RRX Series Repeaters-Short Manual

Tuning and Pinout info:

Attached are some pages from the RRX Series Repeater Manual (RRX-MRM).
The full manual can be purchased from Ritron Sales on 1-800-872-1872.

They cover tuning points for the repeater and connection points for external controllers.

To program the repeater requires the software and programming cable. These are available as a kit (RPT-PCPK-3.0). Call Ritron Sales for price.

The repeater must be put in the programming mode as follows: Use a paper clip, or similar item, to hold in the programming button while powering up the repeater. The access hole for the programming button is to the right of the Mic jack on the right side of the front panel. It may or may not have a plastic plug in the hole.
Power down to get out of the programming mode.

8. EXTERNAL CONTROLLER INTERFACE SETUP

8.1 RRX-450 AND RRX-452 SETUP

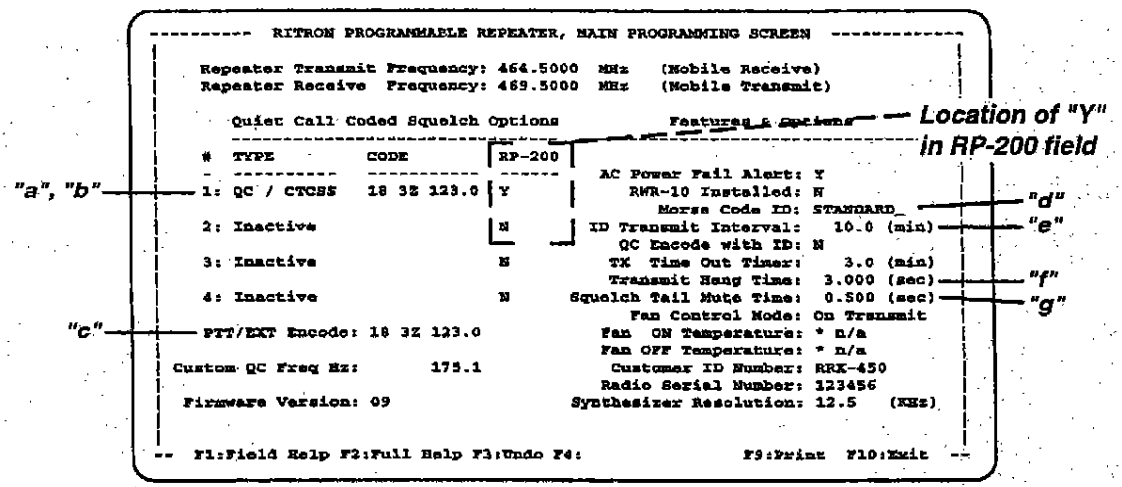
The RRX Control Board has five PJ's (Programmable Jumpers), factory-set so the RRX Repeater will function without the need for any changes, out-of-the-box, in either Conventional Mode, or with an External Controller (provided the External Controller is properly connected by a properly wired interface cable). ALL RRX Control Boards Rev. F and higher (i.e. – having five PJ's), are factory-set as follows:

PJ401	"A"	Audible tone (Morse Code, Power Fail Alert), controlled by RRX µP. ("B" = continuous)
PJ402	"B"	High Pass audio for conventional Repeater use. (A = 10 to 3000 Hz)
PJ403	"A"	For default mode: CTCSS decoder ignored when the REPEAT DISABLE line is grounded by the External Controller. (B = disconnect subaudible decoder)
PJ404	"A"	For default mode: this is the REPEAT DISABLE line to be grounded at the External Controller. (B = Test)
PJ405, PJ406		NOT INSTALLED.
PJ407	"B"	SQ/ Carrier Detect (LO) output to DB-25 (4). The Carrier Detect LED may glow dimly if it is grounded externally; this is acceptable. (No Signal = +5 V)
J401	4 - 7	Ensure a 1 k ohm resistor is inserted in pins 4 - 7; removed if an RP-200 is installed in J401).

The automatic Internal/ External Controller selection functions ONLY if the following are set:

***a.** Quiet Call Code #1 MUST contain a QC (NOT DQC) tone. Hint: 100 Hz is easy to use for testing.
***b.** RP-200 field must be labeled "Y" for Yes; this indicates an External Controller will function.
***c.** For testing, "PTT/ EXT Encode" to the same QC as "a." above.
***d.** "Morse Code ID" is optional. A blank field turns the ID feature "OFF."
***e.** "ID Transmit Interval": DO NOT ENTER ZERO. Refer to "d." above.
f. "Transmit Hang Time": set as short as desired (LTR = 0.031). (e.g. mobile fade delay; Conventional ≅ 1.0 sec.)
g. "Squelch Tail Mute time": set as desired (LTR = 0.031). (Conventional > 0.3 sec.)
h. Disconnect the 6-pin plug to J402 if you are not using DC/ TONE REMOTE terminal inputs.
***i.** Install a 1 k ohm 1/4 watt leaded resistor in J401, pins 4 - 7, to defeat CTCSS when External Controller is connected.
***j.** DB-25, pin 19, GRN wire, to C464, neg. input side, for direct (i.e. DC) DISCRIMINATOR AUDIO connection.

** Factory settings*



RRX-450 and RRX-452 Programming Software Screen

The Repeater may be set as shown above on 464.500 MHz (including the 1 k ohm resistor), without an RP-200 installed, if optional rear panel DB-25 ACCessory connector RRX-ACC is ordered installed.

For the reasons outlined below, RITRON advises you to adjust the External Controller's levels to the RRX Repeater, rather than adjusting internal control levels of the RRX Repeater:

1) Not adjusting internal control levels of the RRX Repeater leaves it operational in Conventional mode when it is separated from the Controller. **2)** Repeaters that are kept at STANDARD factory settings can be "hot swapped" for site repair as needed. **3)** Controllers that have been adjusted to the standard Repeater(s) can also be "hot swapped" and expected to function nominally. **4)** The RRX-ACC option adds a nonadjustable, DC direct DISCRIMINATOR AUDIO output. **5)** The Controller does not function at all when it is disconnected from the Repeater. **6)** The Repeater will function if it is left ready for default.

You may need to modify some Controller inputs and/ or outputs op amp gain stages. Some have fixed resistors on PJ's that only allow choices of unity or too little or too much gain. Inserting a pot in series with the low gain PJ pins (with unity gain shorting jumper removed) will give you the adjustable control needed to set Controller's listed optimum values.

27. RRX-ACCESSORY CABLE PINOUT TECHNICAL NOTES

RRX-ACC (optional internal wiring to back panel DB-25F) and RRX-GCI, -TNT, -RMC Cable(s) color codes are the same throughout, with one exception. Not all wires are used in any one particular installation. Unused lines should be left unterminated as these connections are often in parallel with similar inputs. Grounding an unused line may or may not have an undesired effect. e.g.: Grounding a second PTT line will send the RRX-450 into Transmit Mode, while Grounding a second audio input line will have no adverse effect. Check carefully. Notes below provide details, drive levels, and impedences.

RRX-GCI WIRING COLOR CODES:

PIN	WIRE COLOR	PIN	DESIGNATION/ USE
DB-25		*J411*	
1	Drain Wire	--	Single Point AUDIO ground for foil shield ONLY
2	Bus Bar/Black	--	CHASSIS GROUND/NEGATIVE POWER connection. See notes.
3	Orange	4)	TX AUDIO voice input (filtered internally for 300-3000 Hz, 0.6 V P-P = 3 KHz Dev
4	Blue/White	6)	CARRIER DETect output (LO, if PJ407 in "B" position)
5	Green/Black	8)	TONE SQuelch QC/DQC detected (LO)
6	Blue/Black	10)	Signal Ground (path for PTT) (not intended for power)
7 – 13	N/C		
Second Row:			
DB-25		*J411*	
14	Green/White	1)	RX Audio Output (DC blocked). (FACTORY TEST POINT. ADJUST R475 TO SET 2.1 V P-P on this line with a strong RF carrier modulated with a 1000 Hz tone @ 60% of max dev.)
15	Blue	3)	CTCSS/DCS IN Subaudio/Trunking Data INPUT to TX (0.4 V P-P Nominal = 0.6 KHz deviation)
16	Red	5)	+12 Volt, 1.0 A max, unfused
17	White	7)	PTT External TX command line. LO for TX.
18	Orange/Black	9)	REPEAT DISable = External Controller Enable; LO
19	Green	--	C464) True Discriminator out for Trunking Data + RX Audio Output (no DC block)(3.0 KHz dev = 0.7 V P-P).
20	N/C		
DB-25		*J-402*	
21	White/Black	1)	REMOTE TX AUDio voice input (will be filtered to 300 – 3000 Hz) (0.031 V P-P = 3.0 Khz deviation)
22	Black	2)	Extra signal ground pin; no wire connection in any external cable; only connected internally to pin.
	V+	3)	
23	Black/White	4)	MONITOR Control Line (RWR-10 must be set to "YES"; GND = CAR SQ)
24	Red/Black	5)	REMOTE KEY or TX/PTT Control line
25	Red/White	6)	REMOTE RX AUDio output (min 2000 ohm impedence)

See detailed notes and information on following pages by pin number.

NOTES:

1. The DRAINWIRE is connected at ONLY one point (inside RRX-450), to chassis ground for single-point grounding for audio line shielding. To prevent ANY DC current (supply or ground loops) from flowing on the foil shield (which could cause induced hum on the audio), DO NOT GROUND the drain wire or foil shield at any other point (e.g.: the Remote/External Controller). The DC POWER GROUND connection (Pin 2) DOES NOT flow across DB-25, Pin 1.
2. The BLACK WIRE of any supplied EXTERNAL cable for DC GROUND/ Negative Power lead is connected to the DB-25M, Pin 2 (RRX end). The Black Wire DOES NOT connect internally to DB-25F, Pin 2. A separate, larger gauge, short length of BUS BAR connects DB-25F, Pin 2 to Chassis Ground to supply the DC current needs of an external device.

   The bus bar splits and isolates the two grounds: Power Ground at Pin 2 and Audio Ground at Pin 1, to provide separate, direct, low impedence ground paths for DC power and audio shielding.

(continued)

3. Limit the audio input on this line to the transmitter to 1.0 V P-P maximum when the LIMITER (VOICE DEV R426) is set for 5 KHz systems, or 2.5 V P-P for 2.5 KHz systems (yes, more!). This level will drive the transmitter to hard limiting (maximum permitted Deviation). Nominal (60% Deviation) 1000 Hz tone levels are 0.5 V P-P for 3 KHz (5 KHz systems) and 0.6 V P-P for 1.5 KHz (3 KHz systems). Audio (low pass) frequency filtering is internal to the RRX-450 and need not be filtered externally. There is no low-frequency filtering on this line.
4. CARRIER DETECT output, if selected by PJ407 in the "B" position, is pulled HI (47 KOhm to +5 V) until ANY RF CARRIER ON FREQUENCY BREAKS CARRIER SQUELCH level (as set by R112, RX Board). Any received carrier (green "CD" LED) will send this line LO and can sink an additional 50 mA of current to ground.
5. QC/ DQC/ Tone Squelch (internal decode and detect) is to be defeated internally (RRX-450 PJ403 to the "B" position), to isolate the function (pulled HI to +5 V). If an external output of any/all internal decoder(s) is desired (PJ403 left in the "A" position), this line will go LO and sink 50 mA (100 mA max) to ground. There is no differentiation between multiple tones if equipped for more than one tone (up to four with three optional RTS-6P modules).
6. This pin is a local board Ground connection intended for signal level or PTT TX use, NOT a power connection point. Use Pin 2 (Black Wire) for Power Supply.
14. This is the Audio output selected by PJ402; it is DC Blocked, 10 – 3000 Hz (FLAT) or 300 - 3000 Hz (HIGH PASS), (as opposed to DIRECT DISCRIMINATOR line output, DB-25, pin 19 – Green wire). The factory setting is HIGH PASS 2.1 V P-P @ 1000 Hz @ 60% (3 KHz or 1.5 KHz deviation); reset on PN402 if FLAT is selected. The impedence output rating is 2000 Ohm. The level is first set here first, then all other levels (REPEAT, VOICE DEV/ LIMITING) are set from this standard. RITRON accessories are set to accept this 2.1 V P-P input for "plug-in" installation and operation.
15. This is for external sub-audio input (QC, DQC, TRUNKING LOGIC or data) line to RRX-450 TX modulator AFTER VOICE LIMITING. DC is blocked by the negative lead of a 1 uF/16 V tantalum capacitor; 0.45 V P-P = 600 Hz deviation. There is no internal level control.
16. +12.6 VDC Power Connection. Unfused internally except for primary DC power fuse (3 or 10 A, depending on model). ~~Limit draw to 500 mA, 750 mA max.~~
17. EXT PTT/ TX Control line. Ground to TX, pulled HI by 10 K Ohm to +5 V on RX.
18. REPEAT DISABLE is also EXTERNAL CONTROLLER ENABLE. Grounding this pin disables the internal audio routing and time-out features, etc.
    - Internal tone decoding is disabled only by moving PJ403 to the "B" position.
    - Internal tone encoding is disabled only by turning R423 "CTCSS/DCS" control fully CCW. Repeated audio must now come in from an external source (i.e.: Controller re-routing internal or telephone audio) feeding DB-25 pin 3 or 21.
19. DISCRIMINATOR OUT is direct, non-DC blocked, audio out, unsquelched, from the demodulator. Approximately 0.7 V P-P for 3 KHz deviation of a 1000 Hz tone, 2000 Ohm output impedence, pre-emphasis intact.

NOTE: The following DB-25 pins are referred to the internal RWR-10/ J402 port connections. J402 is for connecting a DC or TONE REMOTE handset. It REQUIRES PROGRAMMING RRX-450 TO "RWR-10 YES" via the computer programmer.

21. REMOTE TX AUDio input from external handset. 0.10 V P-P = max deviation (3 or 5 KHz).
22. NO CONNECTION in any EXTERNAL cable. Inside the RRX-450, the black wire grounds (J402 pin 2) this pin (DB-25F pin 22). This uses all internal wires and provides an additional signal ground pin IF needed for the application. Use pin 6 first for signal ground. Move another wire to connect to this pin if needed. USE PIN 2 FOR (-) POWER.
23. a. MONITOR control line, when programmed and grounded, disables tone squelch function to allow reception in carrier squelch mode to MONITOR the channel for co-channel user traffic prior to transmission. Lifting a telephone-style handset should ground this line.
    - Program RWR-10 bit to "YES".

    OR

(23.) b. REPEAT DISABLE if the RWR-10 bit is left as "NO", then grounded.

N/C to J402 V+ connection. Use RRX-450 end DB-25M pin 16 RED wire.

24. REMOTE KEY or PTT line. Ground for TX. Pulled HI by 10 Kohm to +5 V on RX.
25. REMOTE RX AUDio out. Low power medium impedence (2000 ohm, DC blocked) output to feed handset earpiece (or speaker amplifier when on-hook) tone squelched audio (or carrier squelched audio when MONITOR function activated).

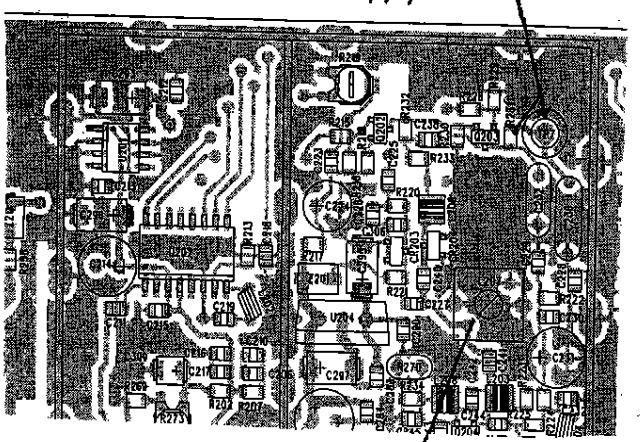
RRX+FRX REPEATERS

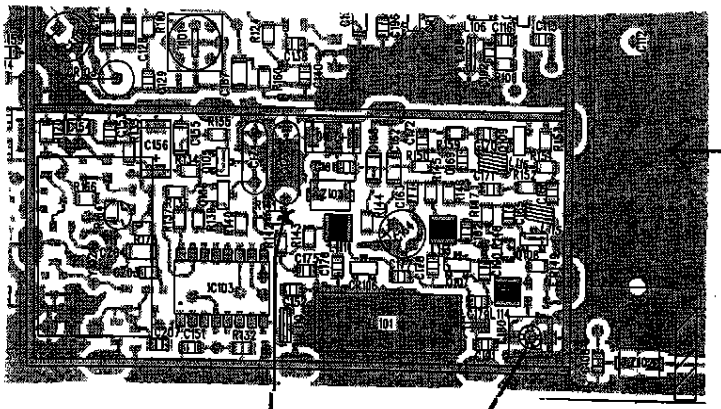
VCO VOLTAGE

USE A 1/16 IN. SQUARE "TWEEK" TOOL TO ADJUST L207

Tx

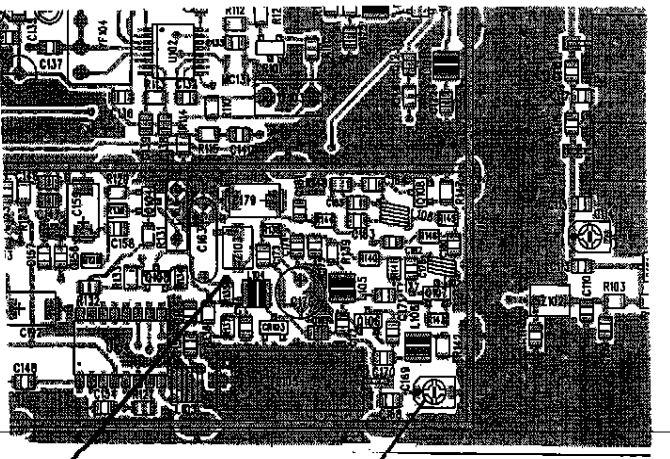
ALL VCO'S ARE SET AT 4 VOLTS

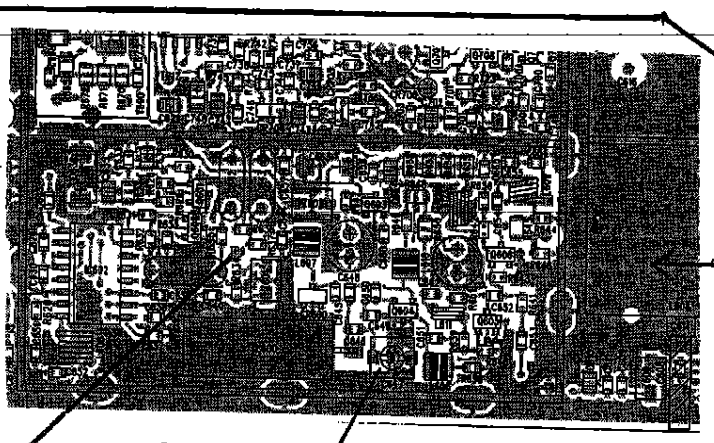




RRX-450/452 Rx

RRX-452/455 Rx





RRX-460 Rx

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7. ALIGNMENT PROCEDURE

This alignment procedure is correct for the following RRX-450 Repeater systems:

- Standard Repeater
- Repeater with Autopatch
- Telenexus

7.1 RECOMMENDED TEST EQUIPMENT

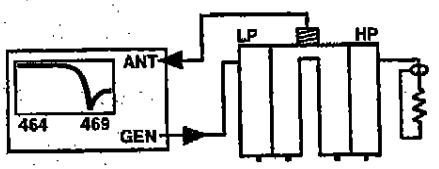
1. FM service monitor (to 470 MHz)
2. Oscilloscope (to 20 MHz)
3. FM deviation meter
4. RF Wattmeter, 10 Watts full scale
5. Frequency counter (to 470 MHz)
6. VTVM or DMM
7. SINAD measuring device
8. RSM-3X remote speaker/microphone
9. T-10 Torx Driver (for Top & Front panel screws)
10. Xcelite XST-100 Phillips screwdriver or equivalent

7.2 DUPLEXER

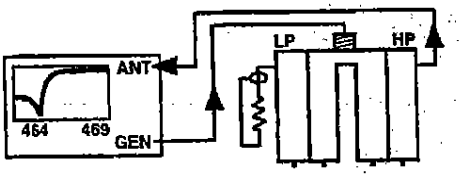
A normal repeater frequency split has the transmit frequency low and the receive frequency high. The LP end of the duplexer connects to the transmitter and the HP end connects to the receiver. By convention, F-low is the TX frequency and F-high is the RX frequency in a NORMAL setup. In a Telenexus or any other "RF LINK" system (INVERTED setup), the inverse of this arrangement appears at the other end, so F-low is the RX frequency and F-high is the TX frequency.

1. Remove the 5 screws securing the enclosure lid.
2. Unplug the two RF cables connecting the transmitter and the receiver to the duplexer.
3. Connect a UHF signal generator to the duplexer LP cable (RCA male).
4. Connect a spectrum analyzer to the antenna connector (UHF) on the rear panel of the RRX-450. Connect a 50Ω load to the HP cable.
5. Tune the signal generator and spectrum analyzer to the F-high frequency.
6. Using a 1/4" open-end wrench, carefully loosen the locking nuts on the tuning screws of the LP cavities; watch the analyzer while turning the screws to tune the notch.
7. While keeping the locking nut snug, fine-tune one of the LP tuning screws to achieve minimum transmission of the F-high frequency as seen on the analyzer. Repeat this procedure for the other LP screw. The LP side notch should be about -73 dB deep and within 50 KHz of the desired notch.

DUPLEXER TUNING: TX SIDE

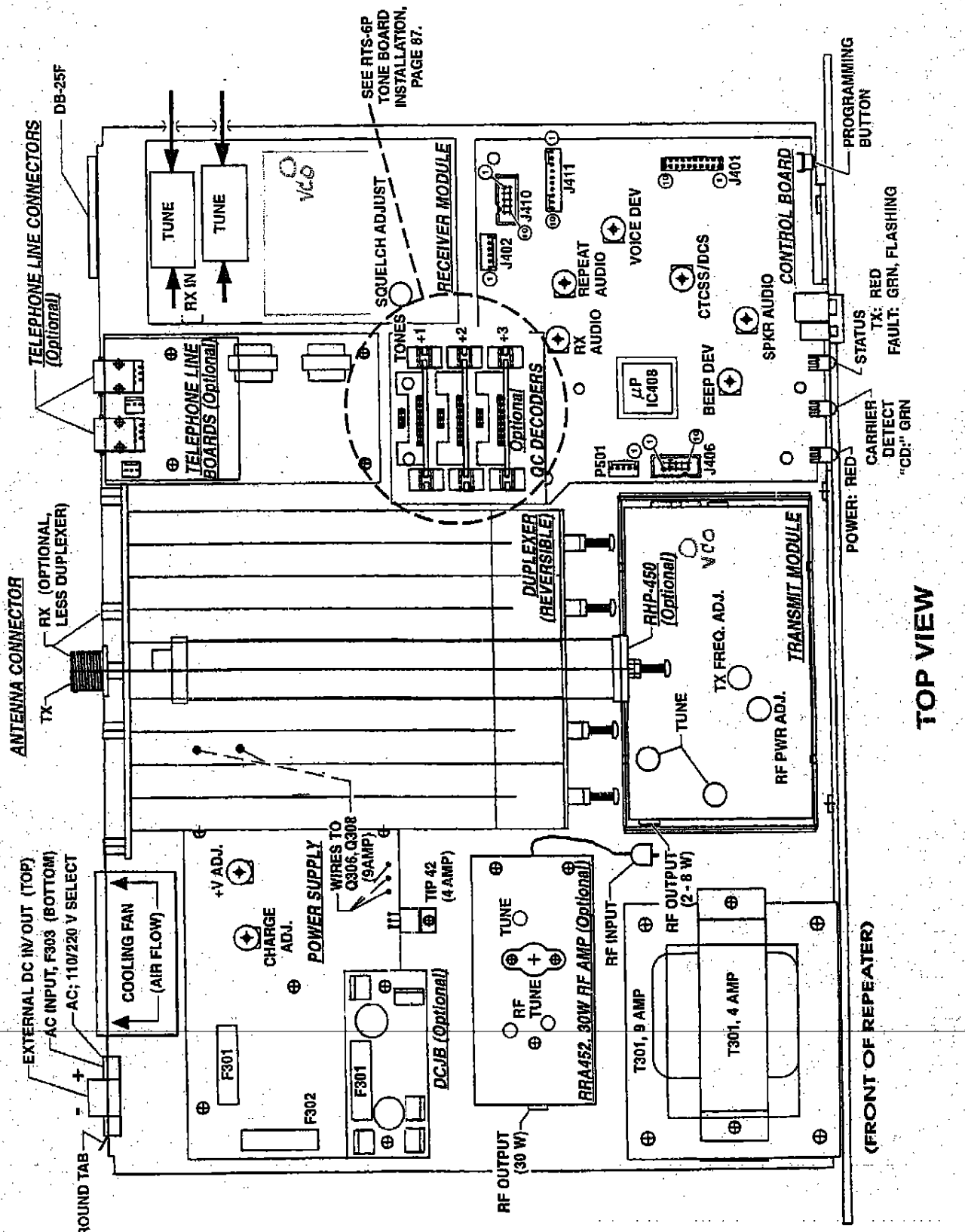


DUPLEXER TUNING: RX SIDE



8. Put the 50Ω load on the LP cable, GEN(erator) to UHF connector, and HP cable to the ANALYZER input connections. Tune the signal generator to the F-low frequency.
9. Repeat steps 6 and 7 for the HP side. The HP notch should be about -63 dB deep and within 50 KHz of the desired notch.

26. BLOCK DIAGRAM OF RRX-450



MODEL RRX-450 BLOCK DIAGRAM, TOP VIEW