

Ensemble RXTX 03_Local Oscillator

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Local Oscillator Introduction

General

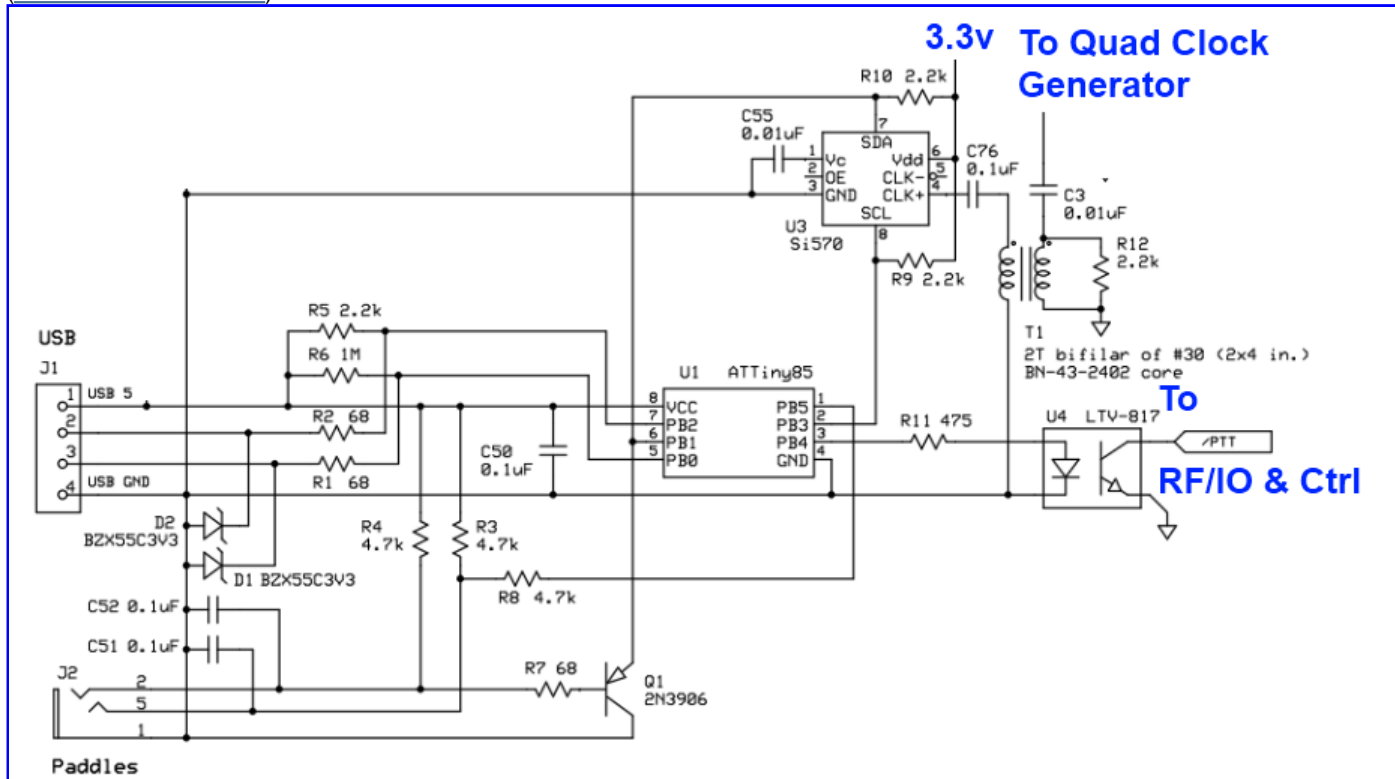
This stage introduces the microcontroller that controls the programmable Si570 oscillator (as well as handle the paddle input and provide ptt signaling for switching functions).

[\(go directly to build notes\)](#)

Local Oscillator Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

[\(Click for Full Schematic\)](#)











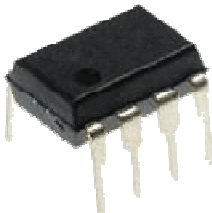

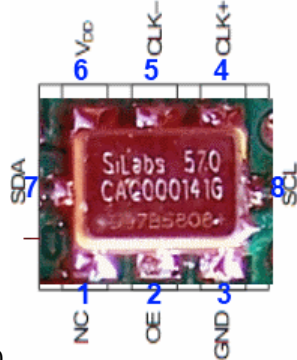
(above schematic has clickable areas that can be used for navigation)





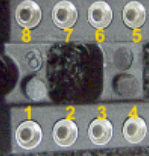


([go directly to build notes](#))

Local Oscillator Bill of Materials

Stage Bill of Materials

(resistor images and color codes courtesy of [Wilfried, DL5SWB's R-Color Code program](#))

Check	Count	Component	Marking	Category
<input type="checkbox"/>	1	475 1/4W 1%	y-v-grn-bl-br 	1/4W
<input type="checkbox"/>	1	1 M 1/6W 5%	brn-blk-grn-gld 	1/6W
<input type="checkbox"/>	4	2.2k 1/6W 5%	red-red-red-gld 	1/6W
<input type="checkbox"/>	3	4.7k 1/6W 5%	yel-vio-red-gld 	1/6W
<input type="checkbox"/>	3	68 1/6W 5%	bl-gry-blk-gld 	1/6W
<input type="checkbox"/>	2	BZX55C3V3 3.3V zener diode	BZX55C 	Axial
<input type="checkbox"/>	1	BN-43-2402 (no markings!)	none 	Binocular core
<input type="checkbox"/>	1	0.01 uF	103 	Ceramic
<input type="checkbox"/>	1	ATtiny 85-20 PU w/V15.12 Firmware	AVR ATTINY85-20PU 	DIP 8
<input type="checkbox"/>	1	LTV-817 Opto-Isolator	LTV 817 	DIP-4
<input type="checkbox"/>	1	Si570 Programmable Oscillator	 SiLabs 570	I2C

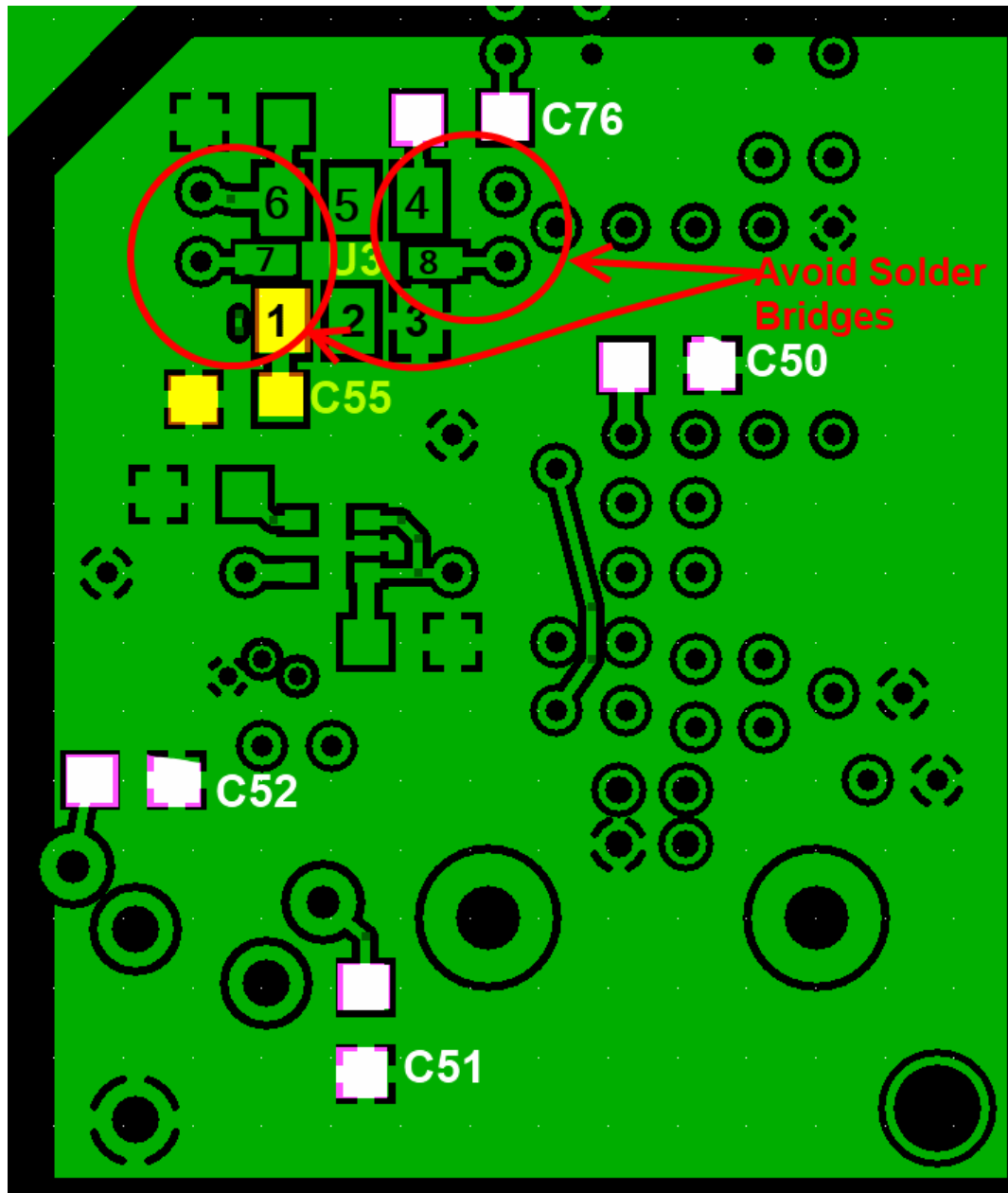
<input type="checkbox"/>	1	3.5mm stereo jack - PCB mount (rt-angle)		Jack-RA
<input type="checkbox"/>	1	0.01 uF	(smt) 	SMT 1206
<input type="checkbox"/>	3	0.1 uF	(smt) black stripe 	SMT 1206
<input type="checkbox"/>	1	0.1 uF	(smt) black stripe 	SMT 1206
<input type="checkbox"/>	1	socket, machine, 8 pin		Socket
<input type="checkbox"/>	1	2N3906 PNP transistor	 2N3906 TO-92	TO-92
<input type="checkbox"/>	1	2T Bifilar #30 (5") on BN-43-2402		Xfrmr

Local Oscillator Summary Build Notes

- Install SMT Components
- Install USB Control Components
- Install Coupling Transformer
- Install Remaining Topside Components
- Download and Install Software and Drivers
- [Test the Stage](#)

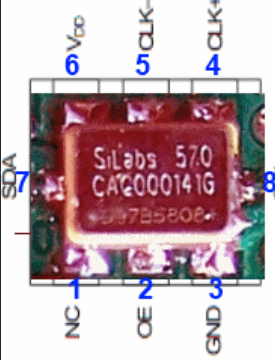

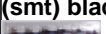
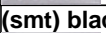
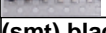

Local Oscillator Detailed Build Notes

Bottom of the Board

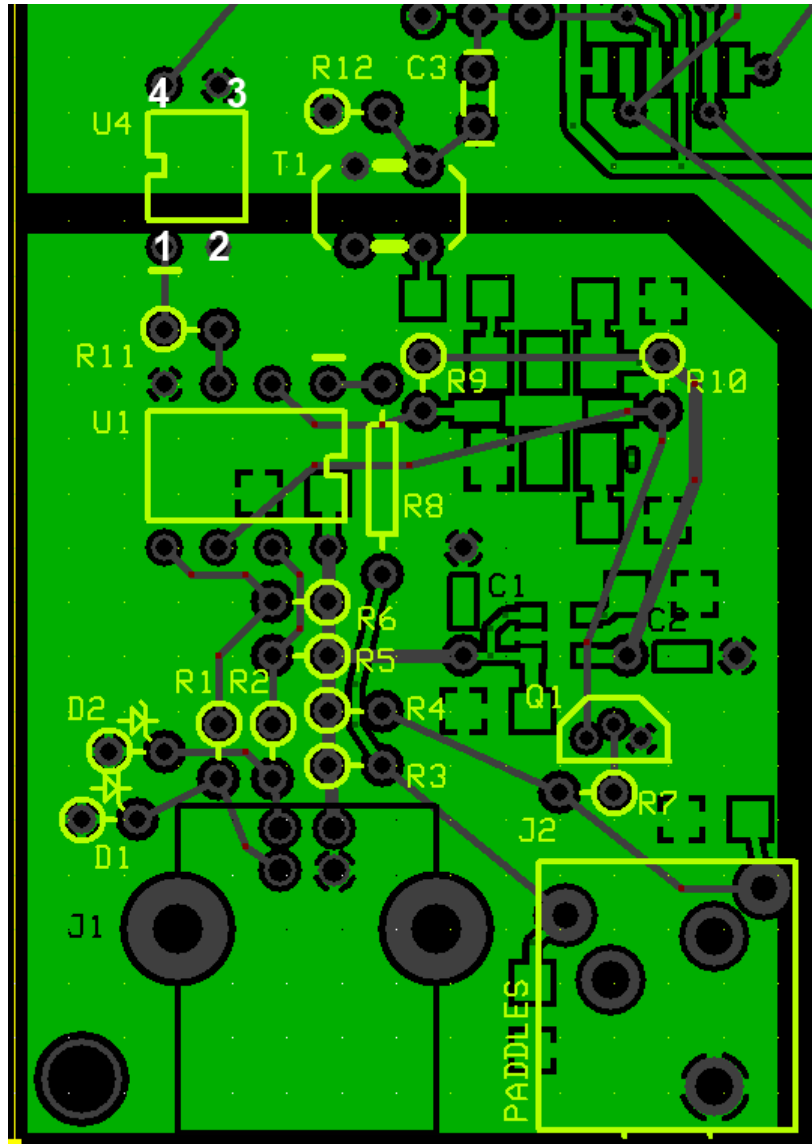


Install SMT Components



Soldering the Si570 must be carefully done Many builders have encountered problems and, in most cases, they are attributable to improper soldering of the Si570 to the (rather tight) pads. Pay special attention to pads for pins 7 and 8, which are quite narrow. These tend to be the biggest source of soldering problems (e.e., solder bridges).

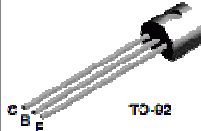
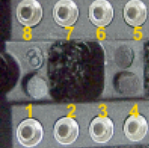
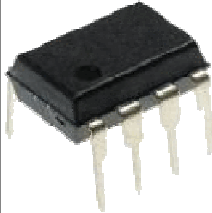
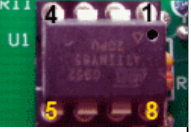

Check	Designation	Component	Marking	Category	Orientation	Notes
<input type="checkbox"/>	U03	Si570 Programmable Oscillator	<p>SiLabs 570</p> 	I2C		Take ESD precautions
<input type="checkbox"/>	C55	0.01 uF	(smt) 	SMT 1206		
<input type="checkbox"/>	C50	0.1 uF	(smt) black stripe 	SMT 1206		
<input type="checkbox"/>	C51	0.1 uF	(smt) black stripe 	SMT 1206		
<input type="checkbox"/>	C52	0.1 uF	(smt) black stripe 	SMT 1206		
<input type="checkbox"/>	C76	0.1 uF	(smt) black stripe 	SMT 1206		Added 4/4/10

Top of the Board



Install USB Control Components

Check	Designation	Component	Marking	Category	Orientation	Notes
<input type="checkbox"/>	D1	BZX55C3V3 3.3V zener diode	BZX55C 	Axial		
<input type="checkbox"/>	D2	BZX55C3V3 3.3V zener diode	BZX55C 	Axial		

<input type="checkbox"/>	Q01	2N3906 PNP transistor	2N3906 	TO-92		
<input type="checkbox"/>	SO01	socket, machine, 8 pin		Socket		For ATTin7 85
<input type="checkbox"/>	U01	ATtiny 85-20 PU w/V15.12 Firmware	AVR ATTINY85-20PU 	DIP 8		Take ESD precautions Mount in socket SO01
<input type="checkbox"/>	C03	0.01 uF		Ceramic		
<input type="checkbox"/>	R01	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
<input type="checkbox"/>	R02	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
<input type="checkbox"/>	R07	68 1/6W 5%	bl-gry-blk-gld	1/6W	E-W	
<input type="checkbox"/>	R11	475 1/4W 1%	y-v-grn-bl-br	1/4W	W-E	
<input type="checkbox"/>	R05	2.2k 1/6W 5%	red-red-red-gld	1/6W	E-W	
<input type="checkbox"/>	R09	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	
<input type="checkbox"/>	R10	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	
<input type="checkbox"/>	R03	4.7k 1/6W 5%	yel-vio-red-gld	1/6W	W-E	
<input type="checkbox"/>	R04	4.7k 1/6W 5%	yel-vio-red-gld	1/6W	W-E	
<input type="checkbox"/>	R08	4.7k 1/6W 5%	yel-vio-red-gld	1/6W	flat-vert	
<input type="checkbox"/>	R06	1 M 1/6W 5%	brn-blk-grn-gld	1/6W	E-W	

Install Coupling Transformer

Wind and Install the transformer (T1) that couples the Si570 output across the galvanic "border" to the Dividers stage. This requires winding a bifilar (2-wire) length onto a binocular transformer. See the notes at [WB5RVZ Transformer Winding Instructions](#) if you are unfamiliar with winding binocular transformers, and refer to the diagram below.

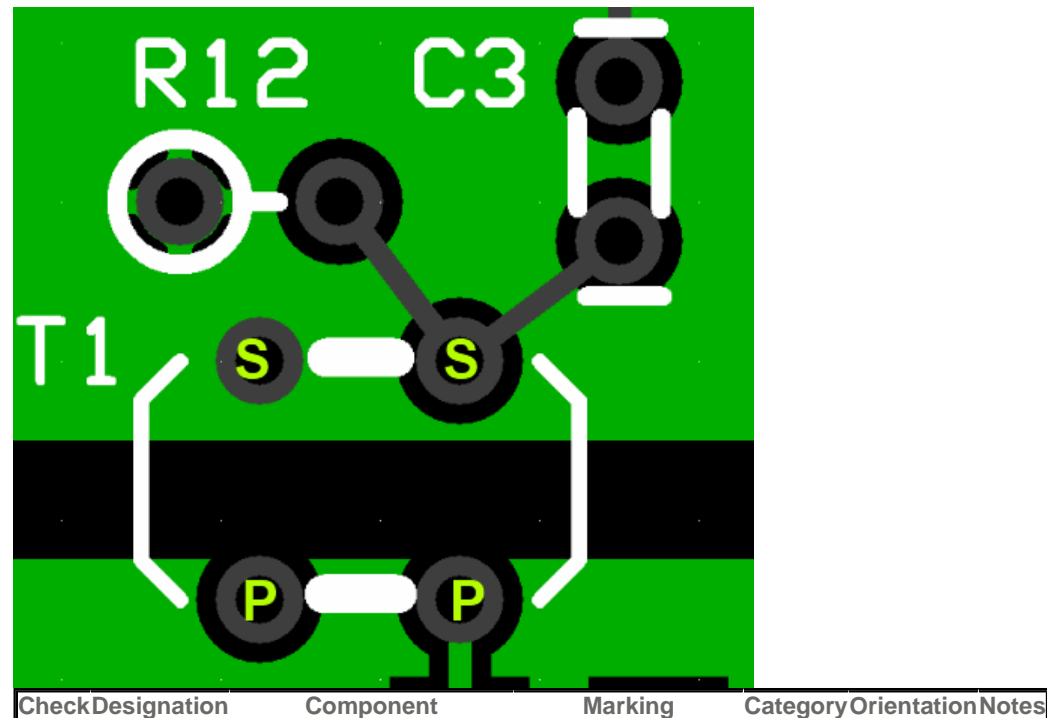
You should take two 5" strands of #30 wire and twist them together ("bifilar") so you get around 3 twists to the inch. Using the resultant bifilar strand, thread it through the binocular core for two turns. Remember a turn is a trip that:

- (1) starts at a particular hole
- (2) goes into that hole and out of the other end
- (3) goes into the hole nthat is across from the hole out of which it just exited, and
- (4) Comes out of the hole at the opposite end and across from the original entry hole.

Do that series twice with the twisted pair and you have a transformer with two windings (each winding corresponding to one of the two twisted single wires).

Each winding (primary and secondary) is two turns. Since the windings are identical in length and number of turns, you can arbitrarily pick either one as the primary, with the remaining winding serving as the secondary winding.



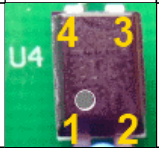
(Hint: use an ohmmeter (or other continuity checker) to identify which wire-ends go together to make the ends of a winding.



<input type="checkbox"/>	T1	2T Bifilar #30 (5") on BN-43-2402		Xfrmr		
<input type="checkbox"/>	R12	2.2k 1/6W 5%	red-red-red-gld 	1/6W	N-S	

Install Remaining Topside Components

U4 is oriented with the dot lined up with the barrel of R11 (i.e., the dot is toward the bottom of the board, closest to the left hand edge)

Check	Designation	Component	Marking	Category	Orientation	Notes
<input type="checkbox"/>	J2	3.5mm stereo jack - PCB mount (rt-angle)		Jack-RA		
<input type="checkbox"/>	U04	LTV-817 Opto-Isolator	LTV 817 	DIP-4		Take ESD precautions

Download and Install Software and Drivers

In order to test (and later, operate, your rig, you must download and install required software (SDR programs and Dynamic Link Libraries, along with hardware drivers. The actual steps and programs may vary, depending upon your computer's windows operating system version (XP, Vista, or Windows 7) and architecture CPU/memory (32 bit or 64 bit).

The following links are provided and, as of 7/8/2010, are current:

Software	Role/Purpose	Download Link	Notes
CFGSR	Configure/Control Ensemble microcontroller	download	
SRDLL	dll for Softrock controllers	download	
USB driver(s)	drivers for ATTiny85 USB	download	Zip file with 32 and 64 bit drivers*.
WinRadHD	Simple SDR (RX only) Program	download	
(Windows XP) PowerSDR-IQ V1.12.20	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	download	Has Si570 Control Capability
(Windows 7, Vista) PowerSDR-IQ V1.19.3.15	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	download	Has Si570 Control Capability (Please see Christos' message 43204 on the Yahoo Reflector)

*Note on installing PE0-FKO's USB Drivers: Fred's website has an [excellent step-by-step guide to installing the USB driver](#).

Install Driver

The correct procedure is to download the driver and put it in a suitable folder, then plug in the USB lead, Windows should detect new hardware has been found and you need to manually point it to the folder containing the drive. It should then install correctly. Certainly does on Win2000 and XP. On Vista or Windows 7, there used to be some issues with driver signing. There have been messages on the forum describing methods of working around these issues. One such solution is addressed in [the author's MOBO4.3 builders notes](#).

LibUSB - "Unknown Device" Error

Others have experienced the dreaded "Unknown Device" problem upon plugging in the USB cable after having installed the LibUsb driver. This "unknown device" problem (and a remedy for those who are using Logitech cordless mouse) are discussed in [message #45071](#) on the Yahoo Softrock40 Group

Install/Run CFGSR ("ConFiGureSoftRock")

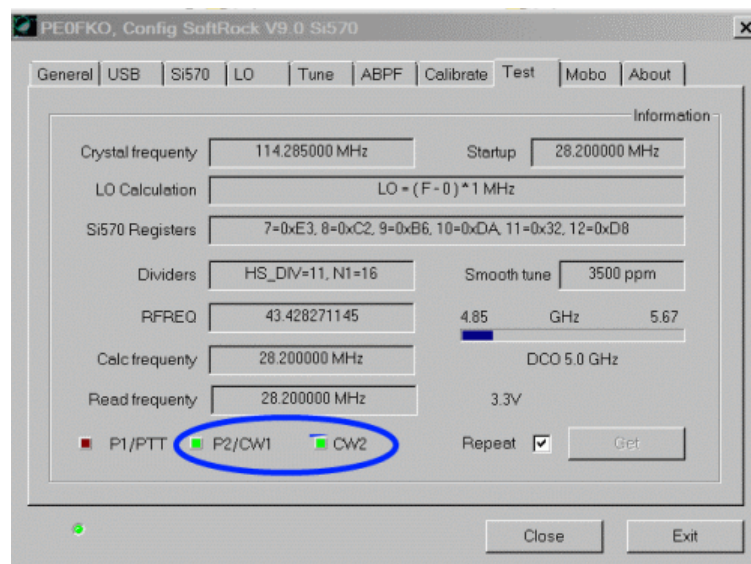
Once the driver is installed, if you run 'CFGSR' that will either automatically 'open' the firmware, or if not, you need to go to the 'USB' tab and select it from the list displayed in the bottom box. Which way depends on if you have 'CFGSR' set up to auto connect on program start or not.

Disable ABPF

it is essential before any functional tests are carried out, as soon as you have the PC talking to the Ensemble using the USB interface is to use 'CFGSR' and go to the 'ABPF' tab and remove the check from the 'Enable Filter (ABPF) box. You must then unplug and reconnect the USB lead in order to reinitialise the AVR chip so it has the PTT and CW key functions enabled. If you do not do this, the AVR chip is supplied with the defaults set for use with the v9.0 RX and BPF module, so will catch a lot of people out, in the same way as the USB to I2C interface has.

Test Paddles

In 'CFGSR' if you select the 'Test' tab, and check the 'Repeat' box, there are three LEDs at the bottom of the screen that display the status of the PTT, CW1 and CW2 lines. You can exercise the CW1 and CW2 key inputs and you will see the LEDs change.



Unfortunately you cannot exercise the PTT function using 'CFGSR'. The easiest way may be to use Rocky, and monitor the voltage on U1 pin 3 (PTT output).

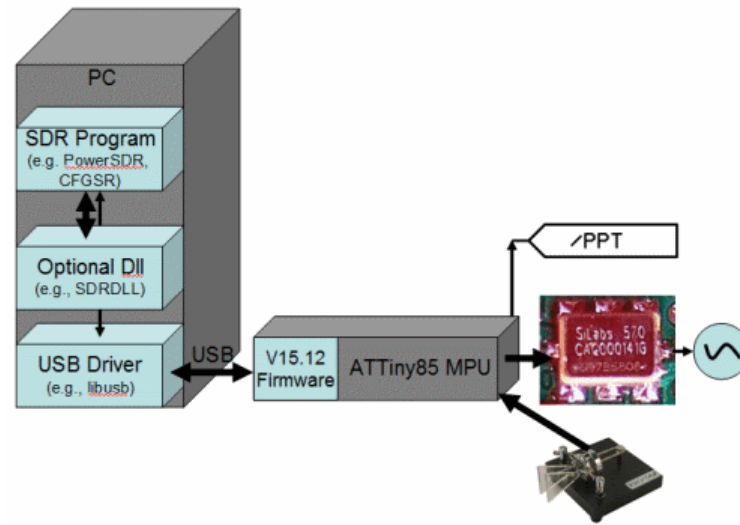
For further discussions of the software side of SDR and soundcard issues, see [Alan G4ZFQ's pages](#).

Test Local Oscillator

You can use 'CFGSR' to exercise the Si570 using the 'Tune' tab that makes it into a 'VFO'. Just a case of setting the frequency, and the Si570 should output a signal at 4 times the frequency displayed on the main display on the screen. The 'Test' tab can also be used to look at all the various Si570 registers etc, but probably unnecessary as if you can hear or measure the Si570 output frequency, you know it is working.

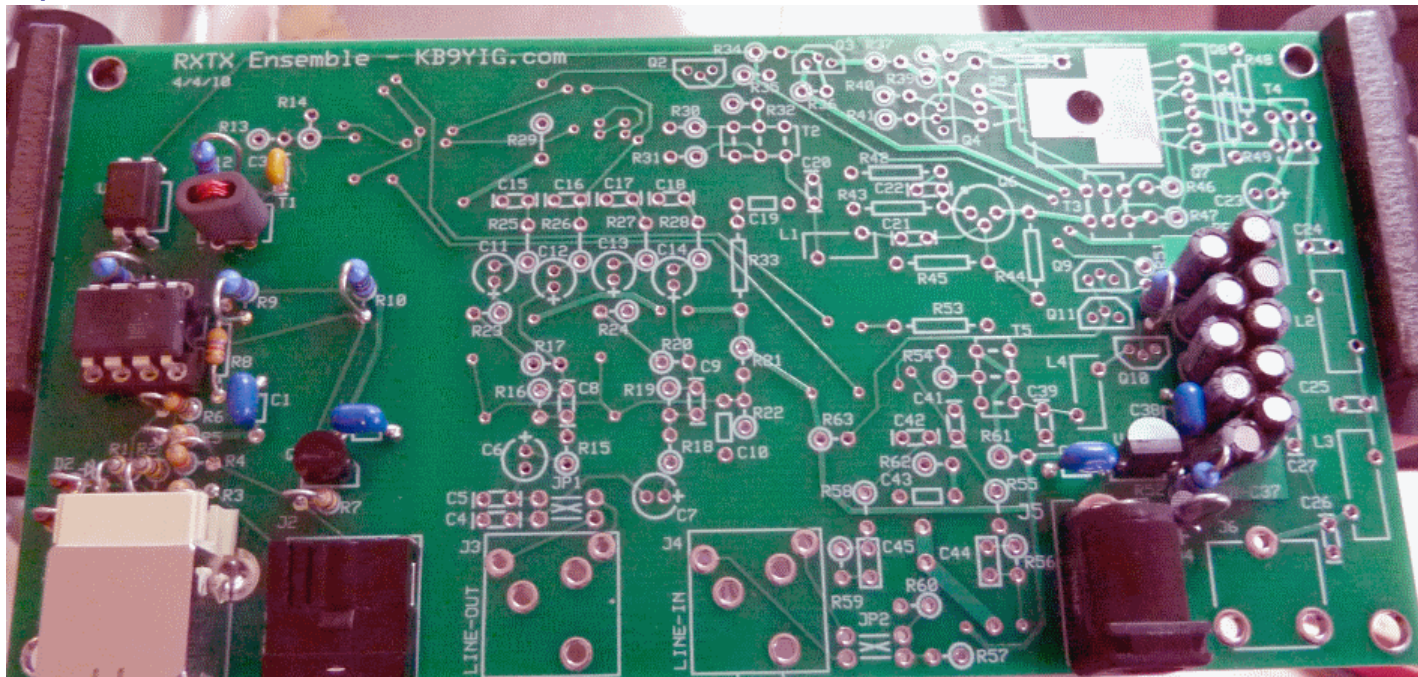
PSDR Issues

There is a lively discussion of the issues in setting up Power SDR (various versions) for the Softrocks at the thread for [Message #47707 in the Softrock40 reflector](#). WB5RVZ has also posted some guidelines in [setting up PSDR for the Vista](#) (and supposedly, Win 7) environment..

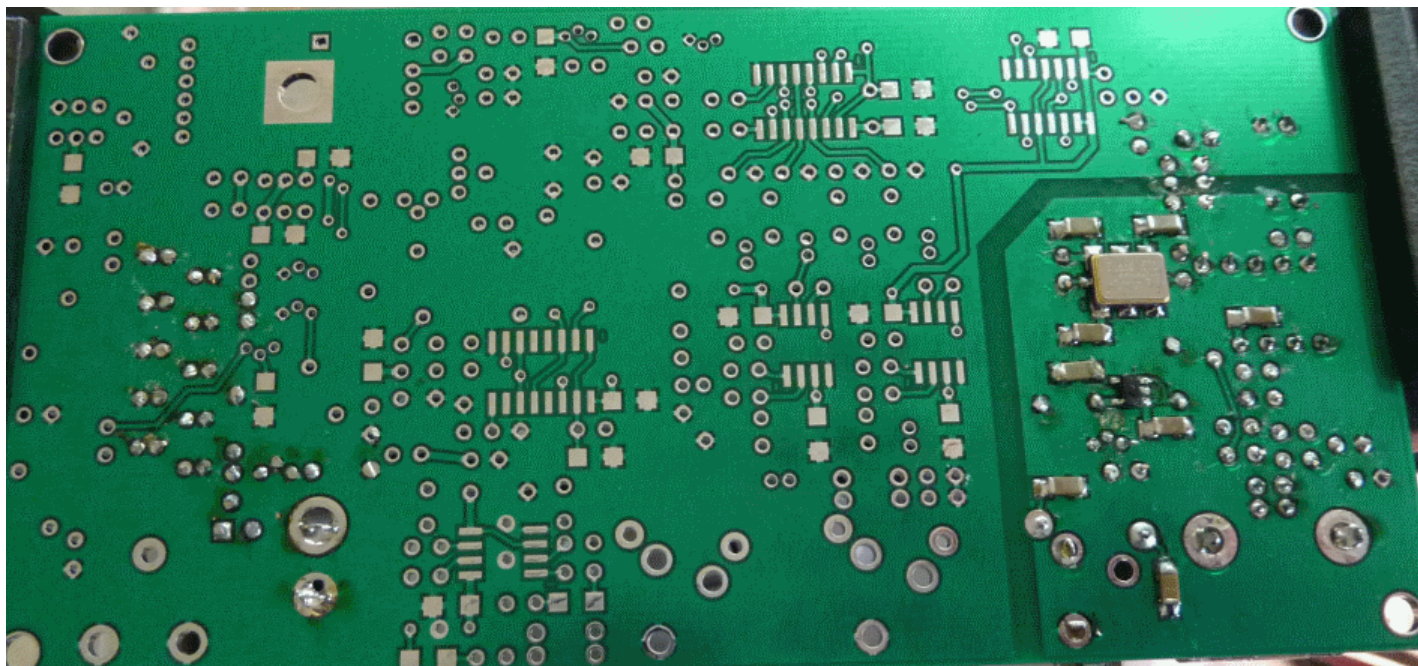


Local Oscillator Completed Stage

Top of the Board



Bottom of the Board



Local Oscillator Testing

LO Stage Outputs

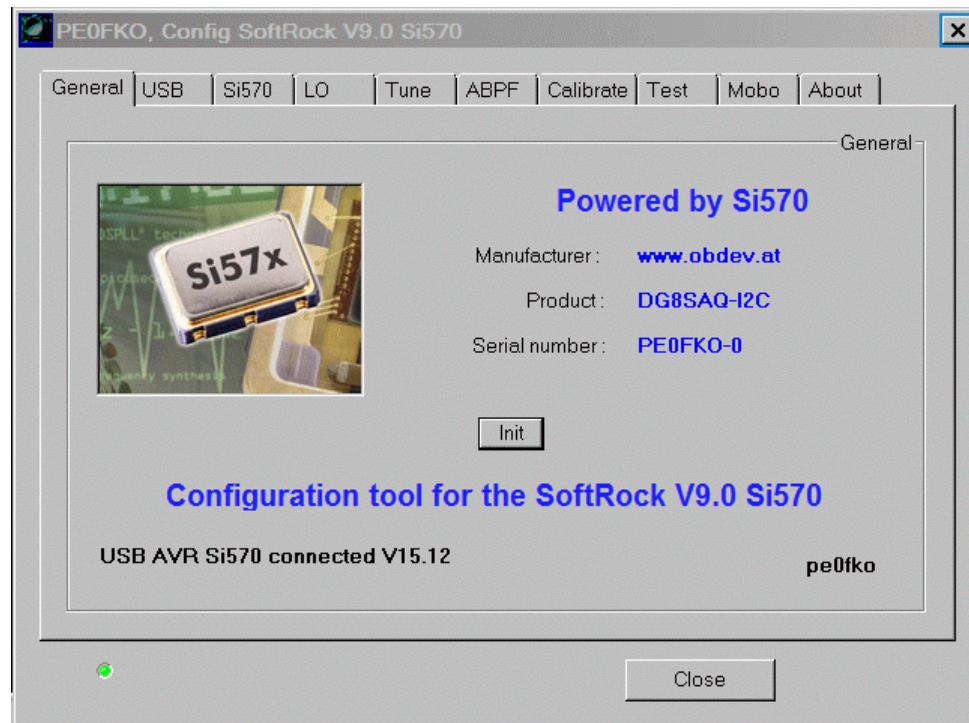
Test Setup

Here we want to measure the outputs (4x center frequency for dividers and /PTT signals for PTT/RX switching). They are measured WRT (regular) ground (at the R50 hairpion lead).

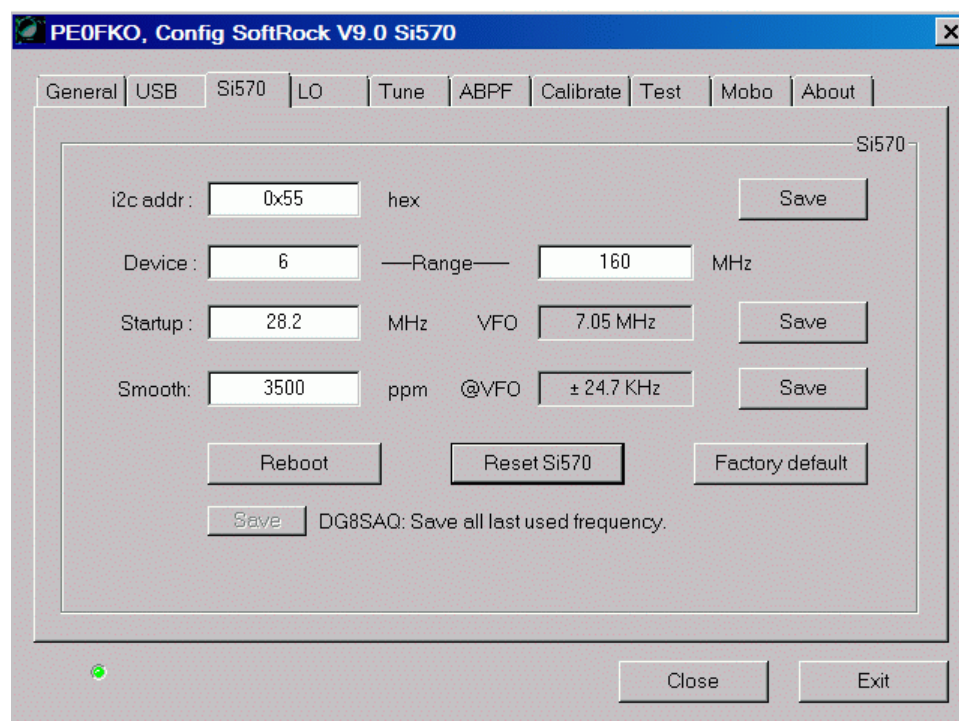
Setup

Be sure all software and drivers, etc., have been installed. Connect the USB jack via USB cable to the PC. You should hear the "BoopBoop" sound the PC makes when it recognizes a device (the Ensemble) has been attached to a USB port..

Next, run CFGSR.exe and you should get the following screen:

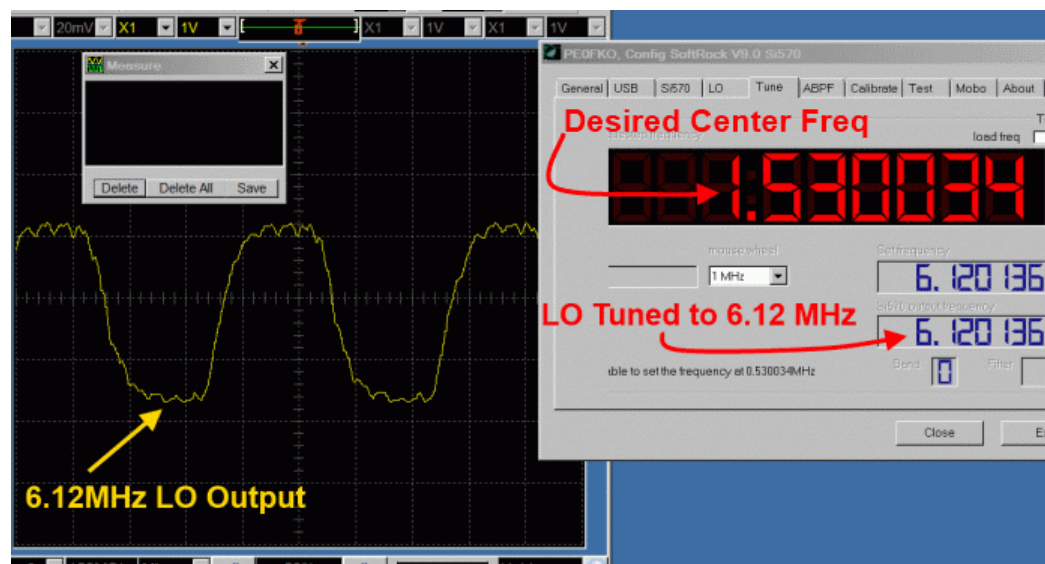


Then, check out the "Si570" tab. It should look like this:



Note that the Local Oscillator's outputs are measured with respect to the analog ground plane, NOT with respect to the galvanically isolated USB groundplane

Using the CFGSR Software (at the "Tune" tab), test scenarios for setting the center frequency (remember, the Si570 produces a signal that is 4 times the desired center frequency) and PTT on/OFF. Measure the outputs at the points indicated as "LO Out" and "/PTT". Below is an example of tuning the Si570 in CFGSR, selecting a center frequency of 6.05 MHz (with an Si570 output frequency of 4x, or 24.2MHz. (Pay no attention to the lousy oscilloscope behind the curtains - the output is really a square wave, but the scope is a cheap USB scope that doesn't sample HF square waves very well.)



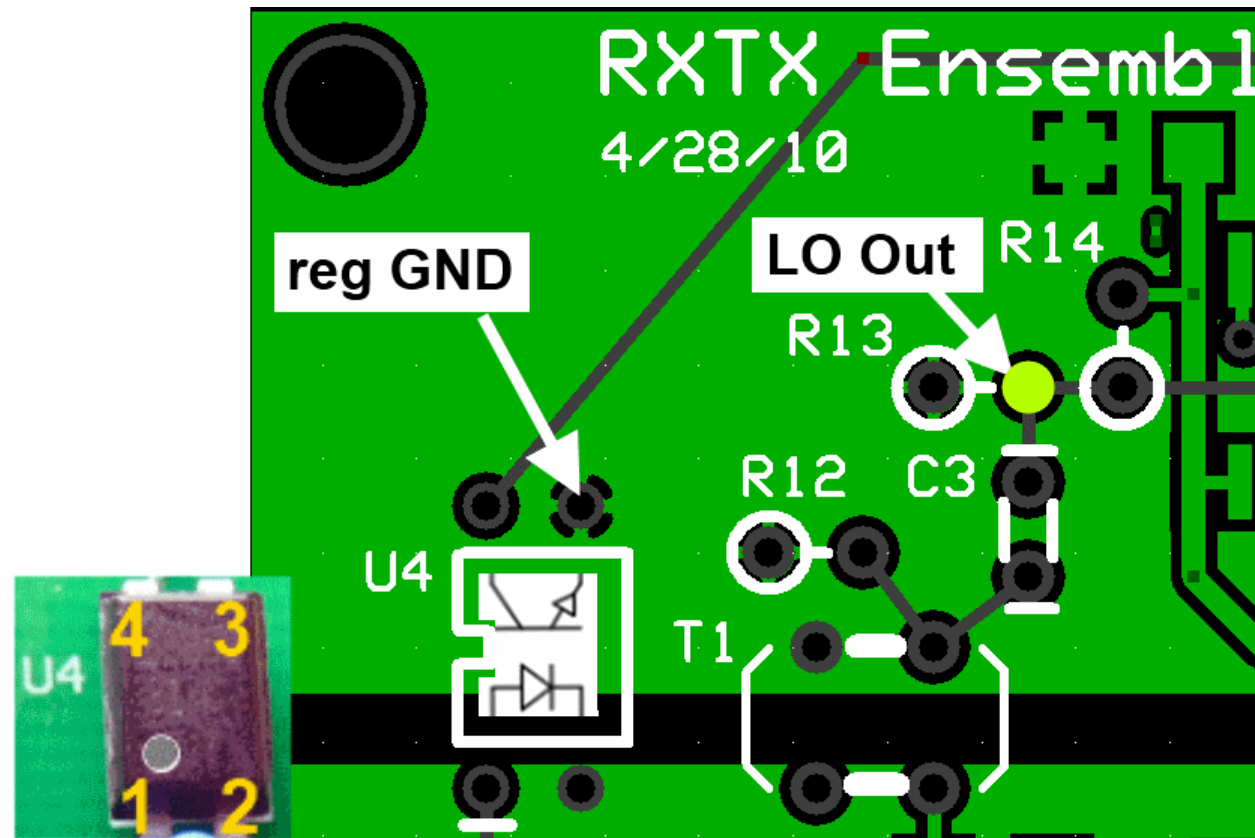
You can place your mouse on the frequency in the center frequency field and turn your mouse wheel. The center frequency will increase or decrease and the LO Output frequency (4x) will increase or decrease at a rate 4 times that of the center frequency.

John, KB6QL, discovered this trick for those with no scope, counter, or HF radio to use in testing LO output:

"Turns out that local oscillator can be tuned for a frequency that is in the FM band. So, as a quick and dirty, I got out my little MP3 player-cum-FM-radio and tuned it to that frequency and let the headset cord/ant drape over the RXTX. It gave me full quieting. Then I switched the RXTX to another frequency and the quieting was gone."

Trouble Shooting

If the LO oscillates at the factory default frequency but will not respond to your attempts to change the frequency, the very first place to look is on the soldering of the Si570, most especially pins 7 and 8. Those pins - and their soldering - constitute the single most often found cause of inability to change the frequency of the Si570.



Opto-Isolator Voltage Test

Test Setup

Power up the board in (default) RX mode

Measure the voltage at pin 1 of the Optoisolator

Pin 1 of the isolator should be less than 0.5 volts with respect to the isolated ground.

☒ Opto-Isolator Voltage

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
U4-Pin 1 (WRT USB Ground)	Vdc	< 0.5	tbd	

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