MOTOROLA

OPTIMIZATION

For *Quantar* and *Quantro*
Station and Ancillary Equipment

1 DESCRIPTION

After the station and ancillary equipment have been mechanically installed, properly cabled, and power applied (as described in the *Installation* section of this manual), the equipment must then be optimized before placing into operation.

An overview of the optimization tasks is as follows:

- Customize the station codeplug and saving the data to the station
- Perform the following alignment tasks:
  - — Rx Wireline
  - — Tx Wireline
  - — Receiver RSSI calibration
  - — Receiver Squelch Adjust
  - — Battery Equalization
  - — Reference Oscillator
  - — Simulcast/ASTRO Launch Time Offset (required for *ASTRO* Simulcast systems only)
- Perform post−optimization checkout procedures, such as verifying power output, deviation, etc.

For detailed instructions to perform these optimization tasks, follow the procedures provided in *Optimizing a New Installation*, located in the RSS User's Guide (68P81085E35).

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1 DESCRIPTION

This section describes the switches, pushbuttons, connectors and LED indicators provided on the *Quantar* station used during local operation of the station and servicing.

Summary of Switches, Pushbuttons, and Connectors

The following switches, pushbuttons, and connectors are provided to allow the station to be operated and/or serviced locally. The location and function of these controls and connectors is shown in Figure 1.

Switches, Pushbuttons, and Connectors

Station Control Module	Power Supply Module
Volume Up Pushbutton Volume Down Pushbutton CSQ/PL/OFF Pushbutton (squelch mode) Intercom Pushbutton Handset/Microphone Connector External Speaker Connector RSS Port Connector External 5 MHz Input BNC Connector	Main Power On/Off Switch

Summary of LED Indicators

Note: *Refer to the Troubleshooting section of this manual for detailed descriptions and interpretation of the LED indicators.*

The following LED indicators are provided to indicate operating status of the station. The location of these controls and connectors is shown in Figure 1.

Summary of LED Indicators

Station Control Module	Power Supply Module	Exciter Module	Wireline Interface Module
Station On Station Fail Intcm/Acc D Control Ch Rx 1 Active Rx 2 Active Rx Fail V.24/Modem	Module Fail Power On	TX Lock PA Full PA Low PA Fail	WL On* WL Fail* **LEDs visible on Station Control Module front panel*

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STATION ON LED

STATION FAIL LED

INTCM/ACC D

CONTROL CH

RX1 ACTIVE LED

RX2 ACTIVE LED

RX FAIL LED

V.24/MODEM LED

NOTE: FUNCTION OF LED INDICATORS IS DESCRIBED IN THE TROUBLESHOOTING SECTION IN THIS MANUAL.

TX LOCK LED

PA FULL LED

PA LOW LED

PA FAIL LED

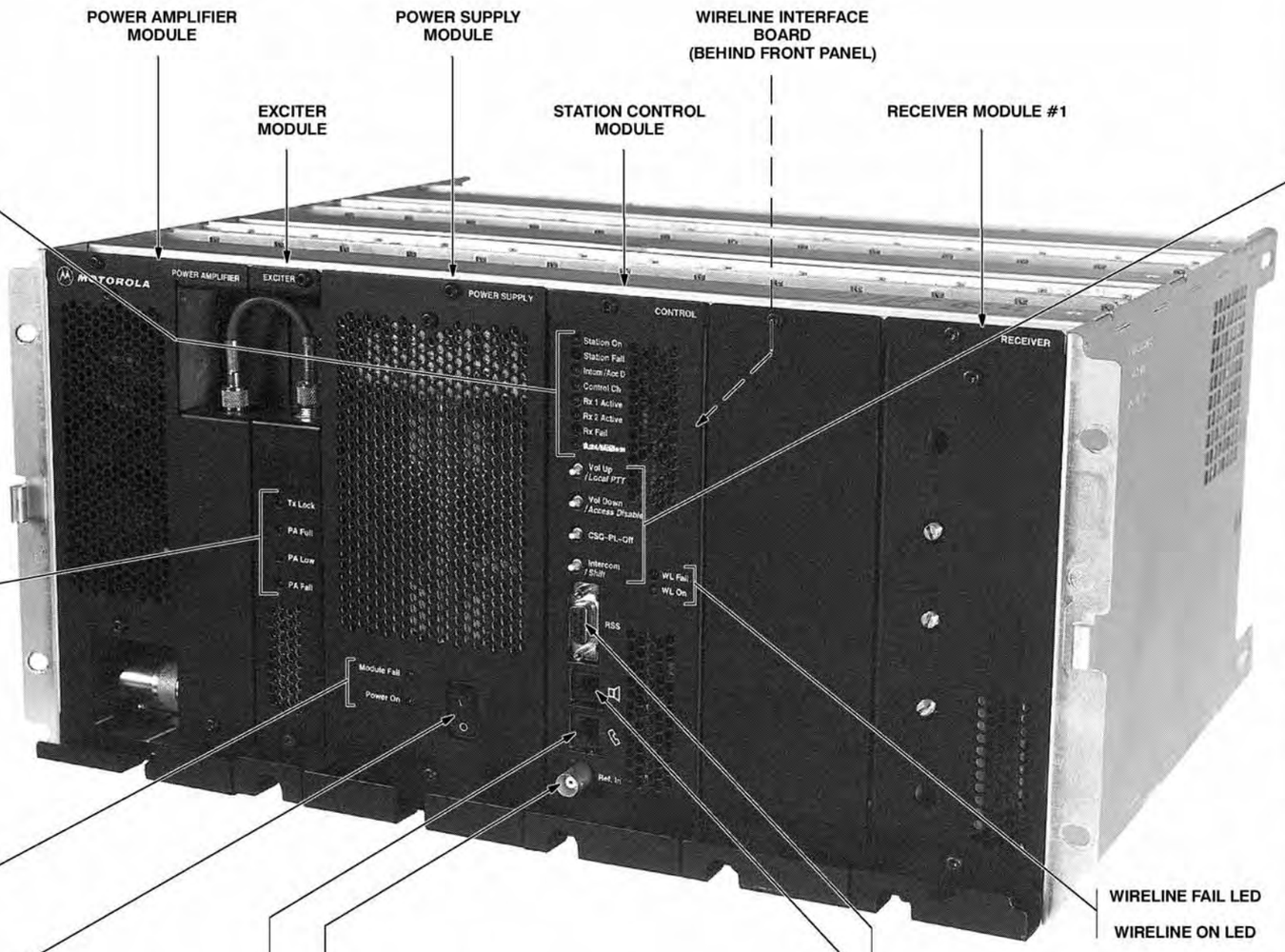
NOTE: FUNCTION OF LED INDICATORS IS DESCRIBED IN THE TROUBLESHOOTING SECTION IN THIS MANUAL.

POWER SUPPLY MODULE FAIL LED

POWER ON/OFF LED

POWER ON/OFF SWITCH

NOTE: FUNCTION OF LED INDICATORS IS DESCRIBED IN THE TROUBLESHOOTING SECTION IN THIS MANUAL.



WIRELINE FAIL LED

WIRELINE ON LED

EXTERNAL REFERENCE INPUT

- USED TO CONNECT AN EXTERNAL SOURCE OF 5/10 MHZ FOR CALIBRATION OF STATION REFERENCE OSCILLATOR

HANDSET/MICROPHONE CONNECTOR (RJ-11)

- USED TO CONNECT TELEPHONE–STYLE HANDSET WITH PTT BUTTON (TMN6164 OR EQUIVALENT)
  OR
  MICROPHONE WITH PTT BUTTON (HMN1001A OR EQUIVALENT)

EIA–232 RSS PORT CONNECTOR

- USED TO CONNECT AN *IBM* PC (OR COMPATIBLE) PC RUNNING RSS SOFTWARE TO PERFORM STATION ALIGNMENT, OPTIMIZATION, AND DIAGNOSTICS
- REQUIRES NULL MODEM CABLE (MOTOROLA PART NO. 30–80369E31)

EXTERNAL SPEAKER CONNECTOR (RJ-11)

- USED TO CONNECT 6W EXTERNAL SPEAKER (HSN1000)

VOLUME UP PUSHBUTTON

- USED TO INCREASE THE VOLUME OF THE LOCAL SPEAKER, EXTERNAL SPEAKER, AND HANDSET EARPIECE
- IF LOCAL SPEAKER ON, EACH DEPRESSION RAISES VOLUME LEVEL ONE OF 16 STEPS; STOPS AT STEP 16
- IF LOCAL SPEAKER OFF, DEPRESS ONCE TO RAISE VOLUME LEVEL ONE STEP AND TURN ON LOCAL SPEAKER

VOLUME DOWN PUSHBUTTON

- USED TO DECREASE THE VOLUME OF THE LOCAL SPEAKER, EXTERNAL SPEAKER, AND HANDSET EARPIECE
- EACH DEPRESSION LOWERS VOLUME LEVEL ONE OF 16 STEPS; STOPS AT STEP 0
- IF LOCAL SPEAKER ON, HOLD BUTTON IN FOR 2 SECONDS AND RELEASE TO LOWER VOLUME LEVEL ONE STEP AND TURN OFF LOCAL SPEAKER

SQUELCH SELECT PUSHBUTTON

- USED TO SELECT BETWEEN PL, CARRIER, OR SQUELCH OFF
- WITH SQUELCH OFF, EACH DEPRESSION OF PUSHBUTTON SELECTS SQUELCH IN FOLLOWING SEQUENCE:

OFF>CARRIER>PL

INTERCOM PUSHBUTTON

- USED TO TOGGLE INTERCOM MODE
- WHEN INTERCOM MODE ENABLED, TECHNICIAN AT SITE AND REMOTE CONSOLE OPERATOR MAY COMMUNICATE IN AN INTERCOM FASHION (USING MICROPHONE/HANDSET WITH PTT BUTTON); NEITHER PARTY'S AUDIO IS TRANSMITTED OVER THE AIR

DESCRIPTION OF SPECIAL FUNCTIONS

PUSHBUTTON COMBINATION	FUNCTION
VOLUME UP, VOLUME DOWN, & INTERCOM	STATION RESET — PERFORMS A "WARM" STATION RESET; TAKES APPROXIMATELY 10–20 SECONDS
INTERCOM & VOLUME UP (NOTE)	TOGGLE TX KEY — KEYS/DEKEYS STATION TRANSMITTER WITHOUT PL NOTE THAT TX KEY TIMES OUT AFTER APPROXIMATELY 2 MINUTES.
INTERCOM & VOLUME DOWN (NOTE)	ACCESS DISABLE SELECT —TOGGLES ACCESS DISABLE MODE; WHEN IN ACCESS DISABLE, STATION MAY BE KEYED ONLY BY LOCAL MICROPHONE/HANDSET, INTERCOM & VOLUME UP BUTTONS, OR BY APPROPRIATE FUNCTION KEY FROM RSS.
NOTE: USE THE INTERCOM BUTTON AS A "SHIFT" KEY TO PERFORM MULTIPLE PUSHBUTTON FUNCTIONS. FOR EXAMPLE, PRESS AND HOLD INTERCOM, THEN PRESS VOLUME UP TO TOGGLE TX KEY FUNCTION.	

Figure 1. Switches, Pushbuttons, Connectors, and LED Indicators for *Quantar* Station (UHF Shown)

MOTOROLA

ROUTINE MAINTENANCE

For *Quantar* and *Quantro*
Station and Ancillary Equipment

1 INTRODUCTION

This section provides routine maintenance recommendations for the *Quantar* and *Quantro* station and associated ancillary equipment.

Routine Maintenance Overview

The *Quantar* and *Quantro* station and ancillary equipment have been designed with state–of–the–art technology and operate under software control, thus requiring minimal routine maintenance. Virtually all station operating parameters are monitored and self–corrected by the Station Control Module, making virtually all periodic adjustments and tuning unnecessary.

Providing that the equipment is installed in an area which meets the specified environmental requirements (see Pre–Installation planning for environmental specifications), the only routine maintenance task required is the calibration of the station reference oscillator circuit (and the optional UHSO, if installed). The calibration procedure is provided in the RSS User's Guide (68P81085E35).

Note: If the station equipment is installed in a particularly dusty environment, precautions must be taken to filter the air used for forced cooling of the station. Excessive dust drawn across and into the station circuit modules by the cooling fans can adversely affect heat dissipation and circuit operation. In such installations, be sure to clean or replace external filtering devices periodically. Refer to Pre–Installation Planning in the Installation section of this manual for recommended filtering techniques.

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2 RECOMMENDED SCHEDULE

The circuit device(s) responsible for determining the station reference frequency exhibit slight variations in their operating characteristics over time ("infant aging"). Approximately 90% of the component aging process occurs during the first year of operation. After the initial one year period, the device(s) remain stable for a substantially longer period of time. Therefore, it is recommended that the station reference oscillator be calibrated after one year of operation, and thereafter less often as prescribed in a recommended schedule of periodic calibration.

Station Reference Calibration Schedule

After performing the initial one year calibration procedure, periodic calibration is required according to the schedule shown below. Note that the intervals are affected by the accuracy (in PPM) required either for FCC compliance or by the system requirements, whichever is more stringent.

Table 1. *Recommended Intervals for Calibrating Station Reference Oscillator (After Initial One−Year Calibration)*

Accuracy Desired/Required	***Recommended Interval***
±5 PPM	Every 4 years
±2.5 PPM	Every 2 years
±1.5 PPM	Once yearly
±1.0 PPM (821−824 MHz Public Safety Band)	Once yearly
±0.1 PPM (see note)	Once yearly

Note: ±0.1 PPM accuracy requires the use of either the UHSO Option X873AA or an external 5 MHz source. The UHSO option requires both the internal station reference oscillator **and** the UHSO to be calibrated once yearly using the RSS. When using an external 5 MHz source, the internal station reference oscillator must be calibrated once yearly using the RSS, and the external source must be calibrated once yearly using the manufacturer's recommended procedure.

MOTOROLA

TROUBLESHOOTING

For *Quantar* Station and Ancillary Equipment (VHF, UHF, 800 MHz, and 900 MHz)

1 INTRODUCTION

This section provides troubleshooting recommendations and procedures for the *Quantar* station and associated ancillary equipment.

Troubleshooting Overview

The troubleshooting procedures and supporting diagrams provided in this section allow the service technician to isolate station faults to the module/assembly level. Defective modules are then replaced with known good modules to restore the station to proper operation.

Troubleshooting information includes:

- Table defining the function of the various alarm LED indicators
- Troubleshooting flow charts
- Module replacement procedures
- Post-repair procedures for performing alignment following replacement of defective modules

2 RECOMMENDED TEST EQUIPMENT

The following list of test equipment is recommended to perform troubleshooting procedures on the *Quantar* station and ancillary equipment.

List of Test Equipment

- Motorola R2001 or R2600 Series Communications Analyzer (or equivalent)
- PC with RSS program
- 9-pin female to 9-pin male Null Modem Cable (30−80399E31)
- In-Line Wattmeter (Motorola S-1350 or equivalent)
- Dummy Load (50Ω, station wattage or higher)
- Handset/Microphone with PTT switch (TMN6164 or equivalent)
- Torx driver with #15 bit (for removal of module front panels)
- IC Extraction Tool (01−80386A04)

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3 TROUBLESHOOTING PROCEDURES

The troubleshooting and repair philosophy for the *Quantar* station and ancillary equipment is one of Field Replaceable Unit (FRU) substitution. The station is comprised of self-contained modules (FRUs) which, when determined to be faulty, may be replaced with a known good module to quickly bring the station back to normal operation. The faulty module must then be shipped to a Motorola repair depot for further troubleshooting and repair to the component level.

Because the *Quantar* station is computer-controlled and employs state-of-the-art digital signal processing techniques, many of the troubleshooting procedures require the use of the Motorola-supplied Radio Service Software (RSS). The RSS is run on a PC (or compatible) with RS-232 communication port capability. The RSS allows the technician to access alarm log files, run diagnostics, and set up the equipment for various audio and rf tests. Complete details on the operation of the RSS are provided in the RSS User's Guide (68P81085E35).

Troubleshooting Overview

Introduction

Two procedures are provided for troubleshooting the *Quantar* station and ancillary equipment. Each procedure is designed to quickly identify faulty modules, which may then be replaced with known good modules to restore proper station operation.

Procedure 1 — Routine Site Visit Functional Checkout

Procedure 1 consists of a series of non-intrusive tests that can be quickly run during a routine site visit. This procedure allows the technician to verify the proper station operation without taking the station out of service. An overview of the procedure is shown in the flow chart (Figure 1) on page 3.

Procedure 2 — Troubleshooting A Reported/Suspected Problem

Procedure 2 should be used when an equipment problem has been either reported or is suspected. This procedure is comprised of both non-intrusive (equipment not taken out of service) and intrusive (requiring the equipment be temporarily taken out of service) tests that allow the technician to troubleshoot reported or suspected equipment malfunctions. An overview of the procedure is shown in the flow chart (Figure 2) on page 4.

How to Use These Troubleshooting Procedures

Perform the following basic steps in order to efficiently troubleshoot the *Quantar* station equipment.

Step 3. Select the appropriate troubleshooting procedure flow chart (Procedure 1 or Procedure 2).

Step 4. Perform the tasks given in the selected flow chart. Tasks requiring additional explanation are marked with page references. Locate the additional information, perform the tasks (if any), and return to the flow chart.

Step 5. Once the faulty module has been identified, proceed to *Module Replacement Procedures*, beginning on page 21.

PROCEDURE 1

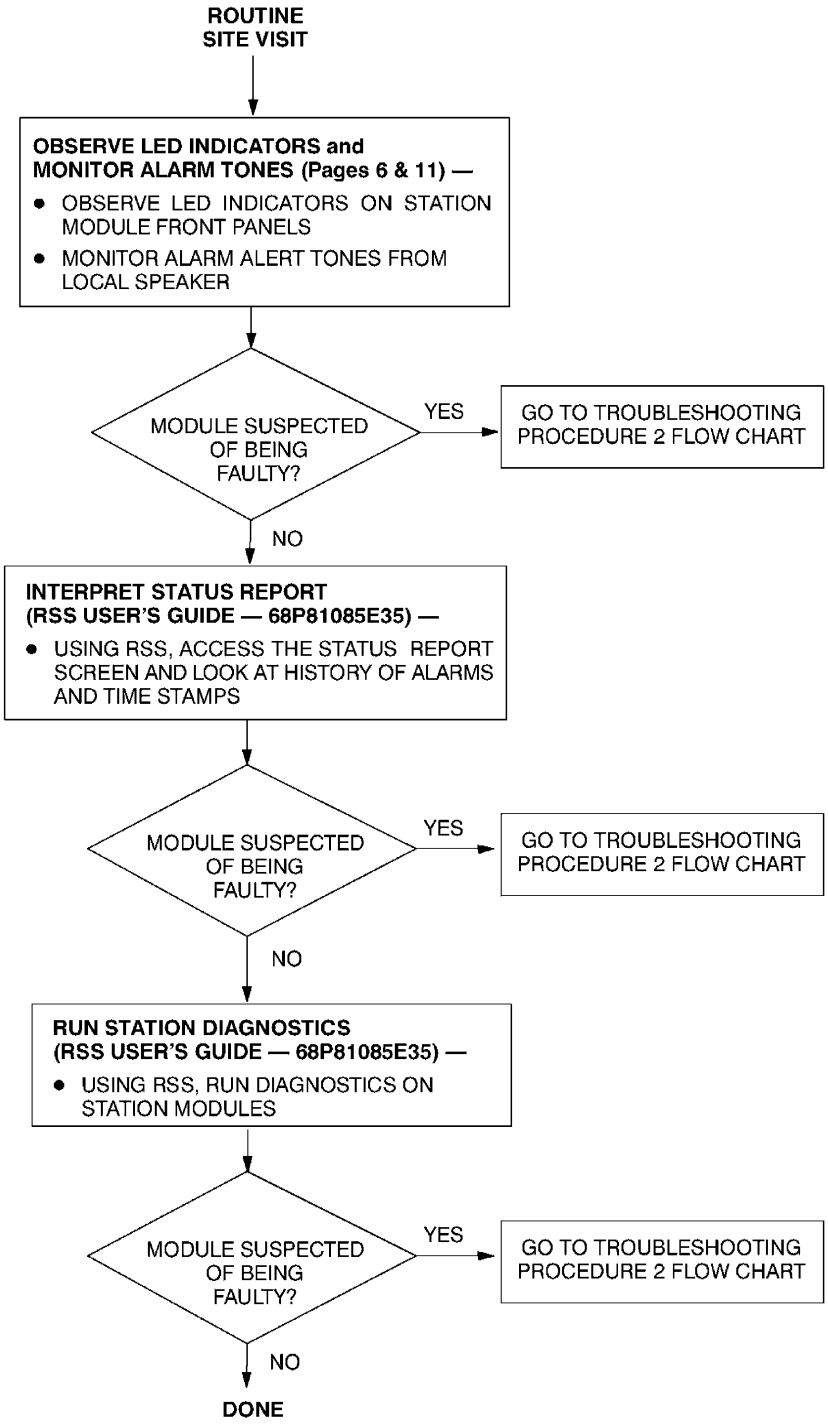

Figure 1. *Quantar* Station Troubleshooting Overview (Procedure 1 — Routine Site Visit)

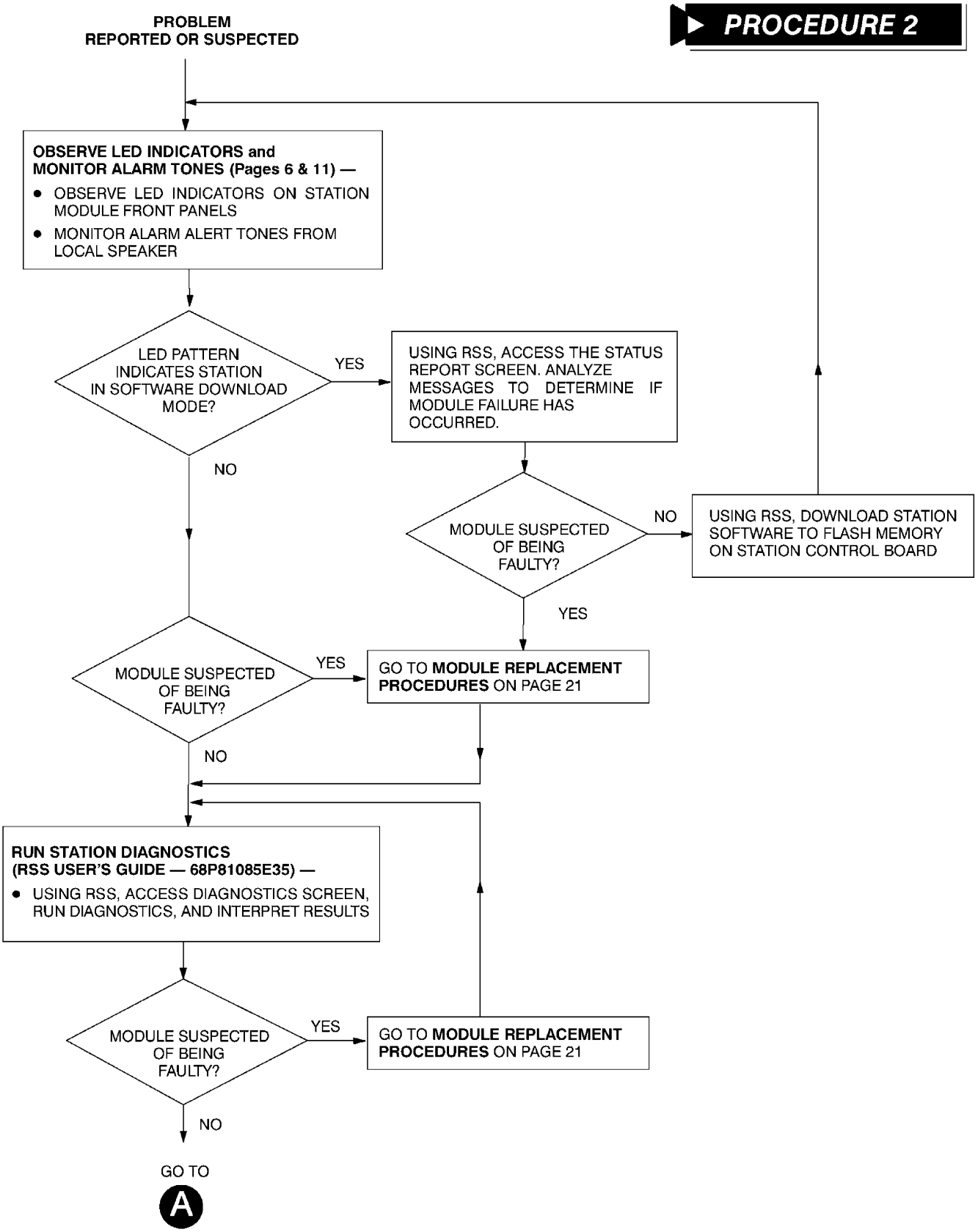

Figure 2. *Quantar* Station Troubleshooting Overview (Procedure 2 — Reported or Suspected Problem)

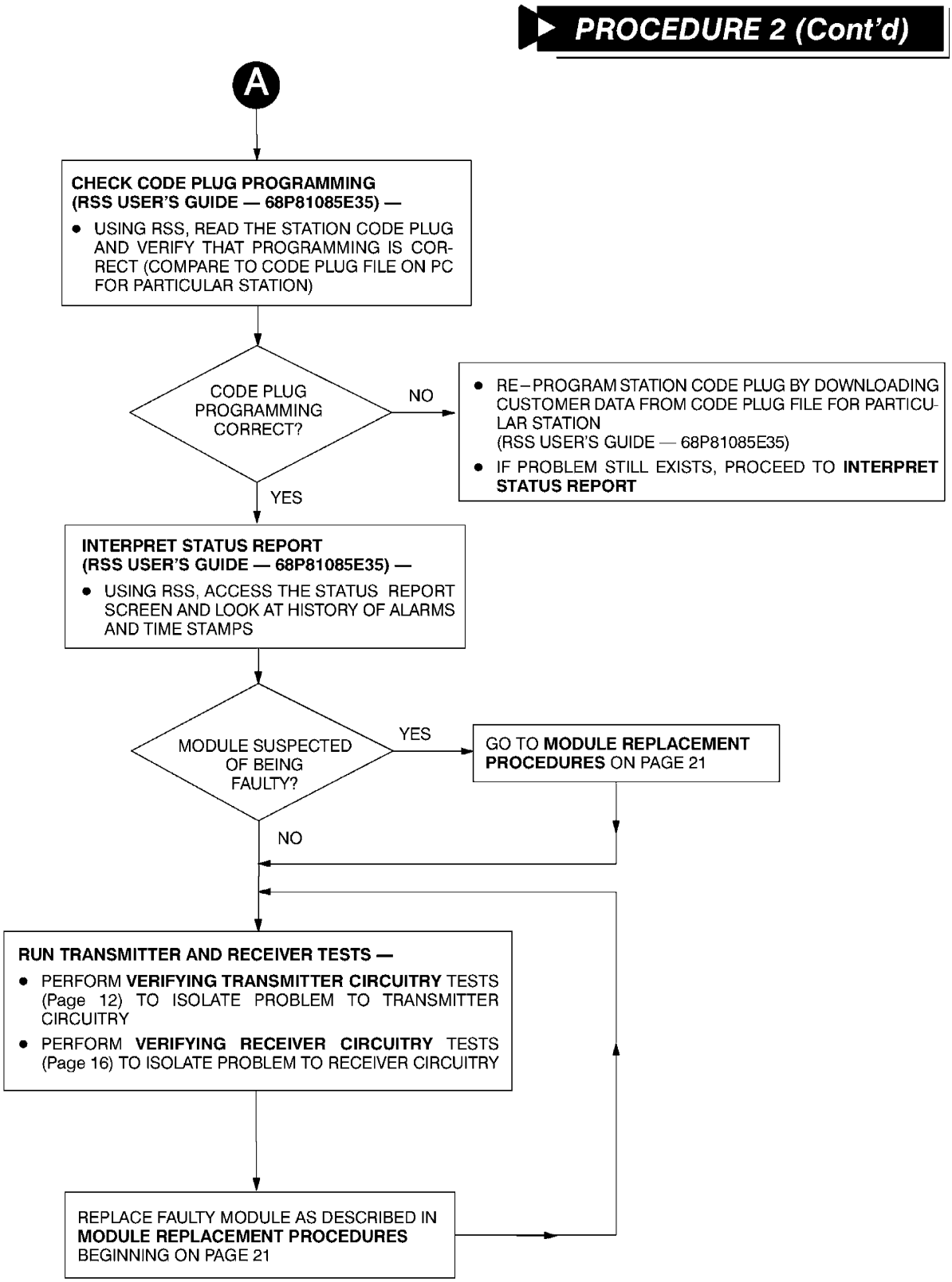

Figure 2. Troubleshooting Procedure 2 (Continued)

Interpreting LED Indicators

Several LED indicators are provided on the front panels of the modules that indicate specific operating conditions. The service technician may observe these LEDs to obtain a quick status indication of the station equipment.

Figure 3 shows the location of all LED indicators provided on the station equipment. Table 1 lists each LED indicator along with a description of the status indicated by each LED.

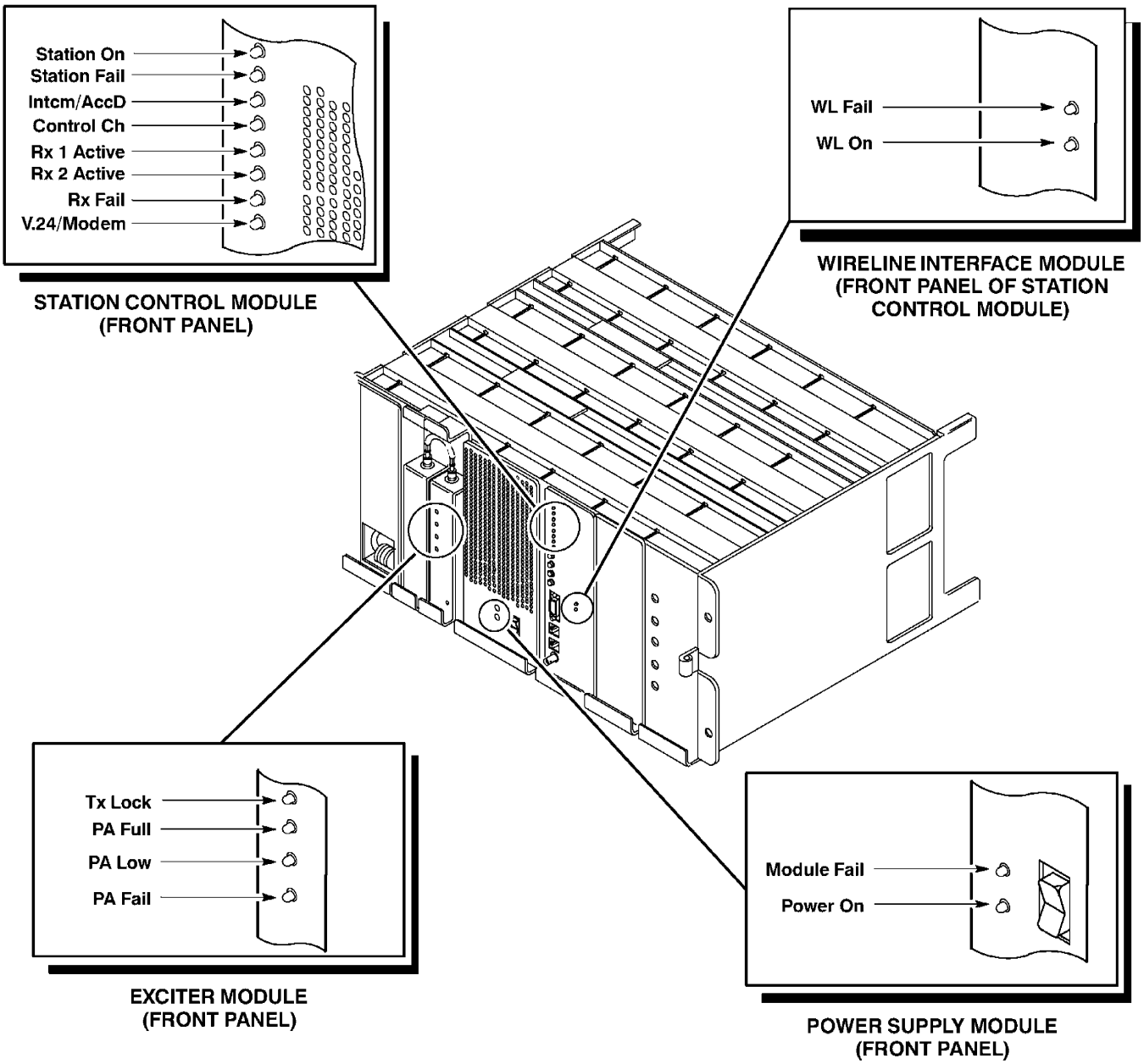

Figure 3. *Quantar* Station LED Indicators (UHF Shown)

Table 1. *Quantar Station* LED Indicator Functions

LED Location	LED Name	Status Definition
EXCITER MODULE	TX Lock	– GREEN when Exciter synthesizer is locked; module fully functional. – OFF when: synthesizer is out of lock **or** +5V, +14.2V, or both are absent
	PA Full	– GREEN when transmitter is keyed and PA output power is at expected power level (as set by technician via RSS during station alignment) – OFF when: PA not keyed **or** PA keyed but PA output power is **not** at expected power level (as set by technician via RSS during station alignment)
	PA Low	– YELLOW when transmitter is keyed and PA output power is less than expected power level (as set by technician via RSS during station alignment) but not shut down (for example, during power cutback mode) – OFF when: PA not keyed **or** PA keyed and PA output power is at expected power level (as set by technician via RSS during station alignment)
	PA Fail	– RED when: No PA output power (for example, during PA shutdown mode); LED status is latched, thereby indicating status during current key or for previous key **or** (High power models only) Overdrive alarm is generated by Driver PA **Note:** Any component associated with the PA could cause LED to light. These include the +5V/IPA Module, the Driver PA Module, the Final PA Module, and rf peripherals (such as the circulator, low pass filter, etc.) – FLASHING when PA is in Test Mode (activated by technician via RSS; when in Test Mode, power cutback, VSWR protection, and open power loop protection are disabled) – OFF when PA output power is either at expected level or at specific cutback levels (any level other than shutdown); LED status is latched, thereby indicating status during current key or for previous key
POWER SUPPLY MODULE	Module Fail	– OFF during normal operation. – Lights RED when module malfunction occurs, such as shorted output, current limit exceeded, loss of communication with Station Control Module, etc.
	Power On	– GREEN with ac input power present and switch turned ON – OFF when ac input power absent or switch turned OFF

Table 1. *Quantar Station* LED Indicator Functions (continued)

LED Location	LED Name	Status Definition
STATION CONTROL MODULE (SCM)	**Station On**	– GREEN when SCM fully functional – FLASHING when front panel switch press detected – OFF for SCM failure
	Station Fail	– RED for SCM failure – OFF when SCM fully functional (no failure)
	Intcm/Acc D	– YELLOW when station is in Intercom mode – FLASHING once per second when station is in Access Disable Mode – FLASHING twice per second when station is TX Inhibited – OFF when station is not in Intercom mode
	Control Ch	– GREEN when station is control channel (trunking systems only) – FLASHES each time station decodes ISW (*IntelliRepeater* systems only) – OFF when station is not control channel (trunking systems only)
	RX 1 Active	– GREEN when Station Control Board is passing audio/data (receive path unmuted) from Receiver #1; The following conditions must be met: Carrier at proper frequency being received Carrier signal level is above threshold set in codeplug Squelch criteria met (carrier, PL, DPL, ASTRO, secure, etc.) (Note that squelch criteria can be manually altered via RSS for testing purposes) – OFF when above conditions are not met for Receiver #1
	RX 2 Active	– Indicates condition of Receiver #2; Same status definitions as RX 1 ACTIVE
	RX Fail	– RED when Receiver #1 and #2 are both non–functional ★ – BLINKING ONCE PER SECOND when Receiver #1 is non–functional ★ – BLINKING TWICE PER SECOND when Receiver #2 is non–functional ★ or when SAM Module or UHSO Module is non–functional – OFF when both Receiver #1 and #2 are functional ★ (or no receiver modules installed) ★ A receiver module is considered non–functional if a failure is detected during diagnostics run at time of power–up or during normal operation.
	V.24/Modem	– GREEN when *ASTRO* Link (V.24 or *ASTRO* modem) between the station/receiver and infrastructure equipment is operational – FLASHING once per second when station/receiver is attempting to establish the analog portion of a Hybrid Link – FLASHING twice per second when station/receiver is attempting to establish the *ASTRO* Link (V.24 or *ASTRO* modem) – OFF for non-*ASTRO* systems or for *ASTRO* systems where station/receiver software does not support the LED functionality
	All LEDs Flashing On and Off in Unison	– Station is in Software Download mode, either initiated by the RSS or due to software failure.
	LEDs Flashing Up and Down in Sequential Pattern	– Stationhas received software files from RSS and is in process of downloading the software to FLASH memory in the Station Control Module

*Table 1. **Quantar Station** LED Indicator Functions (continued)*		
LED Location	**LED Name**	**Status Definition**
WIRELINE INTERFACE BOARD (WIB)	**WL On**	– GREEN when WIB fully functional – OFF for WIB failure
	WL On	– GREEN when WIB fully functional – OFF for WIB failure
	Both LEDs Blinking Rapidly	– WIB is in Software Download mode (operating software is being downloaded into the FLASH memory on WIB from Station Control Module)

Notes:

1. All LEDs momentarily light following station reset (Volume Up, Volume Down, and Intercom buttons on SCM front panel pressed simultaneously) or upon station power up.
2. If no LED indicators are on, make sure that ac power to the station power supply is present. Check the circuit breaker at the ac source. Check the ac line cord. If no problem found, suspect Power Supply Module.

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Interpreting Alarm Alert Tones

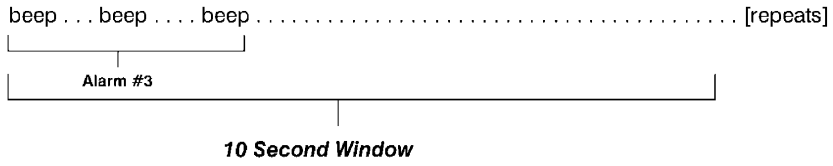
Note: *The alarm tones may also be routed to the console (via the wireline) and transmitted over the air. Refer to the* ***RSS User's Guide 68P81085E35*** *for details on enabling/disabling these two alarm routing options.*

Introduction

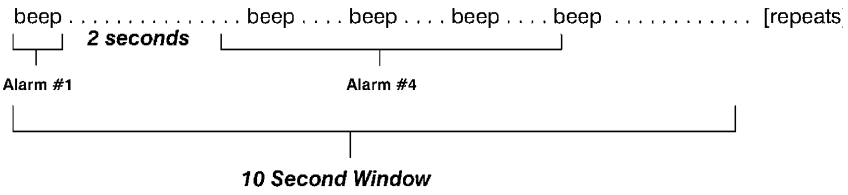
Four station alarm conditions are reported with audio alert tones which are routed to the local speaker. The alarms are also entered into the alarm log which can be accessed using the RSS (*refer to RSS User's Guide 68P81085E35*).

The four alarm conditions are represented by a series of alarm tones, from a single beep to four beeps. Each beep is a 1200 Hz tone lasting 125 msec. The alarm tones occur during a repeating 10 second window, with 2 seconds between successive alarms (when more than one alarm are active). The following two examples illustrate the timing of the alarm tones.

Example 1: Single Alarm (#3)



Example 2: Multiple Alarms (#1 and #4)



The alarm tone definitions are as follows:

Number of Beeps	Alarm Condition Name	Alarm Condition Description
1	Battery Revert	Alarm is reported when station loses ac line power and reverts to battery backup. Alarm is cleared when station receives ac power.
2	PA Fail	Alarm is reported when PA fails to key up to full output power. Alarm is cleared upon successful keyup to full power.
3	Synthesizer	Alarm is reported when either TX or RX synthesizers fail to lock. Alarm is cleared when both synthesizers lock.
4	Overvoltage	Alarm is reported when battery charging voltage is above +34.5 V (100 W stations) or +17.25 V (20 W stations). Alarm is cleared when voltage returns to normal range.

Verifying Transmitter Circuitry

IMPORTANT

Performing this procedure requires that the station be taken out of service. It is recommended that, unless the station is already out of service due to an equipment malfunction, this procedure be performed during off-peak hours so as to minimize the disruption of service to the system subscribers. To take the equipment out of service, use the **Access Disable** function described in the *Operation* section of this manual.

Introduction

While most module faults can be detected by running the station diagnostics provided by the RSS, the following procedure provides a more traditional method of troubleshooting the transmitter circuitry. This procedure is useful in the event that the RSS is not at hand or for some reason cannot be utilized (PC malfunction, etc.).

This procedure allows the service technician to make minor adjustments and verify proper operation of the station transmit circuitry, including:

- Exciter Module
- Power Amplifier Module
- Power Supply Module
- 2.1 MHz reference oscillator circuitry
- Transmitter-related circuitry on the Station Control Board (SCM)

In general, the transmitter circuitry is exercised by injecting and measuring signals using a Motorola R2001 Communications Analyzer (or equivalent). Incorrect measurement values indicate a faulty module(s); measurement values within the acceptable range verify proper operation of the above listed modules and circuitry.

Required Test Equipment

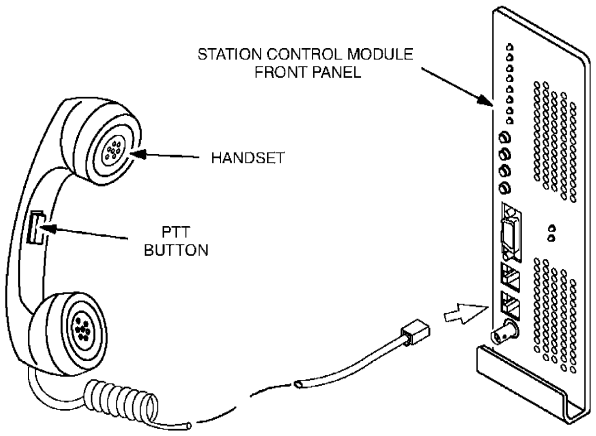
The following test equipment is required to perform the procedure:

- Motorola R2001 Communications Analyzer (or equivalent)
- Telephone-style handset with PTT switch (TMN6164 or equiv.)
- In-Line Wattmeter (Motorola Model S-1350 or equivalent)
- Dummy Load (50Ω, station wattage or higher)

Verifying Transmitter Circuitry Procedure

Step 1. Connect test equipment by performing Steps 1–3 shown in Figure 4.

Step 2. Connect handset to RJ-11 connector on SCM front panel as shown.



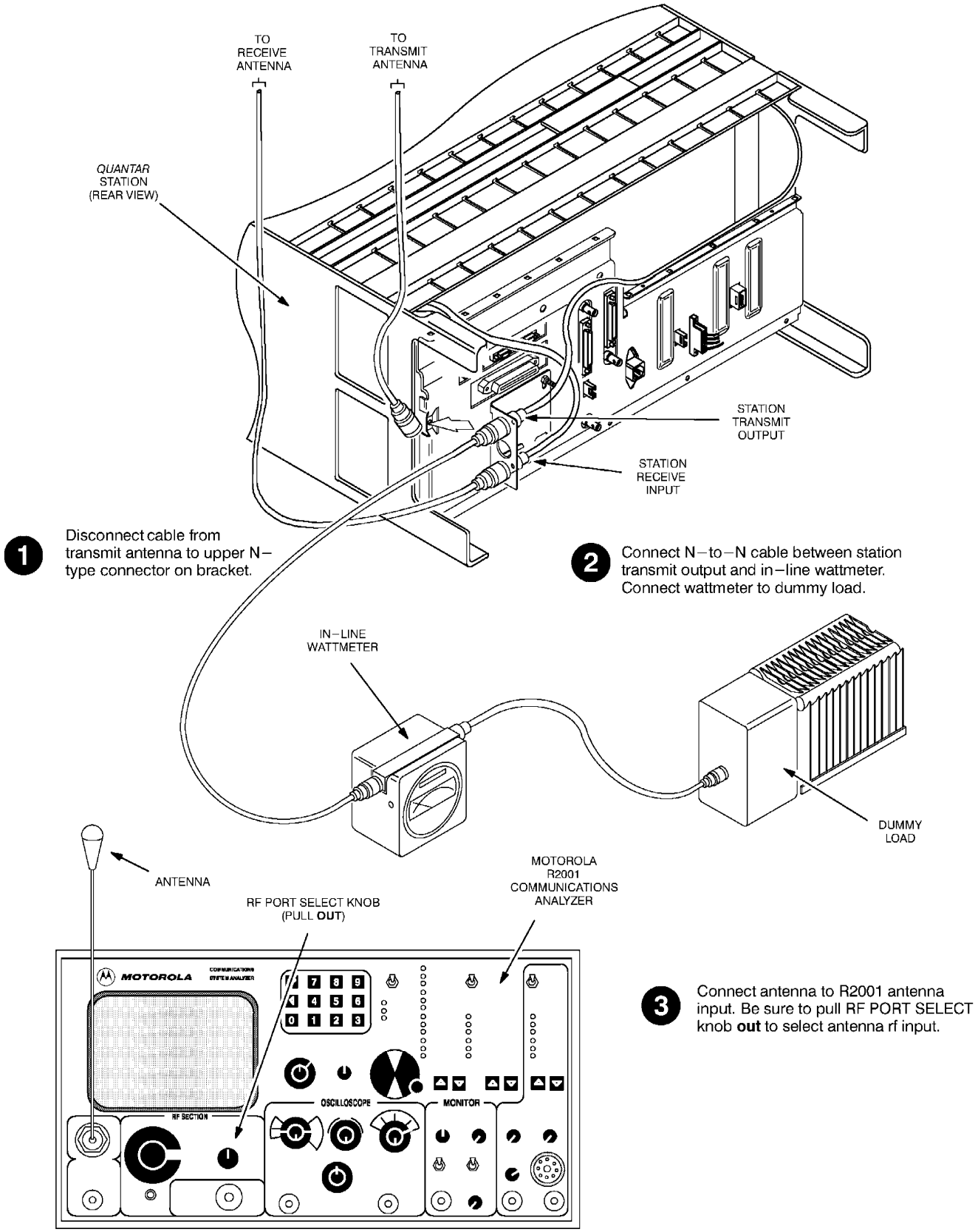


Figure 4. Test Equipment Setup for Verifying Transmitter Circuitry

Verifying Transmitter Circuitry (Continued)

Note: *Suspected faulty modules are shown ranked in order of most to least likelihood.*

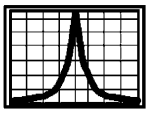
Step 3. Press the PTT button and observe LED indicators on Exciter Module front panel.

- If **PA Low** or **PA Fail** LED is lit, suspect the following:
  Power Amplifier Module failure
  Exciter Module failure
  Loose or bad Exciter-to-PA rf cable
  Loose or bad PA-to-antenna rf output cable
  PA rf output cable not properly terminated
- If **TX Lock** LED is off, suspect the following:
  Faulty Station Control Module
  Faulty Exciter Module
  Faulty backplane

Step 4. Measure output power by pressing the PTT button and observing reading on in-line wattmeter.

- If PA output not at proper power (as set for particular site), adjust the output power as described in the RSS User's Guide (68P81085E35).

Step 5. If PA output power OK, set up R2001 for spectrum analyzer display. Press the PTT button and observe the display. The display should look similar to:



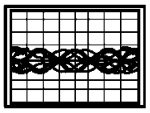
- If the display shows multiple carriers evenly spaced about the carrier, suspect a faulty PA module or +5V/IPA Module
- If the display shows a solid carrier but off frequency, suspect the following:
  Faulty Exciter or Station Control Module
  Faulty external 5 MHz reference source
- If the display shows a single carrier moving erratically, suspect:
  Faulty Station Control Module
  Faulty Exciter Module
  Faulty PA Module

Note: *Suspected faulty modules are shown ranked in order of most to least likelihood.*

(continued on page 15)

Verifying Transmitter Circuitry (Continued)

Step 6. If display OK, set up R2001 to display modulation. Using the handset, push the PTT button and speak into the mouthpiece. Verify that the display shows:



- If proper display is not obtained, suspect faulty SCM or Exciter Module.

Step 7. Set the R2001 for GEN/MON MTR. Press the PTT button and speak loudly in the mouthpiece to cause maximum deviation. Display should read ±5 kHz maximum.

- If proper display is not obtained, suspect faulty SCM or Exciter Module.

Step 8. This completes the **Verifying Transmitter Circuitry** test procedure. If all displays and measurements are correct, the transmitter circuitry may be considered to be operating properly. Remove test equipment, restore the station to normal service, and return to the troubleshooting flow chart to resume troubleshooting sequence.

Verifying Receiver Circuitry (Analog Capable Stations)

IMPORTANT

Performing this procedure requires that the station be taken out of service. It is recommended that, unless the station is already out of service due to an equipment malfunction, this procedure be performed during off-peak hours so as to minimize the disruption of service to the system subscribers. To take the equipment out of service, use the **Access Disable** function described in the *Operation* section of this manual.

IMPORTANT

Note that if station operates as a repeater the transmit output from the station must be connected to a dummy load to prevent over-the-air broadcast during receiver testing.

Introduction

While most module faults can be detected by running the station diagnostics provided by the RSS, the following procedure provides a more traditional method of troubleshooting the receiver circuitry. This procedure is useful in the event that the RSS is not at hand or for some reason cannot be utilized (PC malfunction, etc.).

This procedure allows the service technician to make minor adjustments and verify proper operation of the station receive circuitry, including:

- Receiver Module
- Power Supply Module
- 2.1 MHz reference oscillator circuitry
- Receiver-related circuitry in the Station Control Module (SCM)

In general, the receiver circuitry is exercised by injecting and measuring signals using a Motorola R2001 Communications Analyzer (or equivalent). Incorrect measurement values indicate a faulty module(s); measurement values within the acceptable range verify proper operation of the above listed modules and circuitry.

Required Test Equipment

The following test equipment is required to perform the procedure:

- Motorola R2001 Communications Analyzer (or equivalent)
- Telephone-style handset with PTT switch (TMN6164 or similar)
- Female N-type to Female N-type coaxial cable
- RJ-11 to BNC cable
- Dummy Load (50Ω, station wattage or higher) required for repeater stations only

Verifying Receiver Circuitry Procedure

Step 1. Connect test equipment by performing Steps 1–3 shown in Figure 5.

Step 2. Disable PL and carrier squelch by repeatedly pressing the **PL/CSQ/Off** button until receiver noise is heard thru the handset (or external or internal speaker). If no audio is heard, suspect the following:

- Faulty Receiver Module
- Faulty Station Control Module
- R2001 is outputting a carrier signal

Step 3. Set R2001 to generate a .5 µV (–113 dBm) FM signal at the *Quantar* receiver frequency, modulated by a 1 kHz tone at 3 kHz deviation. The 1 kHz tone should be audible thru the handset (or internal or external speaker). If no audio is heard, suspect the following:

- Faulty Station Control Module (2.1 MHz reference)
- Faulty Receiver Module
- Faulty antenna-to-Receiver preselector rf cable
- Faulty R2001-to-station rf cable

(continued on page 18)

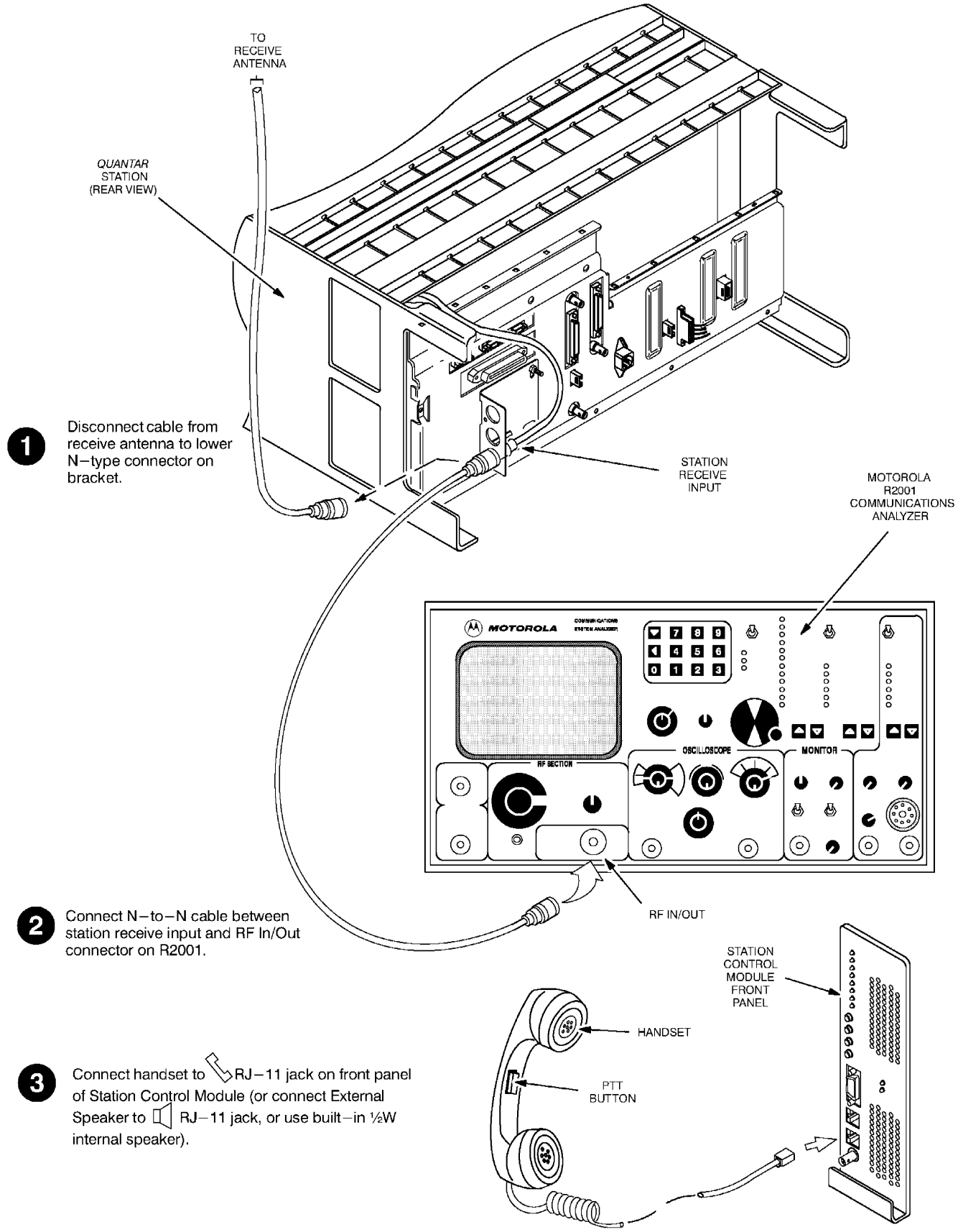
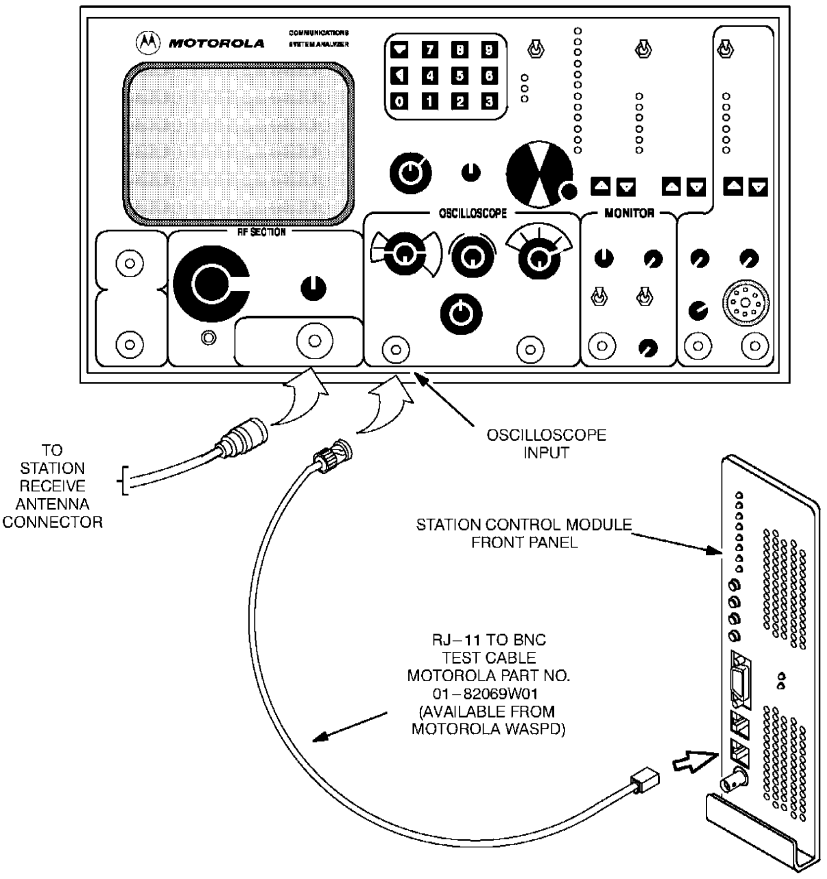


Figure 5. Test Equipment Setup for Verifying Receiver Circuitry

Verifying Receiver Circuitry (Continued)

Step 4. If audio is heard, connect the HANDSET RJ−11 jack to the Oscilloscope input BNC connector, as shown below:



Step 5. Use **Volume Up** button to increase volume to maximum. Measure the audio level using the R2001.

- Audio level should measure approximately .75 to 1.5 V p−p. If not, suspect faulty SCM.

Step 6. Change R2001 injection signal level to:

VHF: .25 μV (−119 dBm)
UHF: .35 μV (−116 dBm)
800, 900: .30 μV (−117.5 dBm)

Note: *To measure SINAD, the station must be programmed for mixed mode Analog/Digital operation. Incorrect reading will result if programmed for Digital Only operation.*

Note: *For VHF and UHF stations only, refer to* ***5. Preselector Field tuning Procedure*** *in this section for procedures to tune the receiver preselector.*

Step 7. Measure the receiver SINAD. The value should read 12 dB or greater. If not, tune the preselector (VHF and UHF only) and recheck SINAD. If 12 dB SINAD cannot be achieved, replace the Receiver Module.

Step 8. This completes the **Verifying Receiver Circuitry** test procedure. If all displays and measurements are correct, the receiver circuitry may be considered to be operating properly. Remove test equipment, restore the station to normal service, and return to the troubleshooting flow chart to resume troubleshooting sequence.

Verifying Receiver Circuitry (Digital Only Stations)

IMPORTANT

Performing this procedure requires that the station be taken out of service. It is recommended that, unless the station is already out of service due to an equipment malfunction, this procedure be performed during off-peak hours so as to minimize the disruption of service to the system subscribers. To take the equipment out of service, use the **Access Disable** function described in the *Operation* section of this manual.

IMPORTANT

Note that if station operates as a repeater the transmit output from the station must be connected to a dummy load to prevent over-the-air broadcast during receiver testing.

Introduction

While most module faults can be detected by running the station diagnostics provided by the RSS, the following procedure provides a more traditional method of troubleshooting the receiver circuitry.

This procedure allows the service technician to make minor adjustments and verify proper operation of the station receive circuitry, including:

- Receiver Module
- Power Supply Module
- 2.1 MHz reference oscillator circuitry
- Receiver-related circuitry in the Station Control Module (SCM)

In general, the receiver circuitry is exercised by injecting and measuring test pattern signals using a Motorola R2670 Communications Analyzer (or equivalent) and analyzing the Bit Error Rate using the RSS. Incorrect measurement values indicate a faulty module(s); measurement values within the acceptable range verify proper operation of the above listed modules and circuitry.

Required Test Equipment

The following test equipment is required to perform the procedure:

- Motorola R2670 Communications Analyzer with *ASTRO* CAI Option (or equivalent)
- PC running Radio Service Software (RSS) program
- Female N-type to Female N-type coaxial cable
- Dummy Load (50Ω, station wattage or higher) required for repeater stations only

Verifying Receiver Circuitry Procedure

Step 1. Proceed to the procedure *ASTRO Bit Error Rates Reports* (located in Chapter 4 of the *RSS User's Guide 68P81085E35*). Follow the instructions for setting up the test equipment and initiating a BER report using the RSS.

Step 2. If the BER reading is above 5%, suspect the following:

- Faulty Station Control Module (2.1 MHz reference)
- Faulty Receiver Module
- Faulty antenna-to-Receiver preselector rf cable
- Faulty R2670-to-station rf cable

Step 3. Change R2670 injection signal level to:

VHF: .25 µV (−119 dBm)
UHF: .35 µV (−116 dBm)
800, 900: .30 µV (−117.5 dBm)

(continued on page 20)

Verifying Receiver Circuitry (Analog Capable Stations) (Continued)

Note: *For VHF and UHF stations only, refer to* ***5. Preselector Field tuning Procedure*** *in this section for procedures to tune the receiver preselector.*

Step 4. Note the receiver BER reading. The BER reading should be 5% or less. If not, tune the preselector (VHF and UHF only) and recheck the BER reading. If a reading of 5% or less cannot be achieved, replace the Receiver Module.

Step 5. This completes the **Verifying Receiver Circuitry** test procedure. If all displays and measurements are correct, the receiver circuitry may be considered to be operating properly. Remove test equipment, restore the station to normal service, and return to the troubleshooting flow chart to resume troubleshooting sequence.

4 MODULE REPLACEMENT PROCEDURES

Station modules suspected of being faulty must be replaced with known good modules to restore the station to proper operation. The following procedures provide instructions for replacing each of the station modules and performing any required post-replacement adjustments or programming.

General Replacement Information

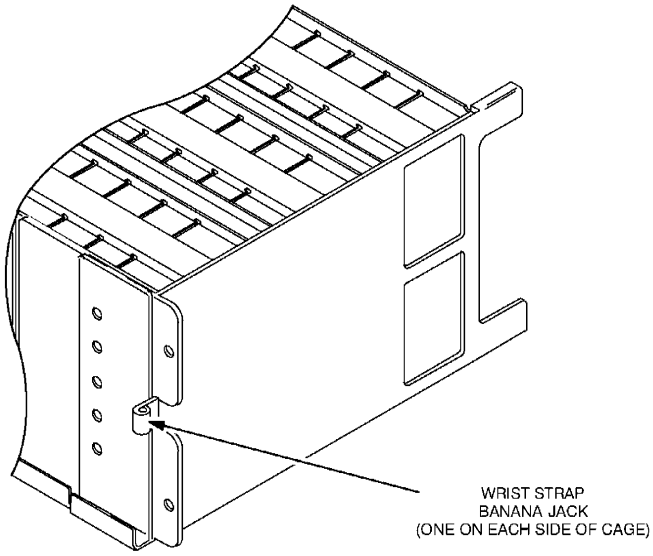
Anti–Static Precaution

The station circuitry contains many C-MOS and other static-sensitive devices. When servicing the equipment, you must take precautionary steps to prevent damage to the modules from static discharge. Complete information on prevention of static protection is provided in Motorola publication 68P81106E84, available through Motorola National Parts. Some additional precautions are as follows:

- A wrist strap (Motorola Part No. RSX4015A, or equivalent) should be worn while servicing to minimize static buildup. Banana jacks are built into the station cage for connection of the wrist strap.

WARNING

When wearing Conductive Wrist Strap, be careful near sources of high voltage. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentally touching high voltage sources.



CAUTION

DO NOT insert or remove station modules with power applied. This may result in damage to the modules.

- **Do not** insert or remove modules with power applied. Always turn off the station using the On/Off switch located on the front of the Power Supply Module before inserting or removing modules.
- All spare modules should be kept in a conductive bag for storage and transporting. When shipping modules to the repair depot, always pack in conductive material.

General Replacement Information (Continued)

Care of Gold–Plated Connector Contacts

The connections between the modules and the station backplane board are made with gold-plated card edge connector contacts to provide maximum reliability. Gold-plated materials do not form a non-conductive oxide layer, and therefore should not require cleaning under normal conditions.

When the modules have been subjected to many extraction/insertion cycles, or if the station is operated in a dusty environment, the contacts may require cleaning. **Do not** use an eraser or any type of abrasive substance to clean either the module card-edge connectors or the backplane connector contacts. Any type of abrasive cleaning (typically employed for cleaning non gold-plated contacts) can result in the removal of the gold plating or bending of the connector contacts.

If cleaning of the gold-plated contacts is required, use a soft cloth dampened with alcohol to lightly wipe the contacts. Be sure not to touch the contact surfaces with your fingers, as finger oils and salts can contaminate the contact surfaces.

Cleaning Module Rails

After a few module extraction/insertion cycles, wipe the module rails with a soft cloth to remove any oxidation or foreign material. This ensures a good ground connection between the module and the cage.

Power Down Station Before Removing/Inserting Modules

Before removing or inserting a module into the station cage and engaging the backplane connector, be sure to turn off the station power using the Power Supply Module On/Off switch.

Important! If the station is equipped with battery backup, turning the On/Off switch to OFF **will not** turn the station off. You must also disconnect the battery revert cable from the station backplane. Remember to reconnect the battery cable before restoring the station to operation.

Validating Repairs

After replacing a faulty module with a known good module, perform one of the following tests to validate the repair before leaving the site.

- If the faulty module was detected as the result of running station diagnostics via the RSS, run the diagnostics again after the repair is made to ensure that the replacement module passes all diagnostic tests.
- If the faulty module was detected by an operational failure, perform the operation to ensure that the repair corrected the reported/detected failure.

Replacing Power Amplifier Module

Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Using a Torx #15 driver, remove anti-vibration screw(s) (if installed) from top and/or bottom of module front panel.

Step 3. Disconnect mini–UHF connector on rf cable connecting Exciter Module to Power Amplifier Module.

Step 4. Slide the module out to the first stop. Disconnect the N-type connector (rf output from the module) from the lower left side of module.

Step 5. Remove faulty module from cage.

Step 6. Install replacement Power Amplifier Module by sliding module into cage (about 2 inches from full insertion). Connect the rf output cable to the N-type connector at the lower left side of the module.

Step 7. Slide the module in completely and firmly seat the module connector into the backplane. (**Do not** slam the module against the backplane or push any harder than necessary to seat the connectors.) Now reconnect the rf cable from the Exciter Module.

Step 8. Restore power to the station.

Post-Replacement Optimization Procedure

Perform the *Power Output* alignment procedure located in the RSS User's Guide (68P81085E35).

Replacing Exciter Module

Note *The replacement board must have the same model number as the faulty board (e.g., TLF6920). If it does not, contact the System Support Center at 1-800-221-7144 for instructions on how to proceed.*

Note *If the existing EPROM is faulty, contact the System Support Center at 1-800-221-7144 to obtain replacement part. The version of software contained in the replacement device must match that of the faulty device.*

Note *Use an IC Extraction Tool (Motoorla Part No. 01–80386A04) to remove the firmware devices.*

Replacement Procedure

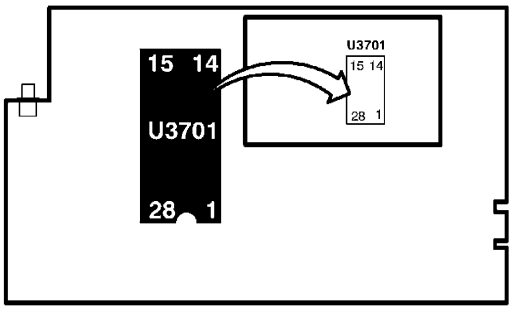
Step 1. Turn off station power (refer to page 22).

Step 2. Using a Torx #15 driver, remove anti-vibration screw(s) (if installed) from top and/or bottom of module front panel.

Step 3. Disconnect mini-UHF connector on rf cable connecting Power Amplifier Module to Exciter Module.

Step 4. Remove faulty module from cage.

Step 5. The Exciter Board software must now be removed from the old board and installed onto the replacement board. The software is contained on a single EPROM. You must remove the EPROM from the replacement board and replace it with the EPROM from the old board. The following illustration shows the location of the EPROM.



Step 6. Install replacement Exciter Module by sliding module into cage and firmly seating the module connector into the backplane. (**Do not** slam the module against the backplane or push any harder than necessary to seat the connectors.) Now reconnect the rf cable from the Power Amplifier Module.

Step 7. Restore power to the station.

Post-Replacement Optimization Procedure

Step 1. Perform the *TX Deviation Gain Adjust* alignment procedure located in the RSS User's Guide (68P81085E35).

Step 2. Perform the *Reference Modulation* alignment procedure located in the RSS User's Guide (68P81085E35).

Step 3. For *ASTRO* Simulcast systems only, perform the *ASTRO/Simulcast Launch Time Offset* alignment procedure located in the RSS User's Guide (68P81085E35).

Replacing Power Supply Module

Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Using a Torx #15 driver, remove anti-vibration screw(s) (if installed) from top and/or bottom of module front panel.

Step 3. Remove faulty module from cage.

Step 4. Install replacement Power Supply Module by sliding module into cage and firmly seating the module connector into the backplane. (**Do not** slam the module against the backplane or push any harder than necessary to seat the connectors.)

Step 5. Restore power to the station.

Post-Replacement Optimization Procedure

Replacement Power Supply Modules are factory aligned. Therefore, no post-replacement optimization is required for this module.

Replacing Station Control Module (all except modules in *IntelliRepeater* Ethernet Networks)

Note *The replacement board must have the same model number as the faulty board (e.g., CLN6961). If it does not, contact the System Support Center at 1-800-221-7144 for instructions on how to proceed.*

Note *If the existing EPROM or FLASH SIMM is faulty, contact the System Support Center at 1-800-221-7144 to obtain replacement parts. The version of software contained in the replacement devices must match that of the faulty devices.*

Note *Use an IC Extraction Tool (Motorola Part No. 01–80386A04) to remove the firmware devices.*

Replacement Procedure

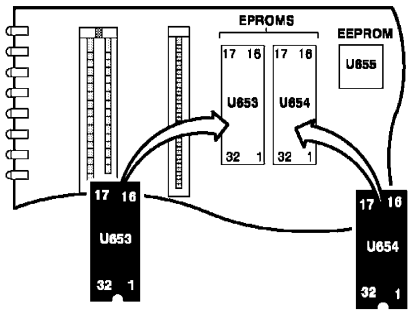
Step 1. If the module is capable of communicating with the RSS, connect the PC to the RSS port, start the RSS program, and save the codeplug from the station to a file on the PC hard disk. This will allow the codeplug information to be downloaded to the codeplug located on the replacement Station Control Board. If the module cannot communicate with the RSS, an archive file (if available) of the particular station codeplug may be downloaded. If no archive codeplug file exists, you must program the codeplug as described in the RSS User's Guide (68P81085E35).

Step 2. Turn off station power (refer to page 22).

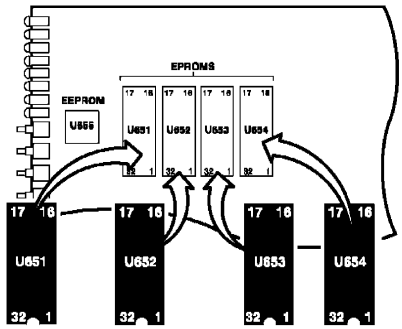
Step 3. Using a Torx #15 driver, remove front panel and Station Control Board as described in Figure 6.

Step 4. The Station Control Board software must now be removed from the old board and installed onto the replacement board. The software is contained on either two or four EPROMS (earlier version boards) or a single FLASH SIMM (later version boards). You must remove the EPROMs or FLASH SIMM from the replacement board and install the EPROMs or FLASH SIMM from the old board. The following illustrations show the locations of the EPROMs and FLASH SIMM.

Software on Two EPROMs



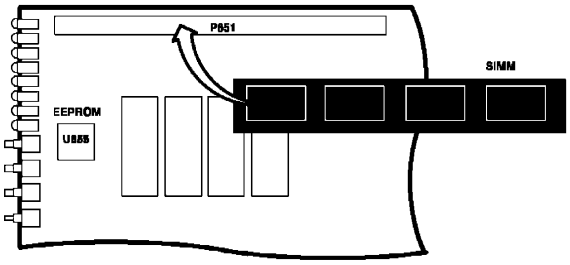
Software on Four EPROMs



Replacing Station Control Module (Conventional/6809) (Continued)

Replacement Procedure (continued)

Software on Single FLASH SIMM



Step 5. Install replacement Station Control Board by sliding board into cage and firmly seating the board card-edge connectors into the backplane. (**Do not** slam the board against the backplane or push any harder than necessary to seat the connectors.)

Step 6. Replace the front panel by pressing it into place and replacing the two screws. Be sure the 2-wire cable from the local speaker is connected to the 3-pin connector at the bottom front of the Station Control Board. If the connector is not keyed (earlier models), you may connect the 3-pin connector in either polarity.

Step 7. Restore power to the station.

Note: *When inserting Station Control Board into cage, place your thumbs on the BNC and D-type connectors and firmly push the board into the backplane connector.*

Post-Replacement Optimization Procedure

Step 1. Replacement Station Control Modules are shipped with default data programmed into the codeplug (EEPROM located on board). After replacing a Station Control Board, you must download codeplug data (unique to the particular station) to the replacement board codeplug. Simply retrieve the file from your archive and follow the instructions in the RSS User's Guide (68P81085E35) for saving data to the codeplug. Note that if no archive codeplug file exists, you may create a new codeplug by copying the ***training.cp*** codeplug file (supplied with the RSS) and then program it as necessary to meet the particular station's requirements.

Step 2. Calibrate the reference oscillator (station reference) by performing the procedure in the Routine Maintenance section of this manual.

Step 3. Perform the alignment procedures listed in the sidebar as described in the RSS User's Guide (68P81085E35).

Alignment Procedures
- RX Wireline
- TX Wireline
- Squelch Adjust
- Battery Equalization (if required)
- Power Output
- Tx Deviation Gain Adjust
- Reference Modulation

For *ASTRO* stations, also perform RSSI and Simulcast/ASTRO Launch Time Offset alignment.

For 6809 Trunking stations, also perform TDATA alignment.

Replacing Station Control Module (for modules in *IntelliRepeater* Ethernet Networks)

Replacement Procedure

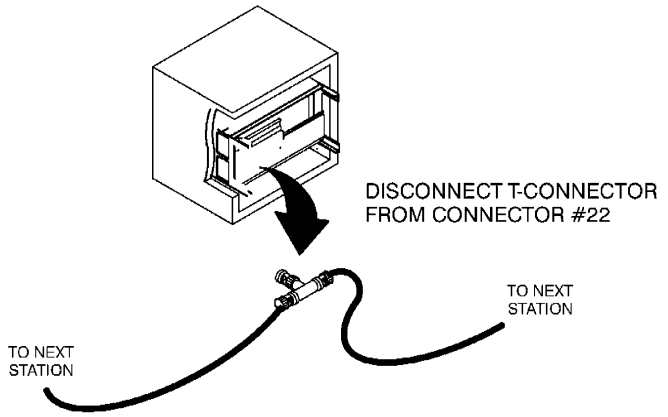
Step 1. If the module is capable of communicating with the RSS, connect the PC to the RSS port, start the RSS program, and save the codeplug from the station to a file on the PC hard disk. This will allow the codeplug information to be downloaded to the codeplug located on the replacement Station Control Board. If the module cannot communicate with the RSS, an archive file (if available) of the particular station codeplug may be downloaded. If no archive codeplug file exists, you must program the codeplug as described in the RSS User's Guide (68P81085E35).

Note *If the Physical Address and/or the IP Address cannot be read, contact the System Support Center at 1-800-221-7144.*

Step 2. Using the RSS, read the *IP Address* and *Physical Address* assigned to the station and jot them down. (From the RSS **Main Menu**, go to **Service:Ethernet Parameters** to read the *IP Address* and the *Physical Address*.)

Step 3. Turn off station power (refer to page 22).

Step 4. Disconnect the station from the Ethernet LAN as described below.



Step 5. Using a Torx #15 driver, remove front panel and Station Control Board as described in Figure 6.

Note *Use an IC Extraction Tool (Motorola Part No. 01–80386A04) to remove the firmware devices.*

Step 6. The Station Control Board software must now be removed from the old board and installed onto the replacement board. The software is contained on a single FLASH SIMM. You must remove the FLASH SIMM from the replacement board and install the FLASH SIMM from the old board. The following illustration shows the location of the FLASH SIMM.

Replacing Station Control Module (for modules in *IntelliRepeater* Ethernet Networks) (Continued)

Note *If the existing FLASH SIMM is faulty, contact the System Support Center at 1-800-221-7144 to obtain a replacement part.*

Note *The replacement board must have the same model number as the faulty board (e.g., CLN6960). If it does not, contact the System Support Center at 1-800-221-7144 for instructions on how to proceed.*

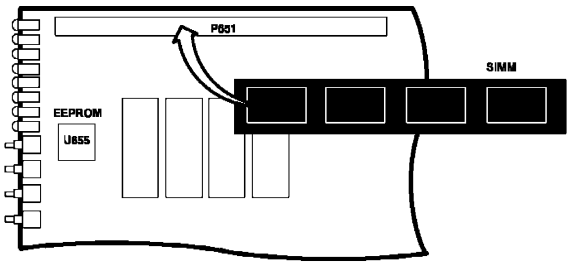
Note: *When inserting Station Control Board into cage, place your thumbs on the BNC and D–type connectors and firmly push the board into the backplane connector.*

Alignment Procedures
- RX Wireline
- TX Wireline
- Squelch Adjust
- Battery Equalization (if required)
- Power Output
- Tx Deviation Gain Adjust
- Reference Modulation

For *ASTRO* stations, also perform RSSI and Simulcast/ASTRO Launch Time Offset alignment.

Replacement Procedure (continued)

Software on Single FLASH SIMM



Step 7. Install replacement Station Control Board by sliding board into cage and firmly seating the board card-edge connectors into the backplane. (**Do not** slam the board against the backplane or push any harder than necessary to seat the connectors.)

Step 8. Replace the front panel by pressing it into place and replacing the two screws. Be sure the 2-wire cable from the local speaker is connected to the 3-pin connector at the bottom front of the Station Control Board. If the connector is not keyed (earlier models), you may connect the 3-pin connector in either polarity.

Step 9. Restore power to the station.

Post-Replacement Optimization Procedure

Step 1. Replacement Station Control Modules are shipped with default data programmed into the codeplug (EEPROM located on board). After replacing a Station Control Board, you must download codeplug data (unique to the particular station) to the replacement board codeplug. Simply retrieve the file from your archive and follow the instructions in the RSS User's Guide (68P81085E35) for saving data to the codeplug. Note that if no archive codeplug file exists, you may copy a codeplug from another station at the site and save it to this station.
Important! When the RSS prompts you to "Crossload" the other stations at the site, answer **NO**.

Step 2. Using the RSS, navigate to **Service:Ethernet Parameters** and change the *IP Address* and *Physical Address* to the addresses you read in Step 2 on page 28.

Step 3. Calibrate the reference oscillator (station reference) by performing the procedure in the Routine Maintenance section of this manual.

Step 4. Perform the alignment procedures listed in the sidebar as described in the RSS User's Guide (68P81085E35).

Step 5. Turn off station power (refer to page 22).

Step 6. Reconnect the T-connector from the Ethernet LAN.

Step 7. Restore power to the station.

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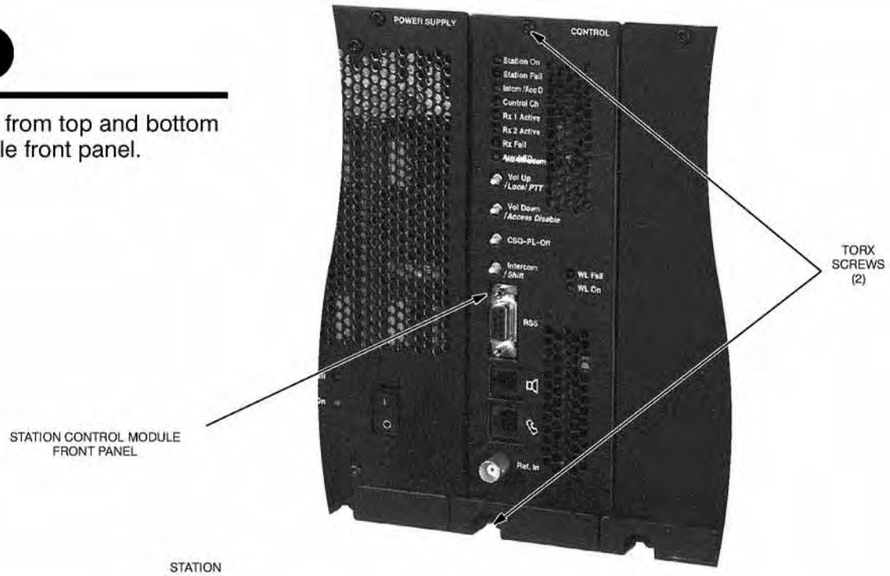
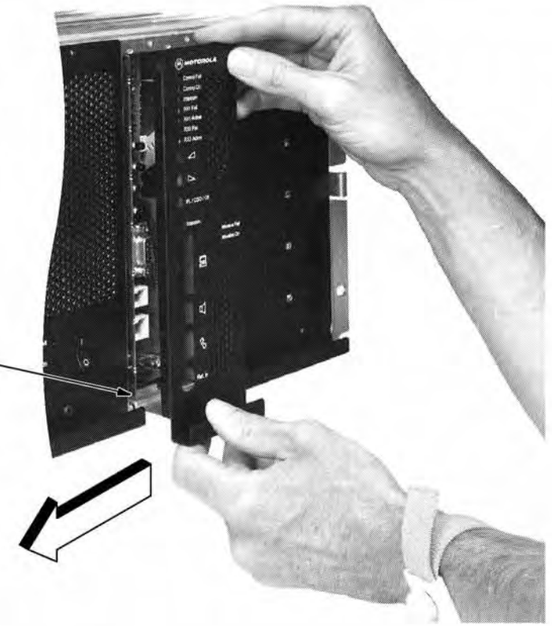
1

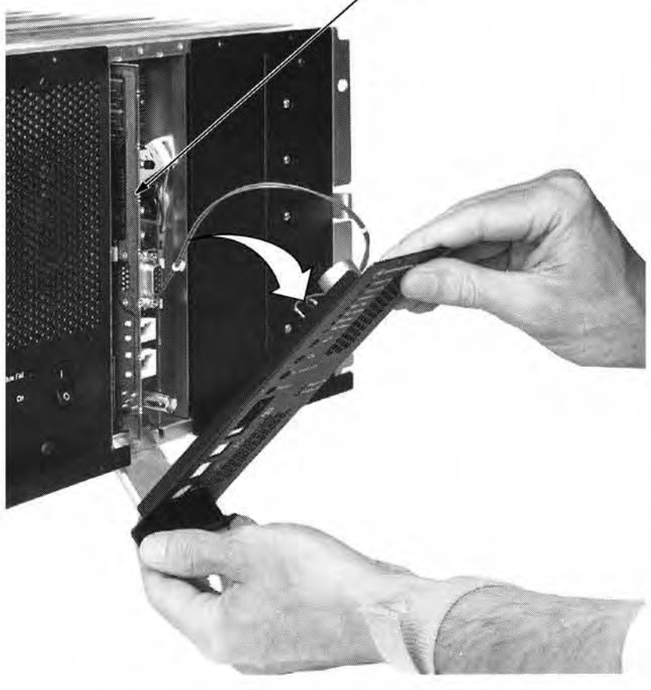
Remove the two screws from top and bottom of Station Control Module front panel.



2

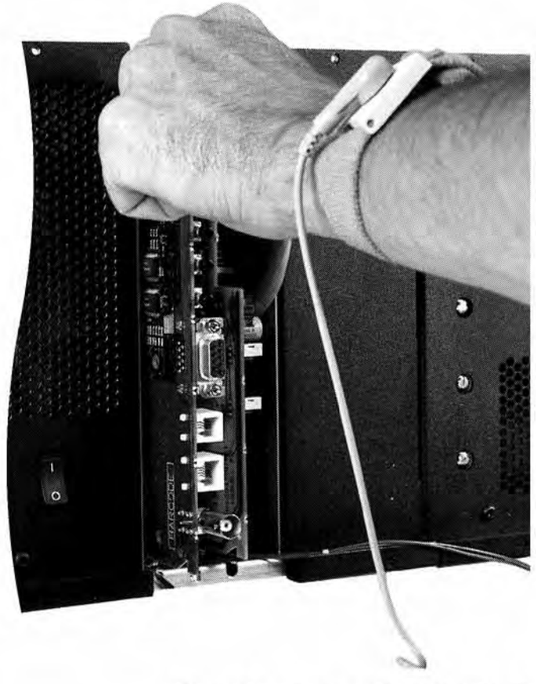
Partially remove front panel and position the board extraction tab on the bottom rail of the cage and slide the panel to the left until the lip of the tab is positioned behind the cutout in the Station Control Board.





3

Tip back on the panel to pry the Station Control Board out of the backplane connectors.



4

Remove Station Control Board from cage.

Figure 6. Removal Procedure for Station Control Board (*Quantar* VHF Station Shown)

Replacing Wireline Interface Board

Note *A later model board (CLNxxxx) can be used to replace both later model boards and earlier model boards (TRNxxxx). However, earlier model boards cannot be used to replace later model boards. (Later model boards support either EPROMs or FLASH; earlier model boards support only EPROMs.)*

Note *If the existing EPROM or FLASH SIMM is faulty, contact the System Support Center at 1-800-221-7144 to obtain replacement parts. The version of software contained in the replacement devices must match that of the faulty devices.*

Note *Use an IC Extraction Tool (Motorola Part No. 01–80386A04) to remove the firmware devices.*

Replacement Procedure

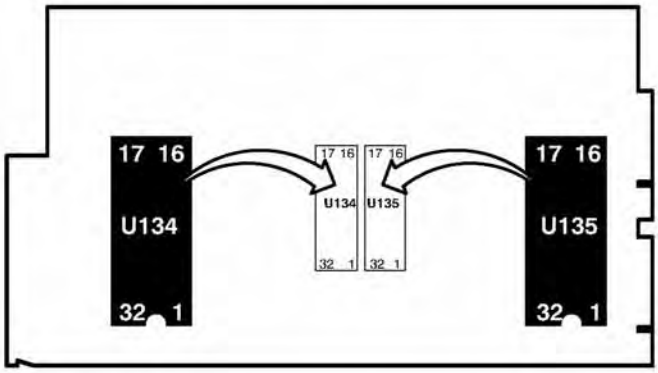
Step 1. Turn off station power (refer to page 22).

Step 2. Using a Torx #15 driver, remove anti-vibration screw(s) (if installed) from top and/or bottom of module front panel.

Step 3. Remove Station Control Module front panel and Wireline Interface Board as described in Figure 6.

Step 4. Set all jumpers on replacement board to match those on the faulty board. These include input/output impedance matching jumpers, 2-wire/4-wire select jumper, and dc remote control selection jumpers.

Step 5. The Wireline Board software must now be removed from the old board and installed onto the replacement board. The software is contained on either two EPROMS (earlier version boards) or two FLASH ICs (later version boards). You must remove the EPROMs or FLASH ICs from the replacement board and install the EPROMs or FLASH ICs from the old board. The following illustration shows the locations of the EPROMs and FLASH ICs.



Step 6. Install replacement Wireline Interface Board by sliding board into cage and firmly seating the board card-edge connectors into the backplane. (**Do not** slam the board against the backplane or push any harder than necessary to seat the connectors.)

Step 7. Replace the front panel by pressing it into place and replacing the two screws. Be sure the 2-wire cable from the local speaker is connected to the 3-pin connector at the bottom front of the Station Control Board. If the connector is not keyed (earlier models), you may connect the 3-pin connector in either polarity.

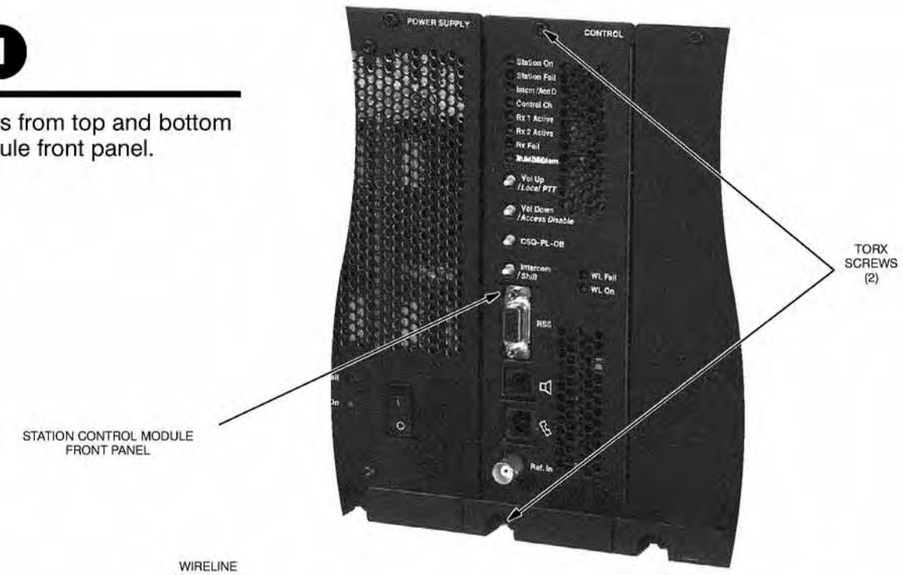
Step 8. Restore power to the station.

Post-Replacement Optimization Procedure

Perform the *Rx Wireline* and *Tx Wireline* adjustment procedures located in the RSS User's Guide (68P81085E35).

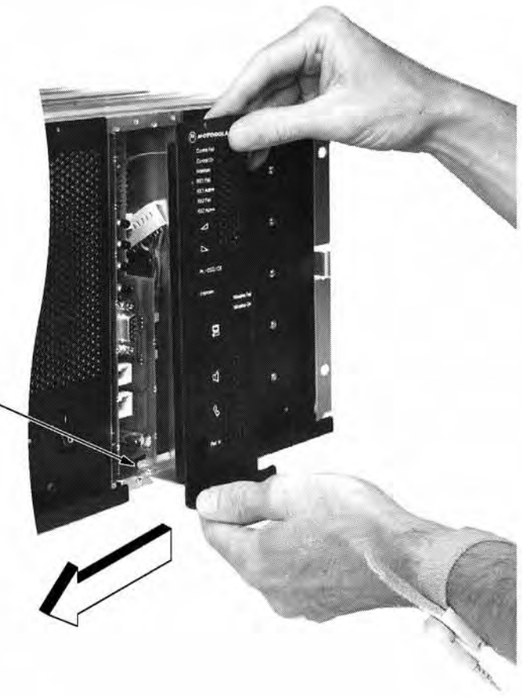
1

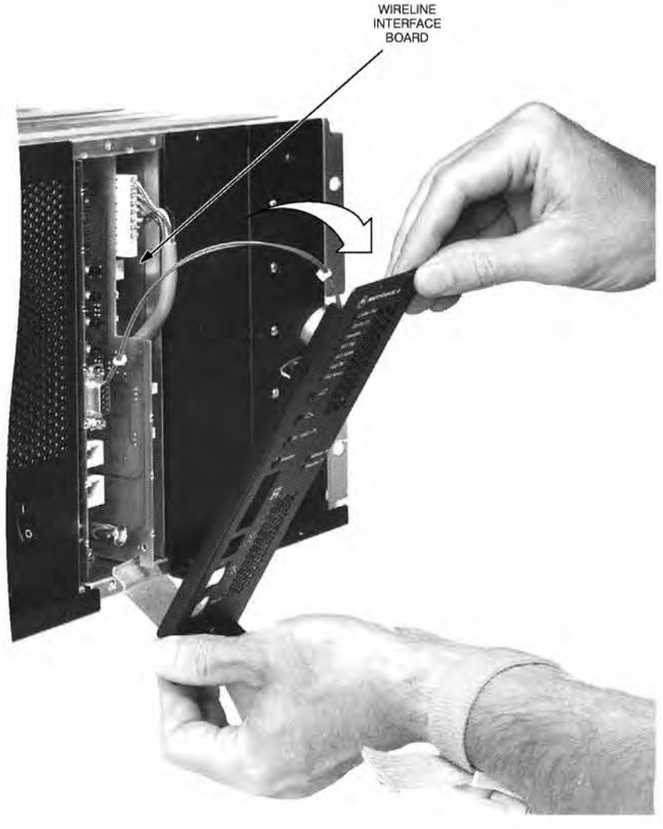
Remove the two screws from top and bottom of Station Control Module front panel.



2

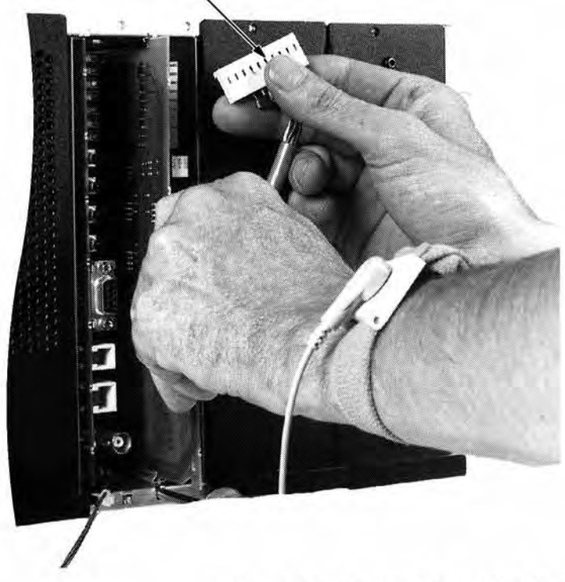
Partially remove front panel and position the board extraction tab on the bottom rail of the cage and slide the panel to the left until the lip of the tab is positioned behind the cutout in the Wireline Interface Board.





3

Tip back on the panel to pry the Wireline Interface Board out of the backplane connectors.



4

Disconnect the 8-position connector as shown and remove Wireline Interface Board from cage.

Figure 7. Removal Procedure for Wireline Interface Board (*Quantar* VHF Station Shown)

Replacing Receiver Module and/or Preselector Assembly (VHF and UHF)

Note: *On VHF and UHF models, the Receiver Module is comprised of a Preselector Assembly and a Receiver Board attached to a module housing. The Preselector Assembly and the Receiver Board are each considered to be a field replaceable unit (FRU). Replacement procedures are given for each FRU. If you choose to replace the entire module (including receiver board and preselector), you must perform the preselector tuning procedure.*

Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Using a Torx #15 driver, remove anti-vibration screws (if installed) from top and/or bottom of module front panel.

Step 3. Slide the module out to the first stop. Disconnect mini-UHF connector on rf cable (rf input to the module) connected to the preselector assembly.

Step 4. Remove faulty module from cage.

Step 5. If **Receiver Board** is being replaced:

— Disconnect cable (mini-UHF connector) connected to Receiver Board.

— Remove nine (9) Torx–head screws securing Receiver Board to module housing. Note location of foam insulating pad beneath VCO portion of Receiver Board.

— Remove faulty board and replace with known good board. Be sure to position the foam insulating pad (noted in previous step) behind the VCO.

— Secure board using Torx-head screws removed previously. Reconnect rf cable to mini-UHF connector on board.

Step 6. If **Preselector Assembly** is being replaced:

— Disconnect cables (mini-UHF connectors) from assembly.

— Remove faulty Preselector Assembly by removing two(2) Torx-head screws securing assembly to module housing.

— Install known good assembly and secure using Torx–head screws removed previously. Reconnect rf cables to mini-UHF connectors.

(continued on next page)

Replacing Receiver Module and/or Preselector Assembly (VHF and UHF) (Continued)

Replacement Procedure (Continued)

Step 7. Install repaired Receiver Module by sliding module into cage (about 2 inches from full insertion). Connect the rf input cable to the mini-UHF connector on the Preselector Assembly.

Step 8. Slide the module in completely and firmly seat the module connector into the backplane. (**Do not** slam the module against the backplane or push any harder than necessary to seat the connectors.)

Step 9. Restore power to the station.

Post-Replacement Optimization Procedure

Step 1. If you replaced the **Receiver Board** — Perform the *Squelch Adjust* and the *RSSI* alignment procedures located in the RSS User's Guide (68P81085E35).

Step 2. If you replaced the **Preselector Assembly** — Perform the preselector field tuning procedure beginning on page 38.

Replacing Receiver Module (800 MHz and 900 MHz)

Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Remove anti-vibration screws (if installed) from top and/or bottom of module front panel.

Step 3. Slide the module out to the first stop. Disconnect mini-UHF connector on rf cable (rf input to the module) connected to the preselector assembly.

Step 4. Remove faulty module from cage.

Step 5. Install replacement Receiver Module by sliding module into cage and firmly seating the module connector into the backplane. (**Do not** slam the module against the backplane or push any harder than necessary to seat the connectors.) Connect the rf cable to the mini-UHF connector at the top of the module.

Step 6. Restore power to the station.

Post-Replacement Optimization Procedure

Perform the *Squelch Adjust* and the *RSSI* alignment procedures located in the RSS User's Guide (68P81085E35).

Replacing ASTRO Modem Card

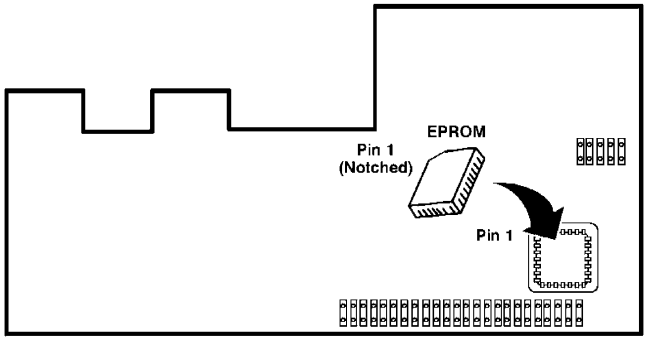
Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Remove the Wireline Interface Board as described on page 32.

Step 3. Unplug faulty ASTRO Modem Card from Wireline Interface Board.

Step 4. Inspect the label on the EPROM (shown below). If the date is **8-16-93**, remove the EPROM and install it on the replacement board. For all other dates, the EPROM on the replacement board is compatible and need not be replaced.



Step 5. Install replacement modem card.

Step 6. Install Wireline Interface Board as described on page 32.

Step 7. Restore power to the station.

Post-Replacement Optimization Procedure

The ASTRO Modem Card requires no settings or adjustments. The card is configured by the Station Control Module on station power up.

Replacing Backplane Board

Replacement Procedure

Step 1. Turn off station power (refer to page 22).

Step 2. Remove all modules/boards from the station cage as described on the previous pages. Make sure that all modules/boards are placed on properly grounded anti-static surface.

Step 3. Label all cables connected to the rear of the Backplane Board. Disconnect all cables from the backplane.

Step 4. Remove the eleven (11) Torx-head screws which secure the metal shield and backplane board to the cage.

Step 5. Remove the metal shield from the backplane, sliding the two guide pins located at each end at the bottom of the shield from the backplane board. Remove the backplane board.

Step 6. Install the replacement Backplane Board and metal shield using the 11 Torx-head screws removed previously, reconnect all cables, and reinstall all modules/boards.

Step 7. Restore power to the station.

Post-Replacement Optimization Procedure

Using the RSS, run a complete battery of diagnostics to exercise all boards and modules.

5 PRESELECTOR FIELD TUNING PROCEDURE

The VHF and UHF Receiver Modules are comprised of a circuit board and a preselector assembly, both secured in a slide–in module housing. The preselector assembly is a 3-pole (UHF) or a 5-pole (VHF) bandpass filter equipped with tuning slugs to adjust the passband corresponding to the operating frequency(s) of the station. The preselector assembly must be field tuned if replaced in the field or if the station operating frequency(s) are modified. The tuning procedure follows.

Required Test Equipment

IMPORTANT

Tuning for best SINAD response **DOES NOT** result in optimum tuning of the preselector assembly. You must use this field tuning procedure to obtain optimum preselector performance.

The following test equipment is required to properly tune the preselector assembly:

- RF Signal Generator — Motorola R2600 Communications Analyzer, R2001 Communications Analyzer (see note), or HP8656A signal generator (or equivalent)
- Dip/Peak Monitor — HP435B Power Meter (or equivalent) with HP8484A sensitive power head, Boonton Model 92E with BNC input, or R2001/R2600 using the spectrum analyzer function
- Torque driver capable of delivering 12 in–lbs of torque and 10 mm deep well socket
- Tuning probe — Motorola Part No. 0180763D22, p/o TRN7799A tuning kit
- Flat–blade screwdriver

Note: *The R2600 Communications Analyzer can both generate and measure simultaneously. The R2001 may be used for either the generator or the monitor function, but not both simultaneously. When using R2001 as the signal generator, rf signal* ***must*** *be taken from the Antenna port.*

VHF Tuning Procedure

Calculating Proper Alignment Frequency

Use one of the following two methods to calculate the alignment frequency to be generated by the signal generator.

For stations with a **single receive frequency**, calculate the frequency of the alignment signal as follows:

Step 1. From the site documentation or the RSS, determine the station receive frequency.

Step 2. If the frequency is ⩽48 MHz (Range 1), or ≥156 MHz (Range 2), subtract 250 kHz. Otherwise, note the actual frequency.

Example: If the station receive frequency is 134.575 MHz, subtract 250 kHz because the frequency is less than 143 MHz: 134.575 MHz - 250 kHz = 134.325 MHz

Step 3. If the Receiver Module is **Range 1**, deteremine the alignment freuency as follows:

If the frequency (from Step 3) is < 134 MHz, then alignment frequency = 133.75 MHz.

If frequency (from Step 3) is > 152 MHz, then alignment frequency = 152 MHz.

Otherwise, use actual frequency from Step 2.

Step 4. If the Receiver Module is **Range 2**, deteremine the alignment freuency as follows:

If the frequency (from Step 3) is < 152 MHz, then alignment frequency = 151.75 MHz.

If frequency (from Step 3) is > 152 MHz, then alignment frequency = 172 MHz.

Otherwise, use actual frequency from Step 2.

For stations with **multiple receive frequencies**, calculate the frequency of the alignment signal as follows:

Step 1. From the documentaton or the RSS, note the receive frequency for each channel supported by the station.

Step 2. Calculate a midpoint frequency as follows:

$F_{mid} = (F_{highest} + F_{lowest}) \div 2$

Step 3. Using F_{mid} in place of the station receive frequency, perform Step 3 through Step 4 from above.

VHF Tuning Procedure (Continued)

Preparing Equipment

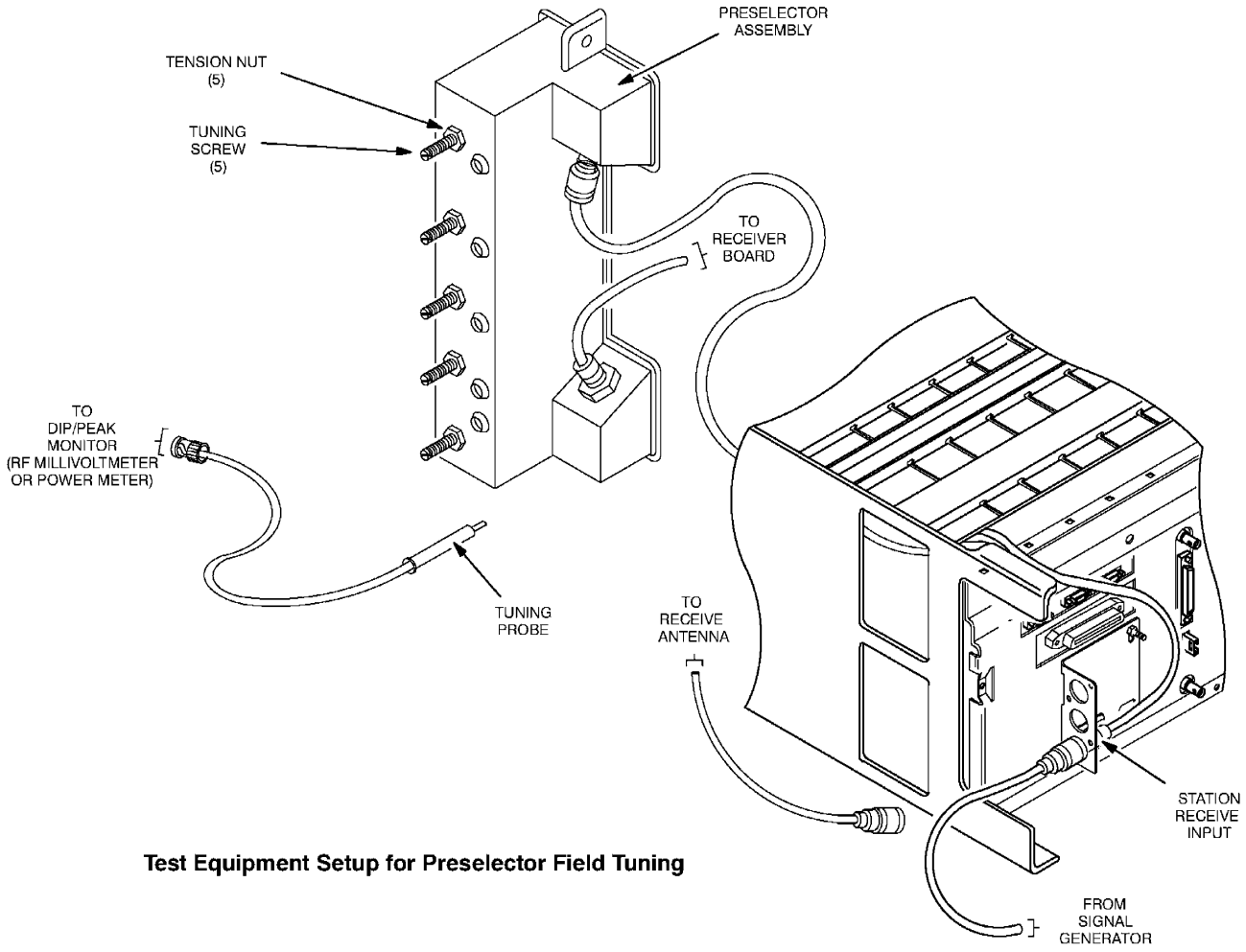
Step 1. Make sure Receiver Module (with Preselector Assembly) is installed in a functional station cage equipped with a Power Supply Module.

Step 2. Remove the two Torx−head screws from the Receiver Module front panel and remove the panel.

Step 3. Detune the preselector as follows.
If the alignment frequency (calculated on the previous page) is greater than 148 MHz (Range 1) or 156 MHz (Range 2), turn the five tuning screws in (CW) until 1/8" protrudes past each of the tension nuts. If the alignment frequency is less than or equal to 148 MHz (Range 1) or 156 MHz (Range 2), back out (CCW) the five tuning screws until ¾" protrudes past each of the tension nuts.

Step 4. Using the torque driver and deep well socket, tighten the five tension nuts on the adjustment screws to 6 in−lbs.

Step 5. Connect the test equipment as shown below:



Test Equipment Setup for Preselector Field Tuning

VHF Tuning Procedure (Continued)

IMPORTANT

When tuning for peak or dip, turn the tuning screw ½ turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

Tuning Procedure

Step 1. Turn the station power supply ON (to provide the active 50Ω termination).

Step 2. Adjust the signal generator to the frequency calculated on page 42. Set the level to +5 dBm.

Step 3. Insert tuning probe into cavity H1 and adjust tuning screw 1 for a **PEAK**.

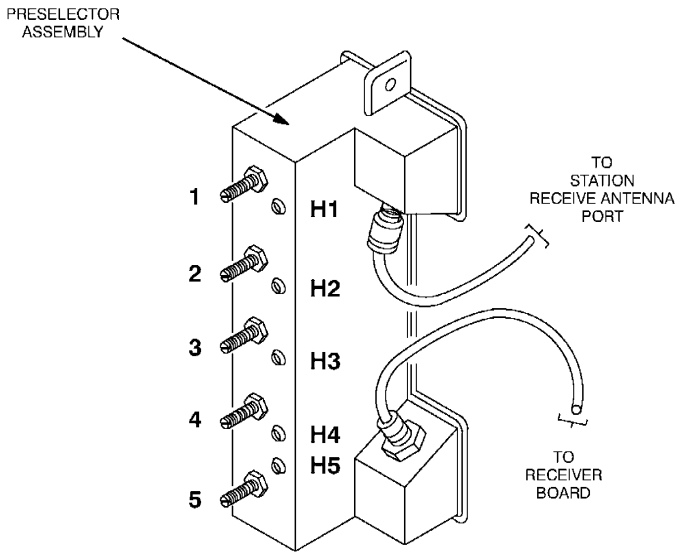
Step 4. Leave tuning probe in cavity H1 and adjust tuning screw 2 for a **DIP**.

Step 5. Insert tuning probe into cavity H2 and adjust tuning screw 3 for a **DIP**.

Step 6. Insert tuning probe into cavity H3 and adjust tuning screw 4 for a **DIP**.

Step 7. Insert tuning probe into cavity H4. Decrease output from signal generator to −5 dBm.

Step 8. Adjust tuning screw 5 for a **DIP**. Then turn tuning screw 5 ¼ turn CCW. (Note that dip will not be as sharp for screw 5 as it was for screws 2 thru 4.)



Location of Tuning Screws and Cavity Probe Holes

UHF Tuning Procedure

Calculating Proper Alignment Frequency

Use one of the following two methods to calculate the alignment frequency to be generated by the signal generator.

For stations with a **single receive frequency**, calculate the frequency of the alignment signal as follows:

Step 1. From the site documentation or the RSS, determine the station receive frequency. **Add 200 kHz.**

Step 2. If Receiver Module is **Range 0**, determine the alignment frequency as follows:

If frequency (from Step 1) is > 431 MHz, then alignment frequency = 431 MHz.

If frequency (from Step 1) is < 382 MHz, then alignment frequency = 382 MHz.

Otherwise, use actual frequency from Step 1.

Step 3. If Receiver Module is **Range 1**, determine the alignment frequency as follows:

If frequency (from Step 1) is > 431 MHz, then alignment frequency = 431 MHz.

If frequency (from Step 1) is < 405 MHz, then alignment frequency = 405 MHz.

Otherwise, use actual frequency from Step 1.

Step 4. If Receiver Module is **Range 2**, determine the alignment frequency as follows:

If frequency (from Step 1) is > 468 MHz, then alignment frequency = 468 MHz.

If frequency (from Step 1) is < 440 MHz, then alignment frequency = 440 MHz.

Otherwise, use actual frequency from Step 1.

Step 5. If Receiver Module is **Range 3 or 4**, determine the alignment frequency as follows:

If frequency (from Step 1) is > 518 MHz, then alignment frequency = 518 MHz.

If frequency (from Step 1) is < 472 MHz, then alignment frequency = 472 MHz.

Otherwise, use actual frequency from Step 1.

— continued on next page —

UHF Tuning Procedure (continued)

For stations with **multiple receive frequencies**, calculate the frequency of the alignment signal as follows:

Step 1. From the site documentation or the RSS, note the receive frequency for each channel supported by the station.

Step 2. Calculate a midpoint frequency as follows:

$$F_{mid} = (F_{highest} + F_{lowest}) \div 2$$

Step 3. Using F_{mid} in place of the station receive frequency, perform Step 1 thru Step 5 from above.

UHF Tuning Procedure (Continued)

Preparing Equipment

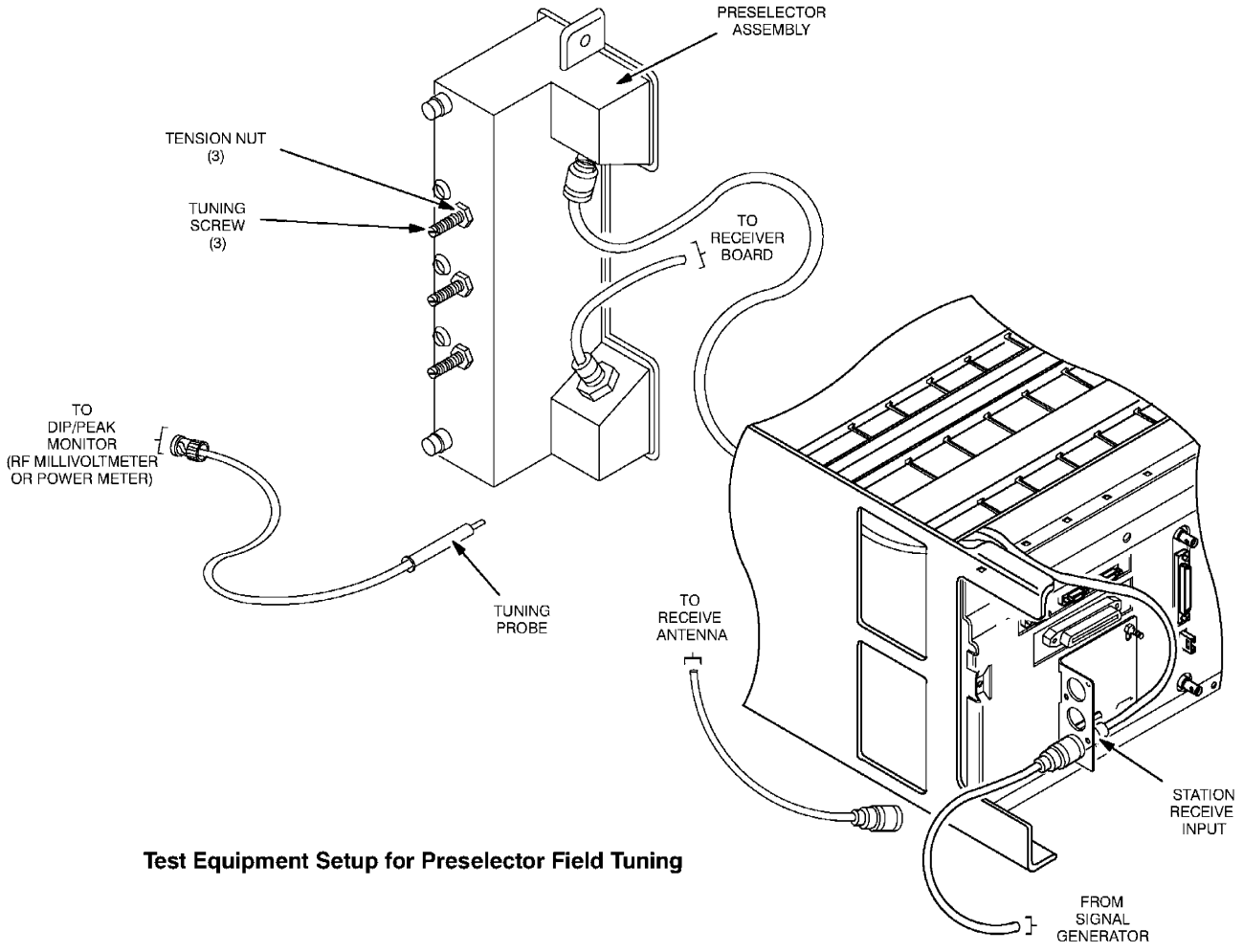
Step 1. Make sure Receiver Module (with Preselector Assembly) is installed in a functional station cage equipped with a Power Supply Module.

Step 2. Remove the two Torx–head screws from the Receiver Module front panel and remove the panel.

Step 3. Using the torque driver and deep well socket, loosen the three tension nuts on the adjustment screws.

Step 4. Detune the preselector as follows.
Turn tuning screws **3** and **4** clockwise until they bottom out. Be careful not to apply more than 3 in–lbs of torque to prevent warping preselector cover and housing.

Step 5. Connect the test equipment as shown below:



Test Equipment Setup for Preselector Field Tuning

Tuning Procedure (Continued)

IMPORTANT

When tuning for peak or dip, turn the tuning screw ½ turn past the peak or dip to verify that you have obtained a true peak or dip. After ensuring you have found true peak or dip, turn the screw back to the location of the original peak or dip.

Tuning Procedure

Step 1. Turn the station power supply ON (to provide the active 50Ω termination).

Step 2. Adjust the signal generator to the frequency calculated on page 42. Set the level to +5 dBm.

Step 3. Insert tuning probe into cavity U2 and adjust tuning screw 2 for a **PEAK**.

Step 4. Tighten tension nut on tuning screw 2 to at least 12 in−lb and fine tune tuning screw 2 for a **PEAK**.

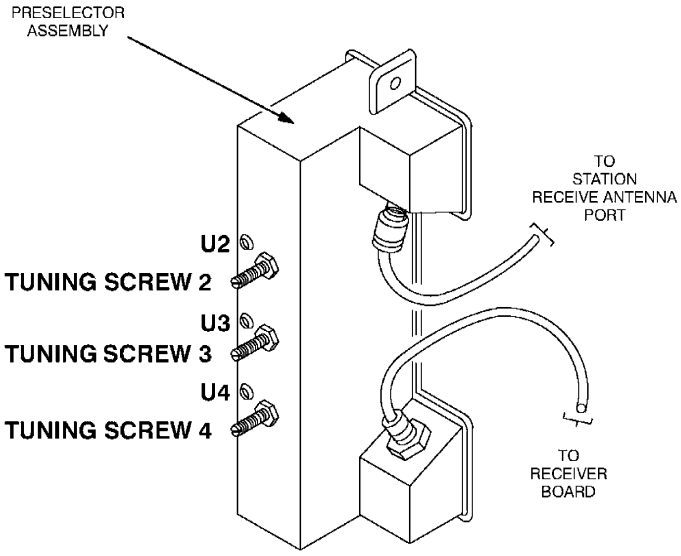
Step 5. Keep tuning probe in cavity U2 and adjust tuning screw 3 for a **DIP**.

Step 6. Tighten tension nut on tuning screw 3 to at least 12 in−lb and fine tune tuning screw 2 for a **DIP**.

Step 7. Insert tuning probe into cavity U3. Decrease output from signal generator to −5 dBm.

Step 8. Adjust tuning screw 4 for a **DIP**.

Step 9. Tighten tension nut on tuning screw 4 to at least 12 in−lb and fine tune tuning screw 4 for a **DIP**.



Location of Tuning Screws and Cavity Probe Holes