Lab 6

System Measurements, and Lab Equipment

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ECEN 299

Procedures

For the lab this week we had to measure the performance of the PCBs in the system. We started with the buffer circuit by sending in a voltage from the function generator. We wanted to test and make sure that we were getting the right gain from our op-amp in the buffer circuit.

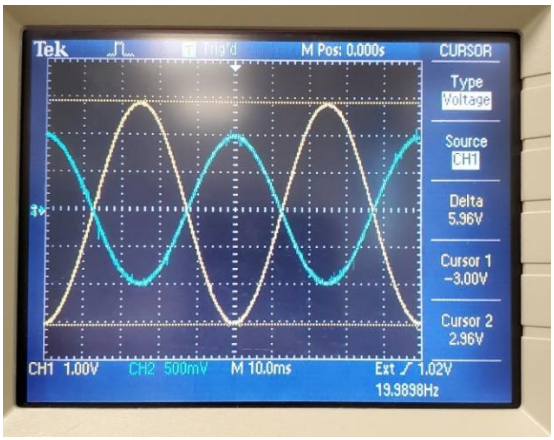

Fig 1: buffer circuit at 20Hz

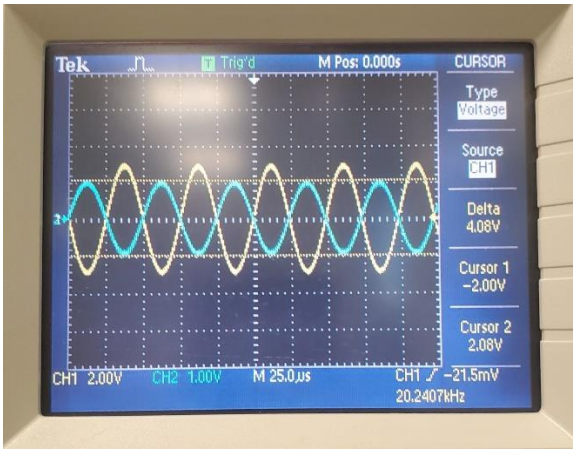

Fig 2: buffer circuit at 20KHz

After collecting the inputs and outputs from the circuit we were able to calculate the gain of the circuit. It matched what we designed for it in the week 3 lab.

Table for the buffer

$V_{in} = 2V_{pp}$ from Function Generator	Frequency	$V_{in(pp)}$	$V_{out(pp)}$	Gain: $A = \frac{V_{out(pp)}}{V_{in(pp)}}$
Left Channel	**20 Hz**	2V	6V	3
Left Channel	**20 kHz**	2V	6V	3

After testing the preamp, we went ahead and started testing the preamp. We hooked up the function generator to the preamp in and the probes to the input and the output of the preamp. After that we went ahead and took measurements from the right channel of the mixer.

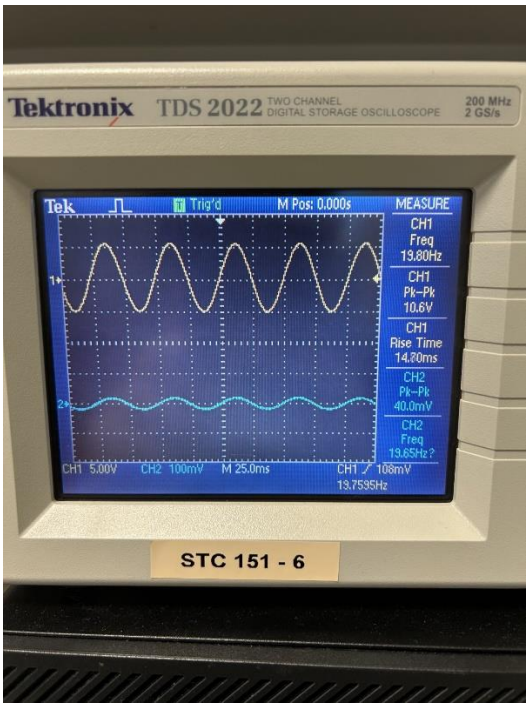

Fig 3: preamp

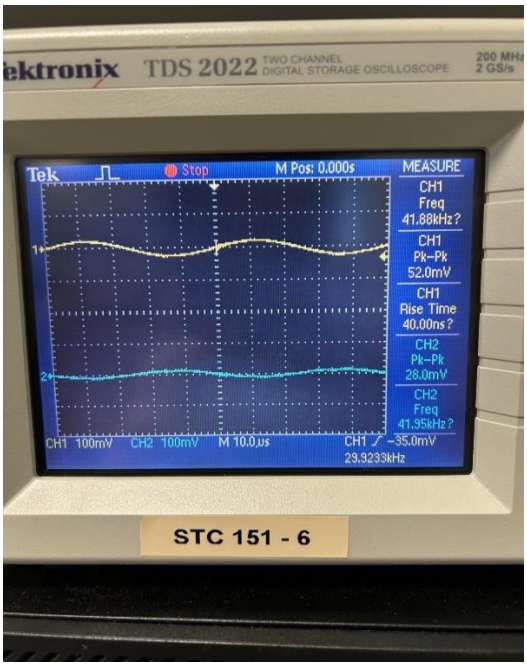

Fig 4: mixer

Table for pre-amp and mixer circuit

Amplifier	Frequency (Hz)	V_{in}	V_{out}	$\lvert A_{dB} \rvert$
Pre-Amp	20	0.040V	10.6V	48.47dB
	$20k$	0.028V	7.4V	48.44dB
Mixer Left Channel	20	.6V	1V	4.43dB
	$20k$	.28	.52	5.37dB

After calculating the gain for both the preamp and the mixer we went on to test our treble and bass circuit. We tested them at both high and low frequencies and calculated the gains.

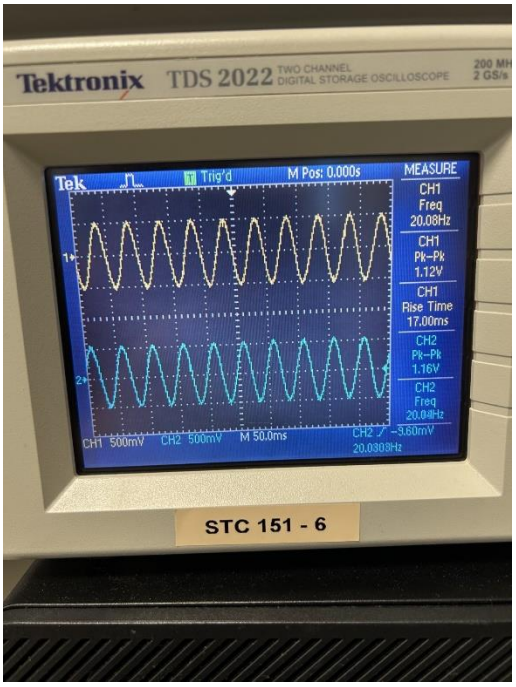

Fig 5: treble low frequencies $\alpha = 1$

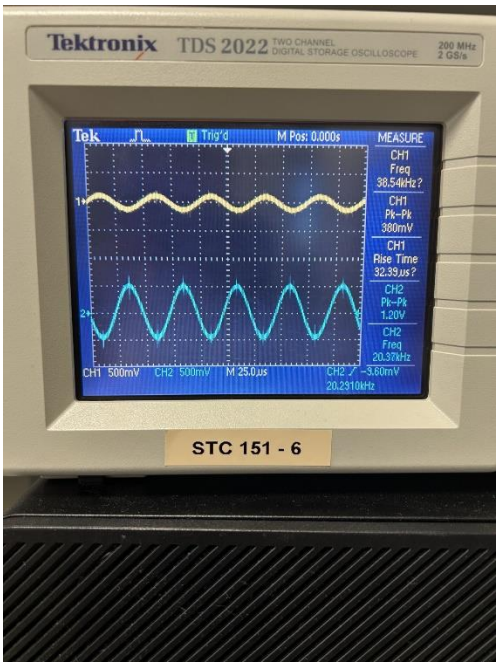

Fig 6: treble high frequencies at $\alpha = 1$

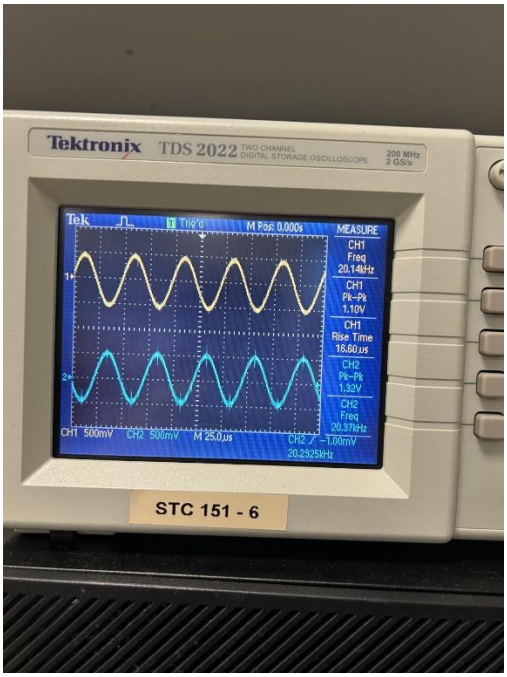

Fig 7: bass high frequencies at $\alpha = 1$

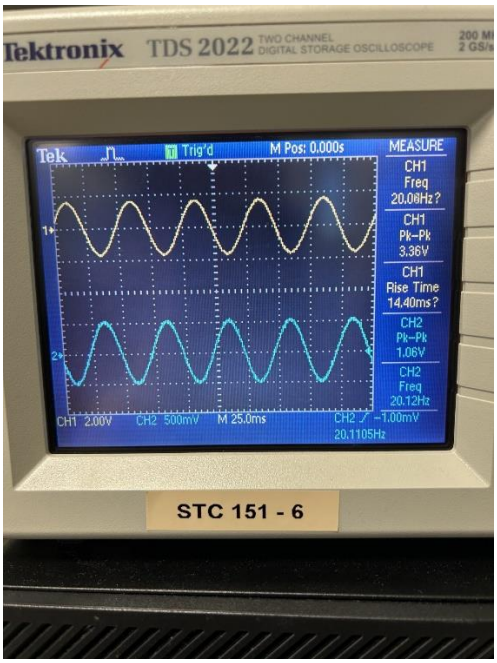

Fig 8: bass low frequencies at $\alpha = 1$

Table for Treble and Bass Frequency Response Measurements.

	Channel	$f(Hz)$	Treble			Bass		
			V_{in}	V_{out}	$\lvert A_{dB}\rvert$	V_{in}	V_{out}	$\lvert A_{dB}\rvert$
$\alpha = 0$	Left	$20Hz$	1.1V	1.1 V	0dB	1.1V	.4V	8.79dB
		$20kHz$	1.2 V	.5 V	6.84dB	1.1 V	1.2 V	0.75dB
$\alpha = 1$	Left	$20Hz$	1.1 V	1.1 V	0dB	1.1 V	3.8 V	10.7dB
		$20kHz$	1.1 V	4.1 V	11.42dB	1.1 V	1.2 V	0.75dB

Lab cleanliness

Inside of lab bucket

Inside of drawer

Conclusion

Over the course of this lab, we ran into several issues all related to getting the correct measurements with the oscilloscope. It seemed like every time our oscilloscope was showing something completely different from what we expected. We were able to get everything connected correctly and the oscilloscope setup correctly eventually, it just took us some time and occasionally help from others.

After this lab, we concluded that the board did meet the design specifications as specified in Appendix A. For the line buffer amplifier, we were able to get the expected gain of -3 and frequency response. For the pre-amp and mixer, we eventually came up with a gain within 10% of 277 and the correct frequency response. For the bass and treble, we came up with the right minimum and maximums for a given frequency range. These led us to conclude the board met design specifications.