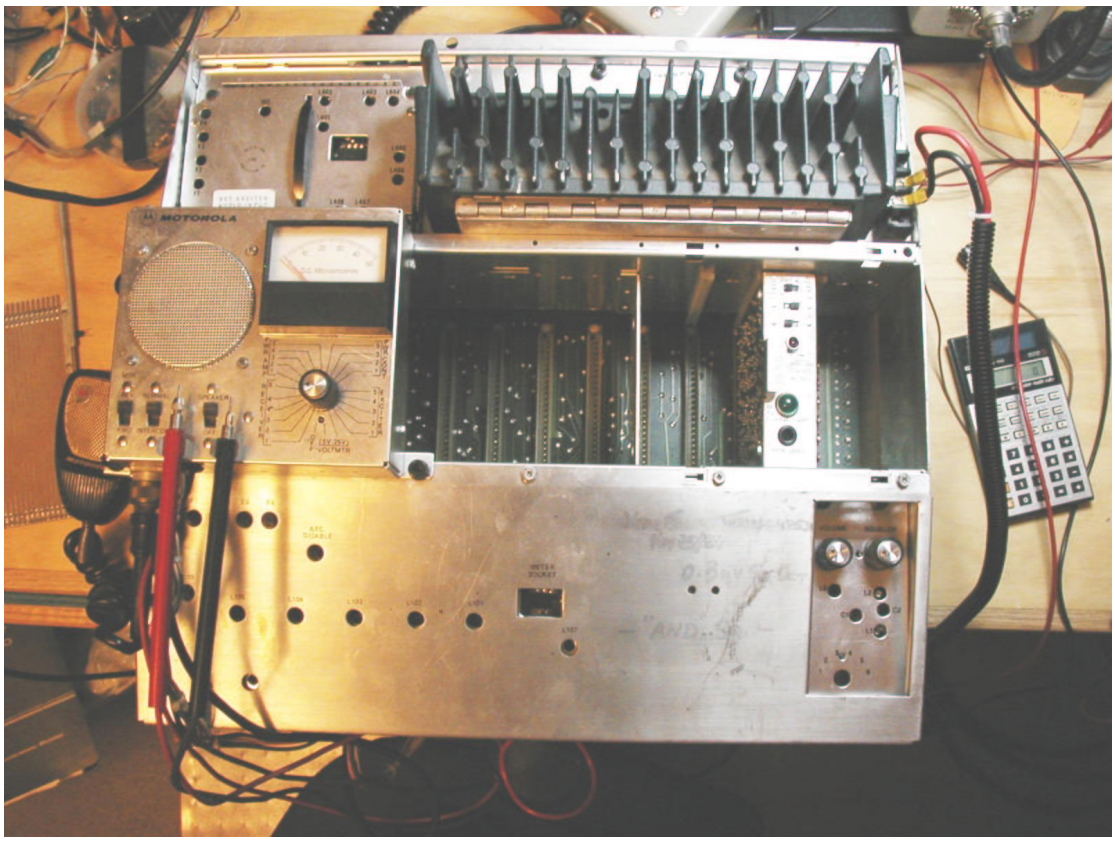

Micor Unified Chassis Base Station Conversion to A Ham Band Repeater

by
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Goals:

-To duplex a base station radio set for repeater usage.
- To mount and tune a micor mobile rx preamp for use with the repeater
- To locate signals on backplane for feeding to an RLC4 repeater controller
- To use standard micor PL encode and decode boards
- To complete the conversion without having access to a service manual.

Lets Get Started

The first step is to open up the radio and remove all the mouse droppings and attempt to clean up the mouse pea. Those critters love the warm dark spaces of a repeater. The second step is to review the board and module numbers to determine what frequency split the various components are designed for. In this modification, I was lucky enough to scrounge up ham band split parts for most of the components. Do not get too depressed if you can't find the ham band split, they are quite rare. With some work, most of the parts can be modified to ham band split. See the references for information on using the higher split boards.

Board ID's in System

Transmitter components/modules
TLD5321A exciter board

TLN5731APR tx PL encoder board with KLN6210A reed @100hz PL

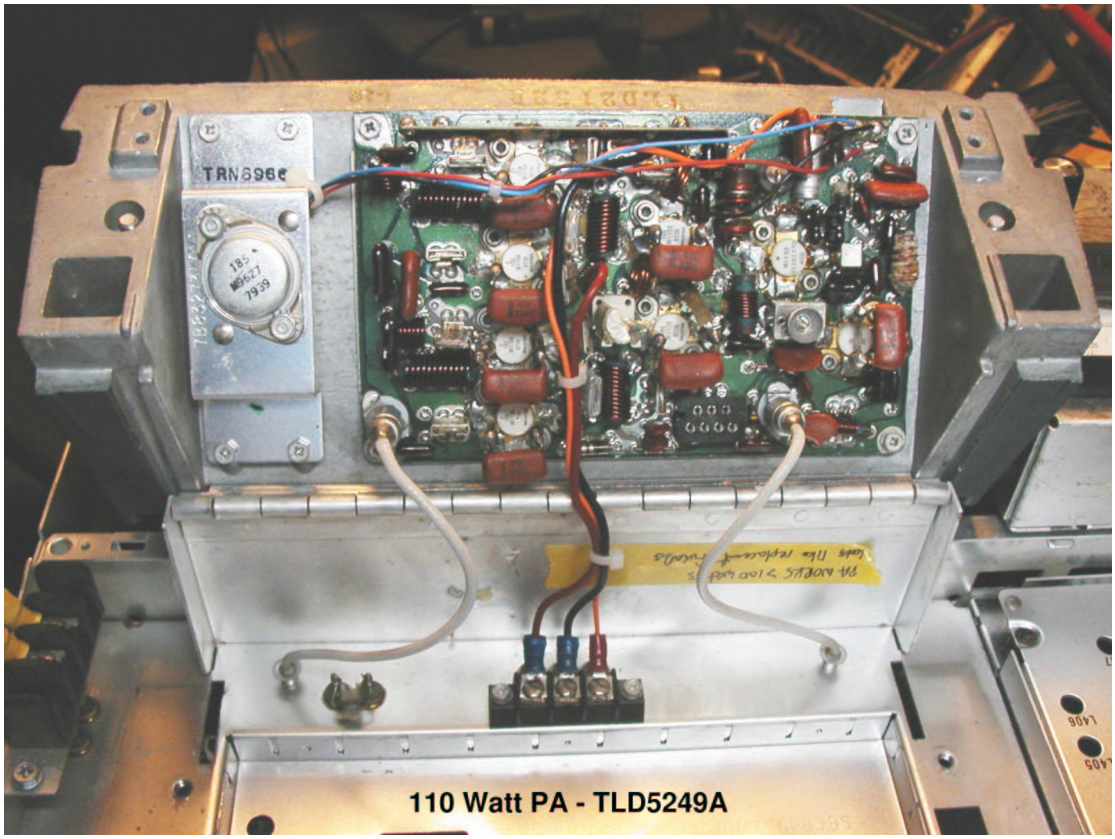
KXN1019B channel element with xtal for T147.280 (xtal => 12.27333mhz * 12). Note: when I received a crystals for this element, they would not tune down to the required frequency. I had to add a 22pf capacitor across the trimmer inside the element. This was enough to give me a little tuning room on the low side (about 500hz @ 12mhz).

TFD6111APR exciter filter (bandpass of 124-161mhz@3db). Note, a TFD6112APR(145-182@3db) may be used or re-tuned for the ham band if you cannot locate a lower split unit.

TRN6971A PA assembly (110watt pa with 70w intermittent heat sink) this PA assembly has a heat sink marked TLD2152B and the actual PA board marked TLD5942A. There are 4 transistors in a row on the final amp marked M1134.

TLD8620a power control board

TFD6101A output filter "brick". A TFD6102A(192mhz low pass filter) will also work.



Receiver components/modules
preamp TLD8422B (150.8-174mhz)this is a high band preamp, but seems to tune down fine into the upper 2 meter band. Use a TLD8421B(132-150.8mhz) if you can find one.

K1005A channel element with xtal for R147.88mhz (xtal => 17.73111mhz * 9 -11.7mhz = 147.88)

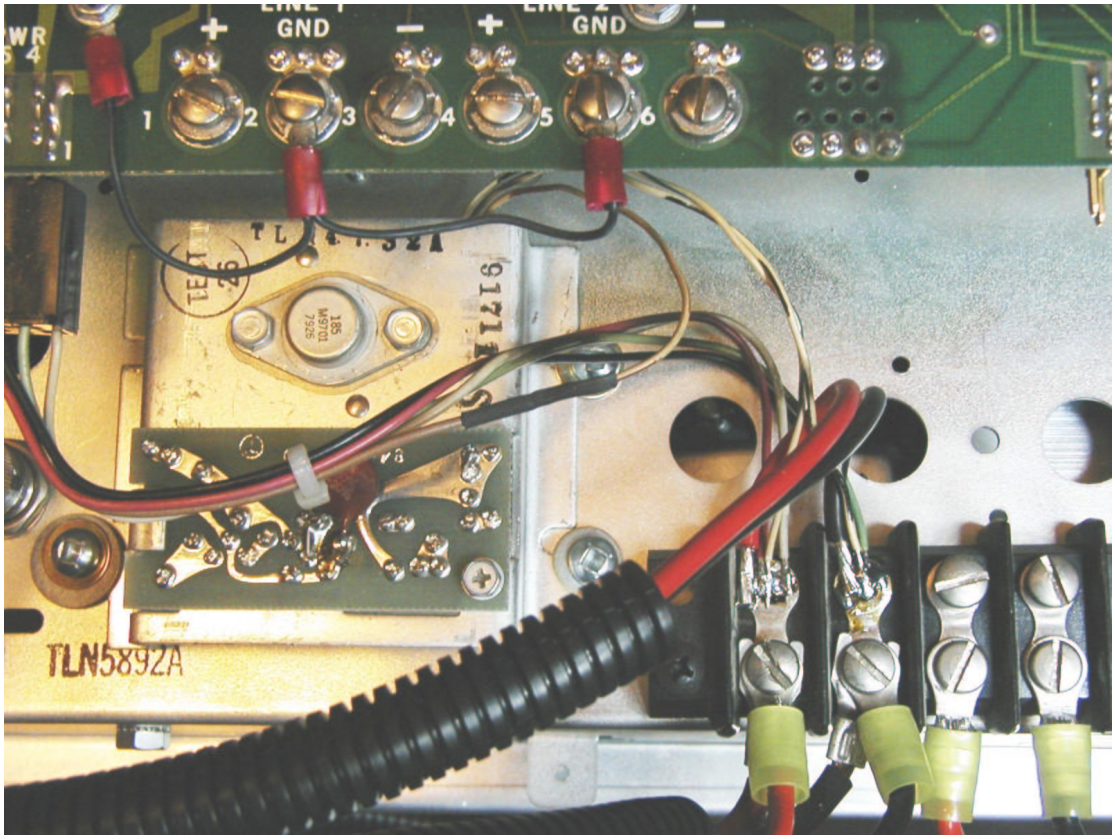
TLD8272B receiver board (142-150Mhz split)

TRN6006A station audio squelch board

TRN6002A pl decode board with TLN8381A 100hz reed

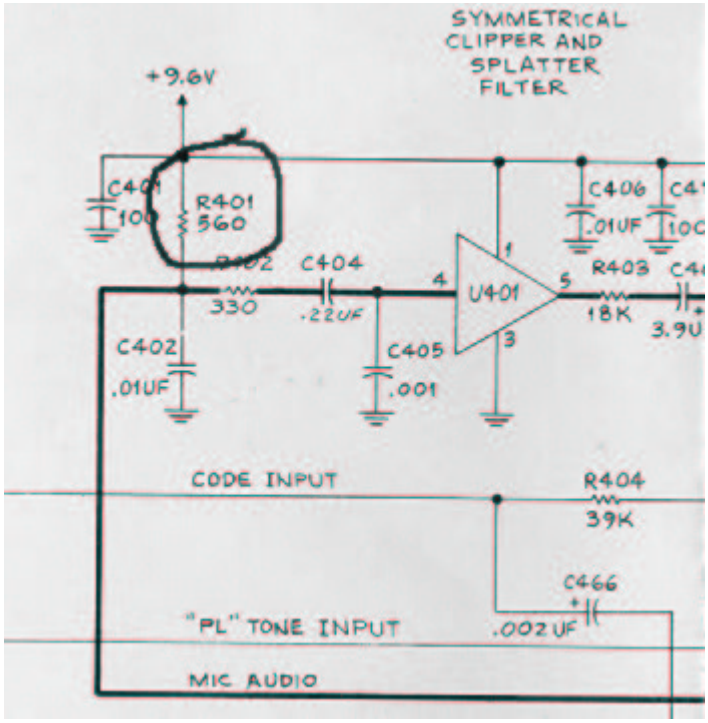
TLN5648A receiver interconnect board

Control Modules
Only the "Station Control Module" is used in the card rack. It should be plugged into the second edge connector from the right hand side of the card cage. You may find other cards in your card cage such as timeout timer, line driver, squelch gate and various tone modules. Just pull then out and file them in the junk box. You will not need them when using an external repeater controller.

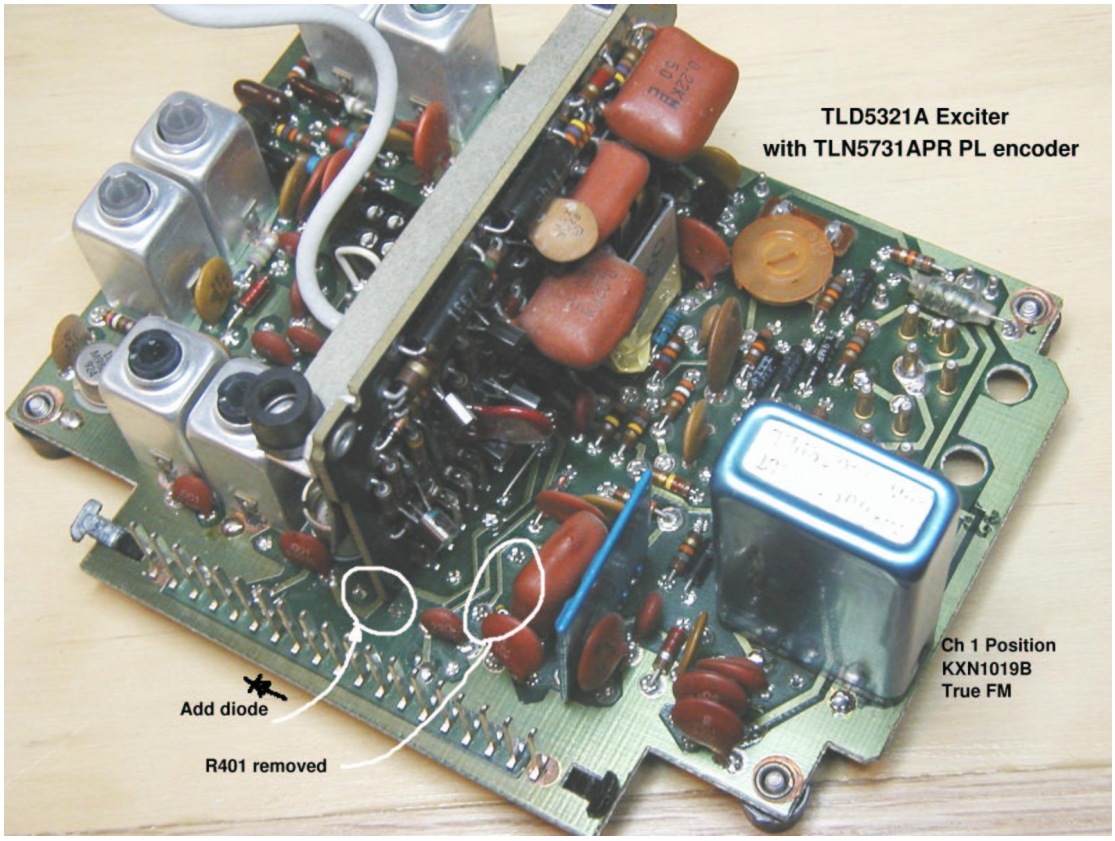


TLN4792A 9.6 volt regulator. This appears to be an add on option for the unified chassis if it is not being used with base station power supply. This board is mounted on the lower rear of the chassis next to the power terminal block and plugs into J1. This is a useful piece if you are running the chassis from a battery powered site with no AC supply. As seen in the photo above, 12 volts is applied to the 4 conductor terminal strip. The heavy red and black wires heading off to the left are a jumper to supply 13volts to the PA stage terminal strip.
Test Set:
TLN1857A (also marked TLN5900A)

Exciter Modification:

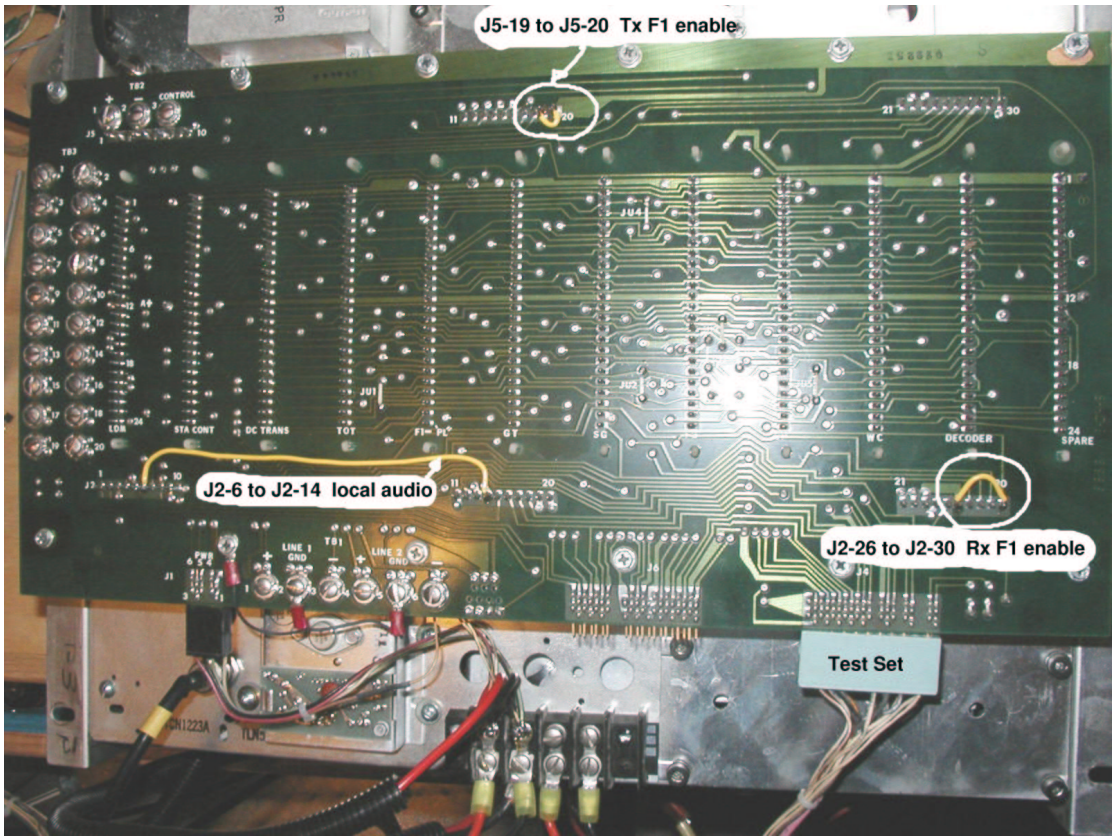


1.) See reference 1. Remove R401 to increase tx audio input impedance and to remove the dc bias from the mic audio line.. This is most likely a 560 ohm resistor. On the board in my base station, this resistor had already been removed.



2). There are two options of modification to allow proper keying of the exciter if

you are not using the original PL encode deck. One is, if you never plan on using the Micor PL encoder, determine that jumper JU401 (JU402 or JU405 some models) exists between pins 8 and 10 on the long interconnect pins (P902 pins). The second method developed is a semiconductor replacement for the jumper. This is especially handy for those who on occasion determine it necessary to remove the PL encoder board for any reason. In place of the jumper on the exciter board, install a silicon diode like a 1N914 or 1N4148 - being sure of its polarity. With the diode installed, it will make no matter if the PL encoder board is installed or not. The banded end of the diode will go toward P902 pin 8. The easiest place to install the diode is on the solder side of the card.



3). Supply the transmit exciter element with a ground to enable it at all times. Connect pin J5-19 to pin J5-20 on the top of the backplane. Pin 19 is F1 channel element select and pin 20 is ground. Plug the channel element into the F1 position (closest to the pin edge connector). If you don't want the tx oscillator running all the time, there is another mod on the net that ties pin 19 to the circuitry that used to run the PTT antenna relay. With the crystal running all the time, it is quite easy to hear the repeater without the transmitter being keyed up. Keeping it keyed should help stabilize the frequency (the initial aging should progress quicker than when only running the oscillator when the TX is keyed).

4). The stock transmitter output runs from a right angle RCA jack on the power control board via a jumper to a BNC chassis connector on the top rear of the rack. I removed this jumper and added a hooded SO-239 chassis connector with a short pigtail of double shielded coax (6 inches). I soldered the pigtail directly to the power control board on the solder side of the original RCA jack and mounted the SO-239 to the upper surface of the rack by enlarging an existing hole.. This makes

changing the power control board a bit of a chore, but it eliminates one mechanical RCA connection.

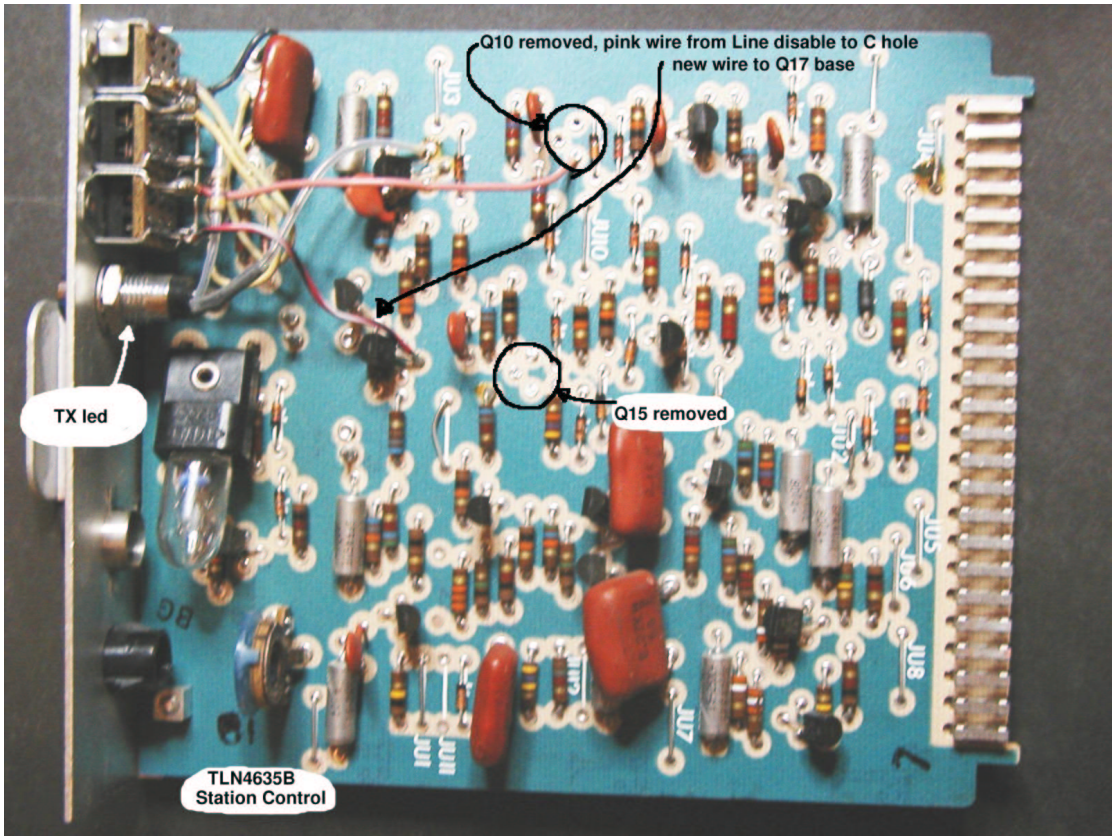
Exciter Tuneup

Step	*Adjust*	*Meter Plug Lcn.*	*Test Set Selector Switch Position*	*Meter Reverse Switch*	*Stage and Procedure*
1	Power Set	Exciter			Turn POWER SET control on power control board fully counterclockwise
2		Exciter	2	FWD	The test set should indicate at least 10 uA (*14ua)
3	All Exciter Coils	Exciter	3	FWD	Pre-Alignment - If the exciter is completely untuned and shows no meter 3 readings, set cores of all tuning coils to the top of their coil forms (away from the circuit board) and proceed with step 5. If the exciter shows meter 3 readings set cores of all tuning coils except L401 and L402 to the top of their coil forms (away from the circuit board). Tune L401 and L402 in that order for maximum meter indication. (*21uA) Go to step 6 of the procedure.
4	L401	Exciter	2	FWD	Modulator Output - Tune L401 for minimum meter reading.
5	L401 L402	Exciter	3	FWD	Modulator Output - Tune L402, then L401 for peak meter reading.
6	L403	Exciter	3	FWD	Tripler Output - Tune L403 for minimum meter reading. (*15uA)
7	L403 L404	Exciter	4	FWD	Tripler Output - Tune L404 and then L403 for peak meter reading.
8	L405	Exciter	4	FWD	First Doubler Output - Tune L405 for minimum meter reading.
9	L405 L406 L407 L408	Exciter	5	FWD	PTT must be keyed when making these adjustments. Exciter Output - Tune L406, L407 and L408, then L405 for peak meter reading. (*9uA) When tuning up an untuned radio, you may have to use a digital meter from pin 5 (lower right) of the exciter test socket to ground because until all 4 coils are peaked, the test set will show very low readings.

Exciter Tuneup					
10	L407 L408	PA	1	REV	Exciter Output - Move the metering plug to the PA. Tune L408 and L407 for peak meter reading. (*11uA)
11					Repeat steps 5, 7, and 9.

As a final check for tuning, I measured the output of the bandpass filter into a 50 ohm load and obtained 500mw (spec is 400mw required to drive PA stage)

Station Control Module Mods



See reference 2 for a more detailed description.

1. Completely remove Q 10 and Q 15 from the board. This disables the ability for an outside source from inhibiting the PTT.

2. Clean out the hole that the collector of Q 10 was in.

3. The common (center pin) of both sides of the Line Disable switch should go to ground from the factory.

4. Unsolder the pink wire that is connected to the top side of the switches normally open contact from the circuit board.

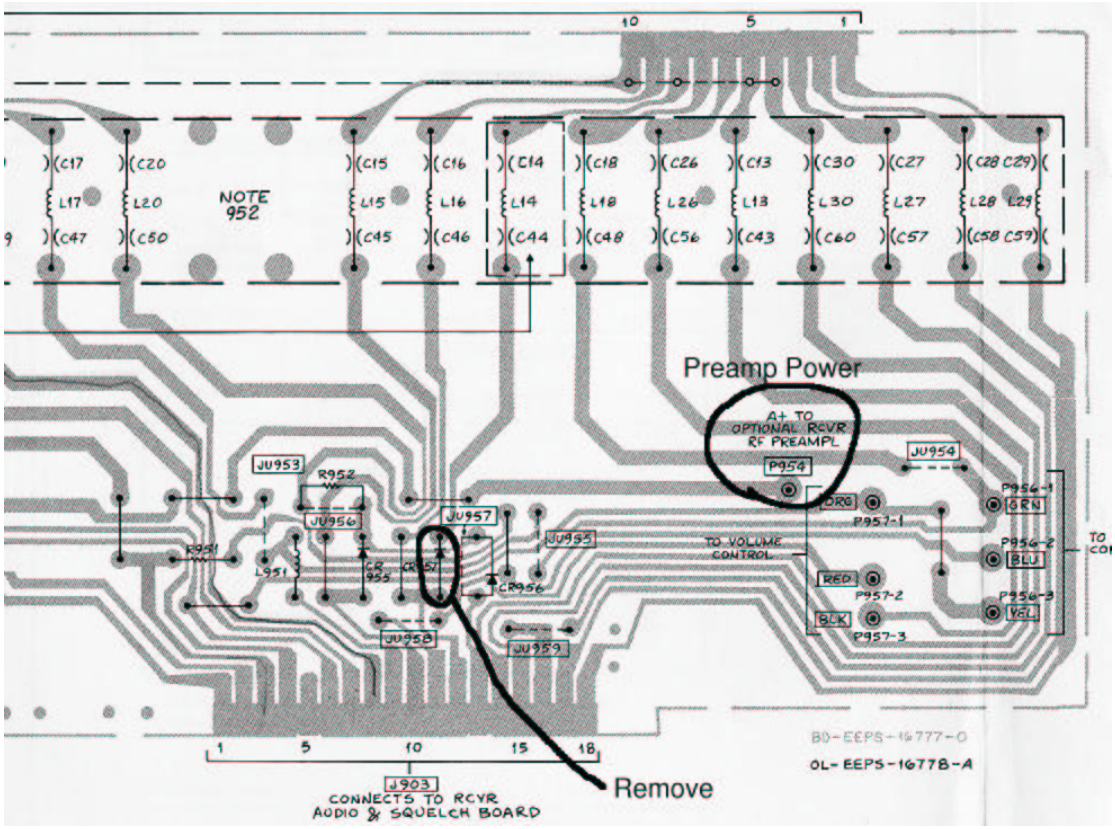
5. Solder the removed end of the pink wire in the opened hole where the collector of Q10 was.

6. Connect a wire from the other normally open contact on the other side of the Line Disable switch to the base of Q 17.

7. Drill the front panel and wire a Red LED through a 2.2 k resistor from the collector of Q 18 to ground.

8. The station control card pin 16 drives the tx exciter audio through JU1 on the backplane. Since our external controller will be responsible for the tx audio, cut the trace leading to pin 16 of the station control module edge connector (cut on the solder side of the station control module). This mod leaves the pin 16 on the backplane available as a convenient place to connect the mic audio cable from the controller.

Receiver Mods

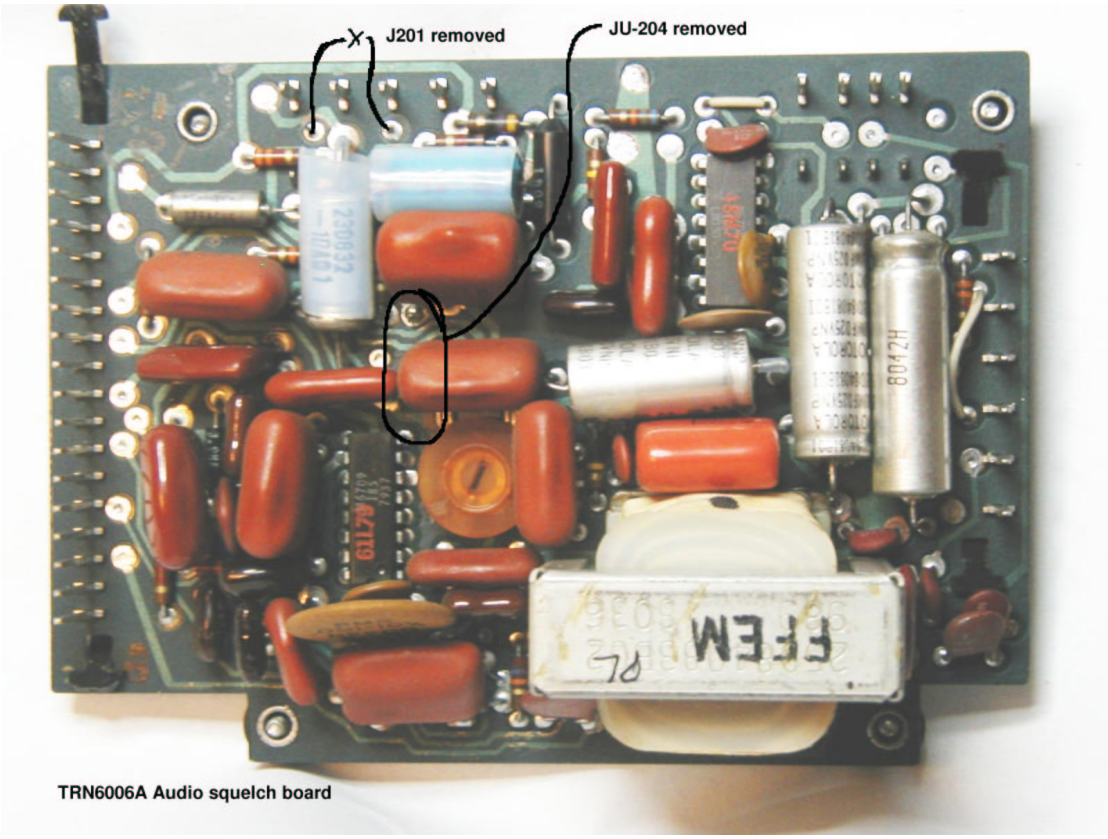


1).Remove CR 957 on receiver interconnect board (the board that lays horizontally between the backplane and receiver board) so that receiver will not be muted when transmitter is keyed. CR 957 is the diode located between JU958 and JU957 on the right hand side of the interconnect board by the audio/squelch board connector. (use the diode for the exciter mod above)

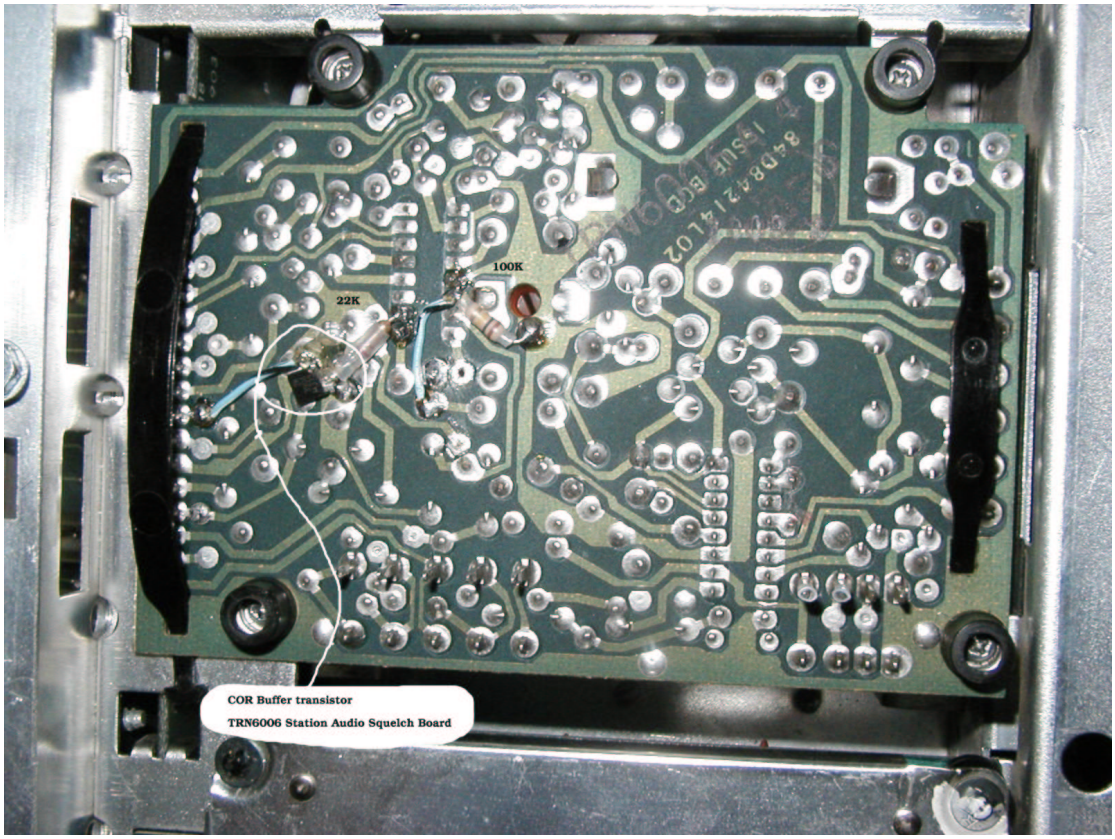
2). Supply the receiver channel element with a ground to enable it at all times. For the receiver, connect pin 30 of the receiver interconnect board pins {J2, bottom row of 30} that come through the backplane, to ground (Pin 26). Pin 30 is R1

oscillator select. Plug the channel element into the F1 position.

3). Jumper J2-6 to J2-14. This enables local audio so no line driver card or squelch gate card are needed. (This takes preamp audio and sticks it into the audio amp for local audio.)



TRN6006A Audio squelch board



Steps 4-11 convert the station version of the audio/squelch board (TRN-6006A) to be more useful for ham controller use. See reference 5 for detailed instructions. The meat of the conversion is replicated here.

4).Set up for AND squelch. On audio squelch board cut jumper wire JU-204 between IC 202 pin 8, and P 201 pin 3. Nothing will be connected to IC 202 pin 8.

5) Cut J201 on the audio squelch board to allow the PL board to filter out the PL tones in the local audio. Depending on which audio source you use to connect to the controller, the PL filter may or may not be active.

6) Cut circuit trace leading from IC 202 pin 6 somewhere between the IC and the edge of the board. (component side of board). (disconnect squelch gate from backplane)

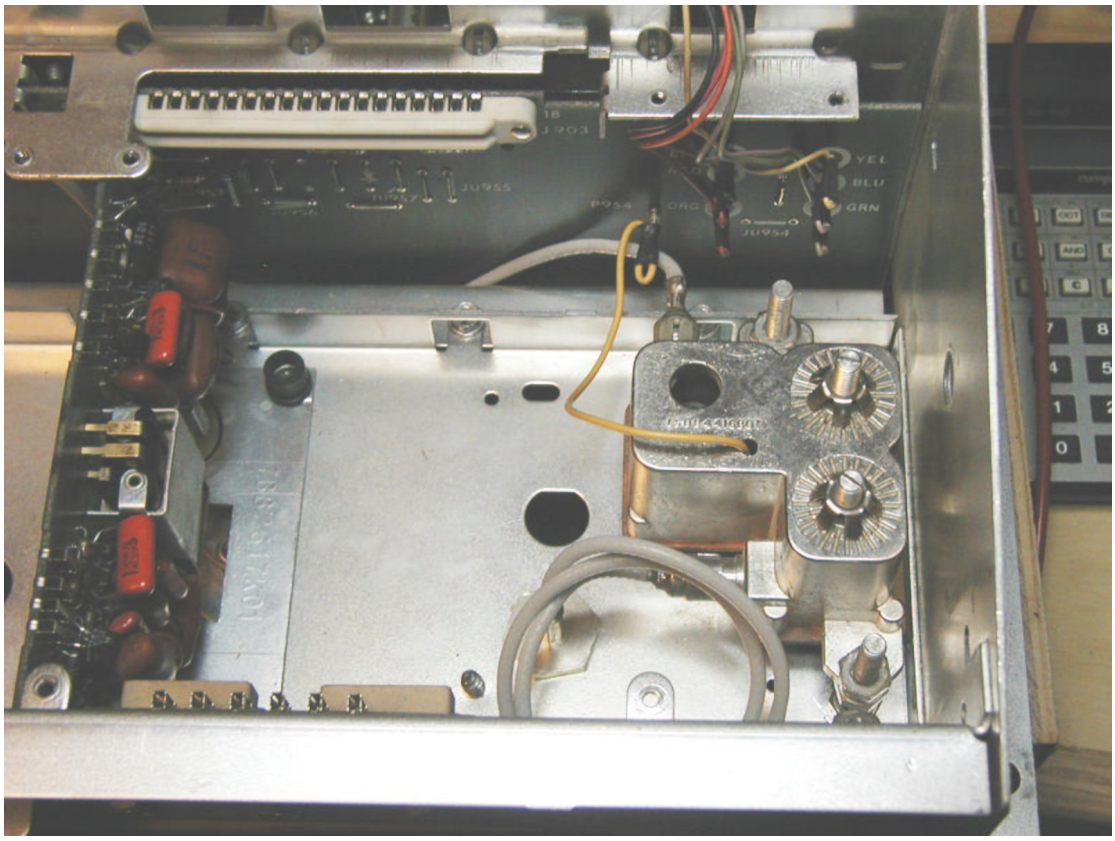
7) Connect a 100 k to 120 k ohm resistor from IC 202 pin 6 to ground at a convenient location.(provide audio termination for squelch gate).

8) Pin 10 of IC202 has a COS signal available but it is not capable of driving the RLC 4 controller directly. Add a 2n3904 or 2n2222a as a buffer stage. Between IC202 and the edge connector there is a large grounded area (see photo above). The emitter lead goes to ground, the base lead connects to pin 10 of IC202 through a 22k resistor and the collector lead connects to a jumper to P903 pin 8. This brings a buffered open collector COS out to the backplane.

9) Connect a jumper wire from IC 202 pin 6 to the intersection of C 211 and C 213. (improves muting performance by using second squelch gate switch)

10) Cut IC 202 pin 13 foil trace after trace connects to C235, a .22 uF cap. IC 202 pin 13 will only be connected through C235 to ground.(avoids potential rfi and backplane interactions)

11) If you don't want to have to run the Station Control Module in "PL Disable" mode to listen to Carrier only signals, cut the trace leading from IC 202 pin 14. This disables the PL Enable lead on the squelch chip allowing either PL or Carrier signals to be heard on the local speaker regardless of the position of the PL Disable switch on the Station Control Module.



12) Add a 4k7 resistor from J2-10 to ground. This gives a load for the PL detect signal. I found operation with the RLC was intermittent without the pull down. The voltage swing at J2-10 should be 0.3(no PL) to 9.0(PL detected) with the controller plugged in. There is a convenient ground connection down and right of J2-10. Its the heavy trace leaving the J1 power connector.

13) Mount the preamp. There is a set of holes labeled L1,L2,L3 below the local volume/squelch knobs that happen to be in a pretty good pattern for matching the 3 tuning adjustments on the preamp. I mounted the preamp on two #10 bolts behind the vol/squelch panel on the main chassis. If you use 3 nuts on each bolt you can adjust the height as required. You will need a RCA-RCA cable about 10" long to run from the preamp to the receiver casting. I salvaged one from a mobile micor unit that had the noise blanker receiver option. Power for the preamp is obtained at P954 on the receiver interconnect board. The preamp power lead just plugs onto the test post. Receiver performance with the preamp is outstanding (approx .2 to .25uv for 12db quieting) with the squelch threshold being a little over .1uv. Since I did not rack mount the system, I changed out the jumper from the RX antenna

BNC to the preamp. I made a cable with an RCA connector on one end and a SO-239 with hood on the other end, with the cable about 8 inches long. I then drilled out the unused switch position on the panel below the volume and squelch controls and mounted the SO-239 in the hole. This provides front access for the jumper connection to the duplexor.

Backplane Jumpers		
JU1	In	
JU2	Out	
JU3	In	
JU4	Out	
JU5	In	
JU6	Out	
JU7	Out	
JU8	Out	

Controller Interface			
Signal	***Backplane Location***	***Comment***	***RLC4- DB9***
RX Audio(1)	J2-14	deemphasized, but not squelch gated receiver audio with PL filtering (0.5vp-p with 1khz tone @ 3khz deviation). This audio is riding on a 4.5v dc bias.	Not used
RX Audio(2)	Pin 21 SCM or J2-15	raw buffered discriminator audio with no PL filtering or de-emphasis applied. (1.2vp-p with 1khz tone @ 3khz deviation) About 0.4v rms noise on no signal	5
RX COR	J2-13	3.6v squelch open, 0v when no signal (grounded)	7
RX CTCSS	J2-10	0.3v no PL present, +7 with PL heard	2
PTT	Pin 5 (local PTT) Station control module	ground to transmit	3
Mic (TX) Audio	Pin 16 SCM or J5-24	0.5v p-p yields about 5khz deviation.	4
Ground	Pin 1,24 SCM		1,6,8,9

Unresolved issues:

- include RX tuneup instructions in PDF.
- include site log document/checklist in PDF

References:

This project would not have been possible without the excellent work of Kevin K. Custer W3KKC and his repeater builder web site.

- 1) http://www.repeater-builder.com/rbtip/micortxbias.html
- 2) http://www.repeater-builder.com/rbtip/stationcontrol.html
- 3) http://www.repeater-builder.com/rbtip/vhftxtuning.html
- 4) http://www.qsl.net/wa1zyx/mods/micorbas.html
- 5) http://www.repeater-builder.com/rbtip/stationa&s.html