Addendum to Mitrek Modifications
Using the UHF Mitrek with a TPRS 9600 Baud Modem

Follow the basic power connections, speaker connection and audio/squelch controls mods and the tune-up instructions as found in the 9600 baud NRZI conversion.

Install the new crystals in the channel elements and tune the radio to the new operating frequency.

STOP. Do not follow any further NRZI conversion information unlesss instructed to do so. **DO NOT change the crystal filters.** This change is not required with the TPRS modem.

Proceed with the following instructions.
Remove the following components in the receiver.

C240, a .0022 capacitor
C451, a 220 pf capacitor
R231, 7.5K. Replace with a 2.2 K 1/4 w 5%.

The above components are also removed as part of the 9600 baud NRZI modification. Refer to that conversion for further details.

Be sure to install a jumper between the collector and emitter leads of Q1 in the transmitter. This keeps the receiver powered during transmit.

Build the RX data interface circut as shown in Appendix ?. This circut is built on a small piece of perfboard approximately 1 1/2 by 1 3/4 inches. As you build the interface, keep in mind that you will have to arrange your component layout to allow for room to drill a 1/8" hole that will be used to mount the board.

When you are building the interface, you need to decide the PTT polarity that you plan to use with this radio. If you wish to use an active high PTT to maintain compatibility with the RCA 700 radios, you will need to build the small data inverter circut on the interface board. If you decide to use active low or pull to ground PTT, skip the PTT inverter section of the interface circut.

The data interface should be installed directly over the detector IC in the radio. The following instructions should assist in installation of this board.

Position the radio so that the front (power plug) end of the radio is facing you.

Locate the detector IC U201. This IC is a 16 pin chip that will have the Motorola house number M2078 stamped on it. (The generic number for this chip is CA3089).

The quadrature coil should be to the left of the M2078. To the right of the chip is a shield can that covers some of the IF circutry. This shield can will have to be removed and a small hole must be drilled in it. This will serve as the mounting for the RX interface.

In order to remove this cover, you will have to unsolder a shield cover on the bottom of the radio to gain access to the mounting tabs. A large “Soldering “Gun” will be required in order to unsolder the bottom shield cover and unsolder the tabs on the IF shield can. I suggest that you use solder wick to help clear the shield can mounting holes of solder.

Carefully mark a point in the center of the can and drill a 1/8 “ hole. Use a 1/2 inch long spacer and install a 4-40 x 1/4 screw to secure the spacer to the shield can. You might want to use a lock washer to help keep the screw tight.

Replace the IF component shield can and solder in place. Then replace and solder the shield cover on the bottom of the radio.

Solder a 4 inch piece of insulated hookup wire to pin 6 of the detector IC. This connection is made on the component side of the circut board.

Solder another 4 inch piece of insulated hookup wire to pin 10 of the detector IC. This connection is also made on the component side of the circut board.

Install the RX data interface circut board on the mounting spacer. This board should be covering the detector IC.

Connect the wires from the detector IC to the appropriate points on the interface board.

The power and ground connections for the RX interface are made at the plug fort h e optional time out timer. If your radio is equipped with a timer, remove it. The TOT is not needed for data operation.

The TOT plug is the white nylon connector with 5 pins . This connector looks similar to the ones that the channel elements plug in to.

The pin-out on this connector as viewed from the component side of the circut board is from right to left. In other words, pin 1 is at the right hand side of the connector.

+ 9.6 V is available at pin 5 of this connector and the ground connection is pin 3. If necessary, use a DVM to verify the correct pins.

After the RX interface board has been installed, power up the radio, and, with no signal applied, adjust the 10K pot on the interface for 5.0 V at the RX output terminal. This is a preliminary adjustment. A final adjustment will be made when t h e radio is interfaced with the TPRS modem.

Transmitter Modification:

The hardest part of the transmitter modification is modifying the channel element. There are a lot of components in the element and they are packed very tightly. Be sure to follow the following instructions carefully.

Locate the 4.7 uf tantalum capacitor. This is an epoxy "dipped" capacitor that is located near the center of the circut board between the frequency adjust coil and the modulation pot. Be sure to note the polarity as you remove this capacitor. Install one lead of a 33K 1/4 w 5% resistor in the hole that was occupied by the negative lead of this capacitor.

At this point the 33K resistor should be standing "on end". Locate the 15K 1/4 w resistor that is standing on end with the body of the resistor right next to the modulation pot.

Bend the "free" lead of the 33K resistor over until it touches the "top" lead of the 15K resistor located in the previous step. Cut the lead of the 33K resistor to length and then solder the connection.

Place the channel element so that the end with the modulation pot is facing you. Note the location of the center lead of this pot. Turn the element over, remove the mod pot, and clean the excess solder from the mounting holes. Turn the element back over and install a 10K 1/4 w 5% resisitor in place of the mod pot. The resistor should be installed in the holes that were occupied by the center lead of the mod pot and the lead closest to the center of the channel element circut board.

At this point, the channel element modifications are complete. Put the case back on the element and proceed with the radio modifications.

Cut the trace between the transmit F1 and F2 channel elements at pin 4. This disables the radio microphone audio section feed to the F1 channel element.

This completes the transmitter modifications. The data and PTT connections will be addressed in the next section.

Data and PTT connections:
The are a couple of different methods by which the data and ptt connections can be brought into the radio. One way is to follow the instructions presented in the Mitrek NRZI modification and bring the connections into the radio through the power plug.
The other way is to drill a 3/8 inch hole in the right side of the radio case. This is the method that I chose.

If you decide to drill the hole, use extreme caution. The hole is drilled in the right side of the radio close to the front. If you look at the radio, you can see that there is a gap between the front of the radio and the vertical daughterboard.This board connects the power plug and various subassemblies such as the PL board to the main circut board.

Drill a small pilot hole in the right side of the radio. This should be centered in the space between the front of the radio and the daughterboard. Use progressively larger drill bits until you reach the desired hole size of 3/8 inch. **Do Not** attempt to drill one large hole. You will probably damage the daughterboard in the process.

Cut three pieces of RG-174 coax to the length required for your installation plus about one foot. This extra length is necessary to allow for the connections inside the radio.

Mark each of these three leads before you begin the connection to the radio. One should be RXD, another TXD, and the last one PTT.

Run the three cables through the 3/8 hole and position them in the space between the power plug and the daughterboard. There is a notch in the daughterboard in the area just to the left of the power plug. The cables should be positioned so that they can enter pass through this notch to the main part of the radio.

The RXD coax should connect to the output of the receive interface board.

The TXD coax should be routed as follows: If you look at a transmit channel element, you will notice that there is a nylon “key” pin on one side of the element. There is a hole in the radio circut board at each channel element position to accept this keying pin. Run the TXD coax through the F2 channel element keying pin hole.

The center of the coax should connect to pin 4 of the F1 channel element. The shield should connect to pin 1 (GND) of the F1 element. Use a small piece of insulating “spaghetti” over the bare shield to help prevent the chance of a short circut.

If you plan to use active high PTT, the PTT coax should be routed to the receive interface board and connected to the input of the PTT inverter. You should then run a short piece of insulated hookup wire from the output of the PTT inverter to pin 13 of the power plug. This connection can be made where the power plug is soldered to the daughterboard.

If you will be using active low PTT, the PTT connection can be made at pin 13 of the power plug. The coax shield may be connected to ground at pin 17, the high current ground connection. This will be a large “buss” terminal with a large black wire connected to it.

Install a connector on the RG-174 data and PTT cables.

The radio modifications are complete at this point.

Modem Modifications:

1. Remove R28, a 220K resistor.
2. Solder a jumper wire across R29, a 330K resistor.

Both of these resistors are in the RX Data input circut that feeds pin 3 of IC U10 in the modem. For more information, refer to the modem schematic.

Final Adjustment:

Plug the radio into the TPRS modem. With no signal applied, use a DVM to measure the voltage at pin 11 of the LM339 comparator U9. Adjust the pot on the receiver interface board for a reading of 5.0 volts DC at this point.

Remove output jumper S1 on the modem.

Key the transmitter with the modem PTT and adjust the tuning slug in the channel to set the transmit frequency.

Install jumper S1 in the modem. Key the transmitter with the modem PTT and set the deviation to 3.0 kHz.

Remove jumper S1 and check the transmit frequency. If necessary, adjust the tuning slug to bring the radio back on frequency.

Install jumper S1 and verify that the deviation is still in the area of 3 kHz. The frequency and deviation adjustments tend to interact. If necessary, repeat steps 17 and 18.

DO NOT **adjust the transmit frequency without removing jumper S1 in the modem.** The presence of TX data on the modulator will give a false reading.

If you are running a simplex system(transmit and receive on the same frequency), you can set the transmitter frequency to match the receiver by observing the receive eye pattern.

Connect a scope to your modem. With the TPRS modem, the scope input should be connected to pin 8 of U10, the TLO74 in the receive filter. The trigger should connect to pin 8 of the 74HC86, U4.

Key the transmitter. Adjust the transmit frequency adjust coil for the best “eye” pattern.

Temporarily disconnect the input to the scope. Be sure the the trace is located in the center of the screen. Use the vertical position control to adjust the trace if necessary.

Re-connect the input and key the transmitter. If there is any vertical shift, up or down, the transmitter is not netted to the receiver.

Fine tune the transmitter frequency for the best eye and minimum vertical shift on the scope as you go from noise with no signal to the transmitted pattern.