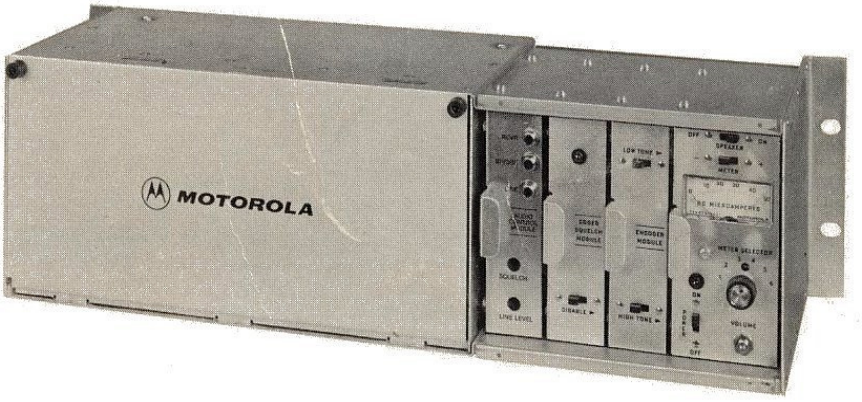
Spectra-Tac micor receiver supplement
by Karl Shoemaker

Spectra-Tac:

This supplement is to be used with the Micor receiver (SRG version) document found on SRG's web site. The spectra-Tac version is self-contained with its own power supplies (12 and 9.6) a nice, shielded 3 RU chassis, with a control shelf, for four card positions, and a type "N" female antenna port.

It uses an ACM (Audio Control Module) TLN6080B or TLN6956A which is a slide-in "card" in position 1. The card has the squelch, line level and other circuits. The line level will become the local speaker volume control. For tone receivers, it uses the TRN6083A PLM (PL module) in position 2. This card's pins and physical mounting is different from the mobile or Station-Compa types. If you are using carrier squelch mode the PLM won't be needed.



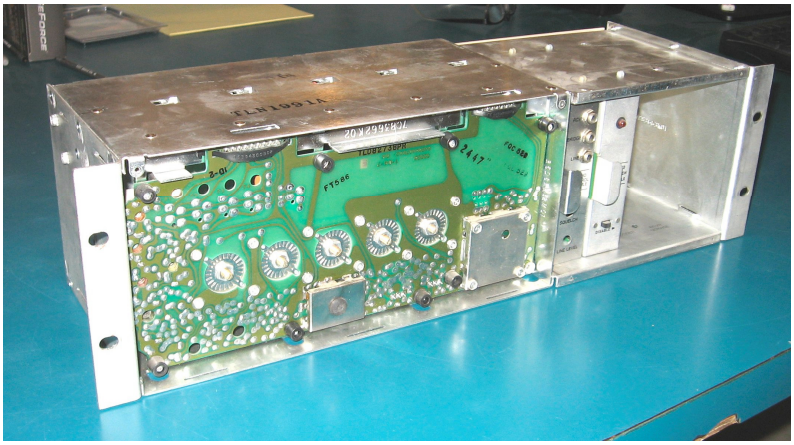
Note: "module" and "card" pretty much mean the same thing and may be used in this document and some others on the SRG web site.

Some of the ones available for this project came out of 800 MHz service. Therefore, the RF-IF board needed to be replaced with a hi-band one.

The cor board can be mounted on a stripped, unused card in position four. The local speaker is covered later in this document.

Currently, for SRG the STE (Status Tone Encoder) is not used, but would be in position three.

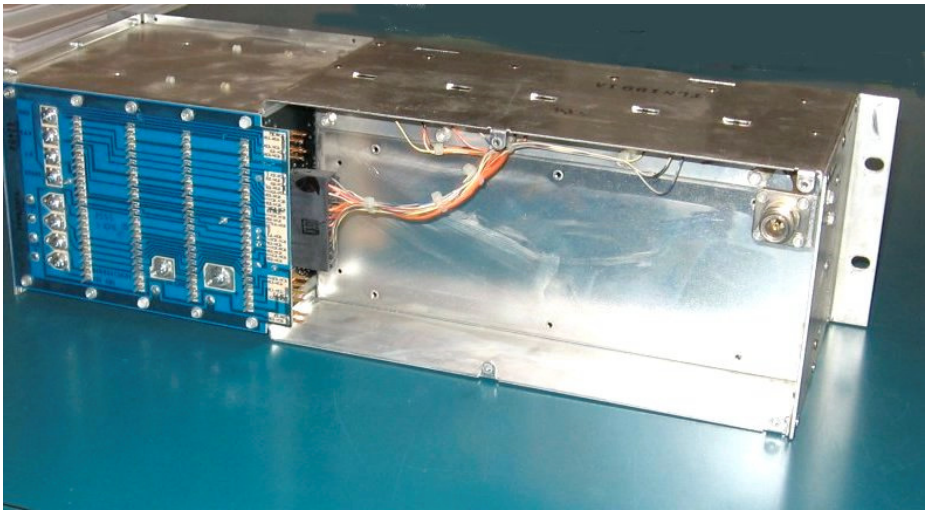
As with the other two types of mobile and compa (separate document), the receiver will be a self-contained unit; you just add the antenna and power (either 110vac or 12vdc). This type will require a different rack mount depth from the first two types. Take this into consideration when planning a station with limited space inside a cabinet near the front door.



Open rack/sites have better flexibility in this area however, are less secure against tampering.

As of 2020 the term "PLI" was changed to address all types of signaling therefore, is now know as "SDI" for Signal Decode Indication (or input).

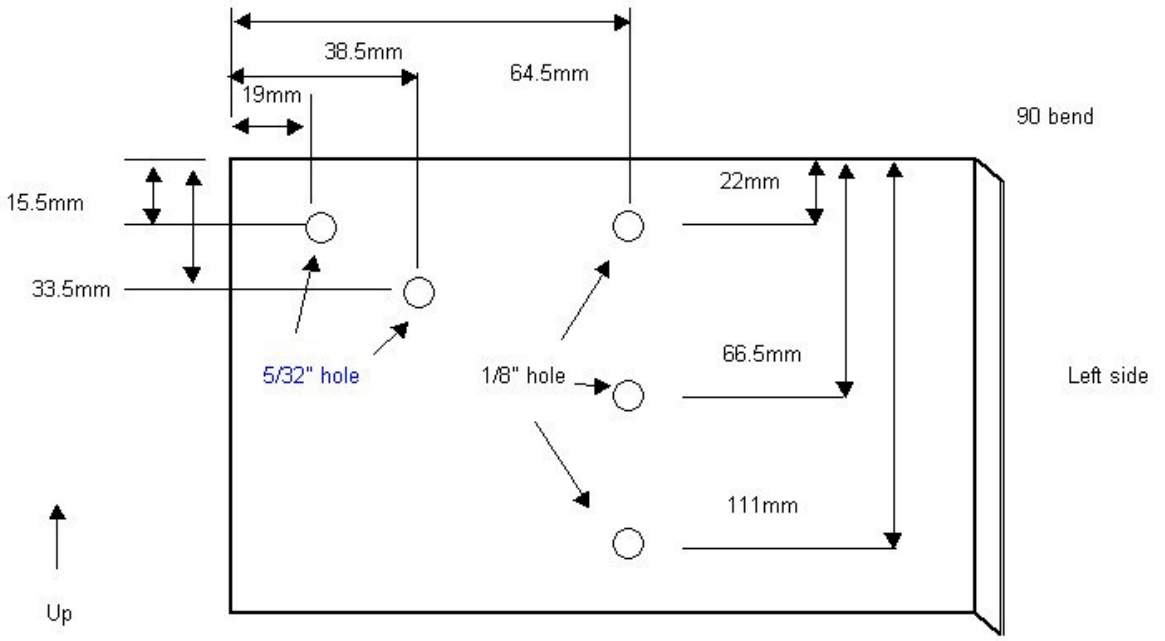
The Author changed the mount by removing the 15 small rivets and turning the side brackets around for front 19" rack mounting as shown here. As it should be, the "new" front access contains the RF board and the cards.

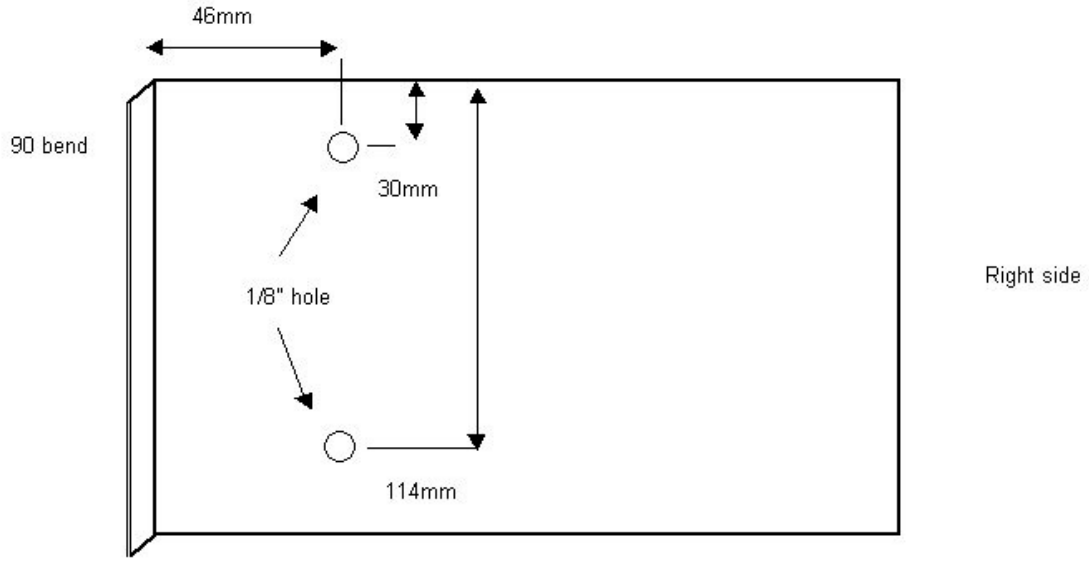


The image below shows the old mount but with the complete package with all covers assembled for reference only.

The new “rear” access contains the back-plane board for external connections and the RF port.

Also, the jumpers, hole & wires for the SM are not yet shown. Below are the seven hole locations for each side bracket. That’s including the two for the antenna connector bracket. “4-3” size rivets were used. 1/8” drill bit is used except for the RF port which is 5/32”.





Shown on the left is the prototype tested in a rack. On the right are several of the chassis mounting change done in one day with the electronics removed. While taken apart, they were cleaned from dust and a little corrosion. The RF deck, cards, power supply, etc. will be installed next. This arrangement appeared to be a good choice by the Author for all SRG (remote) receivers. In some cases, they will replace the mobile and compa (base) versions as well.

Audio Control Module (ACM):

Pretty much everything of this receiver unit works with the ACM. It contains the dual squelch IC, plus the line driver. A medium impedance, 63-ohm speaker was found and works well enough with the line driver. To slightly improve the audio level the speaker is connected to pin 4 of the ACM (instead of the usual 600-ohm output on pins 19 & 20). Later versions will be different.

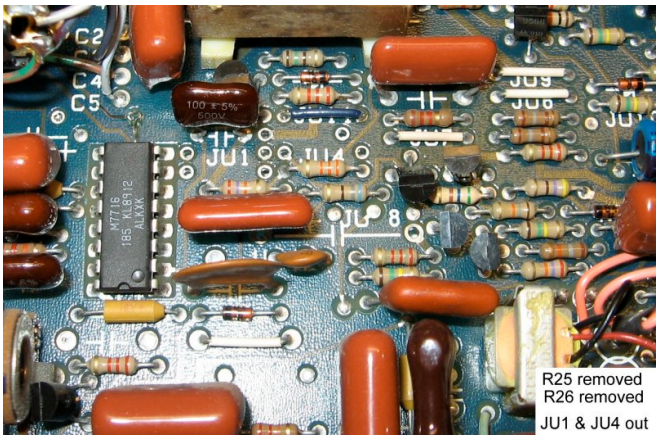
Local Squelch:

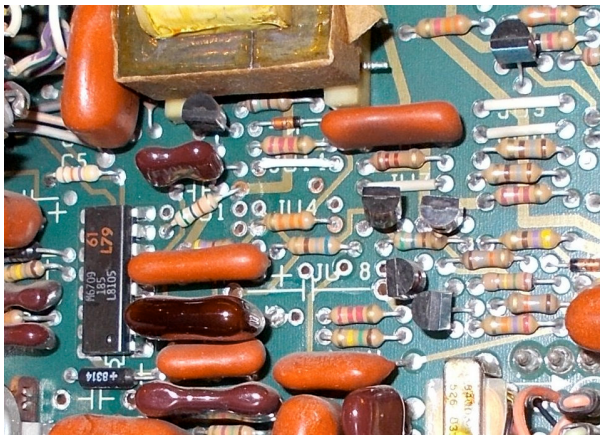
A local squelch and speaker is very useful to listen/verify the squelch setting. Also, for listening for other signals or interference when your attention is turned away for another task at the remote site. OEM circuits put the squelch and audio functions ganged together which is awkward for amateur use. For amateur use, this speaker (function) needs to be on carrier squelch, while not affecting the rest of the station (or its circuits).

To do this, some modifications and jumper settings need to happen to isolate some of these functions from outside of the

ACM, such as the SDI and the control logic on pin 8 of U1. Verify JU1 is out, which will put U1's shunts, on carrier squelch. Pin 7 of U1 needs some changes to properly operate the local speaker squelch, Q3 inverter. Since the PLM's output on pin 16 won't be used (or connected) there's no risk of it sending A+ to the cor card's PL "AND" squelch input and false it. The "AND" squelch is a cor buss on the backplane board (pin 11).

When JU4 is in R25 and R26 are in series. To isolate the SDI (PLI) remove both these resistors as shown on the left image. Use a new R26 with a value of 56k (R25 won't be used in this circuit). Install the new R26 with one lead where the old one was and the other lead where the old R25 was, towards the A+ as shown on the right image. Now, pin 7 is isolated from outside the card and operates the local speaker squelch independently with a "safe" pull-up resistor value. "Safe" will be discussed later. JU4 is optional (in or out). Next, remove C37 and verify JU11 is in. CR5 has little, to no effect; so it's (optionally) left in.





The Author believed this would improve the audio switching/response time for the local speaker. Other modifications to the ACM; per the OEM chart; R7 is 22K, C4 is 1500 pf, C7 is 100 pf, R85 is out and C40 is replaced with a jumper, C41 is out, C9 is 470 pf and R8 is 27K. For better monitor audio frequency response the HP filter is disabled with JU2 out and JU3 in. The de-emphasis component C17 is left in.

COR: (RUI voltage source)

The ACM has a "dual squelch" IC, which is U1, a M6709, M6179 or M7716. The outputs on pins 7 and 6 provide the squelch switches. Pin 7 is for the local speaker and pin 6 is for the "RUI" which is used for the cor pick-off point to signal the cor board. As mentioned before, they are shunts (to ground) during standby and relax during activity.

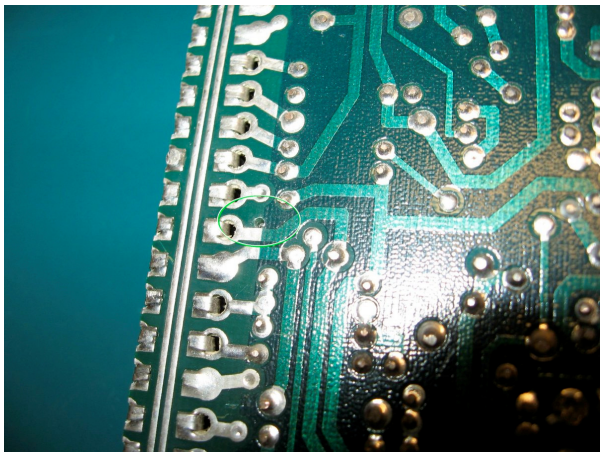
"Safe":

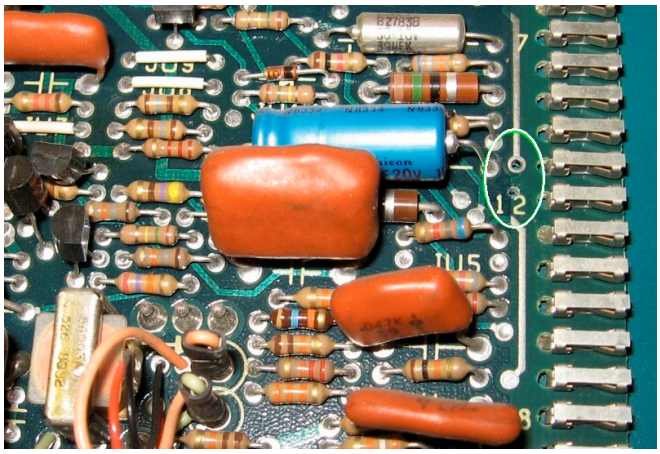
Previously was mentioned "safe" values for the shunt pull-ups. In the past it was believed these shunts were transistor collectors therefore, 10K resistors were used as a pull-up for one of the shunts to generate the cor (RUI) signal. There was a minor symptom noticed that one of the relaxed shunts never pulled up to A+ (probably from R10). Information was not found during those years therefore, the shunts were put in service with no apparent problems since 1998 for the mobile and base (compa) versions.

In 2018 reviled (by good source) these shunts are emitters and they should not have more than 4 volts on each one otherwise, excessive "bias" may cause them to be dysfunctional and eventually fail. OEM has the RUI voltage obtained from another card on the control shelf of the compa version station such as the squelch or line driver modules, or both. It's OEM voltage appears to be somewhat over the 4 volt warning, however. There's more discussion on this with another document called Micor squelch theory on SRG's web site.

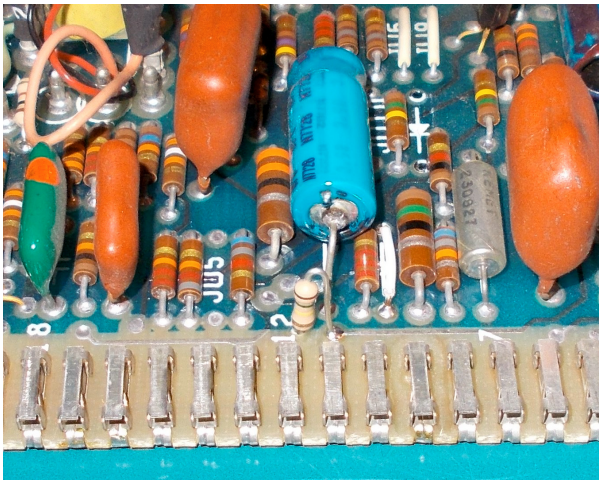
Since SRG's application does not do this, the pull-up resistor needs to be installed here, on the ACM (instead of elsewhere). The new R25 resistor will be used for this SRG modification.

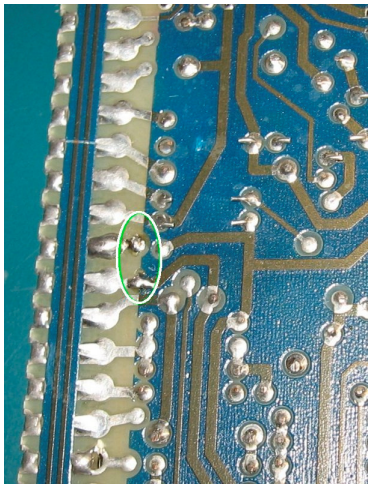
There's a good spot for this near the ACM's edge. There's already one eyelet connected to pin 11 of the card edge. The A+ runs right by this area. Drill a small hole next to the A+ run as shown here.





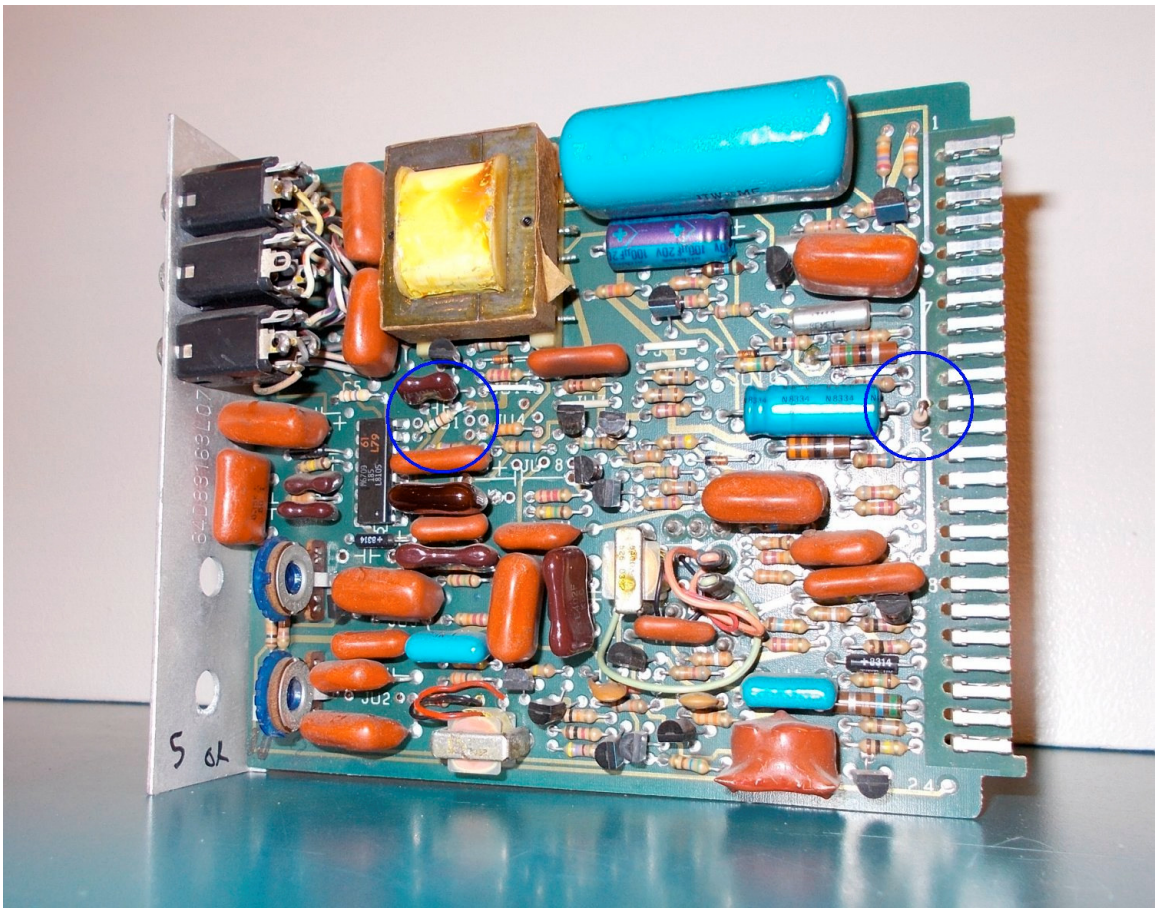
Next, install the new R25 as a 150K, in these holes. As shown, this is the equivalent of U1 pin 6 to A+ as shown on the right image.





This prevents inadvertent activation of the cor card's PTT-1 output if the ACM is pulled hot, for testing, etc. The cor card has its own pull-down resistor to further prevent this.

Here's an overall view of the ACM. The two areas of interest are circled in teal color. The left is the new R26's location and the right is the new R25's location. During production several were modified and tested with it's own "serial number" for maintenance tracking.

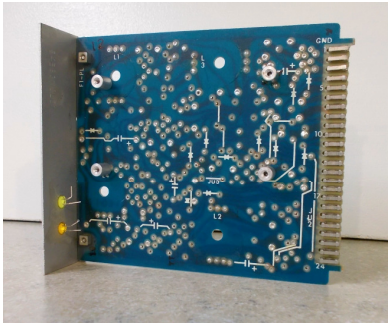


When the new value is installed the relaxed (high) voltage on pin 6 of U1 is now 2.319. If the cor card is pulled (for testing) the shunt relaxed voltage goes up to 3.144. All of this is within the "safe" voltage and still is plenty to activate the cor card. Set VR1 to 2.0 v on the cor card.

To recap, the cor voltage now comes from U1 pin 6 relaxing during activity, sending this signal to the output on pin 11 of the ACM going to the cor buss (pin 11), then to cor card pin 11.

COR Card:

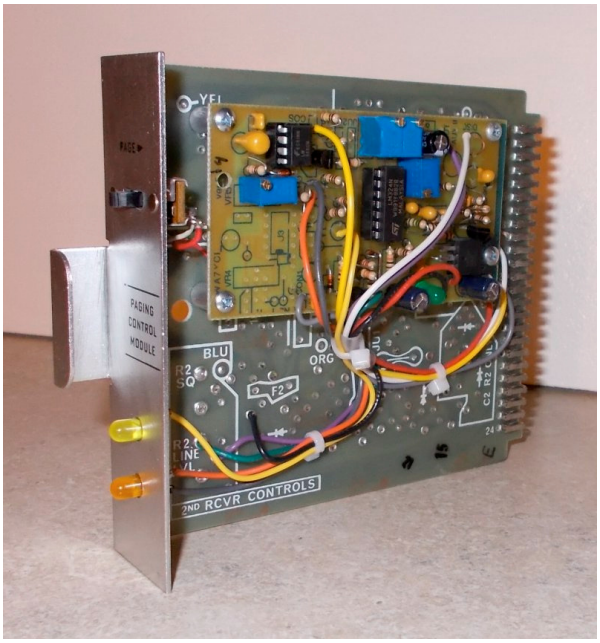
The cor audio board takes in the COR / RUI active going high voltage from pin 11 of the buss. Version 5.4 is used for the Spectra-Tac project. There's no place to mount this board. The Paging Control Module (PCM) was the best choice found however, only a few were found in 2017~2018.



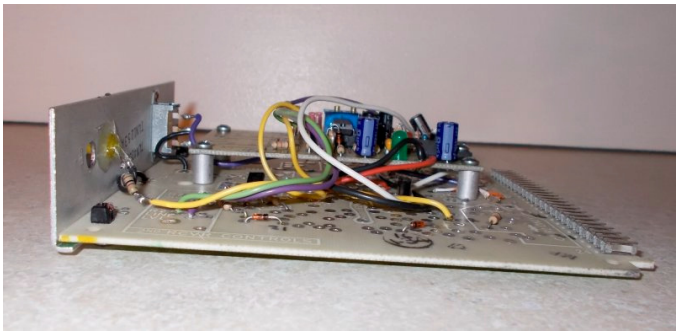
Here shown is a stripped down PCM.

This card has a "page" slide switch that can be used for a monitor function. It's the prototype and has a ground pin jack for testing however, the final design has it elsewhere.

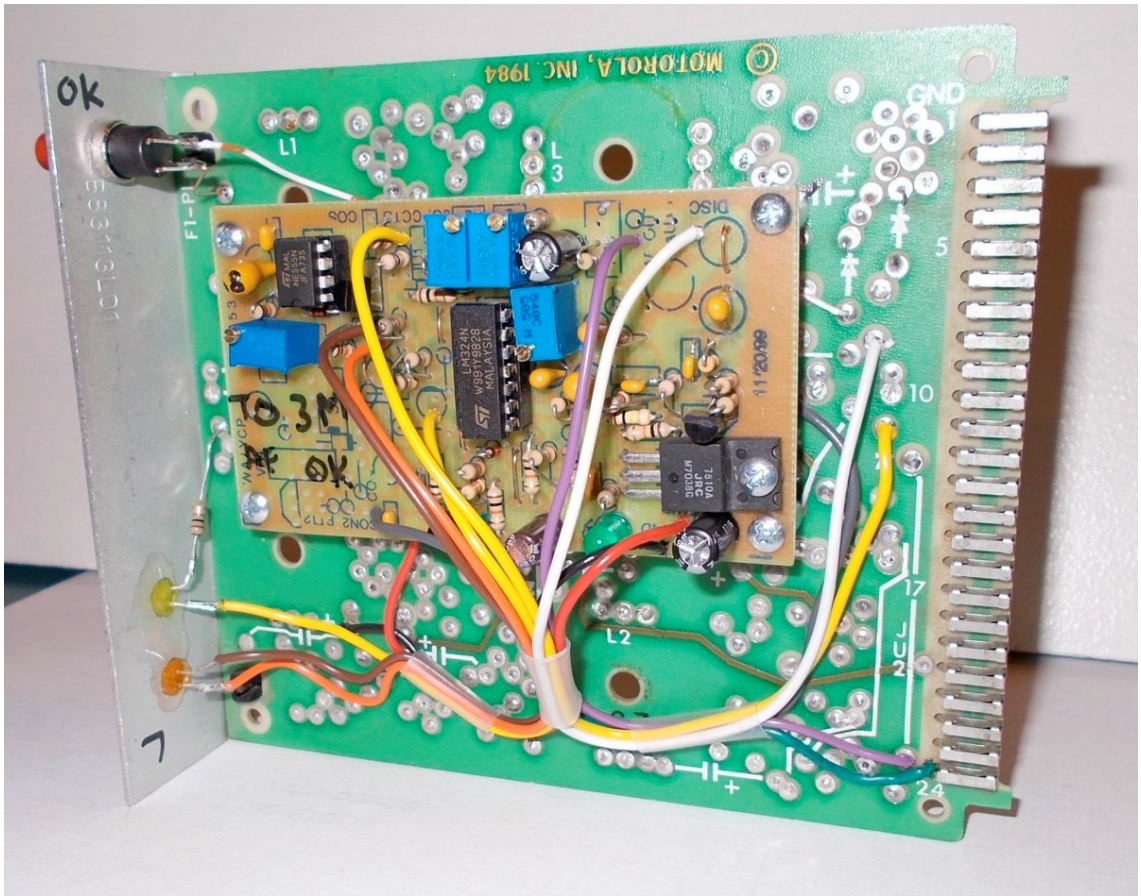
The board is mounted on the PCM with four standoffs. Enough PCB runs were found, analyzed and used to interface to the system board (backplane). It was verified the runs clear the standoffs. Therefore, this now becomes the "new" cor card, which plugs into position four of the control shelf. Currently, there are two indicators, yellow for cor output active. orange is cor over-activity, AKA timed-out.

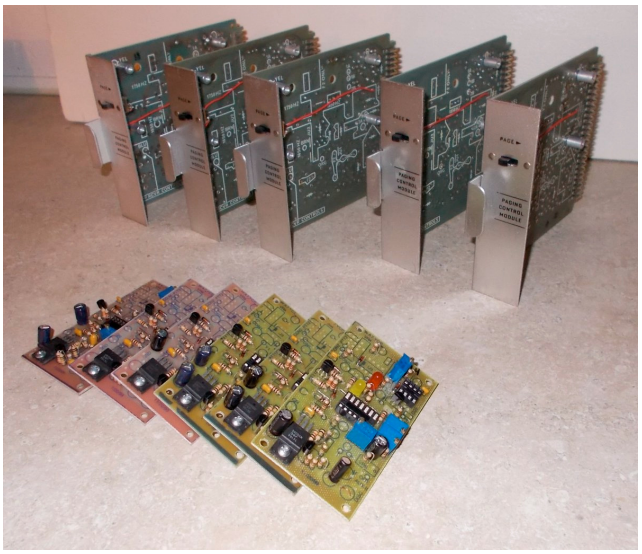


For best clearance, use 3/8” (.375”), round standoffs for the board as shown below.



PCMs are getting hard to find in 2018. The F1 control module card was found as a substitute. It has a lot of components. It’s over an hour painstaking task of removing of all the components. An alternative is to just cut them out which takes about 10 minutes. Some board cleanup may be needed at this point. There’s no (monitor) slide switch so a push button was installed; shown here in completed form. A future version will have a third indicator in red for the CON-1 input.





On th left is another view of production of several cards in production:

On the right shows using a paging control module.

Monitor:

A new service tool created is the "monitor" switch located on the cor card. When used it puts a "low" on pin 9 of the backplane. With the SRG jumpers this goes to pin 9 of the ACM. It does not affect the main squelch or PTT output. This can be handy to check for noise without disturbing the squelch setting.

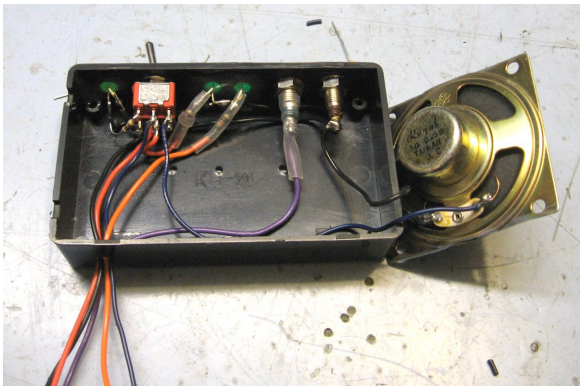
This "low" on the ACM turns on a diode, CR2. However, there may be too much voltage drop through it, causing low monitor audio (Q4 does not turn off completely). Therefore, it's removed and replaced with a jumper.

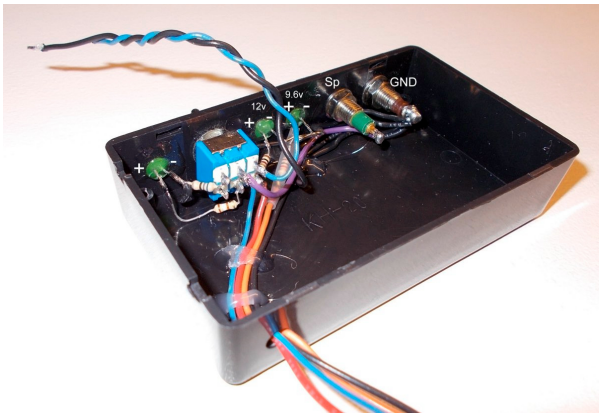
Note: It was found the cor line should not have any capacitance added. This was discovered during a RF protection attempt; a .1 uf cap was added on this line at the cor board end, causing an oscillation around 20 KHz This confused the associate circuitry on the cor card, so the cap was removed.

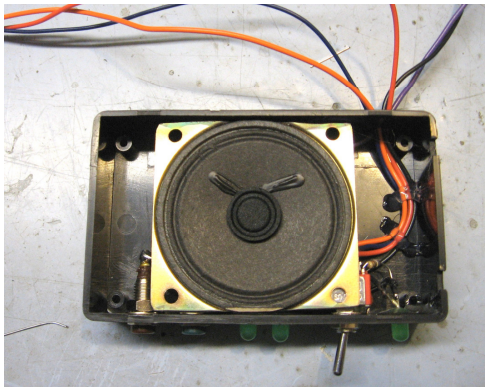
For maintenance tracking each card is serialized. The TO and AF level & response check has been performed as shown on the previous page therefore, is ready for deployment (service). Alignment and setup for the cor card is covered on a separate document on SRG's web site.

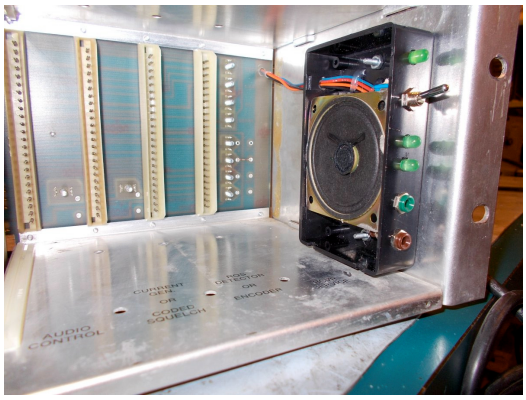
Service Module:

There is no place to install a physical speaker on the chassis (like there is on the compa & mobile versions). Therefore, a new "service module" (SM) is created and mounted on the far right wall of the control shelf, next to the cor card (phantom position 5). The local speaker is built-in as part of this module along with other functions, such as pin jacks; line out and ground. It can be used to measure sensitivity at the de-emped point. There's a green flashing reminder that the local speaker is turned on (to turn it off when leaving the site). The 63-ohm speakers were very hard to find.



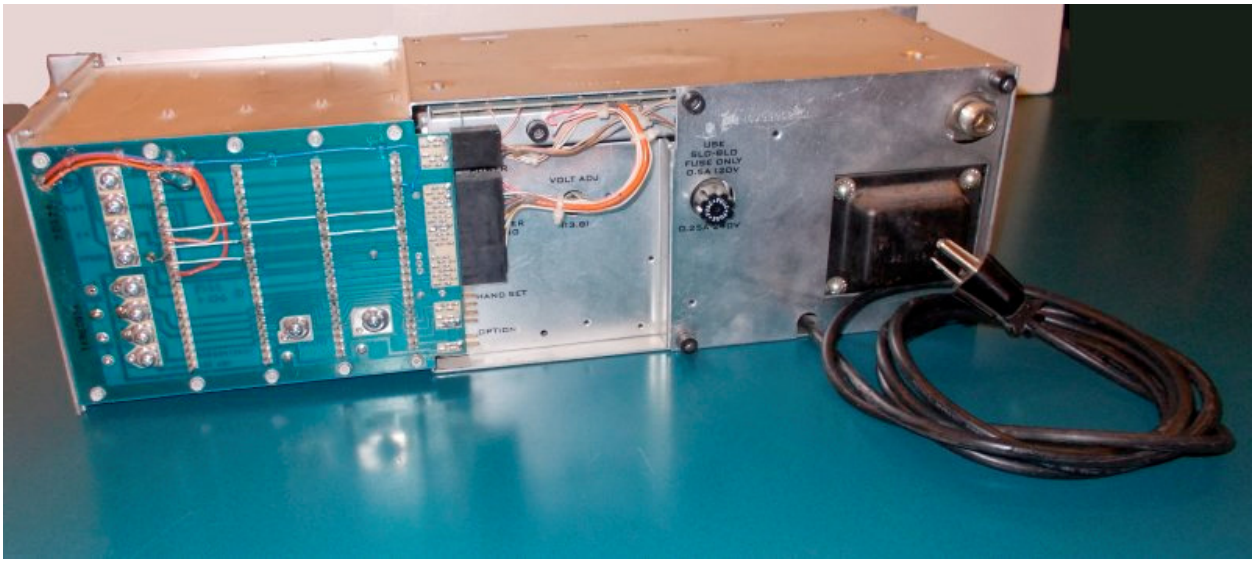




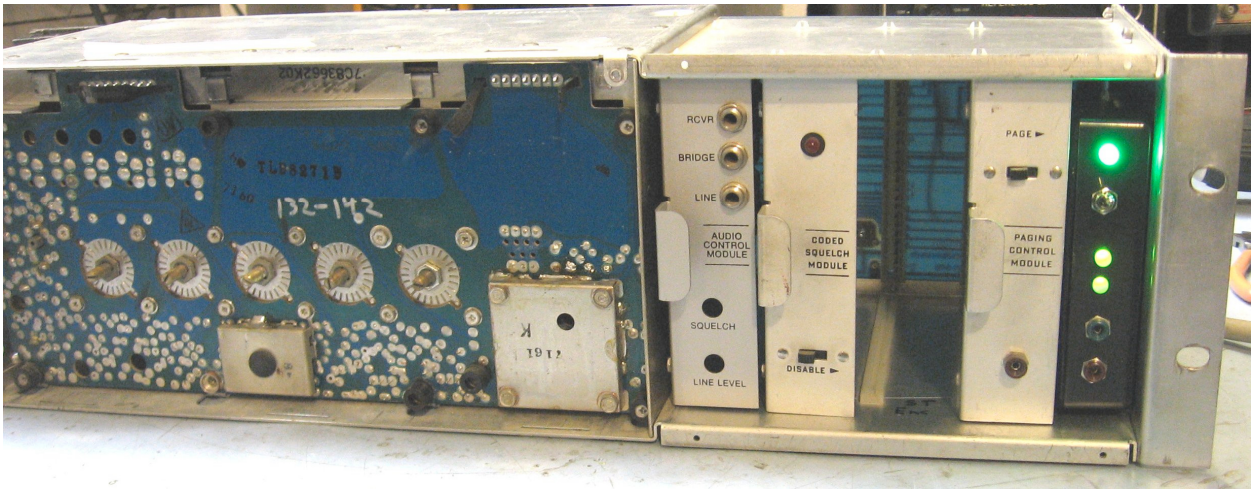


Here's the SM. Top to bottom is the local speaker status, local speaker switch, indicators for 12v (A+) and 9.6v and the pin jacks. The next version will utilize an (IC) op amp but not the 12v indicator. The LM-386 works well and will drive any 8-ohm speaker. This makes obtaining them much easier.

Shown here is the rear with the eight jumpers and wires. The pen markings are only for the prototype since the PCB already has (silk screen) markings for most of the terminal screws.

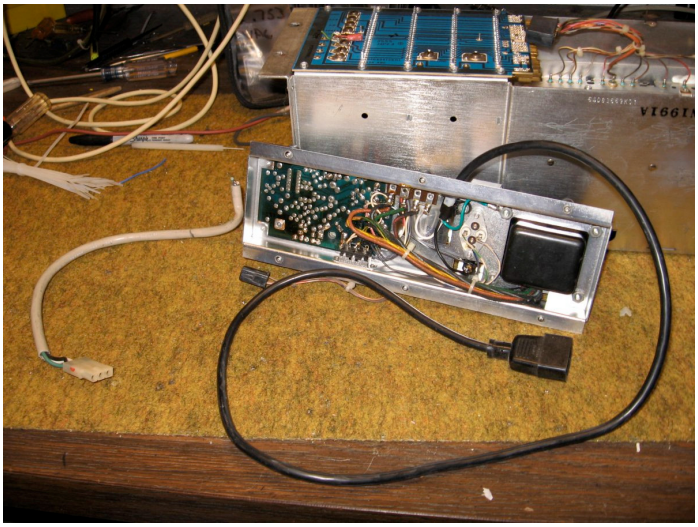


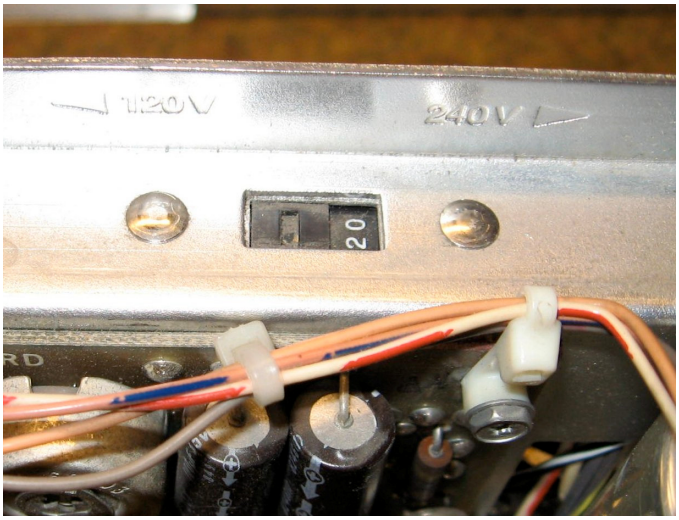
Shown here is the completed project with the cards, RF/IF deck, rear backplain board, power supply and covers installed. The PL module (PLM) is shown here in position two is for the tone receivers.

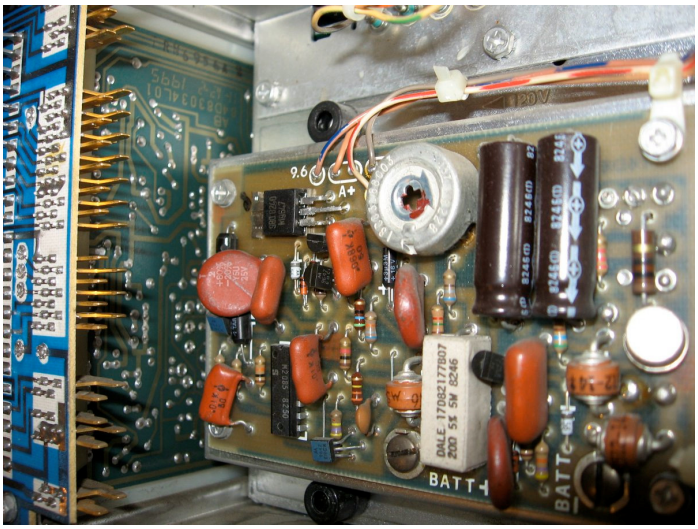


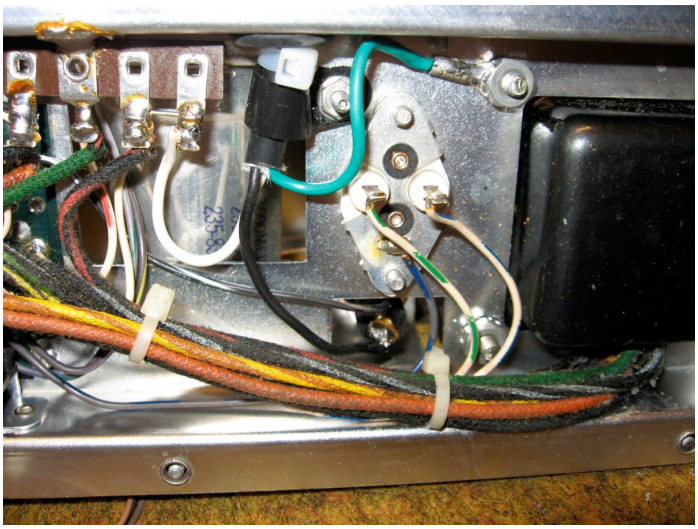
Power Supply:

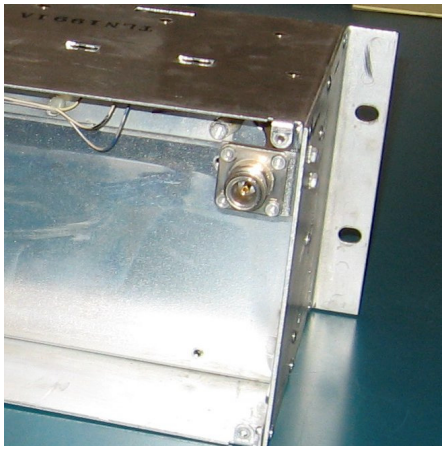
The receiver's power supply was checked out, especially for the first filter capacitor after the rectifier. Also, the stock power supply AC cord was designed as a daisy chain using a molex type connector. This was handy for sites using several receiver units in a rack. The author felt this type connector may be a safety concern plus, SRG stations only use one receiver package, so the cords were replaced with something more common, and wired directly to the supply's input terminals. The other end either has the very common "computer" type IEC C-14 connector or the very common NEMA 5-15P AC plug.











The straight blade type (old school) back plane screws were replaced with the phillups pan head type on the backplane and supply boards. Size 6-32 x 3/8" were used.

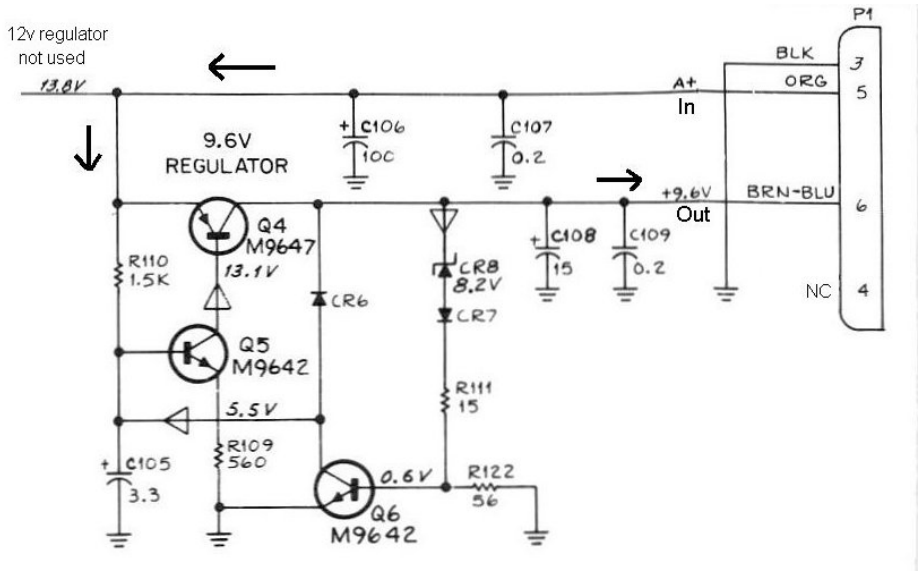
The image on the left shows the antenna port (and bracket for it) mounted on the newly arraigned side bracket. It's the hardest to get the holes in the correct position for this bracket.

A future possibility is to install a chassis mounted NEMA-C14 connector where the old molex type was. This may be dependent on the version of the rear cover to allow the larger jack to be. For now, the AC cord is neatly coiled and tied up on the rear chassis as shown here.

Some (remote) stations do not use the OEM built-in power supply such as an off-grid site with 12 volts available or in the case of most SRG remotes. These sites already have a 12v supply (to run the downlink transmitter) therefore, it simplifies the installation to run both units on the same supply.

The stock supply is still needed in either case. When running the unit with an external 12v source is connected to the third screw terminal down that's labeled (A+) on the PCB silkscreen. This point is more or less an input-output.

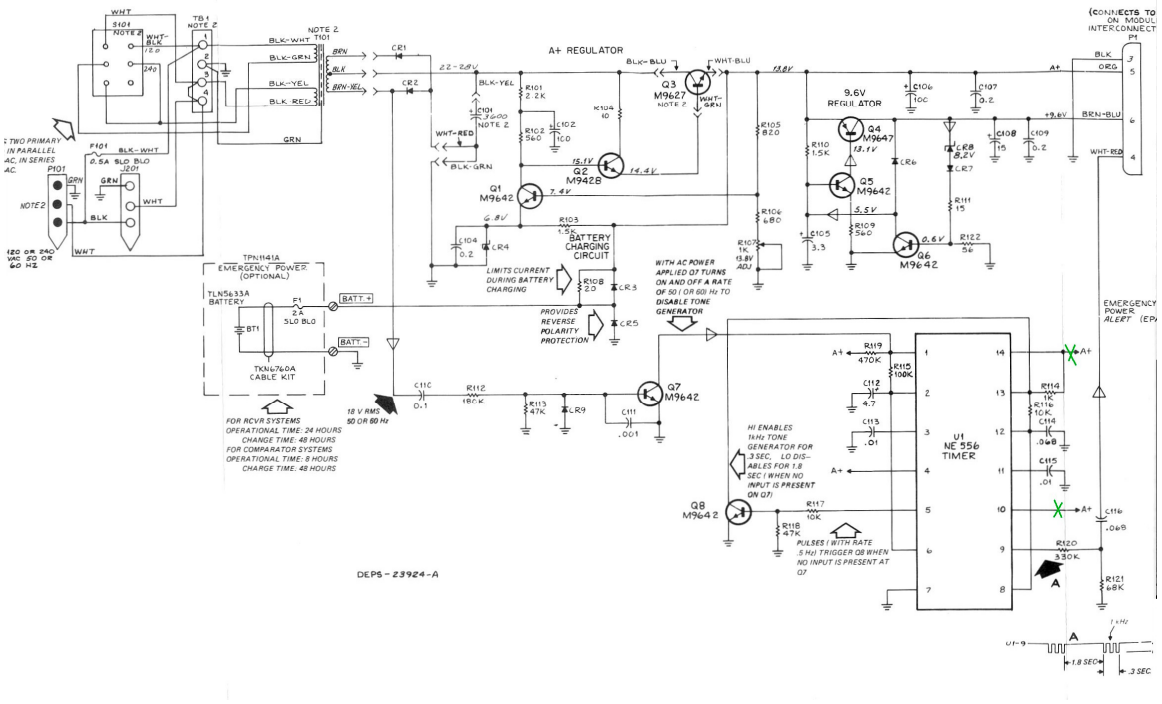
As shown below P1, terminal 5 is being used as an input. External 12v runs the receiver's 12v sections. It also back-feeds at this point to power the (OEM) 9.6 v regulator section to run receiver properly. This is similar to operating the unit with the stock battery backup.



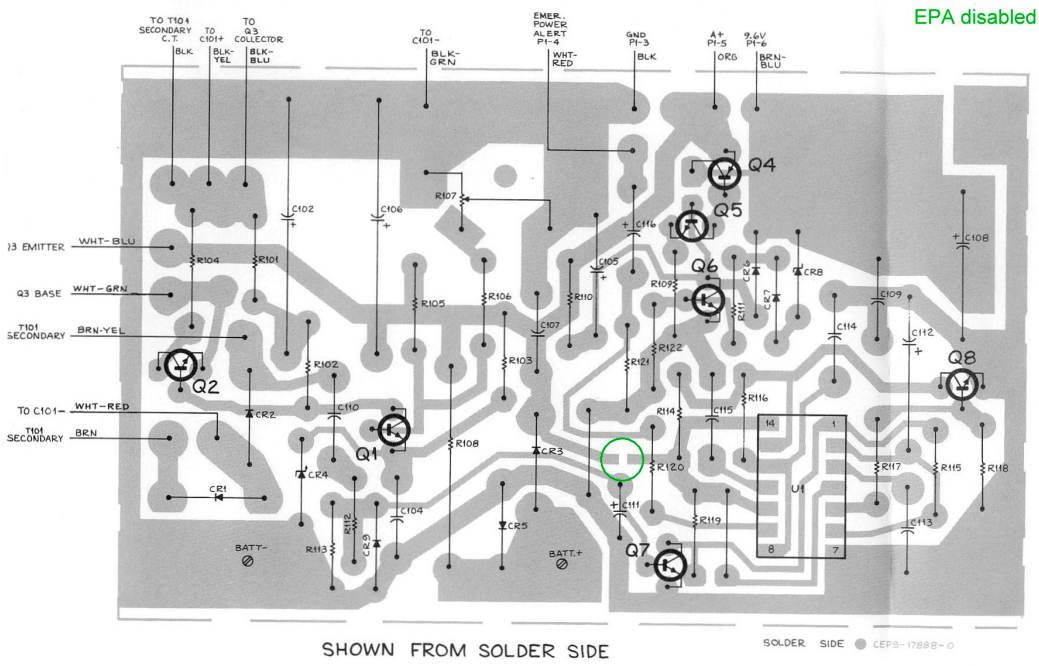
More supply details:

The battery input is also a charging circuit as shown on the entire diagram. When the unit is on battery (AC loss) it also enables a beeper circuit to “alert” the wireline to console (customer) that it’s on battery (emergency) power hence, the name EPA, or Emergency Power Alert. For SRG’s design and operation the EPA is considered just another unnecessary complication. Therefore, the beeper is disabled by removing its supply. This is done with a simple PCB run cut as shown below with the green marks on the diagram and PCB run cut. As discussed earlier Q3 won’t be affected by this back-feed at P1, pin 5; being reverse-biased.

EPA disabled



EPA disabled



Parts list: For all types of receivers:

Micor front end parts list for conversion to "M" (142-150.8 MHz)
21-82133G29 C108 18 pf ** (SRG used 21-82133G58, 27pf, in some builds)
21-82610C44 C109 47 pf ** (SRG used 21-83406D44, 47 pf, in some builds)
21-84494B03 C110 80 pf
21-82133G14 C113 7.5 pf
21-82133G14 C116 7.5 pf
24-84070C01 L101 (w/tap)
24-84070C03 L102
24-84070C03 L103
24-84070C03 L104
1-80713B52 L105 (w/tapped black wire)
Change R107 to 82K (SRG builds declined)
Change R122 to 10K (SRG builds declined)
Change R123 to 15K; (SRG builds declined)
Reverse CR102 and CR104 (because of high side injection, now) (SRG builds declined)

Notes: On the front end coils this range, the windings are closer and more of them (about 7 windings). On C109 there is some differences on the value should be used, in some of the older manuals. Keep that in mind when making the LO multiplier stages to work with a fundamental crystal around 17 MHz.

* In the case of the (old) "Omak Rx" a 10-ohm was used for the monitor function. (replaced now.)
** Some manuals disagree with this value

Jumper chart:
JU201 IN
JU202 OUT
JU203 OUT
JU204 OUT

For Spectra-Tac type receiver: (partial list)
4 of the 3/8" (.375") round standoff for mounting the cor board on Spectra-Tac card ME# 534-3479.

For Service module:
Some ¼" heat shrink, to insulate the hi side of monitor audio
Some 3/8" ? heat shrink for the cabling exit point (7/32" hole) through the back plain PCB.
Some hot glue to secure wires and the speaker.
Some labor to drill 1/8" holes for the speaker grill.
2 clamps for the back-plain screws for wire management.
2 4-40 screws & nuts, to hold the service module
1 box, plastic 100mm, x 60mm x 22mm ?
1 speaker, 63 ohm (later will be 8 or 16 ohm).
1 DPDT switch (later will be a volume / power switch.
2 pin jacks, green and black
2 LED, green T1 ¾
1 LED, green blinking, T1 ¾
2 resistor, 1K
1 resistor 10K

For mobile type receivers

1 19' rack panel #2; Bud radio # PA-1102-WH
6 standoffs, 1/4" hex body, 8-32 female threads
6 machine screws PPH 8-32, 1/2"
6 machine screws PPH 8-32, 1/4"
1 COR/AF board Ver. 5.3

2 25K LT pots w/switch
1 n.o. push button
1 LED, red
2 10K resistor
2 1K resistor
1 4.7 K resistor
mics wire for hookup around 22 gu, various colors, black, red, yellow, etc
some heat shrink to wrap the above wires as a harness
1 terminal block 140-14 (14 position)
1 matching transformer, 1K CT / 8 ohm, Radio Shack 273-1380 (use the 500 ohm tap).

Parts list (supplement)

QTY	Description	Value	Feature 1	Feature 2	Feature 3	Part number
1	Capacitor	18 pf	5 %	Mica, maybe		21-82133G29
1	Capacitor	47 pf	5 %	Mica, maybe		21-82610C44
1	Capacitor	80 pf	5 %	Mica, maybe		21-84494B03
2	Capacitor	7.5 pf	5 %	Mica, maybe		21-82133G14
1	Coil		L101		W/ tap	24-84070C01
3	Coil		L102,3,4			24-84070C03
1	Coil		L105		W/black wire tap	1-80713B52
1	Resistor	82 K	R107			
1	Resistor	10 K	R122			
1	Resistor	15 K	R123			
1	Heat shrink	¼”	Natural			
1	Heat shrink	3/8	Natural			
1	Capacitor	.1 uf	5 or 10%	MLCC	Radial LS .100”	
1	Hot Glue					
10	Labor			1 amp		
1	Clamp	¼”				
1	Box, project	100x60x22mm				
1	Screw	4-40 machine	Ph pan hd	Zinc		
1	Nut	4-40 machine		Zinc		
1	Speaker	8 or 16 ohm				
2	Pin jack	GRN and BLK				
2	L.E.D.	Green		T 1 3/4		
1				T 1 3/4		
2	Resistor	1 K	1/4w, 5%			291-1K-RC
1	Resistor	10 K	1/4w, 5%			291-10K-RC
1	Wire, jumper					
1	Wire, hookup	Red	Stranded	AWG 22	About 6”	
1	Resistor	Black	Stranded	AWG 22	About 6”	
1	Resistor	Blue	Stranded	AWG 22	About 6”	
1	Resistor	Violet	Stranded	AWG 22	About 6”	
1	Resistor	Slate (gray)	Stranded	AWG 22	About 6”	
1	Knob	1/8” shaft				290125 JE
1	Wrench	.058”	Hex key			
1	Board, cor					FAR circuits
1	Resistor	10 Kohm	1/4w, 5%			
1	Resistor	100 ohm	1/4w, 5%			
1	Resistor	10 K	1/4w, 5%			

1	L.E.D.	Red	Diffused	T 1 3/4		
1	L.E.D.	Green	Diffused	1/4w, 5%		34761
1	Resistor	Green	Diffused	1/4w, 5%	Binking	
1	Capacitor	100 pf	5 or 10%	MLCC	Radial LS .100”	
1	Capacitor	.01 uf	5 or 10%	MLCC	Radial LS .100”	
1	Capacitor	10 uf	5 or 10%	MLCC	Radial LS .100”	
1	Capacitor	100 uf	5 or 10%	MLCC	Radial LS .100”	
1	Potentiometer	25 Kohm	5 or 10%	W/ switch	SPST	CT2206-ND
1	Capacitor	.1 uf	5 or 10%	MLCC	Radial LS .100”	
1	I.C.	LM386-4				

Document setup notes: Font: arial 10, margins: top: .7”, bottom: .9, left and right 1.0, header: .2, footer: .7”; portrait. Images: float over text and most are square positioning. AK2O with updates on March 2018, April 2018, Jan 2020, Apr 2020, July 2023.