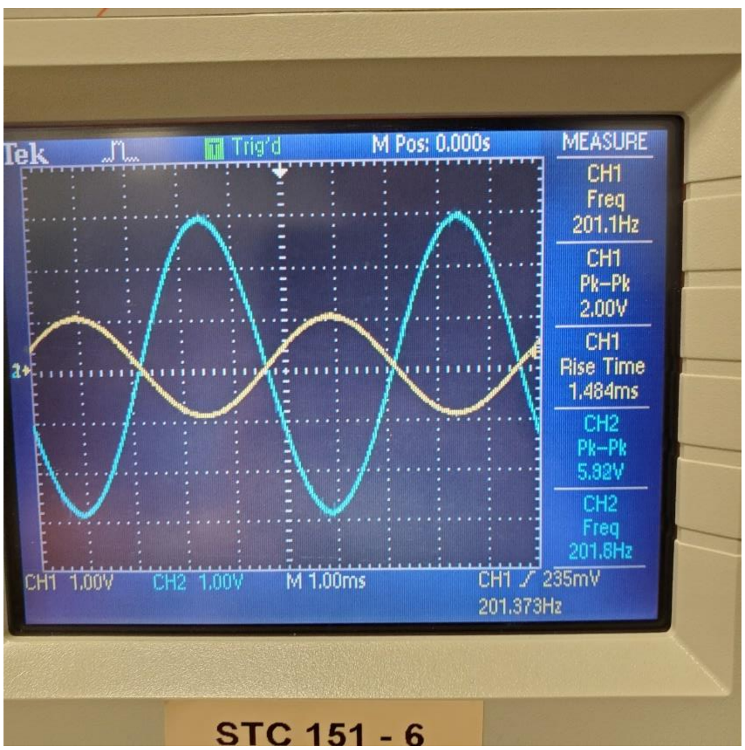

Figure 2, L 200 Hz

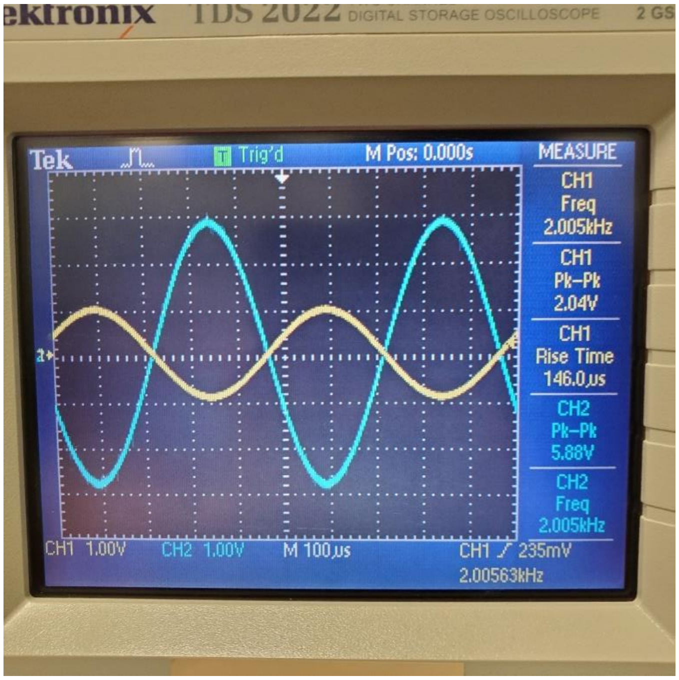

Figure 3, L 2k Hz

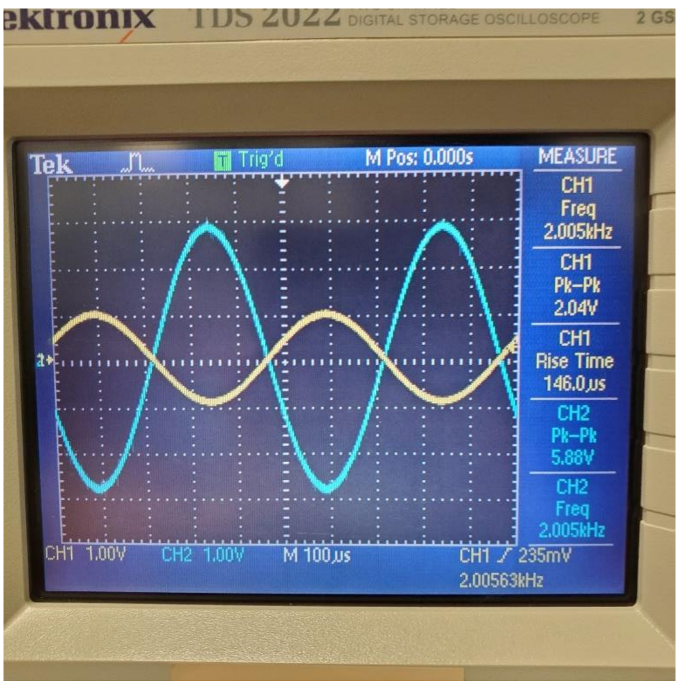

Figure 4, L 20k Hz

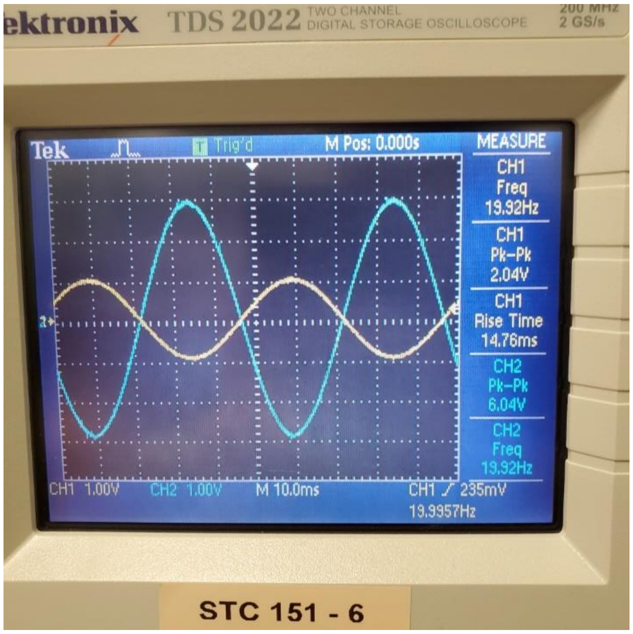

Figure 5, R 20 Hz

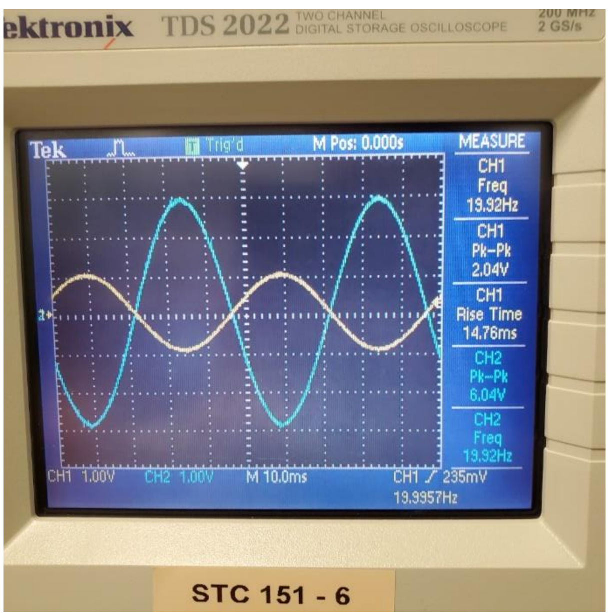

Figure 6, R 200 Hz

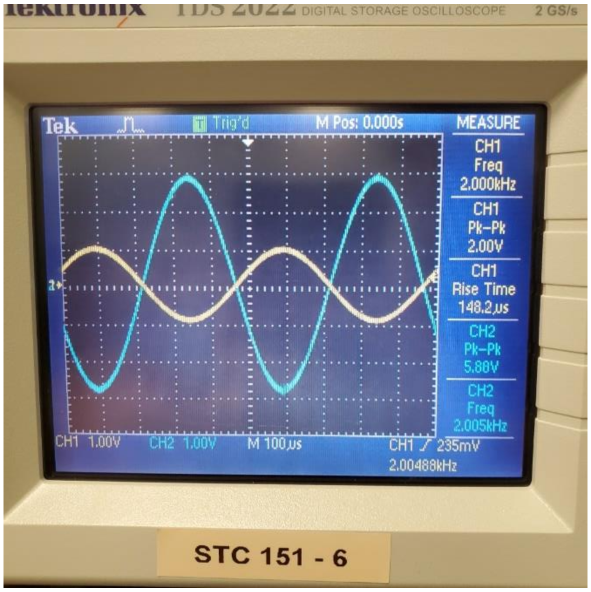

Figure 7, R 2k Hz

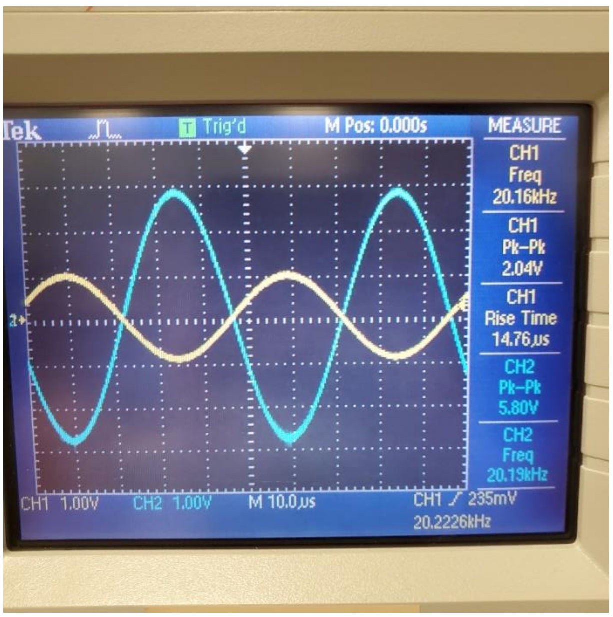

Figure 8, R 20k Hz

$$Right\ Channel\ Deviation\ (dB) = 20 \cdot \log_{10}\left(\frac{6.04}{5.80}\right) = 0.35\ dB$$

$$Left\ Channel\ Deviation\ (dB) = 20 \cdot \log_{10}\left(\frac{5.92}{5.72}\right) = 0.30\ dB$$

Figure 9, Deviation

Figure 10, Lab Kit

Figure 11, Lab Drawer

Conclusion

This lab gave me very good experience in soldering. I had done it once before but it was much easier before, using larger components, longer wires, and more spread out. It was more challenging in this lab, but it was fulfilling to actually put the board together. I did have some trouble with getting my left channel to work at first though. I had to go back and touch up my soldering on one side of the op-amp and after that it worked great. In addition to just getting it to work, the design specifications were also met. My deviation was well below 3dB so the design specifications were met.