SIMREX CORPORATION

GLB
SYNTHESIZED NETLINK RADIO DATA SYSTEM
(SNRDS II)

OPERATION / TECHNICAL MANUAL
FOR 4-WIRE VERSION

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SNRDS 4-WIRE RADIO
OPERATION/TECHNICAL MANUAL

About these instructions

This manual is a TECHNICAL MANUAL and is written for a qualified radio technician who is fully aware of the FCC and DOC standards. This manual will encompass the software, hardware and any other pertinent information required to connect and use this radio. It's assumed that a non-intelligent computer terminal or a computer having a simple terminal emulator program is available, allowing the operator to access the on-board controller. Basic operation is simple, but the myriad of commands and options provided could be initially overwhelming. Learn the basic commands now and review the list of commands at leisure to develop an appreciation for the capabilities provided. New commands can be studied in detail as required.

Character conventions used are as follows:

CR is a line-feed character, usually a RETURN or ENTER key on a keyboard.

LF is a line-feed, or ^J. Control characters are indicated in the text by preceding the character with " ^ ", and are keyed in by holding the control key down while typing the character.

FCC Digital Device or Peripheral - User Notice

Note:

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular application. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ? Reorient or relocate the receiving antenna
- ? Increase the separation between the equipment and the receiver
- ? Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- ? Consult the dealer or an experienced TV/Radio technician for help

Warning

Changes or modifications not expressly approved by SIMREX Corporation could void the user's authority to operate the equipment. Contact SIMREX on the web at www.simrex.com or by telephone at (480) 926-6069 or (716) 206-0174.

SNRDS 4-WIRE RADIO
OPERATION/TECHNICAL MANUAL

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1.1 Applications:

4 Wire Audio Radio

Audio signaling

1.2 Hardware features:

4-Wire SNRDS is supplied in an RF-tight aluminum housing measuring 9.3 L by 2.25 H by 4.6 W inches (23.6 x 5.72 x 11.7 cm). All interconnects are on the rear panel. Switches and indicator LED's are located on the front panel. Any adjustments that may necessary are inside the enclosure. This arrangement leaves the remaining surfaces unobstructed.

Transmit audio is accepted as either a balanced or unbalanced signal from 0 to -21 dB. Receive audio is supplied as either a balanced or unbalanced +3 to -21 dB. The receive audio is squelch gated but constant audio is available. Pre-emphasis and de-emphasis are not provided in the four wire system.

Radio Synthesizer (both transmit and receive) is provided by an on-board controller..

Communications with the on-board controller can be made via the DB25F connector. Be aware that these signals are compatible with RS232 specs. A RS232 programming cable can be obtained from SIMREX, or built by the user.

1.3 Software features:

Control of Radio parameters such as Step spacing, channel of operation etc. is available to the Qualified Technician.

IMPORTANT FEATURES PROVIDED/AVAILABLE

*Balanced audio output and line isolation are achieved by using 600:600 ohm transformer.

*Limiting and low-pass (splatter) filtering are provided.

*On-board Radio Data Controller for Frequency control.

*Keying of the Transmitter is controlled by the RDC and transmit offsets are automatically inserted.

*EEPROM programming by use of a simple terminal program.

2.0 Installation and Connections

The installation of 4-Wire SNRDS will vary with the application, but in general it involves physical mounting;, providing for an antenna, power supply and connection of the user's equipment. For new or experimental systems the next step is to test the radio path by transmitting and receiving between units. Once the radio paths are proven the units can be permanently installed.

2.1 Physical mounting

4-Wire SNRDS units may simply be placed on any horizontal surface or fastened with screws. Placement should include adequate ventilation and air circulation. High humidity (condensing conditions) and temperature extremes are to be avoided to any extent possible. Consideration should be given to access for adjustment, testing and maintenance. Access to the rear panel for connection to a terminal should be considered. If the mounting position makes access to the connectors difficult, extension cables leading out for easy access could be permanently attached. All connections are on a single connector, except for +12 VDC power. A wiring harness can used to separate the various conductors for audio, keying and terminal connections.

2.2 Front Panel

This panel contains the indicator LED's, and future options such as Channel Select switch and Handset connector.

2.2.1 LED Indicators

There are eight active LED's on the 4-Wire SNRDS unit. A power LED will glow whenever power is applied, TX LED when a KEY signal is applied and not timed-out, RX LED when the Receiver Squelch is open. The TE (transmitter error) LED and the RE (receiver error) LED will only glow if the is a problem in the synthesizer section of the applicable RF unit. The RS and CS LED's will be active if the RS232 channel is active.. The DA LED is for future use.

2.2.2 Channel Selector (future option)

Provisions have been made for the future addition of a Channel select switch. This will allow the user to select 1 of 8 pre-programmed channels for use by 4-Wire SNRDS.

2.3 Rear Panel

The panel contains the RF, Power and Main connectors.

2.3.1 Main connector

All non-RF/Power connections are made with this connector, simplifying the panel and making the removal and replacement of the assemblies easier. A cable is normally made up to separate wires according to the various destinations of each connection. The table of pin connections is followed by the signal name and description is given in section 2.7, the Main Connector.

2.3.2 Power connector

All Power connections are made via this connector. A cable is supplied, with a mating connector and open wire ends for the user connections. The red lead is +12Vdc and the black is ground. Please pay attention to polarity and maximum voltage input of the 4-Wire SNRDS unit.

2.3.3 Antenna connector(s)

The RF connector(s) is a female type (BNC default). Allow enough clearance so the coax cable doesn't have to make a sharp bend. Right angle adapters may help to avoid undue stresses on the cable and its' connector.

The 4-Wire SNRDS is designed for a nominal antenna impedance of 50 ohms. The selection, mounting and physical positioning of the antenna is dependent upon the distance and direction to other stations in the system, and other factors such as the noise environment and frequency of operation. Line-of-sight radio paths are desirable for reliability and are necessary to cover long distances. Directional antennas are useful to increase the distance over which communications are possible, and can be helpful in rejecting interference or noise.

Duplex units are available, having two RF connectors instead of one.

2.4 Adjustments Internal

Typically, the normal user would have no need to open the 4-Wire SNRDS. It is never necessary to replace the internal fuse device as it is self-resetting. Adjustments for receive and transmit audio and the squelch are internal to the unit and should only be adjusted by a qualified technician.

2.5 Cabling

2.5.1 Programming Cable

A programming cable is available from SIMREX to change the internal parameters of the on board microprocessor. These parameters control all of the radio related functions (changing of the radio frequency, time out length, etc.). This cable plugs directly into the DB25 connector on the rear panel of the 4-Wire SNRDS. The other end of the programming cable will then be connected to a terminal or a computer running a terminal emulation program at 9600 baud. A diagram of this cable is shown on section 6.1.1.

2.5.2 User Cable

A user cable is available from SIMREX to connect the various audio/control signals to the 4 Wire SNRDS. This cable is wired for balanced audio connections and a /KEY signal. In the future, an external BCD switch can be added to this cable for Channel selection. A diagram of this cable is shown on section 6.1.2.

2.5.3 Universal 4-Wire Cable

A combination of programming and user cable may is available from SIMREX. A diagram of this cable is shown on section 6.1.3.

2.6 Fuse device

There is a self resetting fuse device internal to the 4-Wire low power (5 watts or less) units. No access is necessary. On the 25 watt unit, there is an inline fuse located on the front of the power amplifier cover (the power amplifier is located on the heatsink). If power is correctly applied and the power LED does not light, an open fuse device is indicated. The fuse device can open due to component failure or if reverse voltage is applied to the unit. Although a protective diode forces the fuse device to open in this case, circuit damage could still occur. Care should be taken whenever connecting power to any electronic device to ensure it is being connected with the proper polarity.

2.7 Main Connector (DB25F)

pin	signal name	signal description
1	GND	
14	RXAF1 +	Unbalanced or balanced-high receive audio (also known as RXAF-HI)
2	TXD	DATA IN - RS232 - for controller programming
15		
3	RXD	DATA OUT- RS232 - for controller programming
16	TXAF1 -	Balanced audio return for transmit audio (also known as TXAF-LO)
4	RTS	Flow control in - RS232 - for controller programming
17		
5	CTS	Flow control out - RS232 - for controller programming
18	KEY OUT	TTL - active low signal - indicating the keying of the transmitter
6	DSR	Connected to +12 VDC
19	RXAF1 -	Balanced audio return for receive audio (also known as RXAF-LO)
7	GND	
20		
8	P-DCD	Connected to +12 VDC - Optional connection to squelch
21	SW0	TTL - active low signal - Bit 0 for BCD switch control (future option)
9	SW1	TTL - active low signal - Bit 1 for BCD switch control (future option)
22		
10	RST	TTL - active low signal - to reset the unit
23	SW2	TTL - active low signal - Bit 2 for BCD switch control (future option)
11		
24		
12	KEY IN	TTL - active low signal - for keying of the transmitter via the controller
25	DISC	Unfiltered, DC coupled discriminator output
13	TXAF1 +	Unbalanced or balanced-high transmit audio (also known as TXAF-HI)

3.0 Initial testing

There are three major components to connect: a power supply, the audio and keying interface and an antenna. It's a good idea to connect the antenna (or a dummy load) first, to avoid transmitter operation without a load. A terminal, be it an ASCII terminal or a computer running a terminal program, using a programming cable, can be connected if radio parameters have to be entered or changed. When the power supply and antenna is connected to the 4-Wire SNRDS a preliminary test can be made.

No warm-up time is required, as no crystal ovens are used.

3.1 Terminal interface

A dumb terminal (or computer with a terminal emulator program) should be set for 9600 baud, 8 bits, no parity and 1 stop bit. The number of stop bits is important; if mismatched it may work fine for testing by hand typing, but fail when data is transferred at high speeds.

The SIMREX supplied cable comes as a standard RS232 male to female on Comm 1 and is all that is needed to communicate with most terminals and computers. The Comm 2 connector is wired for audio signals. Baud rate of the on-board processor is preset to 9600 baud.

When power is removed and restored to the unit, the processor should sign on with the message:

TEST CODE-2 CA V0.03B SN xxxxxx (xxxxxx is the Electronic S/N of the unit)

If nothing happens or if a garbled character stream appears repeat the procedure. A garbled sign-on may mean it's somehow missing the correct baud rate. The standard baud rate is 9600, but it can be changed under software control and saved to the EEPROM.

Be aware that the communications interface is only Full RS232 5 wire. RTS/CTS flow control can be used as well as XON/XOFF. These are software selectable and can be saved to the EEPROM (see the SNRDS manual for more information).

3.2 Setting radio frequencies

The frequency settings are typically stored in the EEPROM at the factory. If not, once the frequencies are setup in the radio they can be stored to the EEPROM and it will be initialized to the given channel(s) even if power is lost.

Frequency control software is written for flexibility on different RF sections, requiring a few preliminary entries; Channel step spacing (RS), intermediate frequency (RI) and receiver synthesizer divide modulus (RM). Since calculations are performed on each entry to check consistency, a channel spacing value must be present before the 4-Wire SNRDS will allow any other entries.

3.2 Setting radio frequencies (continued)

Note: These settings are mandated by the particular radio section being used and values are supplied in the EEPROM to match the hardware for any particular 4-Wire SNRDS. **The following examples are shown for reference only.**

All frequencies are entered in kilohertz to the nearest ¼ or ½ kilohertz. The commands must be terminated with a CR. Channel selection must be consistent with channel spacing: that is, any selected frequency must be a multiple of the reference frequency selected with RS. It also must be within range limits or the entry is ignored and an error (?) is indicated. For example, to set the channel step spacing to 12.5 Khz:

RS 0-12.5<CR>

The "RS" is enter and the "0-" is sent by the controller to show the previous value; 12.5<CR> is then entered to set the reference frequency. The Characters "<" and ">" are not typed; they indicate the enclosed sequence is a keystroke.

Next, check the receiver synthesizer modulus; this is set to 64 below 300 MHz and 128 at higher frequencies. Set it to 128:

RM 64-128<CR>

The receiver's IF is a signed value, where a negative value indicates that the local oscillator is on the low side of the signal frequency and a positive indicates it's on the high side.

RI 0-21400<CR>

This "-" is not a minus sign; it's the usual prompt for input sent by 4-Wire SNRDS in response to a command.

The user may change the remaining commands. The first two entries set the range limits for entered frequencies, RL and RU, for lower and upper limit, respectively. These limits offer some measure of protection against accidental operation on unauthorized frequencies. Before any channel frequency command is accepted, the requested frequency is compared to these limits; if out of range, an error is indicated and the frequency is not accepted. Assuming the allowable limits to be 425 and 430 MHz:

RL 455000-425000<CR>

RU 470000-430000<CR>

3.2 Setting radio frequencies (continued)

The RC command is added for channel selection, and optionally, a channel switch can be provided that allows panel selection of these predetermined frequencies. Frequencies are entered independently by selecting a channel, then entering them with RR and RT, or RX in the normal way.

Default frequencies can be supplied with the order, so that a set of initial frequencies is automatically filled in from the EEPROM on reset. The number of channels can be specified when ordered. Simply changing the RC command can change the active channel. Assuming that we want channel 6:

RC 8-6<CR>

Next, a receiver frequency is entered:

RR425000-425025<CR>

And a transmitter frequency:

RT 425000-425025<CR>

If the same frequency is being used for both the RX command can be used, and it will fill in both receiver and transmitter frequencies:

RX 425000-425025<CR>

There is another variable involved if the receiver and transmitter operate on the same frequency: RO, for transmitter Offset. The 4-Wire SNRDS transmitter VCO operate continuously, even in receive mode. The presence of this on-channel signal at close proximity to the receiver (inside the housing) would cause interference to received signals. To avoid this problem the transmitter VCO is shifted to a nearby frequency just far enough to avoid interference. When the transmitter is keyed it's simultaneously shifted back to the actual transmitted frequency. The reason for this strategy is, it takes less time to shift the transmitter a small amount than to lock it from scratch each time it's keyed, resulting in faster turnaround time. RO accepts a signed value such as "-200" to shift the transmitter 200 Khz lower during the receive operation. The best offset to use is normally preset in the EEPROM default values, so this command is described mainly for reference purposes.

RO 0--200<CR>

Note: Here we really do have a minus sign!

3.3 Technical Description

The 4-Wire SNRDS consists of 6 subassemblies; a Mother Board (SMBTR), a Radio Data Controller (RDC), an Audio Interface Board (AUD), a Receiver (RCVR), a Transmitter/Exciter (TXEX2), and a Power amplifier.

3.3.1 Radio Data Controller

This is considered the Radio Control interface board. It consists of a Radio Data Controller without the modem. It employs a Z80180 Microcontroller with peripherals for radio and synthesizer control, and RS232 serial communications with the user. This section also contains an EEPROM for parameter and frequency storage. In the future a multi-channel switch can be provided on the motherboard, or connected to the Main Connector for radio channel selection.

3.3.2 Audio Interface Board

Transmit audio is accepted (balanced or unbalanced), amplified, limited and lowpassed before being provided to the transmitter. Receiver audio is gated and amplified and provided to the user in either balanced or unbalanced form. A Squelch circuit is provided for gating of the receiver audio.

Optional circuitry can be provided for Voice capability using a handset or speaker/microphone. Transmit audio from the microphone, multiplexed with the PTT signal, is accepted, demultiplexed, pre-emphasized, amplified, limited and low-passed before it is prioritized. The output is then sent to the transmitter with a level of 1Vp-p.The receiver audio is gated, de-emphasized, and amplified and the output sent to a speaker. A high level option (500mWoutput to the speaker) is available if required.

3.3.3 Mother Board

This Board provides interconnect capability for the other five PC Boards, reverse power protection and power distribution. There is a capability on this PC board for the mounting of a multi-channel switch, and a handset interconnect. The normal user interface is provided by a DB25F for signals, and a separate connector for power.

3.3.4 Receiver

The receiver has its own frequency synthesizer, controlled by a serial data stream from the controller. It features four helical resonators in the front-end, a RF amplifier, a double balanced mixer and a 21.4 Mhz IF amplifier with a bandpass crystal filter. A second mixer results in an IF of 455 Khz, where a ceramic bandpass filter supplements the selectivity provided in the first IF. The discriminator output is filtered in an active low-pass filter and fed to the Audio PCB.

3.3.5 Transmitter/Exciter

The transmitter has its own frequency synthesizer, controlled by a serial data stream from the controller. The synthesizer VCO operates directly at the output frequency, and its output is fixed to approximately 1mW. Modulation is applied directly to the TCXO, and the synthesizer. The loop time constants are chosen to allow flat modulation low-frequency response to 150 Hz. An interlock prevents transmitter operation if the synthesizer is not locked.

3.3.6 RF Amplifier

The amplifier can be housed within the main unit at up to 5 Watts, and within an external heatsink shield and power amp up to 25 Watts. The amplifier consists of three stages. The first two of these stages operate in class A, while the output stage operates class C for high efficiency.. A low-pass harmonic filter follows, which feeds a reflectometer for mismatch load protection and power adjustment. A T/R switching is implemented with PIN diodes, and the receiver antenna connections into the receiver port of the switch on the amplifier assembly.

3.4 Specifications:

Temperature range:	-30 to +60 degrees C no warm-up time
Humidity:	0 to 99% RH, non-condensing
Size:	9.3 L by 2.25 H by 4.6 W inches (23.6 x 5.72 x 11.7 cm)
Weight:	1.75 lb. (.7 kilograms)
Power Requirements:	12.5 volts DC, negative ground
Current Drain:	300mA receive, 1800 mA transmit
Input and output frequency:	flat response - 300-3000 Hz
Controller:	GLB Radio Data Controller
Serial rate:	9600 baud, RS232 5 wire typical
EEPROM:	256 byte serial EEPROM

Frequency range available is from 100-1000 MHz. Specifications vary with frequency, shown here for the 450-470 frequency band.

RADIO	MIN.	TYP.	MAX.	UNITS, COMMENTS
Range by retuning:	450	---	470	MHz
Range without retuning:	---	2.0	---	MHz 3db degrading of sensitivity
Antenna impedance:	---	50	---	Ohms nominal
Frequency stability:	---	---	+/-2.5	PPM full temp
Operation temperature:	-30	---	+50	Degrees Celsius
Turnaround time:		25	---	milliseconds
Current drain, receive (standby):	---	----	300	milliamperes
Current drain, transmit:	---	---	1800	milliamperes
Conducted spurious:	---	---	-57	dBm*
Transmitter				
Output power:	---	5	---	Watts into 50 ohms @ 13.6 VDC
Spurious & harmonics:	---	---	-13	dBm*
Audio input impedance:	---	600	---	ohms
Receiver				
Sensitivity:	---	-118	-117	dBm 12 dB SINAD
Spurious & image rejection:	70	---		dB
Adjacent channel rejection:	70	---		dB @ 25 Khz
Intermodulation:	70	---	---	dB, third order

*FCC/DOC requirement limit; tighter frequency tolerances available.

4.1 RADIO ADJUSTMENTS

The radio has adjustments for receiver balanced audio output level, voice receiver speaker level (if included), balanced transmitter level, voice microphone level (if included), deviation and the squelch level. These adjustments should be only made by a QUALIFIED radio technician who is knowledgeable of the FCC and DOC requirements for this radio. If adjustments are made to the radio, it is the user's responsibility to assure the unit adheres to FCC & DOC requirements.

4.1.1 Balanced Receive Audio Adjustment

The receive audio output is adjustable from +3 to -21 dBm.. This audio is squelch gated, but a constant audio option is available. To adjust the receive audio level, input an 'on channel' signal with a user required tone, into the receive antenna port with an RF level high enough to fully quiet the receiver. Connect an oscilloscope to the receive audio output (Pin 14 on the DB25F is RXAF1+ and pin 19 is RXAF1-). Adjust R29 for the required audio output (refer to figure 6.2.1 for the location of R29 on Audio PCB).

4.1.2 Balanced Transmit Level Adjustments

The transmit audio input range is from 0 to -21 dBm. To adjust the transmitter output level, connect a radio communications test set (i.e. IFR, Marconi, etc.) to the transmit antenna port. Connect the user operating signal level to the transmitter audio inputs (Pin 16 on the DB25F is TXAF1- and pin 13 is TXAF+). Key the transmitter and adjust R35 until the waveform at TP6 on the audio board, begins to clip (refer to figure 6.2.1 for location of R35 and TP-6 on the Audio PCB). This level will result in a 1Vp-p signal at the Transmitter input (TP-7).

4.1.3 Voice Receive Audio Adjustment

The receive voice audio is adjustable and will result in approximately 0.1 Vrms into an 8 ohm speaker (1.25mW of audio) at the point of clipping. There is a 0.5 Watt option if required. The Audio is de-emphasized and squelch gated. To adjust the audio level, connect the radio to a radio communications test set (i.e. IFR, Marconi, etc.) and set the RF generator to on on-channel frequency with a RF level high enough to fully quiet the receiver and open the squelch. Modulate the carrier with a 1 Khz tone and at the proper deviation for the frequency being used. Adjust the receive audio level using R1 for the desired amplitude (see figure 6.2.1for the location of R1).

4.1.4 Voice Transmit Audio Adjustment

The microphone transmit audio input range is from 10mV to 50mVp-p. To adjust the microphone level, connect a radio communications test set (i.e. IFR, Marconi, etc.) to the transmit antenna port. Connect the output from an audio generator to the microphone input. Set the audio level to match that of the microphone being used. Set the audio frequency at 1 kHz. Adjust R12 until the waveform atTP6 on the audio board just enters clipping (refer to figure 6.2.1 for the location of R12 and TP-6). This will result in a 1Vp-p signal at the Transmitter input.

4.1.3 Deviation Adjustment

If adjusting the deviation using the balanced audio section, connect an audio generator to the balanced input of the SNRDS radio. Set the output level of the generator to obtain the proper clipping at TP6 (see figure 6.2.1.for the location of TP6) Increase the output level 16 dB and key the transmitter by grounding the KEY IN line (Pin 12 on the DB25F is the KEY IN signal). The transmit deviation required for the application, can be adjusted with the input level pot, R29 of the transmitter (refer to figure 6.2.3 for location of R29).

If adjusting the deviation using the voice section of the audio PCB, then connect the audio generator to the microphone input of the SNRDS. Set the output level of the generator to obtain the proper clipping at TP-4 (see figure 6.2.1 for the location of TP-4). Increase the output level by 16 dB and key the transmitter. The transmit deviation required for the application, can be adjusted with the input level pot, R29 on the transmitter (refer to figure 6.2.3 for the location of R29).

The output of the audio PCB is limited. If the deviation is adjusted it is the users responsibility to set the transmit deviation such that it can not be greater than the specification established by the FCC and DOC for the frequency band of operation.

4.1.3 SQUELCH ADJUSTMENT

The squelch is a noise type which also gates the receive audio. To adjust the squelch properly an on channel signal must be input into the receive antenna. This is best accomplished by using a communications test set, since the signal level is easily adjusted. The technician can tell whether the squelch is open or closed by looking at the receive audio since it is gated or by looking at the RX LED on the front of the units. If the squelch is open, the receive audio will be on and the RX LED will be lit. If the squelch is closed, the receive audio will be off and the RX LED will be off. Turn off the input signal to the radio. Adjust R46 (refer to figure 6.2.1 for location of R46 on the Audio PCB) until the squelch closes. Turn on the input signal at the least possible signal level (approximately -135 dBm). Increase the input signal until the squelch opens. Increase the signal level 3 dB. Adjust R46 such until the squelch just opens. The squelch is now properly adjusted.

5.0 COMMAND SUMMARY

This listing of commands is a subset of the SNRDS/RDC command set. Many more commands are available to the user, and can be found in the SNRDS/RDC manuals. The commands here are only the basic commands needed to use the 4-Wire SNRDS radios.

The following commands are used in conjunction with SIMREX's GLB Synthesized Radios for setting frequencies. Frequency entries are in kilohertz to the nearest ½ or ¼ kilohertz depending on the frequency range used.. Channel selection must be consistent with channel spacing and range limits or the entry is ignored and an error is indicated. For example, to set channel spacing to 12.5 Khz

RS 0-12.5

The "0-" is sent by the controller to show the previous value.

There are 11 Basic Radio setup commands:

RS sets the channel spacing frequency in Khz.

RL sets the lower limit frequency in Khz.

RU sets the upper limit frequency in Khz.

RR sets the receiver frequency in Khz for the selected channel pair.

RT sets the transmitter frequency in Khz for the selected channel pair.

RX sets identical receiver and transmitter frequencies for the channel.

RI sets the receiver IF as a signed delta frequency in Khz.

RO sets the transmitter offset as a signed delta frequency in Khz.

RM sets the receiver synthesizer modules (32, 64 or 128).

RF sets the reference crystal frequency in Khz.

Future Command

RC selects the current channel (1 to 8). Internal/External Switch input can replace the use of this command

5.0 COMMAND SUMMARY (continued)

Most of the following 'D' commands are intended for use as diagnostic, debugging or servicing aids. Descriptions are included here for the convenience of some users. They can be dangerous in terms of program function. *These commands can used without guarantees*.

There are 4 basic debug commands:

DC	keys the transmitter on the operating frequency until 'Q' hit.
DU	allows a write of the current configuration to the EEPROM
DOC	writes the current configuration to EEPROM.
DPxxxx yyyy	reads from the EEPROM from address xxxx to address yyyy.

.

5.0 COMMAND SUMMARY (continued)

There is 1 special transmitter command:

Caution: *This command will adjust parameters on the transmitter. If adjusted wrong, the unit will not operate correctly. These values can be different for every radio manufactured. It is suggested that the user* **NOT** *adjust these commands.*

XT Will reply ”XTO-xxx”
(a change xxx can be then be entered)

This indicates the amount of offset voltage required to place the transmitter synthesizer within the lock range.

Enter “B” Will reply “XTB-xxx”
(a change xxx can be then be entered)

This allows the adjustment of the balance between the modulation of the TXCO and the VCO loop.

Enter “N” Will reply “XTN-xxx”
(a change xxx can be then be entered)

This allows adjust of the fractional divide by N reducing the amount of reference on the signal.

Enter “G” Will reply “XTG-xxx”

This allow adjust of the VCO Loop gain, allowing adjustment to result in constant deviation over the tuning range of the exciter.

Enter “S” Will reply “XTG-xxx”

This saves the information entered above to a section of Ram that will be saved the to EEPROM when the commands “DU” “DOC” are entered.

Enter “Q” Will reply with a “:” prompt.

This leaves the command sequence.

5.1 COMMAND EXPLANATIONS

"RS" Command

Sets the channel spacing frequency in Khz.

Since all configuration frequencies are stored as "NA Values" (frequency divided by channel spacing), the channel spacing must be the first value entered. Whenever the channel spacing is changed, all stored NA values must be recalculated (multiplied by the old channel spacing and then divided by the new channel spacing.). In this case, the transmitter and receiver synthesizers must also be reprogrammed.

"RL" Command

Sets the lower frequency limit in Khz.

This parameter is stored in NA format and requires that the channel spacing frequency be initialized. Any receiver or transmitter frequency will be rejected as an error if it is less than this limit.

"RU" Command

Sets the upper frequency limit in Khz.

This parameter is stored in NA format and requires that the channel spacing frequency be initialized. Any receiver or transmitter frequency will be rejected as an error if it is greater than this limit.

"RC" Command

Selects the current channel (1 to 8).

There is a table of channel pairs and the RR, RT and RX commands operate directly upon the currently selected table entry. When the channel is changed, both the transmitter and receiver synthesizers are reprogrammed. In the future there will be an internal or external 3-bit BCD input switch which also selects the current channel. When this input changes, the effect is identical to the equivalent "RC" command.

"RR" Command

Sets the receiver frequency in Khz for the selected channel pair.

This parameter is stored in NA format and requires that the "RS", "RL" and "RU" command values are initialized. When a valid receiver frequency is entered, the receiver synthesizer is reprogrammed. The stored value represents the receive frequency; a signed IF offset frequency is added when the receiver synthesizer is programmed.

5.1 COMMAND EXPLANATIONS (continued)

"RT" Command

Sets the transmitter frequency in Khz for the selected channel pair.

This parameter is stored in NA format and requires that the "RS", "RL" and "RU" command values are initialized. When a valid transmitter frequency is entered, the transmitter synthesizer is reprogrammed. The stored value represents the operating transmitter frequency. If the transmitter is not keyed, a signed offset frequency is added when the transmitter synthesizer is programmed.

"RX" Command

Sets the receiver and transmitter frequency to the same value for the selected channel pair.

This is identical to a combined "RR" command and "RT" command where the same frequency is used. When a valid frequency is entered this way, both the transmitter and receiver synthesizers are programmed.

"RI" Command

Sets the receiver IF as a signed delta frequency in Khz.

This parameter is stored in NA format and requires that the channel spacing frequency be initialized. When a valid offset frequency is entered, the receiver synthesizer is programmed. (The offset is added to the current receiver operating frequency when the synthesizer is programmed.)

"RO" Command

Sets the transmitter offset as a signed delta frequency in Khz.

This parameter is stored in NA format and requires that the channel spacing frequency be initialized. When a valid offset frequency is entered, the transmitter synthesizer is programmed. (The offset is added to the current transmitter operating frequency when the synthesizer is programmed and the transmitter is NOT keyed.)

"RM" Command

Sets the prescaler modules for the receiver synthesizer (32, 64 or 128).

When a valid entry is made, the receiver synthesizer is programmed.

5.1 COMMAND EXPLANATIONS (continued)

"RF" Command

Sets the reference crystal frequency in Khz.

This parameter is stored in NA format and requires that the channel spacing frequency be initialized. When a valid entry is made, both the transmitter and receiver synthesizers are programmed.

"DC" Command

This will key the transmitter until 'Q' is entered.

"DU" Command

Enables EEPROM for a Write command..

"DOC" Command

Writes the configuration to EEPROM.

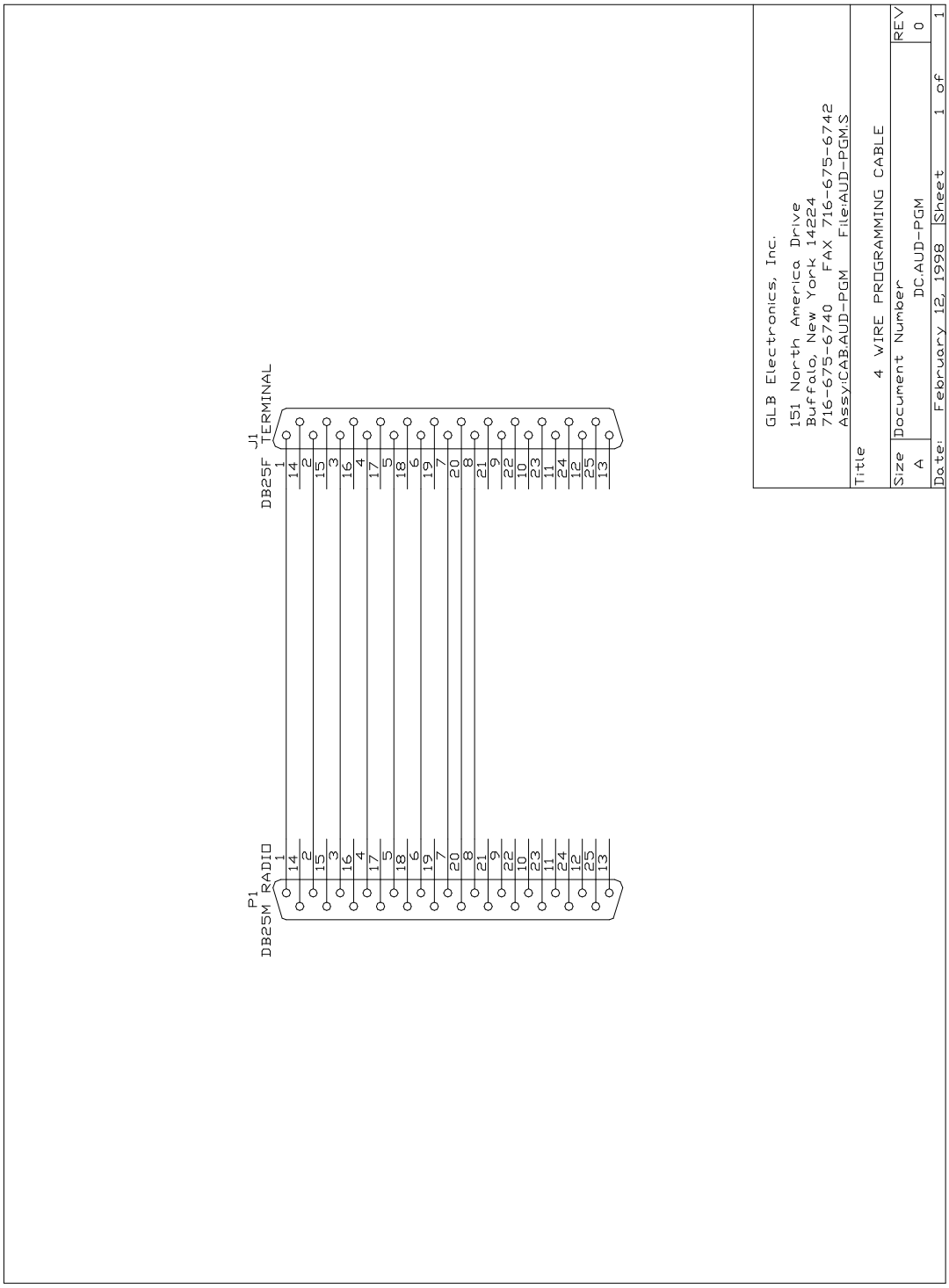
"DPxxxx yyyy" Command

Reads the contents of the EEPROM from address xxxx to yyyy.

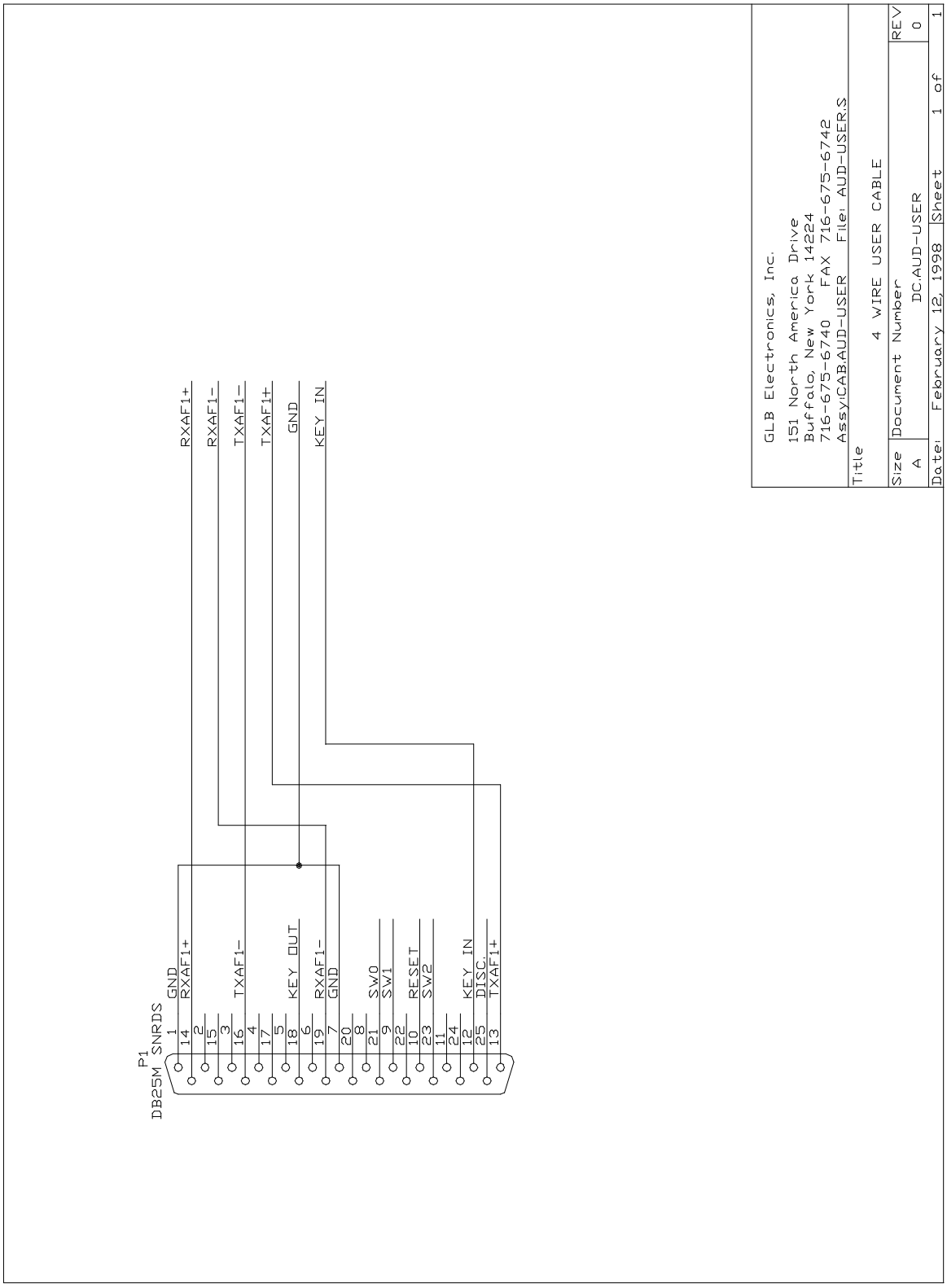
6.0 Figures and Drawings

6.1 Cables

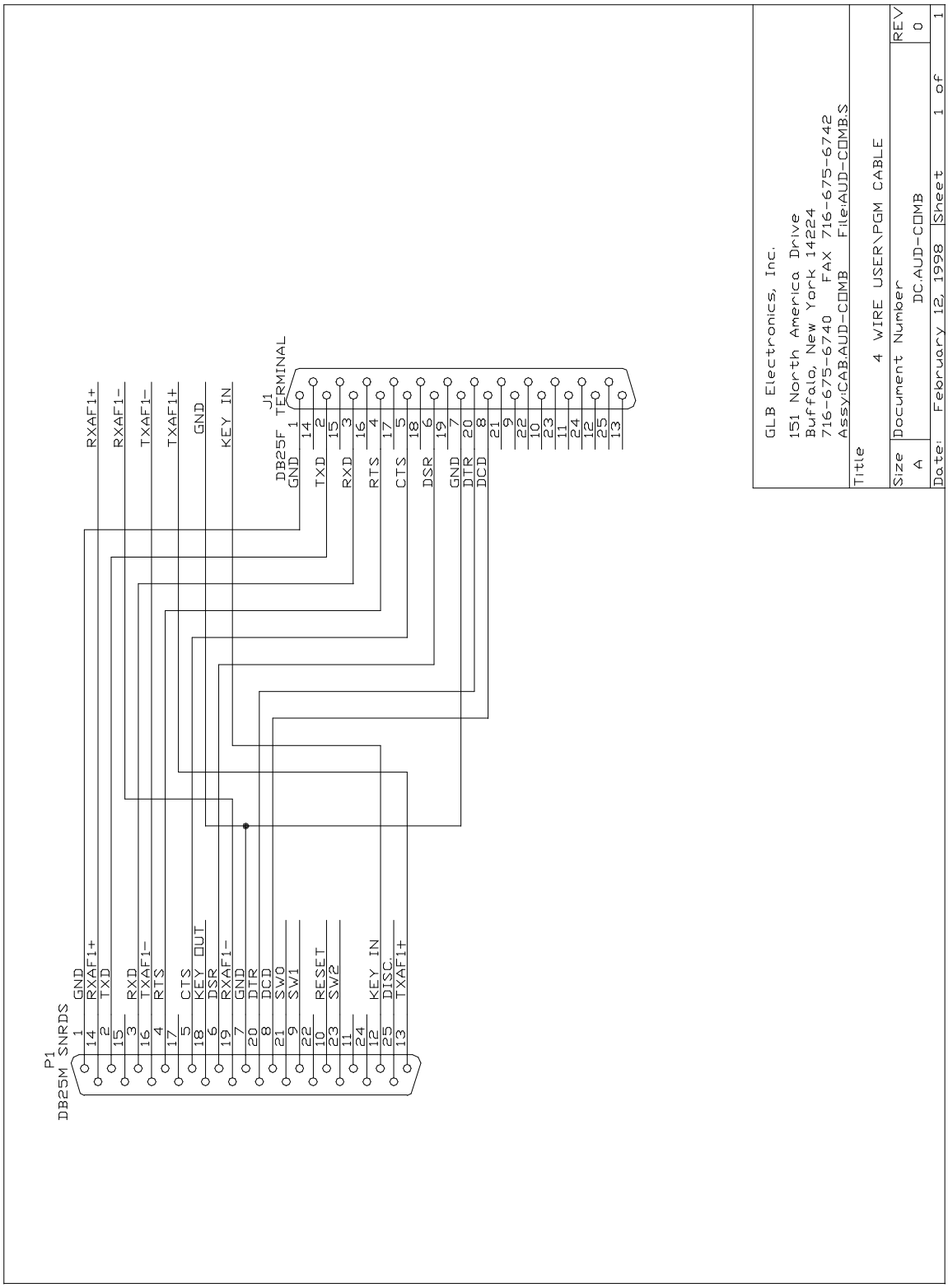
6.1.1 Programming Cable



6.1.2 Cable - user

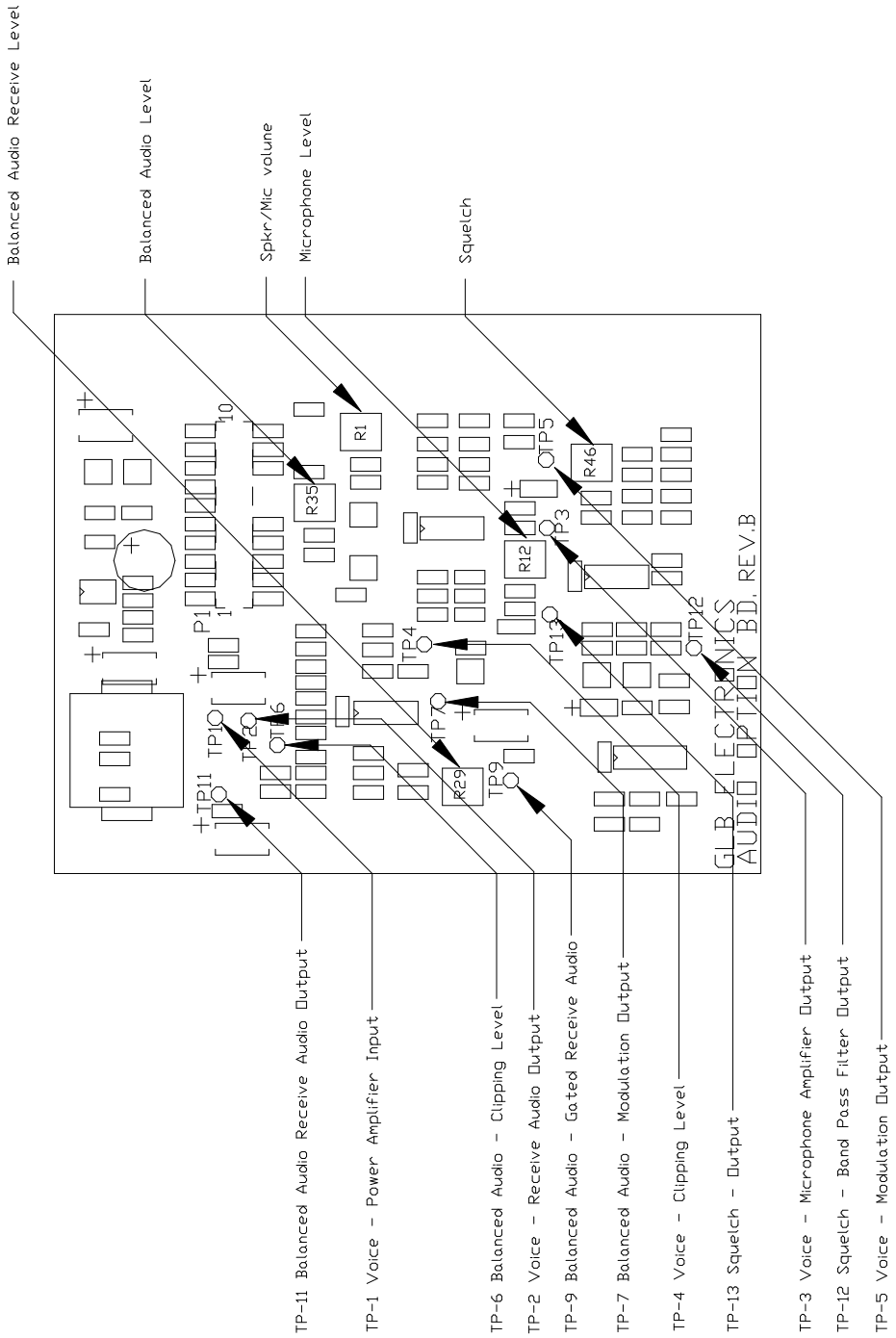


6.1.3 Cable - Combination

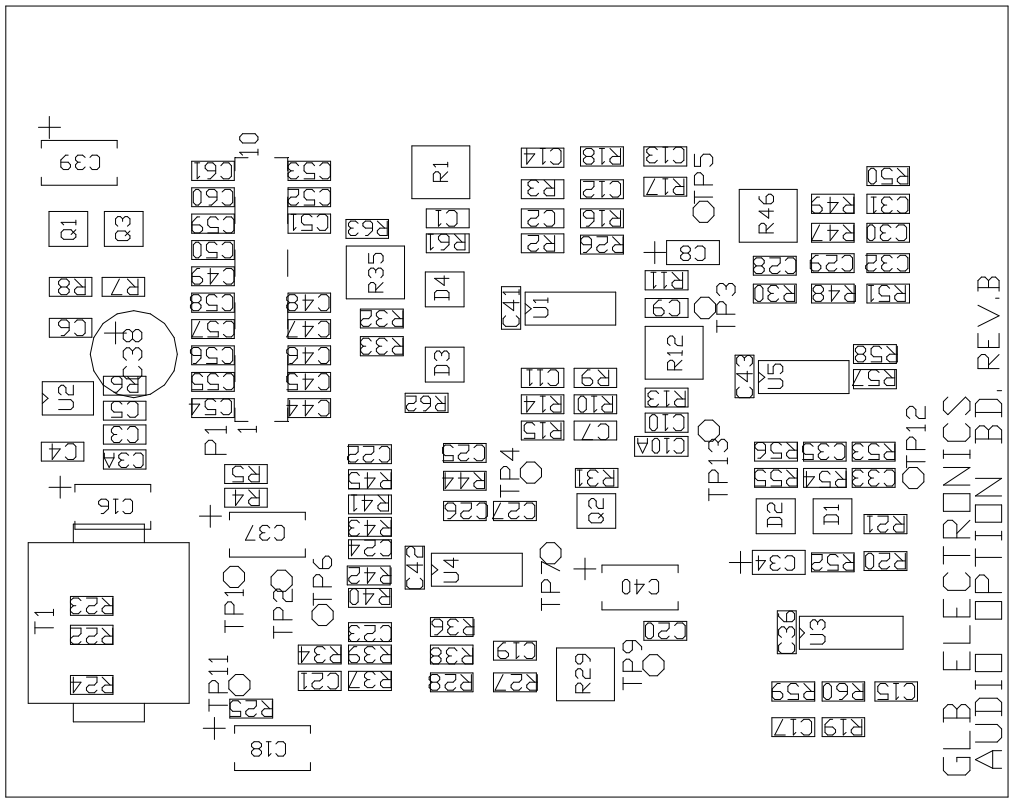


6.2 PCB Layout and Component Locations

6.2.1 Tuning and Test Points Audio PCB



6.2.2 Parts Placement Audio PCB



6.2.3 TXEX Top Side Layout