Lab 8

Mixer and Preamp - Assemble, Troubleshoot, and Evaluate Performance

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Objectives

The objectives for this lab were to put together all the components onto the pre-amp and mixer PCB and make measurements to tell whether it meets specifications or not.

Procedure

Equipment and supplies

- Soldering kit, pre-amp and mixer PCB, function generator, oscilloscope

Procedure

In this lab, we first had to solder the necessary components onto our pre-amp and mixer PCB. This including resistors, the op-amp, and pins. We then could measure the output voltages when applying an input voltage from the function generator. The input/output voltages, gain, and error for both the pre-amp and right and left channels for the mixer can be seen below in Table 2 and Table 1 (from lab4). The frequency response can be seen in Table 3. With these calculations, I found my PCB met design specifications as they were well within the frequency response limits. The oscilloscope measurements can also be seen in Figures 3-14. After making the measurements and calculations, we tested our PCB with the microphone and saw that it behaved as expected, allowing the microphone to be heard through the speakers and it being mixed in with the audio being played.

Figure 1, Schematic

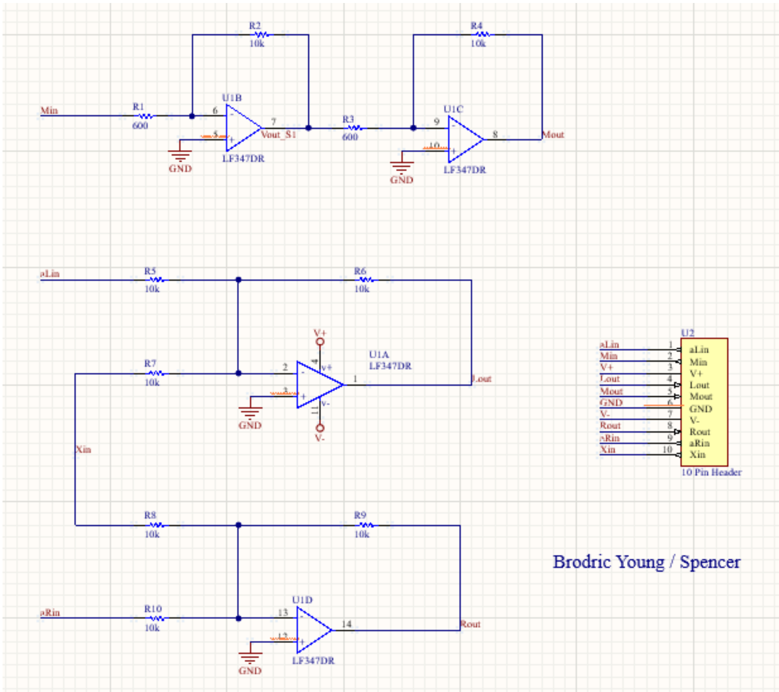

Figure 2, Preamp Simulation

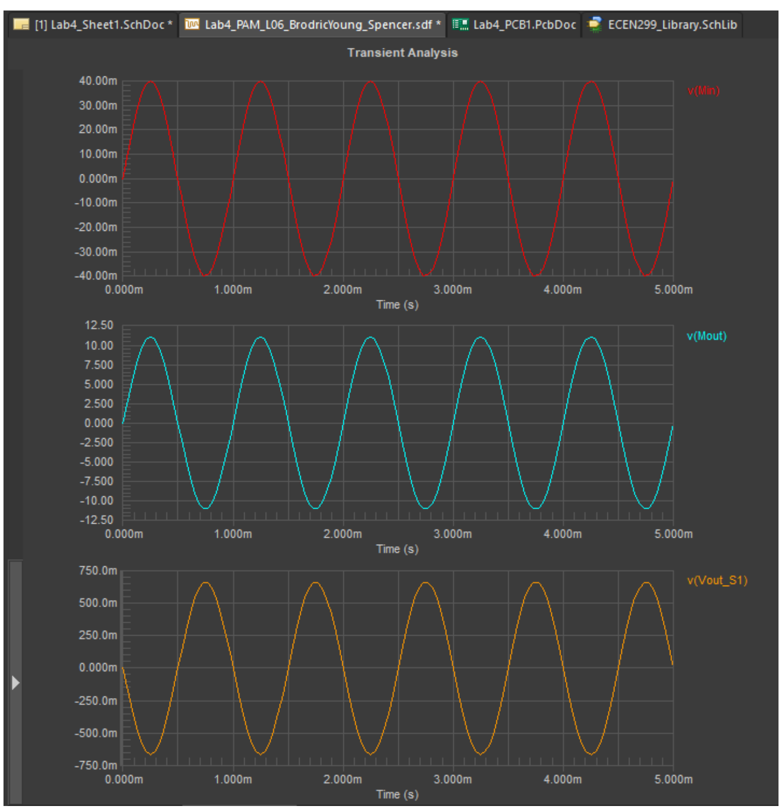

Table 1 Calculated and Simulated Results for Each Amplifier Stage (From Lab 4)

Description	V_{in}	$V_{out(calculate}$	$A_{v(calculated)} = \frac{V_{out(calculated)}}{V_{in}}$	$V_{out(simulated)}$	$A_{v(Simulation)} = \frac{V_{out(simulated)}}{V_{in}}$
Pre-Amp, Stage 1	40mV	-665mV	16.6	-665mV	16.6
Pre-Amp, Stage 2	-665mV	11.1mV	16.7	11.1V	16.7
Pre-Amp, Total	-625mV	11mV	17.6	11V	17.6

Amplifier	Frequency (Hz)	$V_{in(pp)}$	$V_{out(exp)}$	$V_{out(act)}$	$A_{dB(exp)}$	$A_{dB(act)}$	Error $\epsilon = \lvert A_{dB(exp)} - A_{dB(act)} \rvert$
Pre-Amp	20	18.4mV	5.11V	4.6V	48.9	47.9	1
	200	18.4mV	5.11V	4.56V	48.9	47.9	1
	$2k$	18.4mV	5.11V	4.52V	48.9	47.8	1.1
	$20k$	18.4mV	5.11V	4.28V	48.9	47.3	1.6
Mixer Left Channel	20	2.06V	4.12V	4.12V	6.02	6.02	0
	200	2.06V	4.12V	4.12V	6.02	6.02	0
	$2k$	2.04V	4.08V	4.04V	6.02	5.94	0.08
	$20k$	2.04V	4.08V	4.04	6.02	5.94	0.08
Mixer Right Channel	20	1.98V	3.96V	4.12V	6.02	6.36	0.34
	200	2.06V	4.12V	4.12V	6.02	6.02	0
	$2k$	2.02V	4.04V	4.04V	6.02	6.02	0
	$20k$	2.04V	4.08V	4.08V	6.02	6.02	0

Table 2 – Pre-Amp and Mixer Frequency Response

Amplifier	ϵ_{min}	ϵ_{max}	Frequency Response $\epsilon_{max} - \epsilon_{min}$
Pre-Amp	1	1.6	0.6
Mixer (L)	0	0.08	0.08
Mixer (R)	0	0.34	0.34

Table 3 – Frequency Response Verification

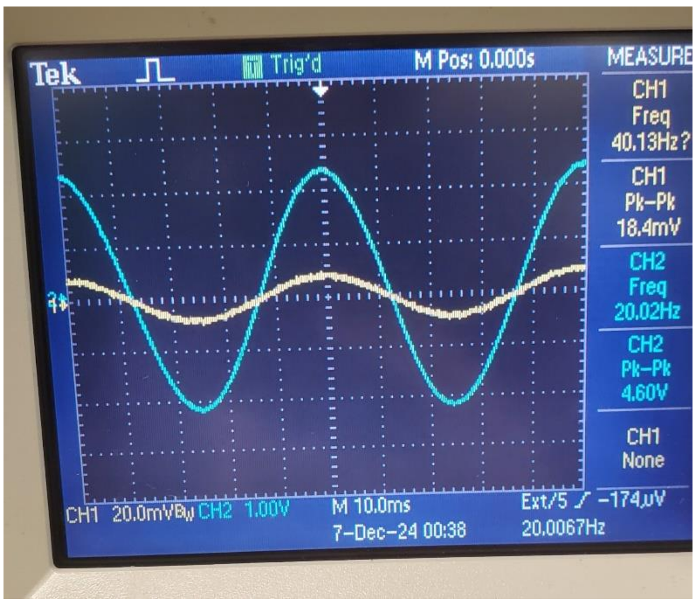

Figure 3, Pre-Amp 20Hz

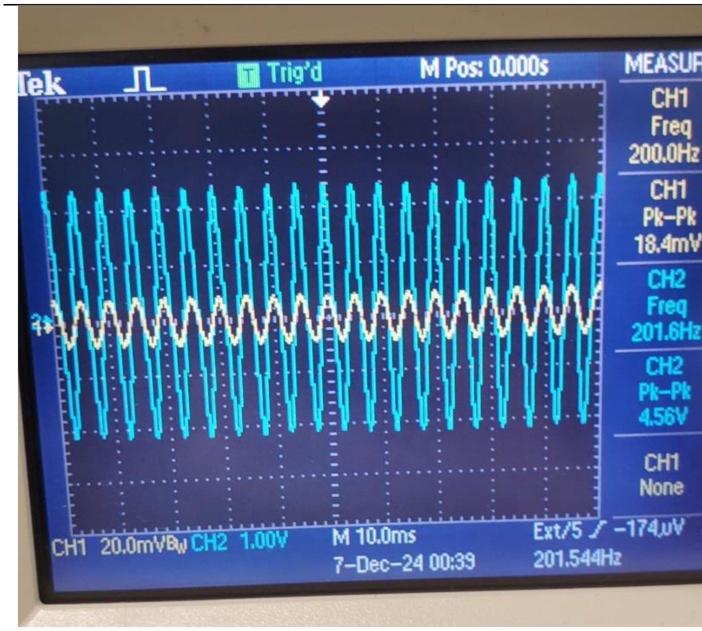

Figure 4, Pre-Amp 200Hz

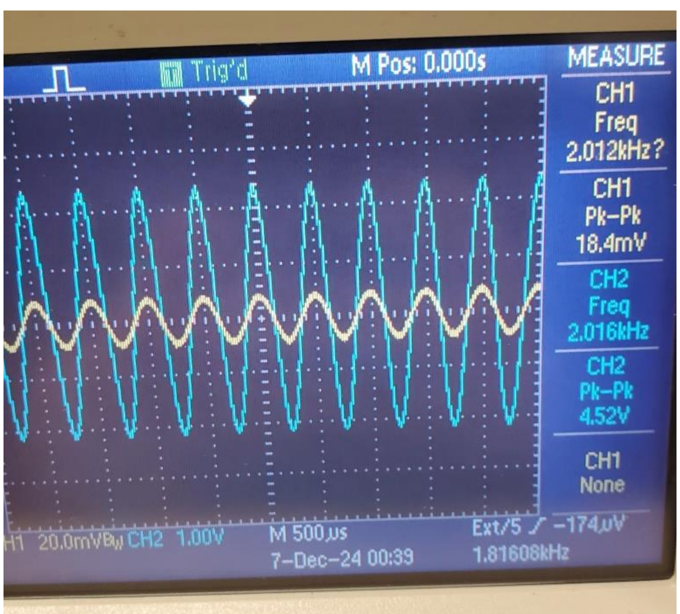

Figure 5, Pre-Amp 2k Hz

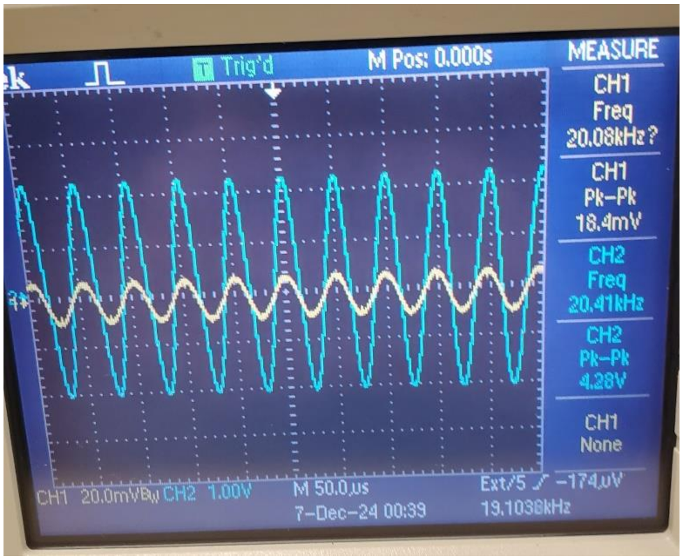

Figure 6, Pre-Amp 20k Hz

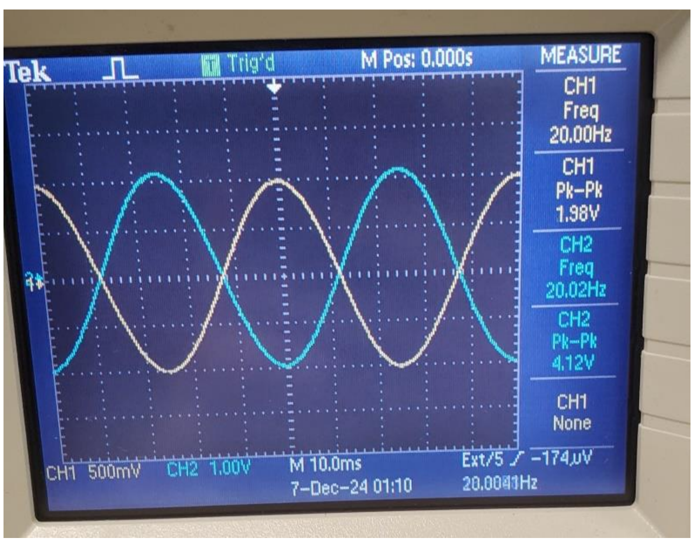

Figure 7, R Mixer 20Hz

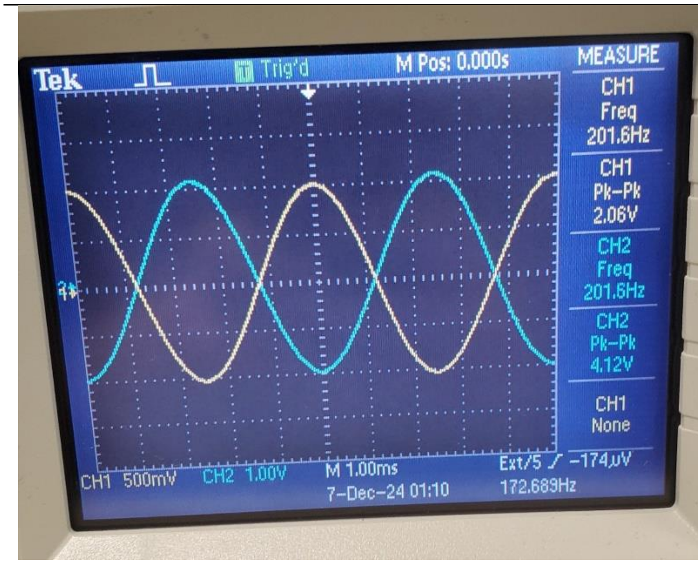

Figure 8, R Mixer 200Hz

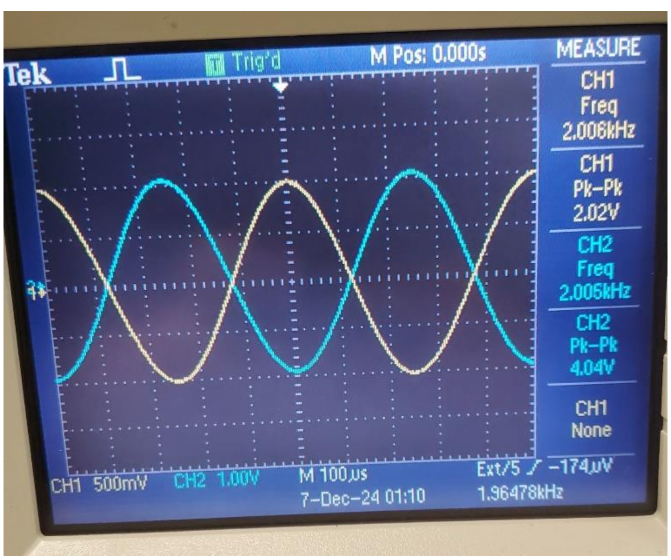

Figure 9, R Mixer 2k Hz

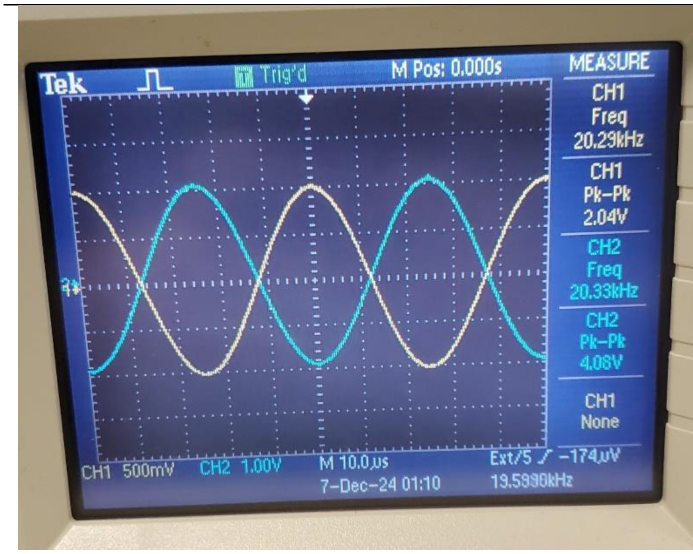

Figure 10, R Mixer 20k Hz

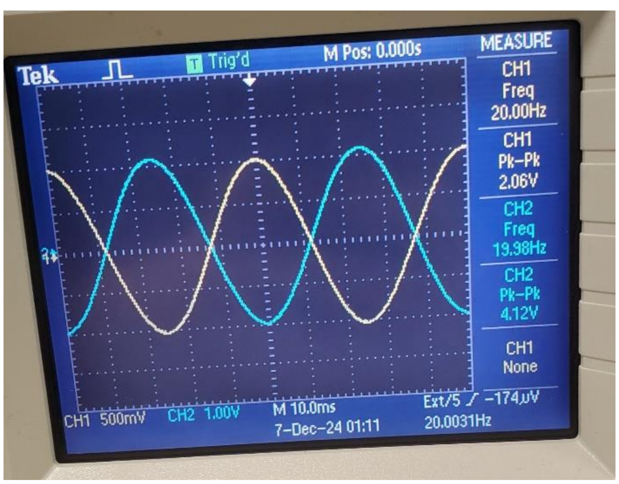

Figure 11, L Mixer 20 Hz

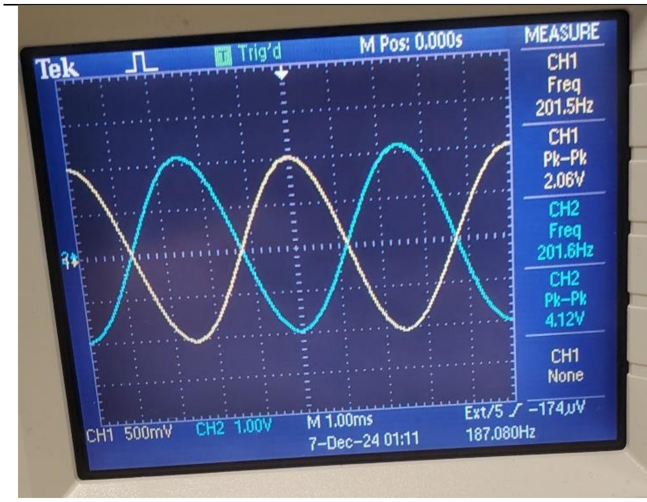

Figure 12, L Mixer 200 Hz

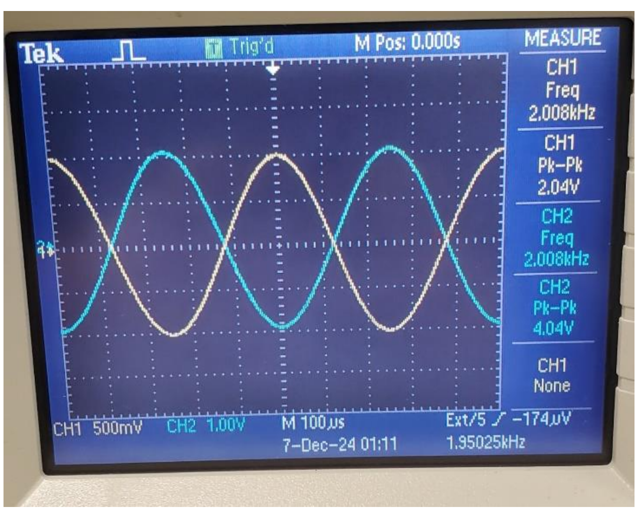

Figure 13, L Mixer 2k Hz

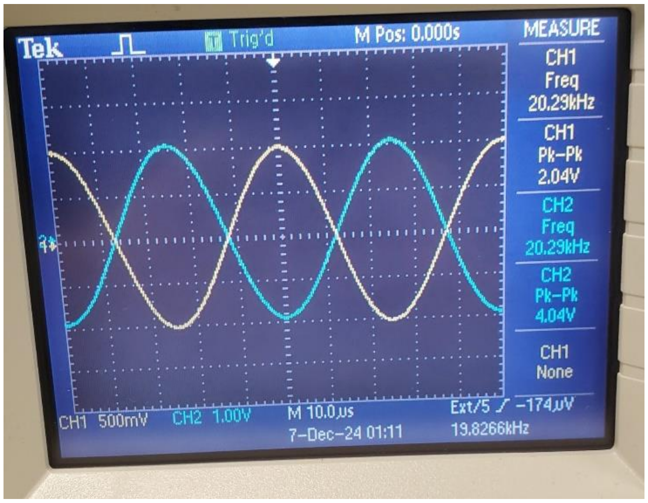

Figure 14, L Mixer 20k Hz

Conclusion

This lab felt much easier than previous labs, mainly because I knew how to solder by now, and the footprints were the proper sizes. It went very smoothly. Sam passed off the circuit, and it behaved as expected. It also met the design specifications being well within the specified frequency response. That was about it for this lab, there wasn't much to it. It went smoothly and well.