Revisions and Testing

The Board Is All Over the Place

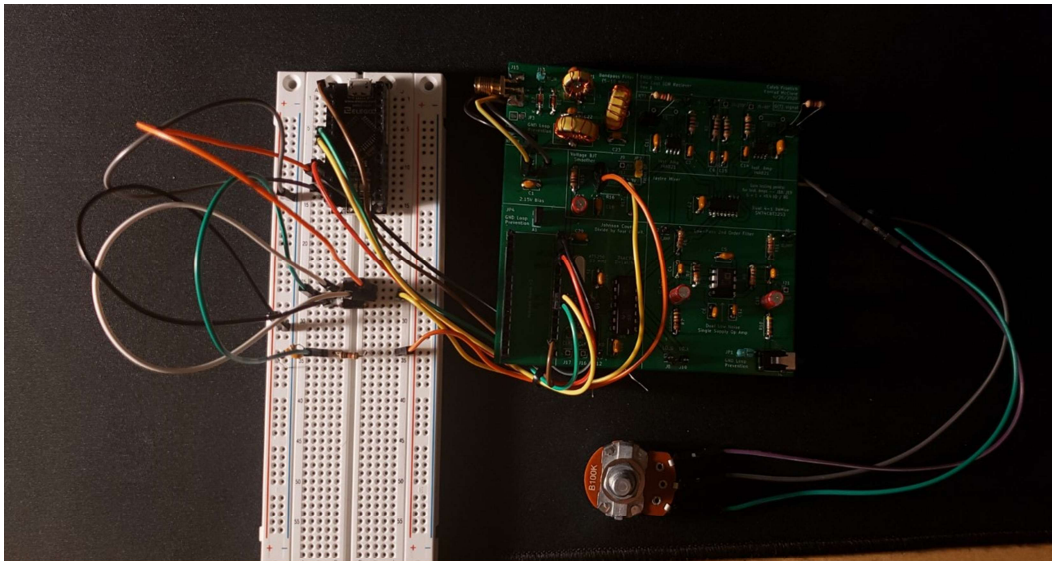
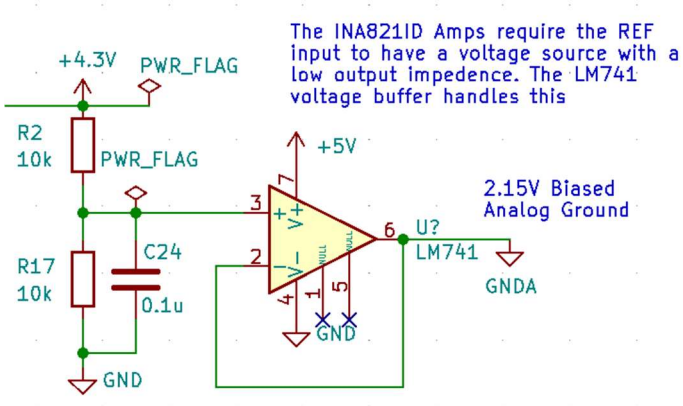


Figure 1 - Board prototype as is. Arduino and voltage buffer for setting GNDA are on the left. Potentiometer shown below for adjusting the input voltage offset.

Corrected Issues

Op Amp Voltage Buffer

Caleb was nice enough to mail me one of his LM741 Op Amps to set up a voltage buffer with. It appears to correct the output impedance problem. It is now set up on the breadboard like so:



SDA and SCL Lines

As it turns out, on Caleb's schematic he had accidentally placed the I2C lines on A3 and A4 instead of A4 and A5. Since those are hardware-based and cannot be changed, we had to move the Arduino to the breadboard and re-route the pins via wire jumpers. We could have tried to cut traces, but we didn't want to risk damaging the board if there was a safer way.

New Issues

MUX Problem (Fixed!)

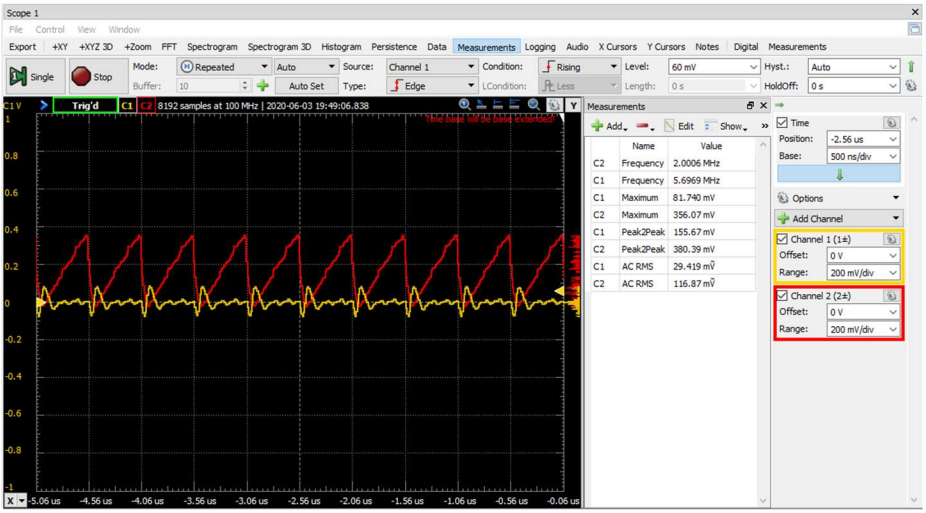


Figure 2 - Signals seen on either side of bandpass filter even when no signal was input on antenna YELLOW = RF_IN Pin, RED = RF_OUT Pin.

After correcting the previous problems, I saw that, with no signal input on the antenna, the above noise appeared on either side of the bandpass filter. When putting a signal in, this noise would overpower it. The frequency of the signal was equal to that of my LO signals, so I determined it must have been coming from there somehow. At Dr. Frohne's suggestion, I dialed the clock generator back so that the LO signal would be at 3kHz so it would be easier to see the signal. Using the RF_OUT jumper pin, I put a 1V DC signal directly into the input of the MUX to observe the switching behavior. The results can be seen below

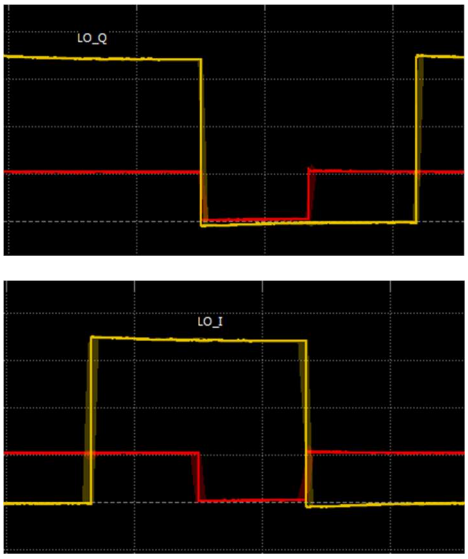


Figure 3 - RED = input signal at RF_OUT (1V DC), YELLOW = LO_I or LO_Q

On the MUX, LO_I = S0 (low bit), LO_Q = S1 (high bit). If we look at the input and LO signals together, we can see that **the input signal is connected to ground at the 01 state of the MUX.** Visually observing the board, I found that the capacitor C14's legs were touching on the back side. After clipping them, the problem disappeared for both the low and high frequency cases.

Voltage Offset Matching (Fixed! Kind of)

After adding the Op Amp Voltage Buffer, I still found that the voltages at the two 10k-10k dividers (GNDA divider and RF_OUT bias point) were off by about 40mV, causing the instrumentation amps to saturate from amplifying the difference. Luckily, I had a 100k potentiometer handy that I first tried to use to replace the GNDA divider with the potentiometer, however no matter how I adjusted it, I couldn't set GNDA low enough to meet the bias point. GNDA would not go lower than 1.96mV while the bias point was around 1.90mV. (These voltages are lower than expected, but that's another matter for now.) As a second attempt, I replaced the bias point instead, which did allow me to tune the bias to be equal with GNDA.

MUX Output at Different Offsets (In Progress: https://github.com/KonradMcClure/SDR_Receiver/issues/3)

The I_0, I_180, Q_90, and Q_270 lines are not at equal voltage offsets, causing the I and Q signals to be about a full volt apart. Need to compare their offsets to GNDA and find a way to get those paths at as close resistances to each other as possible, while also averaging on GNDA...

Arduino 5V Pin Voltage Too Low (In Progress: https://github.com/KonradMcClure/SDR_Receiver/issues/2)

The voltage reads around 4.5V. There's probably something pulling more current than it should. After the BJT smoother, we're aiming for a voltage of about 4.3V, but with the drop from 5V causes it to be around 3.8-3.9V