Caleb Froelich
Konrad McClure
ENGR 357
05/07/2020

Board Construction and Testing Protocol

Prep-Work

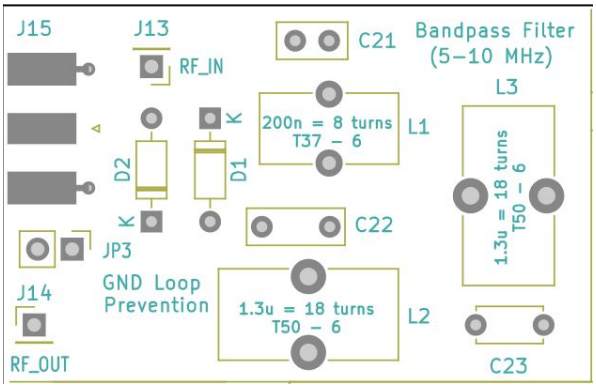
- Prepare documentation

Attenuator:

- Visually inspect the PCB board.
- Check resistance values.
- Solder ‘em boys up.
- Test all the stage combinations using our Digilent Discovery 2.
- Use 50 ohm resistor on the end of the attenuator.

SDR Receiver:

- Check all the parts.
- Assemble inductors.
    - **L1:** T37-6: 8 turns.
    - **L2 + L3:** T50-6: 18 turns.
- Organize parts by section. Note orientation of IC’s and polarized(?) capacitors.
- Visually inspect the PCB board.
- Test NET connections to confirm.
- Start assembling PCB boards by section. (In a given section, do surface mount first.)
- Check Discovery 2 to see if they have 50 ohm input.
    - Solder SMA connector.
    - **Bandpass Filter Section.**



- Solder bandpass filter and components.
- ⚠ Test power connection for shorts ⚠
- Test with Discovery 2, send a small signal in and measure the output voltage. We will compare the measurements with our LTSPICE simulation data.

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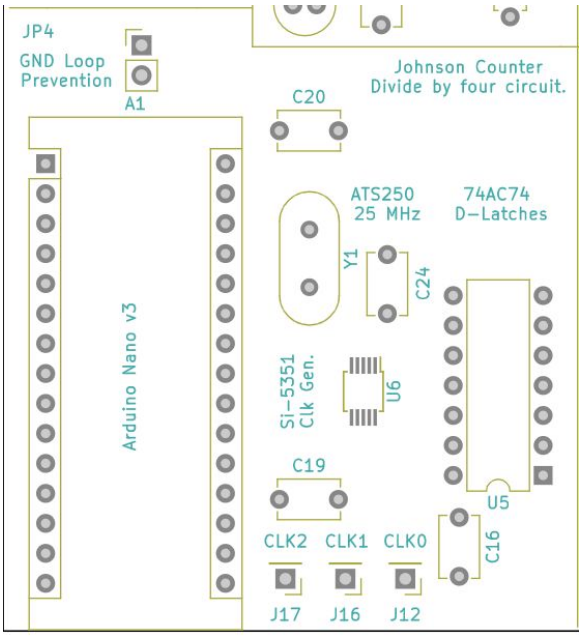
- **Digital Section.**
  - 

  - Solder pin sockets and place Arduino. (Solder bypass capacitors)
    - ⚠ Test power connection for shorts ⚠
    - Isolate code into test files to test specific sections of the board.
  - Install 2.15V biased analog ground.
    - ⚠ Test power connection for shorts ⚠
    - Make sure we have a 50 ohm load for testing purposes.
  - Solder clock generator.
    - ⚠ Test power connection for shorts ⚠
    - Download test program from github.
      - https://github.com/frohro/IQ_SDR/tree/master/Quisk/Arduino/SDR_Test1
    - Test power.
    - Test clock generator. The scope of the Discovery 2 has 30MHz of bandwidth. Since our clock is maximally going to be switching at 40MHz, we will have to refine the test such that we can use the scope on the Analog discovery 2..
  - Solder crystal.
  - Solder D-latches. (Bypass capacitors)
    - ⚠ Test power connection for shorts ⚠
    - Test Johnson Counter. We have two test points to check LO_Q and LO_I. We will be testing to ensure that these are 90° out of phase.
- **Low-pass Filter Section.** (Solder bypass capacitors for op amps)

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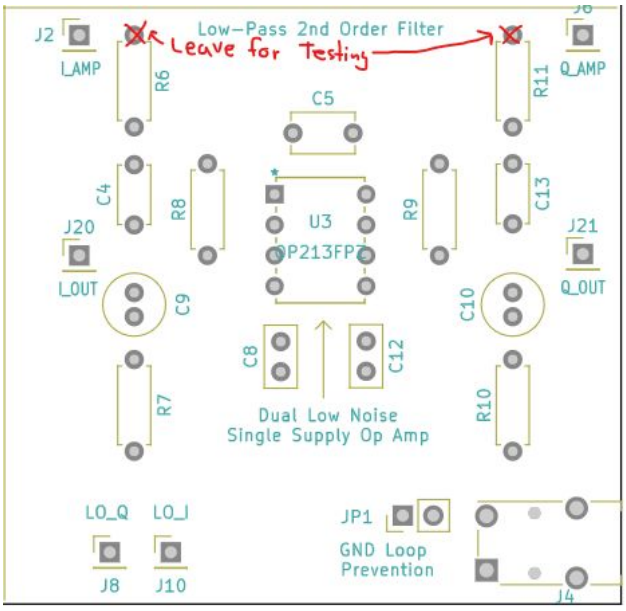
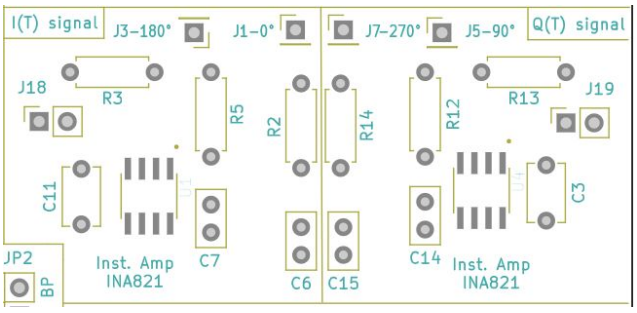
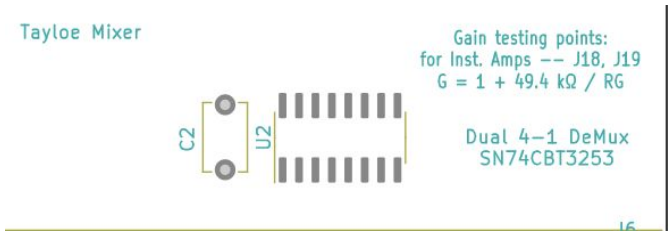
- 

- Solder the 2nd order low-pass filter along with capacitors and resistors.
    - ⚠ Test power connection for shorts ⚠
    - Solder only the filter-side of R6 and R11 at first, using the other end for the signal generator probe. This will keep it isolated until it's time to connect it to the rest of the circuit.
    - Similar testing procedure to the Bandpass filter, send a small signal from the Discovery 2 and measure the output for various frequencies. We will compare the measurements with our LTSPICE simulation data.

- **Instrumentation Amp Section**
    - 

    - Solder instrumentation amps and bypass capacitors.
    - ⚠ Test power connection for shorts ⚠
    - Test common mode rejection of instrumentation amps and differential gain:
    - Send a signal through the I_IN0, I_IN180 and Q_IN90, Q_IN270 test points with the Discovery 2's signal generator and measure the output on the corresponding output test point.
    - The common mode rejection could be measured by applying a DC bias to the input signal.

    - The differential gain can be measured and varied by adding parallel resistance to pins J18 and J19. This would decrease the gain resistance and increase the gain.
- **Tayloe Mixer Section**



    - Multiplexer. (Bypass capacitors and gain resistors and other throughhole parts.)
    - ⚠ Test power connection for shorts ⚠
        - Send a DC voltage through the mux and view the outputs.
- Test sound card.
    - Plug it in, test with operating system
    - Make sure that you can select sound card with Quisk.
    - Test microphone input with microphone/headphones/cable; whatever is available.
- Load arduino code
- Check for shorts using a multimeter.
    - Vcc to GND.
    - Analog GND to GND.
- Hook it all up.
- Send a sinusoidal signal (use attenuator) through the bandpass filter from the Digilent.
- Monitor the current drawn from the power supply. Start out with 0 volts and then turn it up.
- Fry it 🔥🔥🔥.
- Test which GND loop produces the least noise.