Mocom 70 9600 Baud Modifications

Transmit power identification
To determine what model and power level, the following information should help sort things out.

U44BBN-*****	25 watts
T44BBA-*****	50 watts (note the similar model numbers, refer to the next paragraph for the way to tell the difference)
T54BBA-*****	75 watts

There is a great deal of difference between the 25 watt and the 50 and 75 watt radios as far as the transmitter is concerned.

MOCOM 70 — 25 Watt version. Note the size of the heat sink as compared to the 50/75Watt below. The 25W version has heatsink fins, while the 50/75W does not.

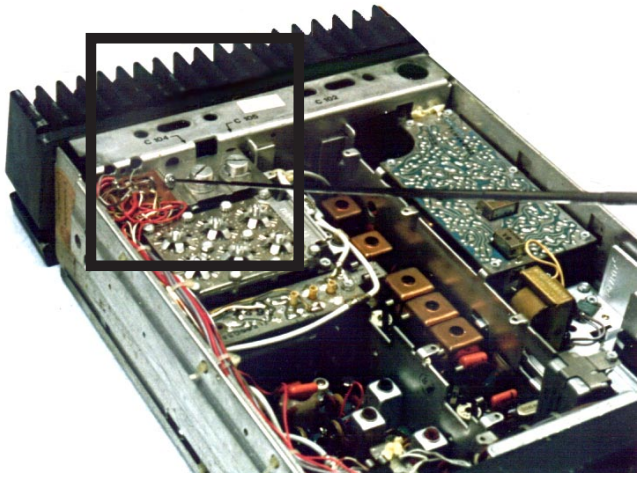
MOCOM 70 — 50/75 Watt version. Note the different style and size of the PA section on the rear. This picture also shows the control head and radio connection (DB9).

They all start out with the same exciter stage, basically a VHF Mocom 70 exciter, output at 150 MHz range. From here on things are VERY different. The 25 watt radio has a 45 watt VHF PA that follows the exciter stage. The VHF PA drives a varactor stage that triples to UHF.

This radio can be identified by two things:

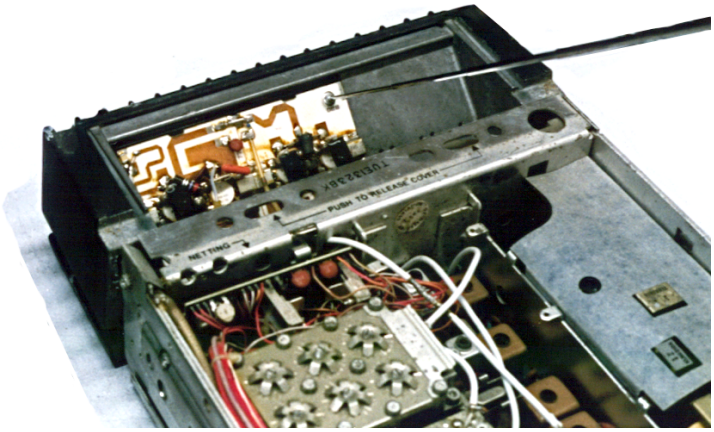
1. A mechanical power switching relay, located in the left rear corner of the radio, just in front of the PA assembly.

2. The varactor tripler unit just to the right of the relay. This assembly has two large screwdriver adjustments for tuning.



The 50 watt radio has an active tripler that follows the exciter and a PA assembly that runs at UHF. The 75 watt radio has two additional UHF PA transistors.

THE 50 & 75 WATT RADIOS USE SOLID STATE POWER SWITCHING. The power switching board used with the 25 watt radio is not needed with these units.



Important note concerning the power switching board used in the 50 & 75 watt units:

This board also provides the PA stages with SWR protection and low power shutdown. If the PA stages do not produce in excess of 10 watts within 40 msec of transmit key-up, the PA will be shut down. I highly recommend that anyone planning to use the higher power radio try to beg, borrow, or otherwise obtain a copy of the Motorola service manual for these units.

One important consideration when using any of these radios is the amount of current drawn in transmit. At 13.8 VDC, the 25 watt radio will draw 14 amps, the 50 watt radio 16 amps and the 75 watt radio 25 amps. Be sure your power supply has sufficient capacity to meet these requirements.

Basic radio conversion
If possible, check the receiver and transmitter at the original operating frequency.

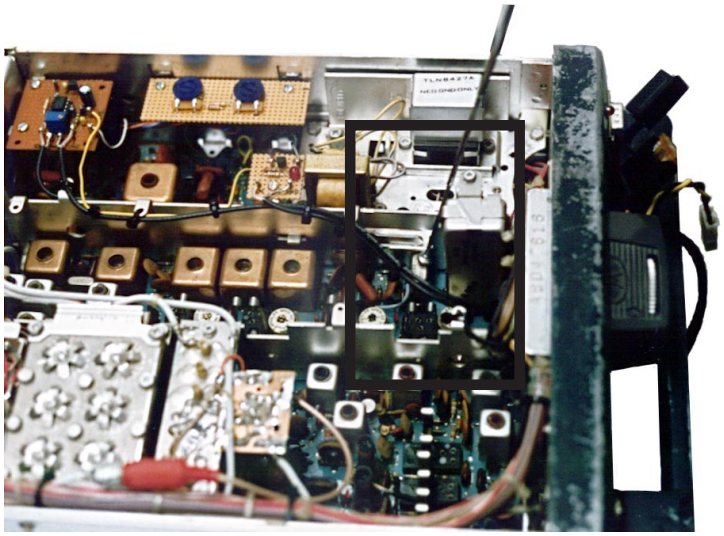
Before you proceed with conversion, take a minute to order the receive and transmit crystals from International Crystal.

1. The receive crystal number is K-1018A. Specify low side injection.

2. The transmit crystal number is KXN-1002A.

Ask for extra aging on these two crysatls. This service is available at no charge and will help cut down on the initial frequency drift as the new crystals age in the field.

If you plan to use a TPRS 9600 baud modem, refer to step 1 in the receiver modification section. If you need a different second IF crystal, include this crystal in your order.



MOCOM 70 — IF Xtal location. Shown at end of pointer.

After you receive the crystals, install them in their respective resonators. Resonators are the small silver "miniature" channel elements. In order to gain access to the crystal, use a small flat blade screwdriver to carefully pry between the black plastic base of the element and the metal housing. With a little effort, the two can

be separated. Remove the old crystal and install the new one. Then snap the base back into the housing.

If you were unable to test the radio at its original frequency, install the new crystals, follow the TX and RX alignment instructions and attempt to verify radio operation at the new frequency.

Assuming that you tested the radio and it is working, proceed with the modifications.

At this point, you must decide how you wish to make the connections between the radio and the modem. My approach has been to install a DB-9P connector on the right hand side of the radio. This connector is installed in the same general area on the right hand side of the radio as the coax connetor is located on the left hand side. In order to install this connector, you must remove the front panel from the radio. Front panel removal requires you to remove lock barrel from the key locking assembly. Unless you have the proper tool to remove the lock, you must resort to breaking the nylon locking bar that secures the radio to the bottom cover. Another option might be attempting to duplicate the lock barrel removal tool. Although I have not tried this approach, I have included a drawing and a few instructions in Appendix " A" that might help you in your efforts. Another option is to cut a notch in the top cover of the radio. A cable of the appropriate length could be constructed and routed through the notch in the top cover. The very brave might consider drilling a 3/8 hole through the front panel. Then continue on and drill a corresponding hole through the radio chassis frame. Be advised that one slip of the drill could do serious damage. If you choose to remove the front panel and add the DB-9 connector, proceed with the following instructions. If you decide on a different approach, skip to step 13.

1. Remove the two small phillips head screw that hold the metal escutcheon plate in place. This plate will have the words "Motorola", "Mocom 70" and possibly the Model and serial numbers printed on it.

2. The metal ID plate is usually glued in place for good measure. Using a small screwdriver, start in the area of the power plug and pry the plate loose from the cover.

3. Removing this plate will expose four 5/16 hex head screws. Before you remove these screws, it's time to deal with the key lock.

4. A special tool, Motorola part number 66-84909B01 is required to free the lock barrel from the outside housing. Removing the lock barrel allows the nylon locking bar to be removed.

The lock barrel is removed as follows:

A. Insert the key into the lock and turn the key horizontally to the unlocked position.

B. Insert tool (# 66-84909B01), with the small end pointed away from the radio, into the small slot in the front end of the lock.

C. Push the tool in until it stops and turn 90 degrees clockwise.

D. Pull the key, this removes the key and the barrel from the lock housing.

Note: The previous two steps are easier said than done. To quote a tech at the local MSS, standing on your head and holding your tounge in the right position will help in performing steps C and D.

E. Remove the nylon locking bar.

5. Remove the four 5/16 hex head screws that hold the front panel in place.

6. Make a cut out to accept the DB-9P in the right side of the front panel.

7. Before you install the connector, you might want to make the various connections to the plug.

8. Cut three pieces of RG-174 or similar shielded cable to the following lengths: 14", 16" and 19".

9. The pin-out on the DB-9P follows the standard that TAPR established on the TNC-1 radio connector.

1	No Connection
2	No Connection
3	RX audio
4	PTT
5	TX audio
6	GND
7	GND
8	GND
9	GND

10 A. Connect the center conductor of the 16" piece of shielded cable to pin 5 of the DB-9P. The shield goes to pin 9. This is the TX audio cable.

B. Connect the center conductor of the 14' piece of shielded cable to pin 4 of the DB-9P. The shield goes to pin 8. This is the PTT cable.

C. Connect the center conductor of the 19" piece of shielded cable to pin 3 of the DB-9P. The shield goes to pin 7. This is the RX audio cable.

11. Install the DB-9P connector in the front panel. You might consider using a few cable ties to bundle the three pieces of shielded cable together. It would also be a good idea to use some type of marking system to help you sort out the cables when it is time to connect them to the appropriate stages.

12. As you re-install the front panel, route the shielded cables through the large notch in the front of the radio frame. This notch exists to allow clearance for the screwdriver operated locking mechanism. Be sure that the cables are not pinched as they run through this hole. These cables will be connected at a later time.

13. For those that decided to use a different approach for radio interface, leave enough cable length inside the radio to connect to the receive discriminator circut. This circut is in the right compartment, toward the rear of the radio.

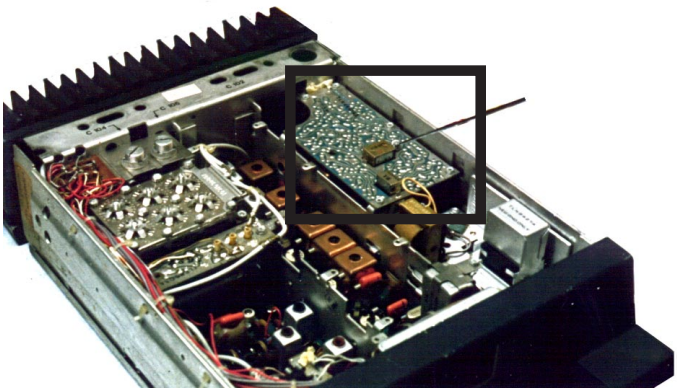
14. The last subject to be covered in this section is power connections. I have enclosed the diagram and chassis layout for a radio interface box. This box was designed by the Hognet Packet group for use with VHF Micor radios. I have adapted this design for use with the Mocom 70. Since you don't need volume and squelch controls in normal 9600 baud operation, you might consider building just one of these boxes to be used for test purposes assuming that you don't have access to a Mocom 70 control head and cables that could be used for testing. For normal operation in the field, a simpler power cable can be constructed. If you decide to use the simple power cable, you will not be able to use a speaker to monitor in the field.

If you have are familiar with the Mocom 70, you might consider the approach that I have

followed. I installed volume and squelch controls inside the radio, making connections to the appropriate places on the main circut board. This allows me to use the simple power cable and still have the ability to use a monitor speaker. The details of this method are beyond the scope of these instructions.

Diagrams for the Hognet radio interface box and the simple power cable can be found in Appendix A.

PL board removal and Power Switching (All models, all modems)



1. If the radio you are using does not have a PL board installed, make sure the following jumpers are in place. These jumper points are located in the right hand compartment of the radio.

Points 3 to 4 in the receiver audio circut
Points 6 to 7; 8 to 9 both in the PTT circut

See receiver schematic for more details.

2. If the radio you are working with has a PL board, remove this board and install jumper wires at the points mentioned above.

3. Verify TX and RX operation after these mods.

If you are modifying a 25 watt radio, proceed with the following steps. If you are working with a 50 or 75 watt radio, skip to step 12.

I suggest that you double check and verify that the radio works before you proceed with the following steps.

4. Locate and remove the following wires from the power switching relay:

Red/Yellow	A+ to receiver
Brown/Red	Filtered unswitched A+
Red/Brown	A+ filtered to exciter
Gray/Red	PTT from power plug
Green/Black	A+ to relay coil
White/Red	+12 switched to ANT relay
Brown/White	Reg 9.1V to receiver

5. Solder the brown/white 9.1V feed to the relay terminal that has two brown/yellow wires connected to it.

6. Two relay terminals will have large red wires connected to them(the small white/red wire was connected to one of these terminals). Remove one of these wires and solder it to the terminal with the other red wire.

7. Pull the remaining six wires back through the wiring harness starting from a point in the vicinity of the antenna relay. With the exception of the black/green wire, these wires will be connected to the solid state switch board. The black/green wire will be used to power the receive preamp.

8. Install a 1N4002 diode across the terminals of the antenna relay coil. The banded end of the diode should connect to the terminal with the white/red wire.

9. Construct the solid state switch board following the schematic in Appendix "B". There is not a PC board available for this switch. I have been using a 2 1/4 by 2 1/2" piece of perfboard.

10. The switch board is mounted in the center section of the radio, over the F4 receiver channel element postion. Mount the perfboard using the two mounting tabs with screw holes that are located in this area. These tabs are part of the shield assemblies that separate the various circuts in the radio. You should allow for 3/8 of an inch clearance between the switch perf board and the Permakay IF filter.

11. Make the following connections to the switch board. You will use the wires removed from the power switching relay in step 4.

Brown/Red	+12V In
Red/Brown	+12V TX
Gray/Red	PTT from radio power plug to active low PTT
White/Red	+12V switched to antenna relay
Red/Yellow	+12V RX or as an option, tie to the brown/red wire at the+12V In terminal. If you choose this option, the receiver will remain on during transmit. I recommend using this option as it improves turn around time and if you are operating simplex, it will allow you to look at your transmit eye pattern on the receiver.

In addition to the above wiring, you will need to provide a ground connection for the switch circutry.

This connection can be a jumper wire to a convenient ground point on the main circut board or soldered to one of the shield assemblies. If you decide on the later connection, use a high wattage soldering iron.

Note that there are two polarities of PTT signals that can be applied to the switch. If you are using a TAPR or G3RUH Modem, use the active low PTT. If you are using the TPRS Texnet modem, you may use either active high or active low, depending on how your modem is strapped. I recommend active high to maintain compatibility with the standard set by the RCA series 700 radios.

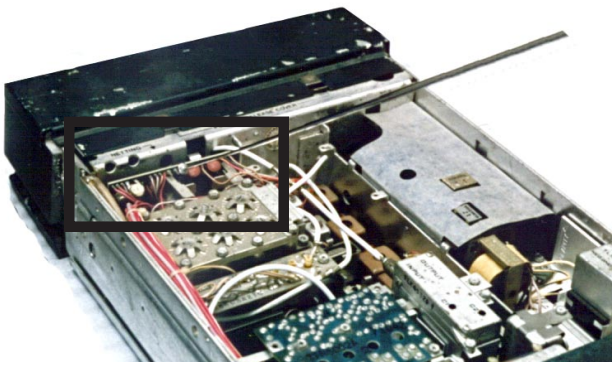
Don't be tempted to take a short cut and tie the antenna relay power to the +12 TX lead and try building a simpler solid state switch. The supplied design provides timing delays that allow the antenna relay to energize before power is applied to the exciter and then keeps the relay energized for a short amount of time after the power is removed from the exciter.

At this point, the radio should be checked for proper operation. You may use the Hognet radio interface box or a standard Mocom 70 control head and cables for this test. You should now proceed to step 17.

The following steps apply to the 50 and 75 watt radios.

12. Optional: If you choose this option, the receiver will remain on during transmit. I recommend this option as improves turn around time and, if you are operating simplex, will allow you to look at your transmit eye pattern on the receiver. To keep the receiver active on transmit, you will need to short across two connections on the protection and switching circut board.

    This board is toward the left rear of the radio, sandwiched between the receiver RF deck and the transmitter PA stages.



In order to gain easy access to this board, you will need to perform steps 12A-H. If you do not choose the continuous receive option, skip to step 17.

A. Remove the bottom shield cover from the radio. This cover is held in place by two phillips screws and two 5/16 hex head screws.

B. Remove the four phillips head screws that hold the TX multiplier stage in place. This stage is located on the bottom side of the radio directly beneath the receiver front end.

C. Looking at the back of the radio, note that there are two 5/16 hex head screws that hold the PA heatsink in place. Loosen these two screws and the PA stage will hinge open to gain access to the PA stages.

D. If you will look at the protection and switching board from the top of the radio, you will see a nylon spacer that holds one side of the circut board in place. Noting the location of this spacer, remove the 1/4 hex head bolt that holds this spacer in place. Access to this bolt is from the PA compartment.

E. Remove the two 1/4 inch hex head screws that hold the switching board heatsink in place. These screws are on the side of the radio.

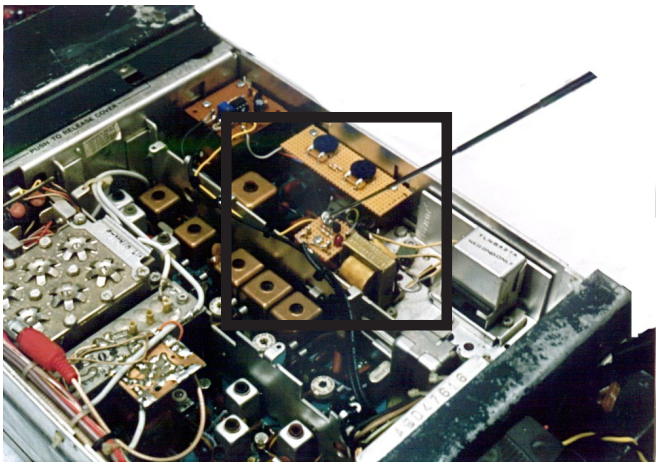
F. Remove the power switching circut board. Be careful not to break any of the multitude of wires that connect to this board.

G. Locate the brown/red and the red/yellow wires. These wires will be at the top edge of the circut board, toward the center of the radio. Install an insulated jumper wire between these two points. This jumper should be installed on the solder side of the circut board.

H. Install the protection and power switching circut board back in the radio. Perform steps B-E in reverse order. Take care not to break or pinch any wires when you are putting the board back in the radio. Leave the bottom shield cover off of the radio. You will need access to the solder side of the main circut board during transmit conversion.

If you are using a TAPR, G3RUH or TPRS modem strapped for active low PTT, proceed to step 17. If you are using a TPRS modem strapped active high for RCA 700 compatibility (recommended), continue with the following steps.

13. Construct the PTT inverter following the schematic in Appendix B. The PTT inverter can be built on a small piece of perfboard approximately 1 by 1 1/8".



14. Refer to step 10 to help determine the correct location and mount the PTT inverter using one screw. Use the mounting tab that is on the shield that separates the two sections of the receiver.

15. Connect the output of this inverter to pin 9 in the receiver audio squelch compartment. Pin 9 has a jumper to pin 8. This wire jumper was present in a carrier squelch radio or was added during PL board removal.

16. The ground connection on the PTT inverter can be connected to pin 11. Pin 11 was the ground connection for the PL board and is located close to pin 9.

Normal active low PTT from the power plug should not be effected by this by this modification. The active high connections will be made in step 18D.

Take a few minutes and check the radio for proper operation. You may use the Hognet radio interface box or a standard Mocom 70 control head and cables.

17. Locate the piece of shielded cable that is to be used for PTT . If you installed the DB-9P connector, this will be the 14" cable. If you used a different method for bringing the modem interface cable in to the radio, locate the PTT cable.

18. Read the following instructions carefully. Follow the step that is appropriate for your radio/modem combination.

A. If you are using a 25 watt Mocom 70 with a TAPR, G3RUH, or a TPRS modem strapped for active low PTT, connect the center of the PTT cable to the active low PTT connection on the solid state switch board. The shield of this cable should connect to ground at a convenient point on the switch board.

B. If you are using a 25 watt Mocom 70 with a TPRS modem strapped for active high PTT, connect the center of the PTT cable to the active high PTT connection on the solid state switch board. The shield of this cable should connect to ground at a convenient point on the switch board.

C. If you are using are 50/75 watt Mocom 70 with a TAPR, G3RUH, or TPRS modem strapped for active low PTT, connect the center of the PTT cable to pin 9 in the receiver audio-squelch compartment. Pin 9 has a jumper to pin 8. This wire was present in a carrier squelch radio or was added during PL board removal. The shield of this cable should be connected to pin 11. Pin 11 is located in the same area as pin 9.

D. If you are using a 50/75 watt Mocom 70 with a TPRS modem strapped for active high PTT, connect the center of the PTT cable to the input of the PTT inverter. The shield of this cable should connect to ground at a convenient point on the PTT inverter board.

You may now proceed to receiver modifications.

Receiver Mods

1. If you plan to use this radio with a TPRS 9600 baud modem, check the frequency marked on the second oscillator crystal Y6. If the frequency is 12.155 MHz, order a new crystal from International Crystal on 11.245. The ICM part number is 164447. Specify HC-6 holder.

   The second oscillator crystal is located in the center compartment of the radio close to the front and soldered in place. Do not confuse the crystal socket for the F4 crystal Y4(may not be present in many radios) with the location of Y6.

2. Align receiver to the new frequency BEFORE changing the second oscillator crystal (if this change is necessary). Receiver alignment instructions are found in Appendix C. If everything is OK, change the crystal.

3. A correctly operating receiver will have a sensitivity of .5 to .7 uV for 12 dB SINAD(for those who can measure SINAD). The receiver front end is at the edge of its tuning range in the amateur band. The "Q" of the resonators is decreased resulting in the reduced receive sensitivity. THIS MEANS THAT A RF PREAMP WILL BE REQUIED FOR RELIABLE OPERATION. 9600 BAUD FSK IS NOT A WEAK SIGNAL MODE.

Suggested preamps are the Hamtronics LNW-432 and the Ramsey PR-40. The physical size of these preamps is perfect for installation in a Mocom 70. Refer to step 9 for further information on preamp installation.

4. FSK receiver data is taken across C329, a 2000 pf disc capacitor. This capacitor is located between the discriminator can and the receiver metering receptacle. It is the disc capacitor closest to the discriminator can. The lead of the capacitor closest to the center of the right hand compartment is the ground connection. Verify with a VOM. The RX data connection is made directly to the other lead of C329. Note: This is a direct connection, no coupling capacitor is used.

4A. For radios that will be used with TAPR/G3RUH modems: If you installed a DB-9P connector on the front panel, the 19 inch length of shielded cable should be routed along the divider shield between the two sections of the receiver and toward the rear of the radio. If you used a different method for bringing the modem interface cable into the radio, locate your receive audio cable. Route this cable to the rear of the radio following the divider shield between the two sections of the receiver.

4B. Refer to step 4 for the location of C329. Solder the center conductor and shield of the RX audio cable to the appropriate leads of C329.

If you will be using a TPRS modem with you radio, complete the following steps. If you are using the TAPR/G3RUM modem, skip to step 10.

4C. Refer to step 4 for the location of C329.

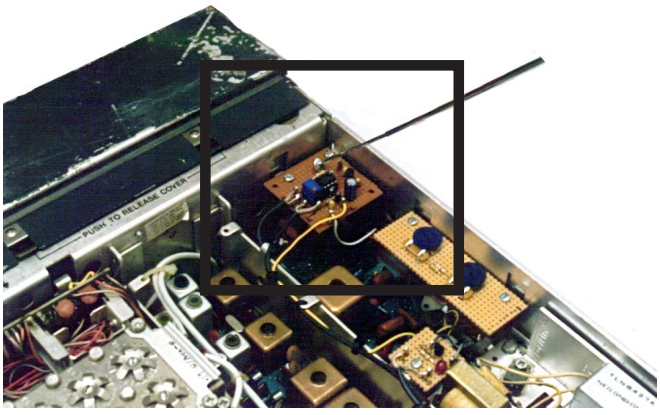
4D. Cut the leads of a 270K 1/4 watt 5% resistor to 1/4".

4E. Solder one lead of the 270K resistor to the lead of C329 that is not connected to ground.

4F. Prepare a 4" length of shielded cable.

4G. The center condoctor of this cable should be soldered to the "free" end of the 270K resistor installed in step 4E. The shield should be soldered to the lead of C329 that is connected to ground.

5. Build the RX data inverter. Follow the schematic in Appendix C. Layout is not critical. The data inverter is built on a small piece of perfboarf that is available at Radio Shack. The part number is 276-148. This is a "double" board that can be split in half. The inverter uses one "half".



6. Mount the data inverter in the right rear corner of the radio using the two "L" brackets that are in this corner. These two "L" brackets were originally used for mounting the PL board.
7. + 12 volts for the data inverter is taken from connection point 16 in the discriminator/audio-squelch area of the receiver. To find connection point 16, look down at the main circut board and slightly toward the rear of the radio from the "back edge" of the metal bracket that holds the Audio PA transistors and transformer. You will see a terminal pin with the number 16 next to it.
8. Connect the 4 inch piece of shielded cable from the receiver discriminator to the input of the data inverter board.
9. If you installed a DB-9P connector on the front panel, the 19 inch length of shielded cable should be routed toward the rear of the radio. Follow the divider shield between the two sections of the receiver and then connect this cable to the data inverter output. If you used a different method for bringing the modem interface cable into the radio, locate your receive audio cable. Route this cable to the rear of the radio following the divider shield between the two sections of the receiver.
10. Install the RX preamp. Use the green/ black wire for +12 volt power to the preamp in 25 watt radios. In 50 and 75 watt radios, preamp power is obtained from connection point 16. Refer to step 7 for the location of this point. Peak the preamp for maximum sensitivity by following the instuctions supplied with the preamp. Note: A properly operating radio with preamp installed will have a receive sensitivity of .2 uV or less for 12 dB of SINAD.

If you are using a TAPR or G3RUH modem, you are finished with the receiver modifications.

If you are using a TPRS modem, a resistor needs to be removed in the modem. Take a few minutes and make this modification before you continue with the radio conversion.

11. Locate and remove R28, a 220K resistor in the receive input stage. R28 is near U10 and VR2.

This completes the receiver modifications.

Transmitter Modifications

1. Plug the re-channeled TX crystal resonator in the F1 socket. In single frequency radios, there will only be one channel element socket.

2. Align the transmitter to the new operating frequency following the steps in the TX alignment guide.

   Skip the next step if you are working with a 50/75 watt radio.

3. Remove the bottom shield cover from the radio. This cover is held in place by two phillips screws and two 5/16 hex head screws.

4. Remove the following components from the exciter: The exciter is located in the left compartment and toward the front of the radio. The components are located next to the the deviation pot R101.

   C190: A .47 uf mylar in 25 watt radios or a 4.7 uf electrolytic capacitor in 50 and 75 watt radios

   R191:A 5.6K resistor

If these two components are left in place, they will, along with the deviation pot, make a nice R-C network that is guaranteed to "mess up" your TX data.

The next step should not be performed unless you will be using a TPRS modem. Remove R110: A 180K resistor. This resistor along with R111 150K is used to bias the varicap at 4.0V.

5. **(All Modems)**
   Insert one lead of a 33K 5% resistor in the circut board board hole that has a trace that runs from the previously removed R191 (5.6K) to the frequency adjust coil L101. If necessary, verify this connection with a VOM. The other end of this resistor will be connected in a later step.

This is the point where things get a little tricky, deciding whether you will use AC or DC coupling when you interface to the varactor modulator. If you are using a Texnet modem, there is only one choice DC. If you are running a TAPR or G3RUH modem, you may have a choice depending on who manufactured your modem.

If you are using a TPRS modem, you can skip to step 7 at this point.

I have seen some differences in the G3RUH modems between the early design and later versions. The early designs had a coupling capacitor in the TX data output and these are AC coupled. The later designs as used in the PacCom Spirit 2 are DC coupled. I have been told that the Kantronics KPC-9612 has jumper selectable coupling.

If you are not sure how your modem is configured, there is one sure way to tell: Hang a DVM across the TX data output and ground. If there is a DC voltage present, you have a DC coupled modem.

In most cases, if you have a choice, use DC coupling. This is the preferred method of interface since it reduces the possibility that you may have poor low frequency response on the transmit side.

The easiest way to determine if you have poor low frequency response is to view the TX signal by looking at the received eye pattern on another modem. Connect the scope to the input of the modem and trigger off the RX clock. Since you are looking at the RX output direct from the receiver detector, you will be bypassing any coupling capacitors that may be used on the input to the modem. If you have any vertical up and down movement of the received eye, you have a low frequecy response problem.

You may have to experiment with a number of diffferent coupling schemes in order to get the best low frequency response but in most cases, DC is best. I would say that DC is best in all cases but I know that there is someone that will find a modem that is an exception to the rule. One that sticks in my mind is the DSP-93. On the other hand, I don't know of very many people that will be using a DSP modem with a Mocom 70 (except me, and I always end up doing unusual things).The main reason that I am using a Mocom 70 in such a configuration is due to the fact that the receiver has good front end selectivity as compared to a lot of the off-the-shelf data radios that are available to Hams.

If you have an older G3RUH modem or one of the TAPR modems, you might want to try jumping across the electrolytic capacitor on the modem output. This would be C34 on the RUH or C30 on the TAPR.

If you end up using DC coupling, I suggest that you skip steps 6a thru 6e and 9a. Follow the instructions in steps 7, 8, and 9b.

The bottom line is that you may have to try several different coupling schemes in order to find the one that works the best. A little extra effort here will pay off in link performance.

The next steps 6a-6e, should be performed if you will be using a TAPR or G3RUH Modem and will be using AC coupling (capacitor).

6a. Cut the leads of a 1200 ohm 1/4 watt resistor to 1/4".

6b. Solder one end of the resistor prepared in step 6a to the end of R111 (150K) that connects to ground. R111 is in the TX F1 oscillator circut, and is located next to the varicap diode. The other end of the 1200 ohm resistor will be connected later.

6c. Cut the leads of a 2.2 uf tantalum capacitor to 1/4".

6d. Solder the positive lead of this capacitor to the "free" end of the 33K resistor installed in step 5.

6e. For 25 watt radios: Install a 680 ohm 1/4 w 5% resistor between the "free" end of the 1200 ohm resistor installed in step 6b and the negative lead of the 2.2 uf capacitor. For 50 and 75 watt radios: Install a 2200 ohm 1/4 w 5% resistor between the " free" end of the 1200 ohm resistor installed in step 6b and the negative lead of the 2.2 uf capacitor.

7. If you installed a DB-9P connector on the front panel, the 16" piece of shielded cable should be routed into the exciter section of the radio. If you used a different method for bringing the modem interface cable into the radio, locate your transmit audio cable. Route this cable into the exciter section of the radio. You may wish to use a couple of cable ties to secure the transmit audio cable to the existing wiring harness.

8. Connect the shield of the cable to the ground end of the varicap CR100. The varicap is between L101 and the crystal socket. If necessary, verify ground end with a VOM.

9. If you are using a TAPR or G3RUH modem perform step 9a. If you will be using a TPRS modem perform step 9b.

9a. Connect the center conductor of the TX Data cable to the junction of the 1200 ohm and 680 (or 2200) ohm resistors.

9b. Connect the center conductor of the TX Data cable to the "free" end of the 33K resistor installed in step 5.

This completes the transmitter mods, frequency and modulation adjustments are covered in the following steps.

If you are using a TAPR/G3RUH modem, follow the instuctions in step 10. If you are using a TPRS modem, follow the instructions in step 11.

10. **(TAPR/G3RUH)**

10a. Set the transmitter in frequency before you connect the modem. L101 is the TX frequency adjust coil.

10b. Connect the modem and adjust the TX level pot in the modem for 3 kHz of deviation.

10c. Check TX frequency and verify that it is still the same. If not, touch up L101 adjustment.

11. **(TPRS)**

11a. Connect the modem to the radio. Remove jumper S1 in the modem. This jumper is near the TX level pot VR3.

11b. Set the transmitter to the correct frequency with coil L101.

11c. Re-install jumper S1 in the modem. Set the TX level pot VR3 for 3.0 kHz deviation.

11d. Remove jumper S1 and re-check TX frequency. If necessary, touch up the frequency adjustment.

11e. Since adjustments 11c and 11d will interact, repeat them a couple of times.

11f. After you have finished, leave the jumper S1 installed. Do not attempt to read the transmit frequency with S1 in place. You will receive an erroneous reading with S1 in place. This is a characteristic of the TPRS modem.

Receiver Alignment

All meter readings are taken from the metering plug that is located in the discriminator/ audio-squelch compartment. Use a 50 uA meter (or VOM on 50uA scale). The positive lead should connect to ground. The pin-out of the meter plug is read counter-clockwise. Disregard any of the center pins on the plug.

Use care in adjusting the slug tuned coils. Make sure you have a good alignment tool. The slugs in these coils are brittle and the use of a poor or worn tuning tool will lead to broken slugs.

The pin numbers mentioned in the following steps refer to positions on the metering plug.

1. Tune L9 and L10 for a peak on pin 6

2. Tune L11, L12, and L13 for a peak on pin 3. L13 is the slug tuned coil located on the multiplier board. This board is located next to the receive RF deck. L14, L15, and L16 are also on this board.

3. Tune L14 for a dip on meter pin 3. Use an insulated alignment tool.

4. Feed an " on frequency" signal into the receiver. Peak L14, L15, and L16 for a peak on pin 1. It will take a strong signal to make it through the mis-tuned RF deck. Reduce the signal generator output as required to keep the pin 1 reading below 30 uA. Touch up the receive frequency adjustment C1 for best quieting.

5. Peak L1 thru L6A on the RF deck for a maximum reading on pin 1. Reduce the signal generator output as required to keep the pin 1 reading below 30 uA.

6. Using an on frequency signal, peak L6B, T1, T2, L7, and L8 for a maximum reading on pin 1. These coils are in the 11.7 IF stage, center compartment. Keep the pin 1 reading below 30 uA.

7. Reduce the signal generator output to the 20 dB quieting level (some noise in the signal). Peak L15, L16, L5, and L6A for best quieting.

8. With the signal generator set to 20 dB quieting, set the receive frequency adjustment C1, for minimum noise. If your signal generator is capable of generating FM, use a 1 kHz tone and set the modulation level to 3 kHz. Adjust C1 for the best quieting with minimum distotion of the tone. Even though pin 4 on the meter plug is supposed to yield a 0 ua reading for an on frequency signal, every Mocom 70 that I have tuned has exhibited as mis-aligned discriminator transformer. Some are as much as 3 or 4 kHz away from the design frequency of 455 kHz. I have found that it is best to leave the discriminator tuning alone. The best results are obtained by the minimum noise method (and best audio recovery if you are modulating with a 1 kHz tone. This method is known as SINAD: signal, noise, and distortion). The 20 dB quieting signal should be 1 uV or less.

Align and set the frequency on the transmitter before perfoming the next step.

9. If you are running a simplex system(transmit and receive on the same frequency) and you elected to keep the receiver on during transmit, you may set the receiver frequency to match the transmitter by observing the receive eye pattern on a scope.

9a. Connect a scope to your modem. Follow the instructions supplied with the modem.

9b. Key the transmitter. Set the receive frequency adjust capacitor C1 for the best "eye" pattern.

9c. With the TPRS modem, fine tune C1 for best eye and minimum vertical (up and down) shift on the scope as you go from noise with no signal to the transmitted pattern.

Transmitter Alignment

All meter readings are taken from the metering plug on the exciter board. Use a 50 uA meter (or a VOM on the 50 uA scale). The negative lead should connect to ground. The pin-out of the meter plug is read counter-clockwise. Disregard any of the center pins on the plug.

1. Position the slugs in coils L102 thru L106 at the top of the coil form. Use care in adjusting these coils. The slugs in these coils are brittle. Using a poor or worn alignment tool will lead to broken slugs.

CONNECT A WATTMETER AND A DUMMY LOAD CAPABLE OF HANDLING THE RF OUTPUT OF THE TRANSMITTER BEFORE PROCEEDING WITH THE FOLLOWING STEPS.

2. Tune L102 and L103 for a peak on pin 3.

3. Tune L104 for a minimum on pin 3.

4. Tune L105 and L106 for a peak on pin 5.

5. Tune C101 for a peak on pin 5.

6. Repeat step 2. Tune L104 for a peak on pin 5. Repeat steps 4 and 5.

7. If you are tuning a 25 watt radio, proceed with the following steps. If you are tuning a 50/75 watt radio, skip to step 12.

8. Tune C105 then C104 on the varactor tripler for maximum output. Tune C103 and C102 on the PA stage for maximum output.

9. Tune C101 on the exciter board for a peak on pin 5.

10. Repeat step 8.

11. Adjust R105 for maximum power output. R105 is the PC board mounted control in the center compartment. Do not exceed 25 watts.

This completes the transmitter alignment for 25 watt radios.

12. 50/75 watt radios: Key the transmitter. Adjust R105 for the desired power output, typically the rated power of the radio. R105 is the PC board mounted control in the center compartment.

This completes the transmitter alignment for 50/75 watt radios.