

# **Maintenance Manual**

EDACS<sup>®</sup> Orion<sup>™</sup>

Local Test Unit (3-RU Version)

For Single-Site Systems

**REVISION HISTORY**

<b>Revision</b>	<b>Date</b>	<b>Reason for Change</b>
R1A	Sep 1996	Original Release of 3 RU Version.

**NOTICE!**

This Manual covers Ericsson and General Electric products manufactured and sold by Ericsson Inc.

**NOTICE!**

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

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**SPECIFICATIONS**

Mechanical:

Width..... 19 in. (483 mm)  
 Height..... 5.25 in. (133 mm)  
 Depth..... 13.25 in. (337 mm)

Power Requirements:

Orion Radio Shelf Fan..... 3.0 A (max) at 13.8 Vdc  
 TU Radio, Receiver..... 3.0 A (max) at 13.8 Vdc  
 TU Radio, 12 Watt Transmitter..... 7 Amperes at 13.6 Vdc

Environmental:

Temperature Range (20% Duty Cycle)..... -30° to +60° C (-22° to +140° F)

## **INTRODUCTION**

### **SCOPE OF MANUAL**

This manual covers installation, operation, and maintenance information for the 3RU version of the Orion Test Unit (TU) for Non-Simulcast applications. The 3RU version of the Orion TU replaces the older 2RU version of the Orion TU (see LBI-39167), the older 900 MHz MDX TU (see LBI-38980), and the older RANGR TU (see LBI-31939). The Orion TU is used to test radio channels at a single EDACS trunked repeater location.

### **RELATED MANUALS**

For additional information, see one or more of the following related manuals:

**LBI-38984** - System Manager, User's Guide

**AE/LZB 119 1914/1** - System Interface Cabinet

**AE/LZB 119 1911/1** - VAX Site Controller Software

**TQ-3374 V12** (or later) - Radio Programming Guide

**LBI-38888** - Orion Control Unit, Operator's Manual

**LBI-38992** - Orion Control Unit, Maint. Manual

**LBI-38903** - Orion VHF Mobile

**LBI-39172** - Orion VHF Mobile, Dual Bandwidth

**LBI-38904** - Orion UHF Mobile

**LBI-39162** - Orion UHF Mobile, Dual Bandwidth

**LBI-38902** - Orion 800 MHz Mobile

**LBI-38906** - Orion 900 MHz Mobile

### **TECHNICAL ASSISTANCE**

For technical assistance, contact the Ericsson Technical Assistance Center (TAC) at the number shown on the last page of this manual.

**DESCRIPTION**

**HARDWARE**

The 3RU version of the Orion Local TU consists of an Orion radio with control unit, antenna, hand-held microphone, power cable, data cable, and programming cable. The Orion radio is specially prepared for operation as a TU (you cannot modify a regular Orion radio in the field to be a TU). Additional special preparation consists of the following:

- Is lowest power model for frequency range.
- Adjusted for reduced power.
- Contains Test Unit flash software, also referred to as diagnostic software.
- Enabled as a diagnostic radio (see note).

**NOTE**

Note that the radio must be enabled as a diagnostic radio by Ericsson. This is not the same as enabling the “MRK and ORION Diagnostics Test Mode” in the user-configurable Radio Diagnostics screen of the radio personality programming software.

The Orion TU is mounted in a 3RU (5.25-inch high) Orion Radio Shelf (see Figure 1). The shelf also contains a fan, Orion Radio Shelf harness, speaker, 30 dB attenuator, and internal coaxial cables. The harness includes a programming switch and external connectors for programming, DC power, and Site Controller. See the Parts Lists and Interconnection Diagrams at the end of this manual for more details.

**APPLICATION**

The Orion Local TU is used to test radio channels at a single EDACS trunked repeater location. The TU tests the radio channels by monitoring the outgoing messages on the Control Channel and placing test calls under the direction of the Site Controller computer. A test call consists of sending a call request on the Control Channel, receiving a Working Channel assignment, and checking data transmission in both directions on the assigned Working Channel. Any failure of the Control or Working Channel to perform as expected is reported to the Site Controller. As a secondary function, the Orion TU can also be used by maintenance personnel as a service or test radio. Refer to the User Call Mode section later in this manual.

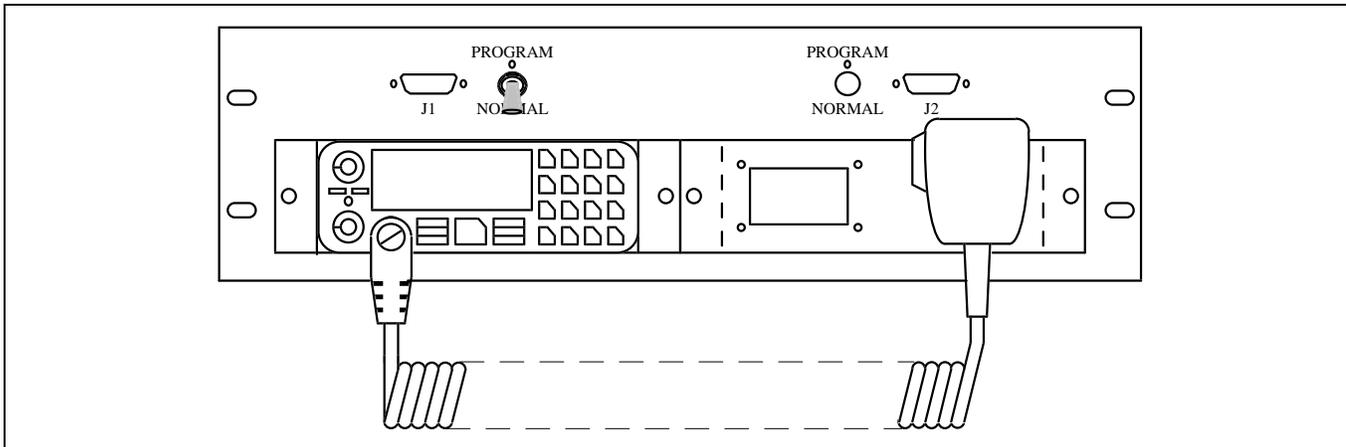


Figure 1 - Front View of 3RU Orion TU Shelf

## INSTALLATION

Regardless of whether the Orion TU was installed in the System Interface Cabinet in the factory or not, be sure to see the TU Personality Configuration and System Manager Configuration headings later in this Installation section. The Orion TU is mounted in the System Interface Cabinet directly below the Alarm and Control Unit as shown in Figure 2.

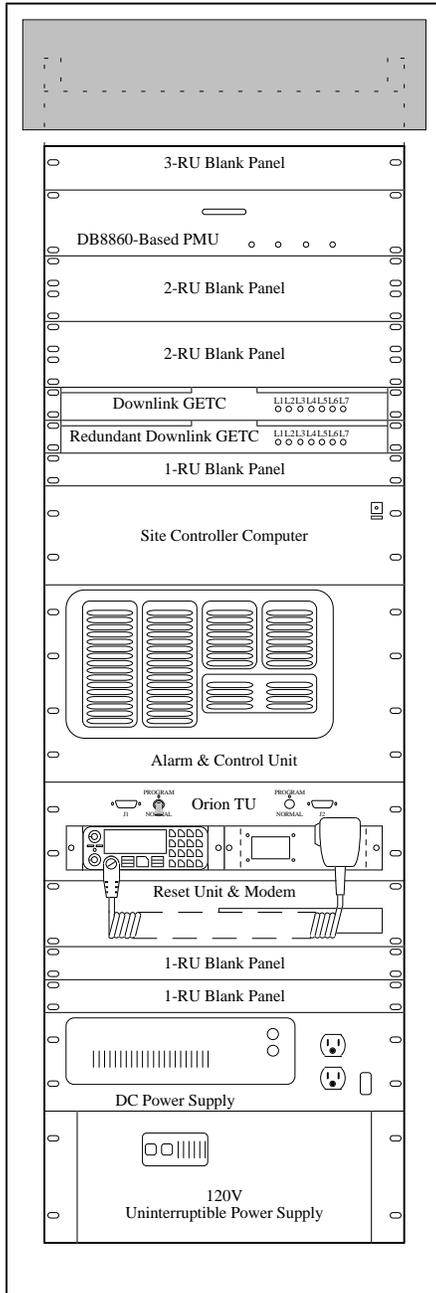


Figure 2 - Front View of System Interface Cabinet

## REMOVE OLD TU SHELF

Skip the steps in this heading if an old TU shelf is not present in the System Interface Cabinet. However, if an old TU shelf (with or without a TU radio) is present, it must be removed before the Orion TU shelf can be installed. Use the following procedure to remove the old TU shelf:

Turn Off DC Power Supply:

- Turn off the DC power supply in the System Interface Cabinet before starting to remove the old TU shelf.

Remove Old Data Link Cable:

- Remove the cable connecting J2 on the ACU (see Figure 3) to Port 27 on the Site Controller computer (see Figure 9). If connections to the Site Controller computer are through DILOG or EMULEX panels, the cable goes to connector 11B (see Figure 10 or Figure 11) instead of Port 27.

Remove Old TU Harness:

- Remove the cable connecting J1 on the ACU (see Figure 3) to the TU radio in the old TU shelf and to the main DC power supply in the cabinet.

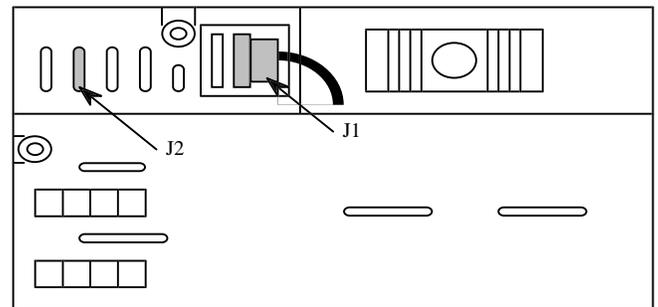


Figure 3 - Back View of ACU

Disconnect Old TU Antenna:

- Disconnect the old TU antenna cable from the attenuator at the back of the TU Shelf.

Remove Old TU Shelf:

- Remove the old TU shelf by removing the four screws holding it to the front mounting rails of the cabinet.

**MOUNT NEW ORION TU SHELF**

Use the following procedure to mount the new Orion TU shelf in the Site Controller cabinet:

Turn Off DC Power Supply:

- If you have not already done so, turn off the DC power supply in the System Interface Cabinet before starting to mount the 3RU Orion Radio Shelf containing the Orion TU.

Install Shelf:

- Fasten the front of the Orion Radio Shelf to the front rails of the cabinet using four Tinnerman clips and four sheet metal screws.

Install Back Supports:

- Fasten two flat support plates (about 1 3/4" square) to the back of the Orion Radio Shelf using two M4 flat washers, two M4 lock washers, and two M4x12 screws (see Figure 4). Then fasten the flat support plates to the back rails of the cabinet using four Tinnerman clips and four sheet metal screws.

- If no TU antenna was previously installed, place the antenna on top of the System Interface Cabinet (or other location) and route the cable down into the cabinet through the hole used by other cables.

Connect TU Antenna Cable:

- Connect the cable from the TU antenna to J7 on the back of the Orion Radio Shelf.

Install DC Power Cable:

- Find the RPM 113 2501 DC power cable.
- Plug the connector into J4 on the back of the Orion Radio Shelf.
- Cut the terminals off the other end of the power cable and strip back the insulation 1/4 inch.
- The connection to the DC power supply will depend upon the model of the DC power supply.

For a 19A149978P1 or -P2 DC power supply (has large high-current connector plugged into F801B on the back - see Figure 5):

- Unplug the connector from F801B on the back of the DC power supply, remove any existing wires with their pins attached, cut off the used pins, and strip back the insulation 1/4 inch.
- Find the two new pins in the hardware kit.
- Twist the red wire from the power cable together with all existing red wires removed from the connector, insert together in one new pin, crimp, and insert into pin position 1 in the connector.
- Twist the black wire from the power cable together with all existing black wires removed from the connector, insert together in one new pin, crimp, and insert into pin position 2 in the connector.
- Plug the connector back into F801B on the back of the DC power supply.

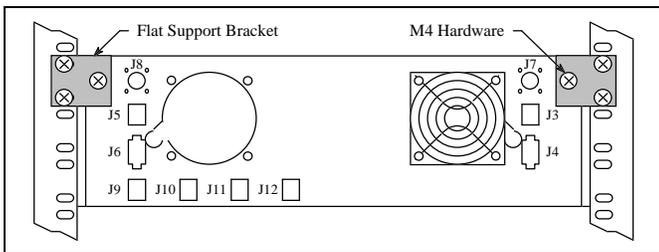


Figure 4 - Back Supports for Orion Radio Shelf

**CABLE CONNECTIONS**

External cable connections to the Orion Radio shelf are the same for all frequencies. However, connections to older models of the Site Controller computer and the DC power supply will be different than for the latest models. Cable connections between the Orion Radio Shelf and the latest models of the Site Controller computer and the DC power supply are shown in Figure 6. Cable connections between the Orion Radio Shelf and the older models of the Site Controller computer and the DC power supply are shown in Figure 7.

Install TU Antenna:

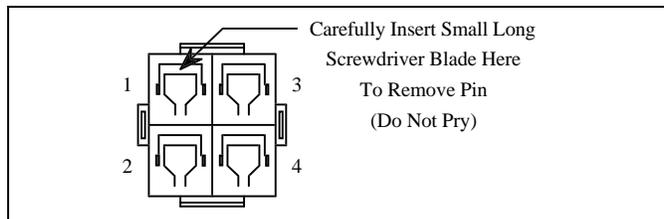


Figure 5 - Pin Removal from High-Current Plug

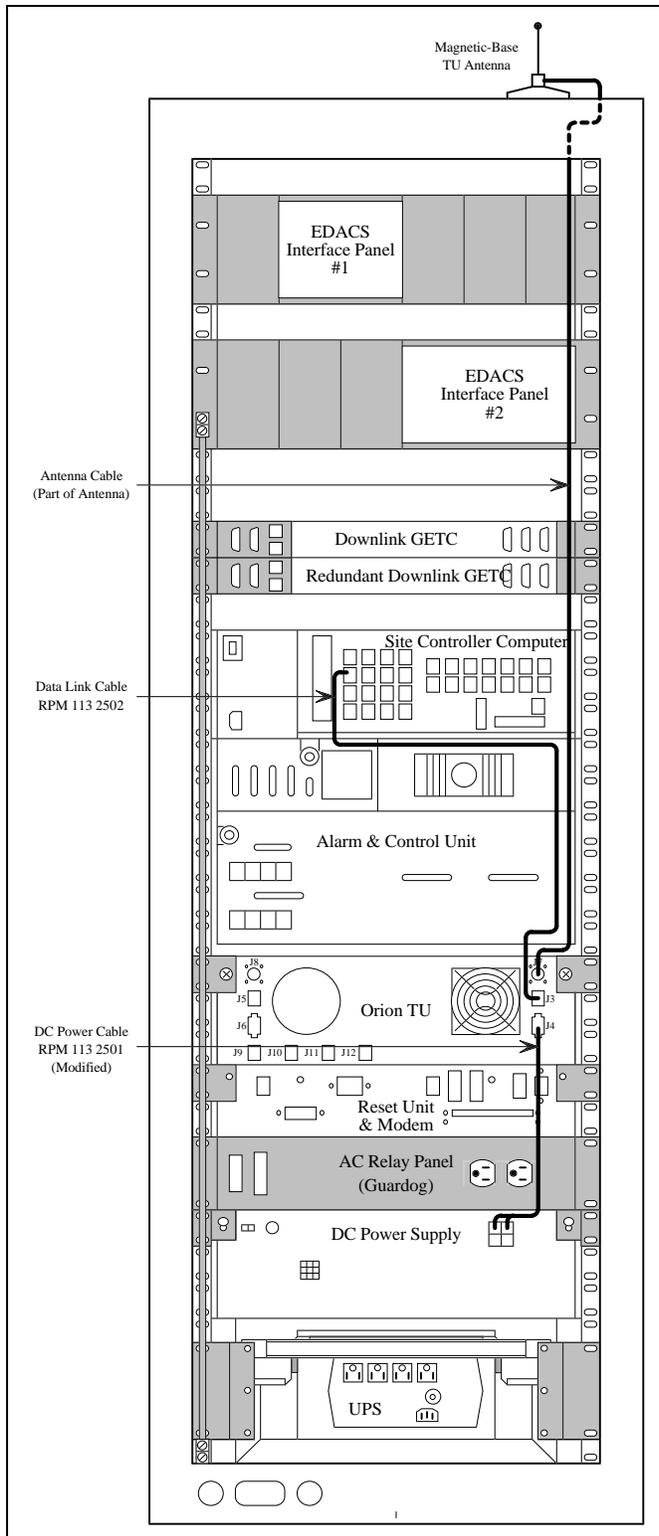


Figure 6 - Cable Connections to Latest Equipment

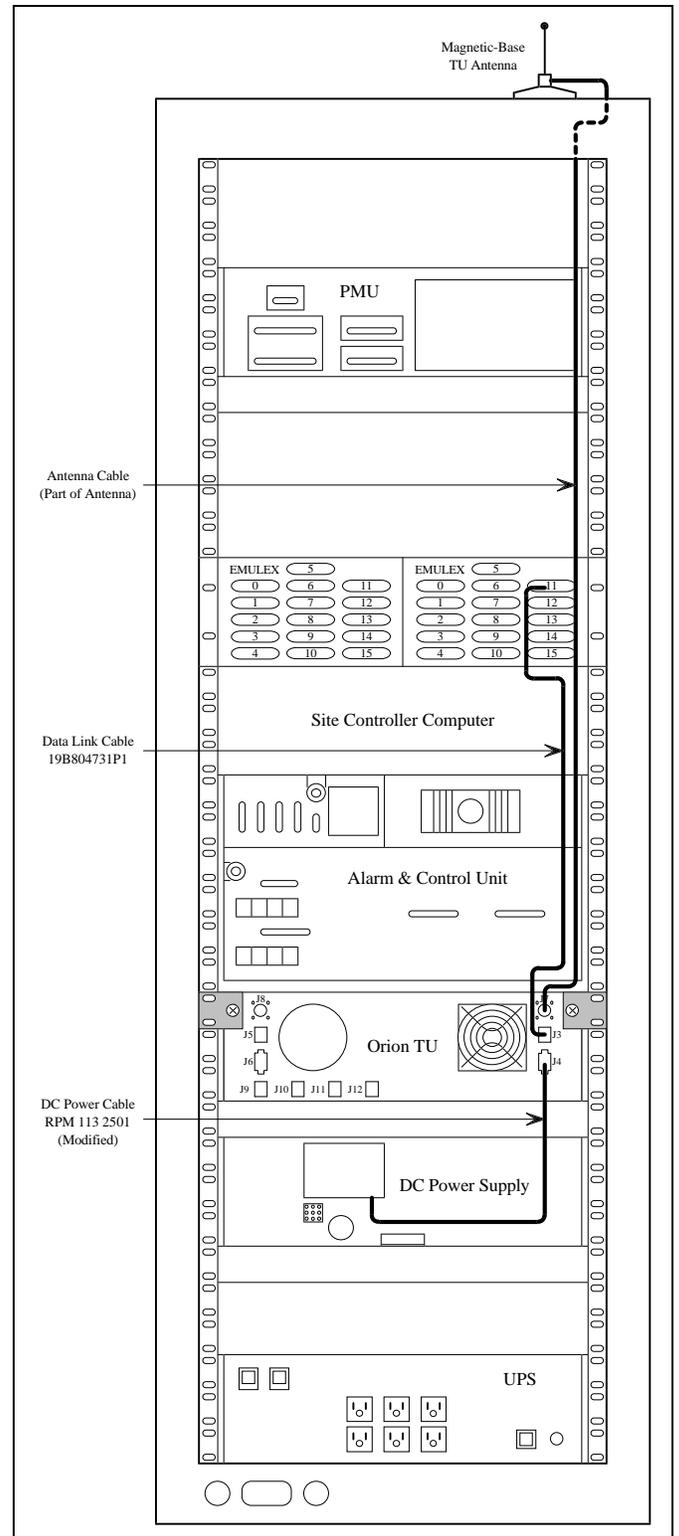


Figure 7 - Cable Connections to Older Equipment

For a 19D430272P1 or -P2 DC power supply (has large black plastic fuse box on the back - see Figure 8):

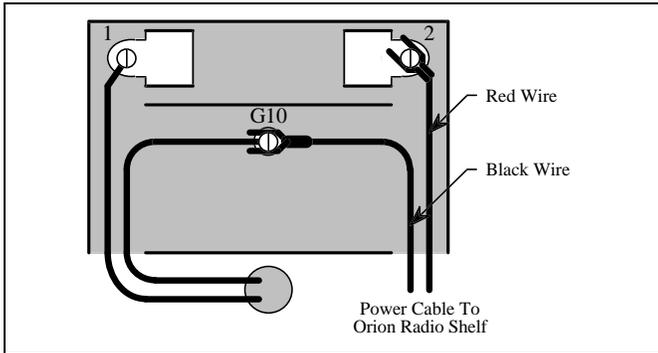


Figure 8 - Fuse Box on Older Power Supply

- Find the two spade lugs in the hardware kit and crimp on power cable.
- Remove the fuse box cover from the DC power supply.
- Connect the spade lug on the red lead of the cable to terminal 2.
- Connect the spade lug on the black lead of the cable to terminal G10.
- Re-attach the fuse box cover to the DC power supply.

Install Data Link Cable:

- The data link cable used will depend upon the model of the Site Controller computer.

For a 19A149302P9 Site Controller (has modular connectors on its back panel - see Figure 9):

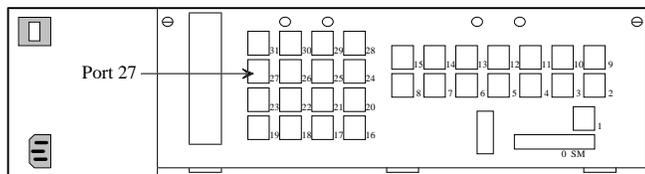


Figure 9 - Back View of Site Controller Computer

- Find the RPM 113 2502 Data Link cable.
- Plug one connector into J3 on the back of the Orion Radio Shelf.

- Plug the other connector into Port 27 on the Site Controller.

For a 19A149302P1 through -P8 Site Controller (uses DILOG or EMULEX panels - see Figure 10 or Figure 11):

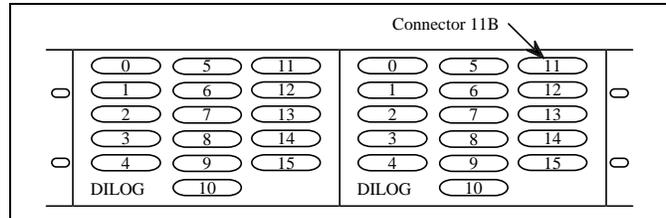


Figure 10 - DILOG Distribution Panels

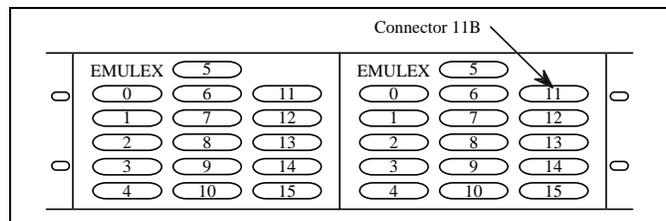


Figure 11 - EMULEX Distribution Panel

- Get one 19B804731P1 data link cable.
- Plug one end of the data link cable into J3 on the back of the Orion Radio Shelf.
- Plug the other end of the data link cable into connector 11B on the DILOG or EMULEX panels.

Turn On DC Power Supply:

- Double check all cables added.
- Turn on the DC power supply in the System Interface Cabinet and check to see that all equipment appears to be working normally.

Power Up TU:

- Turn on the Orion TU radio by rotating the Power On-Off Volume knob clockwise (top left corner of radio).
- Make sure that “TEST UNIT” is displayed on the Orion TU radio before proceeding.

## TU PERSONALITY CONFIGURATION

Regardless of whether the TU was mounted in the factory or at the site, the configuration of its personality must be checked. The Orion radio is enabled as an TU in the factory (you cannot substitute a regular Orion radio). However, the Personality used by the factory may not be exactly what is desired for the actual system (system name, channel frequencies, site ID, unit ID, and GIDs). To check the Personality (and make changes where necessary), use the following programming equipment and procedure.

### Required Equipment

The following radio programming equipment is required to modify the Personality of an Orion TU:

- PC (IBM PC/XT/AT or any true compatible with MS-DOS version 3.0 or later with an available serial port and 640K Internal RAM) - Used to run the EDACS 3 Radio Programming Software.
- EDACS 3 Radio Programming Software (part # TQ3374, version 14 or later) - Used to program an Orion radio.
- RS-232 Data Cable (part # 19B235027P1) - Connects the DB-25 male serial port of the PC to the Data Interface Module. If the PC uses a DB-9 male connector for the serial port, an adapter will be required.
- Data Interface Module (part # 19D438367G2) - Used to adjust logic levels between the Orion radio and the PC.
- 12 VDC Power Supply (part # 19B800850P2 for 120V, 60 Hz operation, or part # 19B800888P1 for 230V, 50 Hz operation) - Supplies power to the Data Interface Module.
- Programming Cable (part # 19B804722P1) - Connects the Data Interface Module to the Orion Radio Shelf, with built-in RS-232 interface circuit.

### Procedure

The procedure given here consists of loading the Radio Programming Software into a PC, reading the Orion radio's existing Personality to the PC, modifying the Personality, saving the modified Personality for future use, and writing the modified Personality back into the Orion radio.

### Load Programming Software

- Turn on the PC and wait for it to complete its initialization.
- When the **C:\>** or **D:\>** command prompt is shown on the PC monitor, insert the EDACS 3 Radios Program Disk #1 (Version 14 or later) into the PC's A (or B) drive, type "A:" (or "B:"), press the **Enter** key, type "INSTALL", and press the **Enter** key again.
- The **Radio Programming Software Installation Procedure** screen will appear. In the highlighted **Target Drive** field, type in the letter of the PC's hard disk (usually C or D) and press the **F1** (Begin) function key.
- The PC will read the Program Disk, create a GE directory in the root directory of the hard disk, and load the programming files into this GE directory. The PC will prompt you to insert Program Disk #2 and #3 when needed. Remove the previous Program Disk, insert the next Program Disk, and press the **F1** (Begin) function key to continue the installation. The PC will prompt you when the installation is complete. Press the **Enter** key and remove the last Program Disk. If your PC's hard disk is the C drive, type "C:" and press the **Enter** key. The **C:\GE\EDACS\BIN>** command prompt should now be shown on the PC monitor. Type in "CD\" and press the **Enter** key to return to the **C:\>** or **D:\>** command prompt.

### Run Programming Software

- With the DOS command prompt **C:\** or **D:\** displayed on the PC monitor, type "CD\GE" and press the **Enter** key (to go to the directory named GE where the programming files are located).
- Type "MRK" and press the **Enter** key (to run the programming file for MRK and Orion radios). You will know that the programming file is running when you see the introductory copyright screen briefly, followed by the **Current Personality** screen on the PC monitor.

### Connect Programming Equipment

- Connect the radio programming equipment to J1 on the front of the Orion Radio Shelf as shown in Figure 12.

- Move the switch closest to J1 to the up or “PROGRAM” position.

**Evoke Programming Mode**

- Turn the Orion TU radio off for one second and then back on again, using the upper left knob on the radio’s control unit.
- Make sure that the message **PC PROG** is displayed on the front panel. If not, check to make sure that the programming equipment is connected as shown in Figure 12, and that the switch on the front of the Orion Radio Shelf is in the up or “PROGRAM” position. Then, try again to evoke the programming mode.

- In the **Selected Filename** field, type a filename to be used to identify the personality for the TU.
- Press the **F1** (Yes) function key to read the TU personality into the PC.
- When complete, press the **Enter** key and check that the new filename is shown in the **Current Personality** screen.

**Check Diagnostic Application**

- In the **Current Personality** screen, use the arrow keys to select (highlight) the file name given to the personality read from the radio.
- Press the **F2** (Change) function key to bring up the **Change/Edit File** window in front of the **Current Personality** screen.
- Check to be sure that the file name given to the personality read from the TU is shown in the **File to be edited:** field.
- Press the **F1** (Yes) function key to go to the **Radio Personality** screen (Figure 14).
- Press the **F7** (Option) function key to go to the **Radio Options** screen.
- Press the **F8** (More) function key until DGNTST appears under F2 in the function key toolbar at the bottom of the screen.
- Press the **F2** (DGNTST) function key to go to the **Radio Diagnostics Options** screen (Figure 15).
- Select **Enable** in the **MRK and Orion Diagnostics Test Mode:** field using the **Tab** key.
- Press the down arrow key to move the cursor to the **Diagnostic Function:** field.
- Use the **Tab** key to select **Local Test Unit**.
- Press the **F10** (Back) function key to go back to the **Radio Options** screen.
- Press the **F10** (Back) function key to go back to the **Radio Personality** screen.

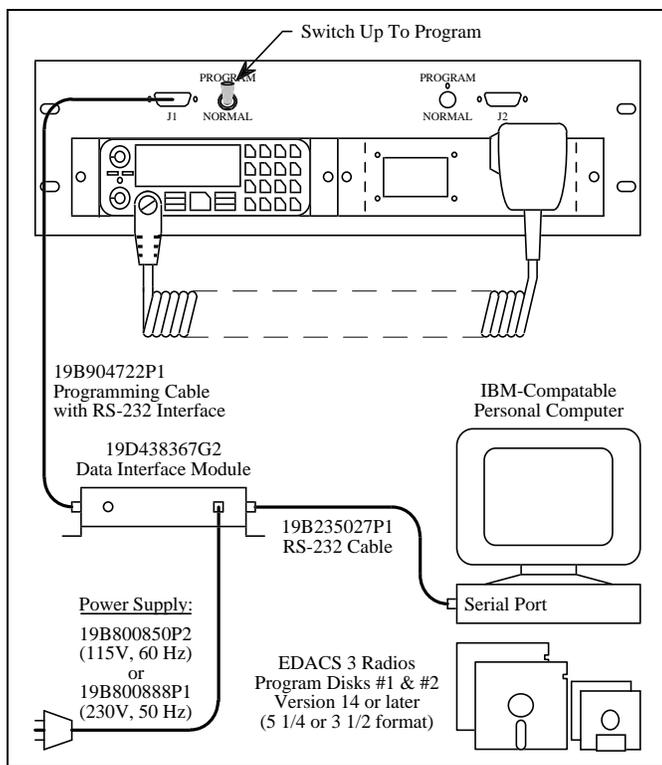


Figure 12 - Programming Setup

**Read Personality from Radio**

- Using the **Current Personality** screen as the starting point, press the **F6** (Read) function key to bring up the **Read Radio** window in front of the **Current Personality** screen (Figure 13).

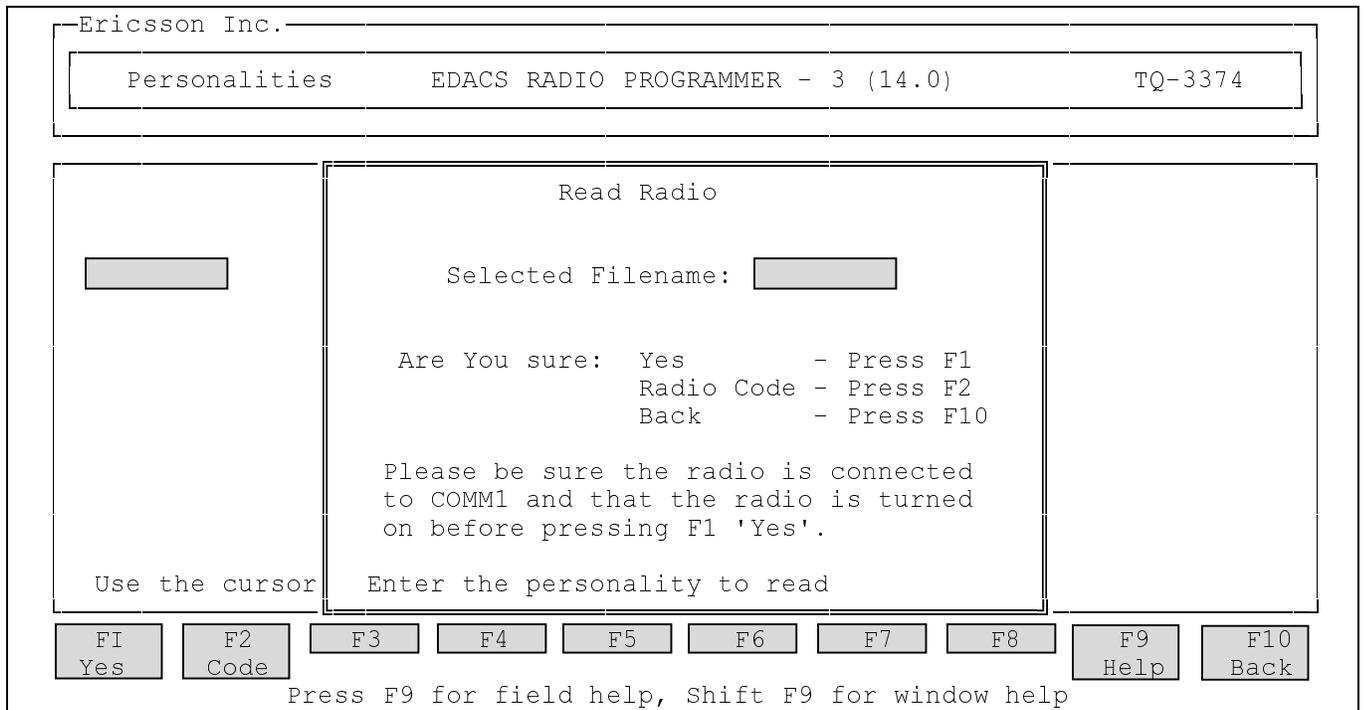


Figure 13 - Read Radio Window

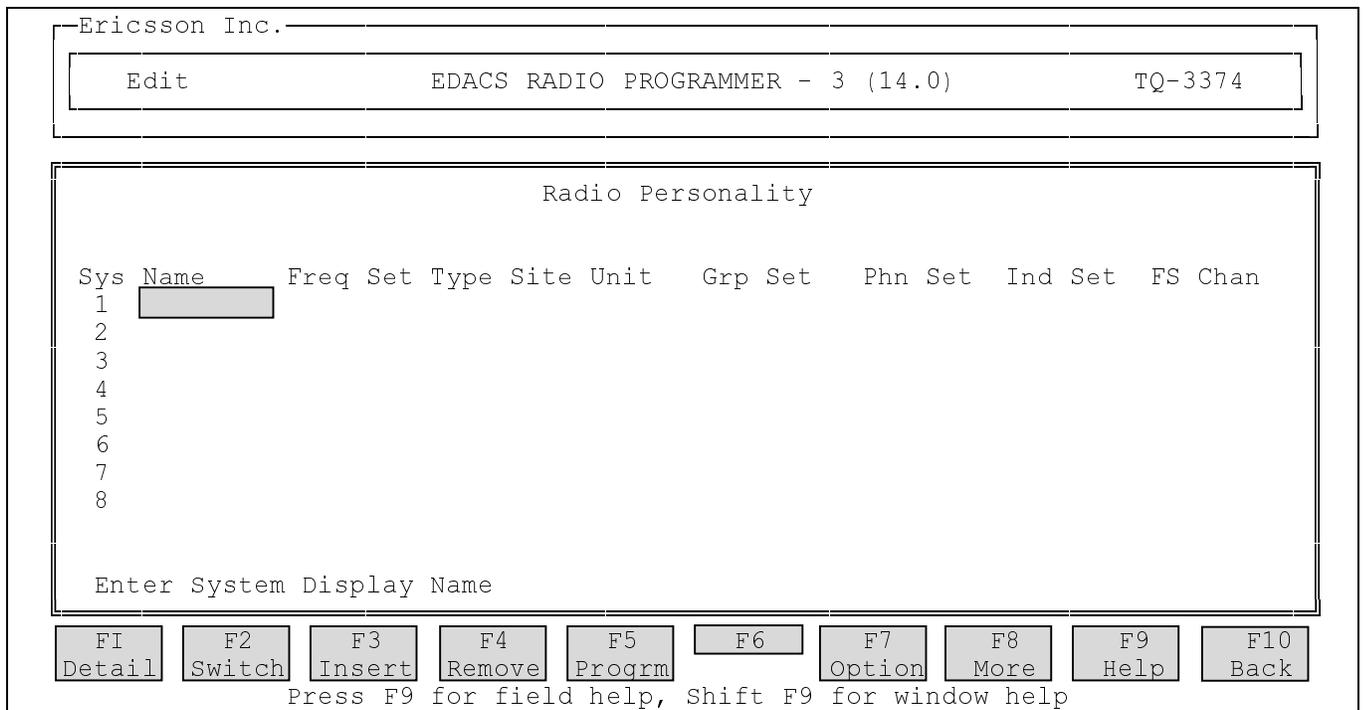


Figure 14 - Radio Personality Screen

### Check Frequency Set

- In the **Radio Personality** screen (Figure 14), use the arrow keys to select (highlight) the top space in the Freq Set column.
- Press the **F1** (Detail) function key to go to the **Trunked Frequency Set** screen (Figure 17).
- Press the **F7** (Option) function key to bring up the **Trunked Set Options** window in front of the **Trunked Frequency Set** screen (Figure 16).
- Check the channel spacing shown in the **Bandwidth Options:** field.
- To change the channel spacing selection, use the arrow keys to select (highlight) the **Bandwidth Options:** field. Then use the Tab key to select the desired channel spacing.
- When the channel spacing shown in the **Bandwidth Options:** field is correct, press the **F10** (Back) function key to go back to the **Trunked Frequency Set** screen (Figure 17).
- Check the transmit frequency shown in the **Tx Freq** column beside each channel (remember that the transmit frequencies for mobiles are the receive frequencies marked on the Station GETC shelf for each channel).
- To change or add a transmit frequency, use the arrow keys to select (highlight) the frequency to be changed or the space where a frequency is to be added, and type over the existing numbers or spaces. Receive frequencies will be changed automatically, based on the transmit frequencies.
- When the transmit frequencies shown in the **Trunked Frequency Set** screen are correct for all channels, press the **F5** (Store) function key to bring up the **Store File** window in front of the **Trunked Frequency Set** screen.
- In the **File to be saved:** field, type a file name to be used to identify the frequency set for this personality. Write the file name down - you will need it to define the personality later in the procedure.

- Press the **F1** (Yes) function key to store (save) the frequency set and remove the **Store File** window.
- Press the **F10** (Back) function key to go back to the **Radio Personality** screen.

### Check Group Set

- In the **Radio Personality** screen (Figure 14), use the arrow keys to select (highlight) the top space in the **Grp Set** column.
- Press the **F1** (Detail) function key to go to the **Group Set Summary** screen (Figure 18).
- Check the GIDs shown in the **Grp ID** column. The GIDs are used by the TU when it is operated in the test or service radio mode. Even if you have no intention of using the TU in the test or service radio mode, at least one GID must be listed here to satisfy the requirements to define the group set, and at least one group set must be defined to satisfy the requirements to define the personality for the TU.
- To change or add a GID, use the arrow keys to select (highlight) the GID to be changed or the space where a GID is to be added, and type over the existing numbers or spaces.
- When you are satisfied with the GIDs shown in the **Group Set Summary** screen (no name is necessary in the **Name** column, but it may be useful), press the **F5** (Store) function key to bring up the **Store File** window in front of the **Group Set Summary** screen.
- In the **File to be saved:** field, type a file name to be used to identify the group set for this personality. Write the file name down - you will need it to define the personality later in the procedure.
- Press the **F1** (Yes) function key to store (save) the group set and remove the **Store File** window.
- Press the **F10** (Back) function key to go back to the **Radio Personality** screen.

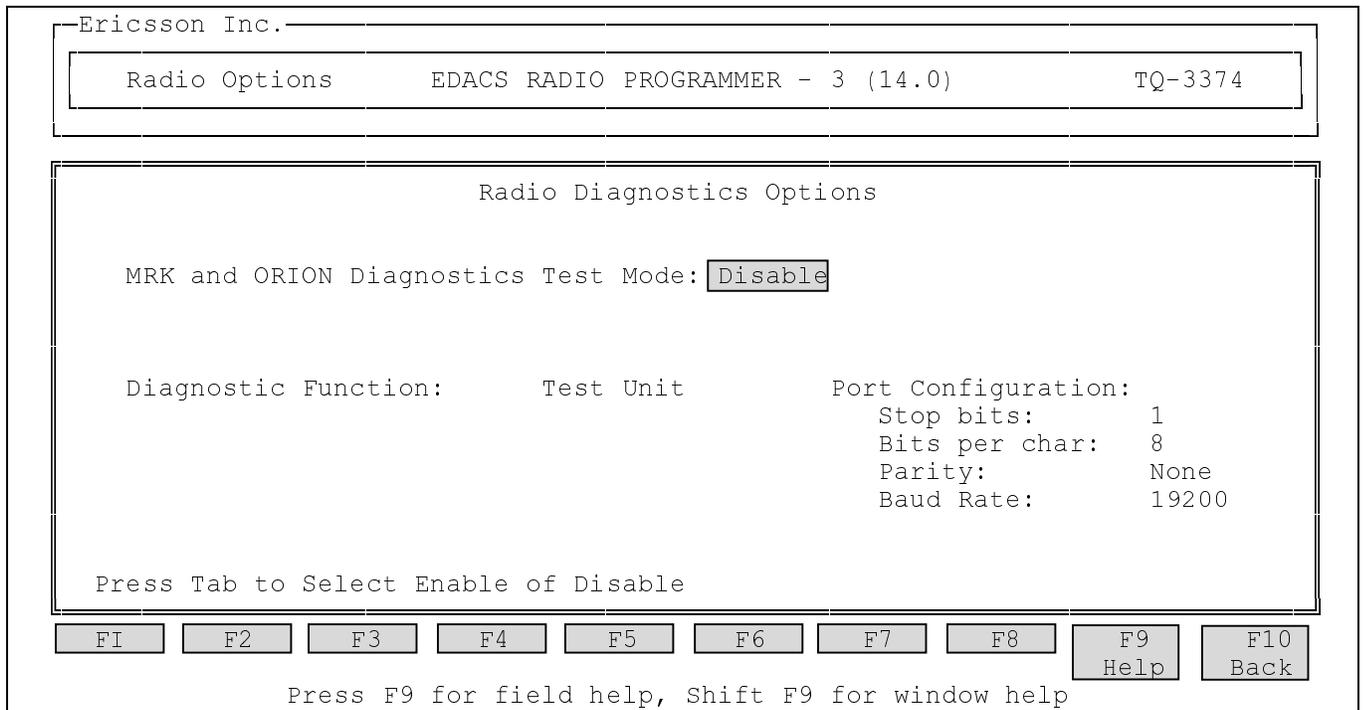


Figure 15 - Radio Diagnostics Options Screen

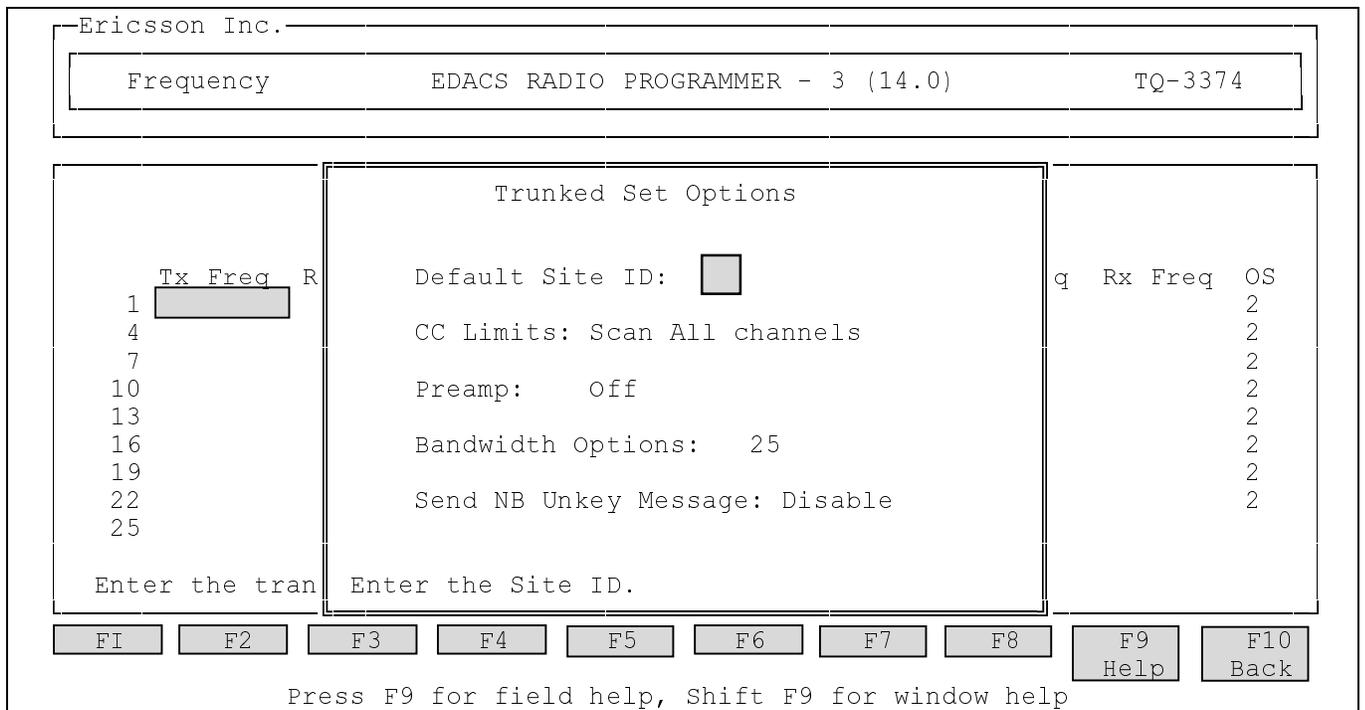


Figure 16 - Trunked Set Options Window

**Define Personality**

- In the **Radio Personality** screen, use the arrow keys to select (highlight) the top space in the **Name** column. Then type the name of the system where the TU is installed.
  - Use the arrow keys to select (highlight) the top space in the **Freq Set** column. Then type the file name you used to identify the frequency set for this personality.
  - Use the arrow keys to select (highlight) the top space in the **Site** column. Then type the site ID where the TU is installed.
  - Use the arrow keys to select (highlight) the top space in the **Unit** column. Then type any LID that is not currently in use in the system. The LID will not be used by the TU, but must be listed here to satisfy the requirements to define the personality.
  - Use the arrow keys to select (highlight) the top space in the **Grp Set** column. Then type the file name you used to identify the group set for this personality.
- Check to be sure that the file name given to the personality read from the TU is shown in the **File to be saved:** field.
  - Press the **F1** (Yes) function key to bring up the message telling you that the file exists.
  - Type “Y” to overwrite the original file and go to the **Current Personality** screen.

**Write Personality to Radio**

- Press the **F5** (Program) function key to program the Orion radio with the modified personality.
- When programming is complete, press the **F10** (Back) function key to go back to the DOS command prompt. Make sure you see the DOS command prompt displayed on the PC monitor before proceeding.

**Disconnect Programming Equipment**

- Move the switch on the front of the Orion Radio Shelf to the down or “NORMAL” position.
- Disconnect the programming equipment from the Orion Radio Shelf.

**Save Personality**

- Press the **F10** (Back) function key to bring up the **Save File** window in front of the **Radio Personality** screen.

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Frequency EDACS RADIO PROGRAMMER - 3 (14.0) TQ-3374

Trunked Frequency Set  
806 - 870

	Tx Freq	Rx Freq	OS	Tx Freq	Rx Freq	OS	Tx Freq	Rx Freq	OS
1			2	2		2	3		2
4			2	5		2	6		2
7			2	8		2	9		2
10			2	11		2	12		2
13			2	14		2	15		2
16			2	17		2	18		2
19			2	20		2	21		2
22			2	23		2	24		2
25			2						

Enter the transmit frequency for this channel

Press F9 for field help, Shift F9 for window help

Figure 17 - Trunked Frequency Set Screen

Ericsson Inc.

Groups EDACS RADIO PROGRAMMER - 3 (14.0) TQ-3374

Group Set Summary

Grp	Name	Grp ID	RX	TX	Scn	ALT	Calls	BCK	VG Key
1			Y	Y	N	Y	Y	Y	DIS
2			Y	Y	N	Y	Y	Y	DIS
3			Y	Y	N	Y	Y	Y	DIS
4			Y	Y	N	Y	Y	Y	DIS
5			Y	Y	N	Y	Y	Y	DIS
6			Y	Y	N	Y	Y	Y	DIS
7			Y	Y	N	Y	Y	Y	DIS
8			Y	Y	N	Y	Y	Y	DIS

Enter the Group Name

Press F9 for field help, Shift F9 for window help

Figure 18 - Group Set Summary Screen

## SYSTEM MANAGER CONFIGURATION

Three TU parameters used by the Site Controller are configurable through the System Manager. Use the following procedure to check and/or change these parameters in the site database and send any changes gracefully to the Site Controller.

### Site Test Parameters Panel

- From the **User Menu** screen, enter **10** in the **Menu Item** field to see the **External Device Definition** screen.
- In the **Selected Device** panel, enter the site number (or site name) in the **Device Number** field (or the **Device Name** field) where the TU is installed.
- Press the **Next** key three times to see the **Site Test Parameters** panel (3:4).

### TU Parameters

- The **Test Unit Enabled** parameter is used to tell the Site Controller if test calls are to be placed on the system. In the **Site Test Parameters** panel, enter **Y** in the **Test Unit Enabled** field.
- The **Local Test Unit** parameter is used to tell the Site Controller if the Test Unit is local to the Site Controller (subject to Site Controller polling), or remote to the Site Controller (not subject to Site Controller polling). In the **Site Test Parameters** panel, use the arrow keys to select (highlight) **Local** in the **Local Test Unit** field.
- The **Background Test Call Interval** parameter is used to set the time interval (in minutes) between Background Test Calls. The field may contain any number from 0 to 1440 (default = 5). Entering a 0 in this field disables Background Test Calls, but the Test Unit will continue to monitor the Control Channel and make Recovery Test Calls on failed Working Channels. In the **Site Test Parameters**

panel, enter the desired number, or (if already OK) go on.

### Save to Database

- After you have completed all the changes you wish to make to the three TU parameters, press the **Do** key to save your changes in the database.

### Send Database to Site Controller

- When you press the **Do** key to save changes to the site database in the System Manager, these changes are not automatically sent to the site. Whenever a Site Controller computer is reset or powered on, it will request that the System Manager download the latest database for that site, including the latest TU parameter changes. However, this is not the way to get TU parameter changes to the site. The remaining steps allow a system administrator to send the TU parameter changes without disrupting the site.
- From the **User Menu** screen, enter **22** in the **Menu Item** field to see the **Site Reconfiguration** screen.
- In the **Selected Site** panel, enter the **Site Number** or **Site Name** for the site to be sent the TU data.
- Press the **Next** key three times to see the **Site Test Parameters** panel (3:5).
- In the **Site Test Parameters** panel (3:5), change the character in the rows between the Database box and the Site box from **N** to **Y** for each TU parameter you wish to send to the site and press the **Do** key.

### Exit

- Press the **F6** function key to return to the **User Menu** screen.
- Press the **F7** function key to exit from the System Manager.

## OPERATION

The Orion TU has two modes of operation: the Test Unit Mode and the User Call Mode. The TU normally operates in the Test Unit Mode to monitor the Control Channel and place test calls, but can (when needed) be used in the User Call Mode to place group calls on the system just like any other user radio.

### TEST UNIT MODE

#### Overview

In the Test Unit Mode, the Orion TU receives all its instructions from, and reports the results of the channel tests, directly to the Site Controller computer through a single serial data link. During normal operation, the TU operates in one of the following states:

- Power-Up
- Set-Up
- Monitor
- Test Call

#### Power-Up State

The TU enters the Power-Up state when power is first applied or after receiving the Reset message from the Site Controller computer. In the Power-Up state the TU sets all switching circuits to a predetermined state and performs self-diagnostic checks. When these checks are completed, the TU sends a Status Response message to the Site Controller computer and waits for a Status Request message in return. If a Status Request message is not received within 10 seconds, the TU again sends a Status Response message and again waits for a Status Request message in return. This continues until a Status Request message is received by the TU.

#### Set-Up State

The TU enters the Set-Up state after sending either of the following messages to the Site Controller computer:

- Status Response (while in the Power-Up state)
- CC Fail

#### Monitor State

The TU enters the Monitor state when it receives the Monitor Control Channel message from the Site Controller computer, or after completing a test call. Upon entering this state, the TU sets its receiver to the local transmit frequency of the Control Channel (given in the Monitor Control Channel message) and begins monitoring the locally-transmitted Control Channel messages.

Monitoring the locally-transmitted Control Channel messages is the primary function of the TU, and consists of the following tasks:

- Obtaining synchronization with the outbound Control Channel data frames.
- Decoding the outbound Control Channel data.

When the TU is unable to complete any one or more of these tasks, it sends the CC Fail message to the Site Controller computer and returns to the Set-Up state. When the Site Controller computer receives the CC Fail message, it logs the failure of the present Control Channel, takes the present Control Channel out of service, allocates a new Control Channel, and sends a CC Monitor message with the new Control Channel number to the TU. When the TU receives the new CC Monitor message, it returns to the Monitor state, sets its receiver to the local transmit frequency of the new Control Channel, and resumes monitoring the locally-transmitted Control Channel messages.

#### Test Call State

The TU enters the Test Call state when it receives a Testcall State message from the Site Controller computer. Upon entering this state, the TU simulates a user placing a call on the system, checks the channel-request sequence, and checks high and low speed data transmission in both directions.

A failure at any step in the sequence causes the TU to send an unsuccessful Call Results message to the Site Controller computer and return to the Set-Up state to wait for further instructions. When the Site Controller computer receives the unsuccessful Call Results message from the TU, it logs the failure and fails the Working Channel.

A normal (successful) sequence contains the following steps:

1. The TU receives a Testcall State message from the Site Controller computer.

2. The TU sends a request for an individual call and waits to receive a Working Channel assignment. (The TU uses a Logical ID of 0 for both the caller and callee.)
3. The TU receives a Working Channel assignment and sets its receiver and transmitter to the corresponding frequencies of the assigned Working Channel.
4. The TU receives a high-speed-data channel confirmation signal from the Working Channel.
5. The TU sends a high-speed-data key message followed by low-speed data to the Working Channel.
6. The Working Channel detects the high-speed-data key message and low-speed data from the TU.
7. The TU stops sending low-speed data to the Working Channel.
8. When the Working Channel stops receiving the low-speed data from the TU, it transmits low-speed data for the remaining 2-second hang-time interval.
9. The TU checks for low-speed data, sends a Call Results message to the Site Controller computer, and returns to the Monitor state to resume monitoring the locally-transmitted Control Channel messages.

If the number of channels failed by any means (as a percentage of the total number of defined channels at the site) reaches the Channel Fault Tolerance Threshold specified in the Site Controller computer's personality (default is 50 %), the Site Controller computer will disable the piece of equipment responsible for identifying most of the failures under the assumption that it is falsely failing channels. If the TU is failed by this mechanism, all channels failed by the TU (both before and after the TU itself was failed) must subsequently be tested OK before the TU itself will be restored to service.

During the time when the TU is failed by this mechanism, the Site Controller computer assigns Working

Channels regardless of whether they have been failed by the TU or not, and continues to instruct the TU to place test calls on all Working Channels.

### NOTE

#### For Site Controller software Prior to G7

Any channel failed by the TU (after the TU itself has been failed by the Site Controller computer) will not show up on the Alarm Screen of the System Manager. The Site Controller computer still keeps track of any additional channels failed by the TU, and all failed channels (those showing an alarm and those not) must be tested OK by the TU before the TU itself is unfailed by the Site Controller computer. If no channels are shown with TU alarms but the TU itself shows an alarm, some channel (not showing an alarm) may not yet have been tested OK by the TU.

### USER CALL MODE

The User Call Mode allows maintenance personnel to use the Test Unit as a service or test radio (for group calls only). To switch to the User Call Mode, press the OPT and CLR keys simultaneously (see Figure 19). The display will show system and group name. Group calls can then be made using the normal procedure for an Orion mobile. To return to the Test Unit Mode, again press the OPT and CLR keys simultaneously.

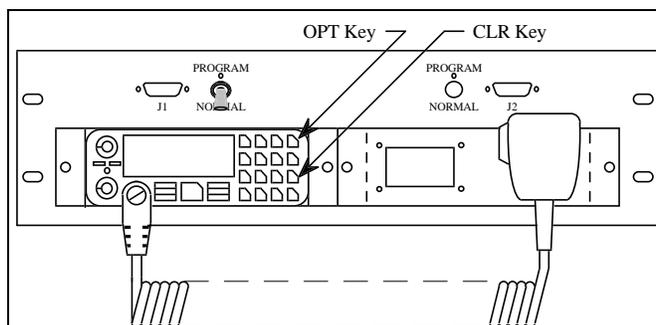


Figure 19 - Location of OPT Key and CLR Key

## MAINTENANCE

Maintenance information, for the Orion radio hardware is described in the Orion maintenance manuals listed in the Introduction section of this manual. The two types of tests described here are used to check the operation of the TU (diagnostic) software.

### BENCH TEST

The bench test checks the TU (diagnostic) software by simulating commands from the Site Controller computer and monitoring the response messages from the TU.

#### Communications Protocol

Communications between the Orion TU and the Site Controller computer is through an asynchronous serial data link using RS-232C levels. When monitoring or simulating messages from the Site Controller computer with a protocol analyzer, set the message protocol as follows:

- Baud Rate = 19,200
- Start Bit = 1
- Data Bits = 8
- Parity Bit = None
- Stop Bit = 1
- Flow Control = None

#### Test Equipment Required

The following equipment (or equivalent) is required to bench test the Orion test radio:

- 12 VDC Power Supply
- RF load, 50 ohms
- Triplet VOM, Model 630-PL, Type 5
- HP 4953A or HP 4951C Protocol Analyzer, or computer with software to allow generation and reception of hexadecimal command strings

#### Test Setup

Before the Orion test radio can be bench tested, it must have all the correct software installed (see the section on programming), and must be completely functional (refer to the Orion mobile radio maintenance manual).

1. Connect the 12 VDC power supply to the Orion test radio, using a 15A fast-blowing fuse. Connect to J1002 for the higher-frequency test radio or J1003 (pins 32 -37) for the lower-frequency test radio.
2. Connect a 50 ohm RF load to the Orion test radio.
3. Connect the protocol analyzer to J1003 on the Orion test radio (TXD to pin 2, RXD to pin 3, and GND to pin 7).

#### Test Procedure

Turn on the DC power supply and verify that the voltage is 13.2 +/- 0.6 Vdc. Turn on the Orion TU radio.

Power-Up: Have the protocol analyzer send a Reset message <AA FD 02> and verify that the TU responds with a Status Response message <AA 91 00 00 EE> indicating that it is now in the Power-Up state.

Set-Up: Have the protocol analyzer send a Status Request message <AA 07 F8> and verify that the TU responds with a Status Response message <AA 91 02 00 EC> indicating that it is now in the Set-Up state.

Monitor: Have the protocol analyzer send a CC Monitor message <AA 08 01 01 00 00 00 00 00 F7> and verify that the TU responds with a CC Fail message <AA 94 ff 01 pb> (where ff is 20 or 40 or 80 and pb is the Parity byte) indicating that it is now in the Monitor state.

Test Call: Testing the operation of the TU in the Test Call state is not possible with this test setup. However, after the Orion TU radio is installed in the Orion TU shelf and connected to the Site Controller computer, the protocol analyzer may be inserted between the Orion TU shelf and the Site Controller computer to see the Testcall State message <AA 10 --> coming to the TU, followed by the Call Results message <AA 92 -- --> leaving the TU. The presence of these messages indicates that it is in the Test Call state.

## IN-SYSTEM TESTS

The in-system tests check the TU (diagnostic) software by simulating abnormal conditions that the TU is designed to detect.

To speed up these tests, temporarily set the Background Test Call Interval to 1 minute using the Site Reconfiguration screen (menu selection 22) of the System Manager. Note the present value so you can set the Background Test Call Interval back to this value when the tests are over.

### Simulated Control Channel Failure

High-Speed Data: The following test simulates a high-speed data failure on the Control Channel by forcing the Control Channel GETC not to send high-speed data:

- Identify the Control Channel GETC by finding the one that has L6 and L7 (last two LEDs on right) lit continuously.
- Pull the GETC shelf out and remove jumper J60.
- Observe that the TU fails this channel, takes it out of service, and selects a new Control Channel (look at the Site Monitor screen (menu selection 32) of the System Manager).
- Replace jumper J60 and push the GETC shelf in.
- Observe that a test call is placed on the original Control Channel and it is returned to service (look at the Site Monitor screen (menu selection 32) of the System Manager).

### Simulated Working Channel Failures

High-Speed Data: The following test simulates a high-speed data failure on the Working Channel by forcing a Working Channel GETC not to send high-speed data:

- Identify a Working Channel GETC by finding one that does not have L6 (LED 2nd from right) lit continuously.
- Pull the GETC shelf out and remove jumper J60.
- Observe that the TU fails this channel and takes it out of service (look at the Site Monitor screen (menu selection 32) of the System Manager).
- Replace jumper J60 and push the GETC shelf in.

- Observe that a test call is placed on this channel and it is returned to service (look at the Site Monitor screen (menu selection 32) of the System Manager).

Low-Speed Data: The following test simulates a low-speed data failure on a Working Channel by forcing the Working Channel GETC not to send low-speed data:

- Identify a Working Channel GETC by finding one that does not have L6 (LED 2nd from right) lit continuously.
- Pull the GETC shelf out and move jumper J17 from pins 1 & 2 to pins 2 & 3.
- Observe that the TU fails this channel and takes it out of service (look at the Site Monitor screen (menu selection 32) of the System Manager).
- Move jumper J17 back to pins 1 & 2 and push the GETC shelf in.
- Observe that a test call is placed on this channel and it is returned to service (look at the Site Monitor screen (menu selection 32) of the System Manager).

Channel Frequency: The following test simulates a Working Channel set to the wrong channel frequency:

- Identify a Working Channel GETC by finding one that does not have L6 (LED 2nd from right) lit continuously.
- Pull the GETC shelf out and record the positions of DIP switches S1-1 through S1-7 and S2-1 through S2-4. Then change the DIP switch settings to a combination not used by the system.
- Observe that the TU fails this channel and takes it out of service (look at the Site Monitor screen (menu selection 32) of the System Manager).
- Return the DIP switches to their original positions and push the GETC shelf in.
- Observe that a test call is placed on this channel and it is returned to service (look at the Site Monitor screen (menu selection 32) of the System Manager).
- Return the Background Test Call Interval to its former value.

## **GLOSSARY**

- ACU..... The Alarm and Control Unit is an EDACS Site Controller option that reports alarms from user-supplied alarm sensors, and controls relays that operate user-supplied devices.
- Control Channel..... A Control Channel is any allowed radio channel (only one at a time) at an EDACS Trunked Site that is used for call requests and Working Channel assignments for trunked calls.
- EDACS..... EDACS, short for Enhanced Digital Access Communications System, is a registered trademark of Ericsson Inc. It is used by Ericsson to describe specific communications systems and their specific equipment which meet or exceed the needs of the Public Service, Industrial, Commercial, and Utility markets world-wide.
- EDACS Trunked Site..... An EDACS Trunked Site is a location having three or more EDACS Repeaters operating together under the direction of a Site Controller computer or the Control Channel GETC.
- MRK..... MRK, a trade mark of Ericsson Inc., is the name of a line of mobile radios.
- Orion..... Orion, a trade mark of Ericsson Inc., is the name of a line of mobile radios.
- TU..... The Test Unit (TU) is an EDACS Site Controller option that provides a means of testing the radio channels for an EDACS Trunked Site by placing test calls on the Working Channels (under the direction of the Site Controller computer), and monitoring the outgoing messages on the Control Channel.
- Working Channel..... A Working Channel is any radio channel at an EDACS Trunked Site that is available or in use to carry trunked calls.

**PARTS LISTS**

Parts for the Orion radio are listed in the manual for the radio. Parts for the Orion Radio Shelf (other than the radio) are listed here.

Orion Radio Shelf Equipped As  
Local Test Unit (TU)

ITEM	QTY	PART NO.	DESCRIPTION
1	1	SXA 120 4222	Orion Radio Shelf, Sheet Metal Only
2	1	Frequency Dependent	Orion TU Radio w Control Unit
3	1	SXK 107 3831 ***	Speaker Panel Assembly ***
4	2	RPM 113 2490/1 RPM 113 2489/1	Orion Radio Shelf Harness w separate power conn on radio w/o separate power conn on radio
5	1	RPM 113 2491/2	RF Cable (TU Radio to Attenuator)
6	1	19A149360P1	RF Attenuator, 50 Ohms, 20 W, 30 dB
7	1	RPM 113 2491/3	RF Cable (Attenuator to Back of Shelf)
---	1	NTM 201 1086 ***	Fan Mounting Kit ***
---	1	NTM 201 1087 ***	Radio Mounting Kit ***
---	1	NTM 201 1090 ***	Shelf Mounting Kit ***

\*\*\* Further breakdown of this part is shown in another parts table.

Fan Mounting Kit  
NTM 201 1086

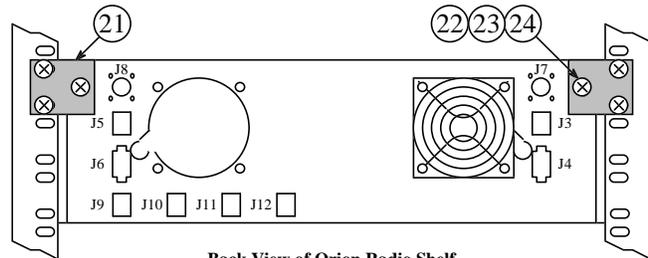
ITEM	QTY	PART NO.	DESCRIPTION
8	1	BKV 301 216/02	Fan
9	2	105 8567/1	Fan Guard
10	1	SRG 120 06	Rubber Grommet (5490477P2)
11	2	SND 109 29/02	Connector Terminal
12	1	RNT 403 405/002	Connector Housing (Amp 172165-1)
13	10	NSV 350 05	Cable Clamp (701863P15)
14	4	SBA 120 040/0450	Screw, M4x45, Torx
15	6	SBA 120 040/0080	Screw, M4x8, Torx, Black
16	8	SCA 101 040/80	Flat Washer, M4, Black
17	16	SBM 101 112/03	Lock Nut, M4, Hex

Radio Mounting Kit  
NTM 201 1087

ITEM	QTY	PART NO.	DESCRIPTION
18	1	SXA 120 4228	Retaining Bracket, Radio Slides
19	1	SXA 120 4229/1	Radio Slide, Left Side
20	1	SXA 120 4229/2	Radio Slide, Right Side

Shelf Mounting Kit  
NTM 201 1090

ITEM	QTY	PART NO.	DESCRIPTION
21	2	SXA 120 4230	Support, Shelf Back
22	2	03/SBA 120 040/0120	Screw, M4x12, Torx
23	2	SCL 112 136	Lock Washer, M4
24	2	SCA 101 040/03	Flat Washer, M4



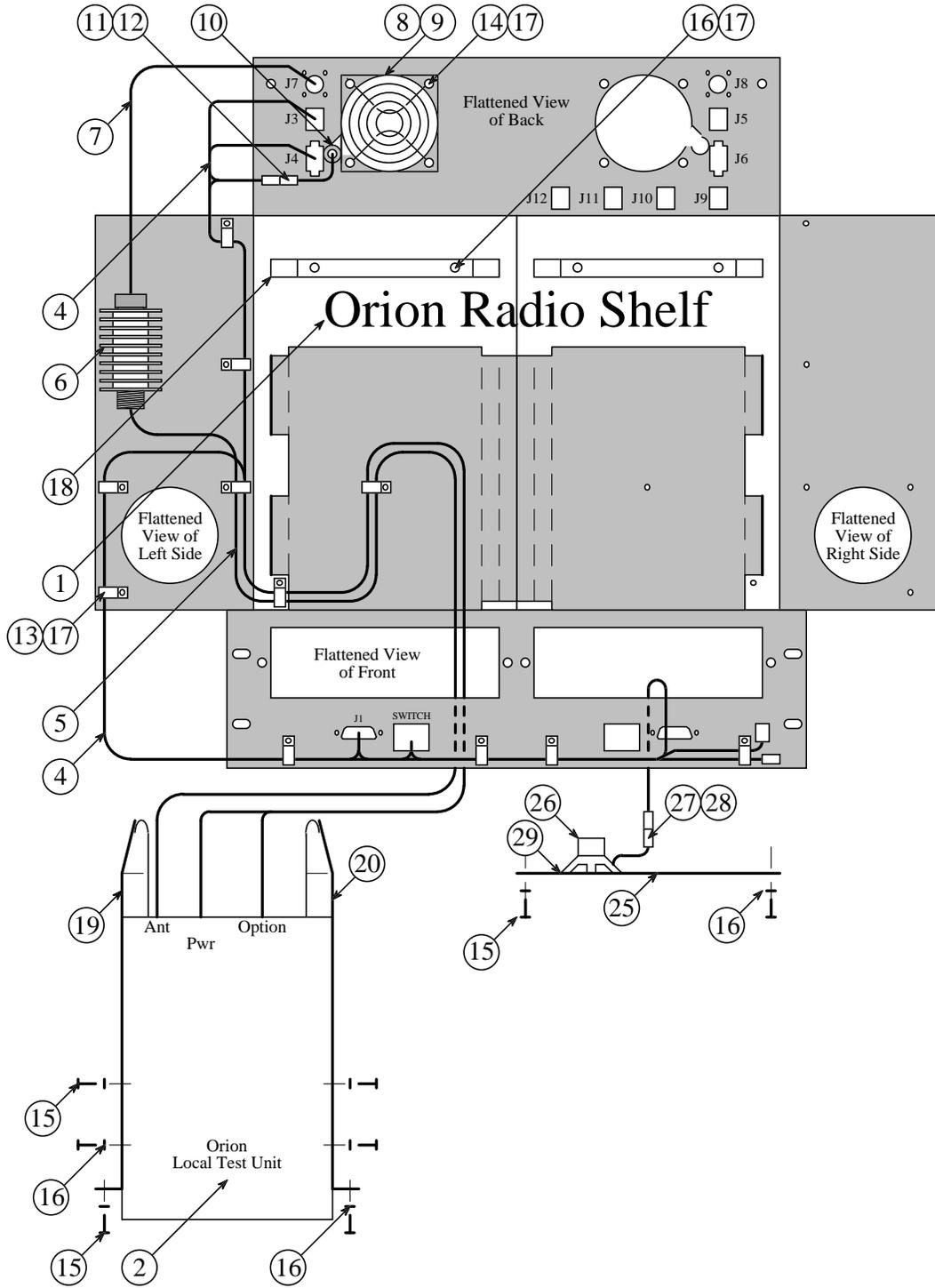
Back View of Orion Radio Shelf

Speaker Panel Assembly  
SXK 107 3831

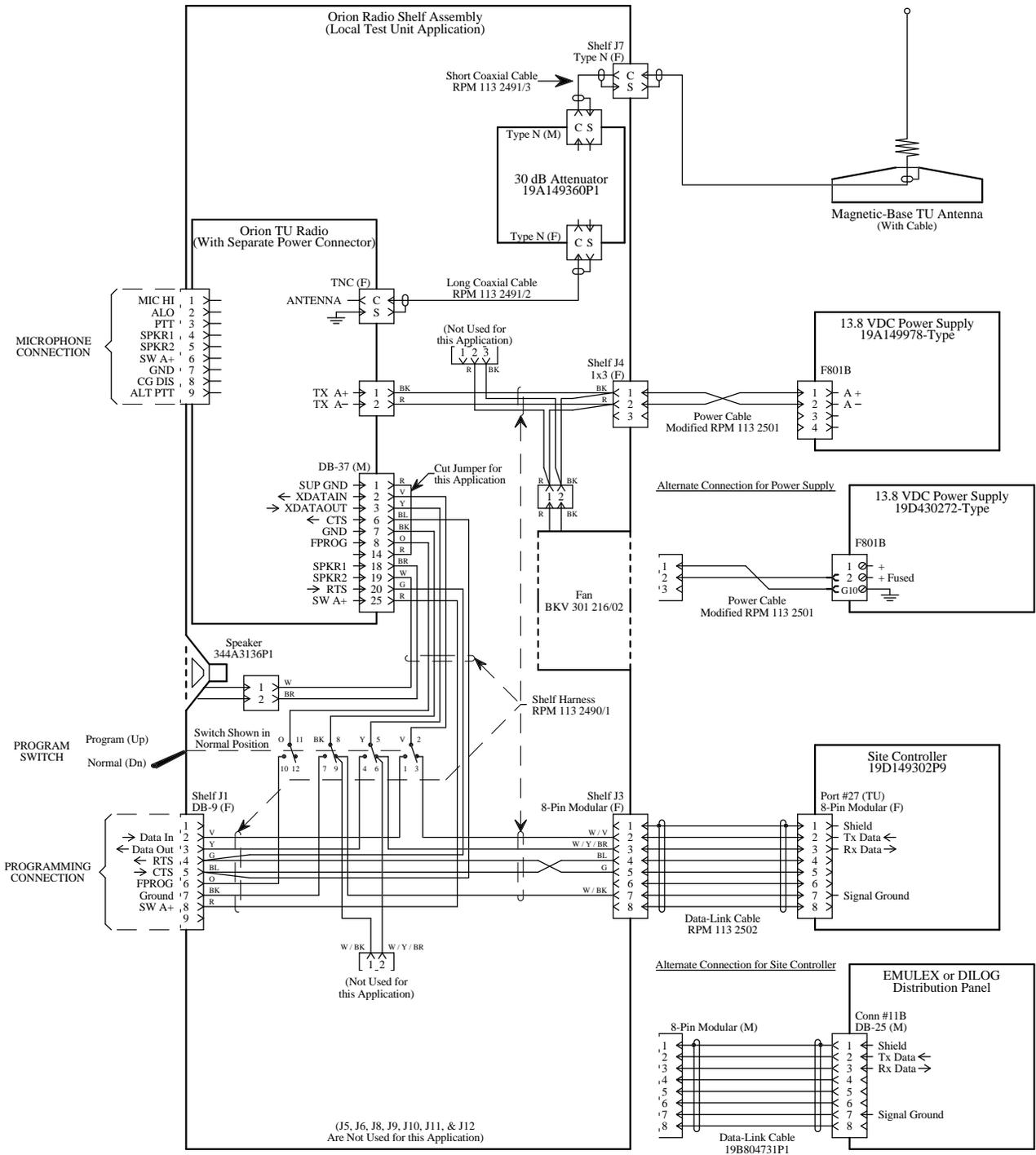
ITEM	QTY	PART NO.	DESCRIPTION
25	1	SXA 120 4226/3	Panel, Sheet Metal Only
26	1	RLE 906 12/1	Speaker, 8 Ohms, 2 Watts
27	1	RNT 403 405/002	Connector Housing
28	2	SND 1009 29/02	Connector Terminals
29	4	SBM 101 110/03	Locking Nut, M3

Miscellaneous

ITEM	QTY	PART NO.	DESCRIPTION
---	1	Frequency Dependent	Magnetic-Base Antenna with Cable
---	1	344A4528P55	Microphone, Handheld
---	1	344A4678P1	Hanger, Microphone
---	1	RPM 113 2501	Cable, DC Power
---	1	RPM 113 2502	Cable, Data Link to Site Controller (for 8-pin modular connector)
---	1	19B804731P1	Cable, Data Link to Site Controller (for EMULEX or DIALOG panel)
---	1	19B804722P1	Cable, Programming







Interconnection Diagram  
Local Test Unit (With Separate Power Connector)

**Ericsson Inc.**  
Private Radio Systems  
Mountain View Road  
Lynchburg, Virginia 24502  
1-800-528-7711 (Outside USA, 804-528-7711)

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