SC800 Evaluation Development Kit

User Guide
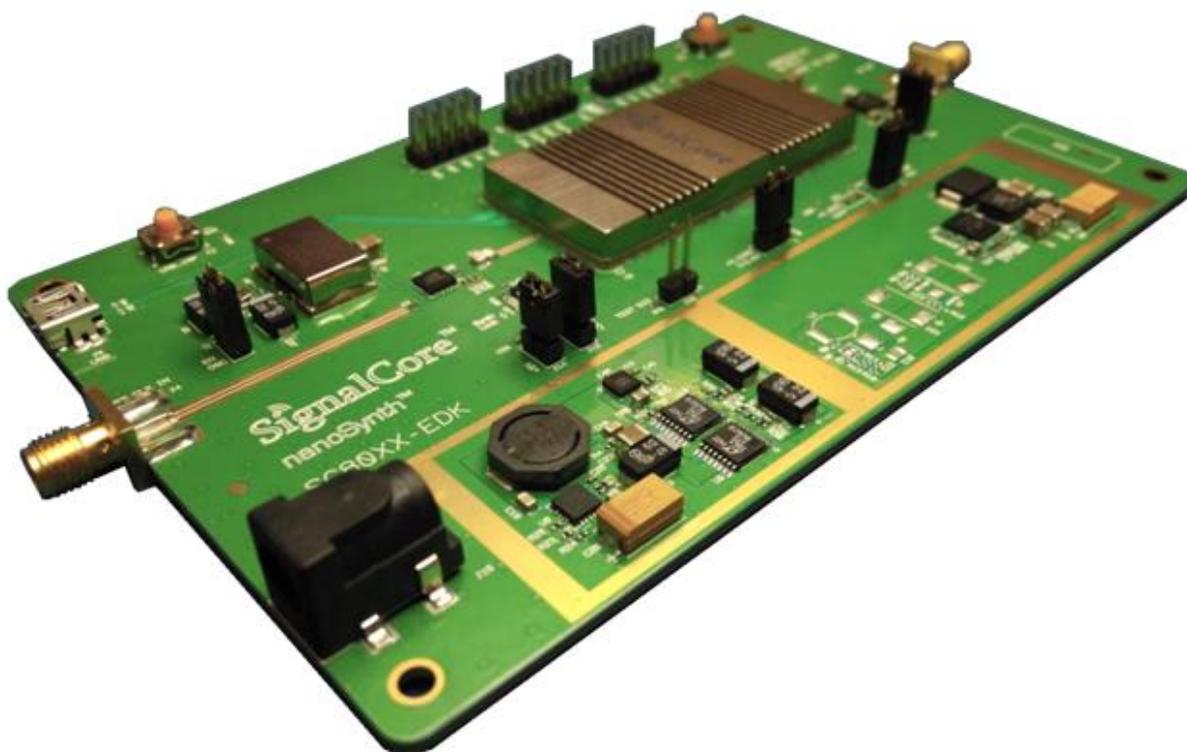
Rev. 1.1

SignalCore
PRESERVING SIGNAL INTEGRITY

Contents

SC800 nanoSynth® Evaluation Development Kit

Thank you for your purchase of the SignalCore SC800 nanoSynth® 6 GHz signal source evaluation development kit (EDK). This EDK user guide will describe how to setup the evaluation board, install the driver, and install and operate the SC800 using the control software.

Evaluation Development Kit Description
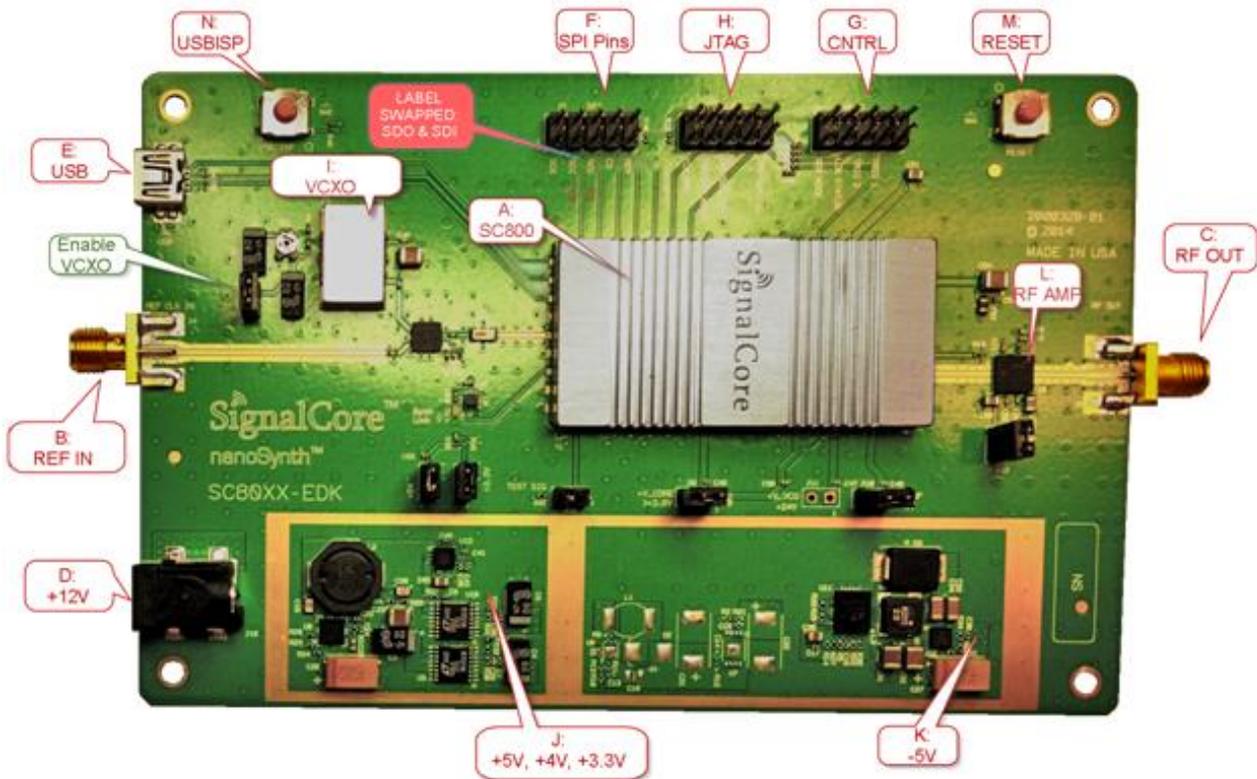
Figure 1. SC800 evaluation development kit.

Label	Description
A	SC800 nanoSynth.
B	Reference input SMA connector. Typical input power is 7 dBm. Max input power is 10 dBm. Input frequency is either 100 MHz or 200 MHz.
C	RF output SMA connector.
D	+12V supply connector, 2.5 mm jack.
E	Mini-B type USB connector for USB communication to the SC800 device .
F	SPI communication header pins. The SRDY pin can be used to monitor the status of the SPI interface. Refer to the SPI interface section in the product datasheet to learn how to properly communicate with the device through this interface. Errata: The label on the PCB has SDO and SDI swapped.

G	External control header pins: SMODE, LCK STATUS, TRIG2 (TRIG IN), and TRIG1 (TRIG OUT). Use the supplied jumpers to shunt each pin to ground as required. See the product datasheet for more information about each signal pin.
H	These are dual function pins. The JTAG functionality can be ignored for normal operation. See the product datasheet for information about each signal pin.
I	100 MHz VCXO. This VCXO is enable by shunting jumper header J7. If the shunt is removed, the VCXO is turned off, and the path to the SC800 reference input is switched to the on-board SMA connection (B).
J	+5.5V supply switcher. Regulated to +5V, +4V, and +3.3V. The SC800 only runs off the +4V supply. The other rails are used to power the VCXO and the digital circuitry.
K	-5.5V supply switcher. Regulated to -5V. Used only by the output driver amplifier (L).
L	RF buffer amplifier. This amplifier boosts the output power to +20 dBm (typical).
M	Reset button. Press the reset button to ensure the device properly operates.
N	USB in-system programming button.

Verifying the Contents of Your Shipment

The contents of the product package should include the following items:

1. One SC800 EDK board
2. One 12V power supply wall adapter
3. One USB cable
4. One SC800 EDK Getting Started Guide document

Inspect the shipping carton for visible damage. If the carton is damaged please notify the carrier and SignalCore immediately.

ESD CAUTION

The SC800 EDK ships in antistatic packaging to prevent damage from electrostatic discharge (ESD). The device should always be stored inside an antistatic bag when it is not in use as ESD can cause damage to the electronic components on the board. Properly ground yourself and use ESD good practices when handling the product at all times.

Open the shipping carton and remove all contents. If the contents show visible damage and/or are missing, please contact SignalCore immediately.

Control Software and Device Driver

The SC800 EDK comes with a USB flash drive that contains everything needed to install, control, and program the SC800. Insert the USB drive into the host computer and launch "SC800 EDK Installer.exe". This top-level menu-based window allows for independent installations of the SC800 software set and the National Instruments LabVIEW Run-Time Engine needed to operate the SC800 Soft Front Panel application. The run-time engine installation can be skipped if LabVIEW 2010 or later is already installed on the host computer. The SC800 software installation files are also available online at www.signalcore.com. Navigate to the SC800 product page; a link to the control and device driver software can be found under the "Library" tab. There are two executables listed – SC800 Setup32.exe and SC800 Setup64.exe. Choose the right one for your operating system, then download and launch the setup file. Whether you use the USB drive for setup or download the files online, running the setup executable will only install the control and development software to your computer and does not install the device driver. The driver must be installed manually by following the instructions in the next section.

Installing the USB Driver

The following driver installations steps apply to Windows 7™. These steps are also sufficient to guide the device driver installation for Window XP™.

1. Power on the device and connect it the host PC. Window 7 will attempt to install the driver, but will fail because the driver has not been loaded. Click the arrow pointer at the lower right corner of the screen and the following screen should appear:
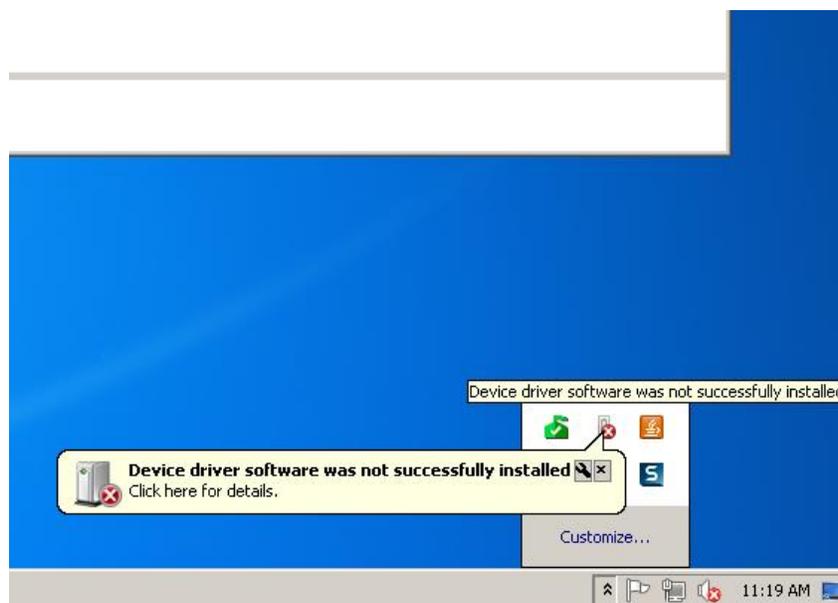
2. Click on the [Start] button, and in the search input box type "mmc devmgmt.msc" as shown below, then press [ENTER].
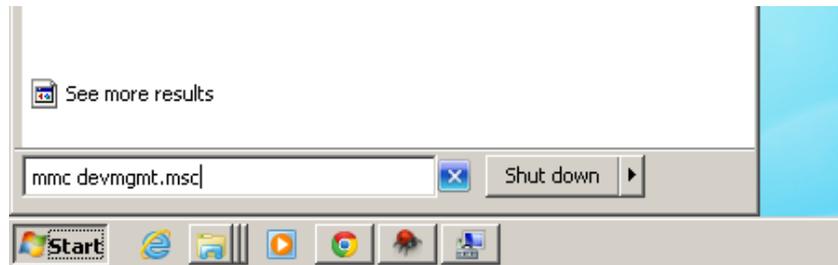
3. This will bring up the "Device Manager" screen as shown below. Right click on "**SC800X nanoSynth**" and select "**Update Driver Software**".
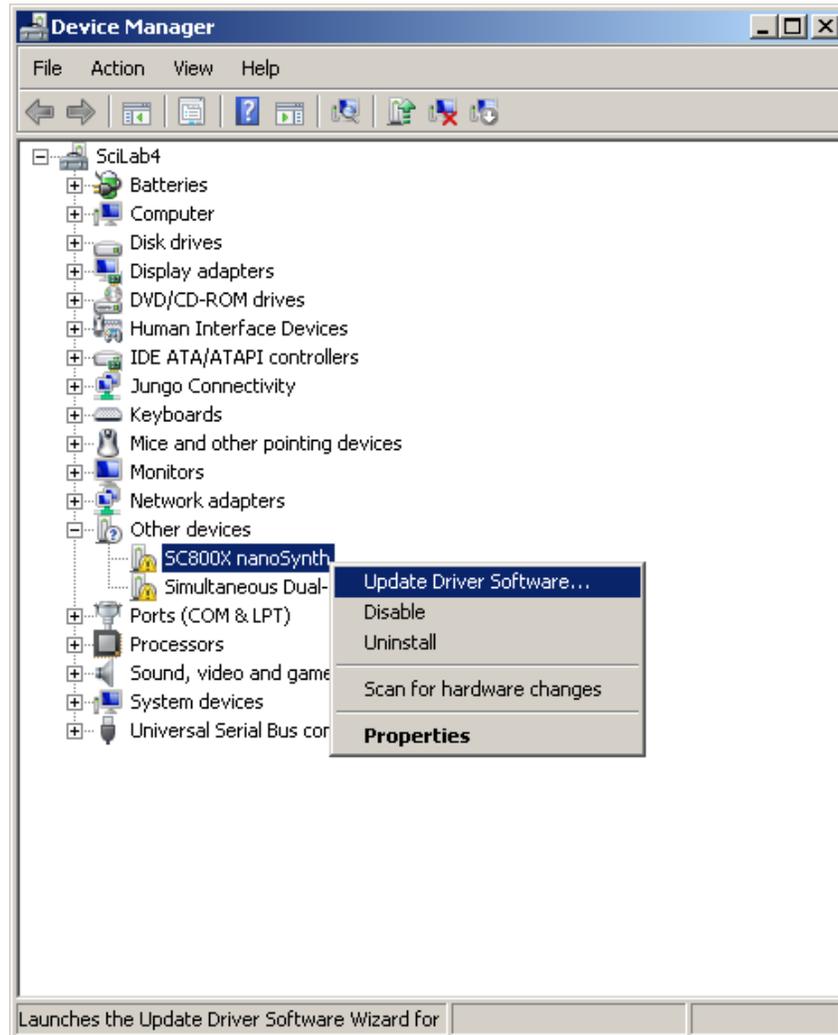
4. The "Update Driver Software" screen will appear. Select "**Browse my computer for driver software**."
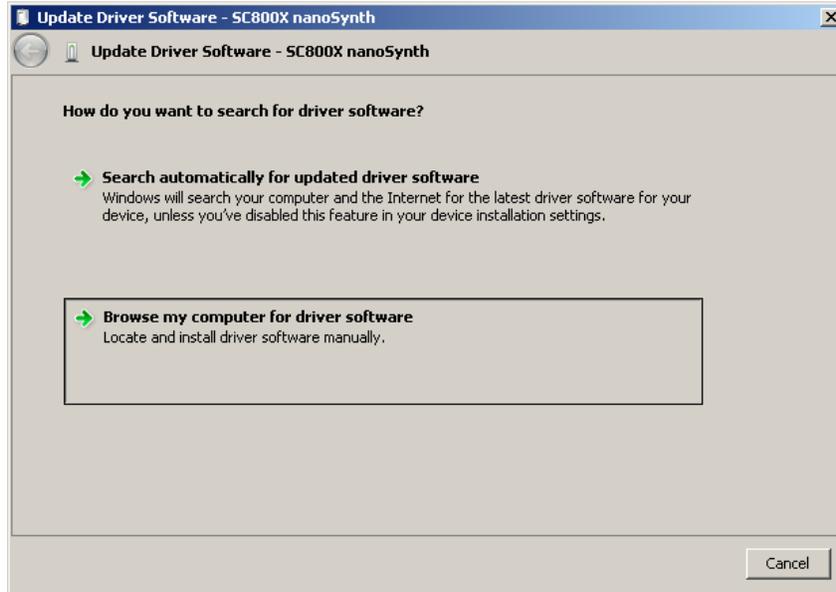
5. Select "**Let me pick from a list of device drivers on my computer**", then click [**Next**] to continue.
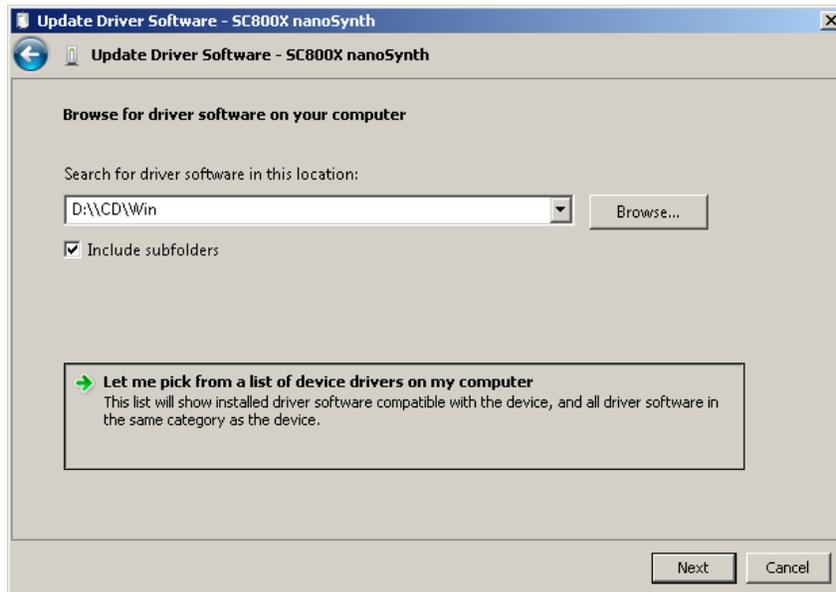
6. Select "**Show All Devices**" and click [**Next**] to continue.
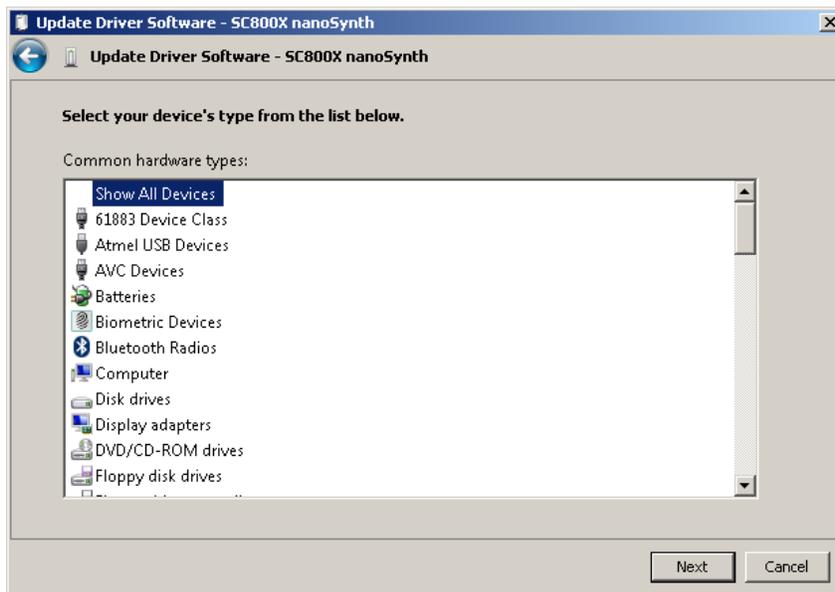
7. On the following 2 screens, click [**Have Disk**…]
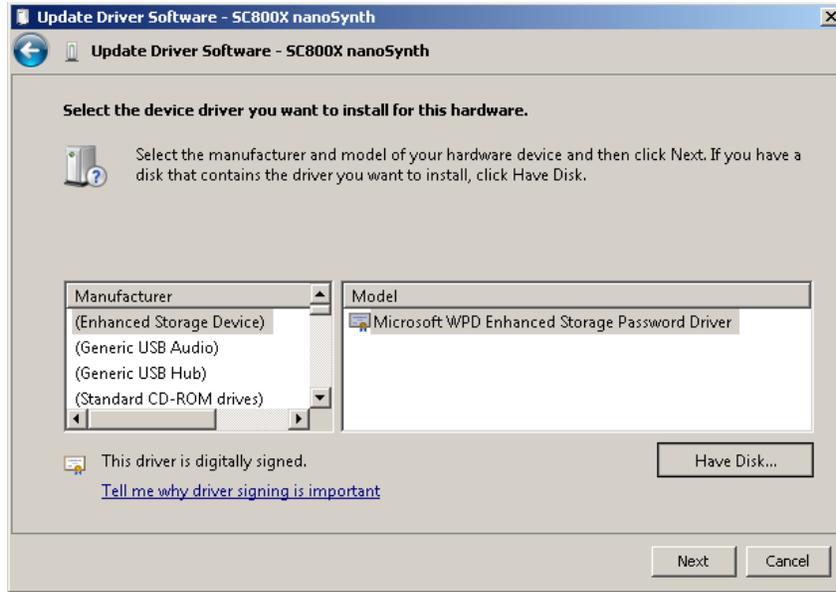
8. On the next screen browse to or type in the directory location where the **sc800.inf** file resides. If you used the default install location for the Setup32 or Setup64 executable, the INF file will be located under C:\Program Files\SignalCore\SC800. Select the appropriate directory and click [**OK**].
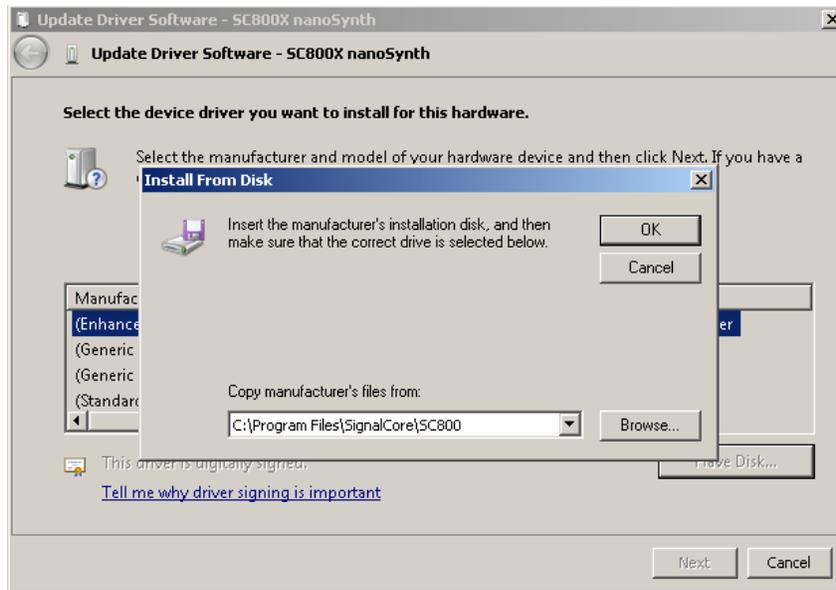
9. The host PC will pick up the information provided by the sc800.inf file and should show that it has found a driver for the device as shown below. If the wrong directory was chosen for the location of the sc800.inf file, the device will not show up in the list. In that case, you will need to click [**Have Disk…**] again and select the correct directory. If the device driver shows up correctly in the list, click [**Next**] to continue.
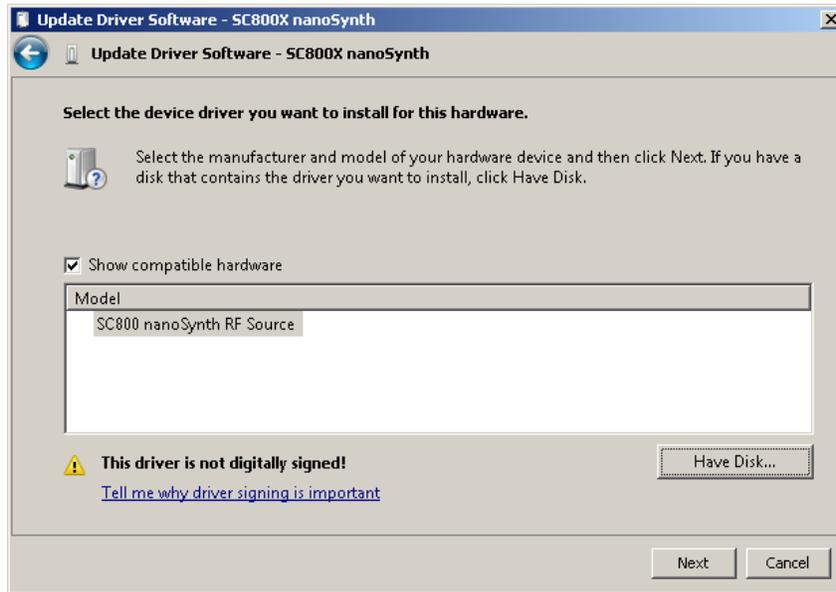
10. You will see the following warning that the driver is not digitally signed and Windows cannot verify the publisher of the driver. The SC800 device drivers are not digitally signed. However, SignalCore takes proper precautions and all device drivers are thoroughly tested. Select "**Install this software driver anyway**" to start the installation.
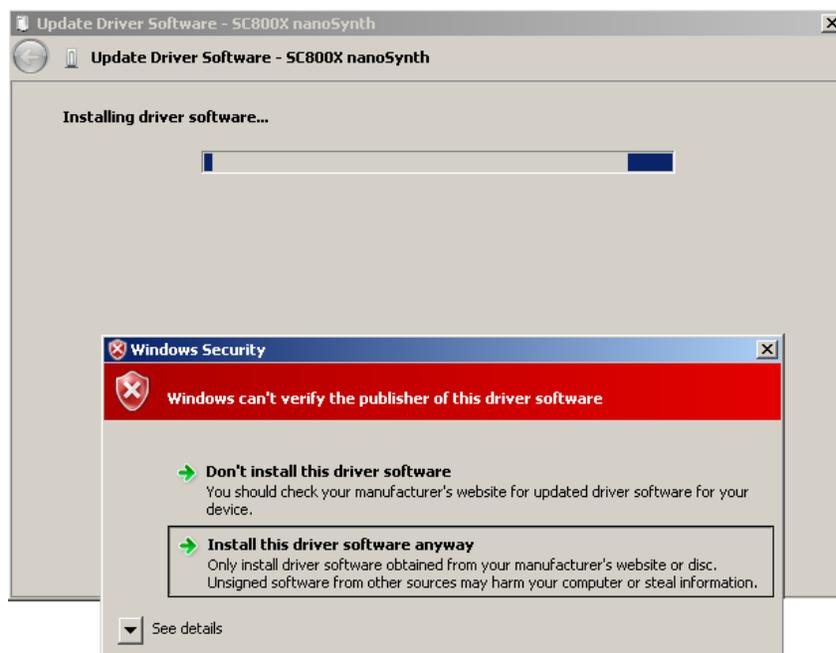
11. The installation should proceed to completion at this point. The following screen should appear upon successful driver installation:
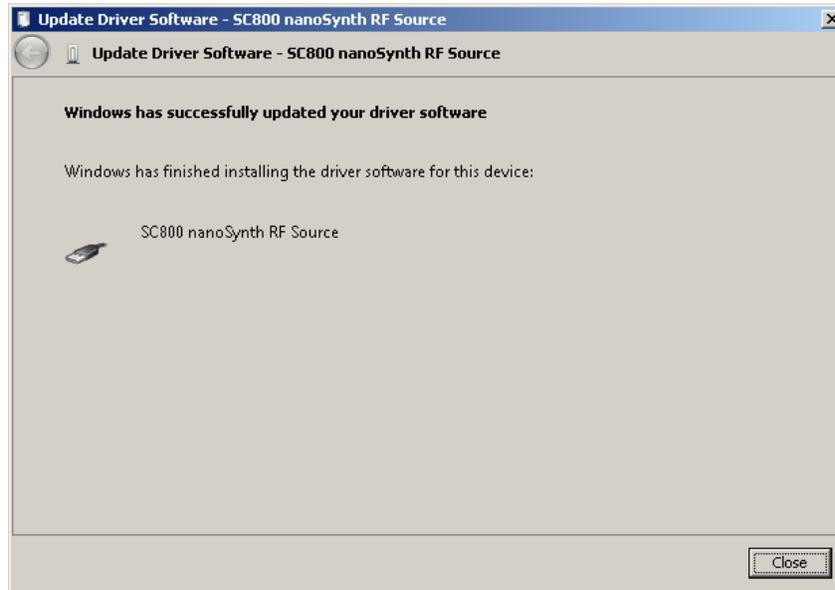
12. You may now go back to your "Device Manager" window to verify that the device has been successfully installed. The SC800 will appear under the "**SignalCore USB Devices**" class with the name "**SC800 nanoSynth RF Source**".
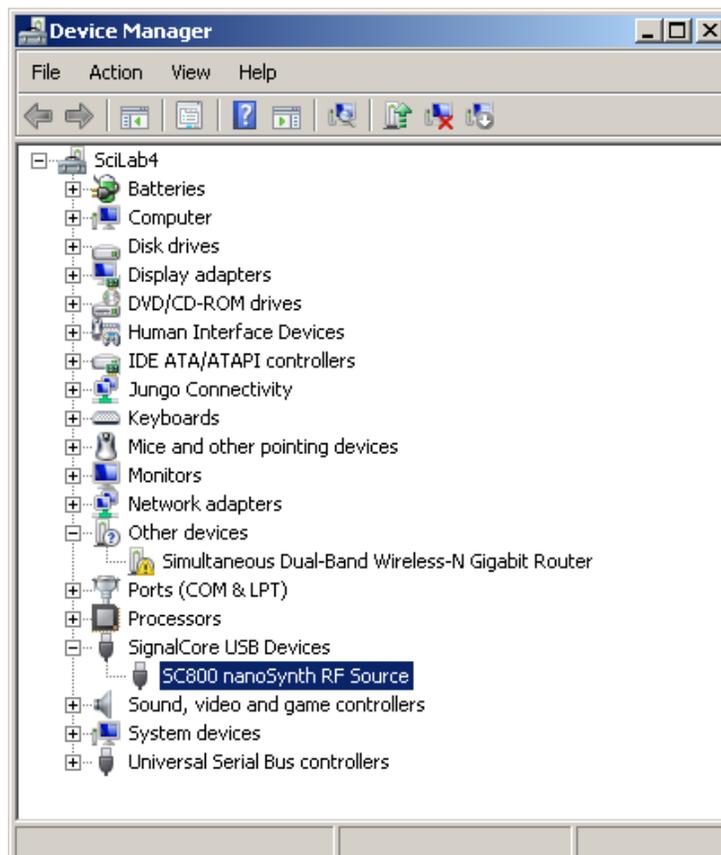
Using the Soft Front Panel

The Soft Front Panel (SFP) for the SC800 (SC800_SoftFrontPanel.exe) can be launched from the START->Programs->SC800 menu once the control software and the driver have been installed. This executable uses the software API functions exclusively; there are no other proprietary functions used in its development. The main panel and all underlying functions used to create the SFP are written in LabVIEW and are available in VI form in the LabVIEW API directory. The LabVIEW API is simply a wrapper of the **sc800.dll**. The startup screen of the SFP is shown in Figure 2:
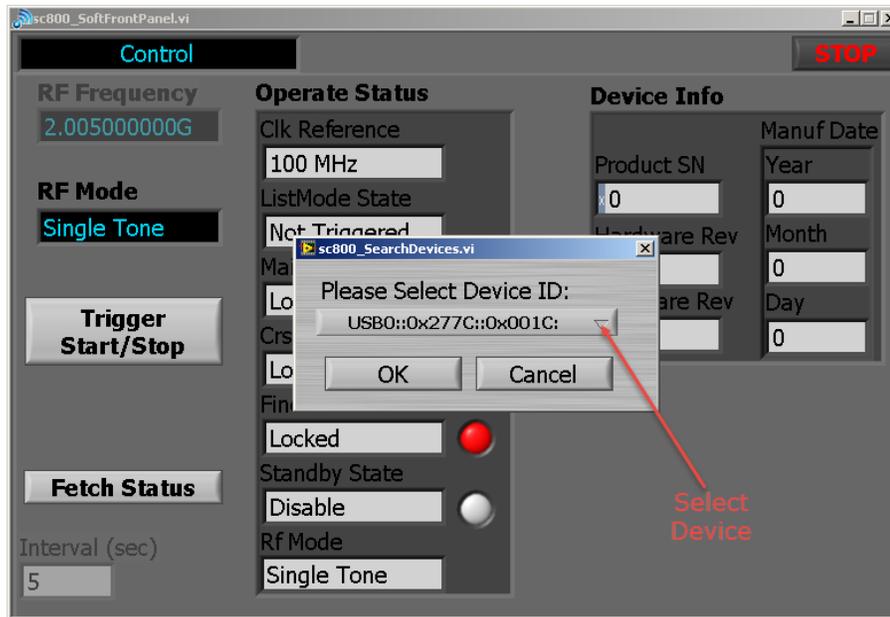
Figure 2. Soft Front Panel main window.

The sc800_SearchDevices dialog will appear showing you the device ID. If there is more than one device, click on the dropdown menu arrow to reveal all of the devices that are available and select the desired one. Click [**OK**] to close the device selection dialog.
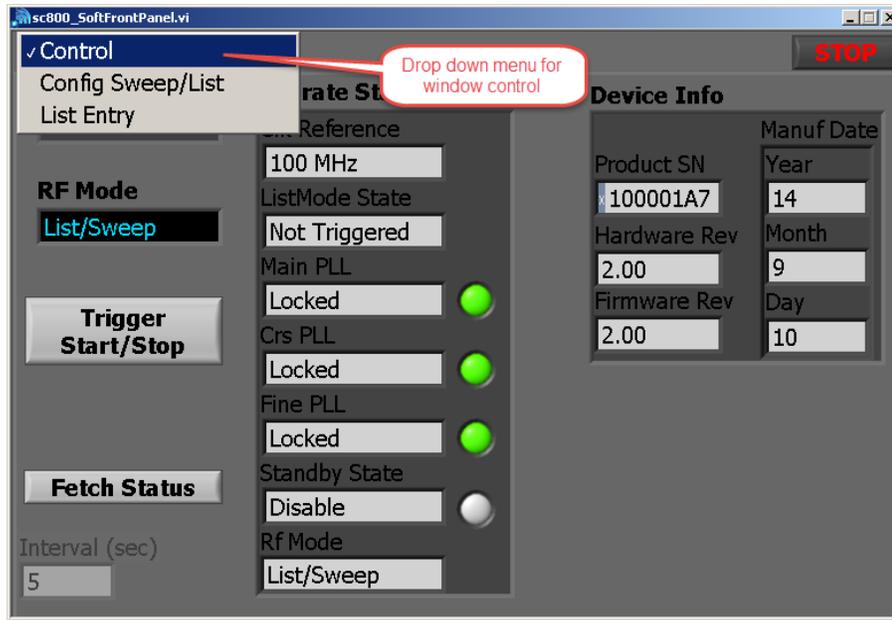
Figure 3. Choosing a configuration screen.

Once a device has been selected and the device session successfully opens, the status of the device, the device information, and its current configuration are read and displayed on the main panel window. The device information and status are shown under the "**Control**" tab, while the list mode configuration parameters are shown under the "**Config Sweep/List**" tab. A dropdown menu in the upper left corner of the panel is used to select one of three possible configuration tabs: **Control**, **Config Sweep/List**, and **List Entry** as shown in Figure 3.

The Control Window

The **Control** tab (Figure 4) shows the static device information and dynamic status information. The status of the device is read every time the configuration of the device changes. Normally, the status is not retrieved at a constant interval unless **Fetch Status** is selected. The status is then fetched at a regular time interval set by the Interval (sec) input. It is not recommended to query the status when **List/Sweep** mode is ON and triggered. Every time the device status is queried it consumes CPU time from the onboard MCU, and this may interrupt the timing of the device sweep. If the PLL lock status of the device is the only parameter of interest, it can alternatively be monitored through the LCK STATUS pin.

RF Mode: Select either **Single Tone** or **List/Sweep** mode. In Single Tone mode, the SC800 frequency is set through software and **RF Frequency** input is enabled. If **List/Sweep** mode is selected, the **RF Frequency** input is disabled and grayed out. If List/Sweep mode is enabled, the [**Trigger Start/Stop**] button can be used to soft trigger the sweep or list behavior as set up in the Config Sweep/List window.
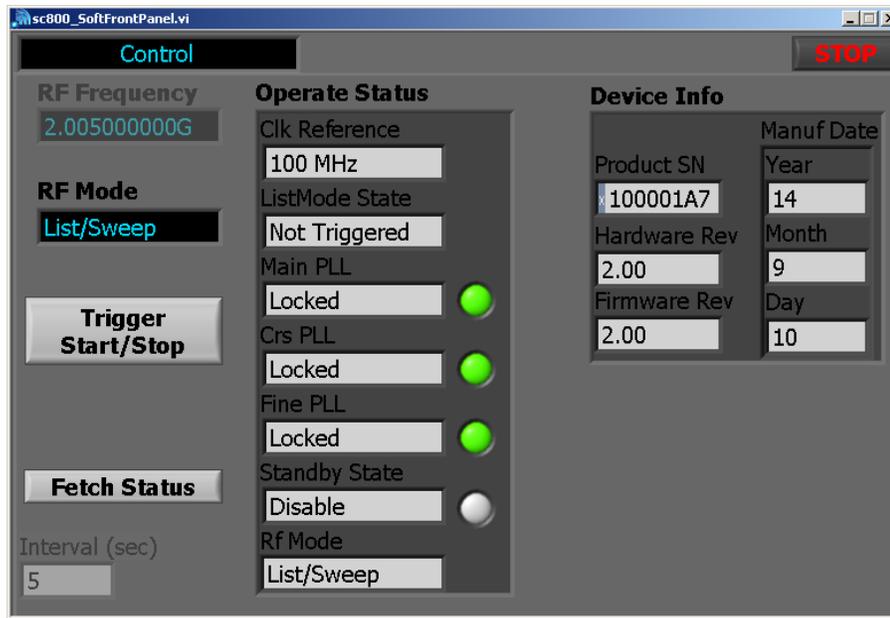
Figure 4. The Control tab window.

The Config Sweep/List Window

The sweep or list parameters are configured in this window as shown in Figure 5. Most of the parameters on this window are implicit except perhaps for the [**Load Config**] and [**Set As Default**] buttons. When all sweep or list (see the List Entry window) parameters are entered, they are loaded to the device by clicking on the [**Load-Config**] button. Ensure that the list/sweep cycle is completed and/or stopped before up loading new parameters. The [**Set As Default**] button will store all these parameters to the device EEPROM and set them as the default power-up or reset state. Refer to the SC800 datasheet for more details on list mode configuration.

When the **Trigger Source** selection is set to "Hardware", the trigger behavior is determined by the **HW Trigger Mode**. Pin TRIG 2 on header J3 is the hardware trigger pin used to start and stop a list/sweep cycle or to step the list on every trigger pulse. When the device is set to step on each hardware trigger, taking it out of step mode before a cycle is completed requires a software trigger or by changing the RF mode to **Single Tone**.

If **Trigger Out State** is enabled, the device will send a trigger pulse out every step or every cycle, determined by the **Trigger Out Behavior**. The high-to-low transition of the pulse indicates that the device has completed its configuration for that frequency. It is not an indication that the frequency has settled. Trigger output is monitored through pin TRIG 1 on header J3.
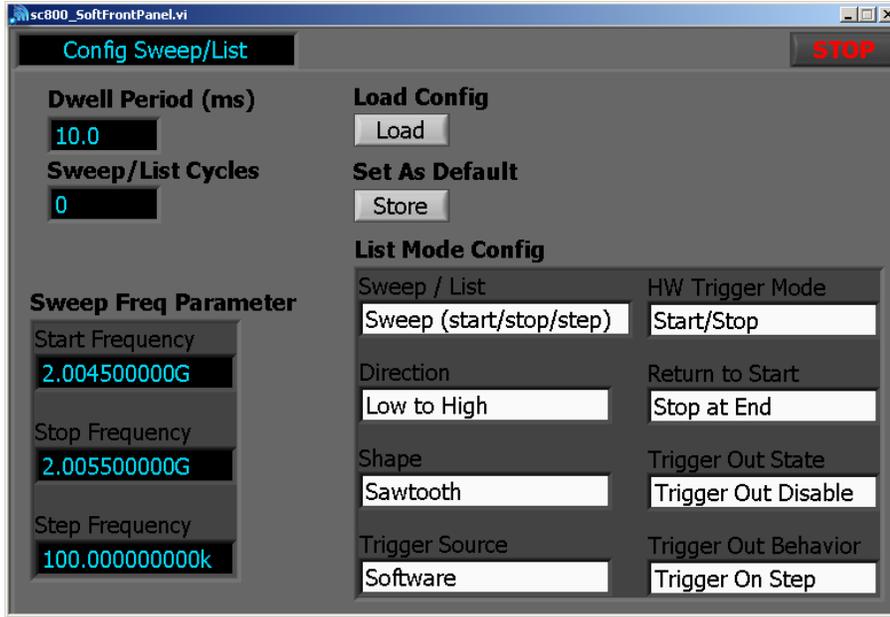
Figure 5. The Configure Sweep/List tab window.

The List Entry Window

The SC800 can store and execute an arbitrary list of 2048 frequency points. The list frequencies can be entered and loaded to the list buffer by clicking the [**Download to Buffer**] button. The [**Save Buffer to EEPROM**] button will save all the values currently in the list buffer to the EEPROM inside the SC800. Values stored in the EEPROM can be written to the list buffer by clicking [**Read EEPROM to Buffer**]. Note - list mode gets its values from the buffer (stored in RAM), so moving data from EEPROM to the list buffer is required to properly operate the device in this mode.
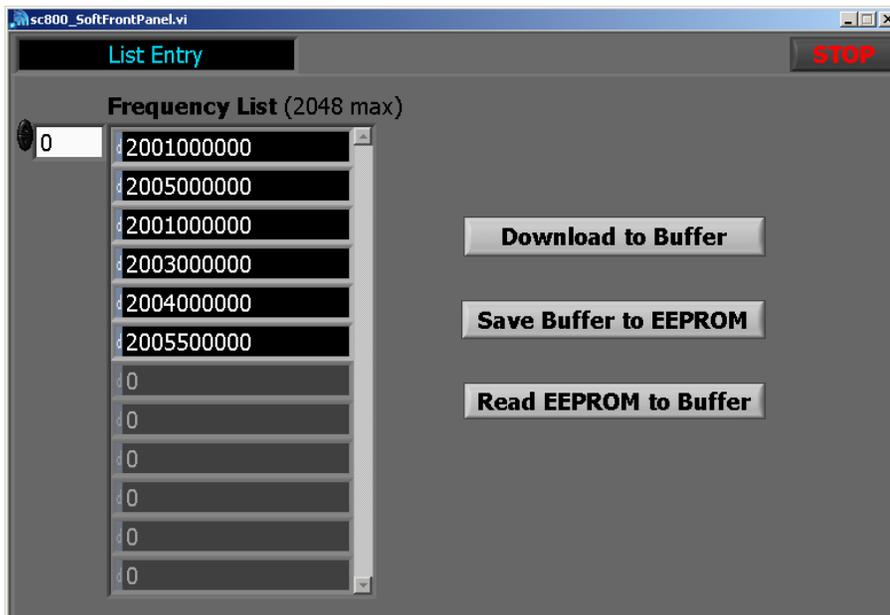
Figure 6. The List Entry tab window.

```
        8           7           6           5           4           3           2           1

F                                                                                                           F


E                                                                                                           E

                                              ┌──────────┐  ┌──────────┐
                                              │   USB    │  │   SPI    │
                                              │          │  │          │
                                              │    Pg 2  │  │    Pg 2  │
                                              └──────────┘  └──────────┘

        ┌──────────────┐
        │    TCXO      │
D       │              │                ┌───────────────────────┐         ┌──────────────┐                 D
        │   100 MHz    │                │                       │         │ RF Driver Amp│
        │        Pg 2  │                │                       │         │              │──── RF Out
        └──────────────┘                │        SC80XX         │─────────│              │
                                   ┌─┐  │                       │         │        Pg 2  │
   CLK Input ────────┐        ─────│ │──│                       │         └──────────────┘
C              ──────┼────────     └─┘  │                       │                                           C
                     └──────────────    │                Pg 2  │
                                        └───────────────────────┘


B                                           ┌──────────┐                                                    B
                                            │  JTAG    │
        ┌──────────────────────┐           │    Pg 2  │
        │ POWER SUPPLY/SWITCHERS│           └──────────┘
        │                      │
A       │               Pg 3   │                                                                           A
        └──────────────────────┘
```

SignalCore Inc.

EE	KY	PROJECT NAME	nanoSynthEval		
ME	JK	SCHEMATIC DESC.	Block Diagram		
Tech	JSY	SIZE A2	DWG.NO 200032B-01		REV B
Approved By	VA	SCALE 1:1	SHEET 1 OF 3	DATE 2014-7-16	

Control Connection

Push Buttons

SPI Connection

Pin 1: Serial Clk
Pin 3: Serial Data out
Pin 5: Serial Data In
Pin 7: Device Select_b
Pin 9: Serial Ready

+3.3V_R

R43 10K   R45 10K   R44 10K

S_MODE
LD_STATUS
TRIG_IN
TRIG_OUT

SW1
KSC442J70SHLFS

SW2
KSC442J70SHLFS

REST

PRG

S_MODE

JTAG/Function Connection

+3.3V_R

R48 10K   R42 10K   R40 10K   R16 10K

R15 10K

Pin 1: TClk
Pin 3: TDO / SPI Mode
Pin 5: TMS / SPI Ready
Pin 6: Reset_b
Pin 9: TDI / Ref Clk Sel (200MHz/100MHz)

HDR-BERG-5X2-THV-2.54MM

REST

USB

J6
VBUS
D-
D+
ID
GND
SHIELD1
SHIELD2
SHIELD3
SHIELD4
UX60SC-MB-5ST

ESD D4   ESD D5

+5V_R   +3.3V_R

R38 0   R39 Spare   J7

C44 100n

C37 47u   VR1 10K   R7 Spare   C53 22u   R49 10K   C57 100n

C6 47u   R8 Spare   C45 100n

Y1
V+   NC
VC
OUT
EN   GND
CVSS-945X-100.000

U2
HMC848LPCE

C1 100p

C38 100p

FL1
LFCN-225+

MULTIPLE LOOP
RF SYNTHCORE

Y2
SC800

DIV
REG

C61 4.7u

+5V_RF_AMP

+5V_RF_FBK

C51 100n

R18 49.9

C60 10p
C12 100n

C11 100n

FB1 220

U5
MAAM-011109

+5V_RF_AMP

RFIN   RF_OUT

J5
End Launch
GND2
GND1
RF
GND3
GND4
GND5
SMA

C10 100n   C59 4.7u

C56 4.7u   C52 100n

0V_RF_AMP

J4
End Launch
GND2
GND1
RF
GND3
GND4
GND5
SMA

C2 100p

J16

R41 49.9

+5V_RF_AMP   +24V_VCO   +0V_SYNTH

C50 100n   C49 100n   C48 100n   C46 100n   C47 100n

D1
HSM1-C16E

R20 100

VCC
VCTL
U4   GND

+3.3V_R

LD_STATUS

+3.3V_R

R46 10K

PRG

+24V SUPPLY (Not Required for SC800 eval)

-5V SUPPLY

SUPPY JACK

Logic and Xtal OSC Supply

Synth Supply

SC801 RF Output Supplies

Eval RF Driver Amp Supply

SignalCore Inc.

		PROJECT NAME			
EE	KY		nanoSynthEval		
ME	JK	SCHEMATIC DESC.			
Tech	JSY		POWER SUPPLIES		
Approved By	VA	SIZE A2	DWG NO 200032B-01		REV B
		SCALE 1:1	SHEET 3 OF 3	DATE 2014-7-16	

Revision Notes

Rev 1.0   Original document
Rev 1.1   Address Removed

www.signalcore.com