



SDR Cube Transceiver Online Assembly Guide

Detailed construction notes for building and testing each of the SDR Cube kit modules

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RF Functional Test

... (Section version 1.0a)

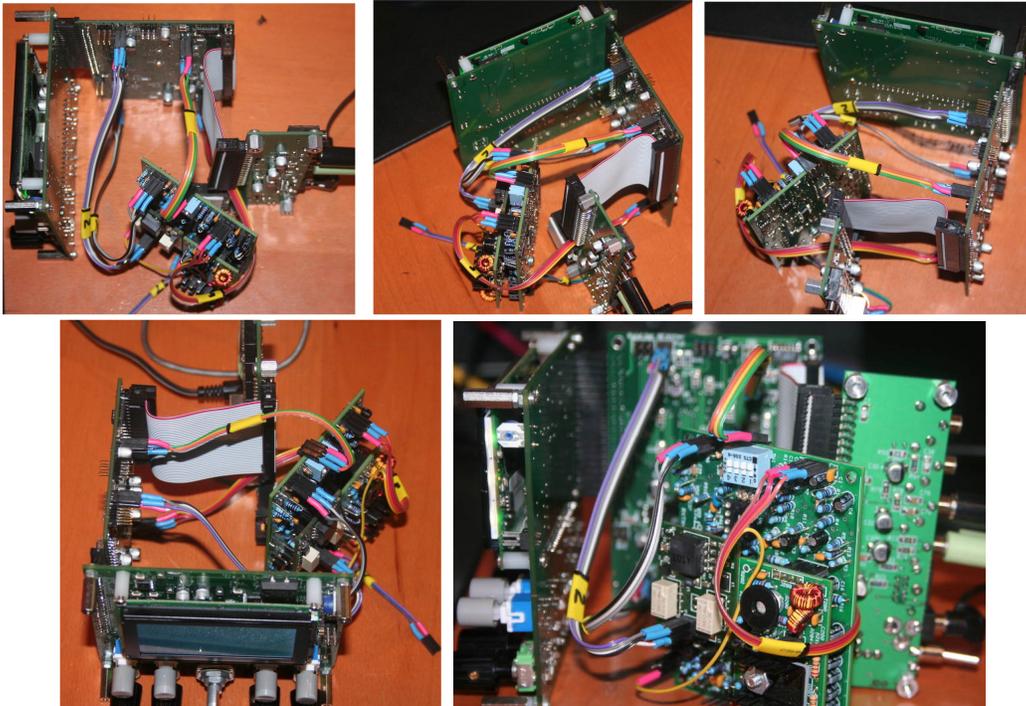
The purpose of this section is to test the SDR Cube with the RF Front End (e.g., with the Softrock RXTX 6.3: SR-Base, TXPA, RXAMP and X-LPF modules).

Step 1: The Starting Point ...

Here's what you should be starting with, as a result of going through [Final Assembly](#) ...



Or, if you didn't intend on using the main Cube Enclosure, here are some views of the completed and connected boards out in the open ...



Step 2: Apply power ...

- With the Softrock front end installed, the typical current draw from a 12V supply will be about 280 ma (In transmit this will increase to about 350 ma.)
- Make sure that you still have the full use of controls and display, as seen in the Digital Subassembly Test section

Step 3: Receive I-Q Balancing

Adjusting the receive-side **I** and **Q** audio paths for gain and phase is important to ensure maximum sideband rejection. In this step, you will adjust either the FIR Gain **I** (or FIR Gain **Q**) and **X** Gain controls to set the received audio of the opposite sideband to a minimum level.

- Input about 1-2 mV rf signal to Cube's BNC connector. The level must be high enough to get meaningful voltage readings from the audio we are going to measure.
- Carefully use a voltmeter (reading AC volts) to probe P8 pin 2 or pin 4. (P8 pin 2 is the pin closes to the lower edge of R18 in the lower left corner of the DSP board.)
- Select USB. (Or LSB if you'd rather use it.)
- Select widest filter.
- Tune the VFO so that you have audio between 500 and 1000Hz. (Anywhere within the Cube's filter pass band will do.)
- Record the meter reading - it should be somewhere between 200 - 350mV.
- Change to the opposite sideband.
- Go into the User Menu and select Fir Gain **I**. (Both **I** and **Q** gains should be 30000 when you start.)
- Start adjusting the **I** gain setting downward. If your meter reading also decreases you are in the right branch. If the audio voltage rises, return the **I** gain setting to 30000 and then adjust **Q** gain. Now, decreasing the **Q** gain should decrease the audio voltage.
- Adjust the setting to produce the minimum audio voltage reading. (The other branch should be 30000 and the one you adjust should be lower.) The audio voltage usually drops down to about 40mV with this amplitude balance adjustment.
- Now select **X** gain. Adjust it up or down to produce a minimum audio voltage reading. You may typically get down to 3.5mV.
- Exit the User menu to save settings and return to normal operation.
- Now switching between LSB and USB should yield a clear difference in the audio levels.

For example, with USB = 650mV and LSB = 3.5mV, the opposite sideband suppression is: $20\log(650/3.5) = 45\text{dB}$.

Typical sweet spot multipliers are **I** : 30000, **Q**: 26300, **X** : -3700

Step 4: CALIBRATING THE Si570

There is a small variability in the default XTAL setting for the Si570. This calibration step corrects for that variability and allows the Cube's VFO to accurately report the exact frequency on the display.

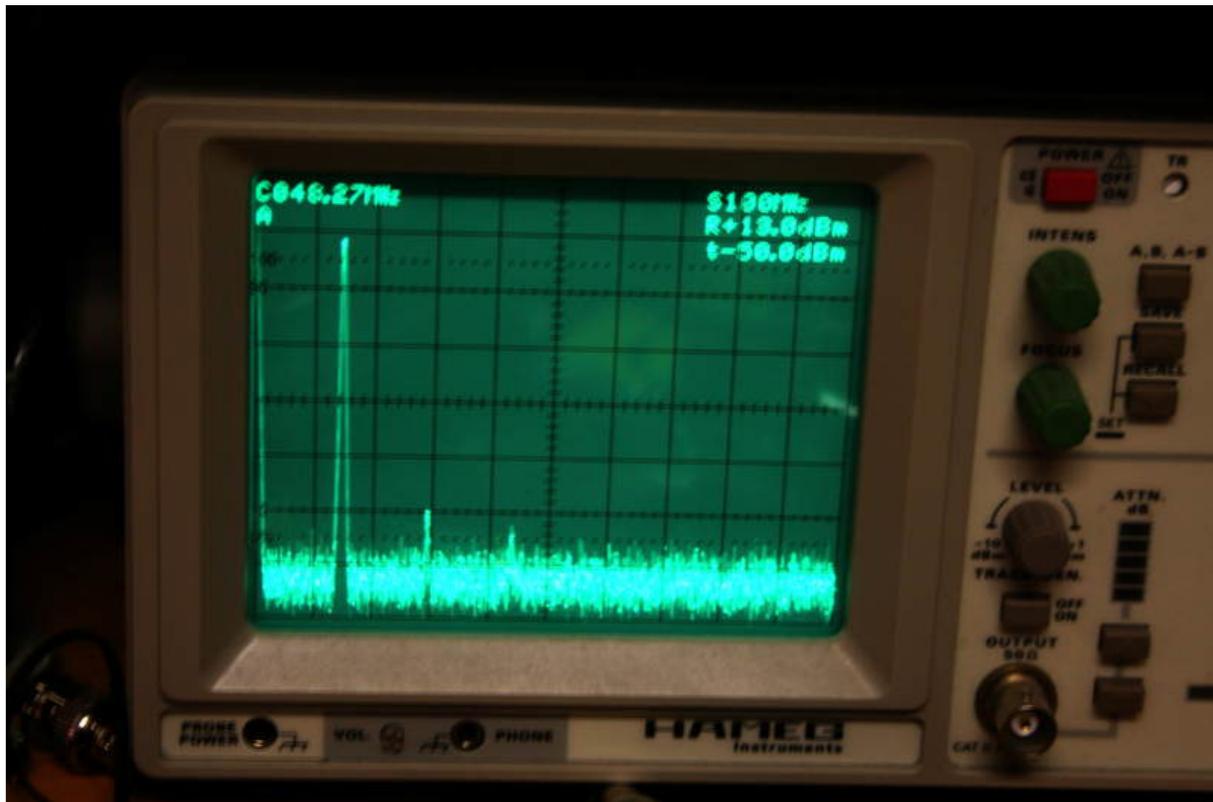
- Connect a known-accurate single tone reference signal (about 1-2 mV) to the antenna connector. For example: 14.200.000 Hz.
- Tune the Cube to 14.200.00, LSB or USB (does not matter). A spectrum spike should be seen near the zero Hertz zero center position of the display.
- Go to the User Menu and select **Si570 XTAL**. Adjust the setting to move the spectrum spike closer and closer toward the center of the display, until it completely disappears at 0 Hz.. (The 0 Hz bin is not shown, and thus is a good indicator of when the frequency is exactly calibrated).
- Write down the calibration figure. Exit the menu to save the values and return to normal operation.

Instead of using a signal generator you can also use the known frequency of an AM station in the Shortwave band. Put the VFO dial reading to that frequency and adjust the **Si570 XTAL** setting to move the the AM station's carrier to the 0Hz position on the display. Then exit the User menu to return to calibrated normal operation.

Typical chip default is 114.271011 and (in one case) the calibrated value is 114.2704

Step 5: Observing the spectrum output of the RF front end

This is a quick view of the RF spectrum of a 1.1 watt transmitted signal on 20 meters. (The Cube is in Tune mode.) Note that the 2nd and third harmonics are down almost 50 dB from the fundamental 14 MHz transmitted signal.



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