SDR-Kits.net

QRP2000 USB-Controlled Synthesizer

1. INTRODUCTION

These instructions are applicable to Printed Circuit Boards V2.03, V2.04 and V2.05 Printed Circuit Boards supplied by SDR-Kits after 24th October 2008.

1. This easy to build project can generate almost any frequency between 3.5MHz and over 200 MHz (160 MHz guaranteed for CMOS) with a resolution of less than 1 Hertz using the Silicon Labs Si570 Programmable Crystal Controlled Oscillator device. An Atmel ATTiny 45 or Atmel ATTiny 85 Micro controller interfaces the Si570 via the I2C bus to the USB bus to a Personal Computer. The frequency of the Si570 can be set using popular SDR Applications like PowerSDR, Winrad, Rocky or a standalone program Si570 USB Control. To use the kit the LibUsb0 driver needs to be installed on the Computer in questions. This driver has been tested with Windows XP, ME, 2000, 98 and Vista home edition. The kit cannot be used with Vista 64 and may not be possible under Linux.

Contents:

Main Applications:

- Full Band or Multi Band coverage of **Softrock** RXTX V6.1 and V6.2 Transceiver. **Soft66RF** Receiver as well as other home brew Receivers, Transmitters and Transceivers
- External Local Oscillator for other SDR hardware Projects – using **SI570 USB Control**
- Wide range oscillator – output frequency programmable in steps < 1 Hz.
- External /PTT output for keying other Transmitter projects/

Basic Specification:

- Frequency Range 3.5 MHz to about 200 MHz (10MHz to 160 MHz guaranteed by SiLab)
- Stability +/- 50 ppm CMOS or +/0 20 ppm LVDS version – Jitter < 0.4 ps

- Output: Square wave : CMOS version 2.6V pk-pk 15pF , LVDS version 0.7V pk-pk into 100 Ohm. The CMOS version is recommended for Softrock RXTX transceivers.
- Power Supply: USB Powered or +5V to +12V Power Supply – approx 80mA for Si570 CMOS version, or 100mA for Si570 LVDS version
- PCB size 41 x 48 mm

Acknowledgments: This project was designed by QRP2000 Design team:

Tom - DG8SAQ – Firmware and Host Application
Guido PE1NNZ and **Alan M0PUB** - PowerSDR Support Of USB Interface
John G8BTR – PCB Design **Steve G0XAR**Beta build – Documentation review
Jan G0BBL – Hardware design – Documentation – Kit Production

Thanks also to **Alex VE3NEA** who kindly provided Rocky USB support for this project

2. BILL OF MATERIALS

No in Kit	Designation	Value	Remarks – V2.03 or V2.04 PCB
2	C1, C10	10uF 16V	Radial
12	C2, C3, C5. C6, C7, C8, C9, C11, C12 C13, C14 + 1 spare	0.1uF 50V	0805 SMD
2	C4 + 1 spare	1nF 50V	0805 SMD Marked black
4	D1, D4, D5, D6	1N4001	
2	D2, D3	3.3 Zener	BZX55-3V3 500mW
1	Q1	2N3904	NPN Transistor (PTT_Out)
1	Q2	2N3906	PNP Transistor (CW_Key_2)
1	J1	USB-B Socket	
1	JP1a	shorting jumper	0.1”
1	JP1	2 pin header male	0.1” (Power selection USB or external)
1	P1	3 pin header male	0.1” (RF Output connector)
2	P2	2 pin header male	0.1” (RF Output connector)
2	R1, R2	68 Ohm	0.4W (red red black gold brown)
1	R3	2k2	0.4W Axial (red red black brown brown)
1	R4	1M	0.4W (brown black black yellow brown)
7	R5, R6, R7, R8, R10, R11, R12	4k7	0.4W (yellow violet black brown brown)
1	R9	220	0.4W (red red black black brown)
1	U1	ATTiny45 or ATTiny 85	Programmed with DG8SAQ firmware
1	U2	Silicon Labs	CMOS = Si570BBC000141DG Or LVDS = Si570BBC000141DG
1	U3	LF33ABV	3.3V Regulator TO220
1	U4	78M05	5V Regulator TO220
1	PCB	USB Synthesizer	QRP2000 Design v2.03 or V2.04
1	IC Socket	8 pin DIL	
6	PCB pins	1mm dia	

Please note: T1 is optional 4:1 transformer for matching Si570 Output to 50 Ohms load. Parts for T1 (43BN2402 core and 60cm #35AWG wire are only supplied with Kit 2 with the Si570BBC000141DG LVDS device.

( ) Inventory of Kit parts is highly recommended – see example Fig 1 below.
Caution: Please observe antistatic precautions for semiconductor devices
Do not remove Si570 device from anti-static bag until needed

Note: If you have a question about the kit. please contact Jan G0BBL via **sdrkits @ gmail.com** (remove all spaces in email address)

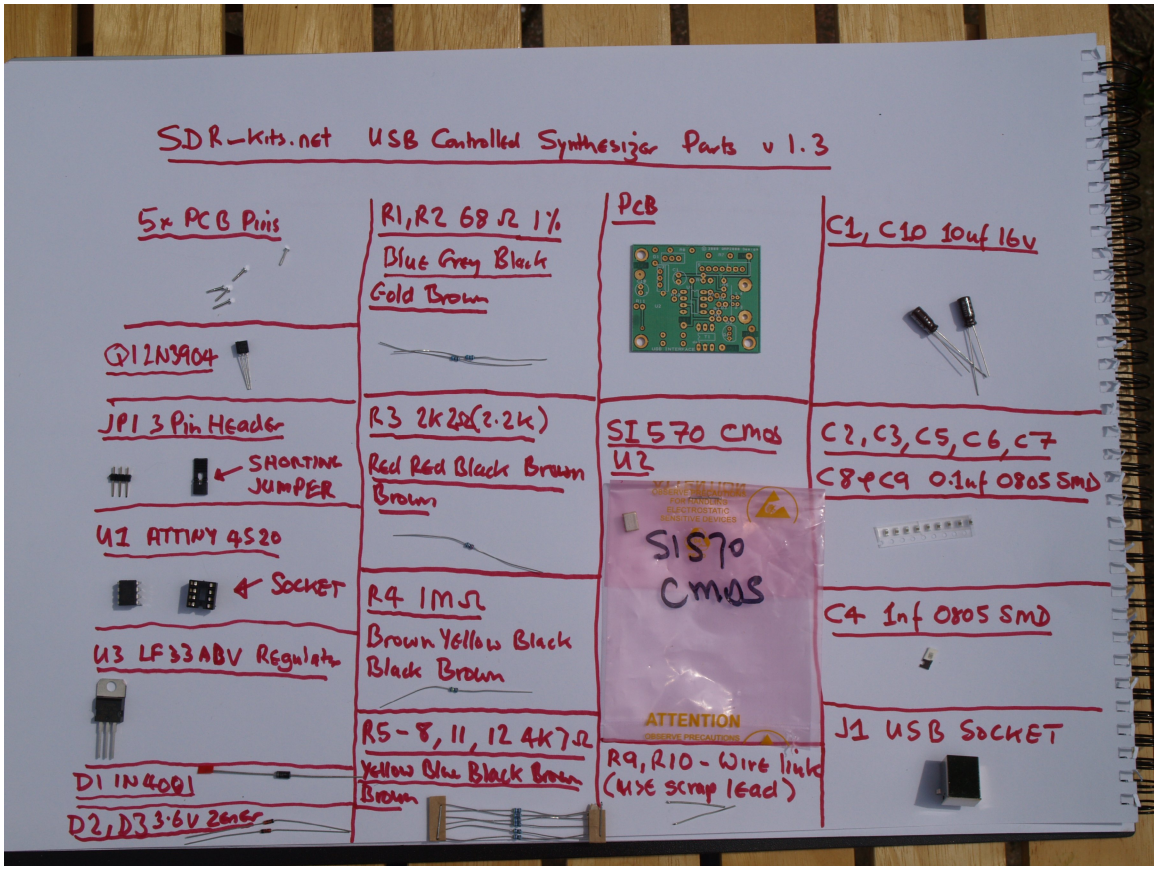


Fig 1 Example Inventory of Kit Parts – (photo by Steve G0XAR)

3. KIT ASSEMBLY

Introduction:

Assembling this kit will involve soldering of surface mount components. This is not difficult but some care and patience is needed. You will need a well lit and clear work surface, a suitable soldering iron with a small tip, some fine (for example 24swg – 0.5mm) resin cored solder and a pair of long

tweezers, The type of tweezers should allow you to hold the component GENTLY, otherwise the your tweezers may act as a rocket launcher for tiny SMD parts!!. Firstly make sure that the PCB is held securely to the work surface so it does not move around. Using "Blue Tack" on the edges of the board is one way of doing this. Then identify the pair of lands on the pcb that the surface mount component will be soldered to. Melt a small blob of solder on to one of the lands as a coat. Then, using the tweezers, pick up the the surface mount component and place it across the lands and melt the solder on the pre soldered land. This should effectively hold the component in place whilst you solder it to the unsoldered land. Then resolder it to the to the first land. Then check that the joints are good using a magnifying glass. This all sounds very complicated but it works in practice. If this is your first time using SMD you may wish to find a junk computer card and practice on it first. There are also a number of excellent tutorials on the internet - and no you **do not need an oven or an SM workstation**. An ordinary soldering iron (preferably temperature controlled is good enough. **Good luck!!**

Bottom PC mounted components

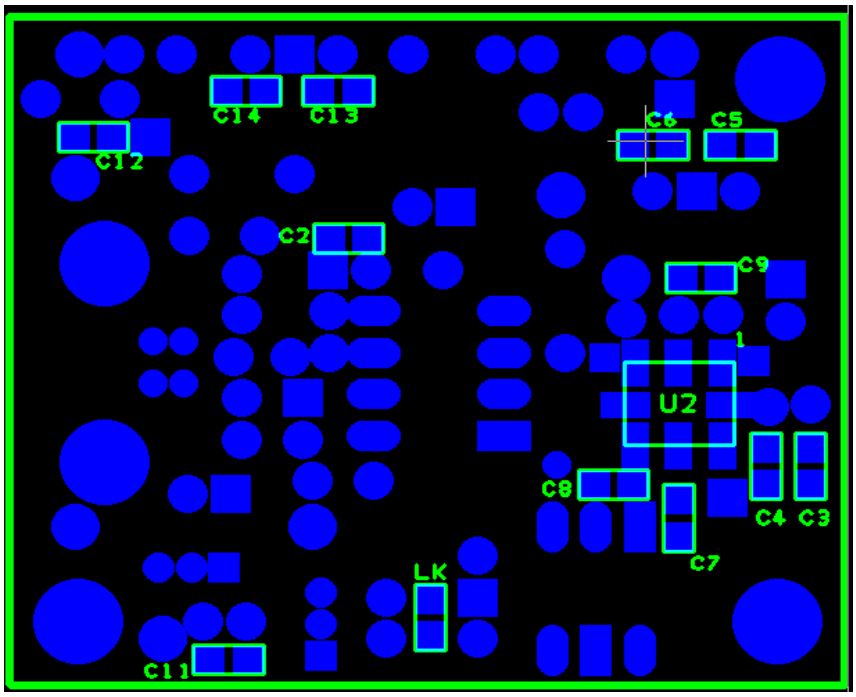


Fig 2 PCB with all components except Si570 fitted at bottom of board
Please note: All Capacitors are 0.1uF except C4 which is 1nF. LK is Wirelink

( ) Remove any components from PCB so PCB is bare

( ) Check Kit contents against Bill of Materials (Parts for T1 are only supplied in Kit 2)

( ) Place PCB upside down as in fig 2.

( ) Look at Figure 2 to see the exact placement of the SMD capacitors and the PCB terminals. The SMD Capacitors are the small oblong shapes (0805 package), the soldered ends of the PCB terminals show as shiny circles.

( ) Adjust Temperature of Temperature Controlled Soldering Station to correct temperature for soldering SMD components. Temperature depends on type of solder you are using normally 330C or 630F with 60/40 Pb/Sn

( ) Solder SMD 0.1uF 0805 Capacitors C2, C3, C5, C6, C7, C8, C9, C11, C12, C13 and C14 as shown in Figure 2. Then check against Figure 2.

( ) Solder C4 1nF 0805 Capacitor (identified with BLACK mark on strip) next to C3 (Lower right hand side of the board

( ) Check all joints – the board should look like fig 2 below

( ) **Note:** 6 PCB pins are supplied, If you are using the kit for other purposes then solder PCB pins to suit your particular application

( ) Fit PCB terminals by pressing pin through PCB using a hard metal surface or long nose pliers making sure that you do NOT damage any of the SMD capacitors in the process and solder at Bottom layer . Typical location of the PCB terminals is: +12V, +5V, GND, CW1, CW2 and PTT as shown in Fig 3 below.

( ) Turn board over

Components mounted on Top ~Layer of PCB (Top Silk)

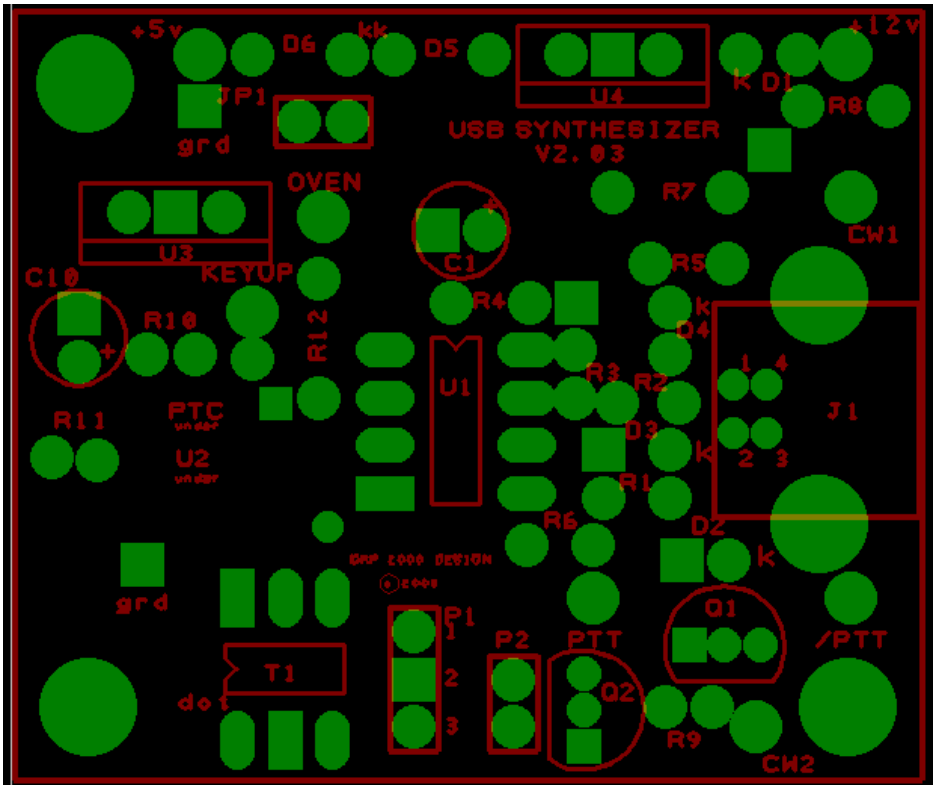


Fig 3 Component lay-out diagram
Please note that "KEYUP" and "OVEN" are not used – Optional Connections

Place the board so you can see the components side with the placement (silk screen) diagram in view. Orient the board so that the words "USB SYNTHESIZER" is at the top.

( ) 8 pin IC socket for U1 ensuring that the indentation on the end of the socket matches that on the silk screen

( ) USB Socket – solder pins including the ground connections.

( ) Mount Diodes D1, D2 D3, D4, D5 and D6

Note: observe cathode band and solder observing the polarity of the diode.
For D1, D4, D5 and D6 the white band should point toward the hole marked "k"
For D2 and D3 the black band should be facing the holes marked "k" next to USB socket J1..

( ) Mount Resistors R1 and R2 (68 Ohm blue grey black gold brown).
Mount R3 (2K2 red red black brown brown).
R4 (1M brown black black yellow brown).
Mount Resistor R9 = 220 Ohm (red red black black)
Mount R5, R6, R7, R8, R10, R11 and R12 (4K7 yellow violet black brown brown)

Note: When installing the resistors make sure you put the right values in the right places. If in doubt, check the values first using a multimeter.

( ) Fit Capacitor C1 (10uF) and C10 (10uF) – **Note**: observe polarity and solder

( ) **Caution: when handling semiconductors observe anti-static precautions: Preferably wear anti-static Strap or touch unpainted metal ground before handling semiconductors**

( ) Fit transistors Q1 and Q2 – **Note**: observe position against top silk and solder

( ) Fit U3 (LF33ABV) – **Note:** observe correct position against top silk and solder

( ) Fit U4 (78M05) - **Note:** observe correct position against top silk and solder

( ) Fit Connector JP1 (2 pin) and solder

( ) Fit Output Connector P1 (3 pin) and solder

( ) Fit Output Connector P2 (2 pin) and solder

Optional LVDS Transformer T1 (supplied with complete Si570 LVDS Kit only)

( ) Cut enameled wire in 3 pieces of 18 cm (7 inches) each and twist uniformly to 4 turns per cm

( ) Wind 5 turns trifiliar on 43BN2402 core supplied. Ensure you do not damage isolation

( ) Scrape and tin the ends of the enameled wires and fit T1 on PCB as shown in circuit diagram

Interim Test Procedure

Note: Jumper JP1 is used to set the Power source for the board on J1.
When the jumper JP1 is set, power to the entire board is supplied from the USB port.
Alternatively for STANDALONE use (not connected to USB port) , the USB-board may be operated by connecting to either a +7....12V or to a +5V Power source.

With Jumper JP1 removed, operation is only possible when connected to a USB port, however the Si570 Synthesizer chip requires power from an external Power supply. This option reduces the power drawn from the USB Port from about 70...90mA to around 10..15mA

( ) Remove Jumper JP1 from J1-

( ) Connect 12V DC or 5V DC Power to PCB – **Note**: observe polarity

( ) Check Voltage on U3 pin 3 to Ground - **Note**: reading should be 3.3V +/- 0.1V

( ) Remove Power to PCB

( ) **Caution: observe anti-static precautions handling semiconductor**

( ) Plug ATTiny45 or ATTiny 85 IC holder for U1 – pin 1 should be aligned towards U3 on the top silk

( ) Connect USB Synthesizer to USB socket of a Personal Computer and measure voltage between U1 Pin 8. Reading should be around 4.3V DC

( ) Disconnect USB cable from USB Synthesizer

Final assembly of Si570 Device

( ) **Caution: observe antistatic precautions handling semiconductors**

( ) The Si570 device is soldered on the bottom of the PCB

( ) Locate the Dot on the Si570 device and align with pin 1 marked on the PCB and solder. The Dot is located on the left hand side of bottom line showing the Batchnumber.

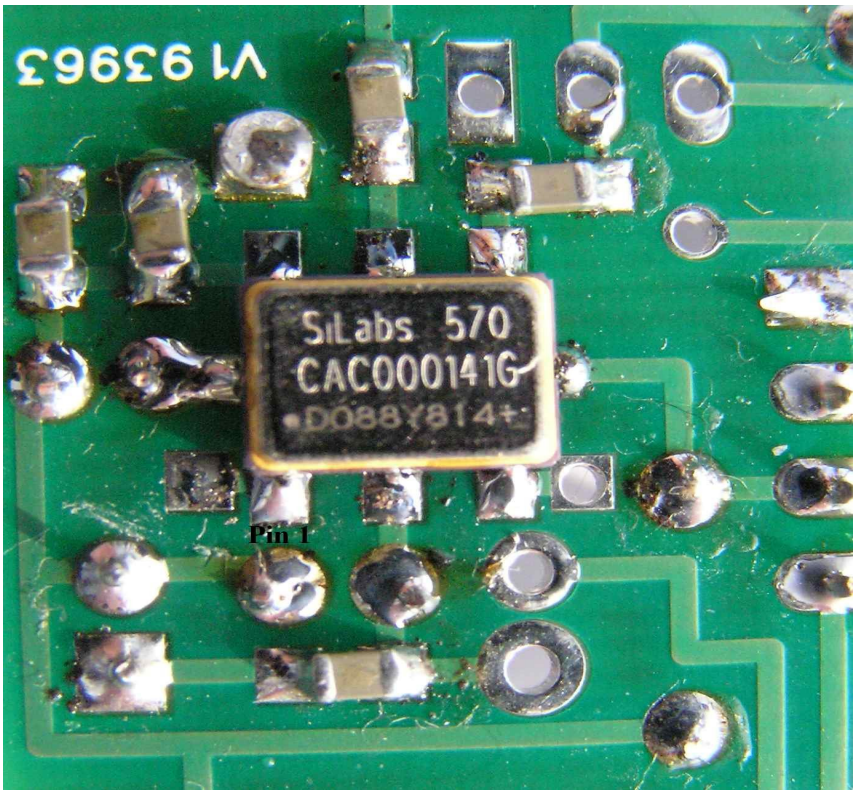


Fig 4 Location of S570 chip – Bottom left pin is Pin 1 aligned with dot on Si571

Final Test and commissioning

( ) Remove Jumper JP1 from J1 which is located next to Diode D6

( ) Connect PCB to a 5-12V DC Power Supply and measure Current Consumption typically should be around 70-85mA

( ) Remove External Powersupply.

( ) Set Jumper JP1 to connect J1 Pin 1 and Pin 2 **(USB Powered)**

( ) If Optional Output Transformer T1 is fitted with **Kit 1 Si570 CMOS** device solder link between P1 Pin 2 and P1 Pin 3. Remove X2 and Y1 from GND. Twist the X2 and U1 and solder together and leave floating. See Fig 12 Ckt diagram on Page 28.

Photo of completed V2.03 PCB (top)

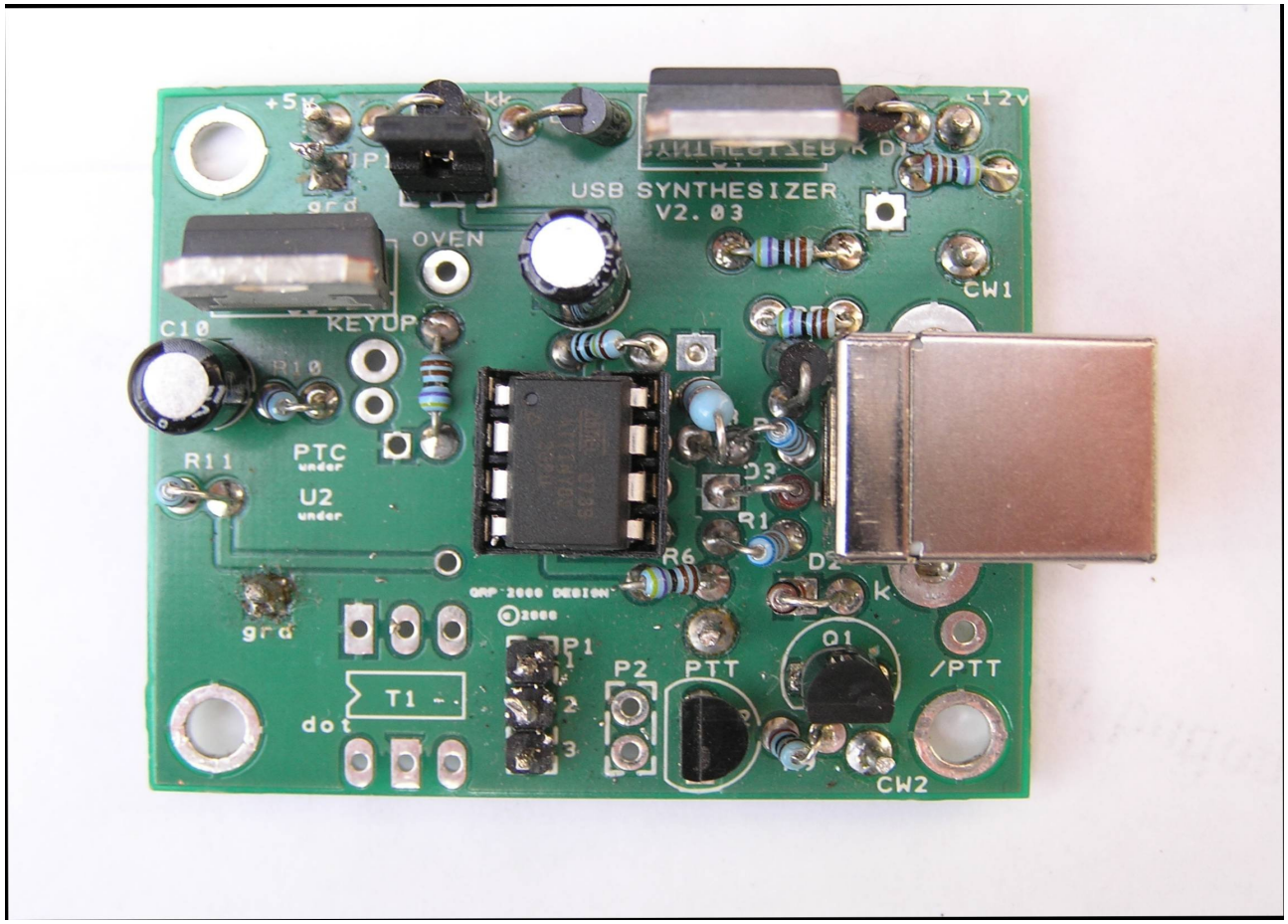
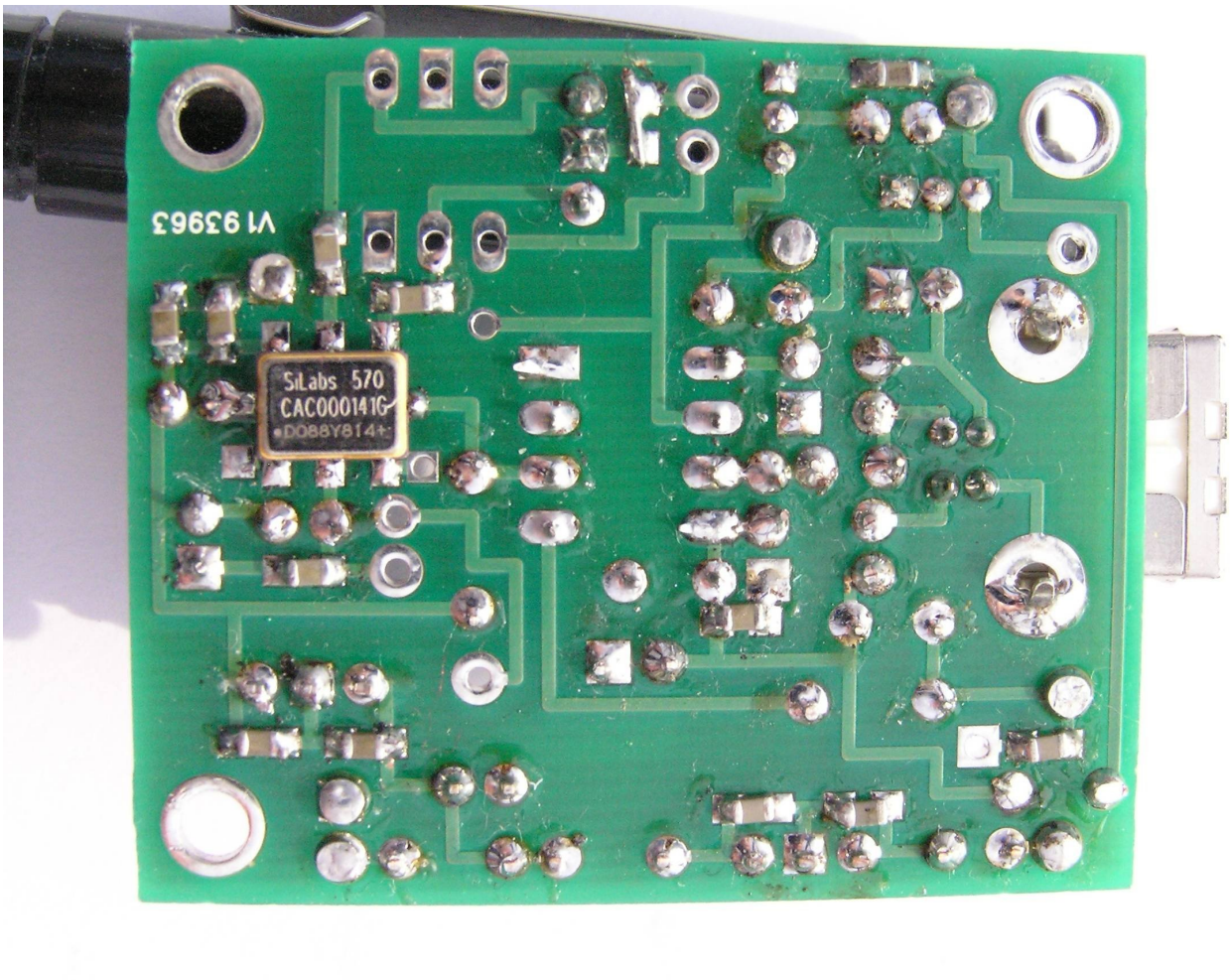


Photo of completed V2.03 PCB (bottom)



USB-Synthesizer output configuration:

Most common application of the USB-Synthesizer uses the Si570 CMOS is as Local Oscillator for Softrock kits or other Receiver and Transmitters. RF Output is obtained from P1 pin 1 and pin 2 as described in chapter 7.. No links are required.

RF output from the module may be configured in several ways depending on the actual application or requirements.
Available options are shown in the table below, together with information on wire links required. (use 0805 0 Ohm jumpers – not included in the kit)
See also fig 12. Circuit diagram.

	RF Output Configuration	Output and typical Application	RF Output connection	Links
1	Si570 CMOS Direct Single Ended Output	3V p-p into > 1KOhm – Use with Softrock Projects and other Projects requiring CMOS squarewave.	RF Output obtained from P1 pin 1 and P1 (Pin 2 = GND)	none required
2	Si570 LVDS Direct Single ended Output	0.7V p-p – square wave into 100 Ohm – Direct LVDS output for use with LVDS devices above 200 MHz	RF Output obtained from P1 pin 1 and P1 (Pin 2 = GND)	none required
3	Si570 LVDS Single ended Output from differential LVDS via 1:1:1 Transformer	0.7V p-p – square wave into 50 ohms Option	RF Output obtained from P2 pin 1 and pin 2.	Fit T1 – On V2.05 PCB fit Link 1 between X2/Y1 to GND (not required on V2.03 & V204 PCB)
4	Si570 CMOS Single ended Output via 4:1 Transformer	+12dBm (0.75V p-p) into 50 Ohms - suitable for driving 50 ohm applications **(**DBM SBL1 etc**)**	RF Output obtained from P2 pin 1 and P2 pin 2	Fit T1 and link P1 pin 2 to P1 pin 3. **On V2.03 and V2.04 PCB ONLY:** do NOT connect T1 X2 and Y1 to GND.
Note: Earthloop connection: With T1 fitted for unbalanced output fit wire LINK between P2 Pin 2 to GND. Omit for Balanced Output				

RF output Configuration for advanced constructors

This completes Kit Assembly

3.1 HARDWARE TROUBLE SHOOTING

Before you can use the synthesizer board, you need to perform Driver Installation as described in Chapter 4. Provided the Driver is installed the following DC voltages should be measured on a normal working USB- Synthesizer Kit:

U1 ATTiny45 or ATTiny85			**U2 Si570 Device**	
Pin 1	+4.3V +/- 10%		Pin 1	Not connected
Pin 2	+3.3V (no I2C activity)		Pin 2	+3.3V
Pin 3	+0.1V (PTT off) +4.3V (PTT on)		Pin 3	0V GND
Pin 4	0V GND		Pin 4	(CMOS: 2.7V pkpk RF) (LVDS: 0.7V pkpk RF)
Pin 5	0.1V DC (idle USB bus)		Pin 5	(CMOS = NC) LVDS: 0.7V pkpk RF out)
Pin 6	+3.3V (no I2C activity)		Pin 6	+3.3V VDD
Pin 7	+2.5V to +2.7V(idle USB bus)		Pin 7	+3.3V (no I2C activity)
Pin 8	+4.3V +/- 10% VDD		Pin 8	+3.3V (no I2C activity)
CW Key 1	Key-up 4.3V DC Key-down 0V		CW Key 2	Key-up 4.3V DC Key-down 0V

The most likely problem is "**USB enumeration failure**" The USB synthesizer is not recognized by the Computer. Tom Baier DG8SAQ has written a paper to help you check this type of failure.

Click HERE to investigate USB-Enumeration failures

4. DRIVER INSTALLATION PROCEDURE

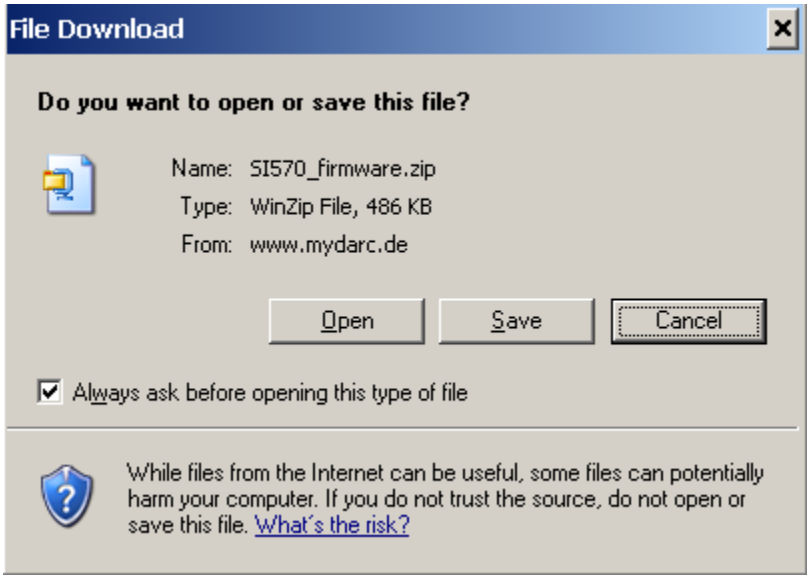
Introduction: Before you can use the Kit you must install a DRIVER on each Computer to which the USB-Synthesizer board will be connected to. The Drivers for the USB-Synthesizer kit are successfully used with the following Operating systems: Windows XP, ME, 2000, 98 and Vista home edition.

There are some reports of successfully operation under Linux, however operation under VISTA 64 is not possible as this operating system only allows for installation of Digitally Signed Drivers.

4.1 For Microsoft VISTA home edition a separate **Vista Driver Installation Document** is available here, courtesy of Steve Farthing, G0XAR.

4.2 Driver Installation Procedure for Microsoft XP Operating System.

- Download Si570_Firmware from: http://www.mydarc.de/dg8saq/SI570/index.shtml

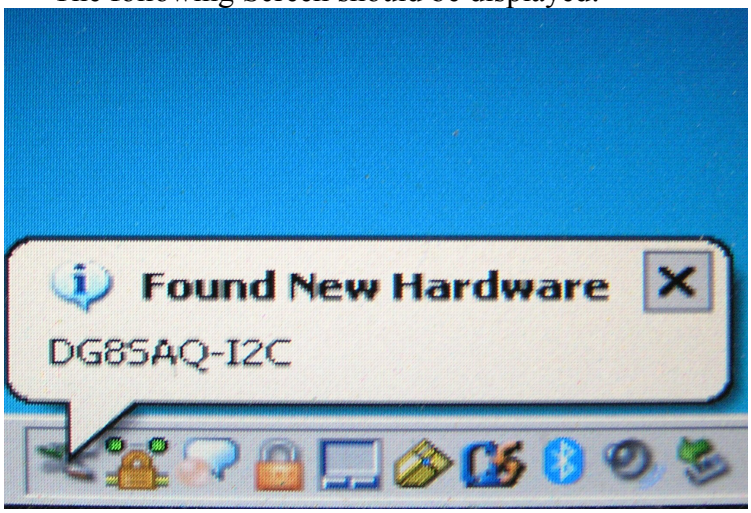


- Press "Save target as"
- Unzip the file SI570_firmware.zip

The following directories will be created

Driver Installation Procedure

- Plug in the USB-Synthesizer module into USB port
- The following Screen should be displayed:



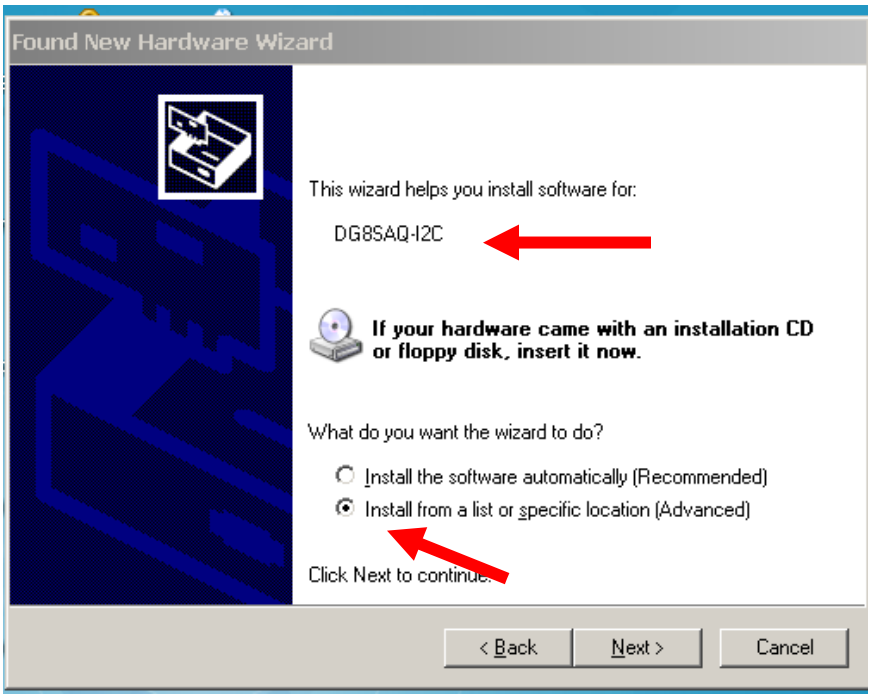
Problem solving: If this screen is NOT displayed

- *Check the USB-Synthesizer hardware for correct operation*
- *Is ATTiny45-20 microprocessor plugged in correctly*
- *Has ATTiny45-20 been loaded with correct firmware*
- *Connect the USB-Synthesizer to the USB port of a different computer*

After about 5 seconds the message below should be displayed:

- Select “No, not this time”
- Press “NEXT”

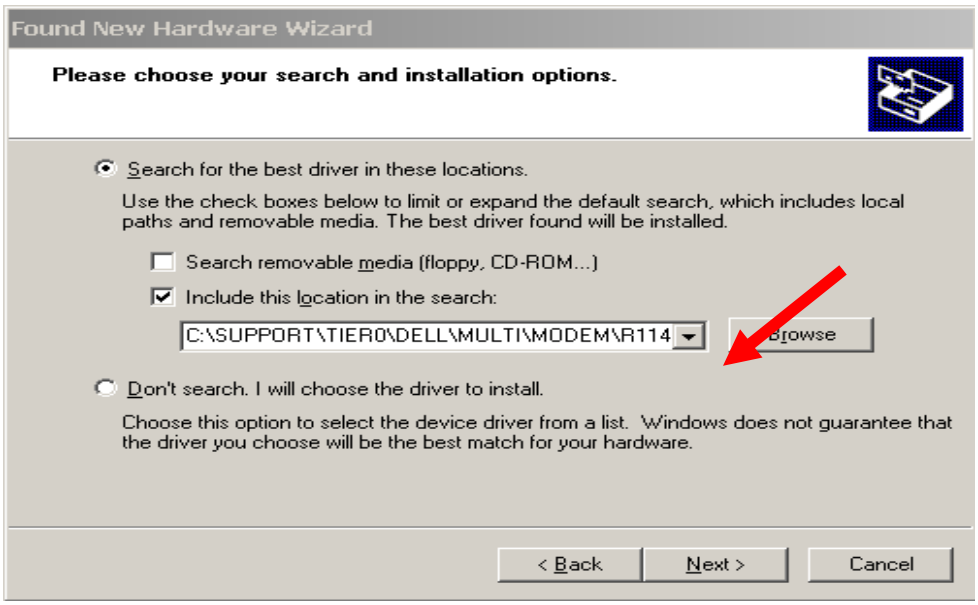
The following screen should now be displayed:



Deselect “Install the software automatically”

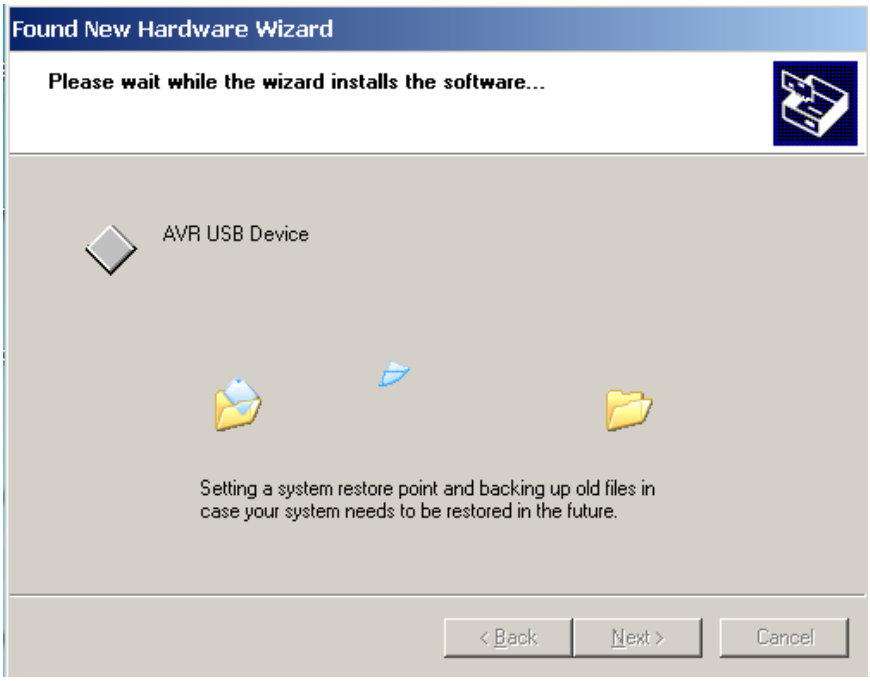
Select “install from a list or specific location”
Press “Next>”

The following screen is displayed

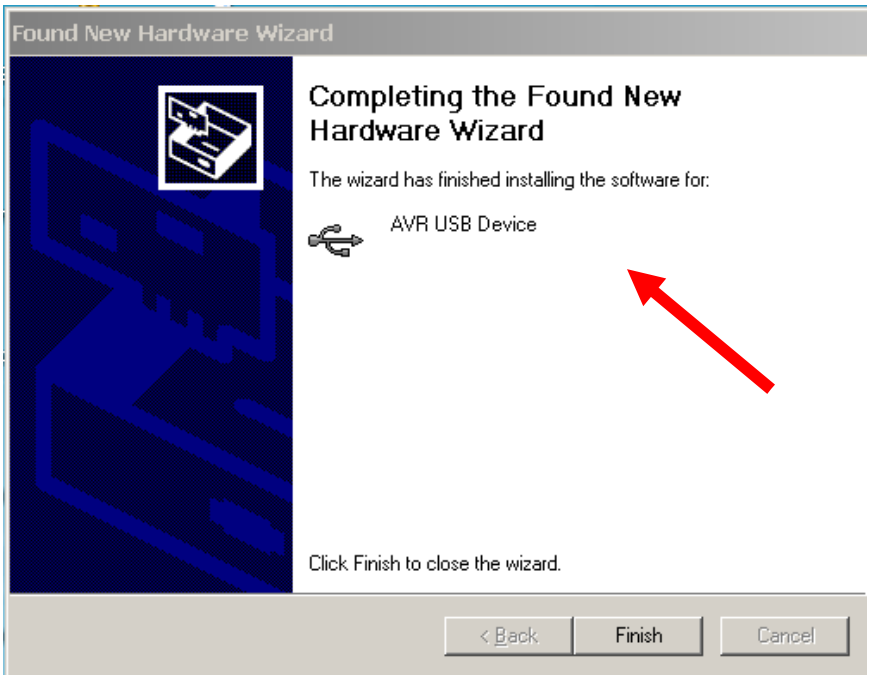


- Deselect “Search removable Media”
- Select “Include this location in the search”
- Press “Browse”
- Select Folder AVR-USB-Driver as shown below

- Click “Ok”
- Press “Next>”
- Software is being installed



When successfully installed, following message displayed:



Click “Finish”
Message displayed “Found New hardware successfully installed”

END OF DRIVER INSTALLATION PROCEDURE

5. DRIVER INSTALLATION VERIFICATION

A check can be made at any time if the driver is properly installed **but only if the USB-module is plugged in**

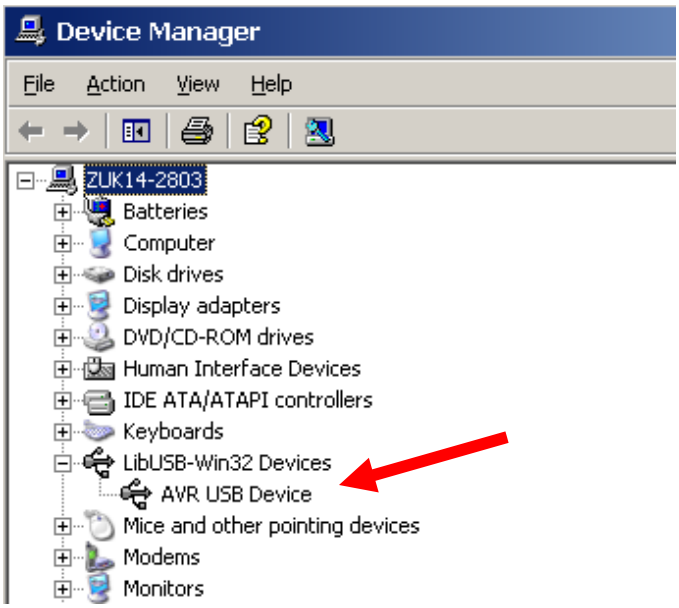
- Press “START”
- Press “Control Panel”
- Select “System”

Following Screen is displayed

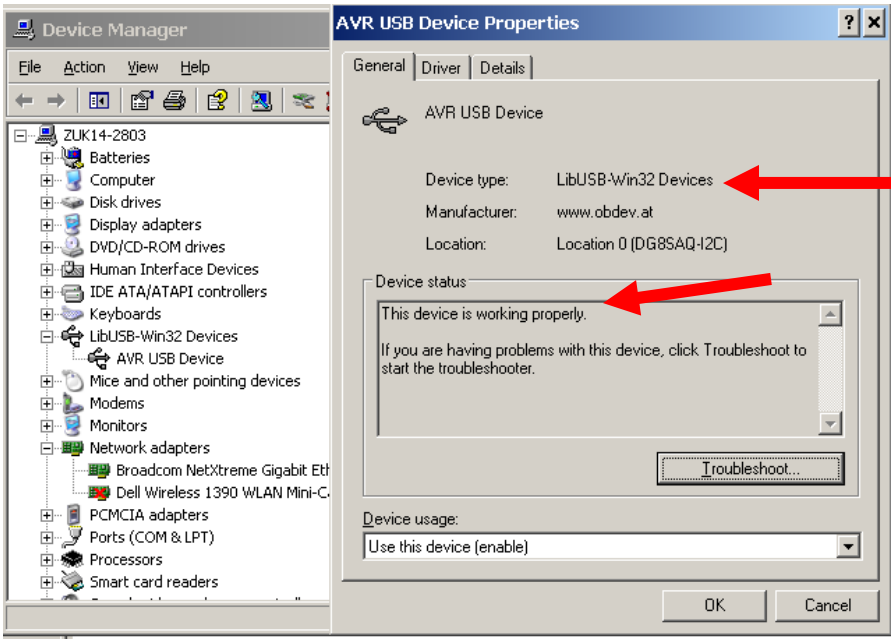
- Select “Hardware”
- Select “Device Manager”

A folder “LibUSB-Win32 Devices” should be displayed
(only when USB-Synthesizer is Plugged-in)

- Press to Expand AVR-USB Device folder



Click on "AVR USB Device"
Proper operation of the Driver may now be checked



- Select tab "Driver"

The screen below is displayed and options made available to

- Remove Driver
- Update Driver
- Reinstall Driver

END OF DRIVER INSTALLATION VERIFICATION

6. FUNCTIONAL TESTS

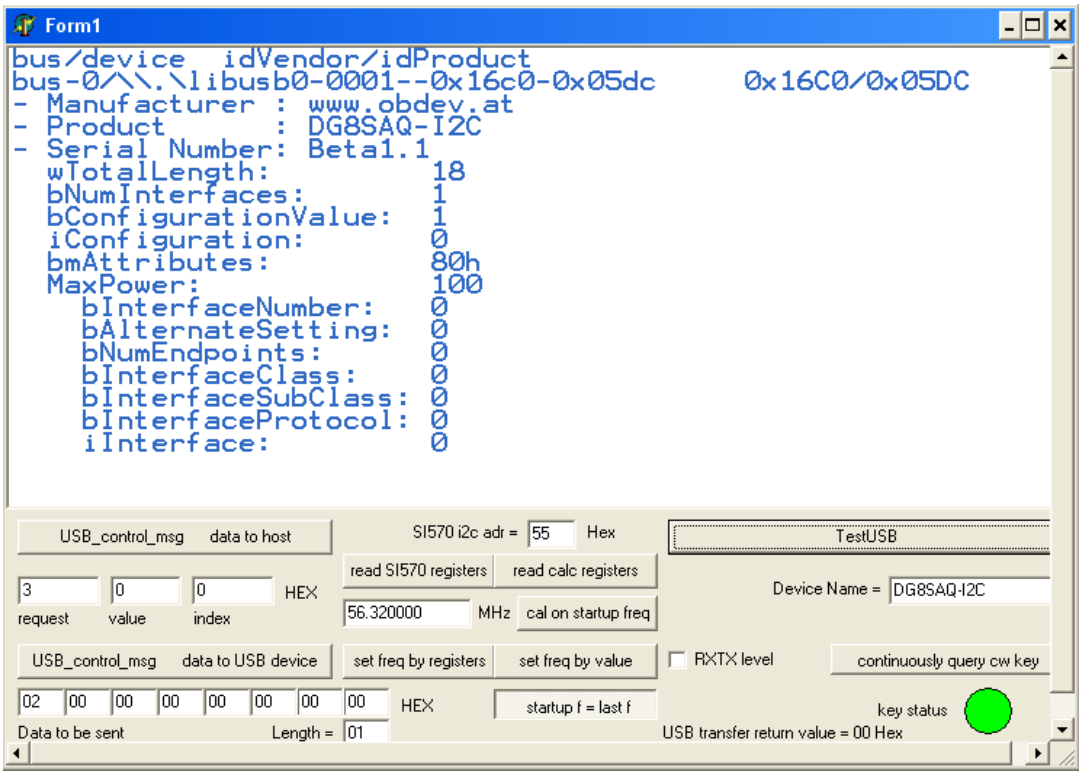
Once driver is installed the USB Synthesizer board can be tested with the application **Si570_USB_ Test** which can be found in the folder 'hostware" which is found in the "Si570 folder" containing the Driver.

Start "**Si570_USB_Test**"
Check SI570 i2c adr is set as follows

- LVDS Si570BBC000141DG i2c address = 55 Hex
- CMOS Si570CAC000141DG i2c address = 55 Hex

Note: the address is 55 Hex is valid for all Si570 devices supplied by SDR-Kits.net.
The address may be different for Si570 devices obtained from other sources.

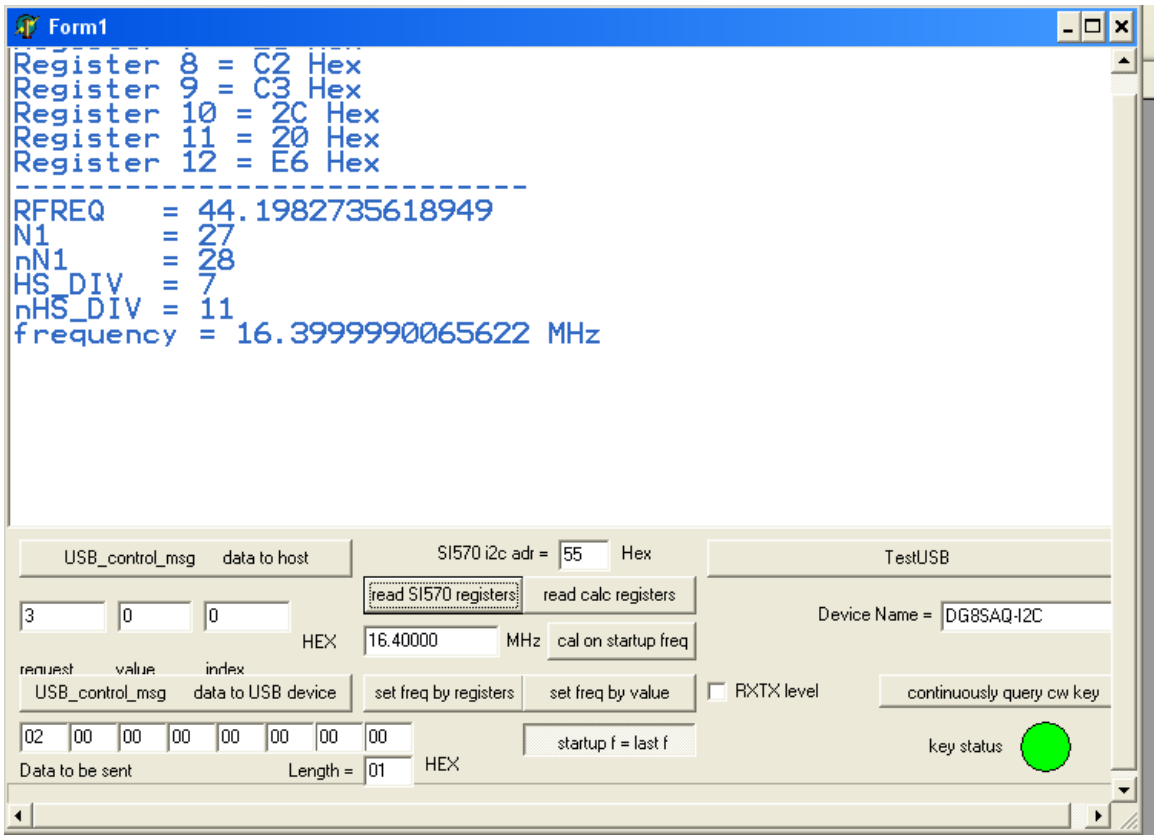
Click button "**TestUSB**"
The following screen should be shown.



Setting Frequency:
Enter the desired frequency in the Window **MHz**

- Example frequency entered **16.400 MHz**
- click “set freq by value”
- click “read SI570 registers”

Following screen should be displayed



END OF FUNCTIONAL TEST PROCEDURE

7. INTERFACING TO SOFTROCK RXTX V6.1 or V6.2 TRANSCEIVER

Three connections are required to connect the USB-Synthesizer to the RXTX V6.x transceiver as follows:

( ) Prepare a 10cm (4 inch) length of RG174 miniature coaxial cable by removing 1 cm plastic at either end of the cable. Next remove 3mm insulation from the inner conductor at both ends.

Fig 5: Preparation of 10cm 4 inch Coaxial cable

( ) On RXTX PCB, disable the Crystal Oscillator by removing 2 pin Jumper from JP2.

( ) On RXTX PCB remove 2 pin Jumper from JP1.

( ) Solder Inner conductor of coaxial cable to JP1 pin 2 as shown in fig 5 below:

( ) Solder Outer conductor of coaxial cable to JP1 pin 4 (Ground) as shown below.

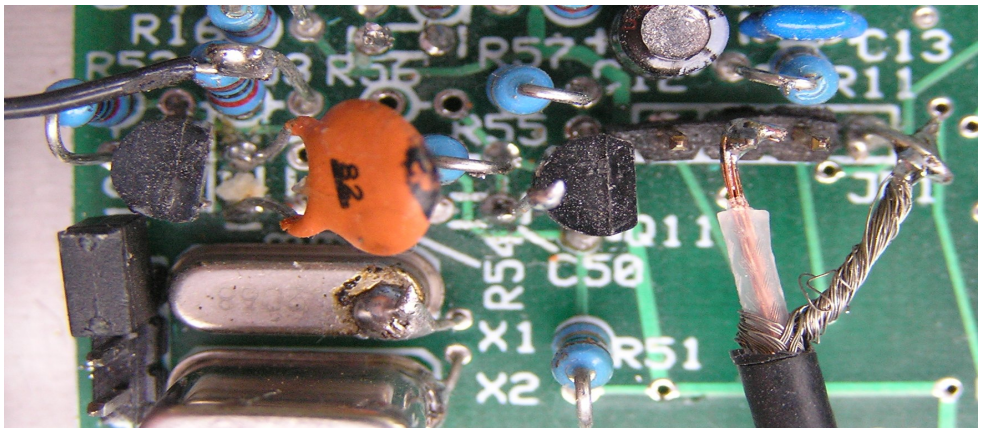


Fig 6: Connection of Coaxial Cable to RXTX PCB JP1

( ) On USB Synthesizer board solder inner conductor of coax cable to pin A

( ) Solder outer braid of coax cable to centre pin B

( ) Connect wire from +12V terminal to +12VDC terminal of RXTX PCB

( ) Connect wire from USB-Synthesizer "PTT" to RXTX PCB "PTT_IN"

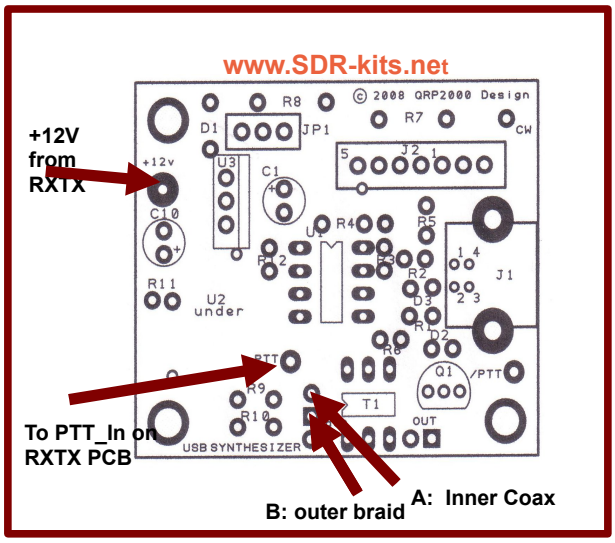


Fig 7: Connections on USB-Synthesizer PCB to support Softrock RXTX

8 POWERSDR SETUP FOR RXTX USB SUPPORT (updated 16th April 2009)

( ) Download PowerSDR application from Flexradio Systems:
Click here which version are currently available for download. Versions recently tested include 1.16.1.exe 1.14.0.exe and 1.12.1.exe

( ) Download and install the required version of PowerSDR.exe

We now need to download and install the file **Sdr1kUsb.dll** (written by Guido PE1NNZ with cooperation from Alan M0PUB) which allows PowerSDR to communicate with USB-Synthesizer board through the driver.

( ) Download the file **Sdr1kUsb.dll** from Sourceforge repository and save this file in the same directory where you installed PowerSDR in the previous step. (for PowerSDR 1.16.1. typically in C:\Program Files\FlexRadio Systems\PowerSDR v1.16.1

( ) Plug-in USB-Synthesizer board with Jumper JP1 set. The board should be recognized. Start PowerSDR.exe application and open tab "Hardware Config" and tick the box "USB Adapter" as shown in fig 8 below. Click "Apply"and "Ok"

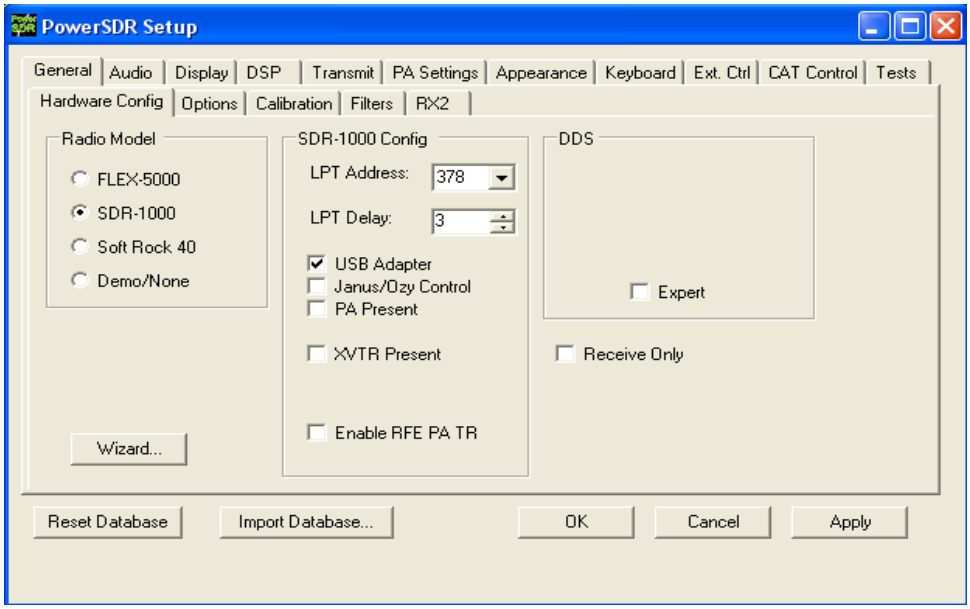


Fig 8: PowerSDR USB setup Screen

Note: Your existing CW keying arrangements (Parallel port or Serial port) as documented in the PowerSDR documentation continues to be supported. The use of the USB-Synthesizer - Straight CW Key-input is optional.

9 ROCKY V3.6 APPICATION SETUP FOR USB CONTROL

The popular Rocky SDR Program by Alex VE3NEA may be downloaded from:
http://www.dxatlas.com/Rocky/

To enable USB Support, Start Rocky, Select "VIEW", Select "Setting", Select "DSP"
Tick "Use Si570-USB, Tick "Multi-Band" and Check Address is set to "85" press "ok"

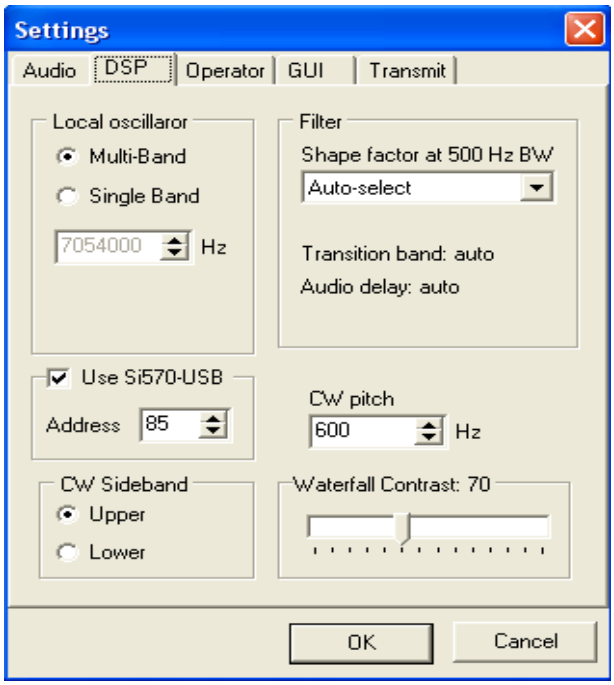


Fig 9: Rocky USB setup Screen

Note: Your existing CW keying arrangements (Parallel port or Serial port) as documented in the Rocky documentation is still supported. The use of the USB-Synthesizer - Straight CW Key-input is optional.

10 SI570 USB SYNTHESIZER APPLICATION – SI570 CALIBRATION

A standalone Si570 Control Application **USB_Synth.exe** provided courtesy of Tom Baier DG8SAQ may be downloaded **HERE**

- Typical Applications include control of Si570 as RX Local Oscillator and VXO for TX applications, Test Oscillator or QRSS Beacon etc.

- The frequency may be set to the nearest Hz. And a Multiplication factor or Frequency offset (IF offset) may be specified as shown in the setup screen below
- "Last Frequency Remember" Option for Standalone applications.
- Provision to Calibrate the SI570 to exact frequency

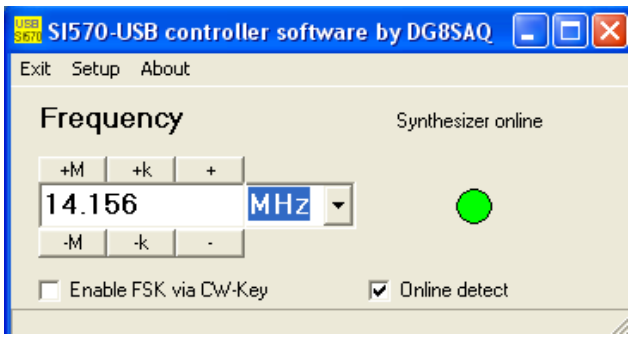


Fig 10: Si570 USB controller USB_Synth.exe

When the SETUP is selected the following screen will be displayed. This shows how the various parameters which may be specified to suit your particular application:

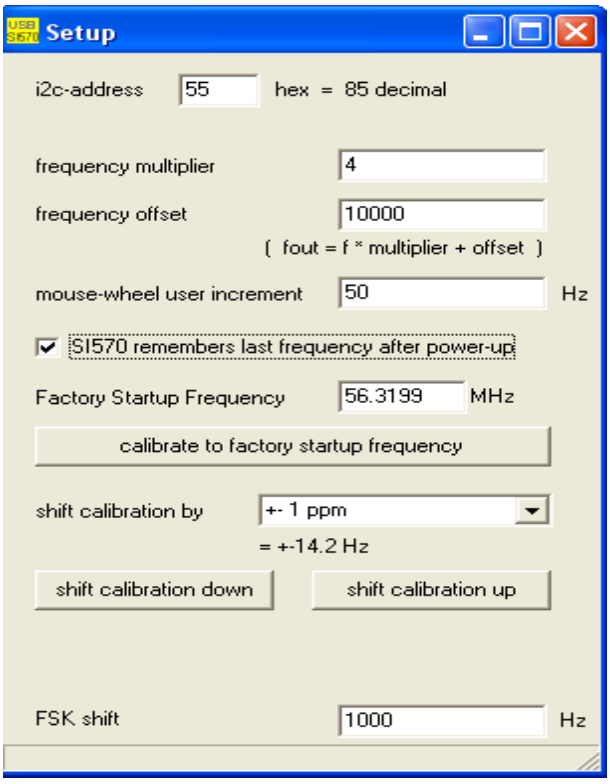


Fig 11: Si570 USB controller USB_Synth.exe Setup Screen

10.1 Si570 FREQUENCY CALIBRATION

Calibration of the Si570 may be easily done using the USB-Synth Application as follows

( ) Set Jumper JP1 and connect USB-Synthesizer to USB Port

( ) On Setup Screen press button “Calibrate to factory Standard start-up frequency”

( ) The SI570 will generate the Standard start-up frequency specified for this device. (For Si570 devices supplied by SDR-Kits this will be nominally 56.320000 MHz)

( ) With accurately calibrated Frequency Counter measure the output frequency of the Si570.

( ) Enter the frequency measured in the window “Factory Calibration Frequency” and press button“Calibrate to factory Standard start-up frequency” to perform calibration.

The calibration values are now stored in AVR EEPROM for future use.

10.2 ALTERNATIVE CALIBRATION ROUTINE FOR WWV OR OTHER SOURCE

( ) Tune Receiver to receive a accurate calibration source like WWV on 10.000 MHz.

( ) Set Jumper JP1 and connect USB-Synthesizer to USB Port. Connect a short wire to the USB_Synth output and couple the output signal to the Receiver until a BEAT frequency with the calibration source is heard.

( ) Operate the 'SHIFT CALIBRATION” buttons until the USB-Synth RF output is **ZERO BEAT** with the calibration source to complete calibration.

This complete Calibration Routine.

10.2 APPENDIX CALIBRATION

Definitions:

Fa = Actual Receive Frequency (Frequency of known Radio Station or Radio Signal published in Frequency list or measured)

Ft = Frequency entered to receive the “known Radio Station”

Fxo = Frequency of the Si570 internal Crystal used in calculate and set “Ft”

Fxn = Corrected Frequency of the Si570 Internal Crystal to set “Ft” to the same frequency as “Fa”

Formula to calculate Fxn = Fxo – (Ft – Fa) / Fa * Fxo

Example = Fxo = 114,300.500 kHz
Fa = 10,000.000 kHz (WWV reception on 10 MHz)
Ft = 9,995.355 kHz Frequency set to receive WWV

Fxn = 114,353.593 (Corrected Crystal frequency – which should be stored (in Hz) for future use by the program)

END OF DOCUMENT

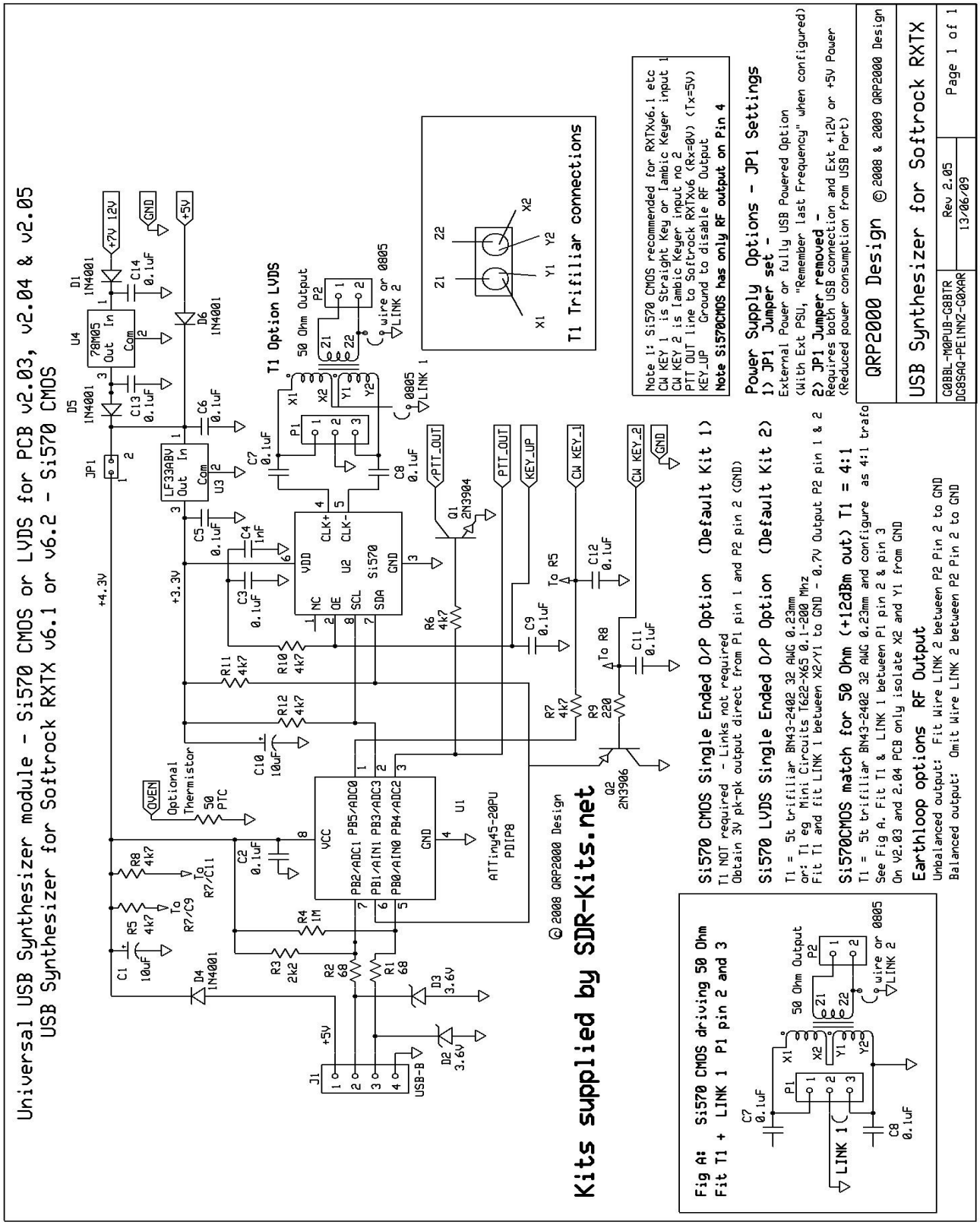


Fig 12: USB Synthesizer Circuit Diagram for PCB V2.03, V2.04 & V2.05