# 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, and Windows 98. For Windows 7 and Vista a Digital Certified Driver should be downloaded, courtesy of Fred Krom PE0FKO. For Linux user there are reports that VK6JBL , usbsoftrock-1.0.1.tar.gz driver is suitable for this Kit.

**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 from 3450 kHz up to 160 MHz (in practice up to 250 MHz) for Si570CAC CMOS. For Si570BBC 3450 kHz up to 280 MHz, For Si570BBB LVDS up to 810 MHz (In practice up to 945 MHz).   The Si570DBA CML device will cover up to 1417 MHz with no gaps in practice, however this is not guaranteed.  If FM modulation is required then use Si571CFC device which in practice provides RF Output up to 250 MHz.

- 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. The Si570DBA CML device has 2 independent RF Outputs which match straight into 50 Ohm Load.

- 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 (Silent Key)** – 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 and
to **Fred PE0FKO** who developed the Digitally Certified Driver for Windows 7 and Vista OS.


## 2.  BILL OF MATERIALS

**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**
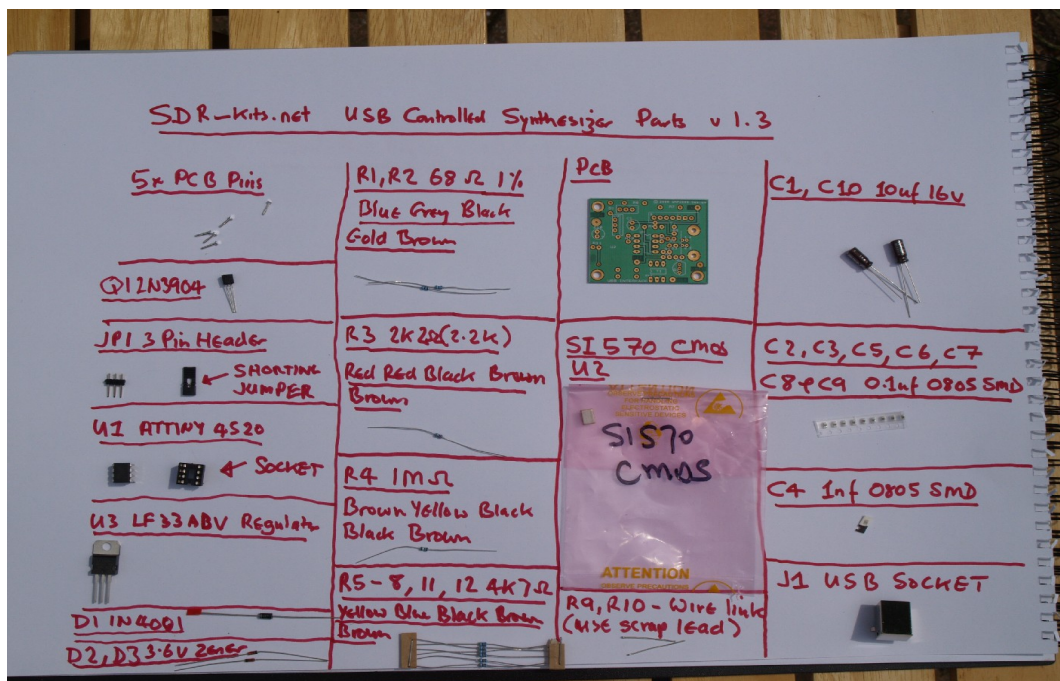**Do not remove Si570 device from anti-static bag until needed**

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

| No in Kit | Designation | Value | Remarks – V2.03 or V2.04 or V2.05 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 stripe |
| 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 (blue  grey 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) or (yellow violet red gold) |
| 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, V2.04 or V2.05 |
| 1 | IC Socket | 8 pin DIL | |
| 6 | PCB pins | 1mm dia | |

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

### 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!!**
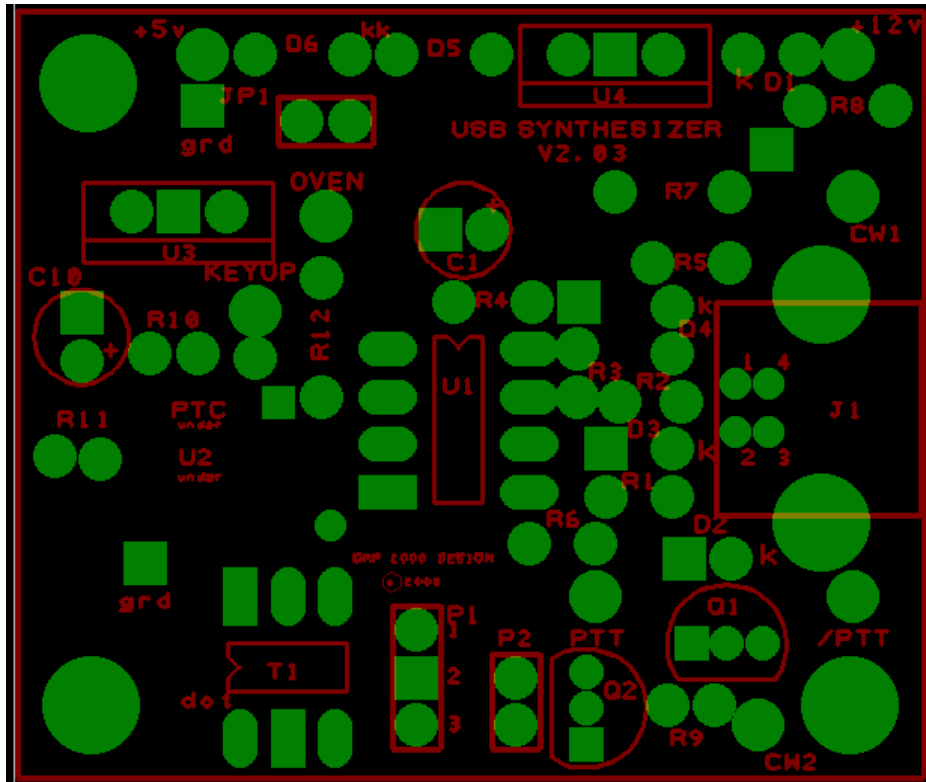
**Bottom PC mounted components**
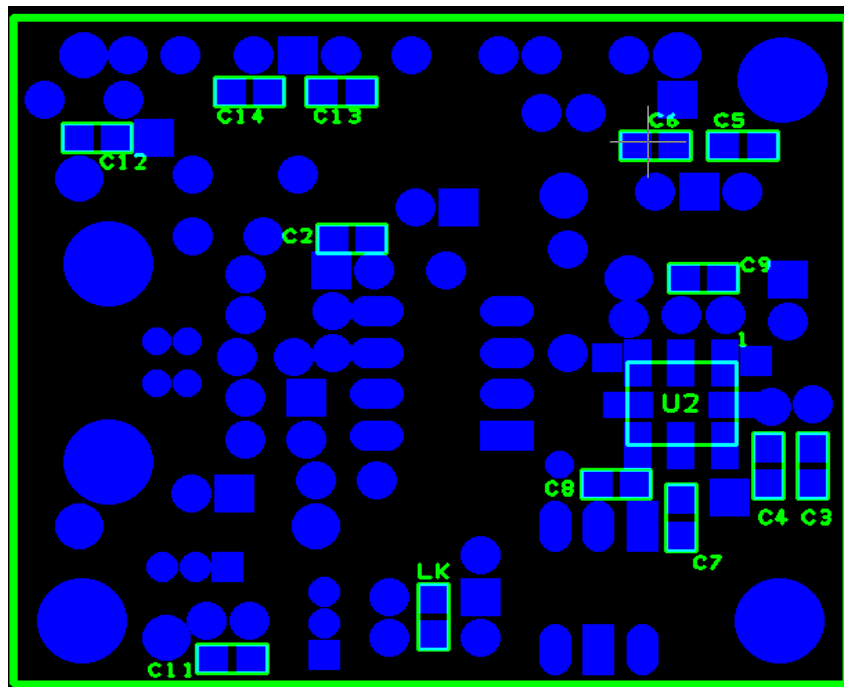


*Fig 2   PCB with all components except Si570 fitted at bottom of board*
*Please note:  All Capacitors are 0.1uF except C4 which is 1nF.  LK is Wirelink*

**(  )**      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 currently 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

(  )      **C**aution: 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**

(  )      **C**aution: observe antistatic precautions handling semiconductors

(  )      The Si570 device is soldered on the bottom of the PCB. Coat the Si570 pads and the PCB pads
         for the Si570 with a tiny amount of solder first.

(  )      Locate the Dot on the Si570 device and align with pin 1 marked on the  PCB.  (The Dot is
         located on the left hand side of bottom line showing the Batchnumber). Apply heat to make the
         joint and add some more solder as shown in fig 4.



*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.
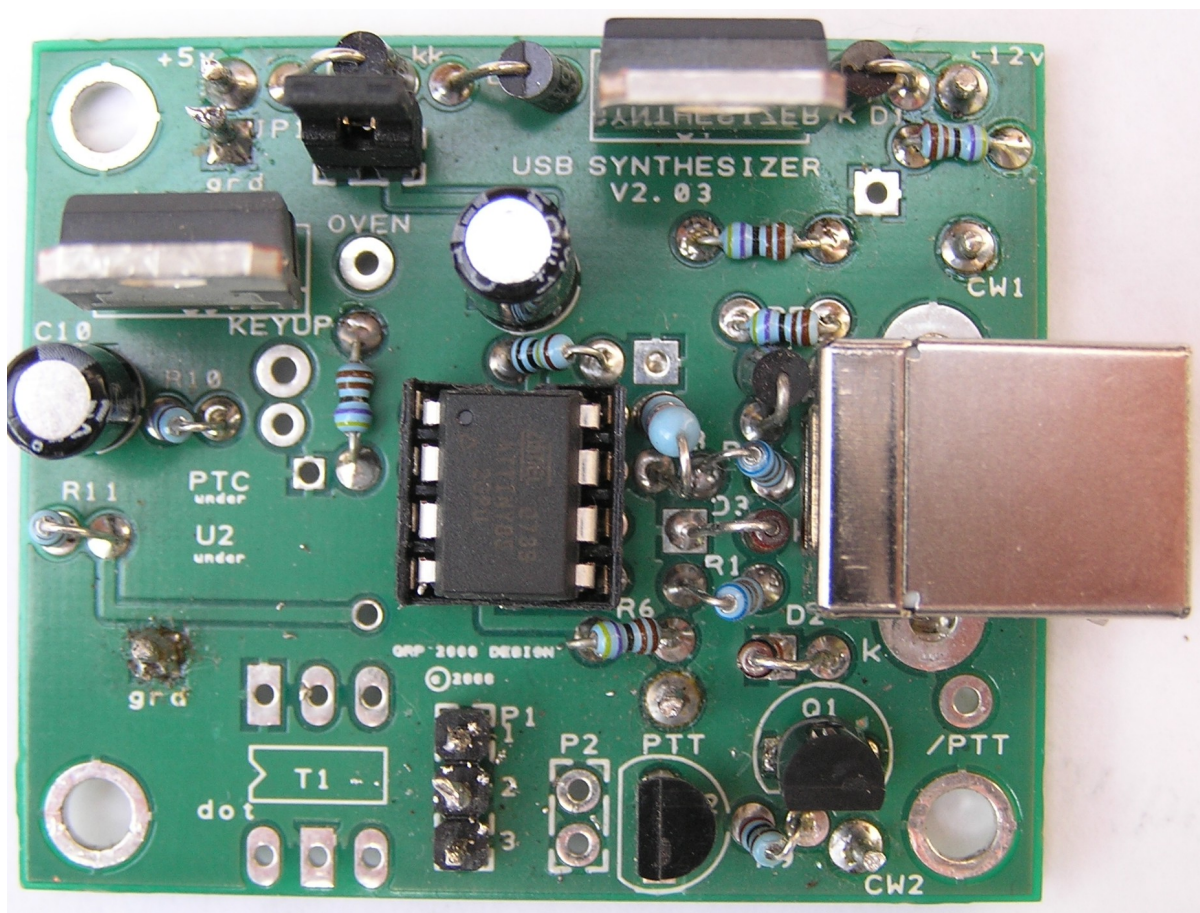


*Photo of completed V2.03 PCB (top)*
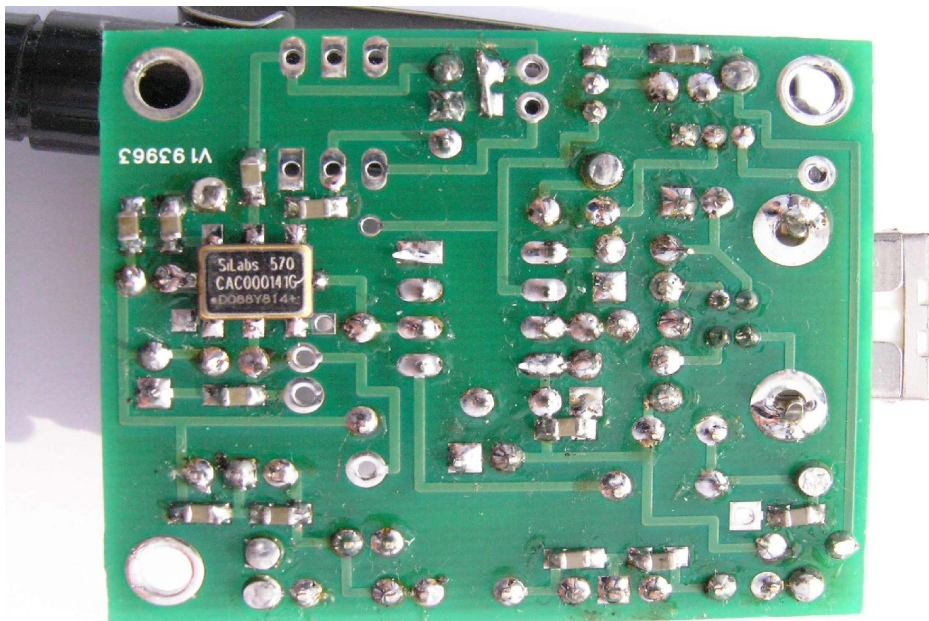
*Photo of completed V2.03 PCB (bottom)*

**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.

**Windows XP, ME, 2000, or Windows 98.**   Traditional Drivers for the USB-Synthesizer kit are successfully used with the following Operating systems:Windows XP, ME, 2000, or Windows 98. For installation see section **4.1 below**

**Windows 7 and Vista (both 32 and 64 bit OS)** require Digitally Signed Driver and a suitable driver is provided courtesy of PE0FKO.  See section **4.3 below**

**LINUX** There are a number of reports of successfully operation under Linux, using VK6JBL, usbsoftrock-1.0.1.tar.gz,  Driver used on Linux Unbunto Operation System.  No further information is available, but check the Softrock Reflector for announcement by other Linux users. http://groups.yahoo.com/group/softrock40/

**4.1 Driver Installation Procedure for Microsoft XP Operating System.**

- Download Si570 Driver from:   http://www.mydarc.de/dg8saq/hidden/SI570_firmware.zip
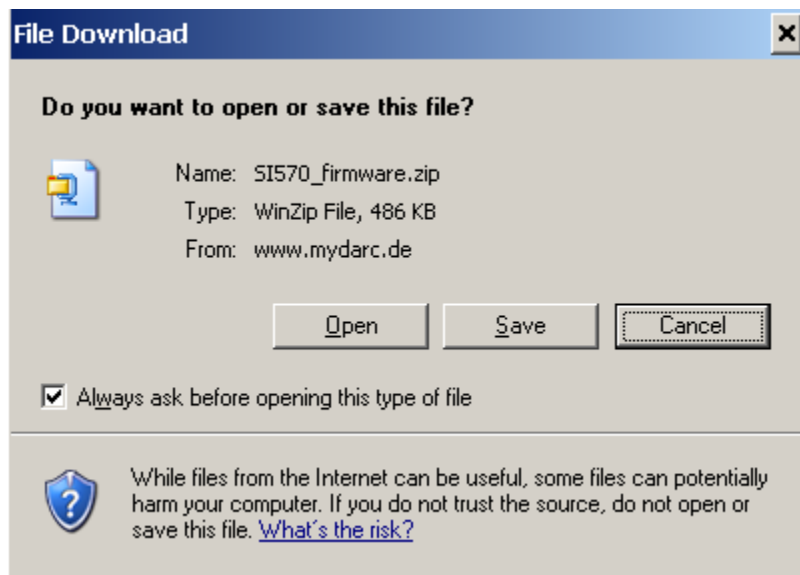


- Press "Save target as"
- Unzip the file SI570_firmware.zip

The following directories will be created

**Driver Installation Procedure**

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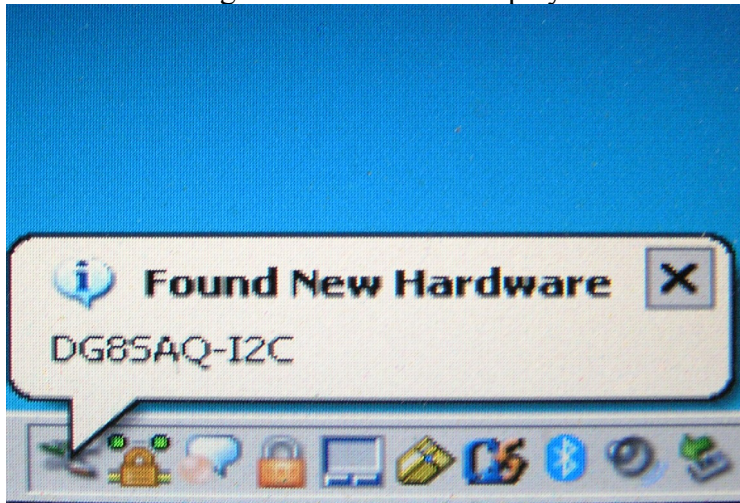


*Problem solving:  If this screen is NOT displayed*
- *Check the USB-Synthesizer hardware for correct operation*
- *Is ATTiny45-20 microprocessor plugged in correctly*
- *Has ATTiny45-20 been loaded with correct firmware*
- *Connect the USB-Synthesizer to the USB port of a different computer*

After about 5 seconds the message below should be displayed:

- Select "No, not this time"
- Press "NEXT"

The following screen should now be displayed:
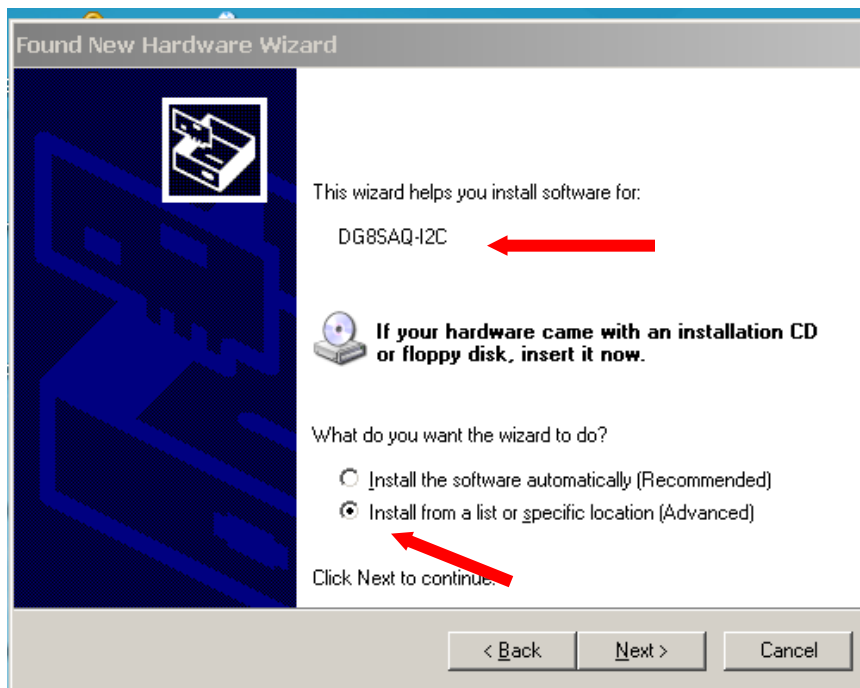


Deselect "Install the software automatically"

Select "install from a list or specific location"
Press "Next>"

The following screen is displayed
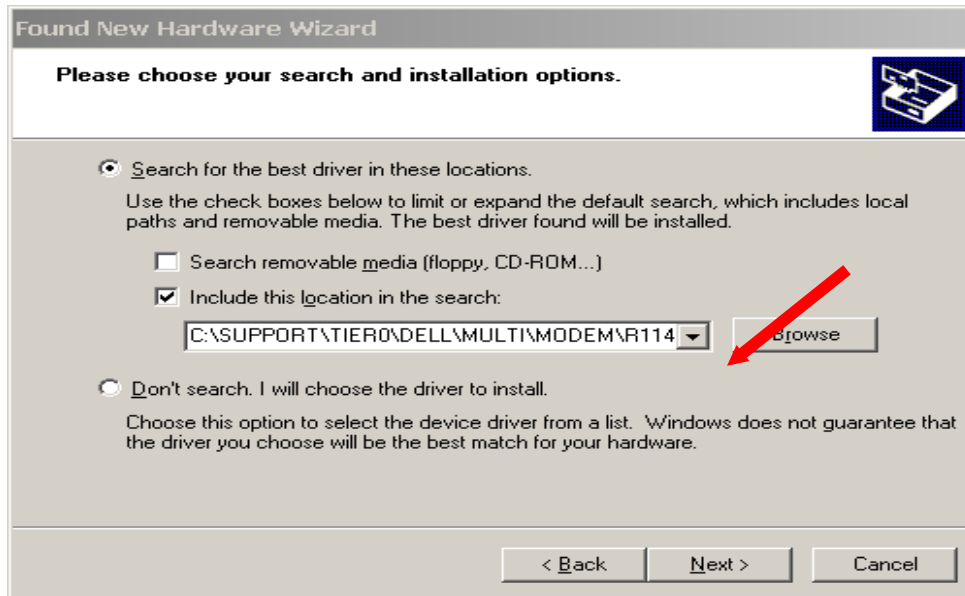


- Deselect "Search removable Media"
- Select "Include this location in the search"
- Press "Browse"
- Select Folder AVR-USB-Driver as shown below
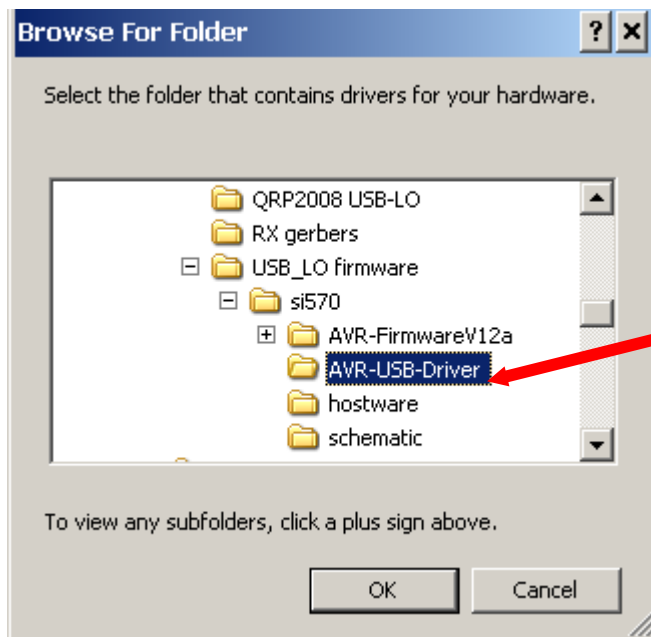
- Click "Ok"
- Press "Next>"
- Software is being installed



When successfully installed, following message displayed:
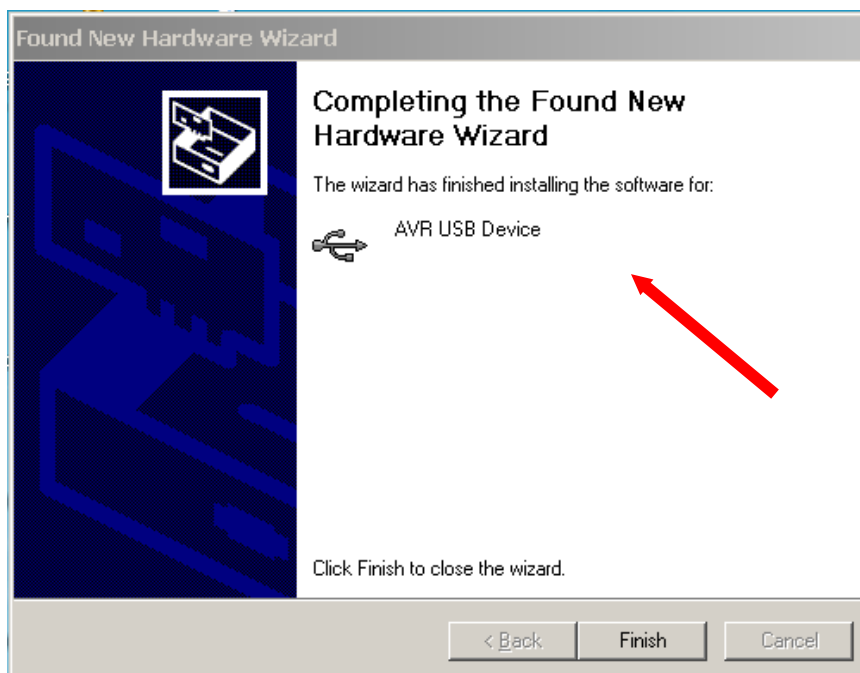
Click "Finish"
Message displayed "Found New hardware successfully installed"

## 4.2 WINDOWS XP, 2000, ME, and 98 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
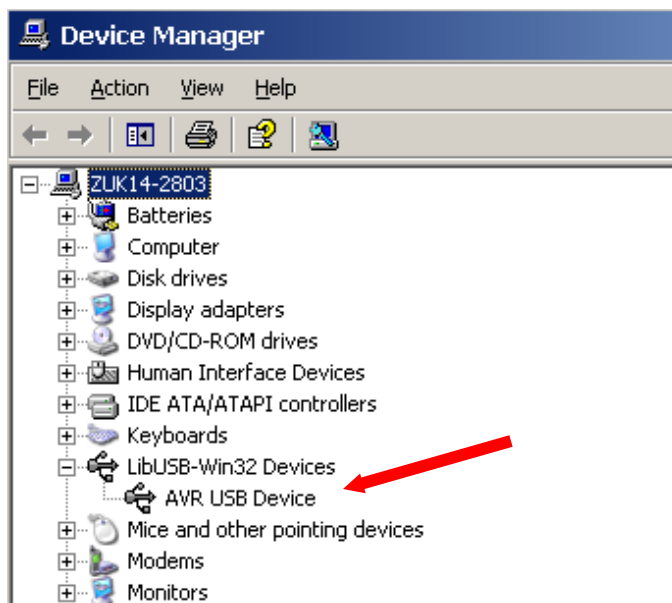
Click on  "AVR USB Device"
Proper operation of the Driver may now be checked
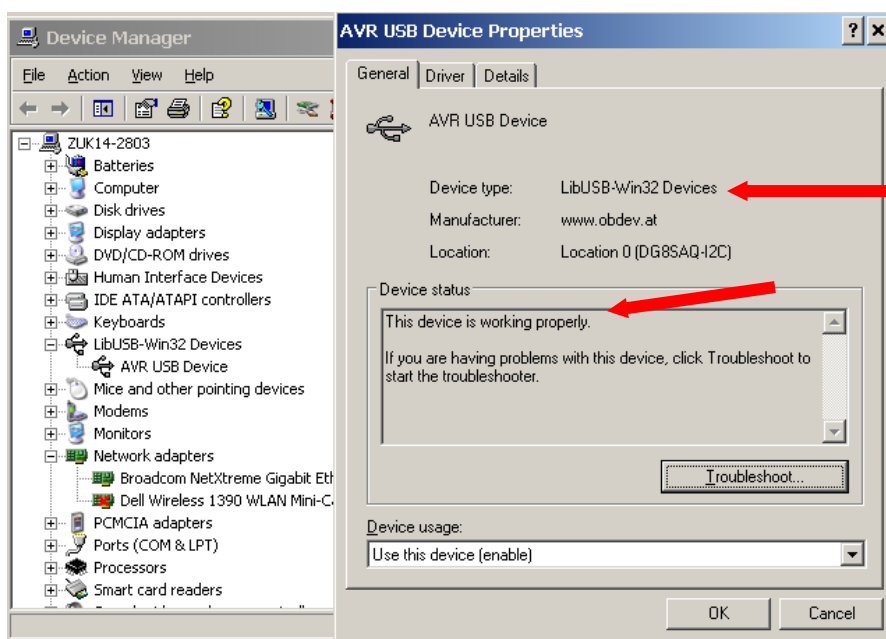
- Select tab "Driver"

The screen below is displayed and options made available to
- Remove Driver
- Update  Driver
- Reinstall Driver
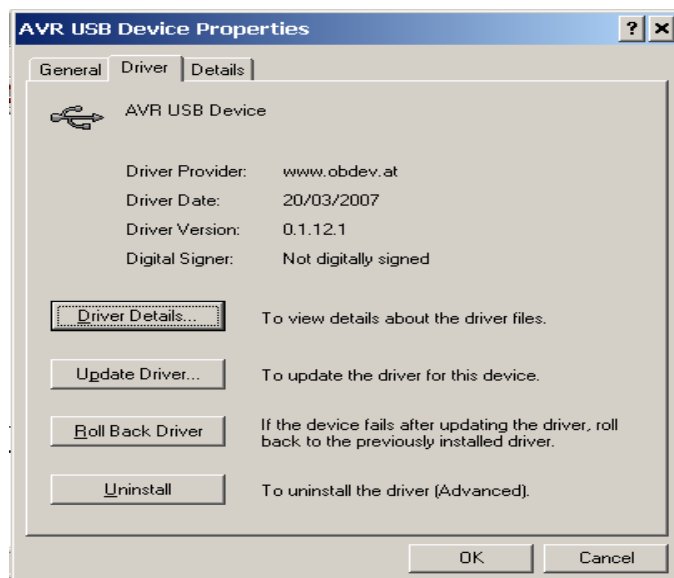
END OF DRIVER INSTALLATION VERIFICATION

**5.0  Driver Installation Procedure for Windows 7 or Vista (64 and 32 bits systems)**

Download the Digitally Signed LibUSB-Win32 driver from:

http://home.ict.nl/~fredkrom/pe0fko/SR-V9-Si570/PE0FKO-USB-Driver-1.2.0.1.zip

Unpack (unzip) and store in folder. (make a note of location of folder)
You should see the following files in the directory:
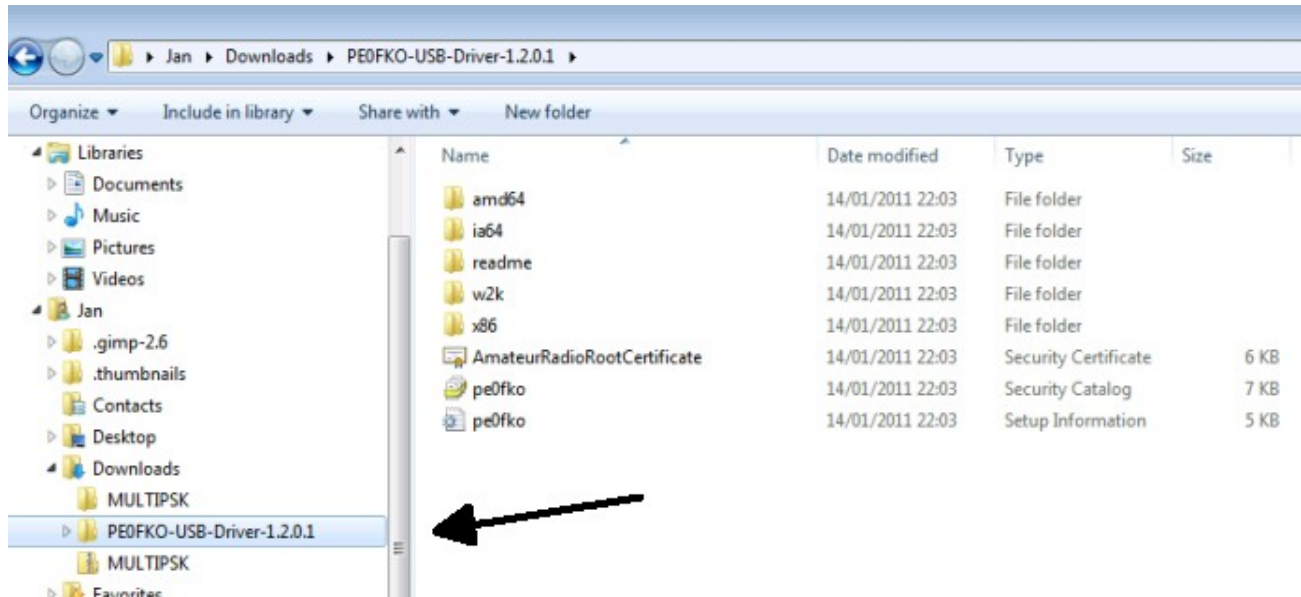


Plugin the QRP2000 Synthesizer

The System will show the following Window.

Select: "Browse for Driver Software on your Computer"
    Press "Browse" and select the Folder where you unpacked the PE0FKO-USB-Driver.
    Tick the box "include Subfolders"
    Press "Next"   Windows will show the following screen:
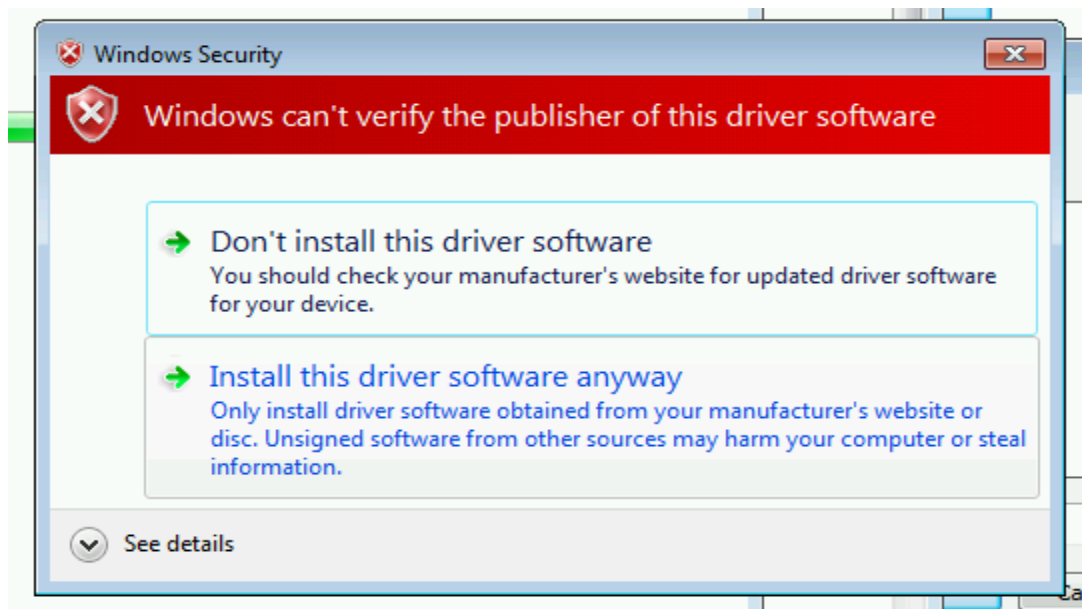
Select "Install this driver software anyway"

The Driver will now be installed. When completed the following screen is shown.



This completes the Windows 7 and Vista Driver installation.

1. **5.2 To check the Windows 7 or Vista Digitally Certified Driver installation:**

Select: Start -Control Panel – System and Security – System – Device Manager

With the QRP2000 US B-Synthesizer must be plugged in the USB Port.
The LibUSB-Win32 device should be present as shown below:
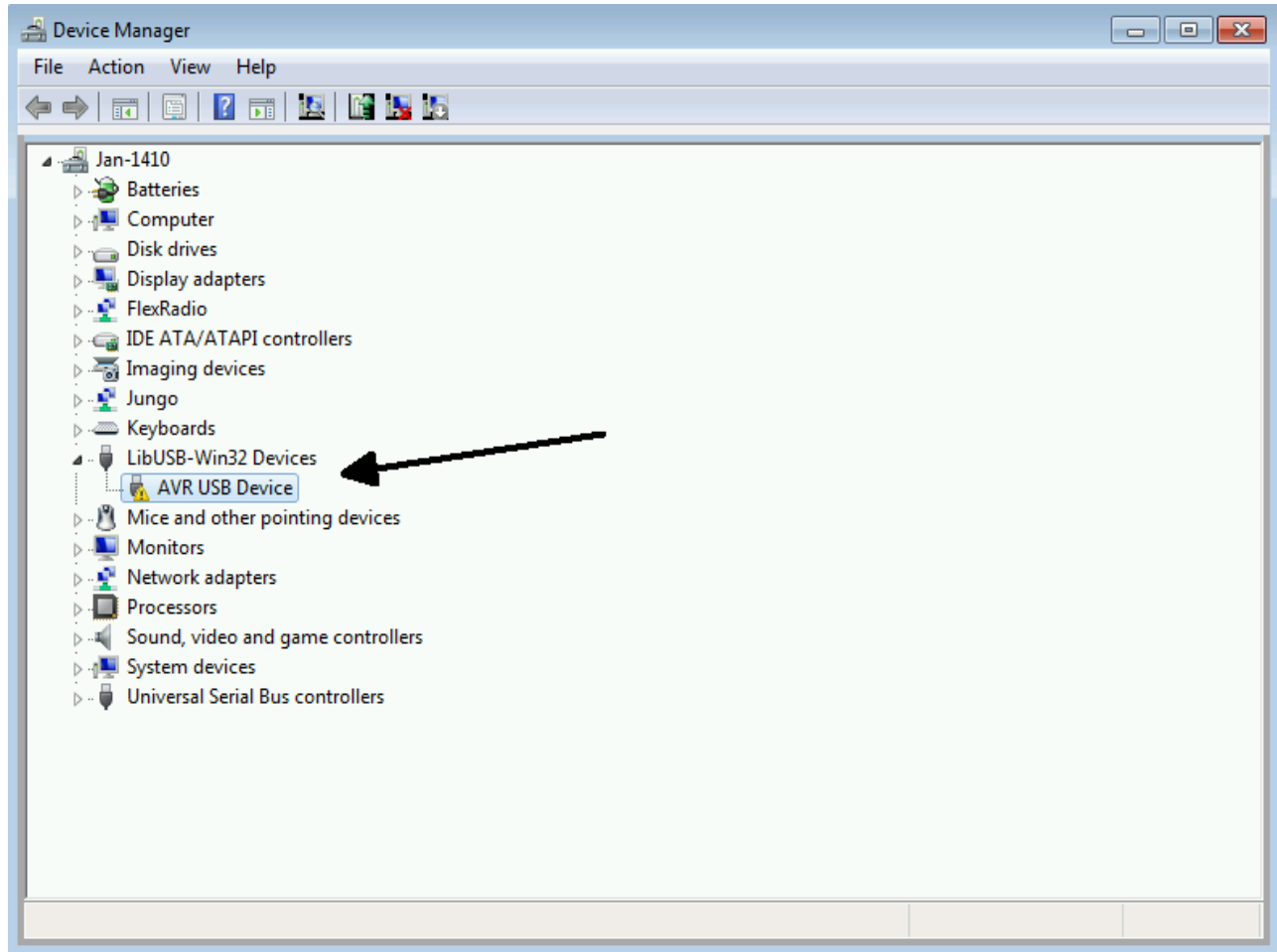


END OF WINDOWS 7 AND VISTA Driver verification.

## 6. FUNCTIONAL TESTS

Once driver is installed the USB Synthesizer board can be tested with the application
**Si570_USB_ Test** which can be downloaded from:  **http://sdr-kits.net/USB/SI570_USB_Test.exe**

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.
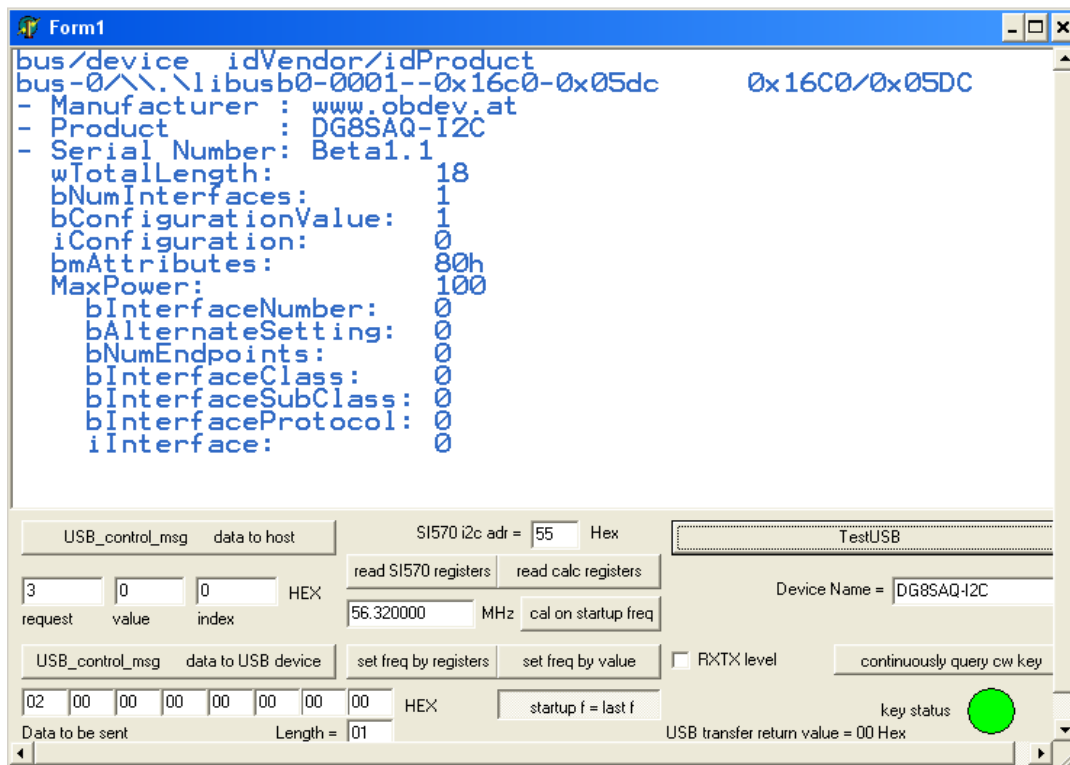


**Setting Frequency:**
Enter the desired frequency in the Window  **MHz**
- Example frequency entered    **16.400 MHz**
- click "set freq by value"
- click "read SI570 registers"

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.
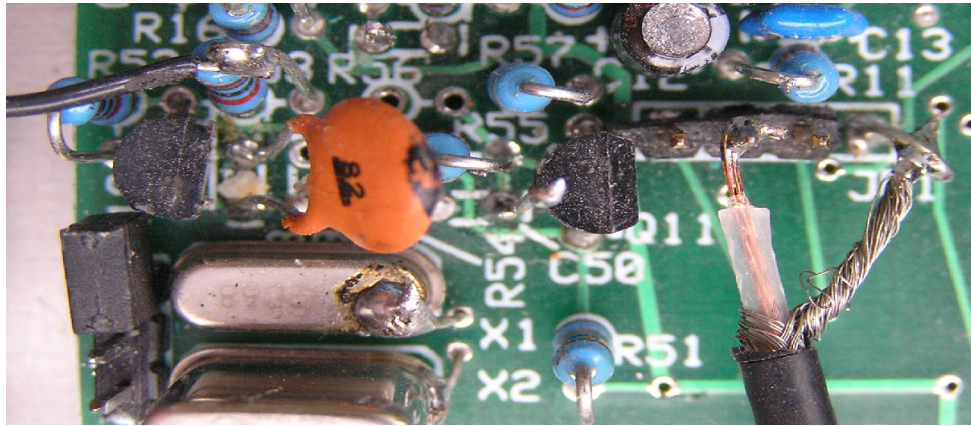


*Fig 6:  Connection of Coaxial Cable to RXTX PCB JP1*

( )      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"
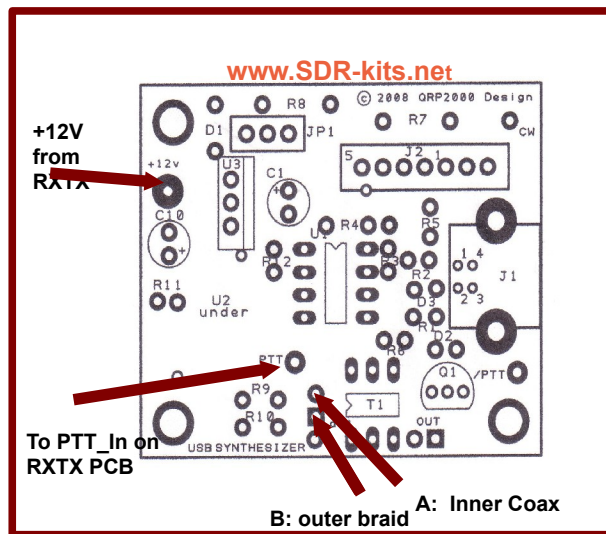


*Fig 7:  Connections on USB-Synthesizer PCB to support Softrock RXTX*

**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"
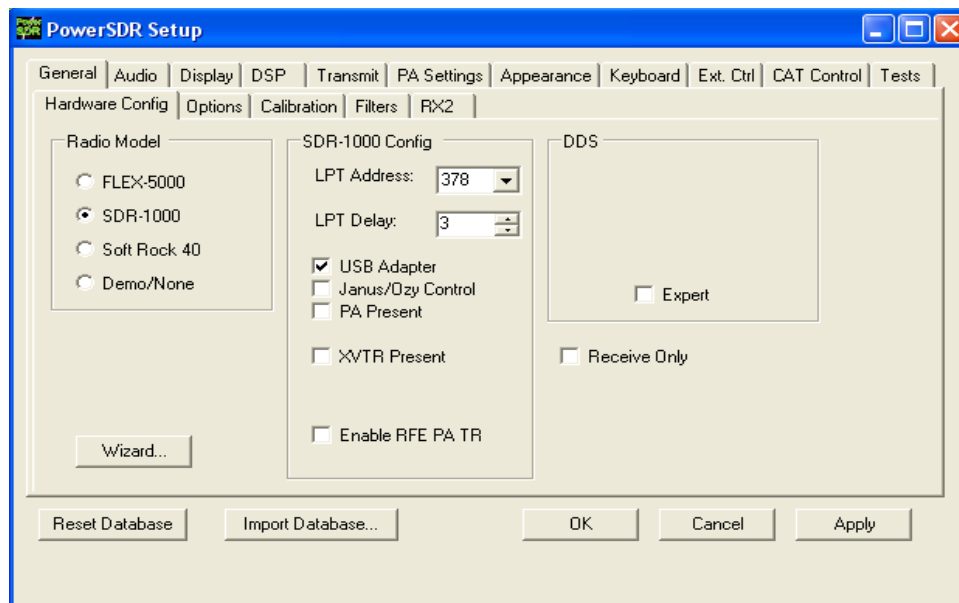
*Fig 8:  PowerSDR USB setup Screen*

**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"
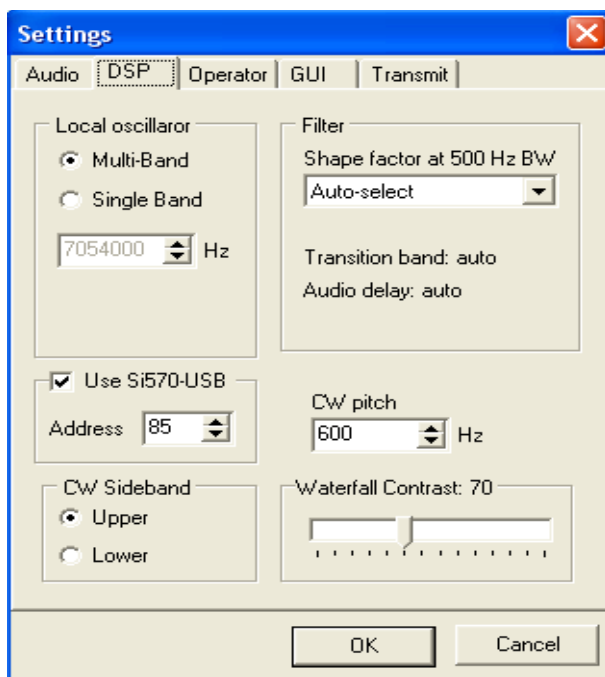


*Fig 9:  Rocky USB setup Screen*

**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 CONFIGURATION AND 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 (including fractions) and/or Frequency offset (IF offset in MHz) may be specified as shown in the setup screen in fig 11.

- "Last Frequency Remember" Option for Standalone applications.
- Provision to Calibrate the SI570 to exact frequency

**Note:** It is important that the correct Grade of the Si570 device fitted is selected for optimum use:
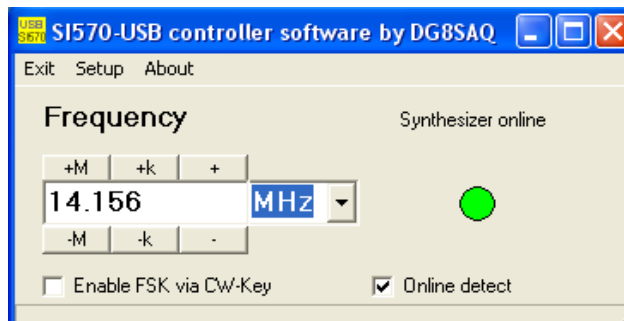


*Fig 10:  Si570 USB controller USB_Synth.exe*

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:
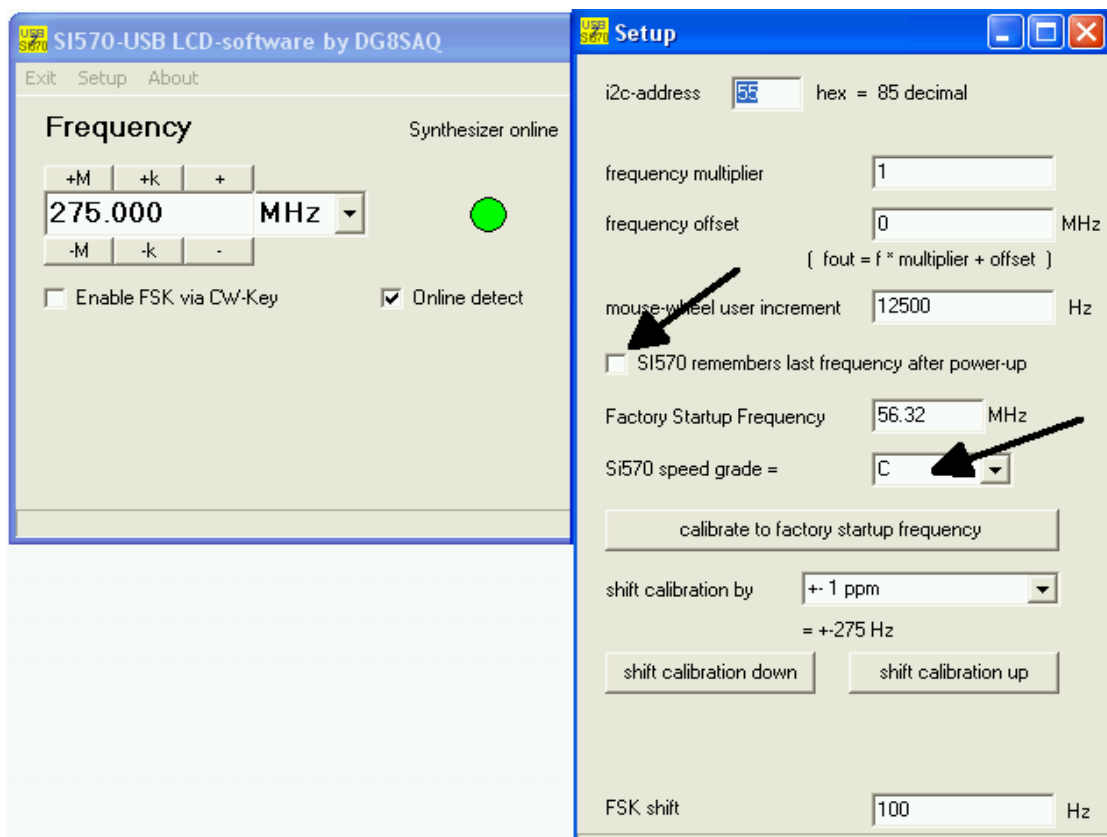


*Fig 11:  Si570 USB controller USB_Synth.exe Setup Screen*

## 10.1 SI570 - SPEED CONFIGURATION

To make optimum use of the capability of the Si570 Device fitted, it is important that the correct Si570 speed grade is selected as shown in Fig 11. For C-grade devices (Si570CAC or Si570BBC) this allows for operation up to the maximum frequency of 280 MHz.

### 10.2 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.
Shift Calibration buttons may also be used to adjust the Oscillator Frequency measured by the Frequency Counter to the value set.

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

### 10.2 ALTERNATIVE CALIBRATION ROUTINE FOR WWV OR OTHER SOURCE

(  )     Tune a 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"

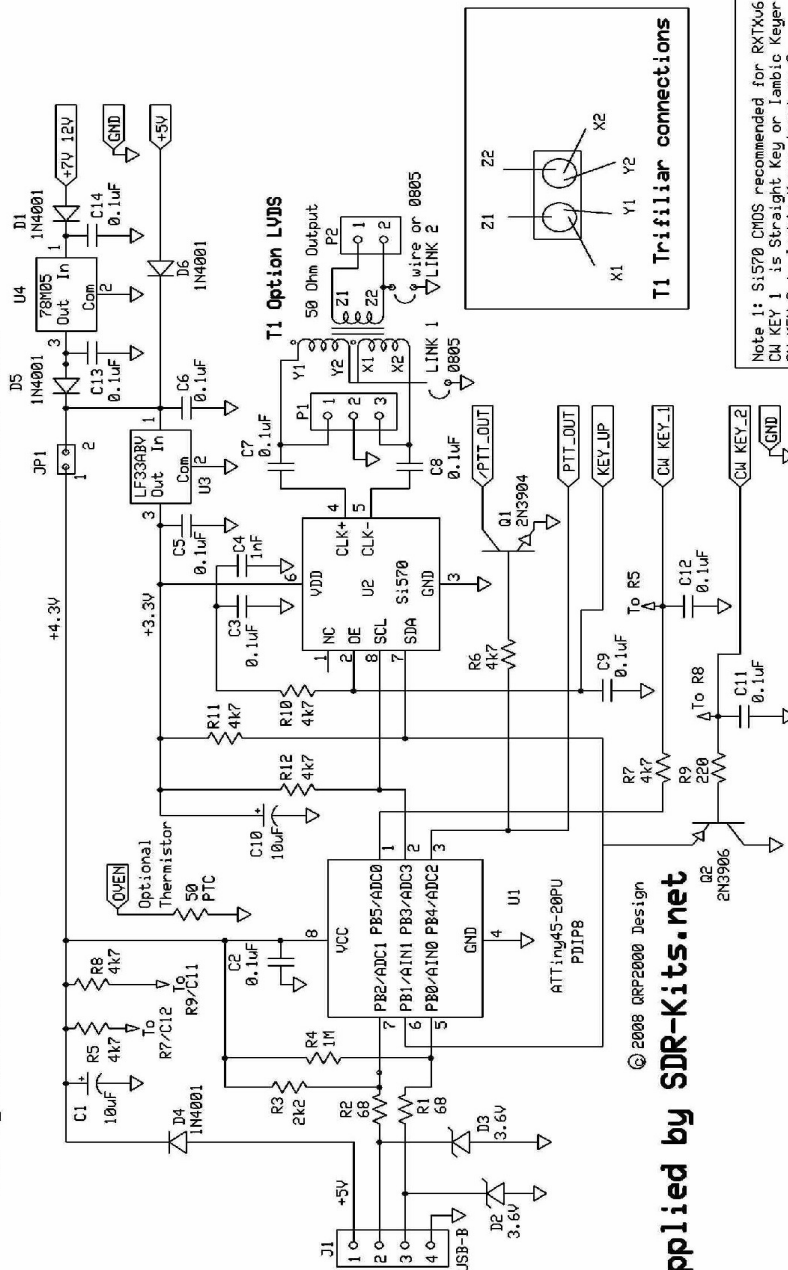Fxn = Corrected Frequency of the Si570 Internal Crystal to set "Ft" to the same frequency as "Fa"

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*