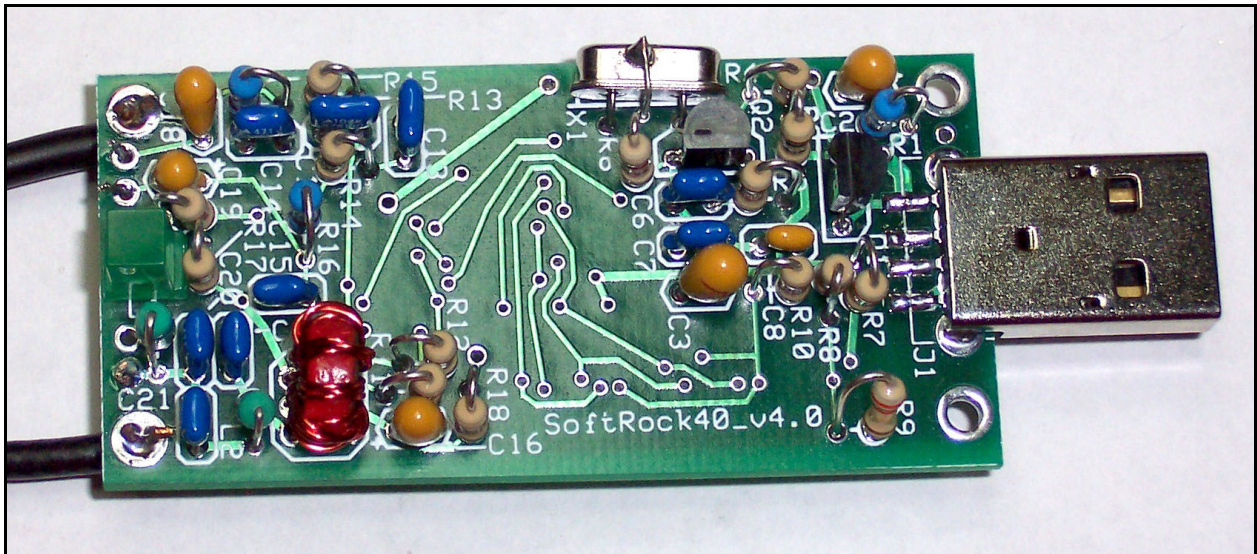# SoftRock-40
Assembly & Operating Manual

A low-cost 40-meter "Software Defined Radio" receiver that plugs into a computer's USB port and delivers I-Q audio signals to the computer's sound card. Merely connect an antenna, plug the audio cable into the 'line in' input on the computer, and run a version of the Flex-Radio PowerSDR Console software program to achieve better than –128 dBm performance!

Designed by …

Tony Parks, KB9YIG and Bill Tracey, KD5TFD

Kitted & sold by …

The American QRP Club, Inc.

Version 1.0 August 31, 2005

SoftRock-40 Assembly & Operating Manual

INTRODUCTION

This document describes the relatively straightforward task of assembling the SoftRock-40 Kit and getting it ready for use. All components are contained on the little 1.1" x 2.4" pc board – a few surface mount components are located on the bottom of the board and the conventional leaded/thru-hole parts mounted on the top side. Overall, it should only take about three hours to assemble the kit and put it into service. If you have any problems or questions, be sure to visit the SoftRock-40 Kit online resource page at www.amqrp.org/kits/softrock40 and check out the Builder's Notes for late-breaking tips & techniques for homebrewers putting their kits together.

Background information, including a detailed "theory of operation" is contained in a feature article concerning the SoftRock-40 in the AmQRP HOMEBREWER Magazine, issue #6.

WORKING WITH SURFACE MOUNT COMPONENTS

In order to maintain a small board size, yet still allow the kit to be easily assembled, we chose to incorporate some surface mount technology (SMT) components. We decided to use the largest SMT packages conveniently available (1206 capacitors and SOIC integrated circuits) to help builders, and we located these parts all on the bottom side of the board.

First, here is a little primer on constructing pc boards containing surface mount technology.

Preparing for the job

The key to being successful with any construction project is selecting and using the proper tools. For projects using SMT, the tools are easy to find. A magnifying lamp is essential for well-lighted, close-up work on the components. Tweezers or fine-tipped pliers allow you to grab the small chip components with dexterity. Thinner solder (.015") than you might normally use is preferred because of its being quicker to melt and smaller in solder volume on the component lead. Use of a fine-tipped soldering iron make soldering the leads of these small parts straightforward and easy. A clean work surface is of paramount importance because SMT components often have a tendency to fly away even when held with the utmost care in tweezers – you'll have the best chance of recovering your wayward part if your table is clear. When the inevitable happens, despite your best efforts of holding an SMT part in your tweezers, you'll have lots of trouble finding it if it falls onto a rug-covered floor covered. It's best to have your work area in a non-carpeted room, for this reason as well as to protect static-sensitive parts.

Attaching SMT Components to the PC Board

Two items will greatly help you successfully solder these small surface mount components to the pc board. The first is a small coil of .015" solder. As described above, this thin solder is perfect for soldering small SMT parts. In order to solder these small components in place, having a fine-tipped, 600-700 degree soldering iron is essential.

A trick that you can use in soldering surface mount devices to pc boards is to (a) pre-solder one of the pads on the board where the component will ultimately go; (b) hold the component in place on the tinned pad using needle nose pliers or a toothpick; (c) re-heat the tinned pad and component to reflow the solder onto the component lead, thus holding the component in place; and lastly (d) solder the other end of the component to its pad.
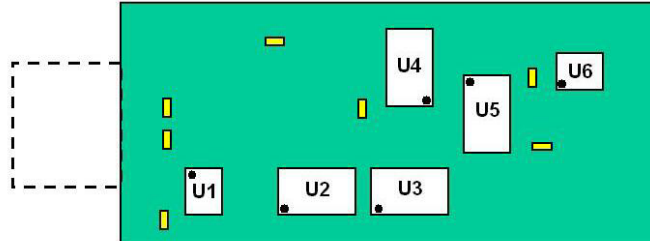
Attaching a Surface Mount IC

Six surface mount integrated circuits will be attached on the bottom of the SoftRock-40 pc board. Pre-solder a pad in one corner of the IC's set of pads on the pc board, then carefully position the leads of the IC over its pads. I generally use my fingers to carefully align the IC over all its pads and then reheat the corner pad to reflow the solder onto the IC pin. This should leave the IC attached by that pin. Again making sure the IC pins are aligned over all pads, carefully solder the opposite corner lead to its pad. This should leave all other pins of the IC aligned over their respective pads, making it easier to solder them. Next solder each of the other pins to their respective pads, being careful not to

bridge solder across any adjacent pads or pins. If this does happen, that's okay! Just grab some solder wick and use it to draw off the excess solder, which should be fairly easy and clean because of the solder mask on the circuit board.

BOARD ASSEMBLY

Refer to the diagram below for locating the positions of the SMT integrated circuits and capacitors.

Bottom side of the SoftRock-40 pcb
showing ICs and SMT caps (yellow objects)

1) **Attach the SMT Capacitors**

Start by soldering down the seven SMT 0.1uF capacitors on the bottom of the board, located as shown in the layout diagram above. Remember, a toothpick makes a good tool for sliding the capacitors in place so that one of each capacitor may be tacked in place. Finish the soldering of the capacitors with only enough solder to provide fillets at each capacitor end.

2) **Attach the Surface Mount ICs**

Integrated circuits U1 through U6 are on the bottom of the board. Refer to the Bottom Side Layout diagram (above) for location and orientation of pin 1.

U1 pin 1 on the 8-lead package is the bottom left corner of the package when the text on the package can be read from left to right.

U2 pin 1 is located on the side of the 14-lead package with the vertical strip.

U3 pin 1 is the same as above for U2.

U4 pin 1 is the same as above for U2

U5 pin 1 is indicated as a dimple in the package plastic.

U6 pin 1 is shown with a slight dimple on the package plastic.

Solder the SMT integrated circuits in the order U5, U3, U4, U1, U2 and U6. In soldering each IC start by tacking down one corner pin first. Reheat that corner pin to get the IC package centered on its pads. When the IC is properly placed on its pads, solder a diagonal pin from the first one soldered. Check again for proper IC placement on its pads and if the placement is good then solder each pin with a only enough solder to form a small fillet at the pin. Look carefully with good lighting and magnification to make sure all leads are soldered and there are no solder bridges between leads. Solder bridges between leads can be removed with solder wick and a brief touch of the soldering iron.
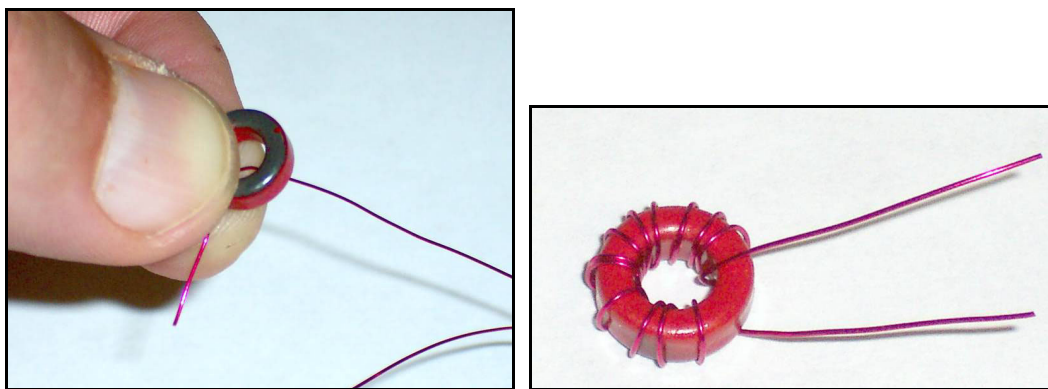
3) **Solder the USB male plug** to the board with the connectors mounting pins soldered from the bottom of the board and the connectors SMT pins soldered on the top of the board.

4) **Mount all resistors** on the top of the board in a "hair pin" fashion. Resistor location are identified on the board silkscreen. The body of each resistor is over the circle portion of the silkscreen pattern for a resistor location. A small line from the circle points to the via for the resistor's other lead. In some cases a leader line runs from the resistor designator to the resistor location on the board.
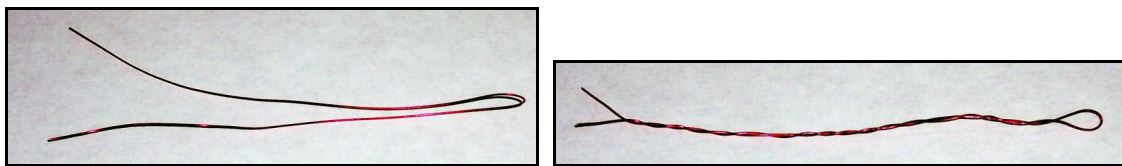
5) **Mount the crystal** with its leads bent parallel to the bottom of the crystal. Use a small piece of one crystal lead to ground the crystal case by running the grounding lead over the top of the crystal so that the lead is pressed against the top edge of the crystal case. Solder the lead to the crystal case with as little heat as needed to make the grounding connection.

7) **Solder the LED flush to the board** if the leads are cut off below the bulge in each lead. Make the cuts in the leads so that the cut off leads are long and short as with the original lead lengths. The long lead goes to the square pad in the DS1 location.

8) **Mount the other parts**. Ensure that the component matches the silkscreen designator for each part location.

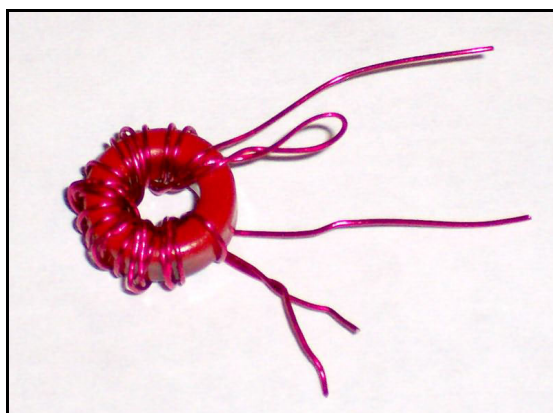9) **Transformer T1** has two windings: a 13-turn primary and a 6-turn bifilar-wound secondary.

   a) Wind the 13-turn primary – Wind 13 turns of the red magnet wire on the red toroid core. Start with about ½" of wire protruding through the core, which becomes the first "turn", and loop the remaining length of the supplied magnet wire twelve more times through the core. When complete, cut off the long extra length of the mag wire (should be about 7") to leave the other end of the primary also at about ½". Spread the windings somewhat evenly around the toroid, as illustrated below in the photos.

   b) Prepare the bifilar-wound secondary – Fold in half the 7" length of magnet wire that was cut off after winding the primary. Grasping the folded end of the wire in the index finger and thumb of your left hand, repeatedly twist the wire with your right while sliding the wire through your left hand fingers, resulting in about 10 twists evenly made along the wire pair. Snip the folded end to create two electrically-separate twisted wires.
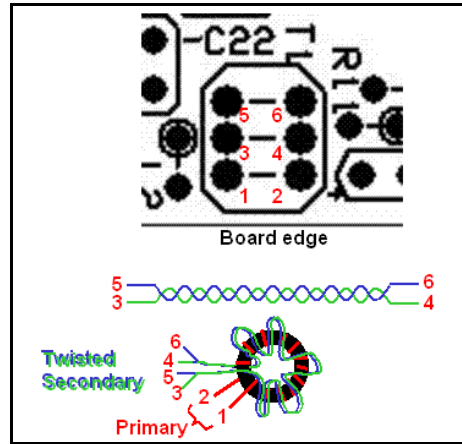

   c) Wind the 6-turn bifilar secondary over the primary winding on the toroid – Holding the toroid in the same manner as done when starting the primary winding, insert the twisted secondary bifilar wire pair through the toroid such that about ½" is protruding, which becomes the first "turn". Repeatedly loop the remaining length of the twisted wire pair another five times through the core and evenly spaced around the core. When done, you will have a length of about ½" extending out of the toroid by the other wires that are sticking out.

   d) Insert the six leads into the PCB –The windings ends coming from one side of the toroid core (primary '1', twisted secondary '3' and '5') go to the left three pads 1, 3 and 5 on the T1 silkscreen

SoftRock-40 Assy & Operating Manual, v1.0   *4*

marking. The wire ends coming from the other side of the toroid core (primary '2', twisted secondary '4' and '6') go to the three pads on the right side of the T1 silkscreen marking. Carefully scrape off about ¼" of the red enamel coating on the end of each wire to expose the copper alloy so it can be soldered to the pads. You could use light sandpaper or the edge of a razor blade to scrape off the enamel, or you could apply heat from the tip of your soldering iron with molten solder on the tip. Whatever way you use, be sure the end of the wire is clean of any enamel so the solder connection made next is a good one. Use an ohmmeter to ensure that you have properly identified wire 3-4 and wire 5-6. As a double-check, wire ends '4' and '5' will be connected by a trace on the bottom of the board, just as they are shown connected on the schematic. Solder all wires to the pads on the bottom side and trim off excess lead length.
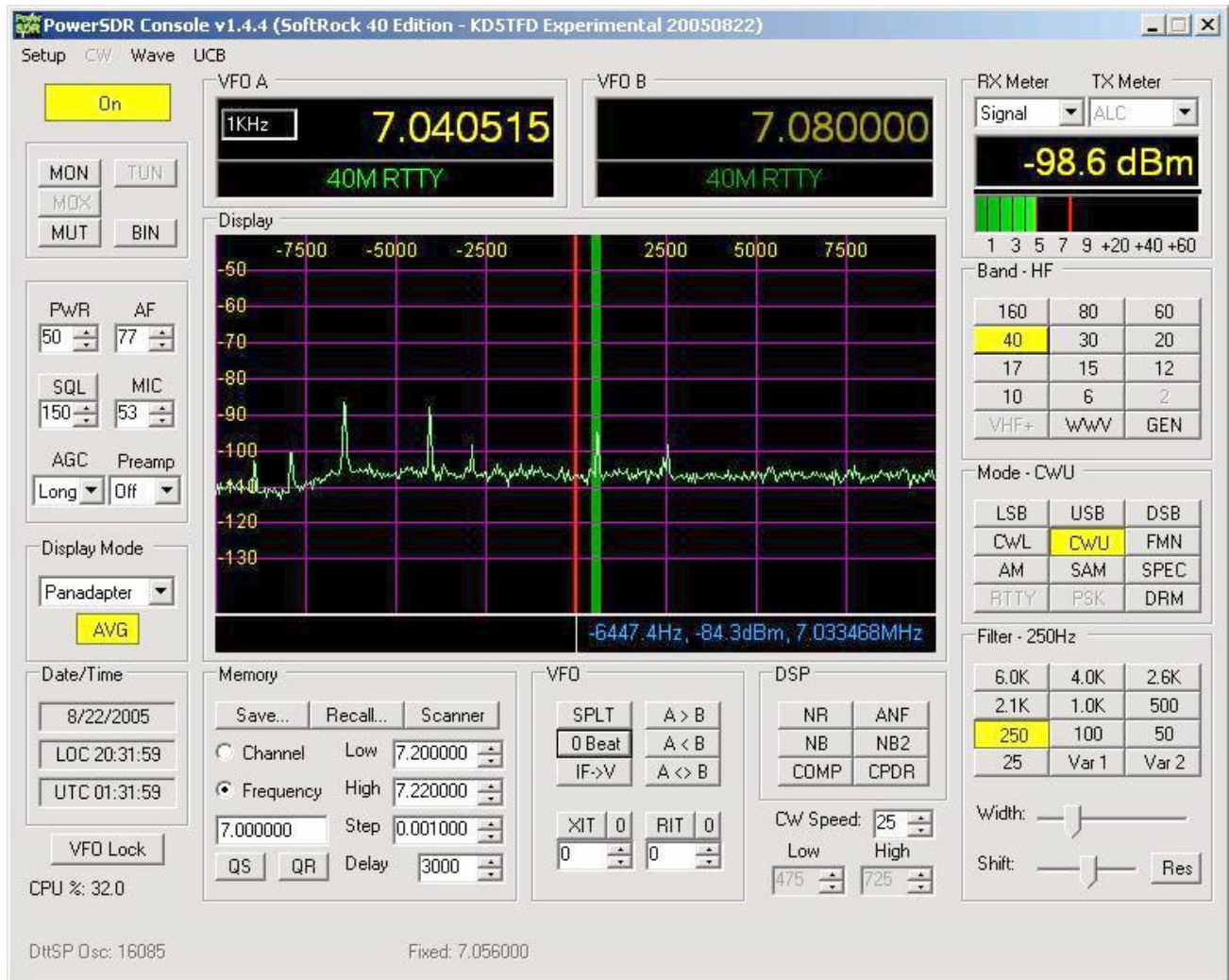

10) **Connect the RG174U coax cable** to the antenna input via, next to the board mounting hole, at the lower right corner of the board. The board mounting hole may be used to provide grounding for the braid of the coax and strain relief for the coax cable. Also, connect the BNC connector to the other end of the coax using the BNC Connector Assembly instructions on pages 12-14 as a guide.

11) **Connect the stereo cable** to the two pads just to the right of the lower left mounting hole. The via closest to the mounting hole is the tip connection and the next pad over is the ring connection. Again, the mounting hole may be used for the stereo cable common connection and for strain relief for the cable.

12) **Check the resistance to ground** from pin 14 of U5. If that resistance is not greater than 5k, then look for shorts before plugging the SoftRock-40 into a computer USB socket.

SOFTWARE

The software part of the SoftRock-40 project turned out to be rather straightforward, building on the solid foundation of the PowerSDR Console software program created for the SDR-1000 transceiver hardware. All that was needed was some fairly simple changes to the PowerSDR code to handle the SoftRock-40 board. Most of these changes were in the area of tuning and hardware control.

The PowerSDR Console program presents a virtual front panel that looks just like the front of a real fancy (read: expensive) transceiver with lots of controls and a multi-mode spectral display of the received frequency.

SoftRock-40 "front panel" – based on the PowerSDR Console software from Flex-Radio

Most controls in the software perform a single function. Some might say: "I am accustomed to using a tuning knob, but there's no tuning knob on my PC!" The PowerSDR Console actually uses a unique mouse wheel tuning control. If you've got to have a tuning knob, there are knobs available that attach via USB port that work well with the PowerSDR software. See the companion article Homebrewer Magazine for details.

It is amazing how many features Flex Radio has packed into the PowerSDR Console software. Ten different bandwidth settings can be selected with a click of a button. The widest is 6 kHz and the smallest 25 Hz. Other selectable values are 4, 2.6, 2.1, and 1 kHz, and 500, 250, 100, 50, 25 Hertz. All filter bandwidths are available; there is no need to buy expensive crystal filters - it's all in the software. If you need a very special bandwidth setting, you can change the software for any bandwidth between, say, 10 Hz and 40 kHz. It is "Free (as in freedom) software", with source code freely available under the GNU Public License, and one can make custom changes in the code using the C# and C source code provided by Flex-Radio … and this is just what we did to adapt PowerSDR Console to control the SoftRock-40 hardware.

The pairing of the relatively simple SoftRock-40 with the powerful PowerSDR Console software makes for a surprisingly full featured homebrew receiver. All the features of a full featured receiver, multiple filters, all mode, CAT control are all available through the software.

For a more complete description of the PowerSDR Console software, including a walk-through of its controls and functions, see the SDR-1000 article in Homebrewer Magazine issue #6, or any of the QEX articles online at www.Flex-Radio.com.

SOFTWARE INSTALLATION

To install the SoftRock-40 files you will need to install an appropriate binary release of PowerSDR from Flex-Radio Systems (www.flex-radio.com) and then overlay that installation with the changed binaries provided at (http://ewjt.com/kd5tfd/sdr1k-notebook/sr40/sw.html). For convenience, the files are also located on the SoftRock-40 Kit web page (www.amqrp.org/kits/softrock40). The binary files are provided, as well as the source files for those wishing to further modify this Open Source project.

Make sure that the main PowerSDR program you install from the Flex-Radio website matches the version of the modified components that you get from the ewjt.com/kd5tfd web page. At the time this manual was written, the 1.4.4 version of PowerSDR was the latest available that SoftRock-40 modifications have been made for.

To install PowerSDR unzip the installation package to a temp directory and run the setup program. The setup program may also require you to download additional components (.NET Framework, DirectX, MDAC, others?) from the Microsoft web site.

Once you've completed PowerSDR installation, unzip the Binary SoftRock-40 files into the same directory as you installed the PowerSDR files. If you also have an SDR-1000, you should copy the existing files to a new directory in order to use separate PowerSDR.mdb database files with the SoftRock-40 and SDR-1000.

CONFIGURE & USE

You're now ready to run PowerSDR for the first time. The first time PowerSDR is run it will take you into the configuration wizard. This config wizard does not know about the SoftRock-40, so it will ask a number of questions about your SDR-1000 configuration. Just select the default and 'Next' on the config panels until you get to the sound card selection panel. If you have one of the listed sound cards, select it. Otherwise, select 'unsupported card' and then the Setup->Audio tab, and select appropriate sound card and drivers for your setup.

At this point the PowerSDR Console software will come up … let's next make several hardware tests to ensure that everything is operating correctly.

1) Plug the SoftRock-40 board into a computer USB socket and note the LED glowing. Plug the stereo cable plug into the computer soundcard line-in input. Attach a 40-meter signal source such as the Elecraft XG1 to the antenna coax BNC.

2) Enable SoftRock-40 operation in the PowerSDR Console software. Select the 'SoftRock' tab in the Setup menu and enter the center frequency of the receiver (nominally 7.056 MHz for the Soft Rock 40). Enable the 'Fixed HW Osc' check box on the page. You will also have to use the Audio tab on setup to tell PowerSDR what sound card the Soft Rock 40 is attached to.

3) Determine if the oscillator can be heard with the SoftRock-40 tuned to the source frequency.

4) With the oscillator running, tune to the frequency that is as much above 7.056 MHz as the test oscillator frequency is set below 7.056 MHz. Go to the DSP Image null page of the PowerSDR setup book and null the image spike by use of the amplitude and phase sliders. If the image cannot be nulled at least 50 dB, then a problem exists with the SoftRock-40 receiver.

5) After nulling the image, go to the General tab on the setup book and set the dBm level to the level from the test oscillator. If you have the XG1 noise source, the settings should be: 50 uV RMS, S9, and the dBm level is -73.

6) Connect the SoftRock-40 to a 50-ohm feedline from a 40-meter antenna or tuner. Check for proper reception of 40-meter signals.

SoftRock-40 pcb plugged into USB port on a desktop computer
The little receiver is powered from the USB port. A cable supplies audio to the 'line in' connector for the PowerSDR software to process the I & Q signals, while another connects to a 40-meter antenna.

TECHNICAL SUPPORT

If you are in need of assistance, please contact any of the following people below, as appropriate.

Kit questions (part shortages, availability, etc.):

Bryan Williams, AA3WM sbw1@enter.net

Technical questions (design, troubleshooting):

Tony Parks, KB9YIG raparks@ctcisp.com

Bill Tracey, KD5TFD bill@ewjt.com

AmQRP website (www.amqrp.org/kits/softrock40)
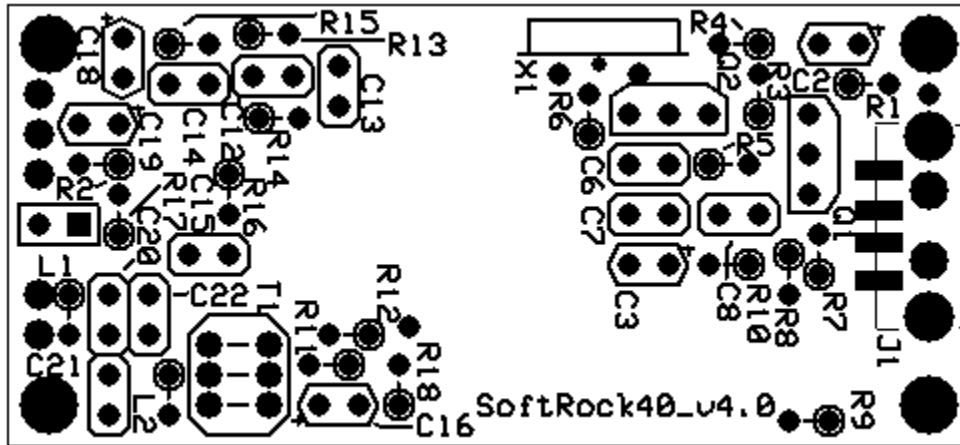
George Heron, N2APB n2apb@amsat.org

THE KITTING TEAM

Gerry Jurrens (N2GJ), Mark Phillips (KC2ENI), Bob Sturcke (KC2GKG), Ed Breneiser (WA3WSJ) and Bryan Williams (AA3WM)
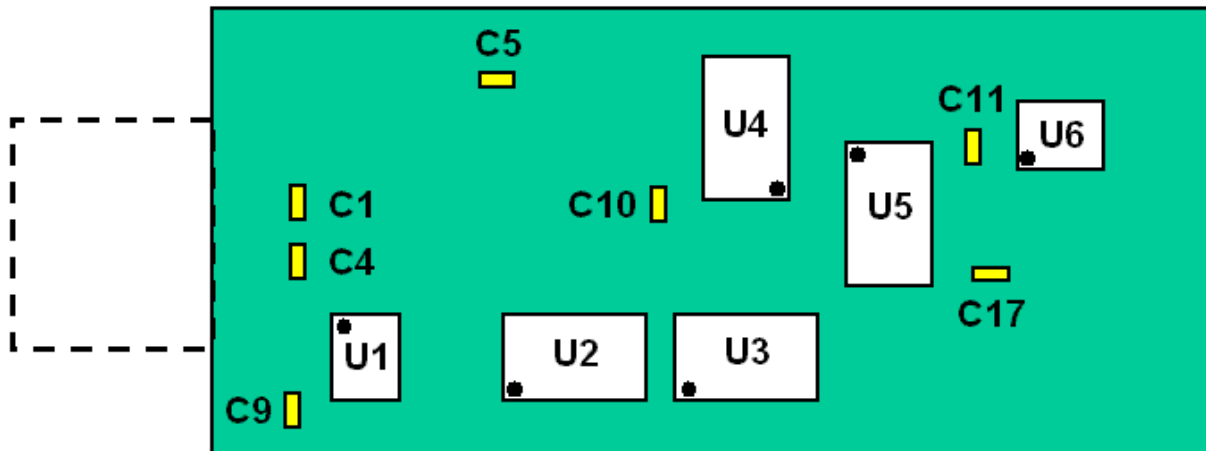
SCHEMATIC

SoftRock40 — Page 1 of 1 schematic

J1 usb pcb mount plug
1
2
3
4

Q1 2N3904
C3 10uF
R2 2.2k
C4 0.1uF
R10 10k
C10 0.1uF
R1 51
C2 10uF
C1 0.1uF
DS1 T1

U2 74HC74
VCC
D
CLK
/CLR
/PRE
GND
2
3
1
4
14
5
6
7

U3 74HC74
VCC
D
CLK
/CLR
/PRE
GND
2
3
1
4
14
5
6
7

U3 74HC74
D
CLK
/CLR
/PRE
12
11
13
10
9
8

C5 0.1uF
R4 10k
Q2 2N3904
R3 10
C8 47pF
R7 330k
U1 LT1719
8
2
3
1
7
4
5
6

X1 28.224 MHz
C6 100pF
R8 10k
R6 2.2k
C7 100pF
R5 10k
R9 330k
C9 0.1uF

U2 74HC74
D
CLK
/CLR
/PRE
12
11
13
10
9
8

U4 74HC08
14
1
2
3
7

QSD CIRCUIT

8 U4 74HC08
6 U4 74HC08
11 U4 74HC08
10 9
5 4
13 12

U5 FST3126
1
2
4
5
10
9
13
12
14
3
6
11
7

QSD Timing Diagram

CLK input to U2 pin 3 28.224 MHz
Q output, U2 pin 5 14.112 MHz
Q output, U3 pin 5 7.056 MHz (LO)
Q output, U3 pin 9 7.056 MHz
Integrate RF signal 270 to 360 degrees
Integrate RF signal 0 to 90 degrees
Integrate RF signal 90 to 180 degrees
Integrate RF signal 180 to 270 degrees

ANT INPUT
C21 180pF
L2 1.8uH
T1
R11 10
90
270
180
R12 10
L1 0.68uH
C22 470pF
C20 470pF

R14 10
C15 470pF
R16 4.99k
R13 10
C14 470pF
C13 0.1uF
C12 0.1uF
R18 10k
R17 10k
C16 10uF
C17 0.1uF
U6 OPA2228
R15 4.99k
C11 0.1uF
U6 OPA2228

C19 1.0uF
C18 1.0uF
TO TIP OF AUDIO CABLE
AUDIO OUT, I
TO RING OF AUDIO CABLE
AUDIO OUT, Q

FLEX RADIO FRIENDS
SoftRock40
Tony KB9YIG | Rev 4.0 | Page 1 of 1
8/19/2005

PARTS LIST

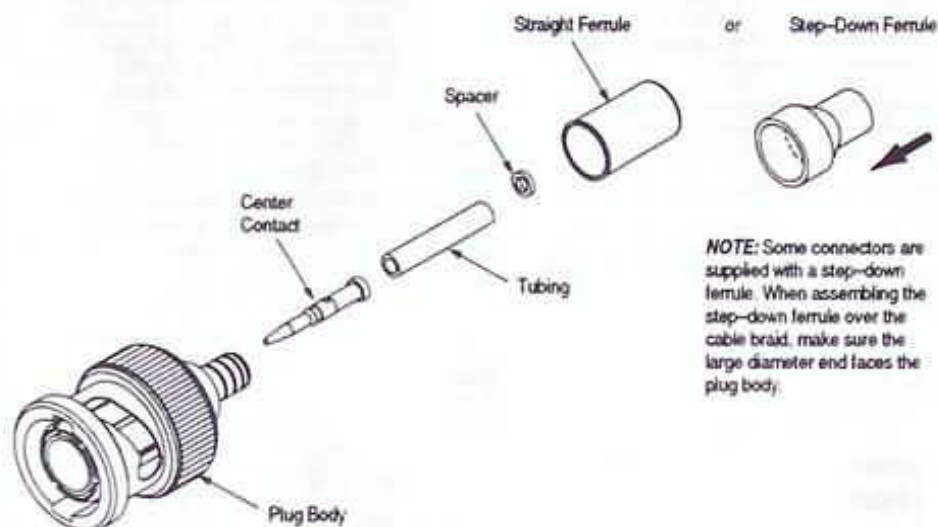| QTY	DESIGNATOR	DESCRIPTION
Capacitors Parts Bag		
7	C1, C4, C5, C9, C10, C11, C17	0.1 uF ceramic, smt 1206 (All located on bottom of board. 2 extra supplied)
3	C2, C3, C16	10 uF, 16 V, tant., 0.1 in. lead spacing
2	C18, C19	1 uF, 16 V, tant., 0.1 in. lead spacing
1	C8	47 pF, 0.1 in. lead spacing
2	C6, C7	100 pF ceramic, 0.1 in. lead spacing
2	C12, C13	0.1 uF, ceramic, 0.1 in. lead spacing
1	C21	180 pF, ceramic, 0.1 in. lead spacing
4	C14, C15, C20, C22	470 pF, ceramic, 0.1 in. lead spacing
Resistors Parts Bag		
5	R3, R11, R12, R13, R14	10, 1/4 W
6	R4, R5, R8, R10, R17, R18	10k, 1/4 W
2	R2, R6	2.2k, 1/4 W
2	R7, R9	330k, 1/4 W
2	R15, R16	4.99k, 1/4 W
1	R1	51, 1/4 W
Semiconductor Parts Bag		
2	Q1, Q2	2N3904, NPN, TO-92
1	DS1	T-1 LED, green
1	U1	LT1719CS8, SOIC 8
2	U2, U3	74HC74, SOIC 14
1	U4	74HC08, SOIC 14
1	U5	FST3126M, SOIC 14
1	U6	OPA2228UA, SOIC 8
MISCELLANEOUS PART BAG		
1	J1	USB A male pcb plug, smt pins
1	P1	1/8 inch stereo cable with plug on one end, 3 ft.
1		RG174U, 4 feet, for antenna connection to board
1	P2	BNC connector
1	L1	0.68 uH, axial lead inductor
1	L2	1.8 uH, axial lead inductor
1	T1	T30-2 core, 13T primary wound first with #26 wire with 6T bifilar secondary wound on top of primary with #26 wire in same direction. Primary connected to via's next to edge of board. Silkscreen lines between via pairs indicate winding connections.
1	X1	Xtal, 28.224 MHz, HC49US case, mound on side with case grounded with bus wire to small gnd via
1		PCB, SoftRock40 v4.0

PC BOARD LAYOUT

Top Side

Bottom Side

BNC Connector Assembly Instructions

COAXICON* BNC 50–Ohm RF Series
Commercial Plug Connectors
(Dual Crimp) 227079–[ ]

AMP

Instruction Sheet
408–2798
19 AUG 97   Rev B

Straight Ferrule   or   Step–Down Ferrule

Spacer

Center
Contact

Tubing

NOTE: Some connectors are supplied with a step–down ferrule. When assembling the step–down ferrule over the cable braid, make sure the large diameter end faces the plug body.

Plug Body

Figure 1

1. INTRODUCTION

This instruction sheet covers the assembly of AMP* COAXICON BNC 50–Ohm Commercial Plug (Dual Crimp) Connectors 227079–[ ]. The plug connectors accept a wide range of coaxial cables and can be crimped using the following tools: AMP CERTI–CRIMP* Hand Tools, such as 220187–1 (408–2774), PRO–CRIMPER* II Hand Crimping Tool Frame Assembly 354940–1 (408–9930), AMP PRO–CRIMPER Coaxial Crimp Tool 58433–1 (408–9140), AMP–O–LECTRIC* Terminating Machine 220152–1 (409–2627), and AMP Single Action Hand Tool 69710–1 (408–2095). AMP 626 C–Head Pneumatic Adapter 318161–1 (408–4190) can also be used. For specific information regarding product part numbers and crimping die numbers associated with Adapter 318161–1, refer to catalog 124208. For details concerning connector crimping procedures, refer to the instruction sheets packaged with the appropriate tool.

Read these instructions carefully before starting assembly.

NOTE *Dimensions on this instruction sheet are in millimeters [followed by inches in brackets].*

Reasons for reissue are provided in Section 4, REVISION SUMMARY.

2. DESCRIPTION (Figure 1)

The 50–ohm version dual crimp connectors feature a plug body with a bayonet locking coupling, a center contact, and a ferrule. Some connectors are supplied with a step–down ferrule, tubing, and a spacer. The tubing is slipped over the cable dielectric before the center contact is crimped. In this use, the tubing compensates for small diameter cable dielectrics. Also, a spacer is provided with connectors which use air core dielectric cable.

NOTE *The ferrules differ with connector selection. Some connectors come with straight ferrules, while others use step–down ferrules.*

3. ASSEMBLY PROCEDURE

NOTE *AMP Catalog 82074 provides a cable–to–connector selection guide which will assist you in matching connectors with a specific cable size, crimping tool, and die assembly. For cable sizes not listed in the guide, contact AMP Product Engineering for connector recommendations.*

NOTE *If using a step–down ferrule, slide it onto the cable with the small opening first.*

1. Slide ferrule onto unstripped cable; then strip cable using the appropriate dimensions in Figures 2 and 3. Do not nick or cut cable braid. Center conductor must be straight and free of burrs.

1 of 3

LOC B

AMP BNC 50–Ohm Dual Crimp Plug Connectors 227079–[ ]   408–2798

NOTE For cables with air core dielectric, spacer must be assembled over center conductor and bottomed against the dielectric prior to assembly of the center contact. If tubing is provided with the connector, slide it over the cable dielectric prior to assembly of the center contact.

2. Insert cable conductor into center contact. The contact shoulder must be positioned against the cable dielectric, as shown in Figure 4.
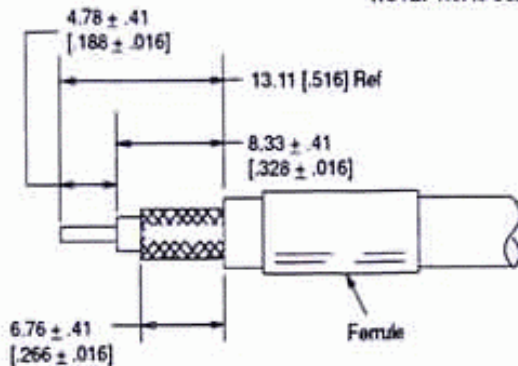
NOTE: Not to Scale

4.78 ± .41
[.188 ± .016]

13.11 [.516] Ref

8.33 ± .41
[.328 ± .016]

6.76 ± .41
[.266 ± .016]

Female

NOTE: For all connectors except those listed in Figure 3.

Figure 2

NOTE: Not to Scale

13.49 [.531] Ref

7.92 ± .41
[.312 ± .016]

5.49 ± .41
[.216 ± .016]

Female

NOTE: For cables with air core dielectric only and used with spacer. For connectors: 227079–3, –7, –11, –49, –72, –74, –76, –81, –85, and –93.

Figure 3

NOTE For cables with air core dielectric, spacer must be assembled over center conductor and bottomed against the dielectric prior to assembly of the center contact. If tubing is provided with the connector, slide it over the cable dielectric prior to assembly of the center contact. Refer to the AMP Customer Drawing for part availability.

3. Crimp the center contact with the recommended crimping tool (fitted with the appropriate die assembly). See Figure 4.

4. Flare cable braid to allow the support sleeve of the plug body to pass under the cable braid.

Crimped Center Contact

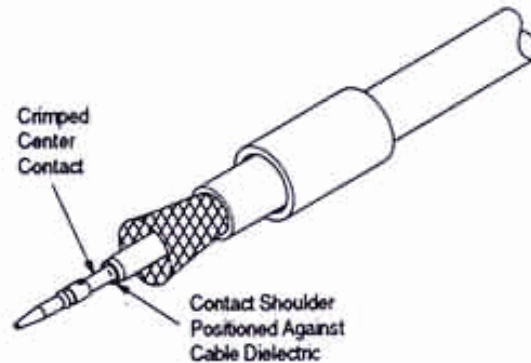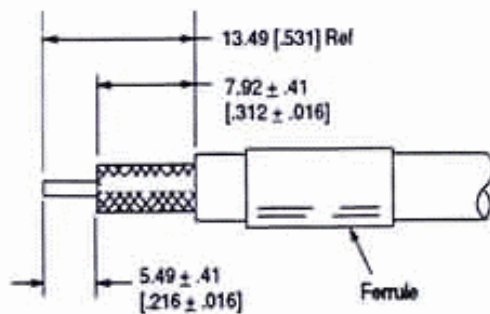Contact Shoulder Positioned Against Cable Dielectric

Figure 4

NOTE Connectors with non–captivated contacts: 1–227079–4, –16, –20, –22, –69, –82, –88, and –90. All other connectors have captive contacts.

5. Insert center contact into plug body until it snaps into place. The cable braid must be positioned over the connector support sleeve. Pull back gently on the cable to ensure that the contact is held in place by the internal locking feature. See Figure 5.

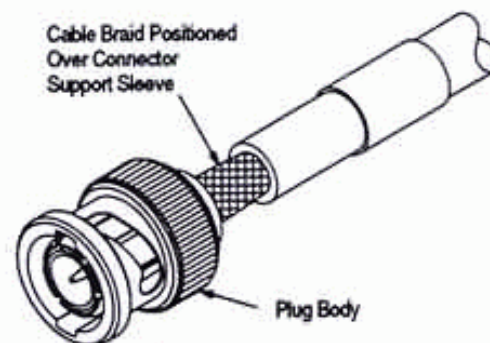Cable Braid Positioned Over Connector Support Sleeve

Plug Body

Figure 5

2 of 3   Rev B

6. Slide ferrule forward over cable braid and support sleeve until it is positioned against the shoulder of the plug body. Crimp the ferrule using the recommended crimping tool (fitted with appropriate die assembly). See Figure 6.
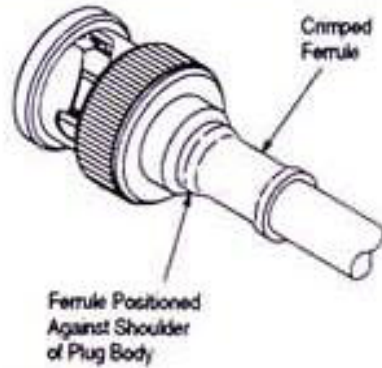
Crimped Ferrule

Ferrule Positioned Against Shoulder of Plug Body

Figure 6

4. REVISION SUMMARY

Since the previous release of this sheet, the following changes were made:

Per EC 0990–0706–97:

* *Section 1. INTRODUCTION:* Replaced obsolete Hand Tool 69365 with 626 C–Head Pneumatic Adapter 318161–1.
* *Section 2. DESCRIPTION:* Revised information on step–down ferrules and cable dielectrics.
* *Section 3. ASSEMBLY PROCEDURE:* Added notes regarding step–down ferrules, cables with air core dielectric, and connectors with non–captivated contacts.