



## 1. FCC REQUIREMENTS

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### IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a general class commercial radio telephone operator's license or by personnel working under their immediate supervision.
2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.
3. The frequency, deviation, and power of a base station transmitter must be maintained within specified limits. It is recommended, therefore, that these three parameters be checked before the station is placed in service.

### REMEMBER

The efficiency of the equipment depends upon a good installation.

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## 2. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

## 3. PLANNING THE INSTALLATION

Since a good installation is important to obtain the best possible performance of the communications system, carefully plan the installation before actual work is started. Location of the station in relation to power,

control lines, the antenna, and convenience and access for servicing should be considered. The cabinet dimensional detail diagrams show the size of the various cabinets for planning the space requirements. Read the entire procedure and the many suggestions offered to help you plan your installation. Make sure all tools, equipment, and facilities are available when the installation is begun.

## 4. VENTILATION

The radio equipment is operated without forced ventilation. The cabinets have been designed with vents that allow outside air to be drawn in through louvered openings in the door and expelled through an opening in the cabinet wrapper (sides). The heated air rising in the cabinet causes a natural draft. Therefore, it is essential that the openings be kept free of obstructions so the air flow will not be restricted. Also, site installations require that adjacent cabinets be located a minimum of six inches from all vents.

### NOTE

Sufficient clearance (10" minimum) must also be provided at the front of the cabinet to allow for servicing and component removal.

Refer to Figure 1 for cabinet dimensional details.

## 5. INSTALLATION OF 26-INCH INDOOR CABINETS

- 5.1 Refer to Figure 1 for cabinet dimensional details.
- 5.2 The cabinet should be located on a solid, level surface convenient to the power source and the rf transmission line. The rf transmission line should be kept as short as possible to minimize line losses.
- 5.3 All antenna power and control lines are connected at the junction box located on the right side of the cabinet.

# INSTALLATION NOTES

## LOCATION

CABINET REQUIRES A MINIMUM OF 6-INCHES CLEARANCE BETWEEN LOUVERED SIDE-PANELS AND EXISTING SURFACES FOR PROPER VENTILATION. ALLOW A MINIMUM OF 10-INCHES ACCESS SPACE AT THE CABINET DOOR.

## FIXED MOUNTING (SEE DETAIL A)

IF DESIRED (BUT NOT NECESSARY UNLESS STACKING CABINETS), THE CABINET CAN BE SECURED TO THE FLOOR USING TWO M8 OR 5/16" BOLTS OF THE APPROPRIATE LENGTH INSERTED THROUGH THE CENTER HOLES OF THE BOTTOM RAILS.

## STACKING CABINETS (SEE DETAIL B)

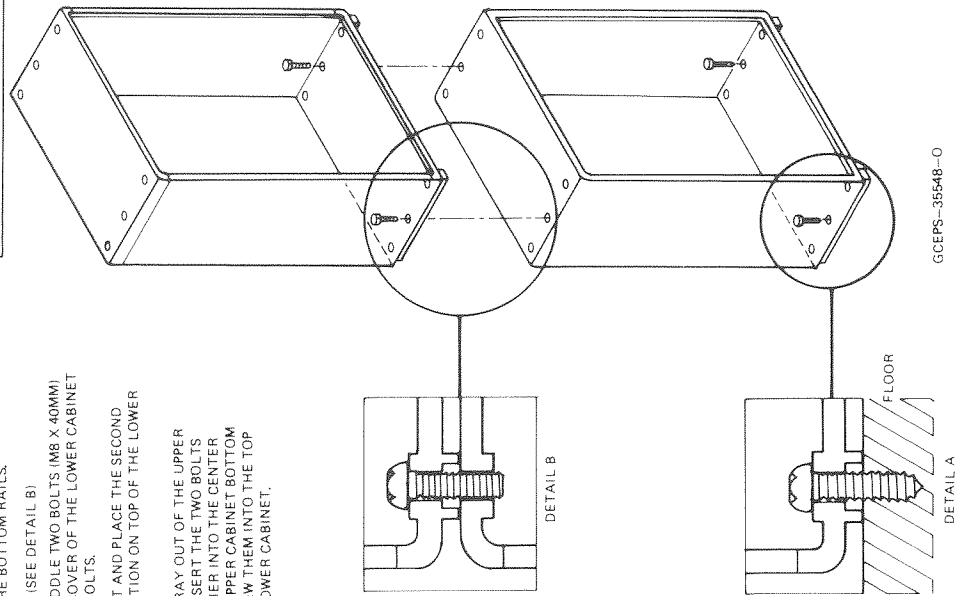
--- REMOVE THE MIDDLE TWO BOLTS (M8 X 40MM) FROM THE TOP COVER OF THE LOWER CABINET AND SAVE THE BOLTS.

--- CAREFULLY LIFT AND PLACE THE SECOND CABINET IN POSITION ON TOP OF THE LOWER CABINET.

--- SLIDE THE RF TRAY OUT OF THE UPPER CABINET AND INSERT THE TWO BOLTS REMOVED EARLIER INTO THE CENTER HOLES OF THE UPPER CABINET BOTTOM RAILS AND SCREW THEM INTO THE TOP RAILS OF THE LOWER CABINET.

## WARNING

THE TOP STATION OF A STACKED INSTALLATION SHOULD BE SECURED TO THE CEILING, OR TO THE WALLS, USING MODEL TRN5757A STACKING HARDWARE KIT. THIS WILL MINIMIZE THE DANGER OF TOPPLING, IN THE EVENT THAT MECHANICAL SHOCK OR VIBRATION OCCURS.



GCEPS-35548-O

## CABINET TOP BOLTS

QTY.	PART NO.	DESCRIPTION
4	3-10943141	M8 X 16 MM TORX  BOLT
2	3-10943145	M8 X 40 MM TORX  BOLT

## HEIGHT DIMENSION TABLE

CABINET SIZE	HEIGHT DIMENSION
24-INCH	24.04 INCHES
28-INCH	28.28 INCHES
32-INCH	32.04 INCHES
37-INCH	37.28 INCHES

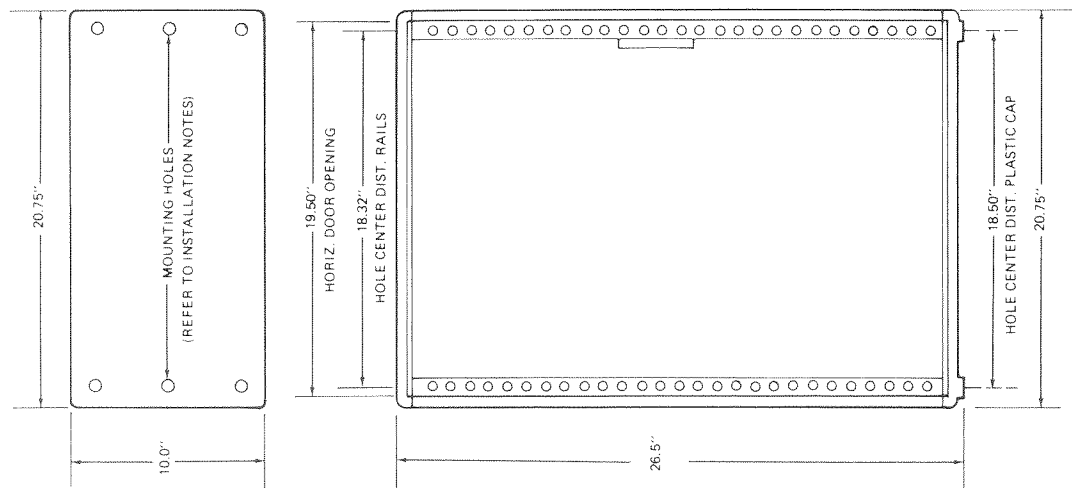


Figure 1. Cabinet Dimensional Details

### CAUTION

It is recommended that no additional holes be drilled into the cabinet.

- 5.4 Refer to Figure 1 for mounting and stacking details.

## 6. ANTENNA CONNECTIONS

### 6.1 INTRODUCTION

6.1.1 The antennas and transmission lines are not part of the station. Therefore, antenna installation instructions are not included in this section. Follow the instructions shipped with the antenna for applicable information.

6.1.2 In its primary application, the station is used for communications with mobile radios. Thus, antennas having omni-directional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area, or if it is to be used for communications with a fixed station, an antenna with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

6.1.3 All coaxial antenna cables connect to the coaxial connectors located on the junction box. For repeater stations without the internal duplexer, two antennas are required; one for the transmitter and one for the receiver. For repeater stations with the internal duplexer, only one antenna is required. Refer to Figure 2 for antenna connection details. Type "N" connectors are used for all stations except simplex units with antenna switches, which are supplied with a single "UHF" connector.

## 7. AC INPUT POWER AND GROUND CONNECTIONS

### 7.1 INTRODUCTION

7.1.1 All stations should have a separate power circuit from a 10-ampere (minimum), 120-volt ac, 60 Hz power source. The power lines should be installed in accordance with local electrical codes. A substantial earth ground must be provided as close to and in as straight a line as possible with the ground terminal provided on the junction box. Do NOT consider the electrical outlet box as a substantial ground. Refer to the Lightning Protection Recommendation sheet, 68P81111E17, elsewhere in this installation section for additional grounding recommendations.

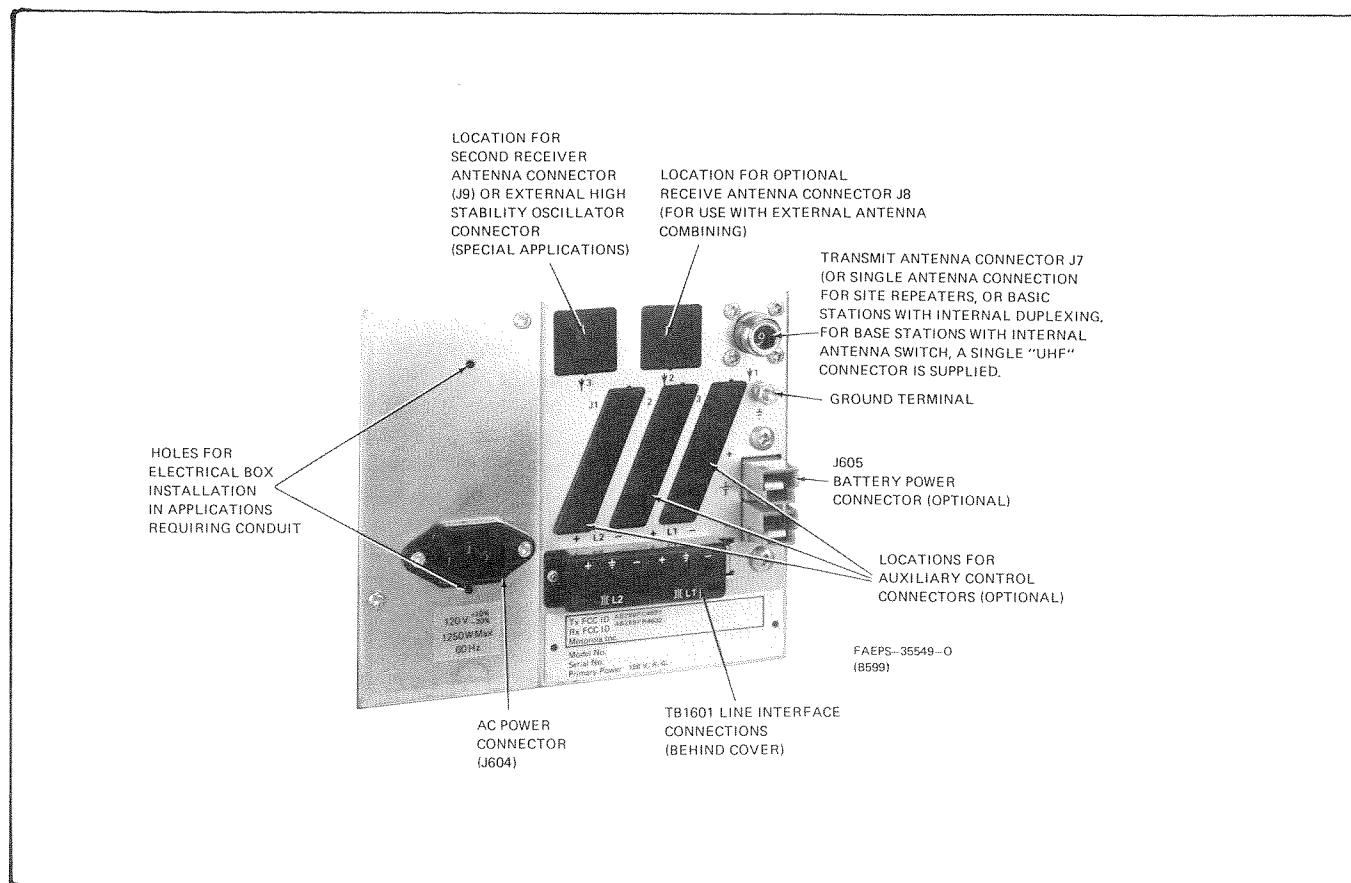


Figure 2. External Connection Details

7.1.2 The primary ac power line may be installed prior to installation of the cabinet and terminated near the location chosen for the station if the power line cord supplied with the station is to be used. If the station power is to be supplied by conduit wiring, the station must be installed first. Separate procedures are provided for each type of installation in the following.

## 7.2 STATION INSTALLATION USING POWER LINE CORD SUPPLIED WITH THE STATION

Step 1. Install the station as described in paragraph 5.

Step 2. Connect the female plug of three-wire ac line cord to the power connector on the junction box. See Figure 2.

Step 3. Connect the male plug of the three-wire ac line cord to the wall outlet provided near the station.

Step 4. Connect the ground terminal on the junction box to a substantial earth ground located as close as possible to the station and in as straight a line as possible with the ground terminal.

### WARNING

Even if a three-wire grounded primary ac power source is available, the radio equipment **must be grounded** separately to prevent electrical shock hazards and provide lightning protection.

### NOTE

A power ON-OFF switch is not provided on the station, therefore, the equipment is immediately operational when the power cord is plugged into a live ac outlet.

## 7.3 STATION INSTALLATION USING CONDUIT FOR PRIMARY POWER CONNECTION

The junction box has provisions that allow ac power connection to the station using conduit. The following installation procedure is recommended.

Step 1. Remove the two screws attaching the ac input connector to the junction box and carefully pull the connector away from the junction box.

Step 2. Cut the wires as close as possible to the ac input connector.

Step 3. Strip insulation from the wires for a sufficient length to allow connection to the incoming power leads.

Step 4. Attach a 4-1/8" × 2-3/8" × 1-1/2" electrical box (Appleton Catalogue No. 184-E, universal code 69351 or equivalent box extension ring, not supplied) to

the junction box using two #6-32 × 5/16" self-tapping washer head screws in the holes provided. See Figure 2.

Step 5. Attach the conduit to the electrical box and make the electrical connections. It may be desirable to provide an ON-OFF switch or convenience outlet on the electrical box.

### NOTE

The primary power wire colors used conform to international standards. Refer to the following cross reference table as required.

Power Connection	International STD Wire Color	US Standard Wire Color
Live	Brown	Black
Neutral	Blue	White
Ground	Green/Yellow	Green

Step 6. Attach a suitable cover to the electrical box.

## 8. OPTIONAL DC INPUT POWER CONNECTIONS

Connection of the optional dc input power requires assembly and connection of the TRN5155A External Battery Cable Kit. This kit includes a fuse block assembly that must be mounted to the base station along with wires and terminals that must be assembled and connected to the external battery. Install as follows:

Step 1. Determine the length of black 8-gauge wire required to run from P605 directly to the battery negative terminal. Route and cut the black wire to length. A ring tongue lug is provided to facilitate connecting the wire to the battery.

### NOTE

The TRN5155A External Battery Cable kit contains 10 feet of red and black 8-gauge wire. Runs longer than 10 feet are not recommended for efficient battery operation. If runs longer than 10 feet are necessary, increase the wire gauge by 3 AWG for each increase of 10 feet in run length.

Step 2. Make sure all power is disconnected from the station.

### WARNING

Refer to Power Supply section for proper battery voltage setting before connecting the station to the battery.

Step 3. Connect the blue connector (P605, part of the TRN5155A External Battery Cable Kit) into the optional battery power connector (J605) located on the junction box. See Figure 2.

Step 4. Remove the fuse from the fuse holder and mount the fuse holder (supplied with the TRN5155A kit) to the battery rack as close as possible to the battery using the two 8 × 1-1/4" tapping screws provided.

Step 5. Determine the length of red 8-gauge wire required to run from P605 to the fuse block. Route and cut the red wire to length. Attach the red wire to the fuse block.

Step 6. Use the cut off piece of red wire to connect the fuse block to the battery. A ring tongue lug is provided to facilitate connecting the wire to the battery. After checking that all connections are secure and that polarity is proper, install the fuse removed in Step 4.

## 9. CODE PLUG OPTIONS

9.1 Various base station features that were previously associated with wire jumpers such as time-out timer duration and repeater dropout delay are now programmed into the TRN5194A Code Plug on the station control board. Certain option boards also contain code plugs, which specify certain functions or features on that board. These features are now selected at the time of shipment according to information given on the customer order forms. These selections are listed in the code plug parameter booklet accompanying the station. Refer to the Maintenance section of this manual for assistance in interpreting the parameter designations.

9.2 The values of certain parameters may be altered in the field by reprogramming the code plug. This requires the use of an R1800 Digital Products Analyzer in accordance with instructions accompanying that unit.

## 10. CONTROL LINE CONNECTIONS

### 10.1 INTRODUCTION

10.1.1 The station can be controlled from a remote point over wireline circuits. Simplex audio is used, meaning that the remote point can send audio to the station or receive audio from the station, but not both at the same time. Therefore, a single audio pair will suffice. For dc remote control operation, the wireline must provide dc continuity for carrying the dc control currents. This must be the same pair that carries the transmit audio. For tone remote control operation, the audio pair also carries the audio control tones. DC continuity is not required for tone remote control operation.

10.1.2 Four-wire audio operation, wherein transmitter audio and receiver audio are carried on separate wire pairs, is possible with the optional tone or dc 4-wire remote module. In such operation, line 1 is the transmit pair and line 2 is the receive pair.

## 10.2 LINE SPECIFICATIONS

The audio wire line(s) must meet the following specifications for acceptable radio communications. Verify the characteristics of leased telephone lines with the company providing the service before installation.

### Wireline Requirements, General

1. Frequency Response: 500-2750 Hz  
+1 dB to -8 dB referenced to 1000 Hz.
2. Impedance: 600-ohm or 900-ohm nominal balanced.

### Additional Wireline Requirements, DC Remote Control

1. Must have dc continuity.
2. DC resistance 0 to 6000 ohms.

### Additional Wireline Requirements, Tone Remote Control

1. Frequency Offset: ± 5 Hz maximum.
2. Line Loss: Less than 30 dB from 600 to 2200 Hz for line impedance tolerance of +100% to -50% from nominal impedance of 600 or 900 ohms. The impedance tolerance only applies to two-wire tone remote control stations in which the level from the remote console is lower than 22 dB below the level of outgoing receiver line audio (i.e., line loss greater than 22 dB).

### 10.2.1 DC Remote Board Wireline Jumpers

10.2.1.1 The dc remote board is shipped in either the 2-wire or 4-wire 600-ohm configuration. If a 900-ohm line is encountered in the field, jumpers JU904 and JU906 on that board should be modified as shown in the following chart.

	JU901	JU902	JU903	JU904	JU905	JU906
2-Wire 600	In	In	In	In	Out	Out
4-Wire 600	Out	Out	In	In	In	In
2-Wire 900	In	In	In	Out	Out	Out
4-Wire 900	Out	Out	In	Out	In	Out

10.2.1.2 If a 4-wire dc remote board exists in the field and a 2-wire board is desired, then two special foil jumpers must be cut. These jumpers are located on the component side of the board directly above P804.

10.2.1.3 If a second station is added in parallel on the wireline, its terminating resistor(s) must be removed from the circuit by cutting JU903 (and JU905 on 4-wire boards).

## 10.2.2 Tone Remote Board Wireline Jumpers

10.2.2.1 The tone remote control board is shipped for either 2-wire or 4-wire 600-ohm operation. The terminating impedance can be changed to 900 ohms or BRIDGE simply by moving jumper plug P1002 (and P1003 on 4-wire boards) to the appropriate position (as labelled on circuit board).

### NOTE

On a 2-wire board, if terminating or bridging across a 900-ohm line, then R1154 (JU26) should be replaced with a wire jumper. This is not necessary, however, if the phone line loss from remote console to L1 terminals of station is less than 27 dB.

10.2.2.2 A 4-wire board may be field-modified for 2-wire operation by configuring jumpers as in the following chart:

	JU22	JU23	JU24	JU25	JU26 (R1154)
2-Wire	IN	IN	OUT	OUT	IN*
4-Wire	OUT	OUT	IN	IN	OUT

\* JU26 (R1154), when in, is a 3.9k resistor in 600-ohm systems, or a wire jumper in 900-ohm systems. See paragraph 10.2.2.1 for details.

10.2.2.3 A 2-wire board may be modified to 4-wire by following the preceding jumper chart and adding the following components (which are normally omitted from 2-wire boards): T1002, C1036, J1003, P1003.

10.2.2.4 Additional stations connected in parallel with the primary station on the wireline should have P1002 (and P1003 on 4-wire boards) moved to the BRIDGE position (overhanging edge of connector). If a 2-wire station is being bridged across 900 ohms, and if the phone line loss from the remote console to the station is approximately 27 dB or greater, JU26 (R1154) should be replaced with a wire jumper.

## 10.3 INSTALLATION

### 10.3.1 General

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the station junction box line interface terminal block.

### 10.3.2 Specific Connection Information

Connect the wirelines to the screw terminals on the junction box line interface terminal block as shown in Figure 2. (In 2-wire applications, use line 1 connections only.)

### 10.3.3 DC Control Line Resistance Test

(Does not apply to tone remote control models)

When the dc control line is initially connected, it must be tested to assure that its loop resistance is low enough to allow sufficient current for remote operation. Use the following test procedure.

Step 1. Connect a dc milliammeter in series with the dc control line.

Step 2. Have the operator press the push-to-talk switch at the remote control console.

Step 3. The current must be at least +4.5 mA to key the transmitter and at least +10 mA for two-frequency transmitters. Check to see that the current is positive and not negative and that the station is actually keyed. Adjust the remote control console for F1 line current until +5.5 mA is achieved. For a two-frequency transmitter, adjust the remote control console for F2 line current of 10 to 12 mA. If the line loop resistance is too high, the console will not be able to source enough current to key the transmitter. There are two alternatives to correct this problem.

- Use a pair of lines having lower resistance while maintaining proper audio response, or
- Use an alternate pair of lines with lower resistance to carry dc current only. This pair need not have good audio loss or response characteristics.

Lower line resistance can be obtained by using larger gauge wires. The following chart shows the relationship between wire size and the maximum recommended distance.

Wire Gauge	Maximum Distance (MI.)
26	14
25	18
24	22
23	28
22	35
21	44
20	56
19	70

Adjust the line current for *Private-Line* disable at the remote control console for -2.5 mA, if a *Private-Line* model is being adjusted.

Step 4. For most applications, Steps 1 thru 3 are adequate to ensure reliable dc control. However, in systems

having two or more consoles in parallel, it may be necessary to adjust the system integration constant in the station control code plug. This will only be necessary if the station performs the function assigned to a  $\pm 5.5$  mA current when a  $\pm 12.5$  mA current is actually sent. Increasing the system integration constant as shown in the following chart will alleviate this problem. (However, when the R1801-M Code Plug Programmer is used, the system integration constant is automatically set when the NUMBER OF DC CONSOLES is entered.)

# of Consoles	Sys. Int. Constant (msec)
1	100
2	175
3	250
4	325
5	400
6	475

## 11. LEVEL ADJUSTMENTS

### 11.1 GENERAL

11.1.1 A local speaker may be used for testing and level setting. A Motorola test set containing a local speaker can be used by connecting the test set to the CONTROL receptacle on the front of the control tray. This is accomplished by using the Motorola RPX4221A Adapter Cables. The receiver VOLUME control knob sets the audio level at the local speaker only.

11.1.2 *Private-Line* receivers must be PL disabled during adjustment by using the PL DIS switch on the control tray front panel.

### 11.2 RECEIVER LINE LEVEL SETTING (LINE LEV)

The LINE LEV pot is factory set for a peak speech level of 0 dBm into 600 ohms, and need not be adjusted upon installation if this level is permitted by the telephone company. Note that VU (volume units) can be converted to dBm (600 ohms) by adding 6 to the vu level (i.e.,  $-6$  vu = 0 dBm). A 0 dBm (600-ohm) level corresponds to 0.77 V rms.

Step 1. Activate PL DIS switch on front panel and apply a strong rf signal to the receiver input (i.e., approximately 1000  $\mu$ V). Modulate with 1000 Hz tone at 5 kHz deviation.

Step 2. With L1 terminated (L2 for 4-wire boards) in phone line or desired load impedance, set LINE LEV control on front panel to desired phone line level (0 dBm recommended) as measured using a high impedance voltmeter (which has both inputs isolated from earth ground).

## 11.3 SQUELCH THRESHOLD SETTINGS

### 11.3.1 Front Panel Squelch Setting

Set the receiver SQUELCH control (front panel) slightly past threshold.

### 11.3.2 Repeater Squelch Setting (RPTR SQ)

The repeater squelch control is factory adjusted to a threshold of 20 dB receiver quieting. It may be re-adjusted as desired. Readjustment is not required unless the uniboard or station control board is replaced, or the receiver i-f or squelch circuits are serviced.

Step 1. Set the receiver SQUELCH control at Squelch threshold.

Step 2. Inject an on-frequency carrier signal into the receiver antenna port. Adjust the signal to 20 dB quieting.

Step 3. *For carrier squelch repeaters*, adjust the RPTR SQ control on the control tray front panel to the point where the transmitter just keys.

*For Private-Line repeaters*, monitor the repeater unsquelch pin, TP6, on the station control board. Adjust the RPTR SQ control on the control tray front panel to the point where the voltage at TP6 just switches from 0 V dc to greater than 3 V dc.

### 11.3.3 Remote Squelch Control Setting (Optional)

Step 1. Send the remote control command to disable the remote squelch control feature (this also selects tight squelch). This is required because the station normally powers up with the remote squelch activated, loose squelch.

#### NOTE

If a remote control device is not available, then the remote squelch feature can be disabled by bypassing the power up state as follows:

- On dc remote control stations, temporarily install a jumper from micro-processor U801 pin 14 to logic ground (LG) test pin on station control board. On tone remote control stations, temporarily connect TP19 to TP1 on tone remote control board.
- Momentarily actuate the TEST switch S801. This brings the board up with the remote squelch feature disabled and tight squelch selected.

Step 2. Adjust the SQUELCH control on the control tray front panel to the level desired for the station.

Step 3. Send the remote control command to enable the remote squelch feature. If the alternate method described previously was used, then simply remove the jumper and actuate the TEST switch again. This places the board in a state with remote squelch enabled and loose squelch selected.

Step 4. Adjust the REM SQ control on the control tray front panel to the squelch threshold desired for the station.

## 11.4 TRANSMIT LEVEL SETTING

### 11.4.1 Tone Remote Control Stations

The XMIT LEV control is factory set and should not require adjustment upon installation. A built-in sample-and-hold AGC automatically sets proper transmit level for any input wireline level between -35 to +11 dBm. To disable the AGC or verify proper settings see MAINTENANCE section.

### 11.4.2 DC Remote Control Stations

On dc remote control stations, the XMIT LEV control must be adjusted to make up for the phone line loss between remote console and station.

Step 1. Apply a 1000 Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression. Adjust the output of the remote control console for 0 dBm (or maximum allowable audio level) at its output terminals, as measured using a high impedance ac voltmeter which has inputs isolated from earth ground (0 dBm = 0.77 V rms in 600-ohm system).

Step 2. While holding station in transmit using line push-to-talk from remote console, adjust the XMIT LEV control on the dc remote control front panel until the audio level at system level test point TP1 on the station control board is equal to the value stamped on the

system level label located on the back inside wall of the control tray (modulator sensitivity plus 6 dB or approximately 5 kHz transmitter deviation).

Step 3. Remove the 1000 Hz audio tone.

### 11.4.3 Special Procedure Using Low Level Test Tone (DC Remote Control Only)

If telephone company rules prohibit use of a test tone at maximum system level, the XMIT LEV adjustment on dc remote control stations may have to be done using the following procedure, in which the test tone level is 6 dB below the maximum audio level.

Step 1. Terminate the remote control console in a 600-ohm load resistor rather than the line.

Step 2. Apply a 1000 Hz audio tone to remote control console at a level sufficient to drive the amplifier into compression.

Step 3. Connect an audio voltmeter across the 600-ohm load resistor and adjust the line output for 6 dB above maximum allowed line level.

Step 4. Reduce the 1000 Hz audio tone input until the voltmeter reads 6 dB below the level measured in Step 3 (= maximum. allowed level).

Step 5. Remove the 600-ohm load resistor and reconnect the line. Readjust the line output for maximum allowed level across the line. Do not change the 1000 Hz tone level.

Step 6. Hold station in transmit using line push-to-talk from remote console. Connect the audio voltmeter at system level test point TP1 and adjust the XMIT LEV control on the control tray front panel so the audio level indicated on the meter is 6 dB less than (or 1/2 of) the value stamped on the system level label located on the back inside wall of the control tray.