Cross Country Wireless, 7 Thirlmere Grove, BOLTON, BL4 0QB, UK
Email chrism@crosscountrywireless.net
Web page http://www.crosscountrywireless.net
Telephone +44 (0) 1204 410626
Mobile GSM 900 +44 (0) 7752 391908

SDR Receiver

Operating Manual

version 2.3

Partners: Mr C.J.Moulding, Mrs S.M.Moulding

Cross Country Wireless

Contents

1 SDR Receiver

2 Specification

3 Receiver hardware

4 Operating with SDR-Radio software

5 Operating with Rocky software

6 Operating with M0KGK SDR software

7 Operating with PowerSDR software

8 Operating with Cross Country Wireless HF APRS SDR

9 Schematic diagrams

10 Modification for use with high spec sound cards

11 EC Declaration of Conformity

1 SDR Receiver

The Cross Country Wireless SDR Receiver is a compact high performance HF software defined radio receiver designed to be used in fixed or portable stations.

It has a choice of two internal crystal oscillators or an external VFO, it's got good RF filtering (high and low pass filters similar to our VHF/UHF filters) before the front end and it's optimised for use with any stereo input sound card so you won't need to buy an expensive sound card to use it.

The 40 / 30m version has centre frequencies of 7.057 MHz and 10.125 MHz.

The 30m version has a narrower front end band pass filter and centre frequencies of 10.125 and 10.140 MHz.

The 80m version has centre frequencies of 3.580 and 3.668 MHz.

Using a 48 kHz sound card, SDR software can tune +/- 24 kHz from the centre frequency.

Features include:

- High performance software defined receiver
- Dual band 40 / 30m or monoband 30m and 80m versions
- Two crystal oscillators and an external VFO input
- RF band pass filter in receiver front end
- Optimised for low cost stereo sound cards
- Minimum signal detectable is better than -127 dBm with a 48 kHz 16 bit sound card
- Expensive sound card not required for operation
- Compatible with SDR software designed for Softrock receivers (Rocky, PowerSDR, WinRad, M0KGK SDR, SDR-Radio)
- No surface mount components
- Supplied built, aligned and tested
- Power requirements 7 to 25V current consumption 60 mA
- Meets EU specifications for EMC, RoHS and WEEE
- Built to last with high grade components in a tough ABS case

I hope you enjoy using the Cross Country Wireless SDR Receiver!

73,

Chris Moulding, G4HYG

2 Specification

SDR Receiver

Input impedance	50 ohms
RF Cable connector	BNC female
AF output impedance	1000 ohms
Minimum Detectable Signal	Better than -127 dBm using a 48 kHz 16 bit stereo sound card with Rocky 3.6 SDR software
Power connector	2.5mm centre pin DC power connector (positive pin, negative outer)
Size (overall)	150mm x 112mm x 35mm 5.9” x 4.4” x 1.3”
Power requirements	7 to 20V, 60mA negative earth
Centre frequencies:	
40 / 30m SDR receiver	7.057 MHz and 10.125 MHz
30m SDR receiver	10.125 MHz and 10.140 MHz
80m SDR receiver	3.580 and 3.668 MHz
RF filtering 40/30m	< 3.5 MHz better than 60 dB >14 MHz better than 40 dB
RF filtering 30m	< 4 MHz better than 60 dB > 14 MHz better than 40 dB
RF filtering 80m	<1.5 MHz better than 60 dB >7 MHz better than 40 dB
Spurious output	<-40 dBm at the antenna terminal (typically -47 dBm maximum)

The SDR Receiver meets the requirements of EC Directives EN50082-1 EMC Generic Immunity Standard (Residential, Commercial and Light Industrial), RoHS (Restriction of Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment). The SDR Receiver is marked with a CE mark.

3 Receiver hardware

Crystal jumpers
X1
X2
External VFO

2.5mm DC power connector, positive pin, negative shield

I/Q audio output to 3.5mm stereo jack

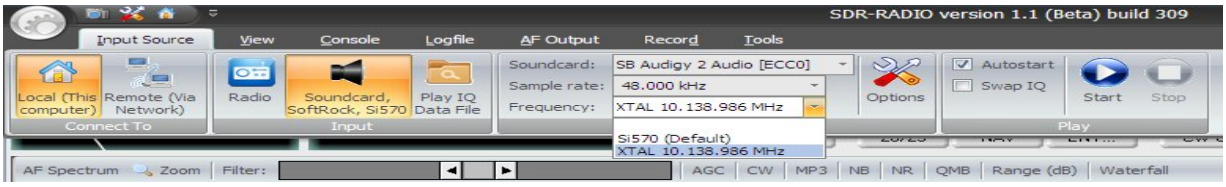
BNC antenna

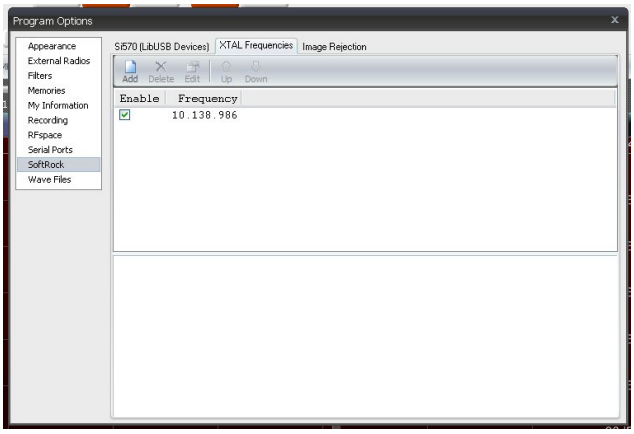
Please note that for the best results the SDR Receiver should be connected to a stereo input sound card. Most laptops use a mono input soundcard.

If a mono soundcard is used the SDR software cannot process the separate I (in-phase) and Q (quadrature) audio outputs to separate the upper and lower sidebands of the receiver centre frequency and both sidebands appear together as a mirror image.

Radio signals can still be received but the frequency display of any SDR software may be incorrect.

4 Operating with SDR-Radio





We recommend SDR-Radio for use with the SDR Receiver because it will work with Vista and Windows 7 and is under active development by Simon Brown, HB9DRV who is the author of the Ham Radio Deluxe program.

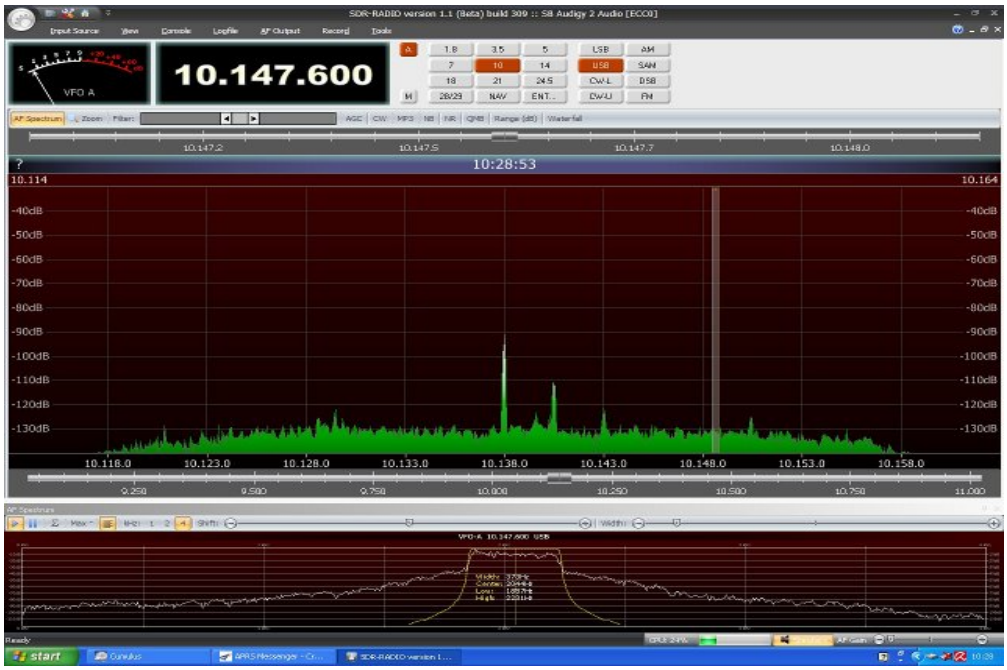
The program is available for download from http://www.sdr-radio.com

Open SDR-Radio, select Input Source, if the program has started select Off then Soundcard, SoftRock, Si570. Select the soundcard that the receiver is connected to and the sample rate (typically 48.000 kHz).

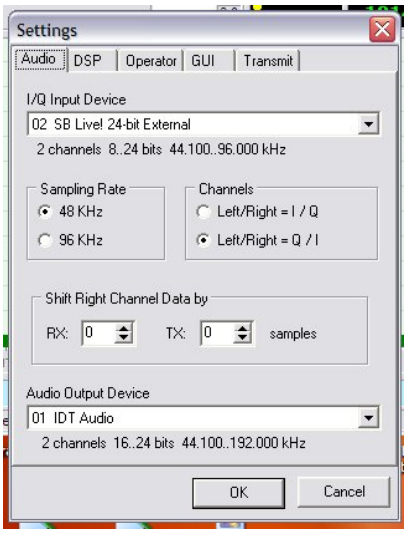
In versions later than v1.0 select Options then XTAL Frequencies. Enter or edit the value to match the centre frequency of your receiver. Close when the frequencies are entered.

Go to AF Output and select the soundcard required for audio output.

Go back to Input Source, Soundcard, SoftRock, Si570, select the XTAL frequency in the Frequency: selection then click Start. The program will now start.



5 Operating with Rocky



Download and install Rocky v3.6 from
http://www.dxatlas.com/Rocky/

Please note that Rocky will not work on Vista or Windows 7.

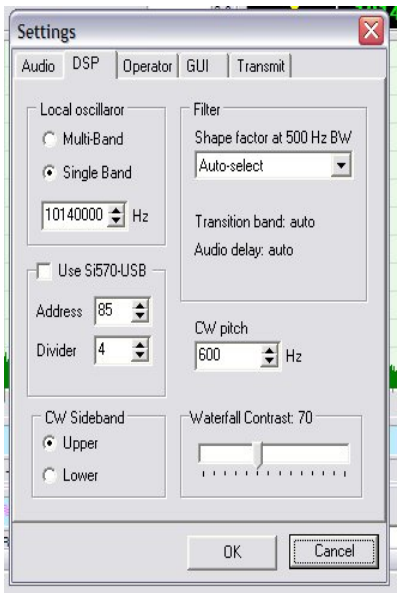
Connect the 3.5mm audio cable from the SDR Receiver to the stereo Line or Mic input of your PC
sound card.

Connect antenna and 12V supply to the SDR Receiver.

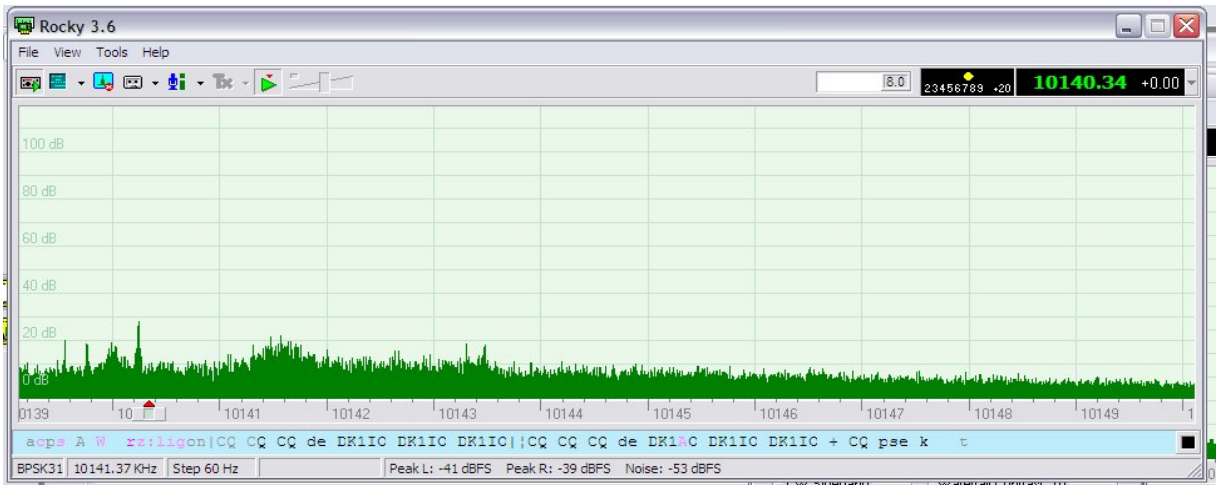
Open Rocky 3.6.

Open View/Settings/Audio in Rocky 3.6 to select the correct sound card and appropriate settings.

Open View/Settings/DSP to set the Local Oscillator frequency.



Press the Start Radio button.



6 Operating with M0KGK SDR software

Download M0KGK SDR Transceiver 1.1 from http://www.m0kgk.co.uk/sdr/index.php

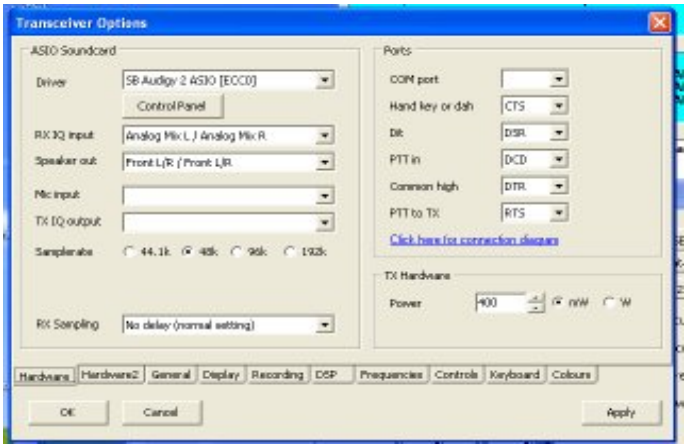
Open Options / Transceiver / Hardware and select the soundcard the SDR receiver is connected to.

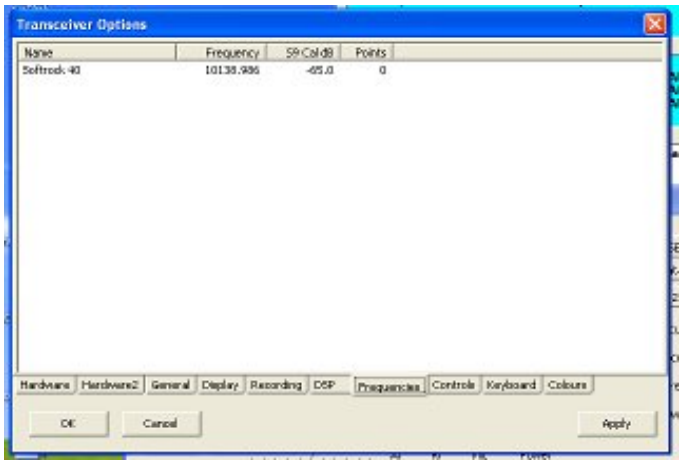
Select Options / Transceiver / Frequencies and edit the frequency with the centre frequency of the SDR receiver.

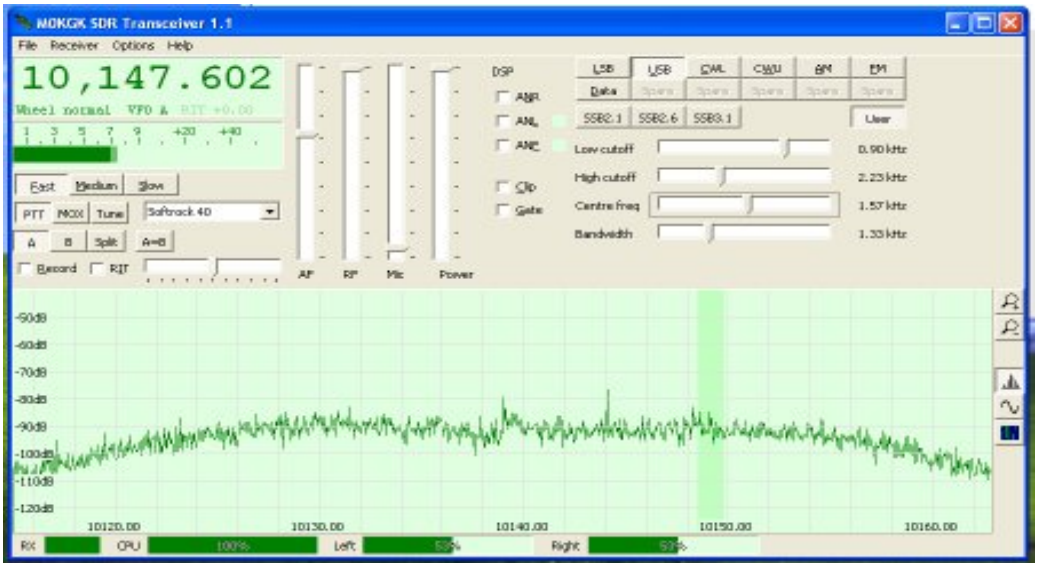
When the Options window is closed the program should start.

You may need to download an ASIO driver for WDM audio from http://www.asio4all,com

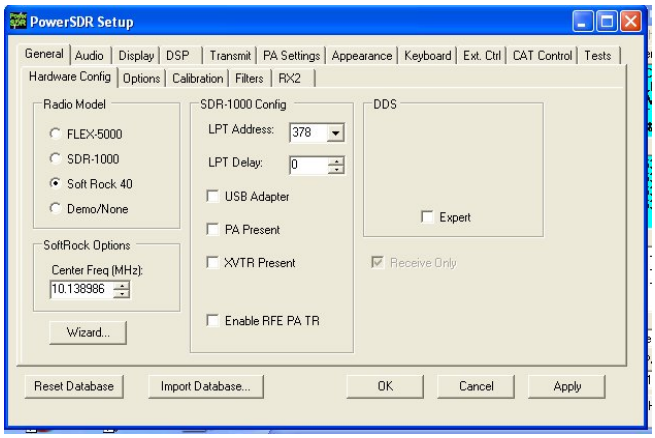
This program can be difficult to set up and get working so we recommend that users start with SDR-Radio or Rocky 3.6 to gain experience before attempting to set-up this program.







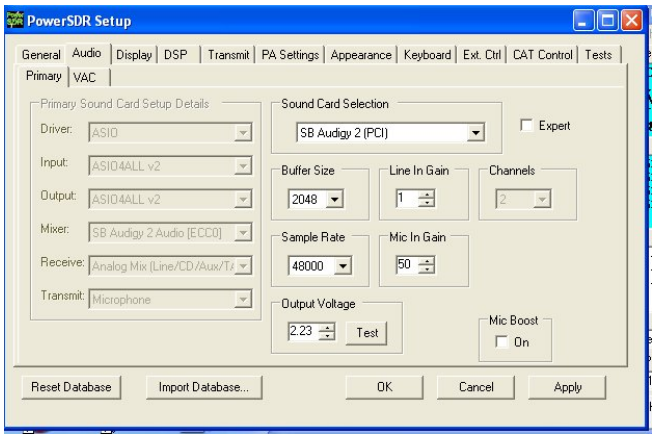
7 Operating with PowerSDR software



Download PowerSDR software from:
http://flex-radio.com

On initial boot-up the PowerSDR program runs a calibration routine. Wait for this to run.

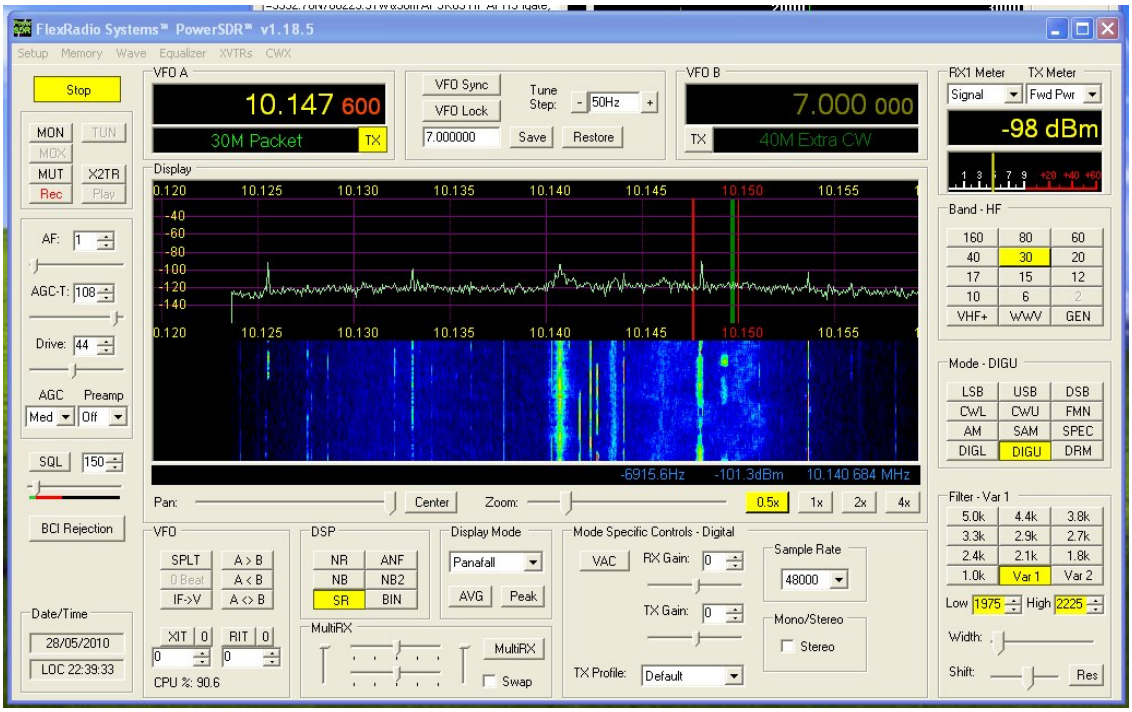
When the program opens select Setup then General. Select the SoftRock 40 option and enter the receiver centre frequency in SoftRock Options, Center Frequency (MHz).



Select Audio. Select your sound card. Please note that PowerSDR is really designed to work with the Flex Radio products and uses a small range of sound cards recommended by Flex Radio. If your sound card is not on the list you can try using Unsupported sound card. You may need to download an ASIO driver for WDM audio from http://www.asio4all,com

Some experimentation may be required to find a suitable range of settings to allow PowerSDR to work. We would recommend that new users start with SDR-Radio or Rocky 3.6 first to gain experience before attempting to configure PowerSDR!

On the main window click Start and the program should start.



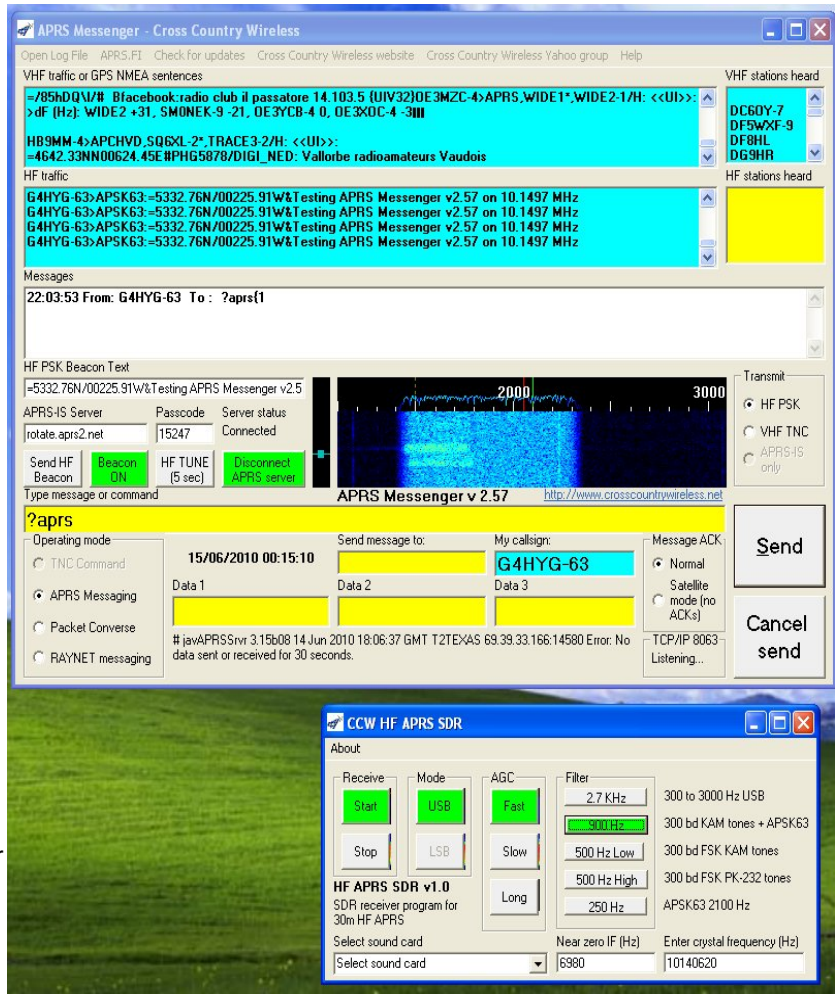
8 Cross Country Wireless HF APRS SDR

We have designed a relatively simple SDR program for use with our APRS Messenger program.

The APRS Messenger program can be downloaded from
http://www.crosscountrywireless.net/aprs_messenger.htm

The HF APRS SDR program can be downloaded from http://www.crosscountrywireless.net/hf_aprs_sdr.htm

To use both programs with an SDR receiver two soundcards are required with an interconnecting cable between the audio output of the sound card used for the SDR receiver and the audio input of the soundcard used with APRS Messenger.



HF APRS on the 30m amateur band operates on three fixed frequencies. The early 300bd AX.25 packet based system operates with a mark frequency of 10.1492 MHz and a space frequency of 10.1494 MHz. The latest APRS over PSK-63 system operates on 10.1497 MHz. A typical receiver installation uses a SSB receiver running USB with a dial frequency of 10.1476 MHz. This gives audio outputs of 1600/1800 Hz for 300bd AX.25 to feed to a suitable 300bd TNC and 2100 Hz for APRS over PSK-63 for use with the APRS Messenger program.

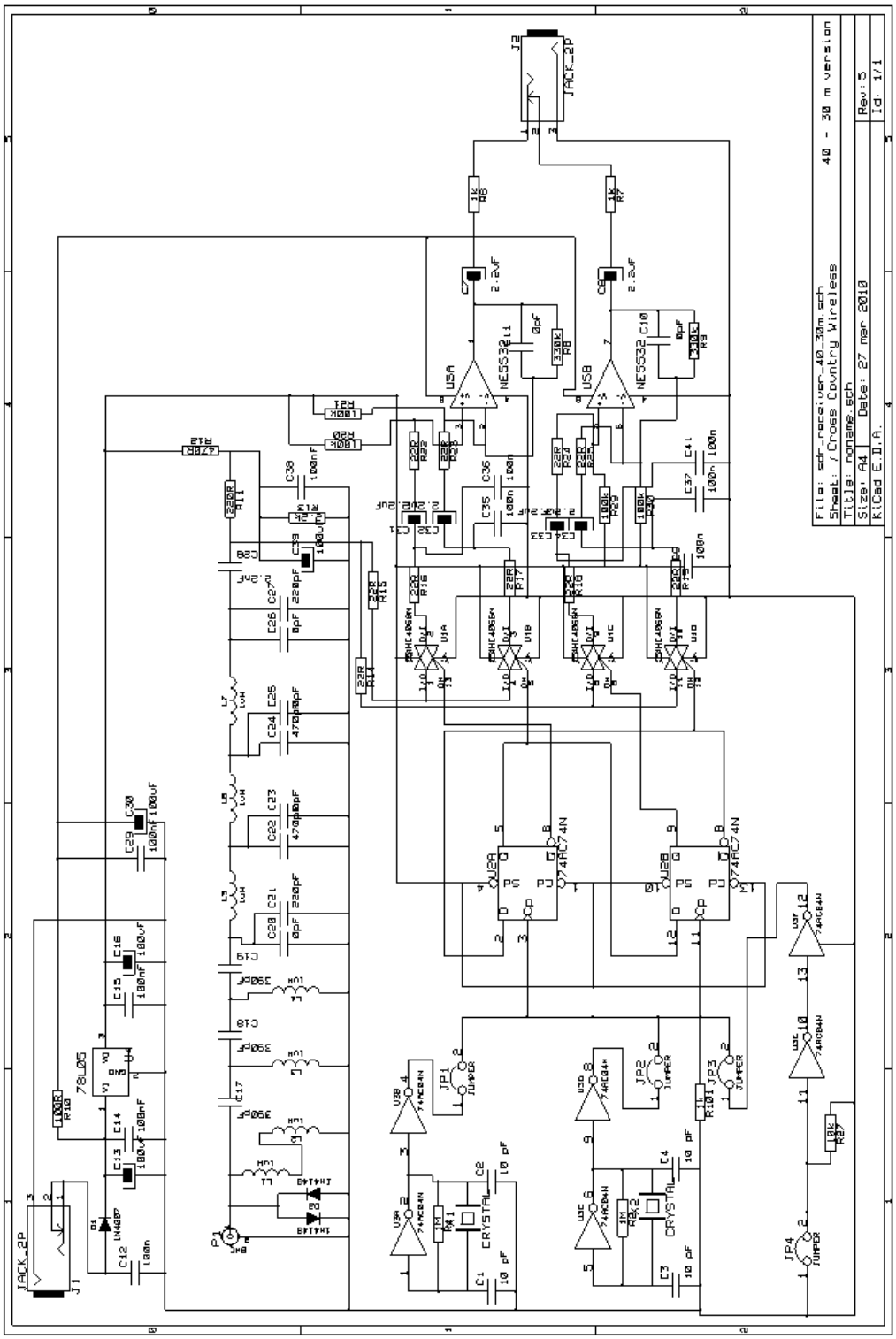
Open APRS Messenger first and set the PSK tone frequency to 2100 Hz, enter your callsign, select the required soundcard and other parameters and click start. The main window opens with a PSK waterfall display window. To act as a receive only Igate to send received packets to the APRS-IS enter your APRS-IS validation number and click connect to APRS server.

Start HF APRS SDR. Select the soundcard connected to the SDR receiver and enter the centre frequency of the SDR receiver between 10127000 Hz and 10147600 Hz. Note that this program is designed for use with the 30m monoband version of the SDR receiver with a centre frequency of 10140000 Hz.

The program automatically calculates the near zero IF frequency to operate the receiver on 10.1476 MHz USB. Press start and the program will start. The PSK waterfall window in APRS Messenger will display activity. A range of click buttons select the correct bandwidths and frequencies for a range of options.

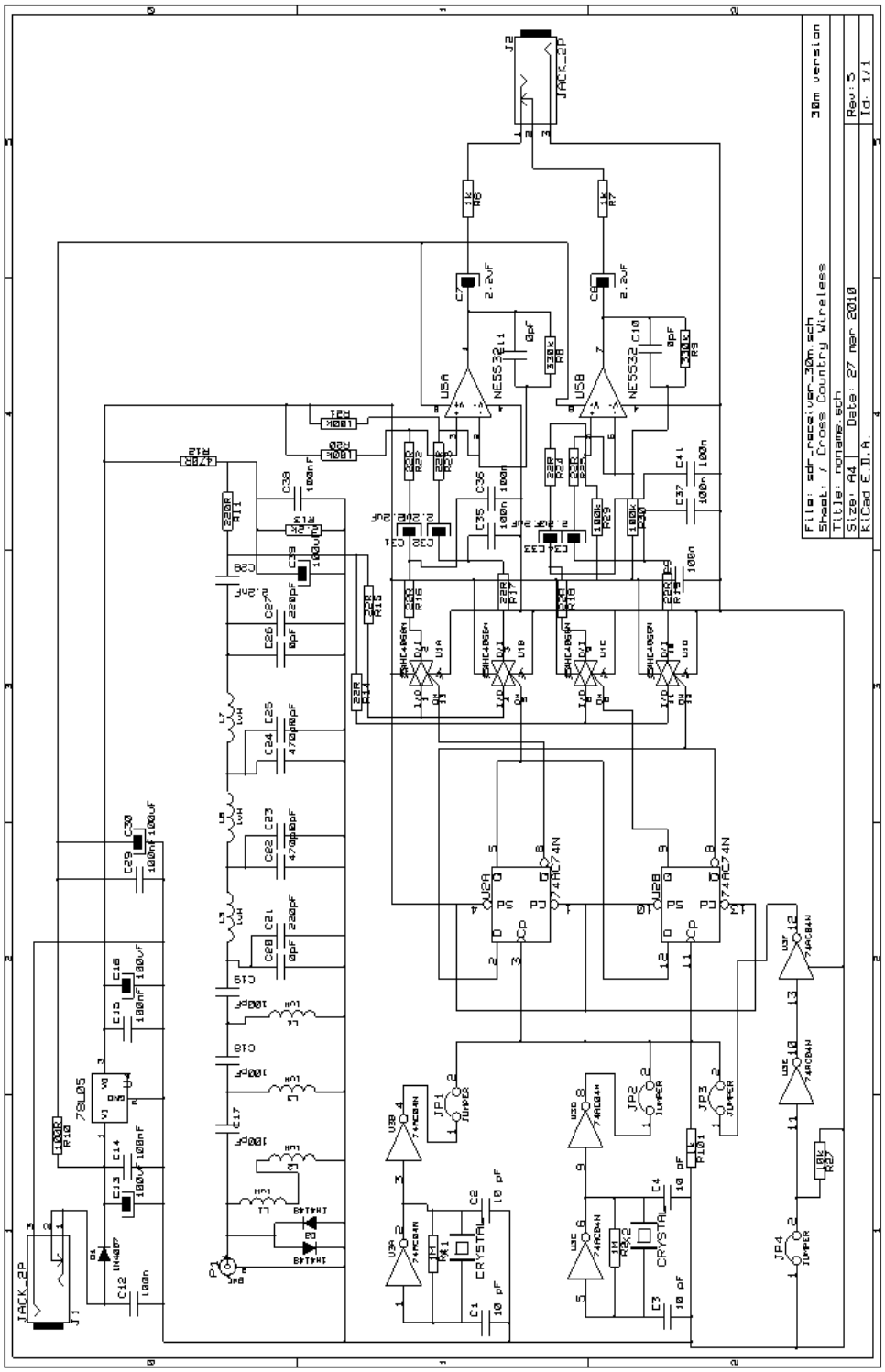
This program uses Microsoft DirectX. A copy of Microsoft's DirectX web update program is included in the download zip file to allow users to obtain the latest updates to their DirectX software.

9 Schematic diagram – 40 / 30m version



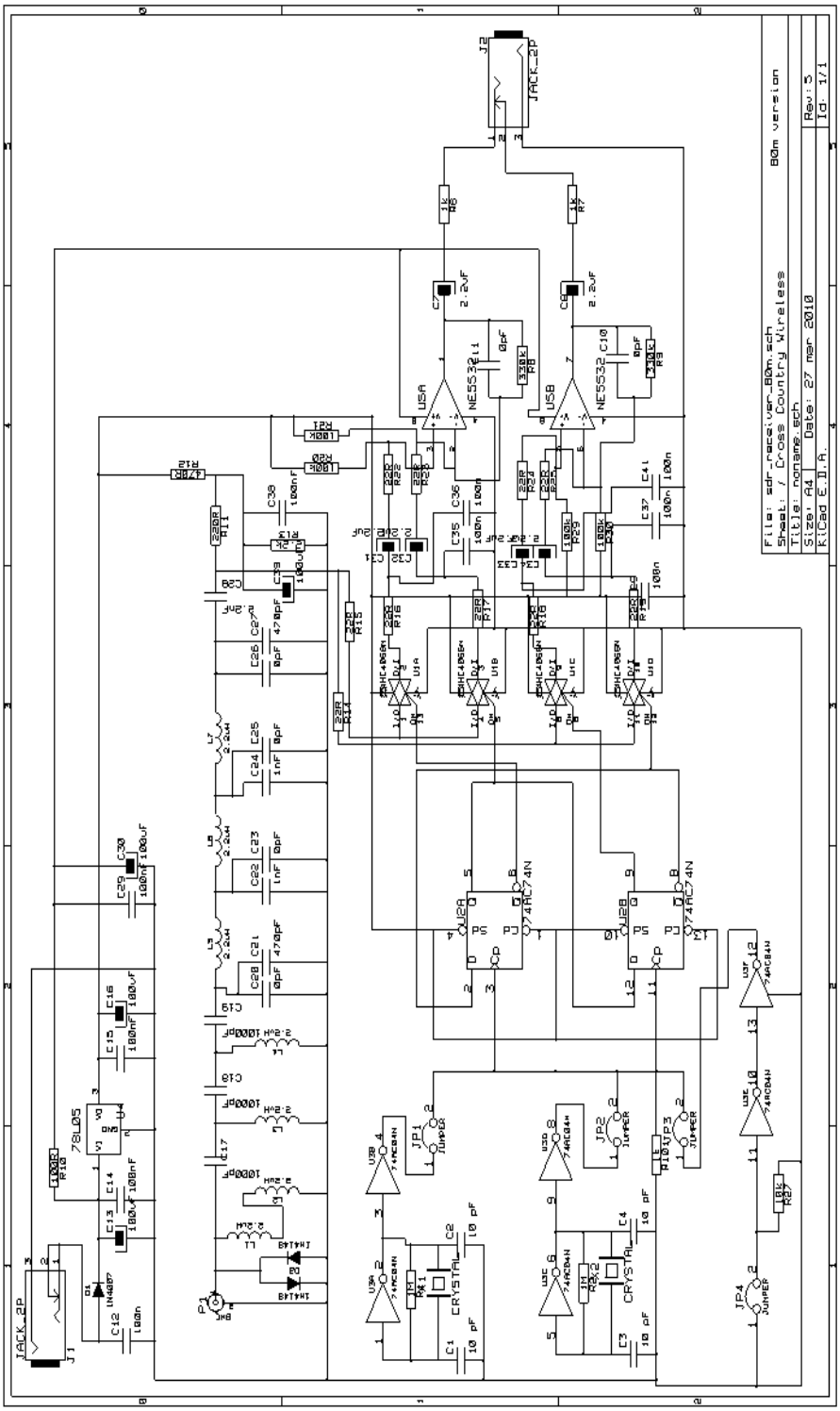
Cross Country Wireless

Schematic diagram – 30m only version



Cross Country Wireless

Schematic diagram – 80m version



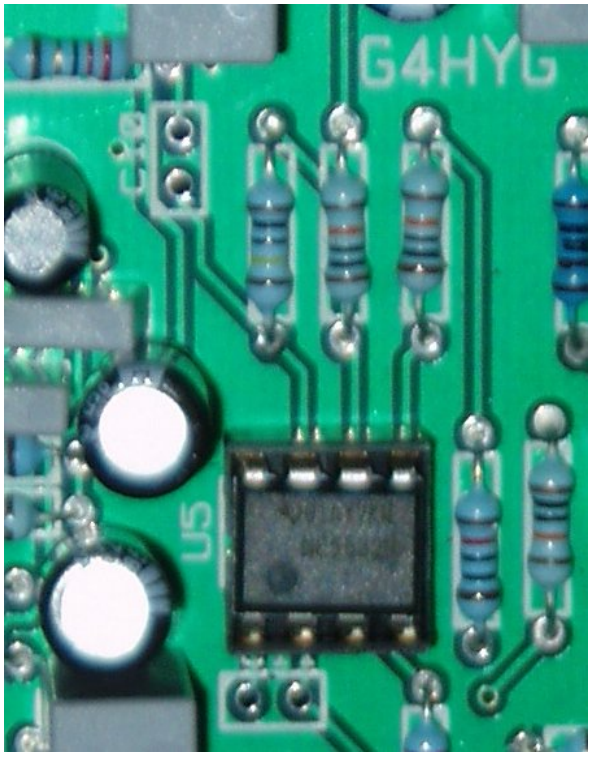
10 Modification for use with high spec sound cards

The CCW SDR Receiver has been specifically designed to work as a high performance HF receiver with the stereo input sound cards usually found installed as standard in desktop PCs.

The audio gain of the I/Q amplifier is higher than may be considered normal in other SDR receivers and users have asked how the audio gain may be reduced to improve performance with high performance sound cards such as the Delta-44 and Edirol.

This can be easily done by installing 2k2 ohm (2200 ohm) resistors in the C10 and C11 positions on the PCB. These positions are usually empty as C10 and C11 are only installed on receivers requiring an audio low pass option.

We recommend that the resistors are metal film 1% 0.25W specification to match the other resistors used in the receiver.



11 EC Declaration of Conformity

Cross Country Wireless, 7 Thirlmere Grove, BOLTON, BL4 0QB, UK
Email chrism@crosscountrywireless.net
Web page http://www.crosscountrywireless.net
Telephone +44 (0) 1204 410626
Mobile GSM 900 +44 (0) 7752 391908

EC Declaration of Conformity

in accordance with EN ISO 17050-1:2004

We: Cross Country Wireless

of: 7 Thirlmere Grove, Bolton, BL4 0QB

in accordance with the following Directive(s):

2006/95/EC	The Low Voltage Directives
2004/108/EEC	The Electromagnetic Compatibility Directives

hereby declare that

Equipment: SDR Receiver
Model number: All models

is in conformity with the applicable requirements of the following documents

Ref no	Title	Edition / date
SI 1994No. 3260	The Electrical Equipment (Safety) Regulations 1994	1994
SI 2006 No. 3418	The Electromagnetic Compatibility Regulations 2006	18/12/2006

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all applicable Essential Requirements of the Directives.

Signed by: .....

Name: Christopher John Moulding
Position: Partner of Cross Country Wireless
Done at: Bolton, Lancashire
On 23 May 2010

CE

Attention!

The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use that must be observed when these products are taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are available on request, and are also contained in the product manuals.

Partners: Mr C.J.Moulding, Mrs S.M.Moulding