

Version

3.8

SDR-1000 SOFTWARE DEFINED RADIO

FlexRadio Systems

Hardware Manual

THE SDR-1000 SOFTWARE DEFINED RADIO

Hardware Description and Installation

© FlexRadio Systems
8900 Marybank Drive • Austin, TX 78750
Phone: 512-426-7077 • Email: support@Flex-Radio.com

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SDR-1000 Overview

The SDR-1000 Software Defined Radio is an open software, 1W transceiver providing general coverage receive operation and amateur radio band transmission between DC and 65MHz.

The FlexRadio SDR-1000 is a complete Software Defined Radio (SDR) designed for Amateur Radio experimentation and use. It offers a true open software interface on a personal computer (PC) for *all* Digital Signal Processing (DSP) and control functions of the radio. General coverage receive operation is provided from DC to 65MHz along with 1W transmit capability on all licensed amateur bands within the coverage range.

The theory behind the SDR-1000 is described in detail in a four part *QEX* magazine series entitled, “A Software Defined Radio for the Masses¹.” The articles are available for download from the FlexRadio website at www.Flex-Radio.com. There are also links on the site to other excellent reference materials related to SDR and DSP theory.

¹ G. Youngblood, “A Software Defined Radio for the Masses: Part 1, Part 2, Part 3, and Part 4,” *QEX*, Jul/Aug 2002, Sep/Oct 2002, Nov/Dec 2002, and Mar/Apr 2003 respectively.

Hardware Specifications

The SDR-1000 is designed to be a PC peripheral that converts the PC into a Software Defined Radio with an open software interface for both MS Windows and Linux platforms. The hardware connects to a standard PC sound card and parallel port to implement a high performance, DC-65MHz general coverage receiver with 160M-6M Amateur Radio band transmit capability.

The SDR-1000 incorporates a novel Quadrature Sampling Detector (QSD) to deliver high dynamic range with minimal components. An Analog Devices AD9854 quadrature DDS and 200MHz, 1ps jitter clock oscillator provides continuous coverage with low phase noise. A power RF op-amp delivers up to 1W RMS into a 50Ω load.

All radio control functions are managed through the PC parallel port including external control for up to seven transverters or other accessories. Use of the parallel port for control eliminates the need for a microcontroller in the radio, thereby removing a source of noise and software complexity. Internal connections are included for controlling up to six filters and TR relay for a user provided linear power amplifier.

SDR-1000 Specification Description	Specification
Receiver Frequency Range	11KHz-65MHz General Coverage
Transmit Frequency Range	All licensed Amateur Radio Bands 160-6M
Minimum Tuning Step	1uH DDS, 1Hz in SDR-Console Software
DDS Clock	200MHz, <1ps RMS jitter (max.)
Maximum Bandwidth	40KHz
Transmit Power	1W PEP (max.)
Control Interface	PC Parallel Port (DB-25S)
Rear Panel Relay Control Outputs	7 Open Collector Darlington Outputs (DB-15S High Density)
Rear Panel Input Controls	PTT and 2 Optional Inputs (5V Logic)
Rear Panel Audio Connectors	Sound Card Line In, Line Out, Speaker Out, Microphone In (3.5mm)
Rear Panel Code Key	3.5mm Jack for Dot/Dash Control
Internal Microphone Connector	4 Pin .100" Right Angle Header
DC Power Connector	2.1mm Rear Panel Jack
DC Power Requirements	12.4-14.5VDC (13.8VDC typ.) @ 1A(max), 0.7A (typ.)
Dimensions	Three Board Set: Each Board 31/8 in. x 3 15/16 in., Stacking Height ~3 in.

Hardware Installation

This section will detail instructions for assembling the SDR-1000 board set into a complete unit and making all external and internal connections. The following details the standard configurations that may be purchased:

SDR-ASM

This is a fully assembled and tested SDR-1000 transceiver, which includes the BPF, TRX, PIO, and RFE boards installed in the SDR1K-ENC enclosure. Space is provided in the enclosure for future addition of the DEMI144-28FRS 2M transverter, 100-Watt power amplifier, and antenna-tuning unit.

SDR-PKG

The SDR-PKG contains exactly the same components as the SDR-ASM above, except that the SDR1K-ENC enclosure is provided in kit form. The following supporting documentation is required for final assembly (located on the customer download site):

1. SDR1K-ENC Assembly Manual
2. RFE Board Installation Instructions

SDR-1000/TR

This transceiver configuration includes assembled and tested BPF, TRX, PIO, and RFE boards. In addition to this manual, the following supporting documentation is required:

1. RFE Board Installation

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SDR-1000/RO

This receive-only configuration includes the BPF, TRX, and PIO boards only. All assembly instructions for the SDR-1000/RO are contained in this manual.

Figures 1, 2, and 3 illustrate the assembly drawings for the TRX (transceiver), BPF (bandpass filter), and PIO (parallel IO) boards, respectively.

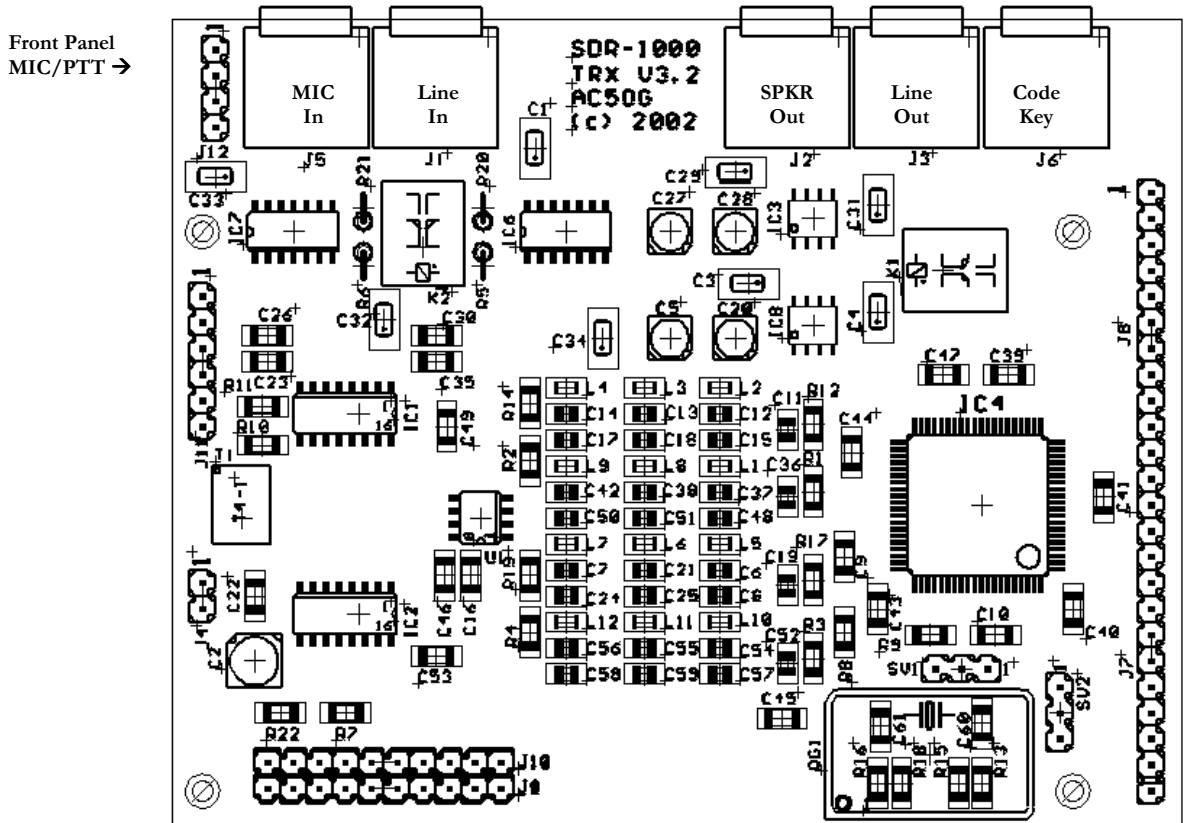


Figure 1 – TRX Board Assembly Drawing

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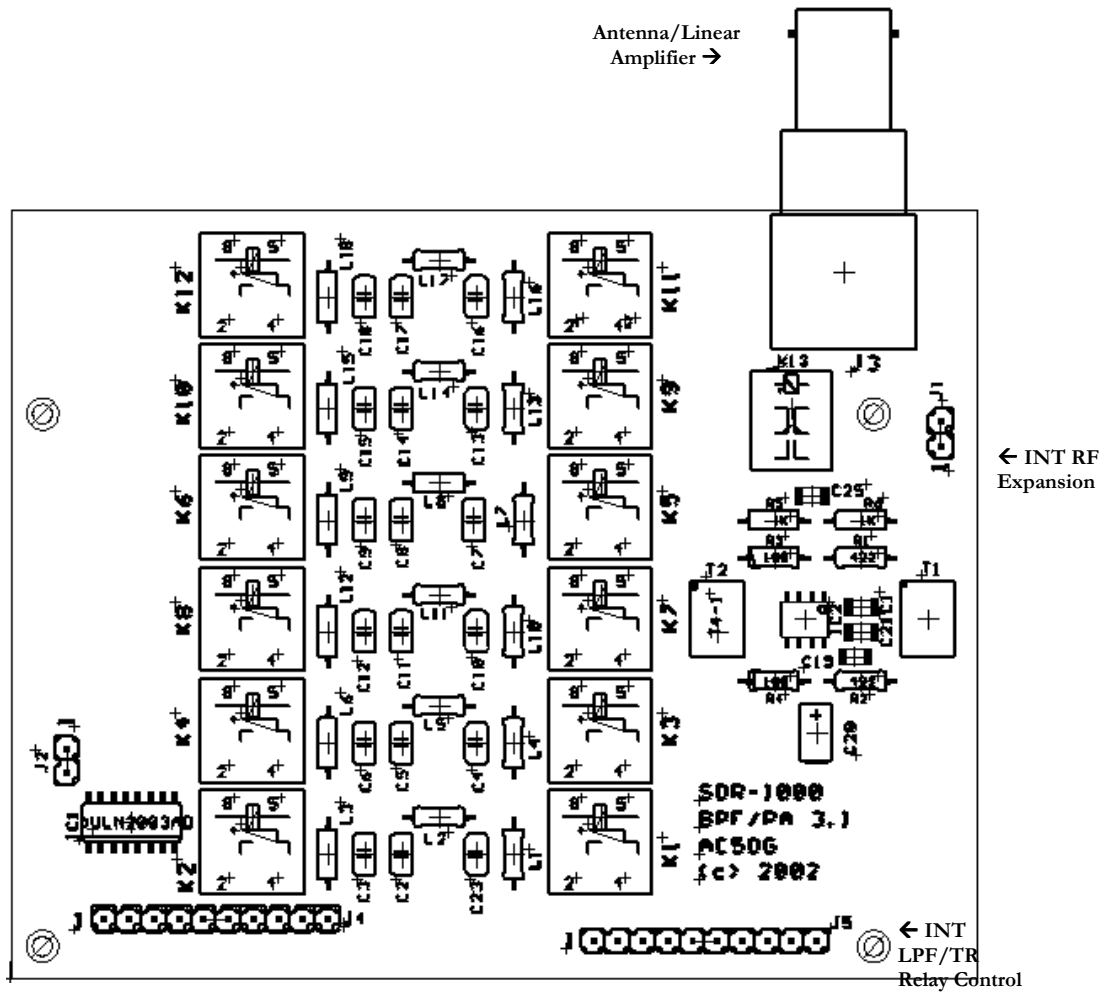


Figure 2 – BPF Board Assembly Drawing

HARDWARE DESCRIPTION AND INSTALLATION

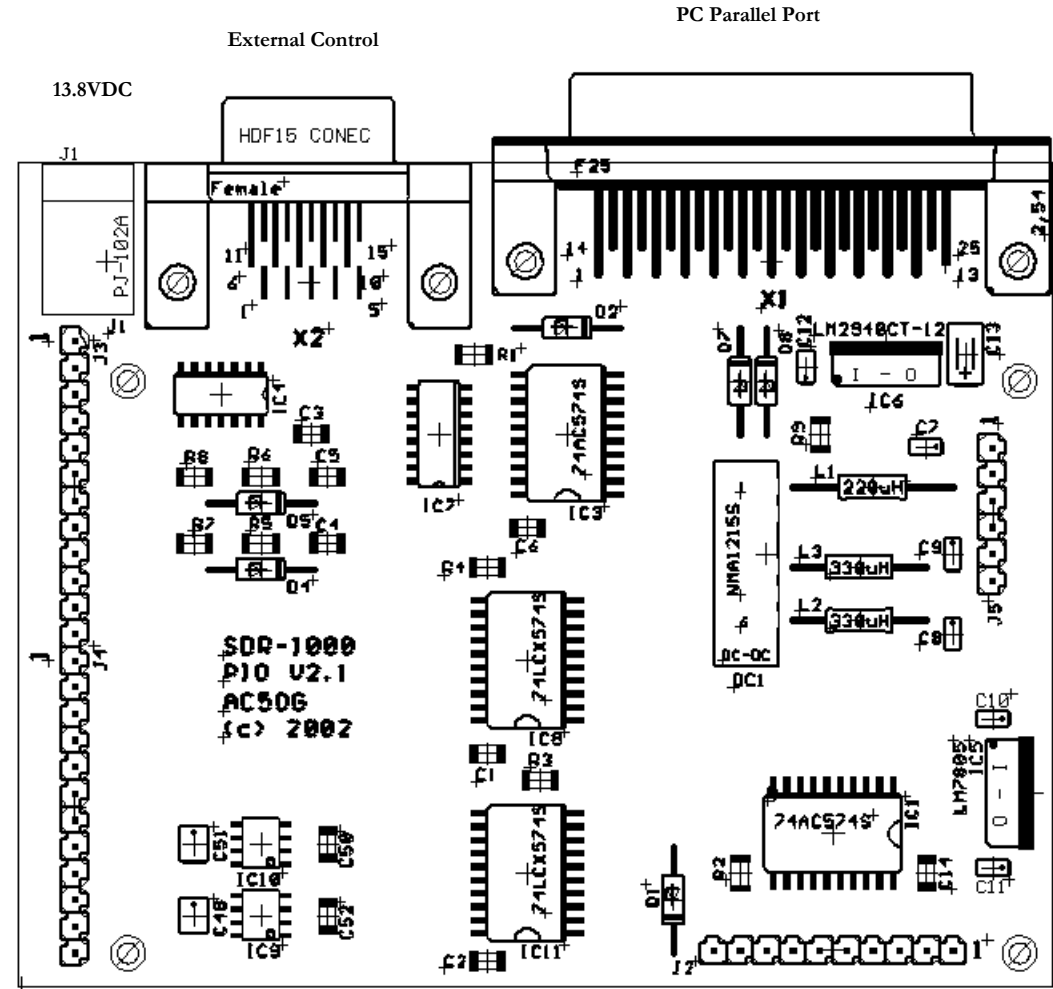


Figure 3 – PIO Board Assembly Drawing

Board Assembly Instructions

The three boards form a sandwich in which connectors on the bottom of the TRX and PIO boards mate together. The bottom of the BPF board then mates to the top of the TRX board as seen in Figure 4a and 4b. Assemble the three boards using the hardware provided. If you have purchased the RF Expansion (RFE) board, please refer to the RFE Installation Instructions before proceeding. **Caution: Use only nylon spacers and washers that are provided to prevent causing a power supply short. Make certain that all pins mate properly to the respective sockets so that the power supply connections do not become shorted.** The component sequence starting from the outside of case for the four screws holding the stack to cabinet bottom is: 4-40 x 1/4 inch screw, #4-40 split washer, #4-40 flat washer, cabinet, 3/16 brass jack screw heat sink plate, #4-40 x 3/8 inch nylon jack screw, PIO board, #4-40 nylon washer, #4-40 x 3/8 inch nylon jack screw, TRX board, #4-40 nylon washer, #4-40 x 3/8 inch nylon jack screw, BPF board, #4-40 nylon washer, #4-40 nut. This is the preferred direction of the male/female sequence of screws and jackscrews to accommodate future options. Refer to the SDR1K-ENC Enclosure Kit Assembly

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Instructions for detail on enclosure mounting. *It is important to provide sufficient airflow through the boards and heat sink. The four metal standoffs on the bottom of the heat sink plate should mount to bare metal on the enclosure to allow heat transfer. Heat sink compound should be used between the mounting studs and the chassis to enhance heat flow. Forced air-cooling is desirable. The heat sink will run about 60 degrees centigrade at room temperature ambient, with no enclosure or forced air. The DDS chip will run about 70 degrees centigrade under the same conditions. The radio will operate safely at this temperature but it will become quite hot to touch. Beginning with shipments after July 20, 2004, heat sinks are installed on all DDS chips.*

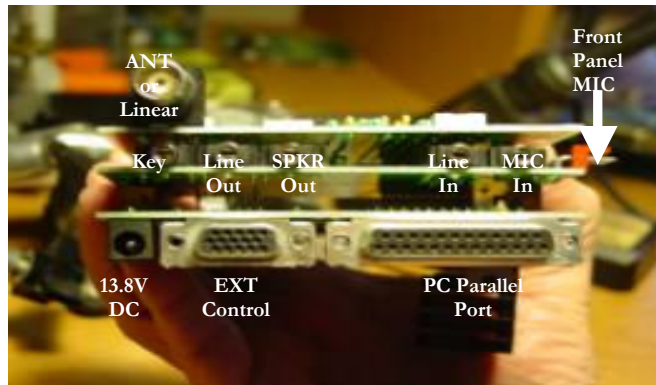


Figure 4a – Board Set Assembly

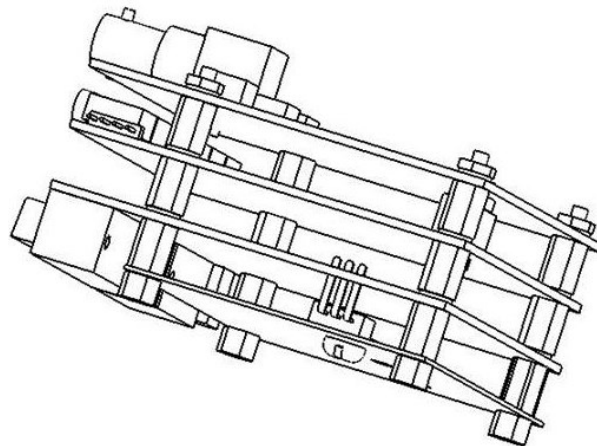


Figure 4b – Spacer Installation

Rear Panel Connections

The rear panel connections to the SDR-1000 fall into the following primary categories:

- Audio connections to and from the PC sound card and amplified speaker
- Control signals from the PC parallel IO port
- Code key input
- Control outputs for external transverters, TR relays, amplifiers, etc.
- 13.8VDC power supply

Figure 4 identifies the function of each connector on the assembled board set and Figure 5 illustrates interconnections between the SDR-1000, the PC, and accessories. Table 1 shows the function by connector ID and provides information on the respective signal levels for the TRX board. Table 2 gives the connections for the PIO board. The only external connection on the BPF board is a female BNC connector (J3) for the antenna/power amplifier connection.

CAUTION: The 1W PEP power amplifier is designed as a 50-ohm driver for a linear power amplifier. The amplifier is sensitive to highly reactive loads and may become unstable under such conditions. Transmitting into an open circuit may also cause damage to the power amplifier. Also, continuous operation at full carrier may cause excessive heat dissipation and thereby damage the part. It is recommended that the drive be set to 50% of full power for continuous carrier modes such as CW Keydown, AM, FM, PSK31, etc.

SDR-Console Parallel Port Selection

Selection of the correct PC Parallel Port base address is required in order for the control functions of the radio to operate. The base address is selected from the “Setup/Setup Options” menu. Select the General tab on the Setup Options form to find the PIO Base Address select box. The default is LPT1 at a base address of h378. The other options are h278 and h3BC. In Windows the base address can be determined by locating the parallel port in the Device Manager and looking at the Resources tab under Properties for the parallel port used for the SDR-1000.

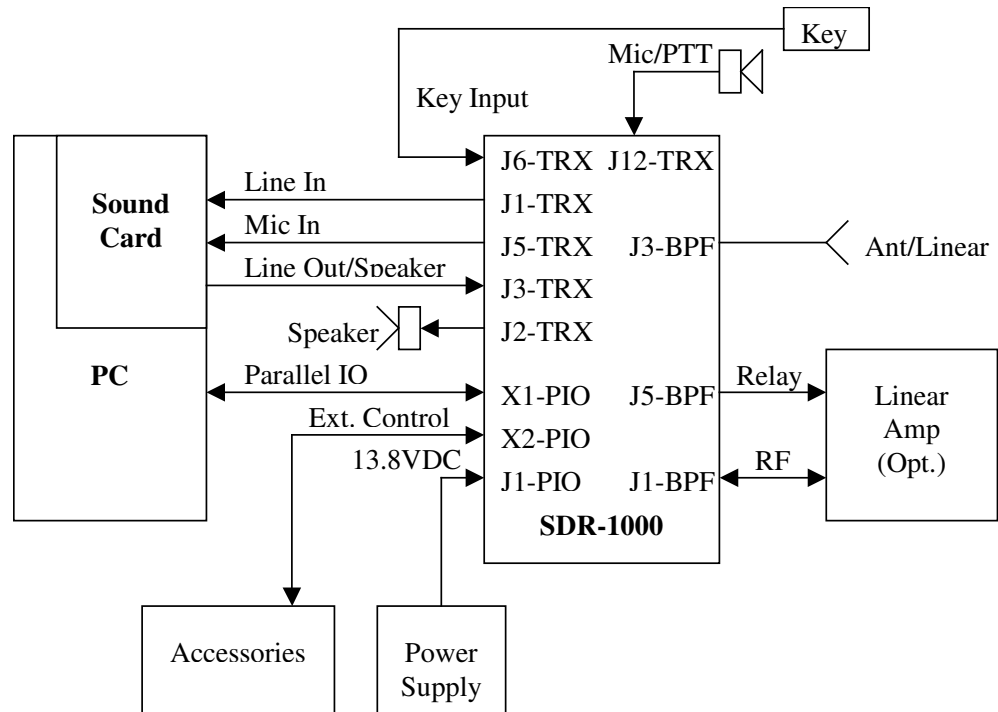


Figure 5 – SDR-1000 Interconnection Diagram

Table 1 – TRX Board Rear Panel Connectors

Connector	Function	Signal Specification
J1	Sound Card Line-In 3.5mm Stereo Jack	Line Level Stereo Audio
J2	PC Speaker 3.5mm Stereo Jack	Line Level Stereo Audio
J3	Sound Card Line-Out 3.5mm Stereo Jack	Line Level Stereo Audio
J5	Sound Card Microphone Input 3.5mm Stereo Jack with Mono Connection	Low Level Mono Microphone Audio
J6	Code Key Input 3.5mm Stereo Jack	Dot/Dash Switch Closure to Ground

Table 2 – PIO Board Rear Panel Connectors

Connector	Function	Signal Specification
J1	13.8VDC Power 2.1mm Coaxial Power Jack	12.4-14.5VDC (13.8VDC typ.) @ 1A(max), 0.65A (typ.), center pin is positive terminal
X1	Rig Control	PC Parallel Port 25 Pin Straight Through Cable
X2	External Control	Open Collector Outputs, 5V Inputs

PC Parallel Port Cable

The PC parallel port connection requires a 25 pin straight through cable with DB-25P (male) connectors on each end. It is essential that the cable is wired for all 25 lines.

Code Key Connector Wiring

Table 3 provides the definition of signal wiring on the code key input connector. The key must ground the Dot/PTT and Dash signals to trigger their respective functions in software.

Table 3 – Code Key Wiring (J6 on TRX Board)

Connection	Function	Signal Specification
Tip	Dot/PTT	5V CMOS: Low = True
Ring	Dash	5V CMOS: Low = True
Ground	Ground	Signal Ground

External Control Connector

The 15 pin, high-density, female “D” connector (X2) on the PIO board allows open collector Darlington output control of up to seven external devices such as transverters, relays, antennas, power amplifiers, etc. It also includes a push-to-talk (PTT) input and two spare inputs (no debounce). The connector has 5V power at up to 50mA for powering external relays or logic. The open collector outputs may also be

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used with external power supplies up to a maximum of 50VDC. The maximum collector current for a single output is 500mA. A common output clamp diode return is provided to handle relay transients. Table 4 denotes the connections for connector X2.

Table 4 – External Control Connector (X2 on PIO Board)

Pin	Function	Signal Specification
X2-1	Control 1	Open Collector Darlington 50V (max), 500mA (max)
X2-2	Control 2	Open Collector Darlington 50V (max), 500mA (max)
X2-3	Control 3	Open Collector Darlington 50V (max), 500mA (max)
X2-4	Control 4	Open Collector Darlington 50V (max), 500mA (max)
X2-5	Control 5	Open Collector Darlington 50V (max), 500mA (max)
X2-6	Control 6	Open Collector Darlington 50V (max), 500mA (max)
X2-7	Control 7	Open Collector Darlington 50V (max), 500mA (max)
X2-8	Diode Clamp Common	Connects to Relay Positive Supply
X2-9	N/C	N/C
X2-10	Push to Talk (PTT)	5V Logic: Low = True
X2-11	S7\ Parallel Port Status Input	5V Logic Input: Low = True
X2-12	S3 Parallel Port Status Input	5V Logic Input: High = True
X2-13	N/C	N/C
X2-14	V _{cc}	5VDC @ 50mA
X2-15	Ground	Signal Ground

DC Power Connector

J1 on the PIO board provides a 2.1mm, 13.8VDC (nominal) power connection for the radio. Typical current drain is <650mA but may be up to 1A if the radio has not been reset by the software. **Start the SDR-Console software after applying power to the radio to make sure that the radio is reset properly. Until reset, the BPF relays may all be simultaneously engaged and cause high current drain.** Table 5 provides the connection information for the 2.1mm coaxial plug (provided).

Table 5 – DC Power Connector (J1 on PIO Board)

Pin	Signal	Signal Specification
Pin 1 – Center	13.8VDC (typ.)	12.4-14.5VDC (13.8VDC typ.) @ 1A(max), 0.65A (typ.)
Pin 2 – Ground Ring	Power Ground	Power Ground
Pin 3	N/C	N/C

Internal Expansion Connections

The internal SDR-1000 connections fall into the following categories:

- Header for a customer supplied front panel mounted microphone connector
- Header for control of up to 6 bandpass filters and TR relay for a linear power amplifier
- Headers for internal connection to a customer supplied linear amplifier

Internal Microphone Connector

A 4-pin right angle header (J12) is provided on the TRX board for connection to a front panel microphone connector to be provided by the user if desired. The header provides a pass-through of the microphone signal to the 3.5mm microphone jack (J5) on the rear panel. It also provides for push-to-talk (PTT) operation from the front panel connector. Table 6 illustrates the internal connections for J12. The 4-pin mating connector is a Molex 22-01-3047 terminal housing with 08-50-0114 crimp pins (provided).

Table 6 – Internal Microphone Connector (J12 on TRX Board)

Pin	Signal	Signal Specification
1	Microphone Hot	Depends on Sound Card Specifications
2	Microphone Ground	Ground
3	PTT Ground	Ground
4	PTT Hot	Switch Closure to Ground

Internal Amplifier Expansion Connectors

J2 on the BPF board parallels the BNC RF connector on the rear panel to allow internal connection of a customer supplied linear power amplifier and lowpass filters. J5 on the same boards allows up to 6 filters and a TR to be controlled by 5VDC relays. J5 provides a parallel connection to the BPF board band switching and TR relays. Table 7 gives the connections for the internal RF header (J2) and Table 8 shows the connections for the band relays and TR control relay. **NOTE: It is extremely important that the driver is not operated with a high SWR. Under such conditions the driver amplifier may be damaged.**

Table 7 – Internal RF Header (J2 on BPF Board)

Pin	Signal	Signal Specification
1	RF Hot	50 Ohm
2	RF Ground	RF Ground

Table 8 – Internal Filter and TR Relay Control (J5 on BPF Board)

Pin	Signal	Signal Specification
1	Band 1	Open Collector Darlington
2	Band 2	Open Collector Darlington
3	Band 3	Open Collector Darlington
4	Band 4	Open Collector Darlington
5	Band 5	Open Collector Darlington
6	Band 6	Open Collector Darlington
7	TR Relay	Open Collector Darlington
8	5VDC Relay Hot	5V @ 50mA (max)
9	12VDC	12V @ 100mA (max)
10	Ground	Ground

Image Reject Alignment

One of the problems that can occur with quadrature demodulation in analog systems is that amplitude and phase imbalance between the in-phase (I) and quadrature (Q) channels. Since the SDR-1000 has an analog front end, there can exist imbalances between the I and Q channels. Fortunately this is easy to correct in the DSP software.

The SDR-Console Receive Options form allows fine adjustment of amplitude and phase to allow a null of the opposite sideband image in the time domain. In the future this adjustment will move to the frequency domain for even higher accuracy.

Currently it is possible to null the image to the point that phase noise takes over because of the magnitude of the carrier required to see the image. The initial software release has only a single setting for the phase and balance controls. In the future two memories will be added to accommodate both the +20dB and +40dB gain settings.

A signal generator or a transmitter with dummy load is required for this alignment. Begin by selecting "Setup/Setup Options" from the console menu. Next, click on the Receive tab on the Setup Options form. You will note the two controls for Phase and Amplitude adjustment. Set the SDR-1000 to 3.5MHz, DSB mode and 4KHz filters. This will give you plenty of spectrum viewing area to find the signal. Inject a strong signal (-40dBm for example) at 3.501MHz into the receiver so that you see the signal

generator carrier at an offset of +1KHz from the VFO frequency. Leave the signal generator set to 3.501MHz and tune the SDR-1000 to 3.520MHz. The image of the 3.5MHz signal will be at ~3.522MHz, ~22KHz away from the signal generator carrier. This is because the IF is set in software +11.025KHz from the DDS frequency. The image will therefore be 22.050KHz below the desired signal. If you don't have access to a signal generator, you can use a near by transmitter connected to a dummy load to generate a test signal.

Start with the Phase control at zero (left hand side of the slider control) and the Amplitude set at zero (mid range on the slider control). First adjust the amplitude plus or minus to null the image as much as possible. You may find it easier to do fine adjustments using the right and left arrow keys after the slider has been selected. Next, adjust the Phase slider to further null the image. Alternate between the two controls until the image is minimized. Now, increase the signal generator amplitude if desired to raise the image above the noise to fine-tune the adjustment. At some point the phase noise will take over the noise floor so that no further adjustment is possible.

Clock Oscillator Adjustment

A 200MHz low jitter oscillator clocks the AD9854 DDS. Frequency compensation is provided in the SDR-Console software to correct for oscillator offset. Begin by selecting "Setup/Setup Options" from the console menu. Next, click on the General Options tab on the Setup Options form. The Clock Offset text box allows the user to enter a clock correction factor directly in Hertz or to use the associated Up/Down control.

One way to adjust the offset is to measure the 200MHz clock against an accurate frequency standard or counter. The difference frequency is simply entered into the Clock Offset text box. The other method is to either inject a signal of known frequency such as with a 10MHz standard or by tuning WWV. The offset can then be adjusted to zero beat the injected signal. It is worthy of note that since the DDS divides the clock frequency to generate its phase wheel; absolute frequency error in Hertz will decrease with the DDS output frequency. For greatest accuracy, the DDS has a capability of tuning in 1uHz steps. This does not, however; offer the best phase truncation spur performance. To reduce or eliminate phase truncation spurs it is necessary to step the DDS in roughly 3KHz increments (most significant 16 bits of the tuning word). The fine-tuning is then done in the DSP code.

Hardware Description

As stated in the Hardware Overview section, the SDR-1000 design theory has been described in some detail in the QEX article series, “A Software Defined Radio for the Masses.” Each of the four articles may be downloaded from the FlexRadio Systems web site at www.Flex-Radio.com. This section will therefore focus on the specific hardware implementation of the SDR-1000.

Parallel IO Board Description (PIO)

The Parallel IO board connects to the parallel port of the PC to implement all control functions of the radio. The board also includes internal, regulated +15VDC, -15VDC, +12VDC, and +5VDC voltages from the external 13.8VDC radio power supply. Refer to the PIO Board schematic in Figure 7 for the following discussion.

Connector X1 brings in the control signals from the PC parallel port. Signals D0-D7 are the parallel port data lines. C0\, C1\, C2, and C3\ are control signals that are used to latch the data signals into octal latches IC3, IC1, IC11, and IC8 respectively. Signal inputs are fed back to the PC through S3, S4, S5, S6, and S7\. S6 may be enabled through software as a PC parallel port hardware interrupt. With appropriate driver software, this provides for the capability to interrupt the CPU based on code key or PTT inputs. S6 may also be used in polling mode for the same purpose.

S4 and S5 are designated for Dash and Dot/PTT inputs respectively. Switch debounce circuits are implemented with IC4A and IC4B and the surrounding circuitry: R5-R8, C4-C5, and D4-D5. D7, D8, and R9 form an OR circuit that triggers the S6 PTT line from either the Dash or Dot/PTT inputs.

IC1 and IC3 (74AC574 latches) operate from 5VDC for relay control, while IC8 and IC11 (74LCX574 latches) operate from 3.3VDC for control of the AD9854 DDS. IC7 (ULN2003) provides seven open collector Darlington outputs for control of external devices. IC4C provides the signal control for TR Switching on the TRX Board.

IC6 (LM2940-12) regulates the 13.8VDC (nominal) power to 5VDC by the IC5 (LM7805) and to 12VDC. The 5VDC power is used internally for relay control. The 12VDC power is used both to power the linear driver amplifier on the BPF Board and is converted to +15VDC and –

15VDC by the DC-DC converter, DC1 (NMA1215S) to be used by the analog baseband audio circuitry on the TRX Board. IC10 and IC11 (TPS76833) regulate the 5VDC to 3.3VDC for the AD9854 digital and analog power supplies respectively.

Transceiver Board Description (TRX)

All frequency control as well as signal down conversion and up conversion are implemented on the TRX board. As described in the QEX articles, the SDR-1000 uses a novel Quadrature Sampling Detector (QSD) and Quadrature Sampling Exciter (QSE). Refer to the TRX schematic in Figure 8 for the following discussion.

IC4 (Analog Devices AD9854) is a quadrature DDS operating at a directly clocked frequency of 200MHz. A <1ps jitter crystal clock oscillator, QG1, is connected in differential mode to the AD9854. Optionally, SV1 and SV2 pin header jumpers allow the connection of a single ended oscillator. Pin sockets are provided on board for either half or full sized plug-in oscillators. Table 9 provides SV1 and SV2 switch setup for the respective oscillator types.

Table 9 – Single Ended and Differential Clock Selection (SV1 and SV2)

Clock Mode	SV1	SV2
Differential	Short Pins 1 & 2	Short Pins 1 & 2
Single Ended	Short Pins 3 & 4	Short Pins 3 & 4

The DDS has true differential outputs for in-phase and quadrature local oscillator signals. Differential 70MHz, 7th order elliptical lowpass filters are used on each of the two channels to drive U1A and U1B (DS90VL028) high-speed comparators. The comparators in turn provide the quadrature local oscillator drive to IC1 and IC2 (FST3253 dual 4:1 MUX/DEMUX), the QSD and QSE respectively.

The RF signal is connected to the BPF board through the J4 header. T1 provides single ended to differential conversion for the double balanced detector and exciter circuits. The 150-ohm “swamping” resistors, R10 and R11, are selected to hold the QSD bandwidth to a minimum of 40KHz with a maximum SWR of 3:1. *For lowest noise operation, the resistors can be replaced with zero ohm resistors but SWR must be controlled.*

The QSD (detector) circuit is comprised of IC1 (FST3253), C23, C26, C30, C35, T1 (T4-1), R10, and R11. The instrumentation amplifiers IC6 and IC7 (INA163) are connected to differentially sum the in-phase and quadrature baseband signals respectively. Relay K2 allows selection between 20dB and 40dB of baseband gain. T1 provides an additional 6dB of differential voltage gain ahead of IC1.

IC2-IC3 (DRV135), IC8 (FST3253) and T1 form the QSE (exciter). IC2 and IC3 are differential audio line drivers with 50-ohm outputs. The circuit is capable of driving 10dBm CW into a 50-

ohm load when provided with sufficient quadrature audio drive on J3. K1 provides the capability of monitoring or muting the transmit audio under software control. TR switching is accomplished by inversely driving the enable pins (1 and 15) of IC1 and IC2 respectively by signals from the PIO board.

Bandpass Filter Board Description (BPF)

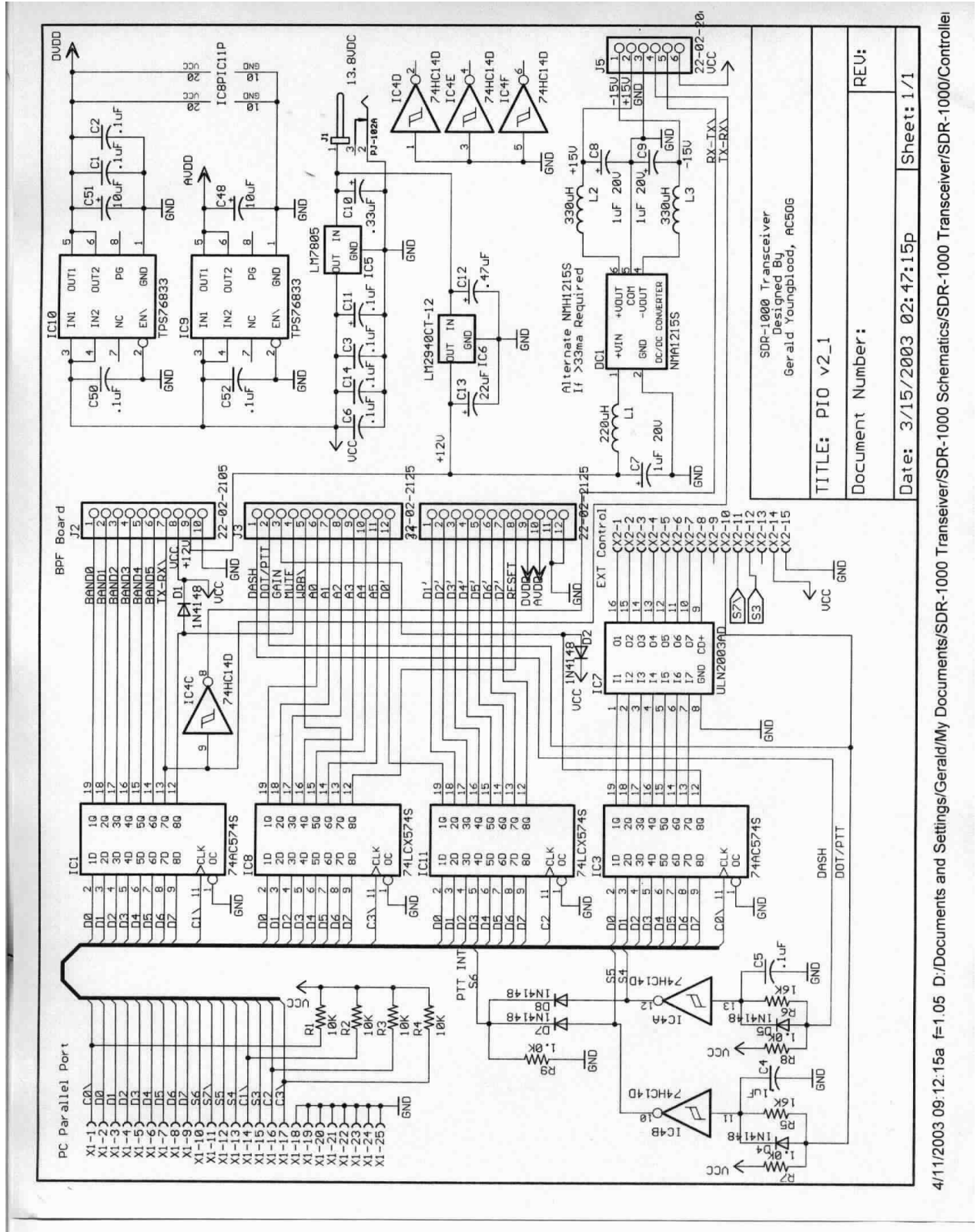
The Bandpass Filter Board contains six filter banks (1 LP and 5 BP) that allow general coverage receive and amateur band only transmission from DC to 65MHz. The schematic is shown in Figure 9. Table 10 gives the coverage for each of the six filter sets. The board also includes a 1W linear driver amplifier based on relatively new op amp technology developed for the broadband xDSL market. Refer to the schematic in Figure 9 for the following discussion.

Table 10 – Bandpass Filter Frequency Coverage

Band	Low Cutoff	High Cutoff
1	0Hz	2.5MHz
2	2MHz	6MHz
3	5MHz	12MHz
4	10MHz	24MHz
5	20MHz	40MHz
6	35MHz	60MHz

Relays K1-K12 and IC1 select the band of interest. Relay K13 provides TR switching for the linear PA driver, IC2.

The OPA2677 is capable of driving 500mA peak from a 12V supply. In push-pull mode as used in the SDR-1000, it is capable of supplying 1W RMS into a 50-ohm load. TI specifies the OPA2677 to have harmonic distortion of <85dBc. Transformer T2 and resistors R3 and R4 match the 50 output of the QSE to the differential inputs of IC2. T1 delivers a 33.33-ohm load to the differential output of the drivers. With full input drive the differential output can provide 20Vpp (1W) into the load.



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Figure 7 – PIO Board Schematic

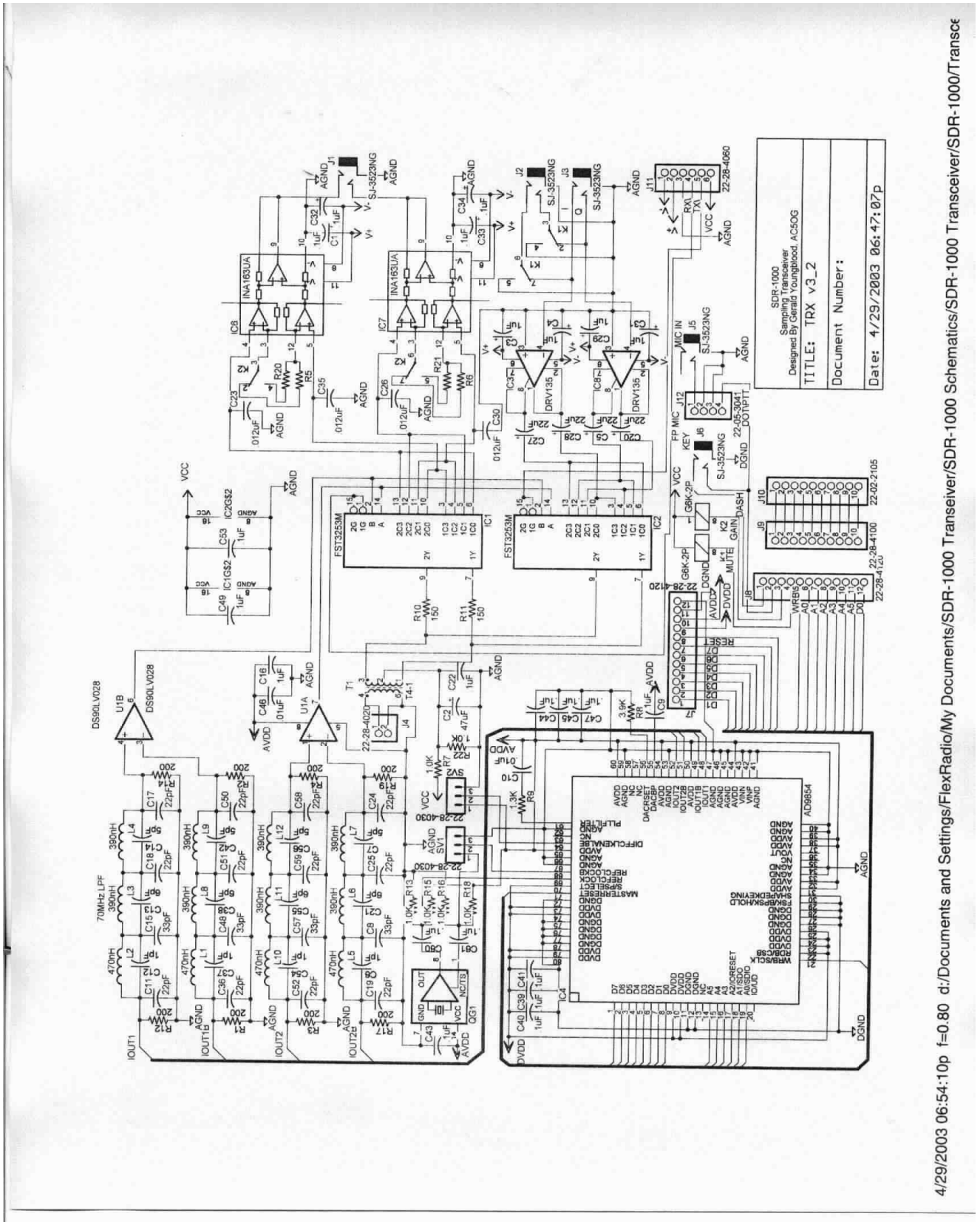


Figure 8 – TRX Board Schematic

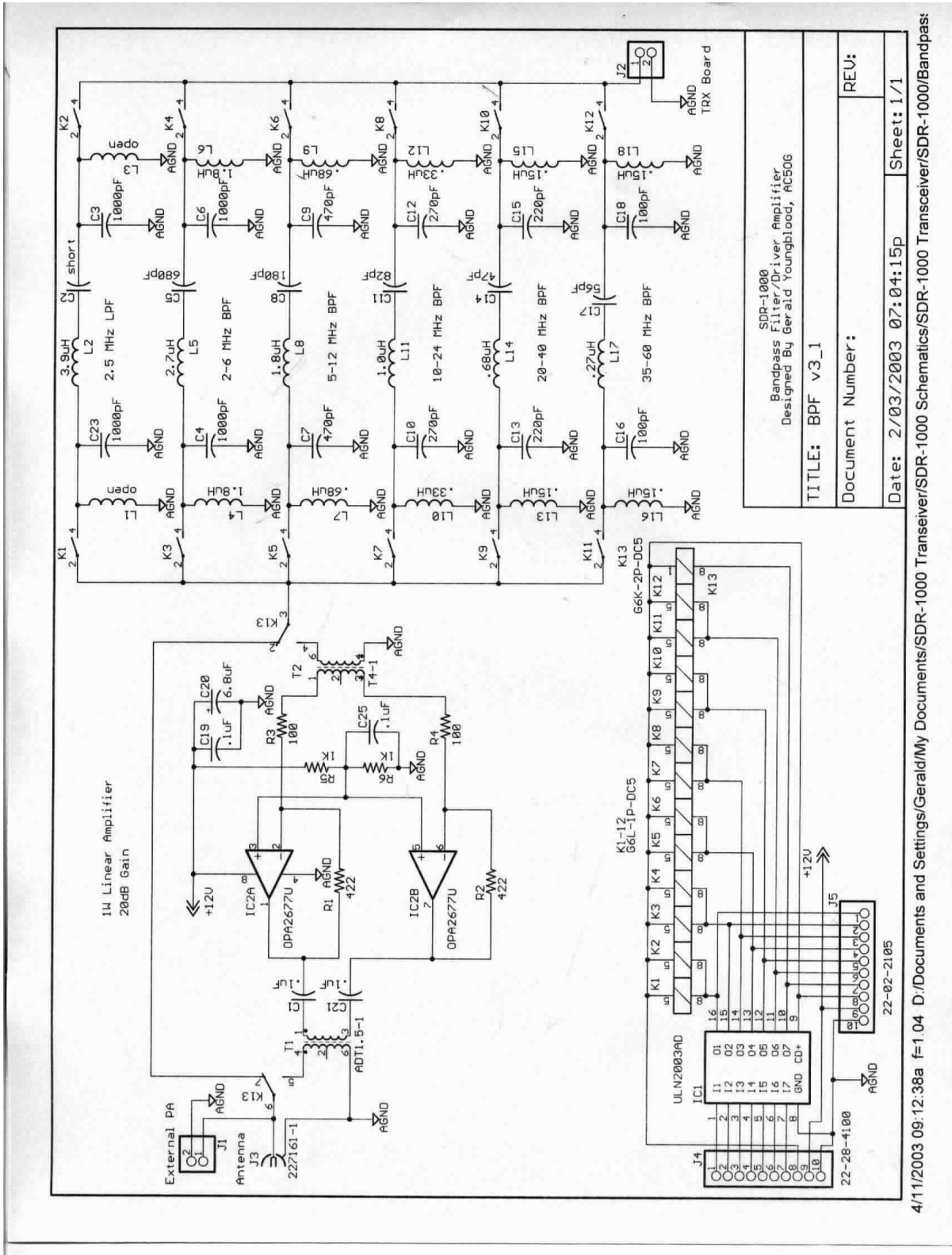


Figure 9 – BPF Board Schematic

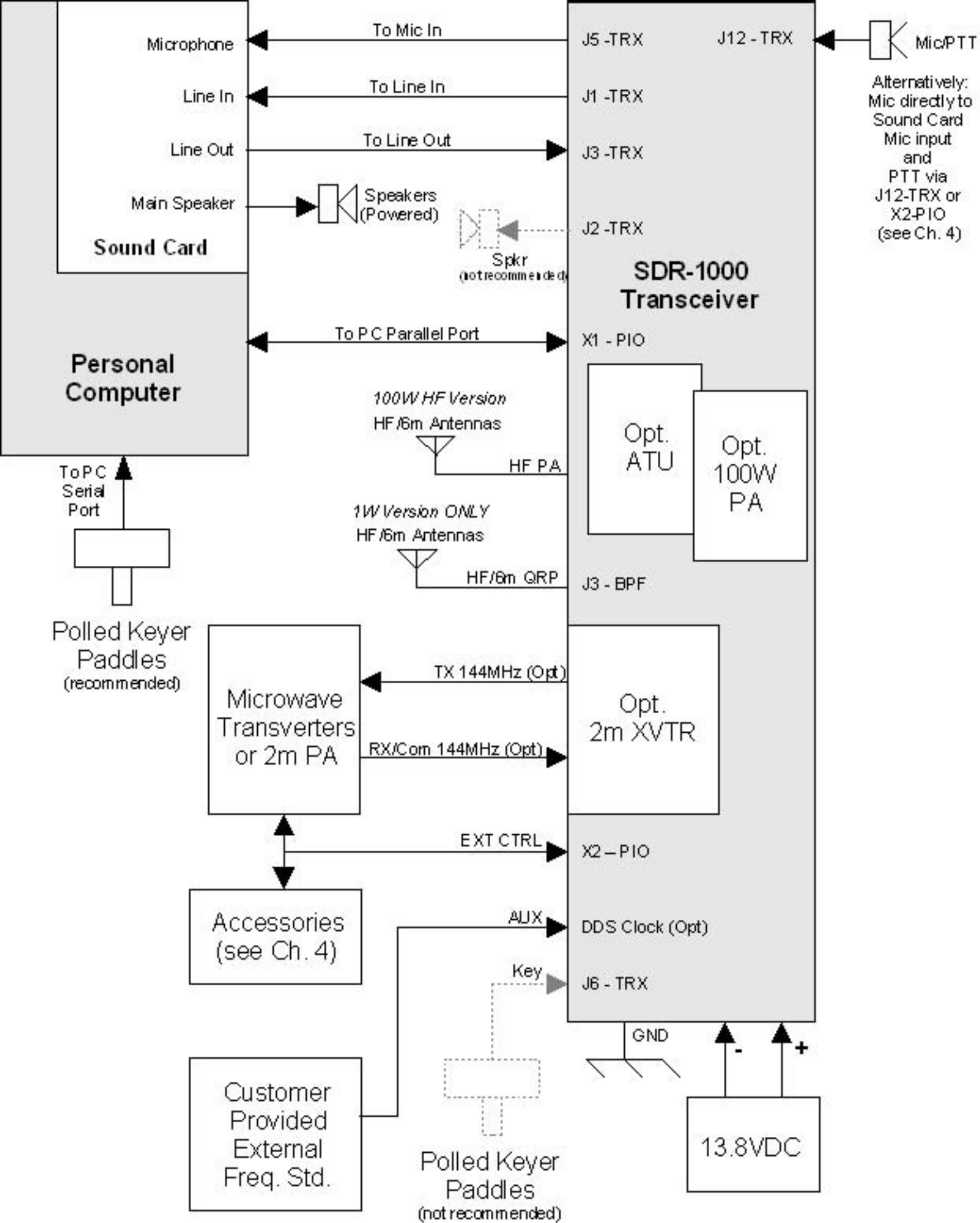
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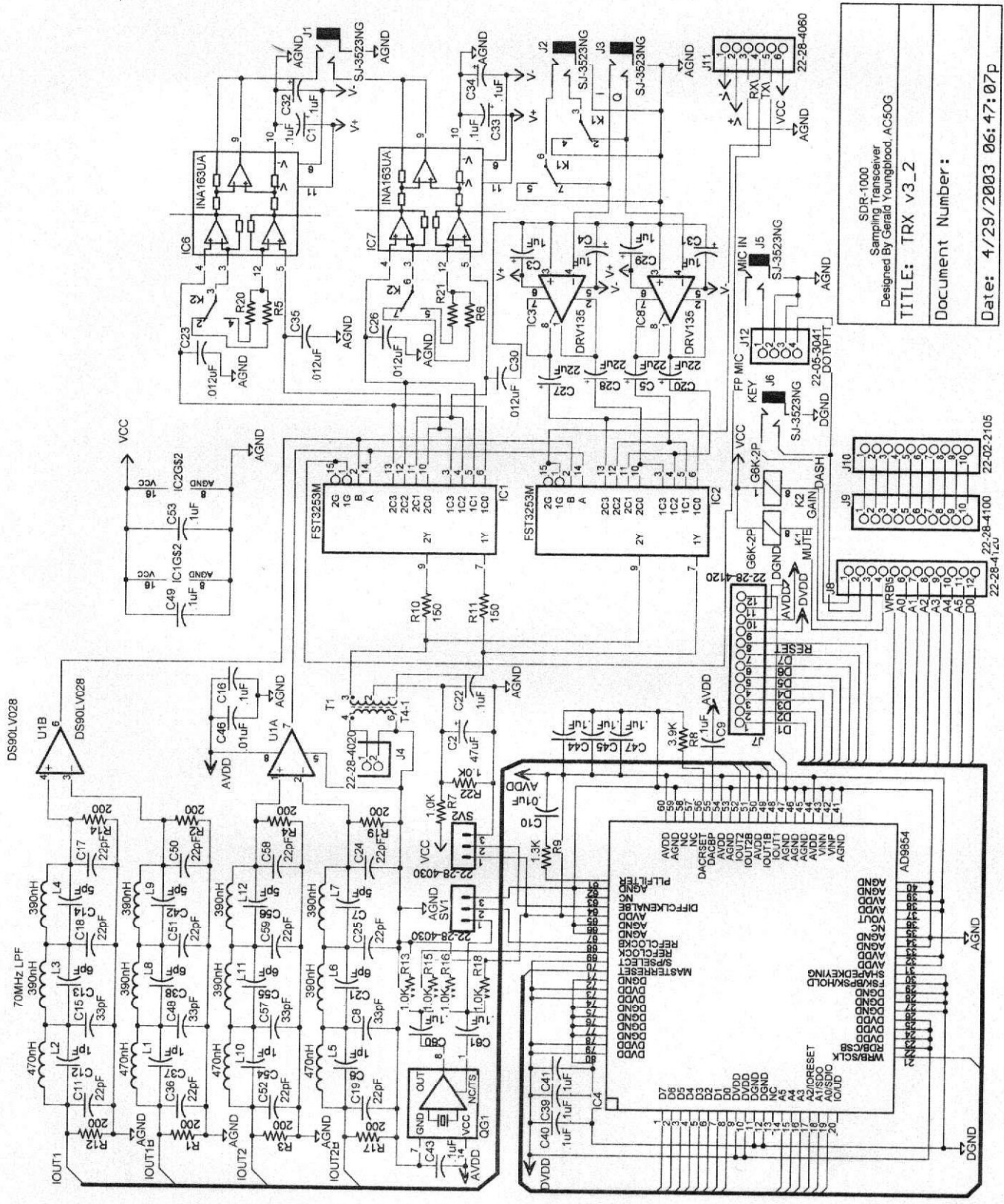
Manual Revision History

Version 3.3 – Added Figure 5, SDR-1000 Interconnection Diagram. Added information on PC parallel port cable and spacer specifications in Chapter 2.

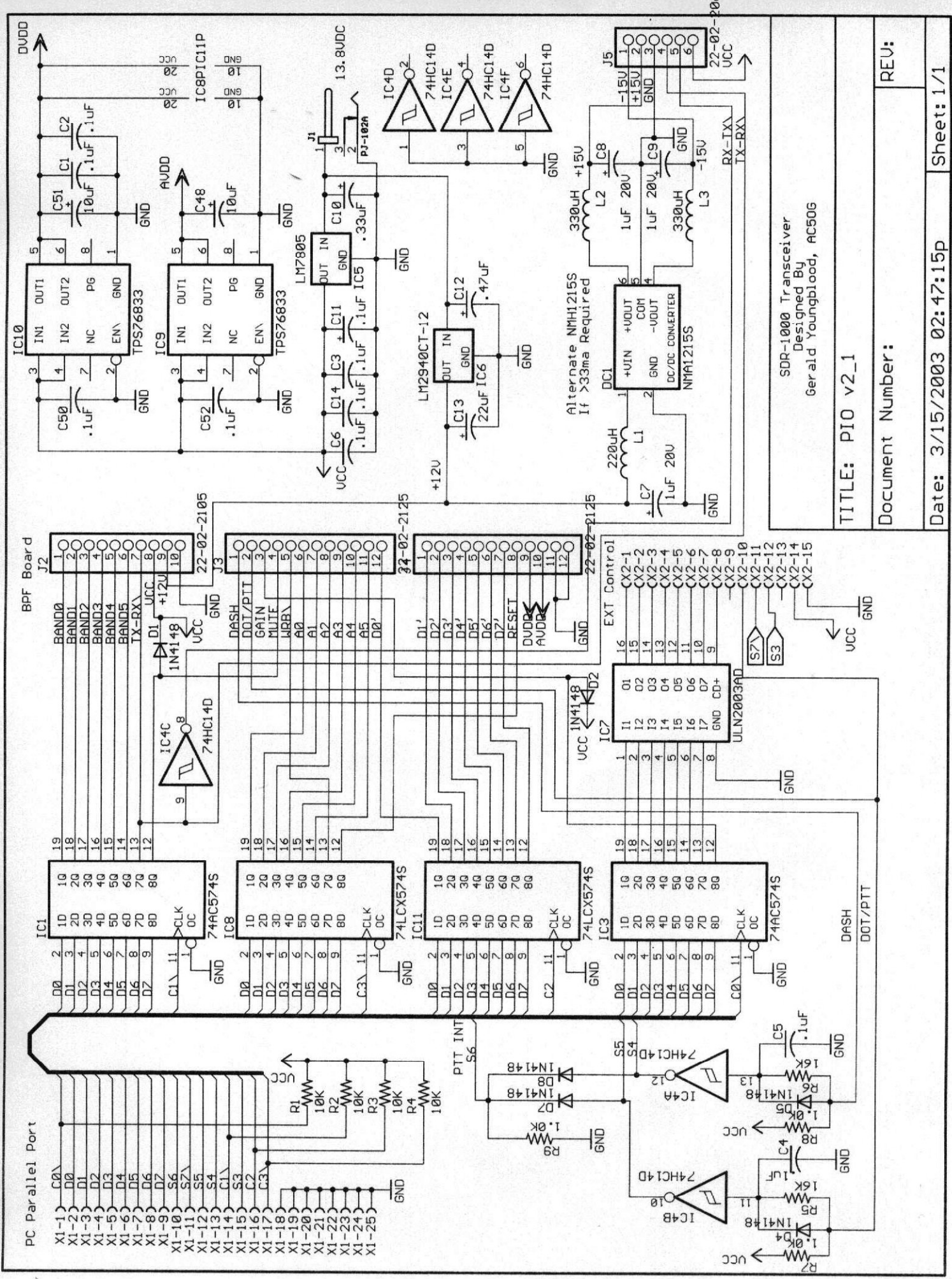
Version 3.4-3.7 – not documented

Version 3.8 – Added SDR-ASM, SDR-PKG, SDR-1000/TR, and SDR-1000/RO configurations to the Hardware Installation section.





SDR-1000
 Sampling Transceiver
 Designed By Gerald Youngblood, AC5OG
TITLE: TRX v3_2
 Document Number:
 Date: 4/29/2003 06:47:07P



SDR-1000 Transceiver
 Designed By
 Gerald Youngblood, AC50G

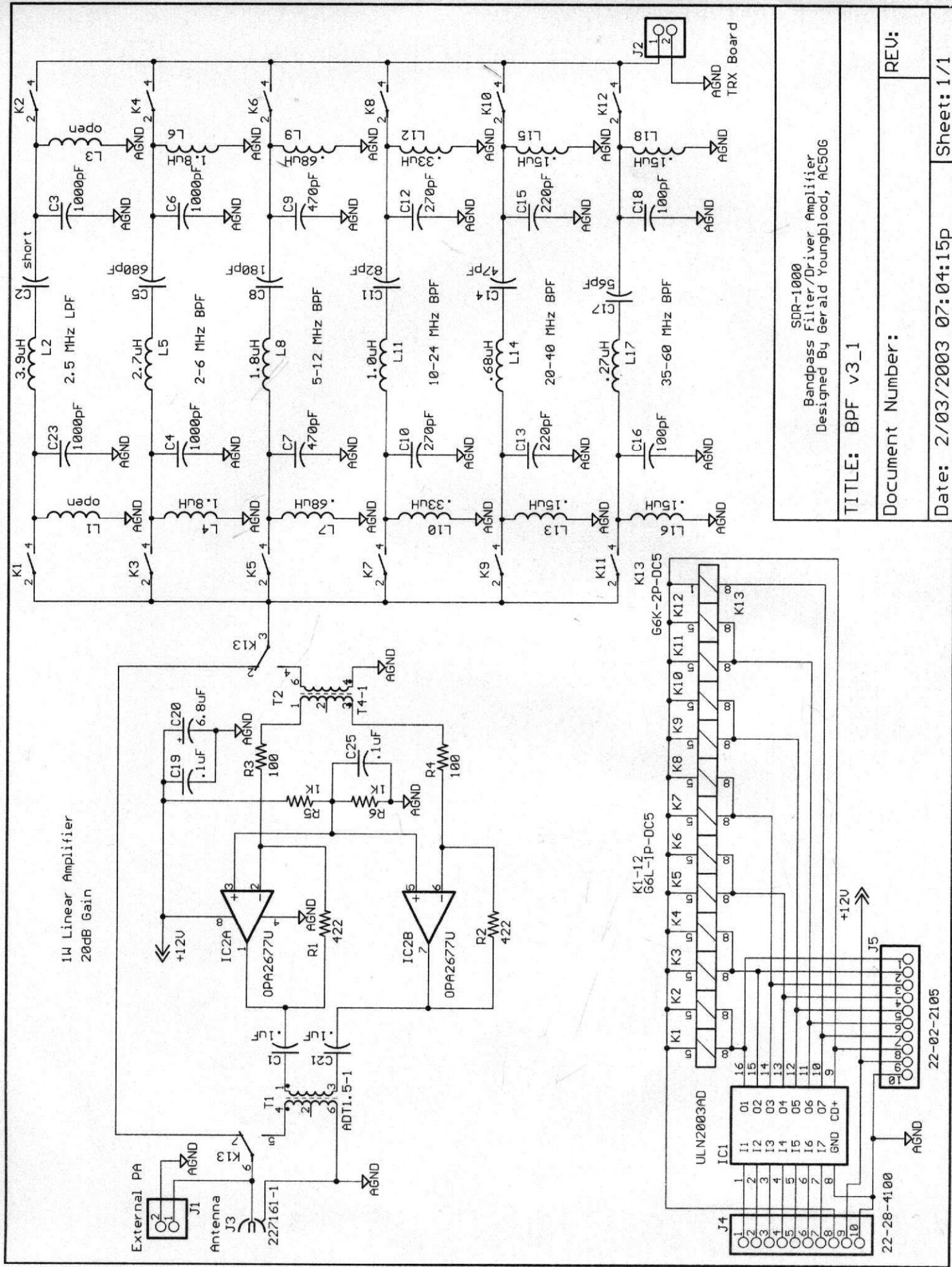
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SDR-1000
Bandpass Filter/Driver Amplifier
Designed By Gerald Youngblood, AC50G

TITLE: BPF v3_1

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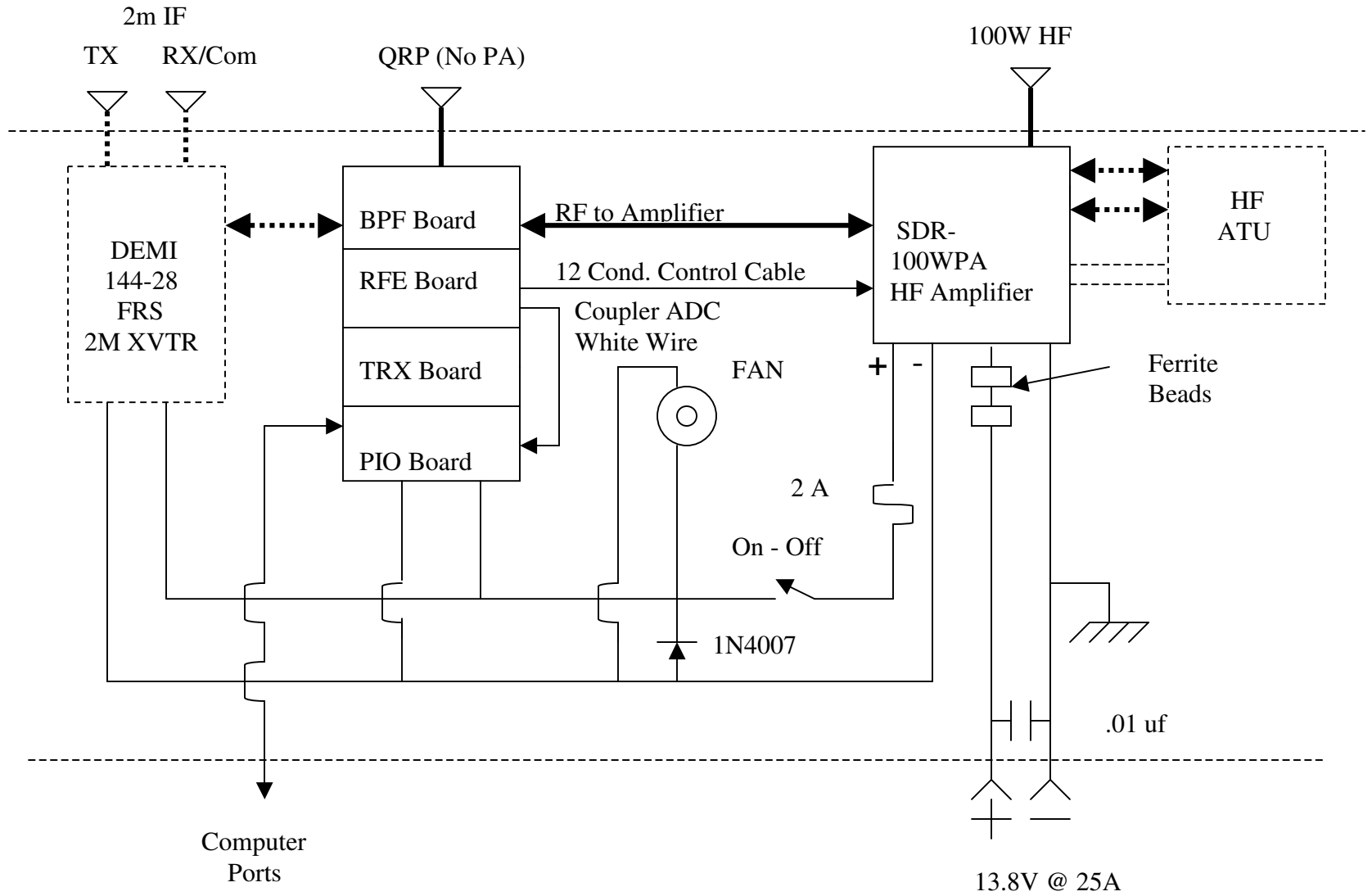
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SDR-1000 Enclosure Wiring Diagram

13 December 2004





5-Step SDR-1000™ Installation and Quick Start Guide

The purpose of this guide is to get you on the air as quickly as possible so you can begin to enjoy your new SDR-1000™.

This document is not a substitute for the operator's manual. You will eventually need to read it to complete the installation process and to optimize the SDR-1000's performance.

The screen shots in this document are from PowerSDR v1.6.0 software.

All information in the shaded areas can be found on our website at the Support & Downloads->Getting Started page.

Nearly all malfunctions are due to setup errors. Please *double-check all cable connections* before using the radio. If you need assistance, please call us at (512) 250-8595.

Good luck and enjoy your new radio.

WARNING

NO WARRANTY IS IMPLIED WHEN THE SDR-1000™ IS USED WITH ANY SOUND CARD OTHER THAN THOSE CURRENTLY SUPPORTED AS STATED ON THE FLEXRADIO SYSTEMS WEBSITE. UNSUPPORTED SOUND CARDS MAY OR MAY NOT WORK WITH THE SDR-1000. USE OF UNSUPPORTED SOUND CARDS IS AT THE CUSTOMERS OWN RISK.

Step 1. Getting Your PC Ready

We assume you are using Windows XP. Older operating systems may require the installation of additional components, which can be found on the FlexRadio web page at Support & Downloads->Getting Started page.

Step 2. Sound Card Installation

M-Audio Delta 44 Sound card (See Figure 1)

1. Install the PCI card according to your computer manufacturer's instruction. This usually is as simple as removing a side panel and inserting the card.
2. Attach the thick black cable between the PCI card and the silver "breakout" box.
3. Insert the HOSA cables into the silver box as shown below. The orange plugs go into the even numbered ports. INS 3 is the microphone input. Nothing goes into INS 4.

Do NOT connect the other end of the audio cables to the SDR-1000 at this time.

4. Turn on your computer and load the Delta 44 driver for the new sound card.

A copy of this driver is located on the FlexRadio [Knowledge Base](#). Please check the M-Audio web site for the most up to date drivers for your PC's operating system

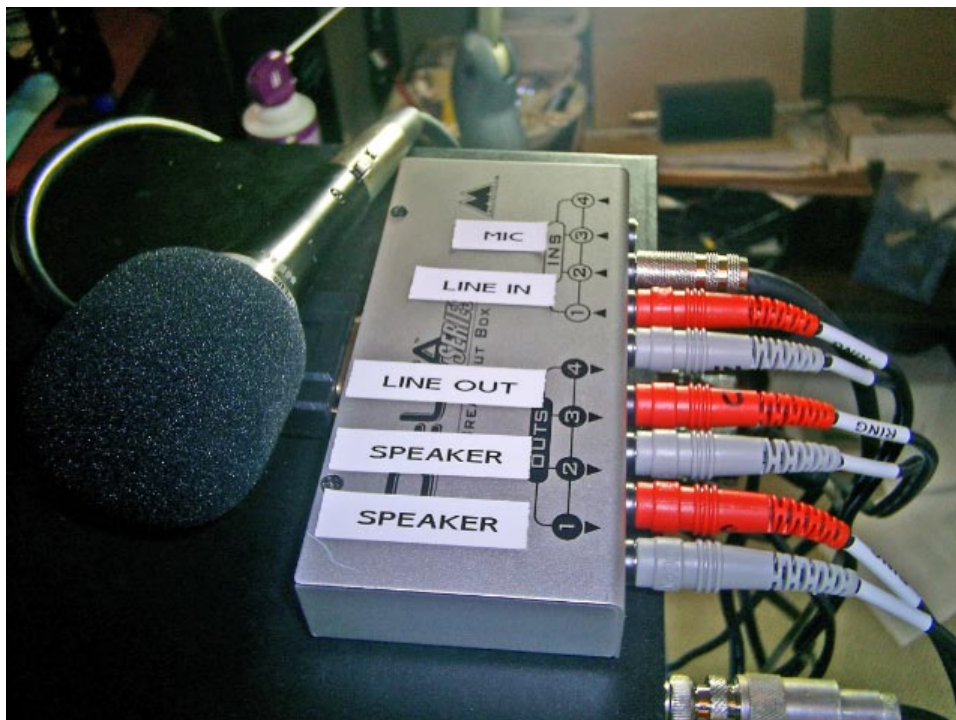


Figure 1.

Presonus Firebox Sound Card (See Figure 2.)

1. Connect the thick black cable to either of the firewire ports on the Firebox. DO NOT CONNECT this cable to the computer at this time.
2. Connect the Hosa cables as shown below-the orange color plug is on the bottom. DO NOT CONNECT the other end of the cables at this time-repeat-do not connect the other end of the cables at this time.

Note: Line Out 5/6 is not used

Turn on your computer and load the Presonus Firebox driver installation program. A copy can be found on the FlexRadio [Knowledge Base](#). Please check the Presonus web site for the most up to date drivers for your PC's operating system

DO NOT CONNECT the Firewire cable to the computer until you are directed to do so during the driver installation.

Do NOT connect the other end of the audio cables to the SDR-1000™ at this time.

5. Set all Firebox front panel controls to the NINE O'clock position.

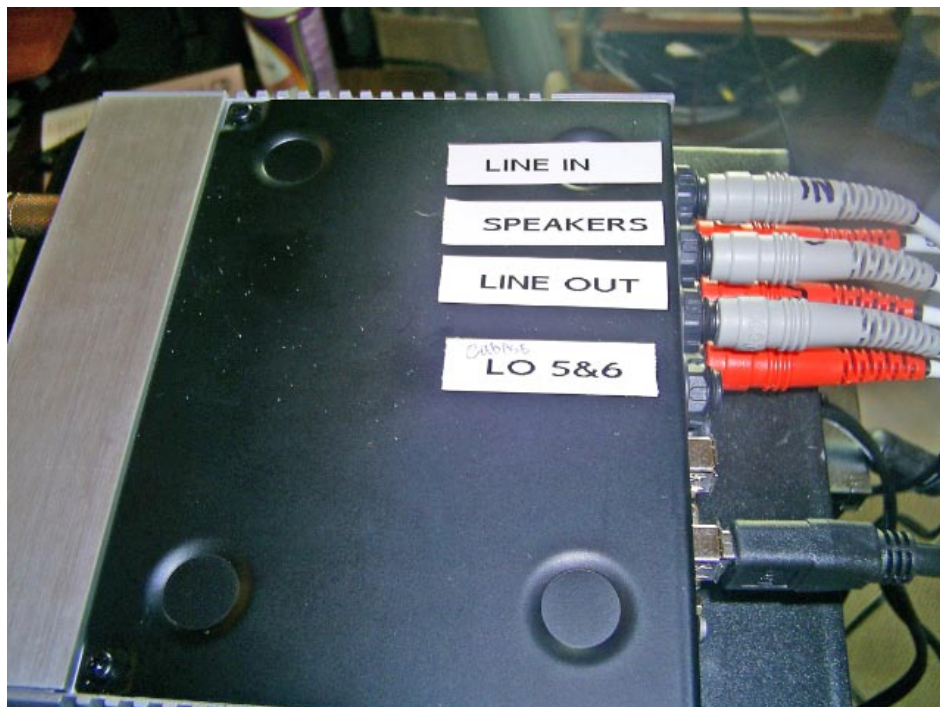


Figure 2.


Step 3. Software (PowerSDR™) Installation and Configuration

Installation

Install the PowerSDR application found on the FlexRadio [Knowledge Base](#) in the Downloads -> PowerSDR Releases (Windows) folder

Follow the prompts to complete the installation.

Configuration

1. Start the PowerSDR™ console software by clicking on the shortcut 
2. Complete the Setup Wizard by following the prompts to configure your system.

Step 4. Connecting to the SDR1000™ (See Figure 3.)



Figure 3

1. **RX I/Q AUDIO:** Connect the cable from the sound card LINE IN port into the **TO LINE IN** jack on the back of the SDR1000™ using the 1/8" TRS connector.
2. **TX I/Q AUDIO:** Connect the cable from the sound card LINE OUT port into the **TO LINE OUT** jack on the back of the SDR1000™ using the 1/8" TRS connector.
3. **RADIO CONTROL:** Connect the beige colored **parallel cable** between the computer and the SDR-1000 **-OR-** Connect the custom **USB cable** between the computer and SDR-1000™. Load the USB driver found on the FlexRadio Knowledge Base in the Downloads->PowerSDR™ Drivers and Utilities
3. **ANTENNA:** Connect an HF antenna to the BNC jack closest to the DC power jacks. The other connector is used for 6 meters or QRP operation if you have the one watt radio.
4. **CW KEY:** Plug your key into the jack labeled CW key.
5. **SPEAKER:** Do **not** connect a speaker to the speaker jack on the back of the SDR when using either the Delta 44 or Presonus sound cards but instead connect your computer *powered* speakers to the end of the Hosa cable with the female 1/8" plug.
6. **MICROPHONE: BEST:** connect the microphone directly to the sound card. On the Delta 44 it's the INS 3 jack. On the Firebox, it's the MIC 1 position on the front of the box. Either of these direct inputs can be wired for either balanced or unbalanced operation.

If an XLR connector is used with the Firebox, the input will provide a low impedance balanced input.

If a TRS 1/4" jack is used with either the D44 or the Firebox, it will result in a high impedance *balanced* input. Using a 1/4" TS jack will result in a high impedance *unbalanced* input

8-PIN MIC CONNECTOR: Refer to the Operators manual for the pin configuration. (The pin-out is the same as that used on Yaesu radios.) When the 8-pin connector is used, the black 1/8" phone plug to 1/4" phone plug cable included with your Hosa cable set must be connected from the MIC out jack on the rear of the SDR1000™ to the either the INS3 on the D44 breakout box or the MIC 1 jack on the Firebox.

7. **POWER CORD.** Connect the dual banana plug to the red and black cable (both included). Insert the plug into the SDR-1000 and attach to a 25A 13.8V power supply.

Step 5. Power on...almost there! (See Figure 4)

1. Press the Power-On button on the front of the SDR1000™

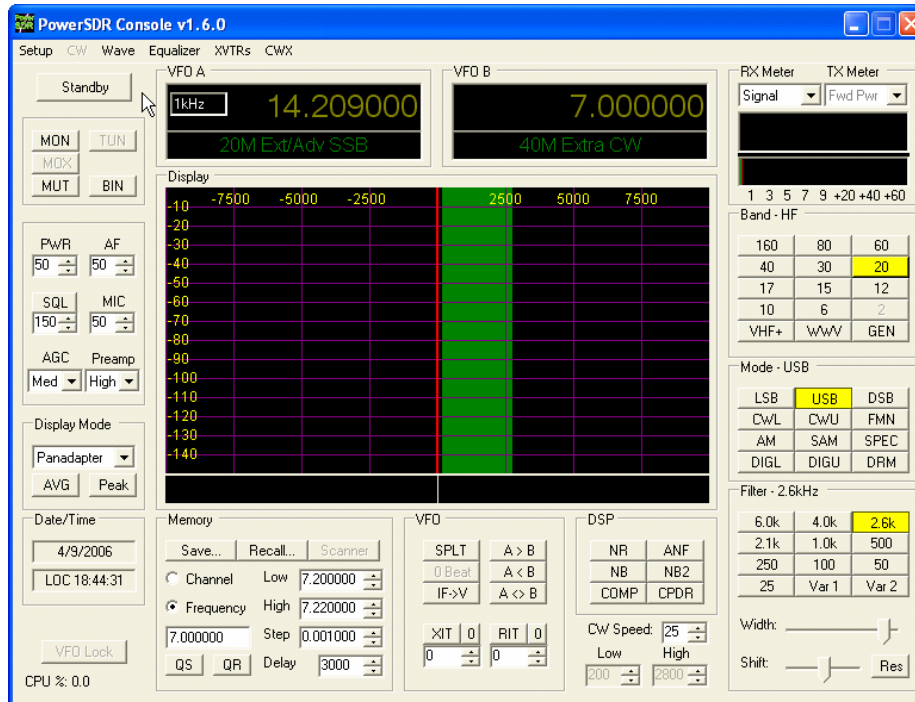


Figure 4.

2. Click on the STANDBY button (top left corner) on the PowerSDR™ panel to activate the software. You should hear the relays click as the radio comes to life.

You can now begin to operate the radio. At first you may be over whelmed by all the controls at your command. This is the point where you really do need to...

READ THE OPERATIONS MANUAL

It is recommend that you start with the **Tuning Methods** (Ch 8 - OPERATION) and Frequency **Calibration** (Page 40 - POWERSDR Calibration) then proceed to the section pertaining to your favorite mode.

Optimum performance is achieved when the SDR-1000™ is calibrated; however, complete calibration of the radio is not necessary to make your first contact. We recommend you complete the calibration procedures as soon as possible. As a minimum, calibrate frequency against WWV and the PA [100 watt units only.] Complete instructions are in the SDR-1000™ Operating Manual.

To further assist you, Expert Setup guides are included on the FlexRadio [Knowledge Base](#) at Support & PowerSDR->Quick Start Guides folder.

Welcome “Flexer” to the exciting world of software defined radios. 73 and good luck.

Where to find resources listed in this document.

FlexRadio Knowledge Base Contents by Folder location

[PowerSDR™](#)

[Initial Installation](#)

[Documentation](#)

- SDR-1000 Quick Start Guide (this document)
- SDR-1000 Operating Manual

[Downloads, Resources & Support Tools](#)

[Downloads](#)

[PowerSDR™ Drivers & Utilities](#)

Components for Windows2000

- MDAC 2.8
- .NET Framework 1.1

Components for Both Windows2000 and WinXP

- Delta 44 Driver
- Presonus Driver/Mixer
- VAC setup and use
- USB adapter driver
- N8BV Virtual Serial port driver
- Griffin Powermate Support
- Contour ShuttlePro v2 Support
- Contour ShuttlePro v2 Default preferences

[PowerSDR™](#)

[Quick Start Guides & System Configurations](#)

[Expert Setups](#)

- Delta 44 Quick Start Guide
- Firebox Quick Start Guide

[Downloads, Resources & Support Tools](#)

[Downloads](#)

[PowerSDR™ Releases \(Windows\)](#)

- PowerSDR™ software