EE/CprE/SE 492 WEEKLY REPORT 5

3/13/25 - 4/3/25

sdmay25-16

Project title: Multi-Channel High-Gain Low Noise Amplifier for High-Frequency Ultrasound Signal Acquisition

Client &/Advisor: Manojit Pramanik

Team Members/Role:

Jon Wetenkamp, Yash Gaonkar, Ethan Hulinsky, Ryan Ellerbach

- **Bi-Weekly Summary:**

  This past two weeks the team has been working on physical testing. The team ordered the Boards from ETG and assembled a few stages of the boards to test. We ran several tests on the boards to see if they match the specifications we need. Unfortunately, preliminary tests revealed that our gain fell to 26dB from the 42dB spec we were seeing on the online simulator.

  After this the team decided to start testing the stages individually to see where the problem lay. The first stage seemed to match the gain we were expecting but the second stage did not seem to work. We think this was caused by incorrect biasing due to the observation that the second stage was drawing in too much current. To test this theory, we soldered the stages individually on separate channels to see how they performed apart from each other. This initially seemed to prove that the issues we were seeing did not come from the single stages individually. We then assembled a full stage of the amplifier on the new board to test if there was an issue in the printing of the first board or if we had damaged it during testing/assembly. While this new board initially looked promising, we were unable to perform this testing in the lab we normally use. Unfortunately, due to the different lab, or the different SMA/BNC cables (which we had issues with before) there was too much noise coming from the input attached to the waveform generator to accurately reach any conclusions. The noise This may have been caused by issues with the SMA/BNC cables being used or simply by too much electrical signals in the area.

  The team also started the design of the power supply. We ordered the parts off Amazon, and we are waiting for them to arrive so we can see how we can integrate the power supply with the board.

- **Past week accomplishments**

- Yash Gaonkar: Started the design of the Power supply and helped with the board testing.
- Ethan Hulinsky: Soldered test board and compared actual performance with desired performance in terms of gain, bandwidth, and current consumption. Worked on troubleshooting and made modifications to fix issues with the test board, such as incorrect bias resistors and backwards amplifier orientations.
- Ryan Ellerbach: Set up testing documents, performed gain, bandwidth, and connectivity tests. Soldered another board to test if just the first board was the issue. Applied changes to new design file so we can order the final boards as soon as possible.
- Jon Wetenkamp: Helped with fabrication and testing of the newly printed PCB. Soldered and tested a single amplifier stage on a new board to troubleshoot issues with the two amplifier setup. Compared the new board with a single stage to the old prototype board with a single stage and verified they behaved the same (see attached oscilloscope images).

- **Pending issues**

1) As mentioned above, we are seeing too much noise at the input, which is then amplified at the output. This is causing problems running tests to determine if the circuit is working properly. If we can't resolve this problem soon, time will be an issue.

2) We are still trying to figure out the EM shielding for the circuit and how to integrate the power supply with the board.

- **Individual contributions**

NAME	Individual Contributions *(Quick list of contributions. This should be short.)*	Hours this week	HOURS cumulative
Jonathan Wetenkamp	Helped with fabrication and testing of the newly printed PCB. Soldered and tested a single amplifier stage on a new board to troubleshoot issues with the two amplifier setup. Compared the new board with a single stage to the old prototype board with a single stage	10	50
Yash Gaonkar	Started the design of the Power supply and helped with the board testing.	6.5	39.5
Ryan Ellerbach	Set up testing documents, performed gain, bandwidth, and connectivity tests. Soldered another board for additional testing. Applied changes to design file.	10	51
Ethan Hulinsky	Soldered test board and compared actual performance with desired performance in terms of gain, bandwidth, and current consumption. Worked on troubleshooting	10	56

	and made modifications to fix issues with the test board, such as incorrect bias resistors and backwards amplifier orientations.		

- **Plans for the upcoming week**

  Keep on working on the tests for the board and see if we can reduce the noise seen at the output. Apply any changes we find to our final design on EasyEDA to order new boards and components soon. We also will start working on the power supply as well as start to think about how to present our design for the final presentation.

- **Attachments**

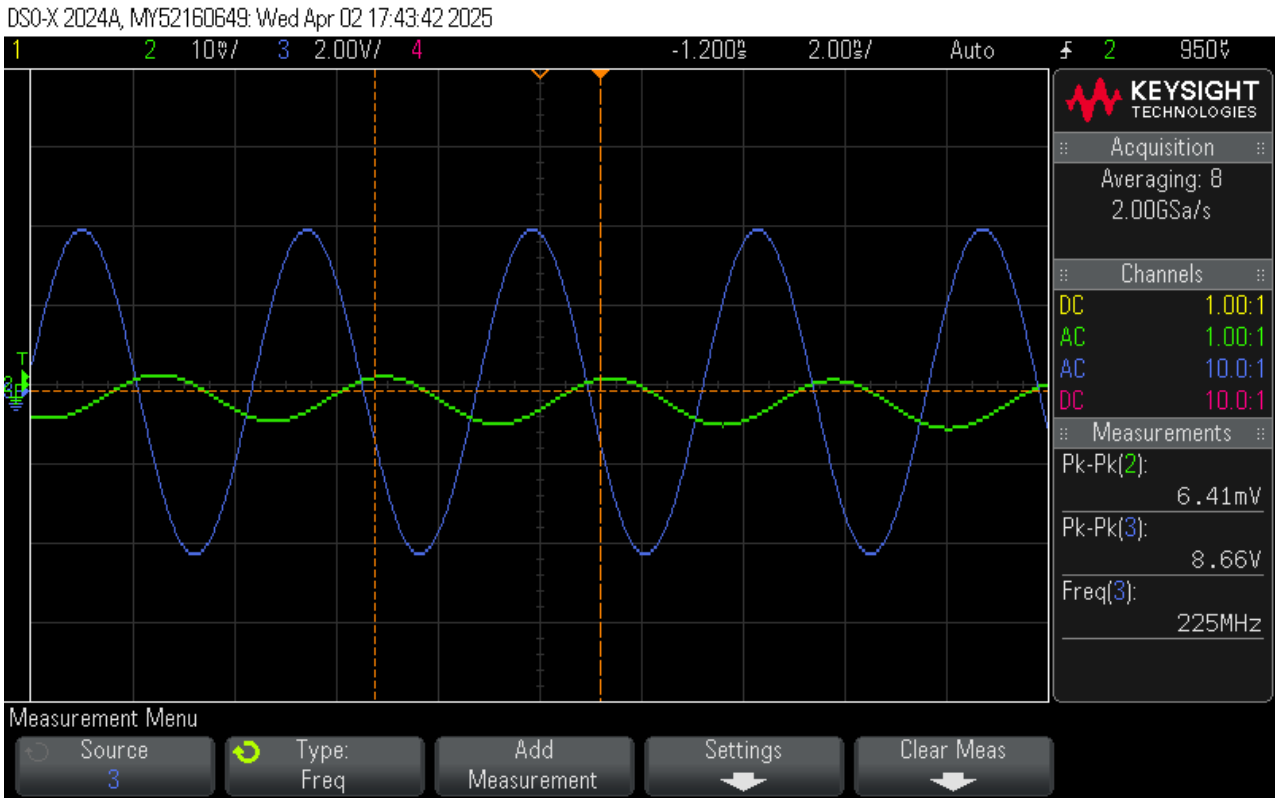
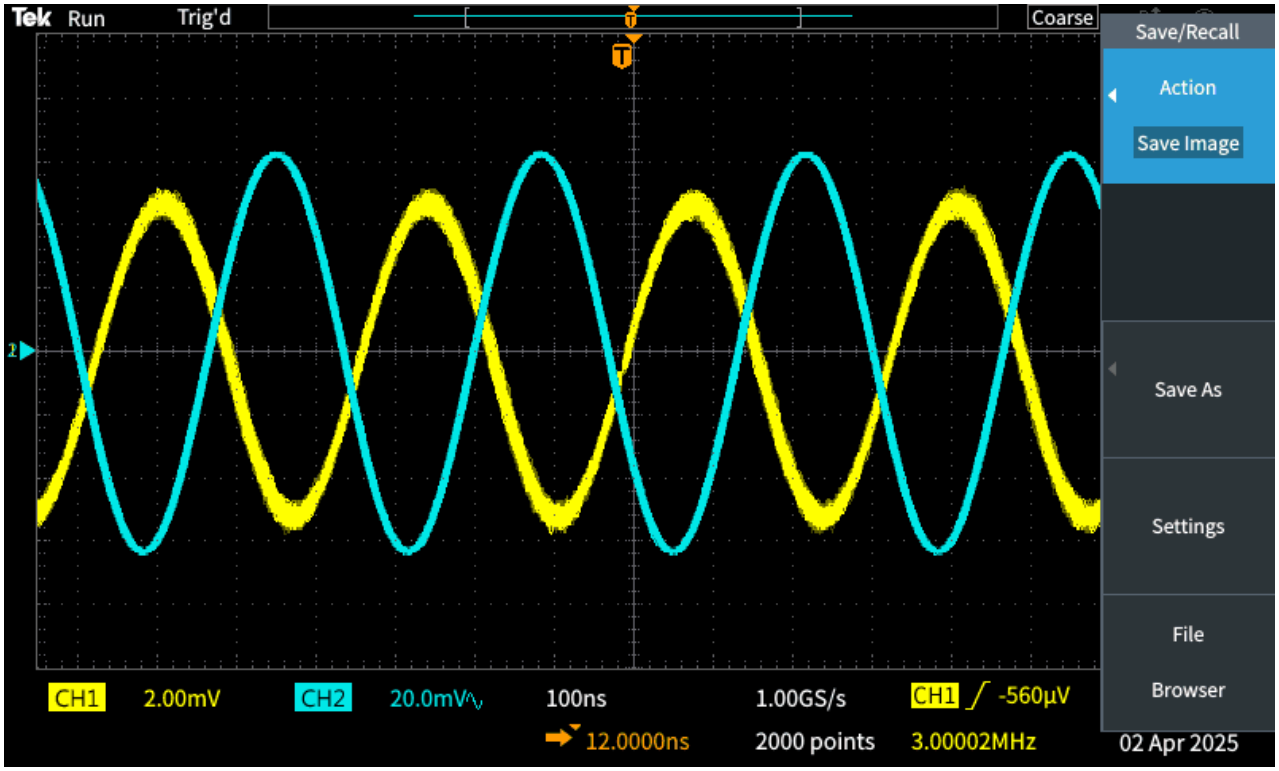


Image of noise at the input and output. The 6.41mV of noise on the input is amplified to be 8.66V of noise at the output. The frequency of this noise is 225MHz, whereas the input signal is 4MHz. Due to the high frequency and similar amplitude of the noise to the input frequency, the output signal is completely obscured.



The old single stage amplfier (above) matches the new single stage amplifier's gain (below)