Folder Structure Overview

The LMF uses a *<x>:\<lmf home directory>* folder that contains all of the essential data for installing and maintaining the BTS. The following list outlines the folder structure for LMF. Except for the *bts-nnn* folders, these folders are created as part of the LMF installation. Refer to the *CDMA LMF Operator's Guide* for a complete description of the folder structure.

Figure 3-1: LMF Folder Structure

(C:)

x:\<lmf home directory> **folder**

cdma **folder**

BTS-nnn **folders (A separate folder is required for each BTS where bts-nnn is the unique BTS number; for example, bts-163.)**

loads **folder**

version folder (A separate folder is required for each different version; for example, a folder name 2.8.1.1.1.5.)

code **folder**

data **folder**
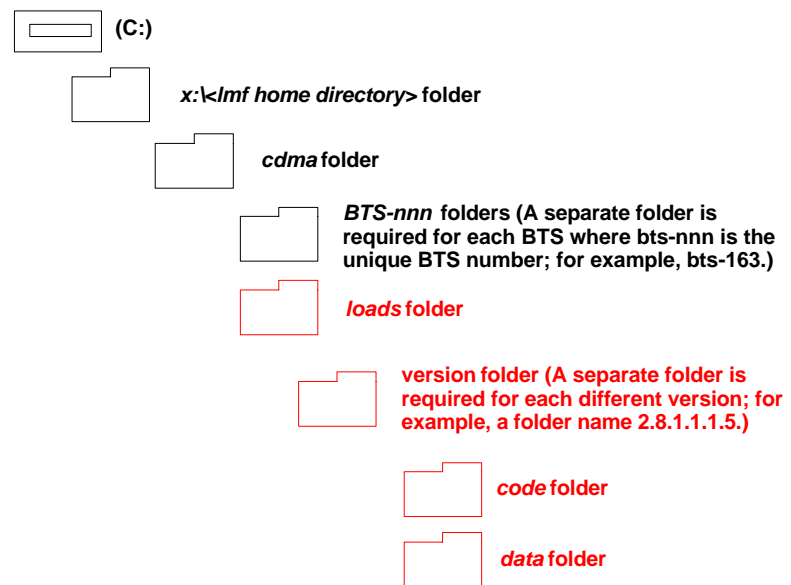
NOTE	The "loads" folder and all the folders below it are not available from the LMF for Software Release 2.16.1.x. These folders may be present as as a legacy from previous software versions or downloaded from the CBSC/OMC-R.

Span Lines - Interface and Isolation

T1/E1 Span Interface

| NOTE	**At active sites,** the OMC-R/CBSC must disable the BTS and place it out of service (OOS). **DO NOT** remove the span line cable connectors until the OMC-R/CBSC has disabled the BTS.

Each frame is equipped with one 50-pair punchblock for spans, customer alarms, remote GPS, and BTS frame alarms. See Figure 3-4 and refer to Table 3-6 for the physical location and punchdown location information.

Before connecting the LMF computer to the frame LAN, the OMC-R/CBSC must disable the BTS and place it OOS. This will allow the LMF to control the BTS, and prevent the CBSC from inadvertently sending control information to the BTS during LMF-based tests.

Isolate BTS from T1/E1 Spans

Once the OMC-R/CBSC has disabled the BTS, the spans must be disabled to ensure the LMF will maintain control of the BTS. To disable the spans, disconnect the BTS-to-CBSC Transcoder span cable connectors from the Span I/O cards (Figure 3-2).

Figure 3-2: Disconnecting Span Lines

Span Line Cable Connectors
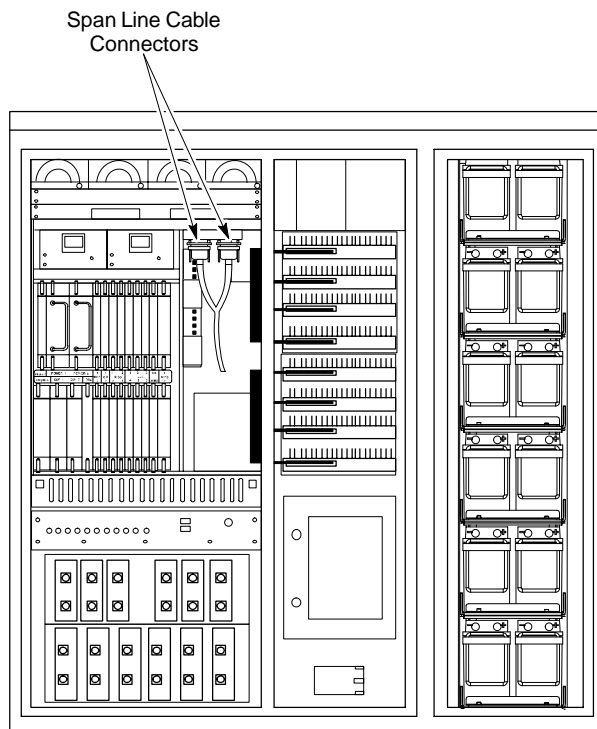
4812ETL0020-1

T1/E1 Span Isolation

Table 3-5 describes the action required for span isolation.

	Table 3-5: T1/E1 Span Isolation
Step	**Action**
1	Have the OMCR/CBSC place the BTS OOS.
2	To disable the span lines, locate the connector for the span or spans which must be disabled and remove the respective connector from the applicable SCCP cage Span I/O board (Figure 3-2).

Configure Optional Channel Service Units

3

The *M-PATH* 537 Channel Service Unit (CSU) module provides in-band SNMP-managed digital service access to T1 and fractional T1 lines. The *M-PATH* 437 Channel Service Unit (CSU) module provides in-band SNMP-managed digital service access to E1 and fractional E1 lines. CSU modules plug into the CSU shelf (see Figure 3-3).

The CSU shelf can support two *M-PATH* 537 or two *M-PATH 437* CSU modules. A 537 CSU module supports a single T1 span connection. A 437 CSU module supports a single E1 span connection.

Remote *M-PATH* management is available through SNMP over an in-band data link on the span line (using a facility data link or 8-64 Kbps of a DS0 channel). The unit at the near end of the management path can be an SNMP manager or another *M-PATH* CSU.

Programming of the *M-PATH* is accomplished through the DCE 9-pin connector on the front panel of the CSU shelf. Manuals and an *MS Windows* programming disk are supplied with each unit.

For more information refer to *M-PATH* T1 Channel Service Unit User's Guide, *Kentrox* part number 65-77538101 or the *ADC M-PATH* E1 Channel Service Unit User's Guide, *Kentrox* part number 1174139.

Setting the Control Port

Whichever control port is chosen, it must first be configured so the control port switch settings match the communication parameters being used by the control device. If using the rear-panel DTE control port, set the SHELF ADDRESS switch SA5 to "up." If using the rear-panel DCE control port, position the SHELF ADDRESS switch down.

For more information, refer to the 2-Slot Universal Shelf Installation Guide, *Kentrox* part number 65-78070001, the *M-PATH* T1 Channel Service Unit Installation Guide, *Kentrox* part number 65-77538001, or the *M-PATH* E1 Channel Service Unit Installation Guide, *Kentrox* part number 1174662, depending on installed equipment.

Plug one of the cables listed below into the Control Port connectors:

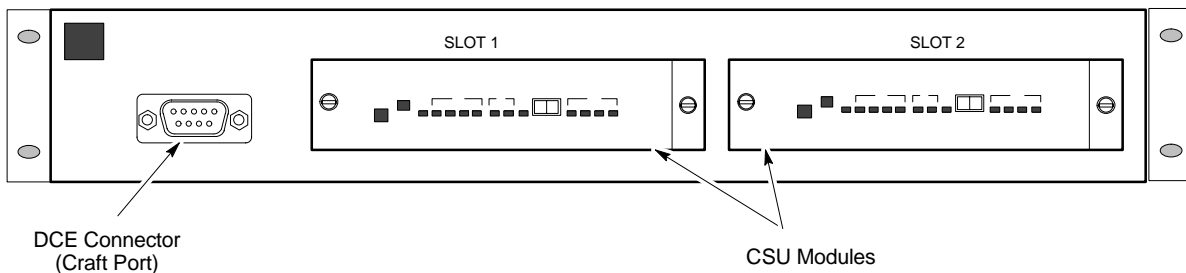| *Part Number*	*Description of Cable*
01-95006-022 (six feet)	DB-9S to DB-9P
01-95010-022 (ten feet)	

The control port cables can be used to connect the shelf to:

　　　　　　　　　　　　　• A PC using the AT 9-pin interface

　　　　　　　　　　　　　• A modem using the 9-pin connector

　　　　　　　　　　　　　• Other shelves in a daisy chain

Figure 3-3: Rear and Front View of CSU Shelf

Rear View

DCE Connector
(Craft Port)

CSU Modules
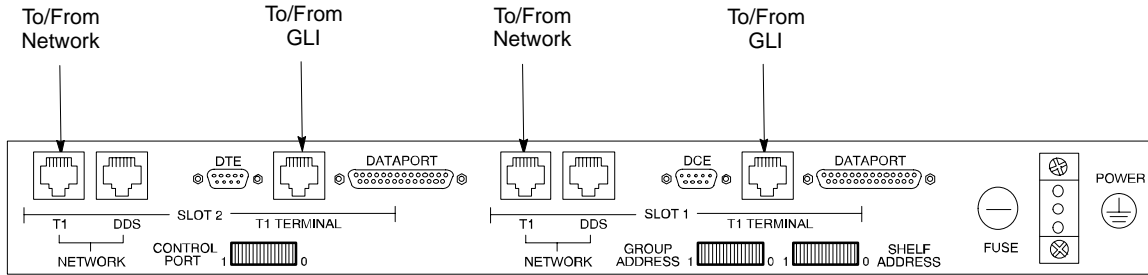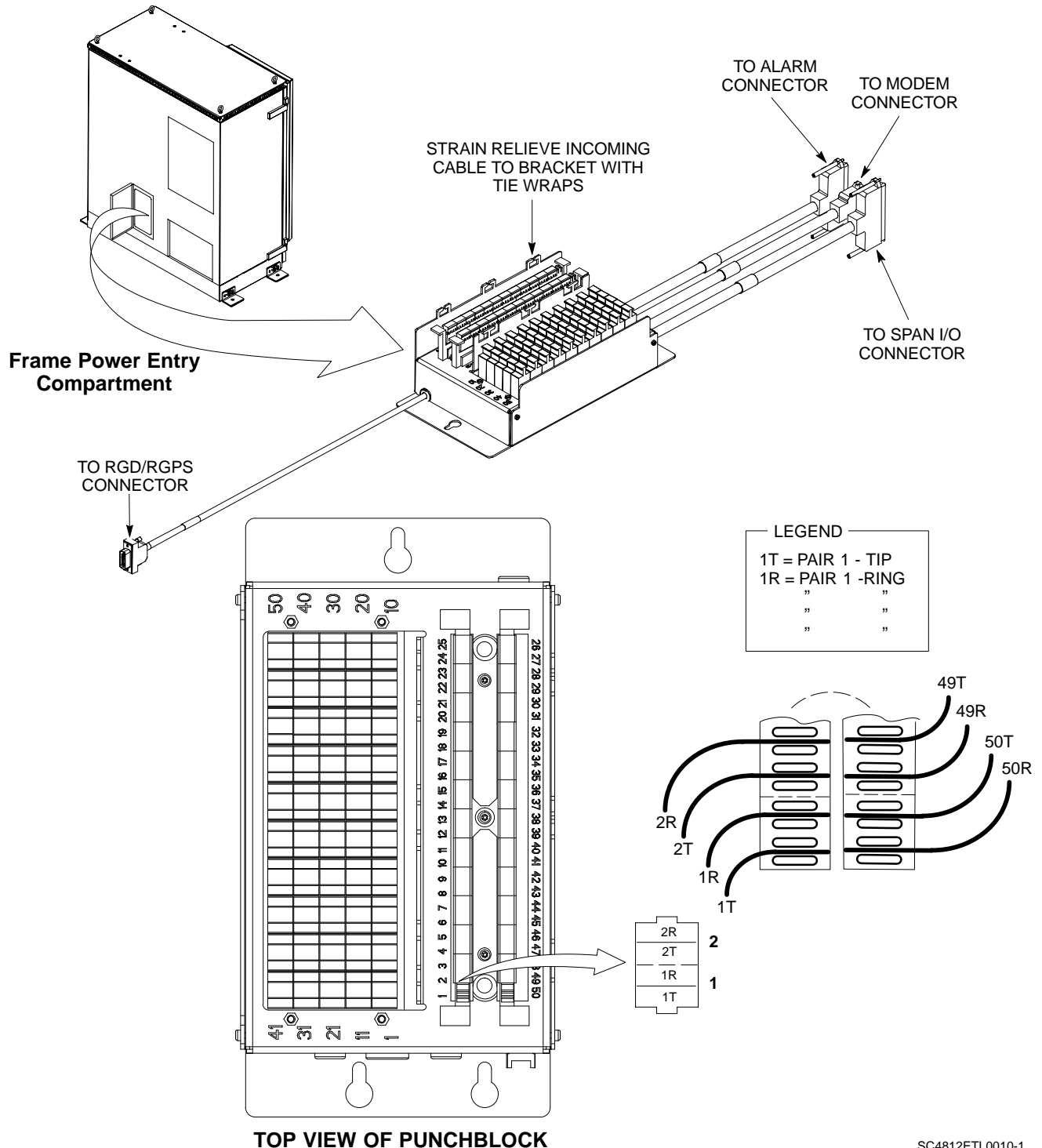
Front View   4812ETL0029-1

Alarm, Span Line, and RGPS Cable Pin/Signal Information

See Figure 3-4 and refer to Table 3-6 for the physical location and punchdown location information for the 50-pair punchblock.

Figure 3-4: 50-Pair Punchblock

TOP VIEW OF PUNCHBLOCK   SC4812ETL0010-1

Table 3-6: Punchdown Location for Stand-alone and Companion Frame 50-Pair Punch Block

Site Component	Signal Name	Punchdown	Color
NOT USED		1T	
		1R	
		2T	
		2R	
		3T	
		3R	
		4T	
		4R	
		5T	
		5R	
		6T	
		6R	
		7T	
LFR/HSO	LFR_HSO_GND	7R	Orange
	EXT_IPPS_POS	8T	Red
	EXT_IPPS_NEG	8R	White
	CAL_+	9T	Red
	CAL_-	9R	Green
	LORAN_ +	10T	Red
	LORAN_ -	10R	Blue
PILOT BEACON	Pilot Beacon Alarm - Minor	11T	
	Pilot Beacon Alarm - Rtn	11R	
	Pilot Beacon Alarm - Major	12T	
	Pilot Beacon Control - NO	12R	
	Pilot Beacon Control-COM	13T	
	Pilot Beacon Control - NC	13R	
CUSTOMER OUTPUTS / INPUTS	Customer Outputs 1 - NO	14T	
	Customer Outputs 1 - COM	14R	
	Customer Outputs 1 - NC	15T	
	Customer Outputs 2 - NO	15R	
	Customer Outputs 2 - COM	16T	
	Customer Outputs 2 - NC	16R	
	Customer Outputs 3 - NO	17T	
	Customer Outputs 3 - COM	17R	
	Customer Outputs 3 - NC	18T	
	Customer Outputs 4 - NO	18R	
	Customer Outputs 4-COM	19T	
	Customer Outputs 4 - NC	19R	
	Customer Inputs 1	20T	
	Cust_Rtn_A_1	20R	
	Customer Inputs 2	21T	
	Cust_Rtn_A_2	21R	
	Customer Inputs 3	22T	
	Cust_Rtn_A_3	22R	
	Customer Inputs 4	23T	
	Cust_Rtn_A_4	23R	
	Customer Inputs 5	24T	
	Cust_Rtn_A_5	24R	
	Customer Inputs 6	25T	
	Cust_Rtn_A_6	25R	
	Customer Inputs 7	26T	
	Cust_Rtn_A_7	26R	
	Customer Inputs 8	27T	
	Cust_Rtn_A_8	27R	
	Customer Inputs 9	28T	
	Cust_Rtn_A_9	28R	
	Customer Inputs 10	29T	
	Cust_Rtn_A_10	29R	

3

Table 3-6: Punchdown Location for Stand-alone and Companion Frame 50-Pair Punch Block

Site Component	Signal Name	Punchdown	Color
SPAN	RCV_TIP_A	30T	Red/Bk
	RCV_RING_A	30R	Red
	XMIT_TIP_A	31T	White/Bk
	XMIT_RING_A	31R	White
	RCV_TIP_B	32T	Green/Bk
	RCV_RING_B	32R	Green
	XMIT_TIP_B	33T	Blue/Bk
	XMIT_RING_B	33R	Blue
	RCV_TIP_C	34T	Yellow/Bk
	RCV_RING_C	34R	Yellow
	XMIT_TIP_C	35T	Brown/Bk
	XMIT_RING_C	35R	Brown
	RCV_TIP_D	36T	Orange/Bk
	RCV_RING_D	36R	Orange
	XMIT_TIP_D	37T	Violet/Bk
	XMIT_RING_D	37R	Violet
	RCV_TIP_E	38T	Gray/Bk
	RCV_RING_E	38R	Gray
	XMIT_TIP_E	39T	Pink/Bk
	XMIT_RING_E	39R	Pink
	RCV_TIP_F	40T	Tan/Bk
	RCV_RING_F	40R	Tan
	XMIT_TIP_F	41T	Bk/White
	XMIT_RING_F	41R	Bk
RGPS	For Frames *without* RGD Expansion (20-pair) Punchblock See **Table 3-7** For Frames *with* RGD Expansion (20-pair) Punchblock See **Table 3-8**	42T	
		42R	
		43T	
		43R	
		44T	
		44R	
		45T	
		45R	
		46T	
		46R	
		47T	
		47R	
Phone Line	Telco_Modem_T	48T	
	Telco_Modem_R	48R	
Miscellaneous	Chassis Ground	49T	Cable Drain
	Reserved	49R	
	Reserved	50T	
	Reserved	50R	

Table 3-7: 50-Pair Punch Block RGPS Punchdown Location for RGPS *Non-Expansion* Frames (Input from RGPS Receiver) and *Secondary* RGPS Expansion Frames (Input from RGPS Expansion Primary Frame 20-pair Punchblock)

Site Component	Signal Name	Punchdown	Color

Table 3-7: 50-Pair Punch Block RGPS Punchdown Location for
RGPS *Non-Expansion* Frames (Input from RGPS Receiver)
and
Secondary RGPS Expansion Frames
(Input from RGPS Expansion Primary Frame 20-pair Punchblock)

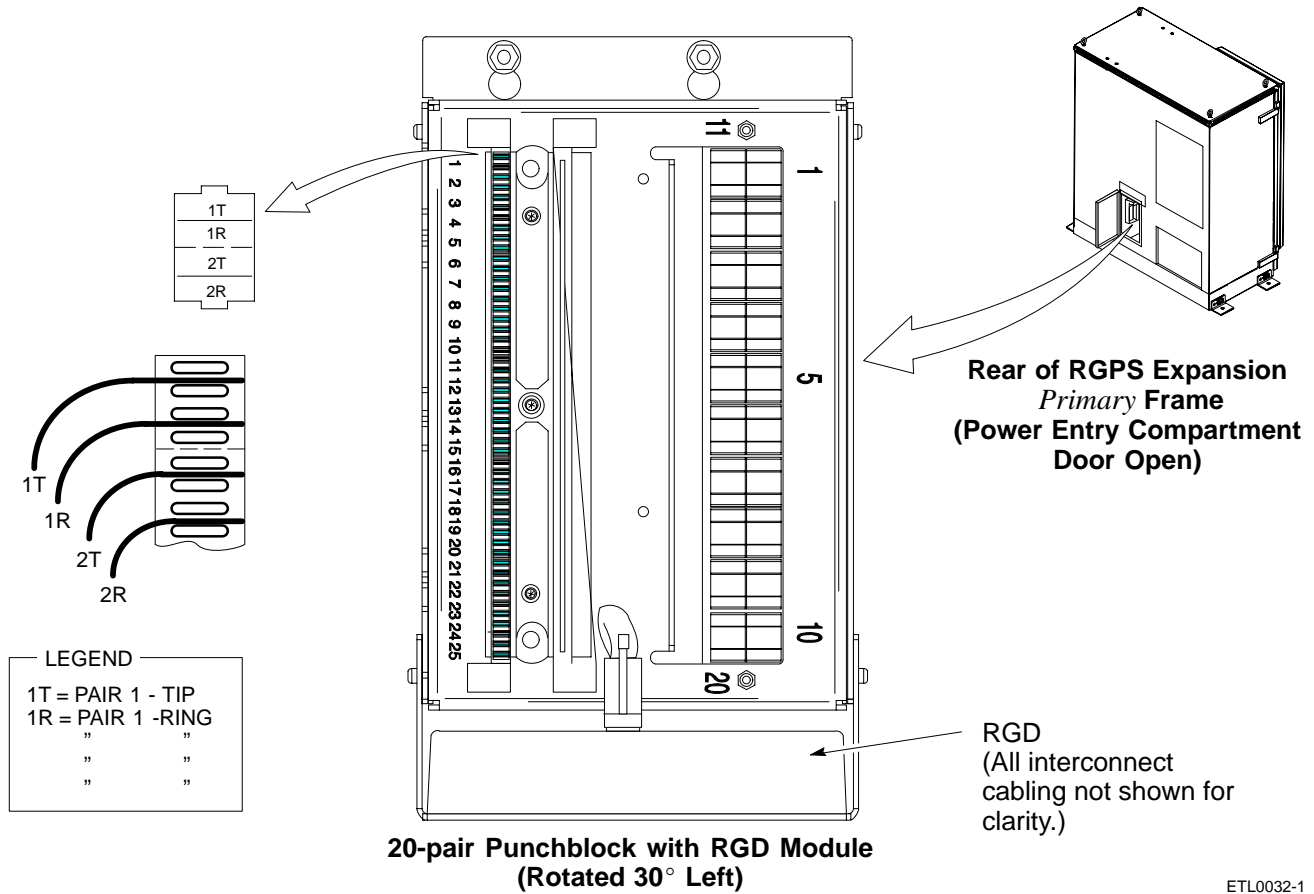| Site Component	Signal Name	Punchdown	Color
RGPS **For frames without RGD Expansion (20-pair) Punchblock**	GPS_POWER_A+	42T	Yellow
	GPS_POWER_A-	42R	Yellow/Bk
	GPS_POWER_B+	43T	Blue
	GPS_POWER_B-	43R	Blue/Bk
	GPS_TX+	44T	White
	GPS_TX-	44R	White/Bk
	GPS_RX+	45T	Green
	GPS_RX-	45R	Green/Bk
	Signal Ground	46T	Red
	Master Frame	46R	Red/Bk
	GPS_1pps+	47T	Brown
	GPS_1pps-	47R	Brown/Bk

Table 3-8: 50-Pair Punch Block RGPS Punchdown Location for
RGPS Expansion *Primary* Frame
(Input from RGPS Receiver)

Site Component	Signal Name	Punchdown	Color
RGPS **For frames with RGD Expansion (20-pair) Punchblock**	GPS_POWER_A+	42T	Yellow
	GPS_POWER_A-	42R	Yellow/Bk
	GPS_POWER_B+	43T	Blue
	GPS_POWER_B-	43R	Blue/Bk
	GPS_TX+	44T	Green
	GPS_TX-	44R	Green/Bk
	GPS_RX+	45T	White
	GPS_RX-	45R	White/Bk
	Signal Ground	46T	Red
	Master Frame	46R	Red/Bk
	GPS_1pps+	47T	Brown
	GPS_1pps-	47R	Brown/Bk

Remote GPS Distribution Punchdown Information

See Figure 3-5 and refer to Table 3-9 for the physical location and RGPS distribution 20-pair punchblock punchdown information for the RGPS distribution cabling to the the RGPS expansion *secondary* frame.

Figure 3-5: 20-pair Punchblock with RGD Module Punchdowns

LEGEND

1T = PAIR 1 - TIP
1R = PAIR 1 -RING
"   "
"   "
"   "

Rear of RGPS Expansion
Primary **Frame**
(Power Entry Compartment
Door Open)

RGD
(All interconnect
cabling not shown for
clarity.)

20-pair Punchblock with RGD Module
(Rotated 30° Left)

ETL0032-1

| **Table 3-9:** 20-Pair Punch Block RGPS EXP(ansion) 1 Punchdown Location for RGPS Expansion Output to *Secondary* Frame (Input from RGPS Receiver Through *Primary* Frame 50-pair Punchblock)			
Site Component	**Signal Name**	**Punchdown**	**Color**
	GPS_POWER_A+	1T	Yellow
	GPS_POWER_A-	1R	Yellow/Bk
	GPS_POWER_B+	2T	Blue
	GPS_POWER_B-	2R	Blue/Bk
	GPS_RX+	3T	Green
	GPS_RX-	3R	Green/Bk
RGPS	GPS_TX+	4T	White
	GPS_TX-	4R	White/Bk
	Signal Ground	5T	Red
	Master Frame	5R	Red/Bk
	GPS_1pps+	6T	Brown
	GPS_1pps-	6R	Brown/Bk
	Chassis Ground	19T	Cable Drain

LMF to BTS Connection

Connect the LMF to the BTS

The LMF computer may be connected to the LAN A or B connector located behind the frame lower air intake grill. Figure 3-6 below shows the general location of these connectors. LAN A is considered the primary LAN.

3

Table 3-10: Connecting the LMF to the BTS	
Step	**Action**
1	To gain access to the LAN connectors, open the LAN cable and utility shelf access panel, then *pull apart the hook-and-loop fabric covering the BNC "T" connector* (see Figure 3-6). If desired, slide out the utility shelf for the LMF computer.
2	Connect the LMF computer to the LAN A (left-hand) BNC connector via PCMCIA Ethernet Adapter. **NOTE** Xircom Model PE3-10B2 or equivalent can also be used to interface the LMF Ethernet connection to the BTS frame connected to the PC parallel port, powered by an external AC/DC transformer. In this case, *the BNC cable must not exceed three feet in length*. *** IMPORTANT** The LAN shield is isolated from chassis ground. The LAN shield (exposed portion of BNC connector) **must not touch the chassis** during optimization.

Figure 3-6: LMF Connection Detail
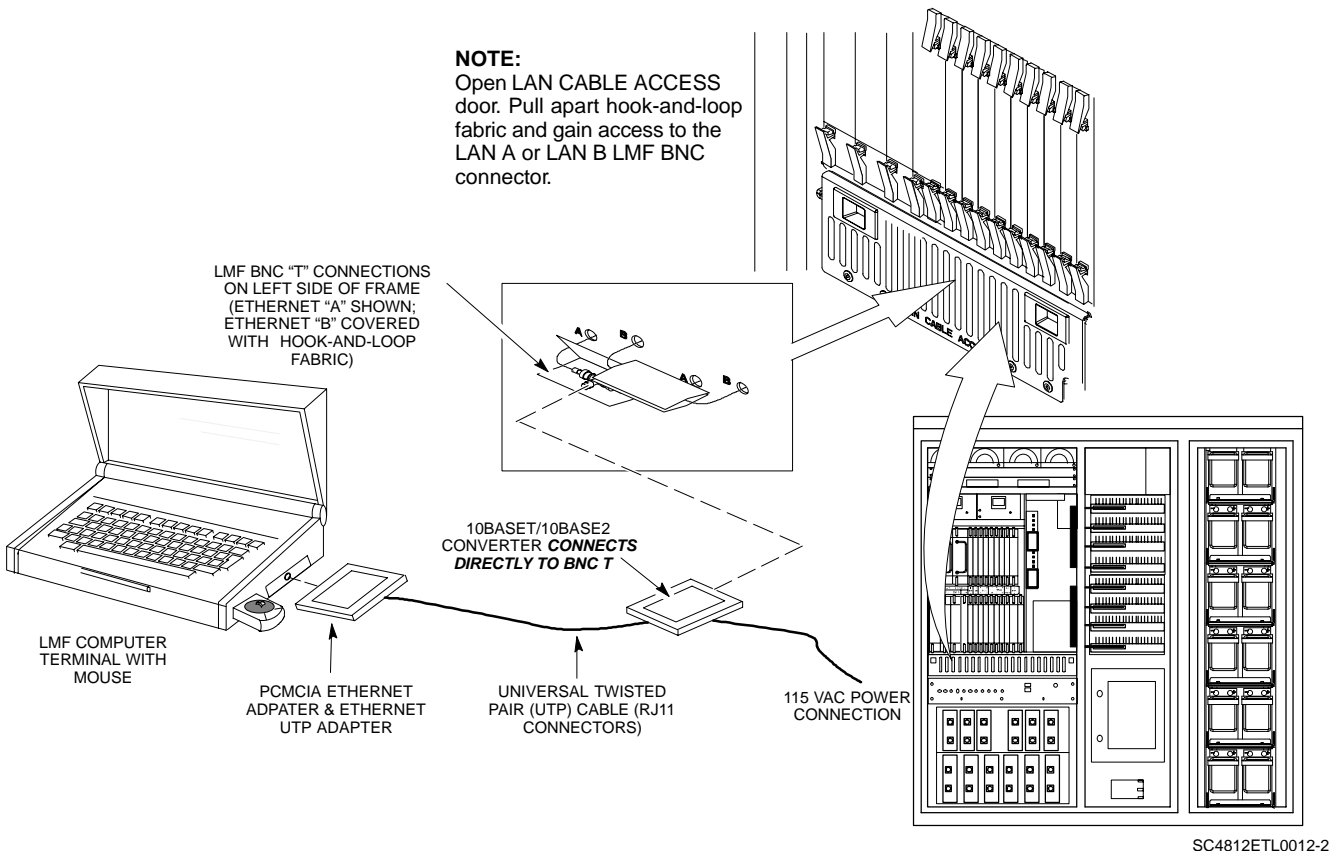
Using the LMF

Basic LMF Operation

LMF Coverage in This Publication - The LMF application program supports maintenance of both CDMA and SAS BTSs. All references to the LMF in this publication are to the CDMA portion of the program.

Operating Environments - The LMF application program allows the user to work in the two following operating environments which are accessed using the specified desktop icons:

- Graphical User Interface (GUI) using the **WinLMF** icon
- Command Line Interface (CLI) using the **WinLMF CDMA CLI** icon

The GUI is the *primary* optimization and acceptance testing operating environment. The CLI environment provides additional capability to the user to perform manually controlled acceptance tests and audit the results of optimization and calibration actions.

Basic Operation - Basic operation of the LMF in either environment includes performing the following:

- Selecting and deselecting BTS devices
- Enabling devices
- Disabling devices
- Resetting devices
- Obtaining device status

The following additional basic operation can be performed in a GUI environment:

- Sorting a status report window

For detailed information on performing these and other LMF operations, refer to the *LMF Help function on-line documentation*.

NOTE	*Unless otherwise noted*, LMF procedures in this manual are performed using the GUI environment.

The LMF Display and the BTS

BTS Display - When the LMF is logged into a BTS, a frame tab is displayed for each RF modem frame (RFMF). For SC4812-series BTSs, the BTS frames are considered the RFMFs. The frame tab will be labeled with "CDMA" and the BTS number, a dash, and the frame number (for example, **BTS-812-1** for BTS 812, RFMF 1). If, as with a single-frame SC4812ET Lite, there is only one frame for the BTS, there will only be one tab.

CDF Requirements - For the LMF to recognize the devices installed in the BTS, a BTS CDF file which includes equipage information for all the devices in the BTS must be located in the applicable *<x>***:***<lmf home directory>***\cdma\bts-#** folder. To provide the necessary channel assignment data for BTS operation, a CBSC CDF file which includes channel data for all BTS RFMFs is also required in the folder.

RFDS Display - If an RFDS is included in the CDF file, an **RFDS** tab labeled with "RFDS," a dash and the BTS number-frame number combination (for example, **RFDS-812-1**) will be displayed.

Logging Into a BTS

Logging into a BTS establishes a communication link between the BTS and the LMF. An LMF session can be logged into only one BTS at a time.

Prerequisites

Before attempting to log into a BTS, ensure the following have been completed:

- The LMF is correctly installed on the LMF computer.

- A *bts-nnn* folder with the correct CDF and CBSC files exists.

- The LMF computer was connected to the BTS before starting the *Windows* operating system and the LMF software. If necessary, restart the computer after connecting it to the BTS in accordance with Table 3-10 and Figure 3-6.

CAUTION	Be sure that the correct **bts-#.cdf** and **cbsc-#.cdf** file is used for the BTS. These should be the CDF files that are provided for the BTS by the CBSC. Failure to use the correct CDF files can result in invalid optimization. **Failure to use the correct CDF files to log into a live (traffic-carrying) site can shut down the site.**

BTS Login from the GUI Environment

Follow the procedures in Table 3-11 to log into a BTS when using the GUI environment.

✓	Step	Action
		Table 3-11: BTS GUI Login Procedure

	1	Start the LMF GUI environment by double-clicking on the WinLMF desktop icon (if the LMF is not running).
		
		   - An LMF window will open and display the LMF build number in the title bar.
		
		NOTE
		If a warning similar to the following is displayed, select **No**, shut down other LMF sessions which may be running, and start the LMF GUI environment again:
		
		`The CLI handler is already running.`
		`This may cause conflicts with the LMF.`
		`Are you sure you want to start the application?`
		
		               Yes No

	2	Click on **Login** tab (if not displayed).

✔	Step	Action
		Table 3-11: BTS GUI Login Procedure
	3	Double click on **CDMA** (in the **Available Base Stations** pick list).
	4	Click on the desired BTS number.
	5	Click on the **Network Login** tab (if not already in the forefront).
	6	Enter correct IP address (normally **128.0.0.2**) for a field BTS, if not correctly displayed in the **IP Address** box.
	7	Type in the correct IP Port number (normally **9216**) if not correctly displayed in the **IP Port** box.

	8	Click on **Ping**.
		
		  - If the connection is successful, the **Ping Display** window shows text similar to the following:
		
		`Reply from 128 128.0.0.2: bytes=32 time=3ms TTL=255`
		  - If there is no response the following is displayed:
		
		`128.0.0.2:9216:Timed out`
		If the MGLI fails to respond, reset and perform the ping process again. If the MGLI still fails to respond, typical problems are shorted BNC to inter-frame cabling, open cables, crossed A and B link cables, missing 50-Ohm terminators, or the MGLI itself.

	9	Select the **Multi-channel Preselector** type from the **Multi-channel Preselector** drop-down list (default is **MPC**) to a device corresponding to your BTS configuration, if required. **NOTE** **Use a Tower Top Amplifier** is not applicable to the SC4812ET Lite.
	10	Click on **Login**. (A BTS tab with the BTS and frame numbers is displayed.) **NOTE** • If an attempt is made to log into a BTS that is already logged on, all devices will be gray. • There may be instances where the BTS initiates a log out due to a system error (i.e., a device failure). • If the MGLI is OOS-ROM (blue), it must be downloaded with RAM code before other devices can be seen. • If the MGLI is OOS-RAM (yellow), it must be enabled before other installed devices can be seen.

3

BTS Login from the CLI Environment

Follow the procedures in Table 3-12 to log into a BTS when using the CLI environment.

NOTE	If the CLI and GUI environments are to be used at the same time, the *GUI must be started first and BTS login must be performed from the GUI*. Refer to Table 3-11 to start the GUI environment and log into a BTS.

Table 3-12: BTS CLI Login Procedure		
✔	**Step**	**Action**
	1	Double-click the WinLMF CLI desktop icon (if the LMF CLI environment is not already running).

	2	**NOTE**
		If a BTS was logged into under a GUI session before the CLI environment was started, the CLI session will be logged into the same BTS, and step 2 is not required.
		
		At the /wlmf prompt, enter the following command:
		
		login bts-<*bts#*> **host=**<*host*> **port=**<*port*>
		
		where:
		
		host = MGLI card IP address (defaults to address last logged into for this BTS or 128.0.0.2 if this is first login to this BTS)
		
		port = IP port of the BTS (defaults to port last logged into for this BTS or 9216 if this is first login to this BTS)
		
		A response similar to the following will be displayed:
		
		`LMF>`
		`13:08:18.882 Command Received and Accepted`
		`            COMMAND=login bts-33`
		
		`13:08:18.882 Command In Progress`
		
		`13:08:21.275 Command Successfully Completed`
		`            REASON_CODE="No Reason"`

3

Logging Out

Logging out of a BTS is accomplished differently for the GUI and CLI operating environments.

NOTE	The GUI and CLI environments use the same connection to a BTS. If a BTS is logged into in both the GUI and CLI environments at the same time, logging out of the BTS in either environment will log out of it for both. When either a login or logout is performed in the CLI window, there is no GUI indication that the login or logout has occurred.

3

Logging Out of a BTS from the GUI Environment

Follow the procedure in Table 3-13 to logout of a BTS when using the GUI environment.

<table>
<tr><td colspan="3" align="center">Table 3-13: BTS GUI Logout Procedure</td></tr>
<tr><td>✓</td><td>Step</td><td align="center">Action</td></tr>
<tr><td></td><td>1</td><td>Click on BTS in the BTS menu bar.</td></tr>
<tr><td></td><td>2</td><td>Click the Logout item in the pull-down menu (a Confirm Logout pop-up message will appear).</td></tr>
<tr><td></td><td>3</td><td>Click on Yes (or press the Enter key) to confirm logout. The Login tab will appear.

NOTE
If a logout was previously performed on the BTS from a CLI window running at the same time as the GUI, a Logout Error pop-up message will appear stating the system could not log out of the BTS. When this occurs, the GUI must be exited and restarted before it can be used for further operations.</td></tr>
<tr><td></td><td>4</td><td>If a Logout Error pop-up message appears stating that the system could not log out of the Base Station because the given BTS is not logged in, click OK and proceed to step 5.</td></tr>
<tr><td></td><td>5</td><td>Select File > Exit in the window menu bar, click Yes in the Confirm Logout pop-up, and click OK in the Logout Error pop-up which appears again.</td></tr>
<tr><td></td><td>6</td><td>If further work is to be done in the GUI, restart it.

NOTE
• The Logout item on the BTS menu bar will only log you out of the displayed BTS.

• You can also log out of all BTS sessions and exit LMF by clicking on the File selection in the menu bar and selecting Exit from the File menu list. A Confirm Logout pop-up message will appear.</td></tr>
</table>

Logging Out of a BTS from the CLI Environment
Follow the procedure in Table 3-14 to logout of a BTS when using the CLI environment.

✔	Step	Action
		Table 3-14: BTS CLI Logout Procedure

	1	**NOTE**
		If the BTS is also logged into from a GUI running at the same time and further work must be done with it in the GUI, proceed to step 2.
		
		Log out of a BTS by entering the following command:
		
		logout bts-<*bts#*>
		
		A response similar to the following will be displayed:
		
		`LMF>`
		`13:24:51.028 Command Received and Accepted`
		`          COMMAND=logout bts-33`
		
		`13:24:51.028 Command In Progress`
		
		`13:24:52.04  Command Successfully Completed`
		`          REASON_CODE="No Reason"`

	2	If desired, close the CLI interface by entering the following command: **exit** A response similar to the following will be displayed before the window closes: `Killing background processes....`

Establishing an MMI Communication Session

Equipment Connection - Figure 3-7 illustrates common equipment connections for the LMF computer. For specific connection locations on FRUs, refer to the illustration accompanying the procedures which require the MMI communication session.

Initiate MMI Communication - For those procedures which require MMI communication between the LMF and BTS FRUs, follow the procedures in Table 3-15 to initiate the communication session.

Step	Action
	Table 3-15: Establishing MMI Communication
1	Connect the LMF computer to the equipment as detailed in the applicable procedure which requires the MMI communication session.
2	If the LMF computer has only one serial port (COM1) and the LMF is running, disconnect the LMF from COM1 by performing the following:
2a	- Click on **Tools** in the LMF window menu bar, and select **Options** from the pull-down menu list. -- An **LMF Options** dialog box will appear.

Table 3-15: Establishing MMI Communication	
Step	**Action**
2b	- In the **LMF Options** dialog box, click the **Disconnect Port** button on the **Serial Connection** tab.
3	Start the named HyperTerminal connection for MMI sessions by double clicking on its *Windows* desktop shortcut. **NOTE** If a *Windows* desktop shortcut was not created for the MMI connection, access the connection from the *Windows* Start menu by selecting: **Programs > Accessories > Hyperterminal > HyperTerminal > *<Named HyperTerminal Connection (e.g., MMI Session)>***
4	Once the connection window opens, establish MMI communication with the BTS FRU by pressing the LMF computer Enter key until the prompt identified in the applicable procedure is obtained.

3

Figure 3-7: LMF Computer Common MMI Connections
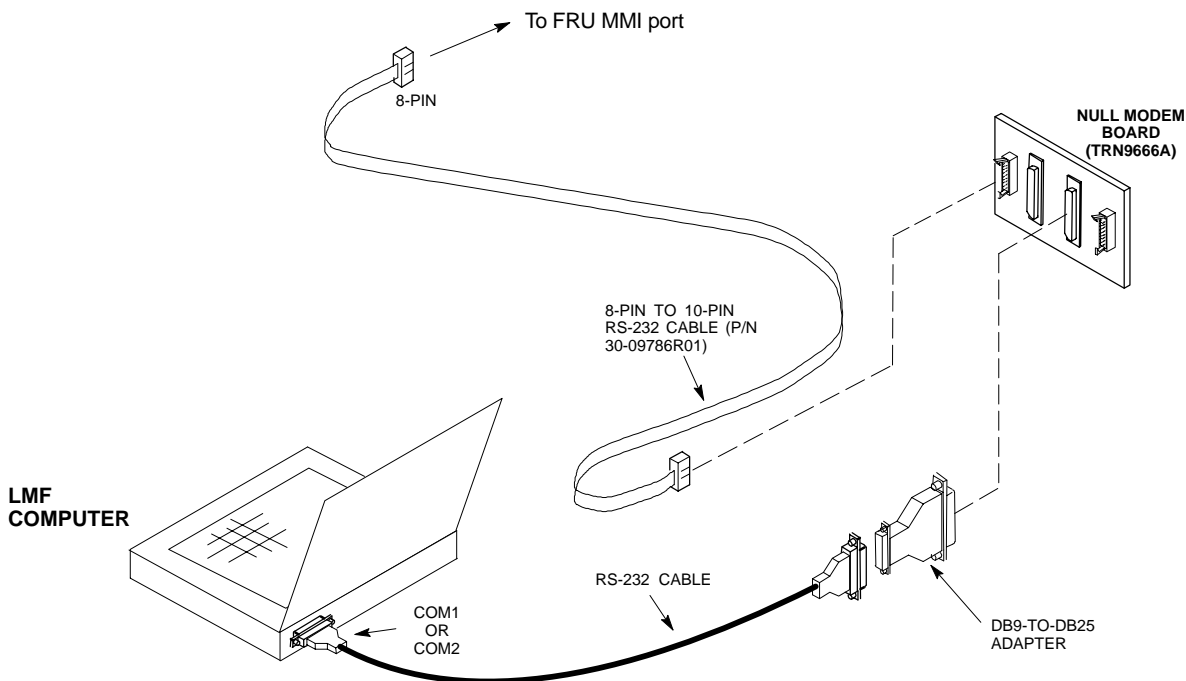
Online Help

Task oriented online help is available in the LMF by clicking on **Help** in the window menu bar, and selecting **LMF Help** from the pull-down menu.

# Pinging the Processors

Pinging the BTS

For proper operation, the integrity of the Ethernet LAN A and B links must be verified. Figure 3-8 represents a typical BTS Ethernet configuration for an SC4812ET Lite stand-alone or companion frame. The drawing depicts cabling and termination for both the A and B LANs.

Ping is a program that sends request data packets to hosts on a network, in this case GLI modules on the BTS LAN, to obtain a response from the "target" host specified by an IP address.

Follow the steps in Table 3-16 to ping each processor (on both LAN A and LAN B) and verify LAN redundancy is working properly.

CAUTION	Always wear an approved anti-static wrist strap while handling any circuit card/module to prevent damage by Electro-Static Discharge (ESD).

Figure 3-8: BTS Ethernet LAN Termination Diagram
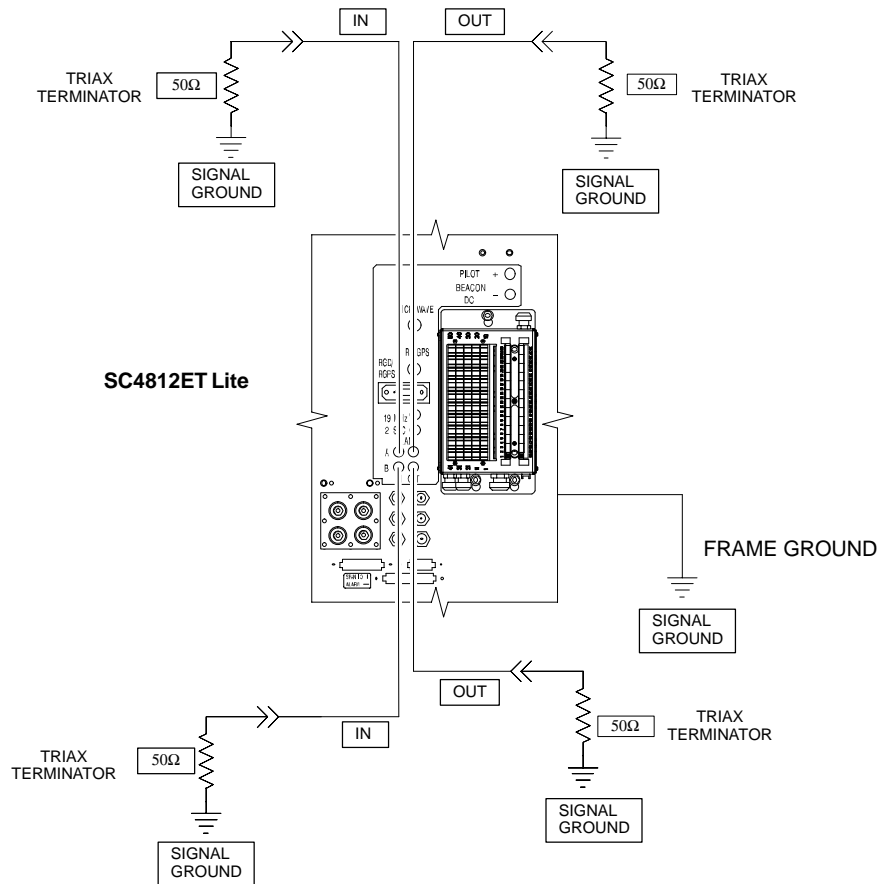
SC4812ETL0013-5

NOTE	The Ethernet LAN A and B cables and/or terminations must be installed on each frame/enclosure external LAN connector before performing this test. All other processor board LAN connections are made through the backplanes.

<table>
<tr><td colspan="2" align="center">Table 3-16: Pinging the Processors</td></tr>
<tr><td align="center">Step</td><td align="center">Action</td></tr>
<tr><td>1</td><td>If this is a <i>first-time communication</i> with a newly-installed frame <i>or</i> a GLI card which has been replaced, <i>perform the procedure in</i> Table 6-3 and then return to step 2.</td></tr>
<tr><td>2</td><td>Be sure any uncabled LAN A and B IN and OUT connectors in the power entry compartment (rear of frame - Figure 3-4 and Figure 3-8) are terminated with 50 Ω loads.</td></tr>
<tr><td>3</td><td><i>If it has not already been done</i>, connect the LMF computer to the BTS (refer to Table 3-10 and Figure 3-6.)</td></tr>
<tr><td>4</td><td><i>If it has not already been done</i>, start a <i>GUI</i> LMF session and log into the BTS (refer to Table 3-11).</td></tr>
<tr><td>5</td><td>In the power entry compartment, remove the 50Ω termination on the frame LAN B IN connector.

- The LMF session should remain active.</td></tr>
<tr><td>6</td><td>Replace the 50Ω terminator on the BTS frame LAN B IN connector.</td></tr>
<tr><td>7</td><td>From the <i>Windows</i> desktop, click the Start button and select Run.</td></tr>
<tr><td>8</td><td>In the Open box, type <code>ping</code> and the MGLI IP address (for example, <code>ping 128.0.0.2</code>).

NOTE
128.0.0.2 is the default IP address for the GLI card in slot GLI-1 in field BTS units.</td></tr>
<tr><td>9</td><td>Click on OK.</td></tr>
<tr><td>10</td><td>If the targeted module responds, a DOS window will appear with a display similar to the following:

<code>Reply from 128.0.0.2: bytes=32 time=3ms TTL=255</code>

- If the device responds, <i>proceed to step 18</i>.

If there is no response, the following is displayed:

<code>Request timed out</code>

- If the GLI fails to respond, it should be reset and re-pinged. If it still fails to respond, typical problems would be: failure of the LMF to login, shorted BNC-to-inter-frame cabling, open cables, crossed A and B link cables, or the GLI itself.</td></tr>
<tr><td>11</td><td>Logout of the BTS as described in Table 3-13, exit from the LMF program, and restart the <i>Windows</i> operating system on the LMF computer.</td></tr>
<tr><td>12</td><td>Restart the LMF <i>GUI</i> program as described in <i>LMF Help function on-line documentation</i>, and log into the BTS as described in Table 3-11.</td></tr>
<tr><td>13</td><td>Perform steps 7 through 10 again.

- If the device responds, <i>proceed to step 18</i>.

If there is still no response, <i>proceed to step 14</i>.</td></tr>
</table>

Step	Action
	Table 3-16: Pinging the Processors
14	If ping was unsuccessful after restarting the LMF computer, press the MGLI front panel reset pushbutton and perform steps 7 through 10 again. **NOTE** *Refer to Table 6-1 if ping was unsuccessful after resetting the MGLI.*
15	After the BTS has been successfully pinged, be sure the 50Ω termination was replaced on the BTS frame LAN B IN connector in the power entry compartment (Figure 3-8). Disconnect the LMF cable from the LAN shelf LAN A connector, and connect it to LAN B (right-hand connector) (refer to Figure 3-6).
16	In the power entry compartment, remove the 50Ω termination on the BTS frame LAN A IN connector.
17	Repeat steps 5 through 9 using LAN B.
18	After the BTS has been successfully pinged on the secondary LAN, replace the 50Ω termination on the frame LAN A IN connector in the power entry compartment.
19	Disconnect the LMF cable from the LAN shelf LAN B and connect it to LAN A.
20	Remove and replace the 50Ω termination on the LAN B IN connector to force the MGLI to switch to primary LAN A.
21	Repeat steps 5 through 9 to ensure proper primary LAN operation.

3

Download the BTS

Overview

Before a BTS can operate, each equipped device must contain device initialization (ROM) code. ROM code is loaded in all devices during manufacture, factory repair, or, for software upgrades, from the CBSC using the DownLoad Manager (DLM). Device application (RAM) code and data must be downloaded to each equipped device by the user before the BTS can be made fully functional for the site where it is installed.

ROM Code

Downloading ROM code to BTS devices from the LMF is *NOT routine maintenance or a normal part of the optimization process.* It is only done in unusual situations where the resident ROM code release level in the device is not compatible with the required release level of the site operating software *and* the CBSC can not communicate with the BTS to perform the download. An example would be a BTS loaded with R16.0 software where a GLI which is factory-loaded with R9.2.x or earlier ROM code must be installed to replace a malfunctioning GLI.

Before ROM code can be downloaded from the LMF, the correct ROM code file for each device to be loaded must exist on the LMF computer. ROM code *must be manually selected* for download.

NOTE	The ROM code file is not available for GLI3s. GLI3s are ROM code loaded at the factory.

ROM code can be downloaded to a device that is in any state. After the download is started, the device being downloaded will change to OOS_ROM (blue). The device will remain OOS_ROM (blue) when the download is completed. A *compatible revision-level* RAM code must then be downloaded to the device. Compatible code loads for ROM and RAM must be used for the device type to ensure proper performance. The compatible device code release levels for the BSS software release being used are listed in the Version Matrix section of the SC™ CDMA Release Notes (supplied on the tape or CD-ROM containing the BSS software).

Procedures to load ROM code are located in Appendix G.

RAM Code

Before RAM code can be downloaded from the LMF, the correct RAM code file for each device must exist on the LMF computer. RAM code can be automatically or manually selected depending on the **Device** menu item chosen and where the RAM code file for the device is stored in the LMF file structure. The RAM code file will be selected automatically if the file is in the *<x>:\<lmf home directory>\cdma\loads\n.n.n.n\code* folder (where *n.n.n.n* is the download code version number that matches the "NextLoad" parameter of the CDF file). The RAM code file in the code folder must have the correct hardware bin number for the device to be loaded.

RAM code can be downloaded to a device that is in any state. After the download is started, the device being loaded will change to OOS_ROM (blue). When the download is completed successfully, the device will change to OOS_RAM (yellow).

When code is downloaded to an MGLI or GLI, the LMF automatically also downloads data and then enables the MGLI. When enabled, the MGLI will change to INS_ACT (bright green). A redundant GLI will not be automatically enabled and will remain OOS_RAM (yellow). When the redundant GLI is manually commanded to enable through the LMF, it will change state to INS_SBY (olive green).

For non-GLI devices, data must be downloaded after RAM code is downloaded. To download data, the device state must be OOS_RAM (yellow).

The devices to be loaded with RAM code and data are:

- Master Group Line Interface (MGLI)
- Redundant GLI
- Clock Synchronization Module (CSM) (*Only if new revision code must be loaded*)
- Multi Channel CDMA (MCC24E, MCC8E, or MCC-1X) cards
- Broadband Transceiver (BBX2 or BBX-1X) cards
- RFDS Test Subscriber Interface Card (TSIC) or RFDS-1X RFDS PROCessor (RPROC) card, if RFDS is installed

NOTE	The MGLI *must* be successfully downloaded with RAM code and data, and in INS_ACT (bright green) status *before* downloading any other device. The RAM code download process for an MGLI automatically downloads data and then enables the MGLI.

Verify GLI ROM Code Loads

Devices should not be loaded with a RAM code version which is not compatible with the ROM code with which they are loaded. Before downloading RAM code and data to the processor cards, follow the procedure in Table 3-17 to verify the GLI devices are loaded with the correct ROM code for the software release used by the BSS.

Prerequisite

Identify the correct GLI ROM code load for the software release being used on the BSS by referring to the Version Matrix section of the SC™ CDMA Release Notes (supplied on the tapes or CD-ROMs containing the BSS software).

Table 3-17: Verify GLI ROM Code Loads	
Step	**Action**
1	*If it has not already been done*, start a *GUI* LMF session and log into the BTS (refer to Table 3-11).
2	Select all GLI devices by clicking on them, and select **Device > Status** from the BTS menu bar.
3	In the status report window which opens, note the number in the **ROM Ver** column for each GLI2.
4	If the ROM code loaded in the GLIs is *not* the correct one for the software release being used on the BSS, perform the following:

Table 3-17: Verify GLI ROM Code Loads	
Step	**Action**
4a	- Log out of the BTS as described in Table 3-13 or Table 3-14, as applicable.
4b	- Disconnect the LMF computer.
4c	- Reconnect the span lines as described in Table 5-7.
4d	- Have the CBSC download the correct ROM code version to the BTS devices.
5	When the GLIs have the correct ROM load for the software release being used, be sure the span lines are disabled as outlined in Table 3-5 and proceed to downloading RAM code and data.

3

Download RAM Code and Data to MGLI and GLI

Follow the steps outlined in Table 3-18 to download the RAM code and data to the MGLI and other installed GLI devices.

Prerequisites

- Prior to performing these procedures, ensure a code file exists for each of the devices to be loaded (refer to Table 3-3).

- The LMF computer is connected to the BTS (refer to Table 3-10), and is logged in using the *GUI* environment (refer to Table 3-11).

Table 3-18: Download and Enable MGLI and GLI Devices	
Step	**Action**
1	Be sure the LMF will use the correct software release for code and data downloads by performing the following steps:
1a	- Click on **Tools** in the LMF menu bar, and select **Update NextLoad > CDMA** from the pull-down menus.
1b	- Click on the BTS to be loaded. -- The BTS will be highlighted.
1c	- Click the button next to the correct code version for the software release being used. -- A black dot will appear in the button circle.
1d	- Click **Save.**
1e	- Click **OK** to close each of the advisory boxes which appear.
2	Prepare to download code to the MGLI by clicking on the device.
3	Click **Device** in the BTS menu bar, and select **Download > Code/Data** in the pull-down menus. - A status report is displayed confirming change in the device(s) status.
4	Click **OK** to close the status window. - The MGLI will automatically be downloaded with data and enabled.
5	Once the MGLI is enabled, load and enable additional installed GLIs by clicking on the devices and repeating steps 3 and 4.
6	Click **OK** to close the status window for the additional GLI devices.

Download RAM Code and Data to Non-GLI Devices

Downloads to non-GLI devices can be performed individually for each device or all installed devices can be downloaded with one action.

NOTE	- CSM devices are RAM code-loaded at the factory. RAM code is downloaded to CSMs *only if a newer software version needs to be loaded*.
	- When downloading to multiple devices, the download may fail for some of the devices (a time-out occurs). These devices can be loaded individually after completing the multiple download.

Follow the steps in Table 3-19 to download RAM code and data to non-GLI devices.

Table 3-19: Download RAM Code and Data to Non-GLI Devices	
Step	**Action**
1	Select the target CSM, MCC, and/or BBX device(s) by clicking on them.
2	Click **Device** in the BTS menu bar, and select **Download > Code/Data** in the pull-down menus. - A status report is displayed that shows the results of the download for each selected device.
3	Click **OK** to close the status report window when downloading is completed. **NOTE** After a BBX, CSM, or MCC device is successfully loaded with RAM code and data have changed to the OOS_RAM state (yellow), the status LED should be rapidly flashing GREEN.

BBX Cards Remain OOS_ROM

If BBX cards remain OOS_ROM (blue) after power-up or following code load, refer to Table 6-7, steps 8 and 9.

Selecting CSM Clock Source and Enabling CSMs

CSMs must be enabled prior to enabling the MCCs. Procedures in the following two sub-sections cover the actions to accomplish this. For additional information on the CSM sub-system, see "Clock Synchronization Manager (CSM) Sub-system Description" in the CSM System Time - GPS & LFR/HSO Verification section of this chapter.

Select CSM Clock Source - A CSM can have three different clock sources. The Select CSM Source function can be used to select the clock source for each of the three inputs. This function is only used if the clock source for a CSM needs to be changed. The Clock Source function provides the following clock source options:

- Local GPS
- Mate GPS
- Remote GPS
- HSO (only for source 2 & 3)
- HSO Extender

- LFR (only for source 2 & 3)
- 10 MHz (only for source 2 & 3)
- NONE (only for source 2 & 3)

Prerequisites

- MGLI is INS_ACT (bright green)
- CSM is OOS_RAM (yellow) or INS_ACT (bright green)

Step	Action
	Table 3-20: Select CSM Clock Source
1	Display the CSM cage view in the LMF by clicking on the CSM area of the SCCP shelf in the picture of the BTS frame.
2	When the CSM cage view replaces the GLI/MCC/BBX view, click on the CSM(s) for which the clock source is to be selected.
3	Click on **Device** in the BTS menu bar, and select **CSM/MAWI > Select Clock Source...** in the pull-down menu list. - A CSM clock reference source selection window will appear.
4	Select the applicable clock source in the **Clock Reference Source** pick lists. Uncheck the related check boxes for Clock Reference Sources 2 and 3 if you do not want the displayed pick list item to be used.
5	Click on the **OK** button. - A status report is displayed showing the results of the operation.
6	Click on the **OK** button to close the status report window.

NOTE	For RF-GPS, verify the CSM configured with the GPS receiver "daughter board" is installed in the SCCP shelf CSM 1 slot before continuing.

Enable CSMs - Follow the steps outlined in Table 3-21 to enable the CSMs installed in the SCCP shelves.

Step	Action
	Table 3-21: Enable CSMs
1	**NOTE** If equipped with two CSMs, enable card in slot CSM 2 first. Click on the target CSM.
2	Click on **Device** in the BTS menu bar, and select **Enable** in the pull-down menu list. - A status report is displayed showing the results of the enable operation.

3

Table 3-21: Enable CSMs		
Step	**Action**	
3	Click **OK** to close the status report window. **NOTE** • The board in slot CSM 1 interfaces with the GPS receiver (either on-board or remote). The enable sequence for this board can take up to *one hour* (see below). • FAIL may be shown in the status report table for a slot CSM 1 enable action. If Waiting For Phase Lock is shown in the Description field, do not cancel the enable process. The CSM will change to the Enabled state after phase lock is achieved.
	NOTE The GPS satellite system satellites are not in a geosynchronous orbit and are maintained and operated by the United States Department of Defense (DOD). The DOD periodically alters satellite orbits; therefore, satellite trajectories are subject to change. A GPS receiver that is INS contains an ephemeris (satellite position table) that is updated periodically to take these changes into account. If a GPS receiver has not been updated for a number of weeks, it may take up to an hour for the GPS receiver ephemeris to be updated. Once updated, the GPS receiver must track at least four satellites and obtain (hold) a 3-D position fix for a minimum of 45 seconds before the CSM will come in service. (In some cases, the GPS receiver needs to track only one satellite, depending on accuracy mode set during the data load).
	NOTE • If two CSMs are installed and the board in slot CSM 1 has enabled, the LMF CSM cage view should show slot CSM 1 as bright green (INS-ACT) and slot CSM 2 as olive green (INS-SBY) • If more than an hour has passed without the board in slot CSM 1 enabling, refer to the CSM System Time - GPS & LFR/HSO Verification section of this chapter (see Table 3-23, Figure 3-9, and Table 3-24) to determine the cause.
4	After CSMs have been successfully enabled, be sure the PWR/ALM LEDs are steady green (alternating green/red indicates the card is in an alarm state).

Enable MCCs

This procedure configures the MCC and sets the "tx fine adjust" parameter. The "tx fine adjust" parameter is not a transmit gain setting, but a timing adjustment that compensates for the processing delay in the BTS (approximately 3 μS).

Follow the steps outlined in Table 3-22 to enable the MCCs installed in the SCCP shelves.

NOTE	The MGLI and CSM must be downloaded and enabled, prior to downloading and enabling an MCC.

3

Table 3-22: Enable MCCs

Step	Action
1	If the GLI/MCC/BBX view is not displayed in the LMF window, click on the GLI/MCC/BBX area of the SCCP shelf.
2	Click on the target MCC(s), or click on **Select** in the BTS menu bar, and select **MCCs** in the pull-down menu list.
3	click on **Device** in the BTS menu bar, and select **Enable** in the pull-down menu list. - A status report is displayed showing the results of the enable operation.
4	Click **OK** to close the status report window.

CSM System Time - GPS & LFR/HSO Verification

Clock Synchronization Manager (CSM) Sub-system Description

Overview - Each BTS CSM sub-system features two CSM boards per RFMF. The primary function of the CSM cards is to maintain CDMA system time. GPS is used as the primary timing reference and synchronizes the entire cellular system. In typical operation, the primary CSM locks its Digital Phase Locked Loop (DPLL) circuits to GPS signals. These signals are provided by either an on-board GPS receiver module (RF-GPS) or a remote GPS receiver (RGPS). RGPS uses a GPS receiver in the antenna head that has a digital output. The second generation CSM card (CSM-II) is required when using the RGPS. A CSM-II card can also be equipped with a local GPS receiver daughter card to support an RF-GPS signal.

SCCP Shelf CSM Card Slot Assignments - The GPS receiver is interfaced to the board in SCCP shelf slot CSM 1. This card is the primary timing source, while the card in slot CSM 2 provides redundancy. The redundant card, does not have a GPS receiver.

CSM-II Card Type Description - Each CSM-II card features a temperature-stabilized crystal oscillator that provides 19.6608 MHz clock, even second pulse, and 3 MHz reference signals to the synchronization source selected from the following (refer to Table 3-24 for source selection/verification procedures):

- GPS: local/RF-GPS or remote/RGPS

- LORAN-C Low Frequency Receiver (LFR) or High Stability Oscillator (HSO)

- External reference oscillator sources

CDMA Clock Distribution Card (CCD) Description - CCD cards buffer and distribute even-second reference and 19.6608 MHz clock signals from the CSM cards. CCD 1 is married to the card in slot CSM 1, and CCD 2 is married to the card in slot CSM 2.

CSM Card Redundancy - The BTS switches between the primary and redundant units (card slots CSM 1 and CSM 2, respectively) upon failure or command. A failure in CSM 1 or CCD 1 will cause the system to switch to the CSM 2-CCD 2 redundant card pair. GPS timing synchronization is continually maintained between the primary and redundant CSM-CCD pairs.

Secondary Timing References - The BTS may be equipped with a LORAN-C Low Frequency Receiver (LFR), a High Stability Oscillator (HSO), or external 10 MHz Rubidium source which the CSM can use as a secondary timing reference. Continuous GPS synchronization is maintained for the LFR or HSO secondary timing references. The CSM monitors and determines what reference to use at a given time.

Timing Source Fault Management - Fault management has the capability of switching between the GPS synchronization source and the LFR/HSO backup source in the event of a GPS receiver failure. During normal operation, the card in slot CSM 1 selects GPS as the primary timing source (Table 3-24). The source selection can also be overridden via the LMF or by the system software.

Low Frequency Receiver/ High Stability Oscillator

General

The CSM and the LFR/HSO - The CSM performs the overall configuration and status monitoring functions for the LFR/HSO. In the event of GPS failure, the LFR/HSO is capable of maintaining synchronization initially established by the GPS reference signal.

LFR - The LFR requires an active external antenna to receive LORAN-C RF signals. Timing pulses are derived from this signal, which is synchronized to Universal Time Coordinates (UTC) and GPS time. The LFR can maintain system time indefinitely after initial GPS lock.

HSO - The HSO is a high stability 10 MHz oscillator with the necessary interface to the CSMs. The HSO is typically installed in those geographical areas not covered by the LORAN-C system. Since the HSO is a free-standing oscillator, system time can only be maintained for 24 hours after 24 hours of GPS lock

Upgrades and Expansions: LFR2/HSO2/HSOX

The LFR2 and HSO2 (second generation cards) both can export a timing signal to other BTS frames located at a site. These *secondary* frames require an HSO-expansion (HSOX) module whether the *primary* frame has an LFR2 or an HSO2. The HSOX accepts input from the primary frame and interfaces with the CSM cards in the secondary frames. LFR and LFR2 use the same source code in source selection (Table 3-24). HSO, HSO2, and HSOX use the same source code in source selection (Table 3-24).

NOTE	Allow the **base site and test equipment to warm up for 60 minutes** after any interruption in oscillator power. CSM card warm-up allows the oscillator oven temperature and oscillator frequency to stabilize prior to test. Test equipment warm-up allows the Rubidium standard time base to stabilize in frequency before any measurements are made.

CSM Frequency Verification

> The objective of this procedure is the initial verification of the Clock Synchronization Module (CSM) cards before performing the RF path verification tests.

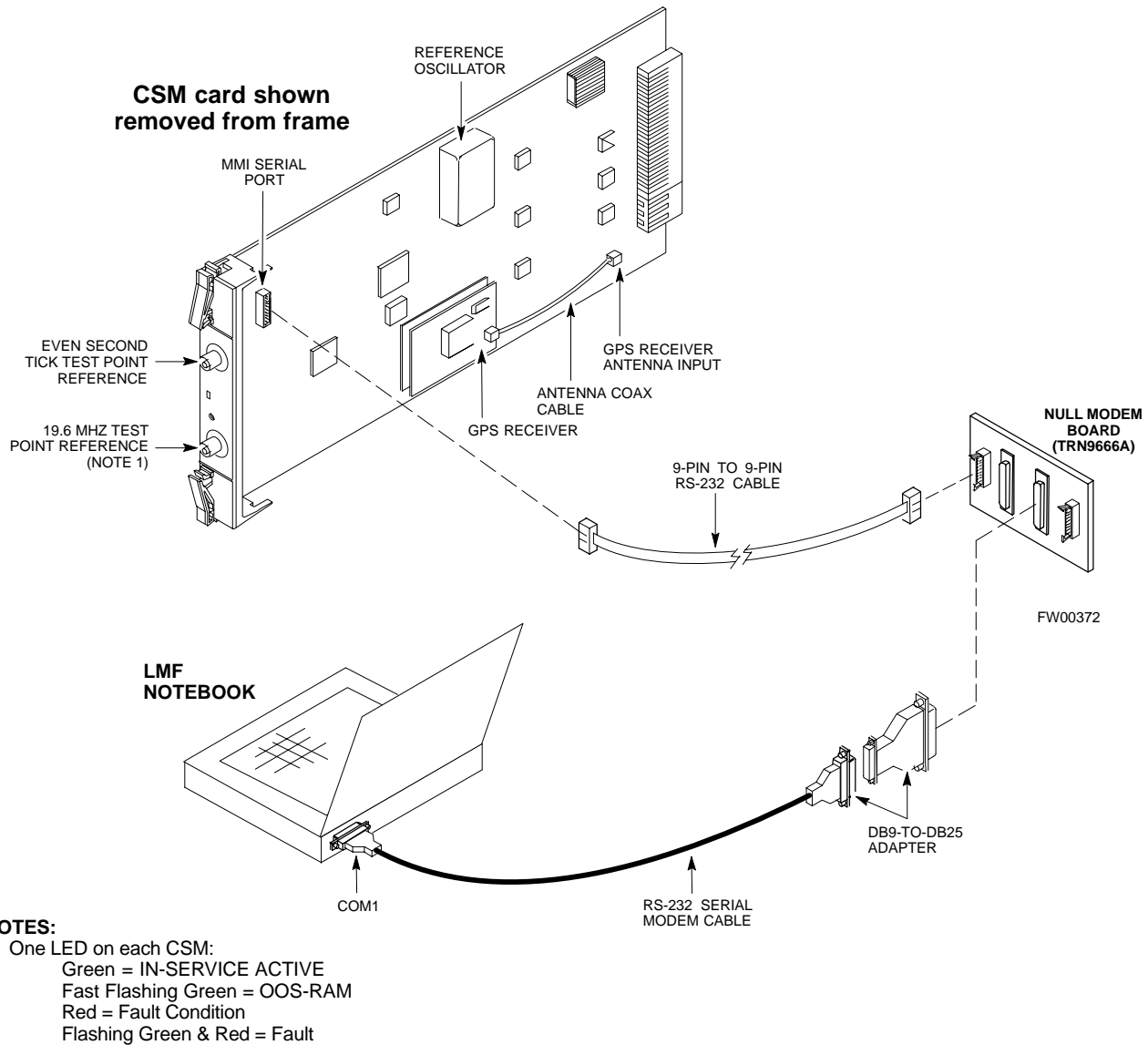## Test Equipment Setup
(GPS & LFR/HSO Verification)

> Follow the steps outlined in Table 3-23 to set up test equipment.

Step	Action
	Table 3-23: Test Equipment Setup (GPS & LFR/HSO Verification)
1	Perform one of the following as required by installed equipment:
1a	- For **local GPS** (RF-GPS): Verify a CSM card with a GPS receiver is installed in the primary CSM slot, CSM 1, and that the card is INS_ACT (bright green). **NOTE** Verify by checking the card ejectors for kit number **SGLN1145** on the card in slot CSM 1.
1b	- For **Remote GPS** (RGPS): Verify a CSM-II card is installed in primary slot CSM 1 and that the card is INS_ACT (bright green). **NOTE** Verify by checking the card ejectors for kit number **SGLN4132ED** or subsequent.
2	Remove the card from slot CSM 2 (if installed) and connect a serial cable from the LMF COM 1 port (via null modem card) to the MMI port on the card in slot CSM 1 (see Figure 3-9).
3	Reinstall the card removed from slot CSM 2.
4	Start an MMI communication session with the card in slot CSM 1 by using the *Windows* desktop shortcut icon (see Table 3-15) .
5	When the terminal screen appears press the **Enter** key until the CSM> prompt appears.

CAUTION	In the power entry compartment, connect the GPS antenna to the RF GPS connector **ONLY**. Damage to the GPS *antenna* and/or *receiver* can result if the GPS antenna is inadvertently connected to any other RF connector.

Figure 3-9: CSM MMI Terminal Connection

NOTES:
1. One LED on each CSM:
     Green = IN-SERVICE ACTIVE
     Fast Flashing Green = OOS-RAM
     Red = Fault Condition
     Flashing Green & Red = Fault

GPS Initialization/Verification

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- The primary CSM and HSO (if equipped) has been warmed up for at least 15 minutes.

- The LMF computer is connected to the MMI port of the primary CSM as shown in Figure 3-9.

- An MMI communication session has been started (Table 3-15), and the CSM> prompt is present in the HyperTerminal window (Table 3-23).

Follow the steps outlined in Table 3-24 to initialize and verify proper GPS receiver functioning.

Table 3-24: GPS Initialization/Verification	
Step	**Action**

1	To verify that `Clock alarms (0000)`, `Dpll is locked and has a reference source`, and `GPS self test passed` messages are displayed within the report, issue the following MMI command
	
	bstatus
	
	- The system will display a response similar to the following:
	
	`Clock Alarms (0000):`
	
	`DPLL `<u>`is locked and has a reference source.`</u>
	`GPS receiver self test result:` <u>`passed`</u>
	
	`Time since reset 0:33:11, time since power on: 0:33:11`

2	Enter the following command at the `CSM>` prompt to display the current status of the Loran and GPS receivers:
	
	sources
	
	- When equipped with LFR, the system will generate a response similar to the following:
	
	`N  Source Name Type    TO Good Status  Last Phase Target Phase  Valid`
	`------------------------------------------------------------------------`
	<u>**`0`**</u> <u>`LocalGPS`</u> `Primary  4  `**`YES`** **`Good`** `0          0       `**`Yes`**
	`1  LFR CHA   Secondary 4  YES   Good  -2013177   -2013177   Yes`
	`2  Not Used`
	`Current reference source number: 0`
	
	- When equipped with HSO, the system will generate a response similar to the following:
	
	`Num  Source Name  Type    TO  Good  Status  Last Phase  Target Phase Valid`
	`--------------------------------------------------------------------------`
	`0    Local GPS    Primary  4   Yes   Good    3          0        Yes`
	`1` **`HSO`** **`Backup`** `4   No    N/A    timed-out*   Timed-out*  No`
	
	*NOTE "Timed-out" should only be displayed while the HSO is warming up. "Not-Present" or "Faulty" should not be displayed. If the HSO does not appear as one of the sources, then configure the HSO as a back-up source by entering the following command at the CSM> prompt:
	
	ss 1 12
	
	After a maximum of 15 minutes, the Rubidium oscillator should reach operational temperature and the LED on the HSO should now have changed from red to green. After the HSO front panel LED has changed to green, enter **sources \<cr>** at the `CSM>` prompt. Verify that the HSO is now a valid source by confirming that the bold text below matches the response of the "sources" command.
	
	The HSO should be valid within one (1) minute, assuming the DPLL is locked and the HSO rubidium oscillator is fully warmed.
	
	`Num  Source Name  Type    TO  Good  Status  Last Phase  Target Phase Valid`
	`--------------------------------------------------------------------------`
	`0    Local GPS    Primary  4   Yes   Good    3          0        Yes`
	`1` **`HSO`** **`Backup`** **`4`** **`Yes`** `N/A    xxxxxxxxxx   xxxxxxxxxx `**`Yes`**

Step	Action
	Table 3-24: GPS Initialization/Verification
3	HSO information (underlined text above, verified from left to right) is usually the #1 reference source. If this is not the case, have the *OMCR* determine the correct BTS timing source has been identified in the database by entering the **display bts csmgen** command and correct as required using the **edit csm csmgen refsrc** command. **NOTE** If any of the above areas fail, verify: - If LED is RED, verify that HSO had been powered up for at least 5 minutes. After oscillator temperature is stable, LED should go GREEN *Wait for this to occur before continuing !* - If "timed out" is displayed in the Last Phase column, suspect the HSO output buffer or oscillator is defective - Verify the HSO is FULLY SEATED and LOCKED to prevent any possible card warpage
4	Verify the following GPS information (underlined text above): - GPS information is usually the 0 reference source. - At least one Primary source must indicate "Status = good" and "Valid = yes" to bring site up.

3

Table 3-24: GPS Initialization/Verification	
Step	**Action**
5	Enter the following command at the CSM> prompt to verify that the GPS receiver is in tracking mode. **gstatus** - Observe the following typical response: ``` 24:06:08 GPS Receiver Control Task State: tracking satellites. 24:06:08 Time since last valid fix: 0 seconds. 24:06:08 24:06:08 Recent Change Data: 24:06:08 Antenna cable delay 0 ns. 24:06:08 Initial position: lat 117650000 msec, lon -350258000 msec, height 0 cm (GPS) 24:06:08 Initial position accuracy (0): estimated. 24:06:08 24:06:08 GPS Receiver Status: 24:06:08 Position hold: lat 118245548 msec, lon -350249750 msec, height 20270 cm 24:06:08 Current position: lat 118245548 msec, lon -350249750 msec, height 20270 cm (GPS) 24:06:08 8 satellites tracked, receiving 8 satellites, 8 satellites visible. 24:06:08 Current Dilution of Precision (PDOP or HDOP): 0. 24:06:08 Date & Time: 1998:01:13:21:36:11 24:06:08 GPS Receiver Status Byte: 0x08 24:06:08 Chan:0, SVID: 16, Mode: 8, RSSI: 148, Status: 0xa8 24:06:08 Chan:1, SVID: 29, Mode: 8, RSSI: 132, Status: 0xa8 24:06:08 Chan:2, SVID: 18, Mode: 8, RSSI: 121, Status: 0xa8 24:06:08 Chan:3, SVID: 14, Mode: 8, RSSI: 110, Status: 0xa8 24:06:08 Chan:4, SVID: 25, Mode: 8, RSSI: 83, Status: 0xa8 24:06:08 Chan:5, SVID: 3, Mode: 8, RSSI: 49, Status: 0xa8 24:06:08 Chan:6, SVID: 19, Mode: 8, RSSI: 115, Status: 0xa8 24:06:08 Chan:7, SVID: 22, Mode: 8, RSSI: 122, Status: 0xa8 24:06:08 24:06:08 GPS Receiver Identification: 24:06:08 COPYRIGHT 1991-1996 MOTOROLA INC. 24:06:08 SFTW P/N # 98-P36830P 24:06:08 SOFTWARE VER # 8 24:06:08 SOFTWARE REV # 8 24:06:08 SOFTWARE DATE 6 AUG 1996 24:06:08 MODEL # B3121P1115 24:06:08 HDWR P/N # _ 24:06:08 SERIAL # SSG0217769 24:06:08 MANUFACTUR DATE 6B07 24:06:08 OPTIONS LIST IB 24:06:08 The receiver has 8 channels and is equipped with TRAIM. ```
6	**Verify** the following GPS information (shown above in <u>underlined</u> text): - At least 4 satellites are tracked, and 4 satellites are visible. - GPS Receiver Control Task State is "tracking satellites". ***Do not continue until this occurs!*** - Dilution of Precision indication is not more that 30. **Record** the current position base site latitude, longitude, height and height reference (height reference to Mean Sea Level (MSL) or GPS height (GPS). (GPS = 0 MSL = 1).

<div align="right">**3**</div>

	Table 3-24: GPS Initialization/Verification

Step	Action
7	**If steps 1 through 6 pass, the GPS is good.**
	NOTE If any of the above mentioned areas fail, verify that: - If *Initial position accuracy* is "estimated" (typical), at least 4 satellites must be tracked and visible (1 satellite must be tracked and visible if actual lat, log, and height data for this site has been entered into CDF file). - If *Initial position accuracy* is "surveyed," position data currently in the CDF file is assumed to be accurate. GPS will not automatically survey and update its position. - The GPS antenna is not obstructed or misaligned. - GPS antenna connector center conductor measureS approximately +5 Vdc with respect to the shield. - There is no more than 4.5 dB of loss between the GPS antenna OSX connector and the BTS frame GPS input. - Any lightning protection installed between GPS antenna and BTS frame is installed correctly.
8	Enter the following commands at the CSM> prompt to verify that the CSM is warmed up and that GPS acquisition has taken place. **debug dpllp** Observe the following typical response if the CSM is not warmed up (15 minutes from application of power) *(If warmed-up proceed to step 9)* ``` CSM>DPLL Task Wait. 884 seconds left. DPLL Task Wait. 882 seconds left. DPLL Task Wait. 880 seconds left. ....etc. ``` **NOTE** The **warm** command can be issued at the MMI port used to force the CSM into warm-up, but the reference oscillator will be unstable.
9	Observe the following typical response if the CSM is warmed up. ``` c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 ```
10	Verify the following GPS information (underlined text above, from left to right): - Lower limit offset from tracked source variable is not less than -60 (equates to 3μs limit). - Upper limit offset from tracked source variable is not more than +60 (equates to 3μs limit). - TK SRC: 0 is selected, where SRC 0 = GPS.
11	Enter the following commands at the CSM> prompt to exit the debug mode display. **debug dpllp**

LORAN-C Initialization/Verification

<table>
<tr><td colspan="3" align="center">**Table 3-25:** LORAN-C Initialization/Verification</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td><td>**Note**</td></tr>
<tr><td>1</td><td>At the CSM> prompt, enter **lstatus <cr>** to verify that the LFR is in tracking mode. A typical response is:

```
CSM> lstatus <cr>
LFR Station Status:
Clock coherence: 512
5930M  51/60  dB  0   S/N Flag:
5930X  52/64  dn -1   S/N Flag:
5990   47/55  dB -6   S/N Flag:
7980M  62/66  dB 10   S/N Flag:
7980W  65/69  dB 14   S/N Flag: . PLL Station .
7980X  48/54  dB -4   S/N Flag:
7980Y  46/58  dB -8   S/N Flag:E
7980Z  60/67  dB  8   S/N Flag:
8290M  50/65  dB  0   S/N Flag:
8290W  73/79  dB 20   S/N Flag:
8290W  58/61  dB  6   S/N Flag:
8970M  89/95  dB 29   S/N Flag:
8970W  62/66  dB 10   S/N Flag:
8970X  73/79  dB 22   S/N Flag:
8970Y  73/79  dB 19   S/N Flag:
8970Z  62/65  dB 10   S/N Flag:
9610M  62/65  dB 10   S/N Flag:
9610V  58/61  dB  8   S/N Flag:
9610W  47/49  dB -4   S/N Flag:E
9610X  46/57  dB -5   S/N Flag:E
9610Y  48/54  dB -5   S/N Flag:E
9610Z  65/69  dB 12   S/N Flag:
9940M  50/53  dB -1   S/N Flag:S
9940W  49/56  dB -4   S/N Flag:E
9940Y  46/50  dB-10   S/N Flag:E
9960M  73/79  dB 22   S/N Flag:
9960W  51/60  dB  0   S/N Flag:
9960X  51/63  dB -1   S/N Flag:
9960Y  59/67  dB  8   S/N Flag:
9960Z  89/96  dB 29   S/N Flag:

LFR Task State: lfr locked to station 7980W
LFR Recent Change Data:
  Search List: 5930 5990 7980 8290 8970 9940 9610 9960
  PLL GRI: 7980W
LFR Master, reset not needed, not the reference source.
CSM>
```
</td><td>*This must be greater than 100 before LFR becomes a valid source.*

This shows the LFR is locked to the selected PLL station.

This search list and PLL data must match the configuration for the geographical location of the cell site.</td></tr>
</table>

Table 3-25: LORAN-C Initialization/Verification

Step	Action	Note
2	Verify the following LFR information (highlighted above in **boldface** type): - Locate the "dot" that indicates the current phase locked station assignment (assigned by MM). - Verify that the station call letters are as specified in site documentation as well as M X Y Z assignment. - Verify the S/N ratio of the phase locked station is greater than 8.	
3	At the CSM> prompt, enter **sources <cr>** to display the current status of the the LORAN receiver. - Observe the following typical response. ``` Num Source Name Type TO Good Status Last Phase Target Phase Valid -- 0 Local GPS Primary 4 Yes Good -3 0 Yes 1 LFR ch A Secondary 4 Yes Good -2013177 -2013177 Yes 2 Not used Current reference source number: 1 ``` ***NOTE** "Timed-out" should only be displayed while the LFR is warming up. "Not-Present" or "Faulty" should not be displayed. If the LFR does not appear as one of the sources, then configure the LFR as a back-up source by entering the following command at the CSM> prompt: **ss 1 2**	
4	LORAN LFR information (highlighted above in **boldface** type) is usually the #1 reference source (verified from left to right). *** IMPORTANT** If any of the above mentioned areas fail, verify: - The LFR antenna is not obstructed or misaligned. - The antenna pre-amplifier power and calibration twisted pair connections are intact and < 91.4 m (300 ft) in length. - A dependable connection to suitable Earth Ground is in place. - The search list and PLL station for cellsite location are correctly configured . **NOTE** LFR functionality should be verified using the "source" command (as shown in Step 3). Use the underlined responses on the LFR row to validate correct LFR operation.	
5	Close the HyperTerminal window.	

Test Equipment Set-up

Connecting Test Equipment to the BTS

The following types of test equipment are required to perform calibration and ATP tests:

- LMF

- Communications system analyzer model supported by the LMF

- Power meter model supported by the LMF (required when using the HP 8921A/600 and Advantest R3465 analyzers)

- Non-radiating transmit line termination load

- Directional coupler and in-line attenuator

- RF cables and adapters

Refer to Table 3-26 for an overview of connections for test equipment currently supported by the LMF. In addition, see the following figures:

- Figure 3-13, Figure 3-14, and Figure 3-15 show the test set connections for TX calibration

- Figure 3-16 through Figure 3-21 show the test set connections for optimization/ATP tests

Test Equipment GPIB Address Settings

All test equipment is controlled by the LMF through an IEEE-488/GPIB bus. To communicate on the bus, each piece of test equipment must have a GPIB address set which the LMF will recognize. The standard address settings used by the LMF for the various types of test equipment items are as follows:

- Signal generator address: **1**

- Power meter address: **13**

- Communications system analyzer: **18**

Using the procedures included in the Setting GPIB Addresses section of Appendix NO TAG, verify and, if necessary, change the GPIB address of each piece of employed test equipment to match the applicable addresses above

Supported Test Equipment

CAUTION	To prevent damage to the test equipment, all transmit (TX) test connections must be through a 30 dB directional coupler *plus* a 20 dB in-line attenuator for both the 800 MHz and 1.9 GHz BTSs.

IS-95A/B Operation

Optimization and ATP testing for IS-95A/B sites or carriers may be performed using the following test equipment:

- CyberTest
- Advantest R3267 spectrum analyzer with R3562 signal generator
- Advantest R3465 spectrum analyzer with R3561L signal generator and HP-437B or Gigatronics Power Meter
- Agilent E4406A transmitter test set with E4432B signal generator
- Agilent 8935 series E6380A communications test set (formerly HP 8935)
- Hewlett-Packard HP 8921 (with CDMA interface and, for 1.9 GHz, PCS Interface) and HP-437B or Gigatronics Power Meter
- Spectrum Analyzer (HP8594E) - *optional*
- Rubidium Standard Timebase - *optional*

CDMA2000 1X Operation

Optimization and ATP testing for CDMA2000 1X sites or carriers may be performed using the following test equipment:

- Advantest R3267 spectrum analyzer with R3562 signal generator
- Agilent E4406A transmitter test set with E4432B signal generator
- Agilent 8935 series E6380A communications test set (formerly HP 8935) with option 200 or R2K and with E4432B signal generator for 1X FER

Test Equipment Preparation

See Appendix F for specific steps to prepare each type of test set and power meter to perform calibration and ATP .

Test Equipment Connection Charts

To use the following charts to identify necessary test equipment connections, locate the communications system analyzer being used in the **COMMUNICATIONS SYSTEM ANALYZER** columns, and read down the column. Where a dot appears in the column, connect one end of the test cable to that connector. Follow the horizontal line to locate the end connection(s), reading up the column to identify the appropriate equipment and/or BTS connector.

3

IS-95A/B-only   Test Equipment Connections

Table 3-26 depicts the interconnection requirements for currently available test equipment *supporting IS-95A/B only* which meets Motorola standards and is supported by the LMF.

Table 3-26: IS-95A/B-only Test Equipment Interconnection

	COMMUNICATIONS SYSTEM ANALYZER				ADDITIONAL TEST EQUIPMENT				
SIGNAL	**Cyber-Test**	**Advantest R3465**	**HP 8921A**	**HP 8921 W/PCS**	**Power Meter**	**GPIB Interface**	**LMF**	**Attenuator & Directional Coupler**	**BTS**
EVEN SECOND SYNCHRONIZATION	**EVEN SEC REF**	**EVEN SEC SYNC IN**	**EVEN SECOND SYNC IN**	**EVEN SECOND SYNC IN**					**SYNC MONITOR**
19.6608 MHZ CLOCK	**TIME BASE IN**	**CDMA TIME BASE IN**	**CDMA TIME BASE IN**	**CDMA TIME BASE IN**					**FREQ MONITOR**
CONTROL IEEE 488 BUS	**IEEE 488**	**GPIB**	**HP-IB**	**HP-IB**	**HP-IB**	**GPIB**	**SERIAL PORT**		
TX TEST CABLES	**RF IN/OUT**	**INPUT 50Ω**	**RF IN/OUT**	**RF IN/OUT**				**20 DB ATTEN. BTS PORT**	**TX1-6**
RX TEST CABLES	**RF GEN OUT**	**RF OUT 50Ω**	**DUPLEX OUT**	**RF OUT ONLY**					**RX1-6**

CDMA2000 1X/IS-95A/B-capable Test Equipment Connections

Table 3-27 depicts the interconnection requirements for currently available test equipment supporting *both* CDMA 2000 1X *and* IS-95A/B which meets Motorola standards and is supported by the LMF.

Table 3-27: CDMA2000 1X/IS-95A/B Test Equipment Interconnection

SIGNAL	COMMUNICATIONS SYSTEM ANALYZER			ADDITIONAL TEST EQUIPMENT						BTS
	Agilent 8935 (Option 200 or R2K)	Advantest R3267	Agilent E4406A	Agilent E4432 Signal Gen.	Advantest R3562 Signal Generator	Power Meter	GPIB Interface	LMF	Attenuator & Directional Coupler	BTS
EVEN SECOND SYNCHRONIZATION	EVEN SECOND SYNC IN	EXT TRIG	TRIGGER IN	PATTERN TRIG IN	EXT TRIG IN					SYNC MONITOR
19.6608 MHZ CLOCK	EXT REF IN		EXT REF IN		MOD TIME BASE IN					FREQ MONITOR
CONTROL IEEE 488 BUS	HP-IB	GP-IB	GPIB	GPIB	GP-IB	HP-IB	GPIB	SERIAL PORT		
10 MHZ	10 MHZ REF OUT	10 MHZ OUT	10 MHZ OUT (SWITCHED)	10 MHZ IN	SYNTHE REF IN					
SIGNAL SOURCE CONTROLLED SERIAL I/O		SERIAL I/O			SERIAL I/O					
TX TEST CABLES	RF IN/OUT	INPUT 50 Ω	RF INPUT 50 Ω						20 DB ATTEN. BTS PORT	TX1-6
RX TEST CABLES	RF IN/OUT *			RF OUTPUT 50 Ω	RF OUT 50 Ω					RX1-6

* WHEN USED ALONE, THE AGILENT 8935 WITH OPTION 200 OR R2K SUPPORTS IS-95A/B RX TESTING BUT NOT CDMA2000 1X RX TESTING.

Equipment Warm-up

NOTE	Warm-up *BTS equipment for a minimum of 60 minutes* prior to performing the BTS optimization procedure. This assures BTS stability and contributes to optimization accuracy.
	- Time spent running initial or normal power-up, hardware/firmware audit, and BTS download counts as warm-up time.

WARNING	Before installing any test equipment directly to any BTS **TX OUT** connector, verify there are *no* CDMA channels keyed.
	- At active sites, have the OMC-R/CBSC place the antenna (sector) assigned to the BBX under test OOS. Failure to do so can result in serious personal injury and/or equipment damage.

Automatic Cable Calibration Set-up

Figure 3-10 and Figure 3-11 show the cable calibration setup for the test sets supported by the LMF. The left side of the diagram depicts the location of the input and output connectors of each test equipment item, and the right side details the connections for each test. Table 3-31 provides a procedure for performing automatic cable calibration.

Manual Cable Calibration

If manual cable calibration is required, refer to the procedures in Appendix F.

Figure 3-10: IS- 95A/B Cable Calibration Test Setup - CyberTest, Agilent 8935, Advantest R3465, and HP 8921A

SUPPORTED TEST SETS

Motorola CyberTest
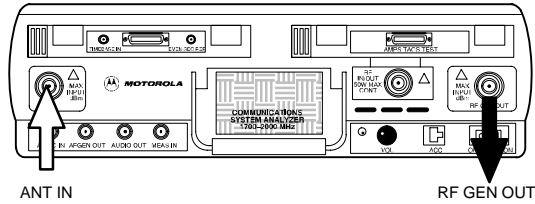
ANT IN   RF GEN OUT

Note: The 30 dB directional coupler is not used with the Cybertest test set. The TX cable is connected directly to the Cybertest test set.

A 10dB attenuator must be used with the short test cable for cable calibration with the CyberTest test set. The 10dB attenuator is used only for the cable calibration procedure, not with the test cables for TX calibration and ATP tests.

Agilent 8935 Series E6380A (formerly HP 8935)

ANT IN   RF IN/OUT

Advantest Model R3465

RF OUT 50Ω

INPUT 50Ω
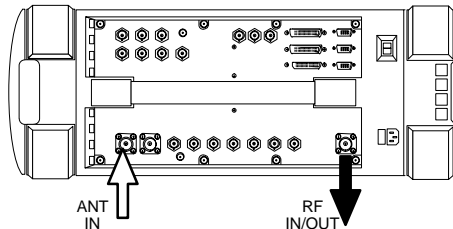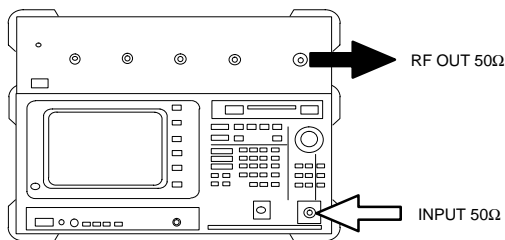
Hewlett Packard Model HP 8921A

DUPLEX OUT   ANT IN
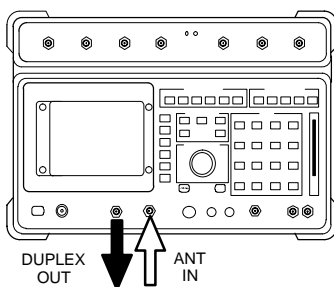
Note: For 800 MHZ only. The HP8921A cannot be used to calibrate cables for PCS frequencies.

CALIBRATION SET UP

A. SHORT CABLE CAL

SHORT CABLE   TEST SET
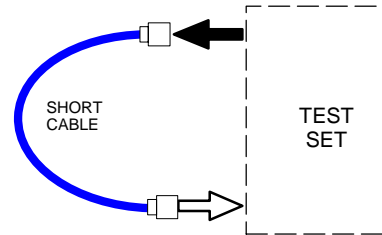
B. RX TEST CAL SETUP FOR TRDC

N-N FEMALE ADAPTER

RX CABLE

SHORT CABLE
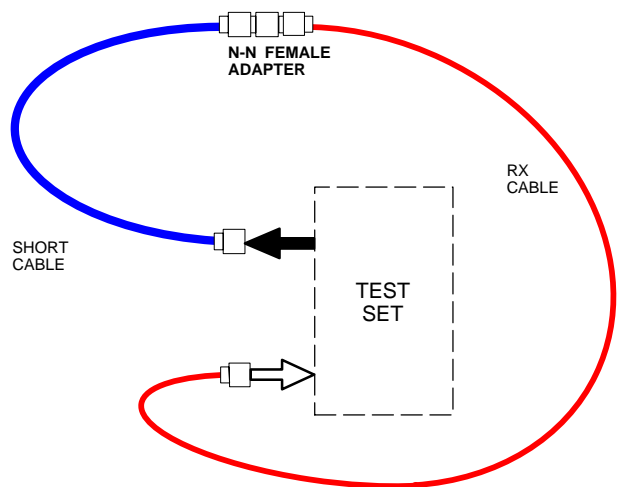
TEST SET

C. TX TEST AND DRDC RX TEST CAL SETUP

50 Ω TERM.   DIRECTIONAL COUPLER (30 DB)

100-W ATT (MIN) NON-RADIA TING RF LOAD

20 DB IN-LINE ATTENUATOR

TX CABLE

SHORT CABLE   N-N FEMALE ADAPTER

TX CABLE FOR TX TEST CABLE CALIBRATION

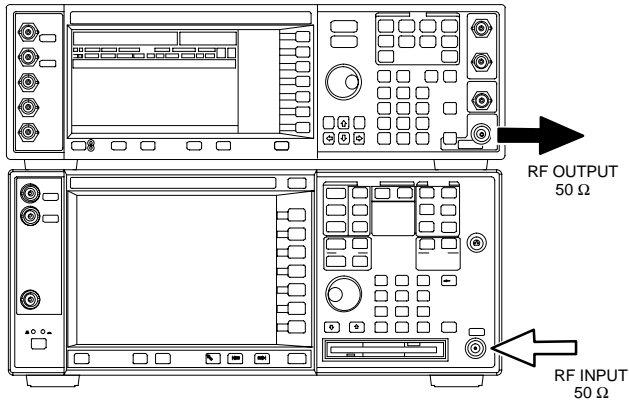RX CABLE FOR DRDC RX TEST CABLE CALIBRATION

TEST SET

3
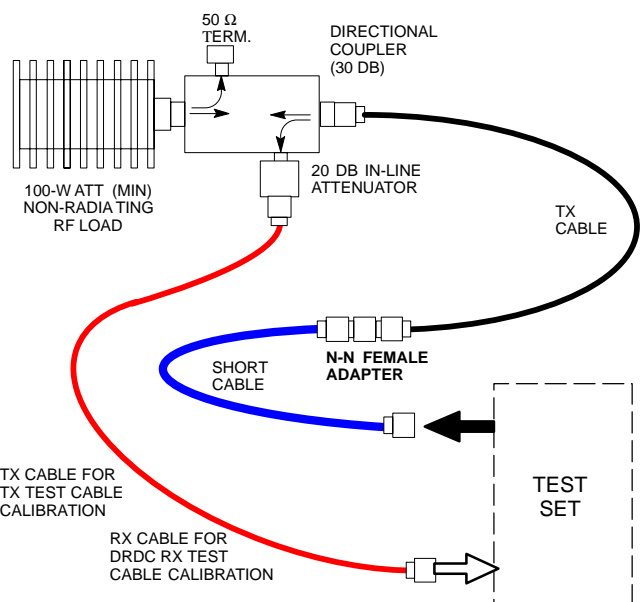
Figure 3-11: IS-95A/B and CDMA 2000 1X Cable Calibration Test Setup - Agilent E4406A/E4432B and Advantest R3267/R3562
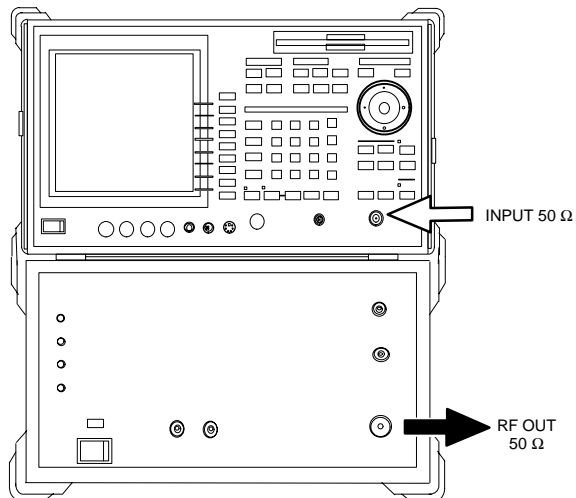
SUPPORTED TEST SETS

Agilent E4432B (Top) and E4406A (Bottom)

RF OUTPUT
50 Ω

RF INPUT
50 Ω

NOTE:

10 MHZ IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO **10 MHZ OUT (SWITCHED)** ON REAR OF TRANSMITTER TESTER (FIGURE F-16).

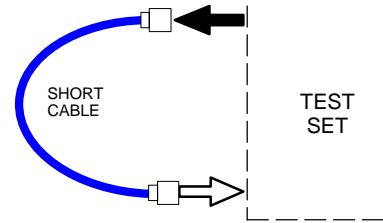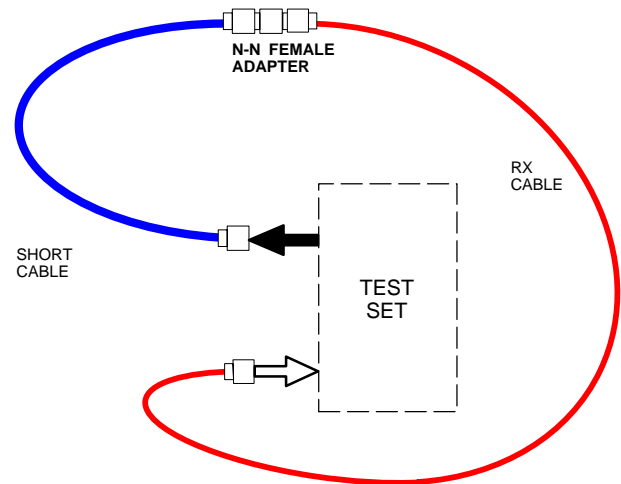**Advantest R3267 (Top) and R3562 (Bottom)**

INPUT 50 Ω

RF OUT
50 Ω

NOTE:

SYNTHE REF IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO **10 MHZ OUT** ON REAR OF SPECTRUM ANALYZER
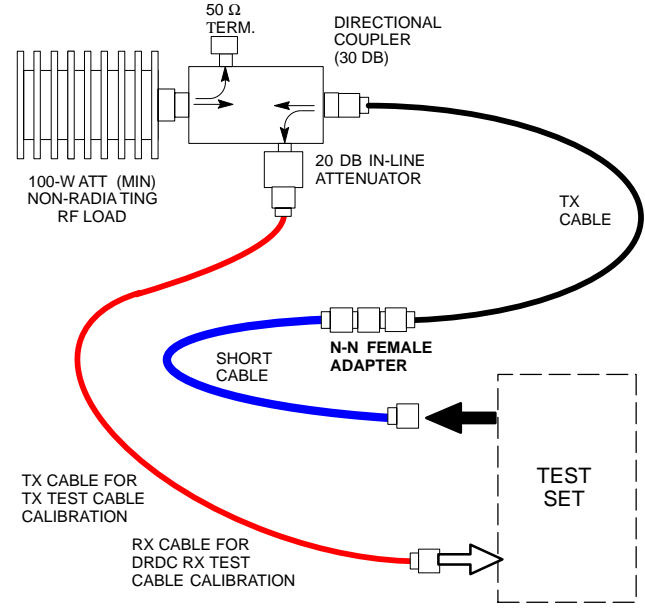
CALIBRATION SET UP

A. SHORT CABLE CAL

SHORT CABLE
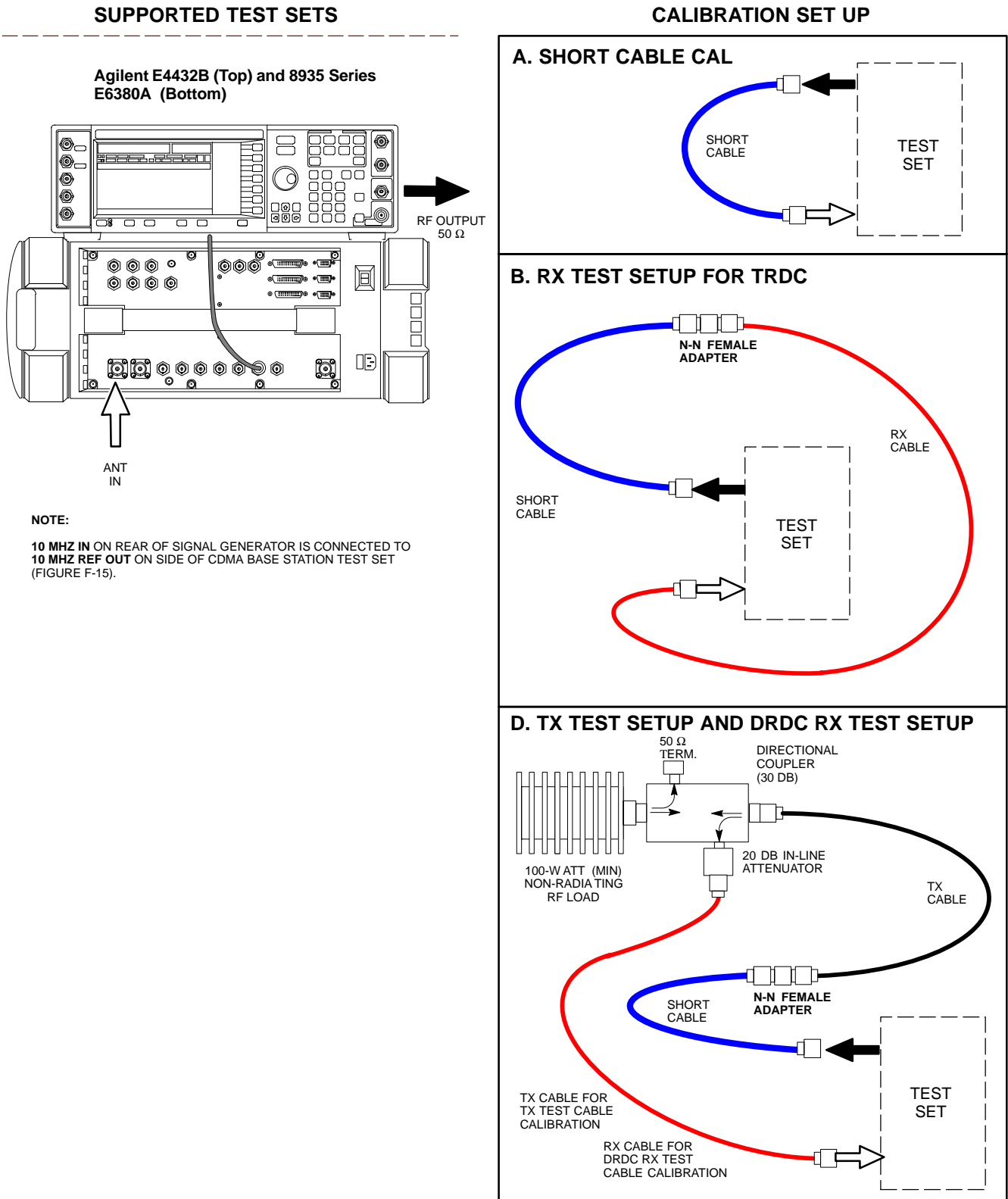
TEST SET

B. RX TEST SETUP FOR TRDC

N-N FEMALE ADAPTER

RX CABLE

SHORT CABLE

TEST SET

D. TX TEST SETUP AND DRDC RX TEST SETUP

50 Ω TERM.

DIRECTIONAL COUPLER (30 DB)

100-W ATT (MIN) NON-RADIATING RF LOAD

20 DB IN-LINE ATTENUATOR

TX CABLE

SHORT CABLE

N-N FEMALE ADAPTER

TX CABLE FOR TX TEST CABLE CALIBRATION

RX CABLE FOR DRDC RX TEST CABLE CALIBRATION

TEST SET

Figure 3-12: CDMA2000 1X Cable Calibration Test Setup - Agilent 8935/E4432B

SUPPORTED TEST SETS   **CALIBRATION SET UP**

**Agilent E4432B (Top) and 8935 Series
E6380A (Bottom)**

RF OUTPUT
50 Ω

ANT
IN

NOTE:

10 MHZ IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO
10 MHZ REF OUT ON SIDE OF CDMA BASE STATION TEST SET
(FIGURE F-15).

A. SHORT CABLE CAL

SHORT
CABLE

TEST
SET

B. RX TEST SETUP FOR TRDC

**N-N FEMALE
ADAPTER**

RX
CABLE

SHORT
CABLE

TEST
SET

D. TX TEST SETUP AND DRDC RX TEST SETUP

50 Ω
TERM.

DIRECTIONAL
COUPLER
(30 DB)

100-W ATT (MIN)
NON-RADIATING
RF LOAD

20 DB IN-LINE
ATTENUATOR

TX
CABLE

SHORT
CABLE

**N-N FEMALE
ADAPTER**

TX CABLE FOR
TX TEST CABLE
CALIBRATION

RX CABLE FOR
DRDC RX TEST
CABLE CALIBRATION

TEST
SET

3

Set-up for TX Calibration

Figure 3-13 and Figure 3-14 show the test set connections for TX calibration.

Figure 3-13: TX Calibration Test Setup - CyberTest (IS-95A/B) and Agilent 8935 (IS-95A/B and CDMA2000 1X)
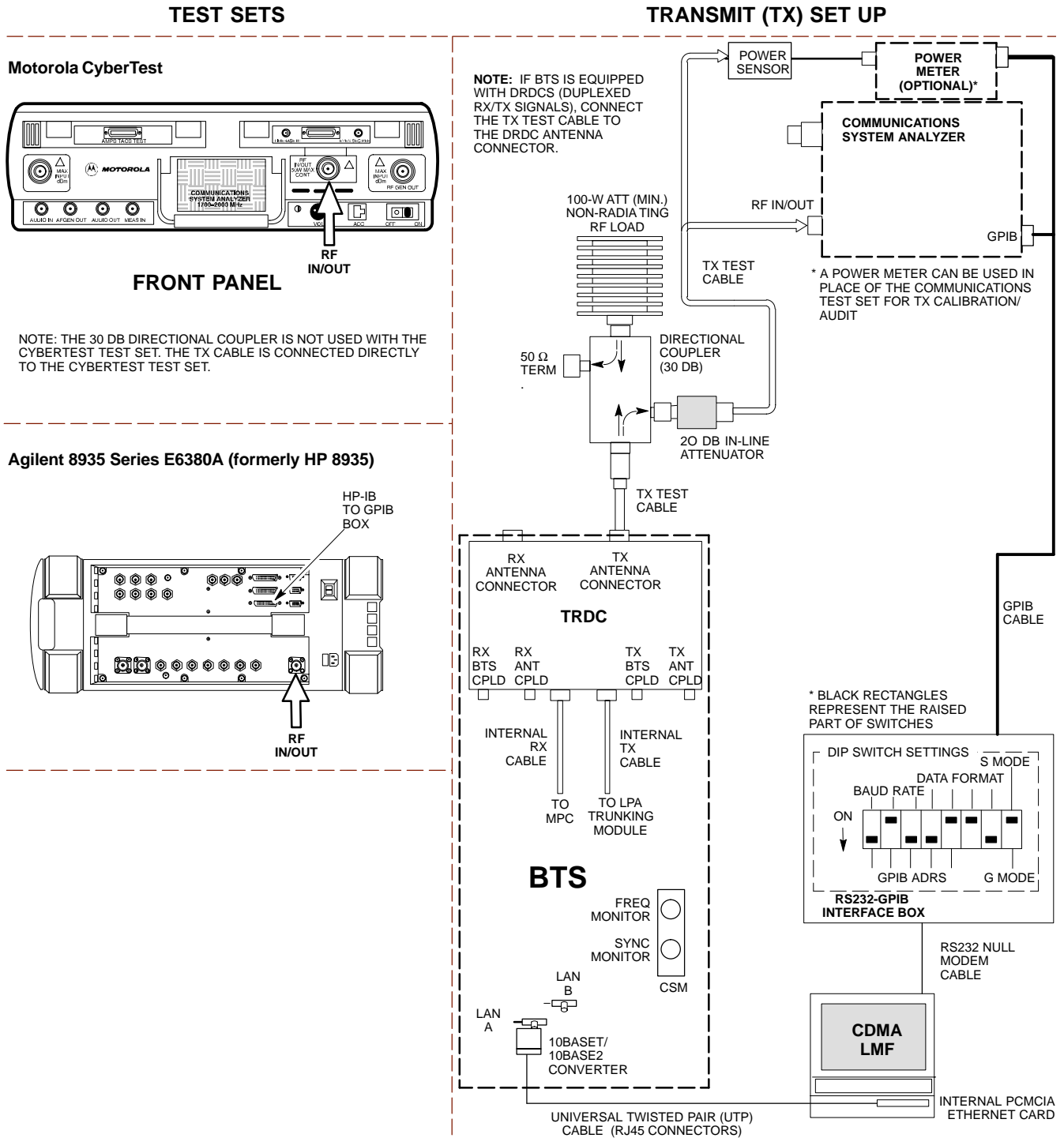
Figure 3-14: TX Calibration Test Setup - Using Power Meter

TEST SETS	TRANSMIT (TX) SET UP

NOTE: THE HP8921A AND ADVANTEST R3465 *CANNOT* BE USED FOR TX CALIBRATION. A POWER METER MUST BE USED.
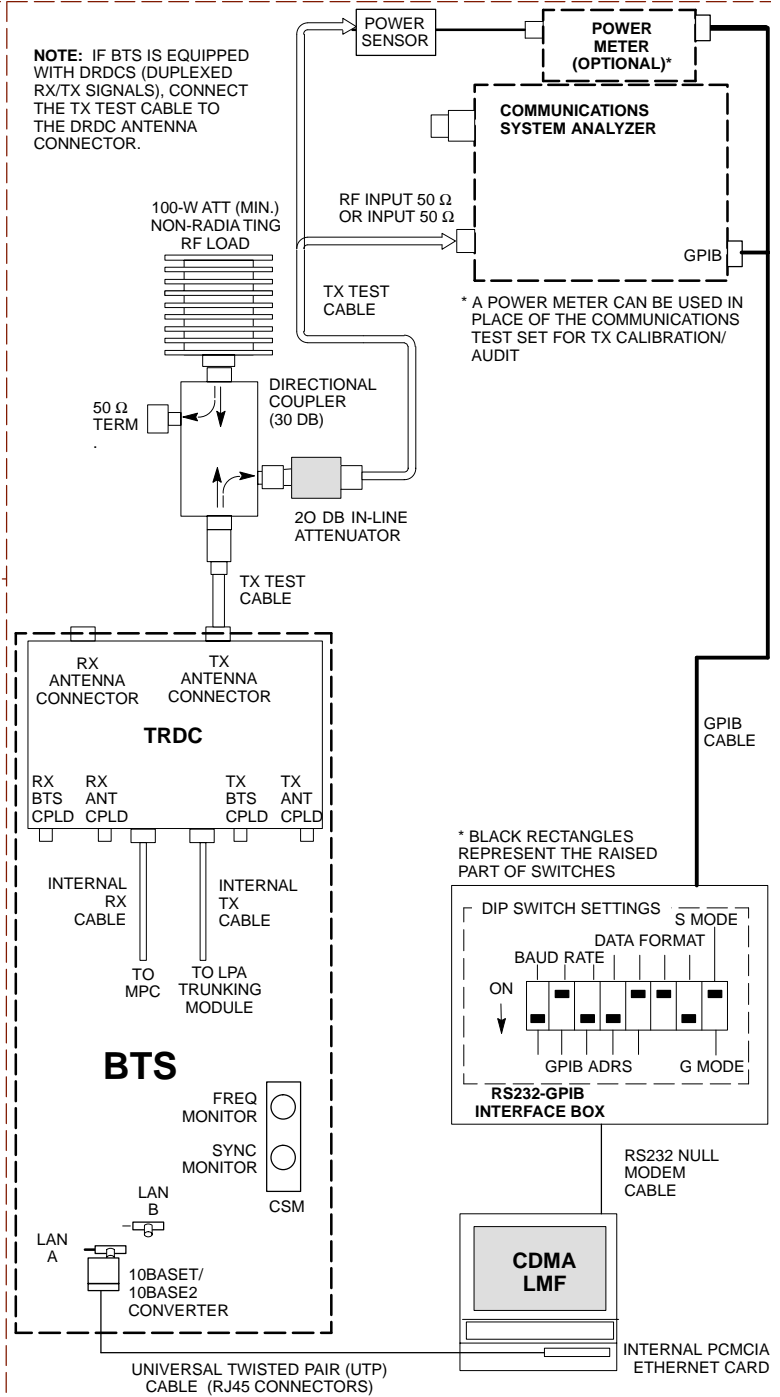

NOTE: IF BTS IS EQUIPPED WITH DRDCS (DUPLEXED RX/TX SIGNALS), CONNECT THE TX TEST CABLE TO THE DRDC ANTENNA CONNECTOR.

POWER SENSOR

POWER METER

100-W ATT (MIN.) NON-RADIATING RF LOAD

TX TEST CABLE

50 Ω TERM

DIRECTIONAL COUPLER (30 DB)

2O DB IN-LINE ATTENUATOR

TX TEST CABLE

RX ANTENNA CONNECTOR

TX ANTENNA CONNECTOR

TRDC

RX BTS CPLD　RX ANT CPLD　TX BTS CPLD　TX ANT CPLD

INTERNAL RX CABLE

INTERNAL TX CABLE

TO MPC

TO LPA TRUNKING MODULE

BTS

FREQ MONITOR

SYNC MONITOR

CSM

LAN B

LAN A

10BASET/ 10BASE2 CONVERTER

GPIB CABLE

* BLACK RECTANGLES REPRESENT THE RAISED PART OF SWITCHES

DIP SWITCH SETTINGS

S MODE

DATA FORMAT

BAUD RATE

ON

GPIB ADRS

G MODE

RS232-GPIB INTERFACE BOX

RS232 NULL MODEM CABLE

CDMA LMF

INTERNAL PCMCIA ETHERNET CARD

UNIVERSAL TWISTED PAIR (UTP) CABLE (RJ45 CONNECTORS)

Figure 3-15: TX Calibration Test Setup - Agilent E4406A and Advantest R3567 (IS-95A/B and CDMA2000 1X)

Set-up for ATP

Figure 3-16 and Figure 3-17 show the test set connections for ATP tests.

Figure 3-16: IS-95A/B ATP Test Set-up, TRDC Shown - CyberTest, Advantest R3465, and Agilent 8935
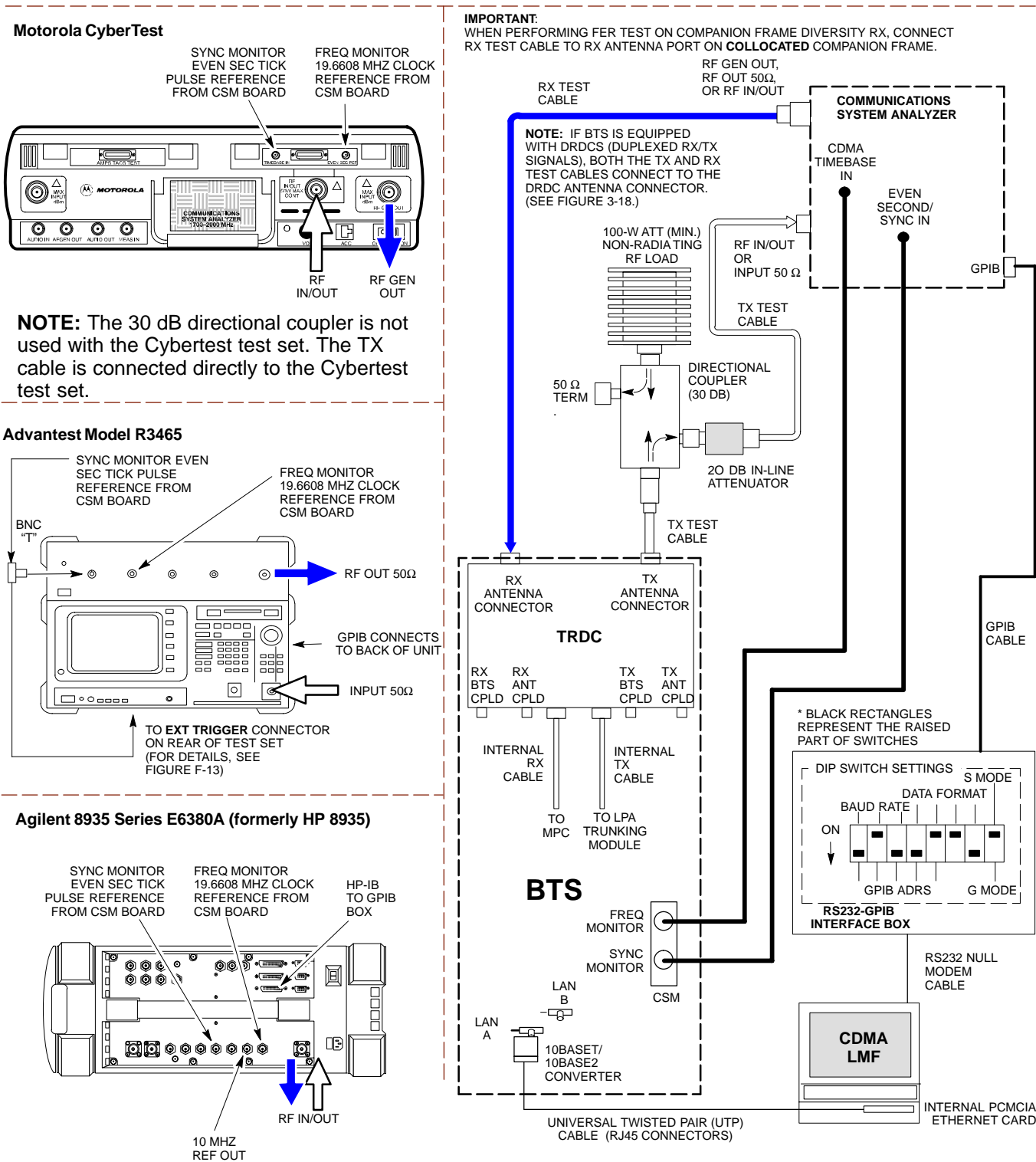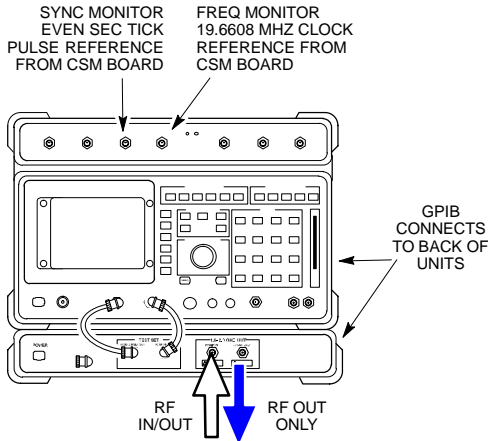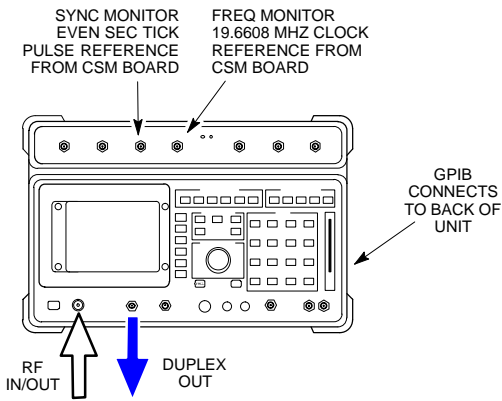

TEST SETS

Motorola CyberTest

NOTE: The 30 dB directional coupler is not used with the Cybertest test set. The TX cable is connected directly to the Cybertest test set.

Advantest Model R3465

Agilent 8935 Series E6380A (formerly HP 8935)

Optimization/ATP SET UP

Figure 3-17: IS-95A/B ATP Test Setup - HP 8921A

Figure 3-18: IS-95A/B and CDMA2000 1X ATP Test Setup With DRDCs - Agilent Test Equipment
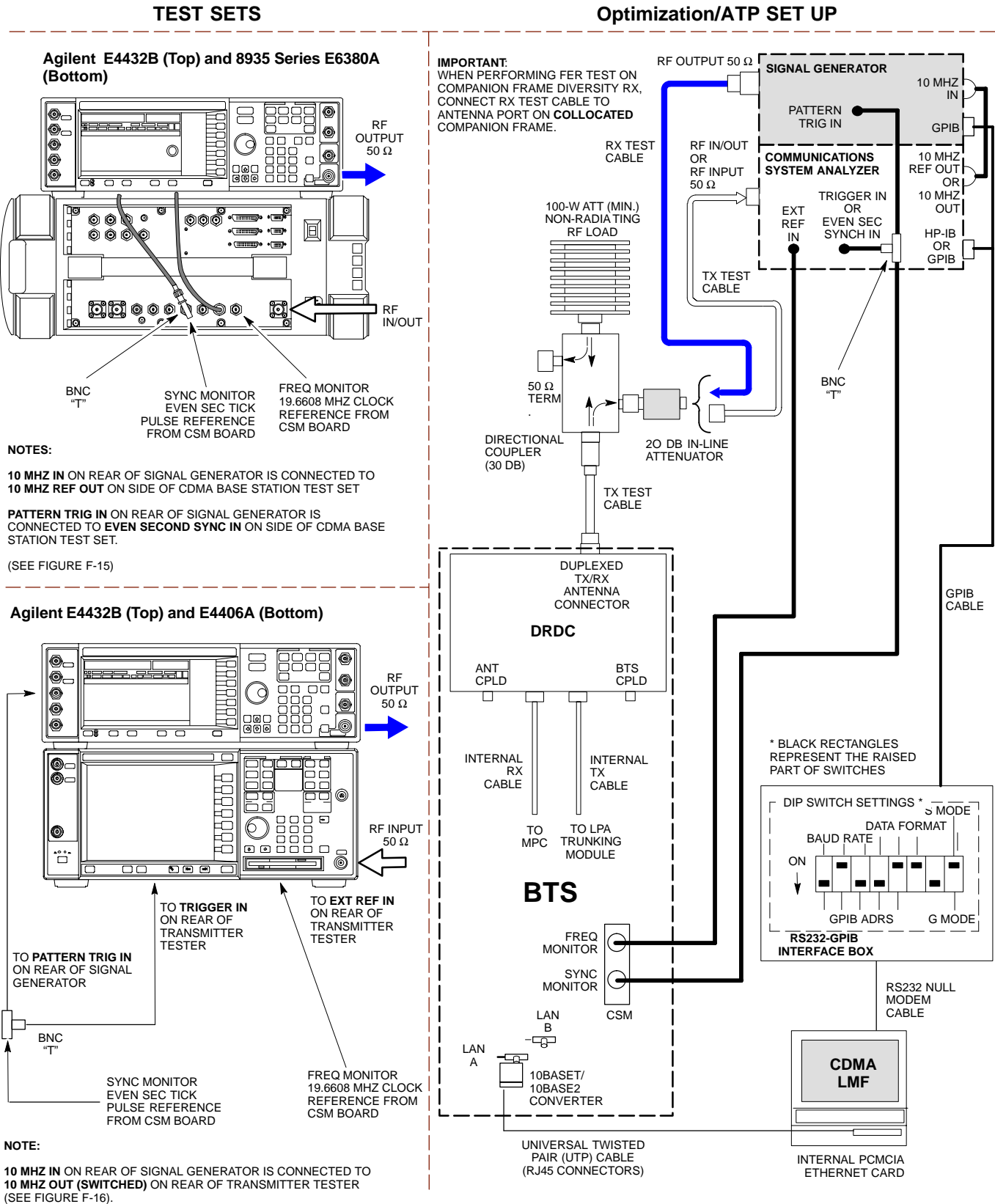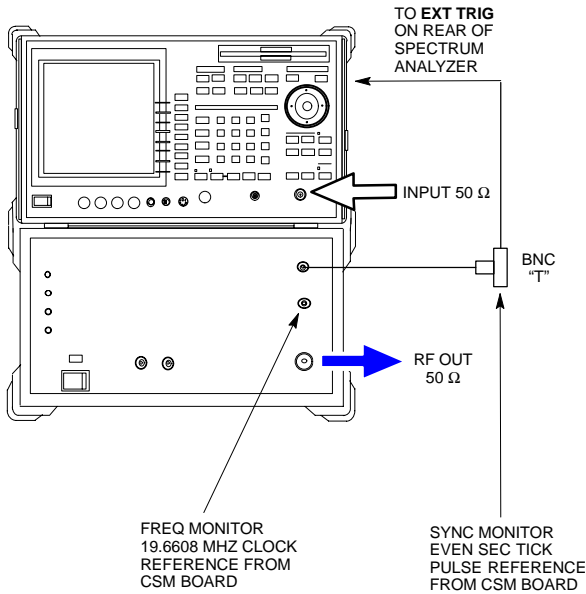
Figure 3-19: IS-95A/B and CDMA2000 1X ATP Test Setup With DRDCs - Advantest R3267/3562 Test Equipment

TEST SETS **Optimization/ATP SET UP**

Advantest R3267 (Top) and R3562 (Bottom)

TO **EXT TRIG** ON REAR OF SPECTRUM ANALYZER

INPUT 50 Ω

BNC "T"

RF OUT 50 Ω

FREQ MONITOR 19.6608 MHZ CLOCK REFERENCE FROM CSM BOARD

SYNC MONITOR EVEN SEC TICK PULSE REFERENCE FROM CSM BOARD

NOTE:

SYNTHE REF IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO **10 MHZ REF OUT** ON REAR OF SPECTRUM ANALYZER (SEE FIGURE F-17)

IMPORTANT: WHEN PERFORMING FER TEST ON COMPANION FRAME DIVERSITY RX, CONNECT RX TEST CABLE TO ANTENNA PORT ON **COLLOCATED** COMPANION FRAME.

RF OUT 50 Ω

SIGNAL GENERATOR

MOD TIME BASE IN

EXT TRIG IN

SYNTHE REF IN

GPIB

RX TEST CABLE

100-W ATT (MIN.) NON-RADIATING RF LOAD

SPECTRUM ANALYZER

INPUT 50 Ω

10 MHZ OUT

EXT TRIG

GPIB

TX TEST CABLE

BNC "T"

50 Ω TERM.

20 DB IN-LINE ATTENUATOR

DIRECTIONAL COUPLER (30 DB)

TX TEST CABLE

GPIB CABLE

DUPLEXED TX/RX ANTENNA CONNECTOR

DRDC

ANT CPLD

BTS CPLD

INTERNAL RX CABLE

INTERNAL TX CABLE

* BLACK RECTANGLES REPRESENT THE RAISED PART OF SWITCHES

TO MPC

TO LPA TRUNKING MODULE

DIP SWITCH SETTINGS

S MODE

DATA FORMAT

BAUD RATE

ON

BTS

GPIB ADRS

G MODE

RS232-GPIB INTERFACE BOX

FREQ MONITOR

SYNC MONITOR

CSM

RS232 NULL MODEM CABLE

LAN B

LAN A

10BASET/ 10BASE2 CONVERTER

CDMA LMF

UNIVERSAL TWISTED PAIR (UTP) CABLE (RJ45 CONNECTORS)
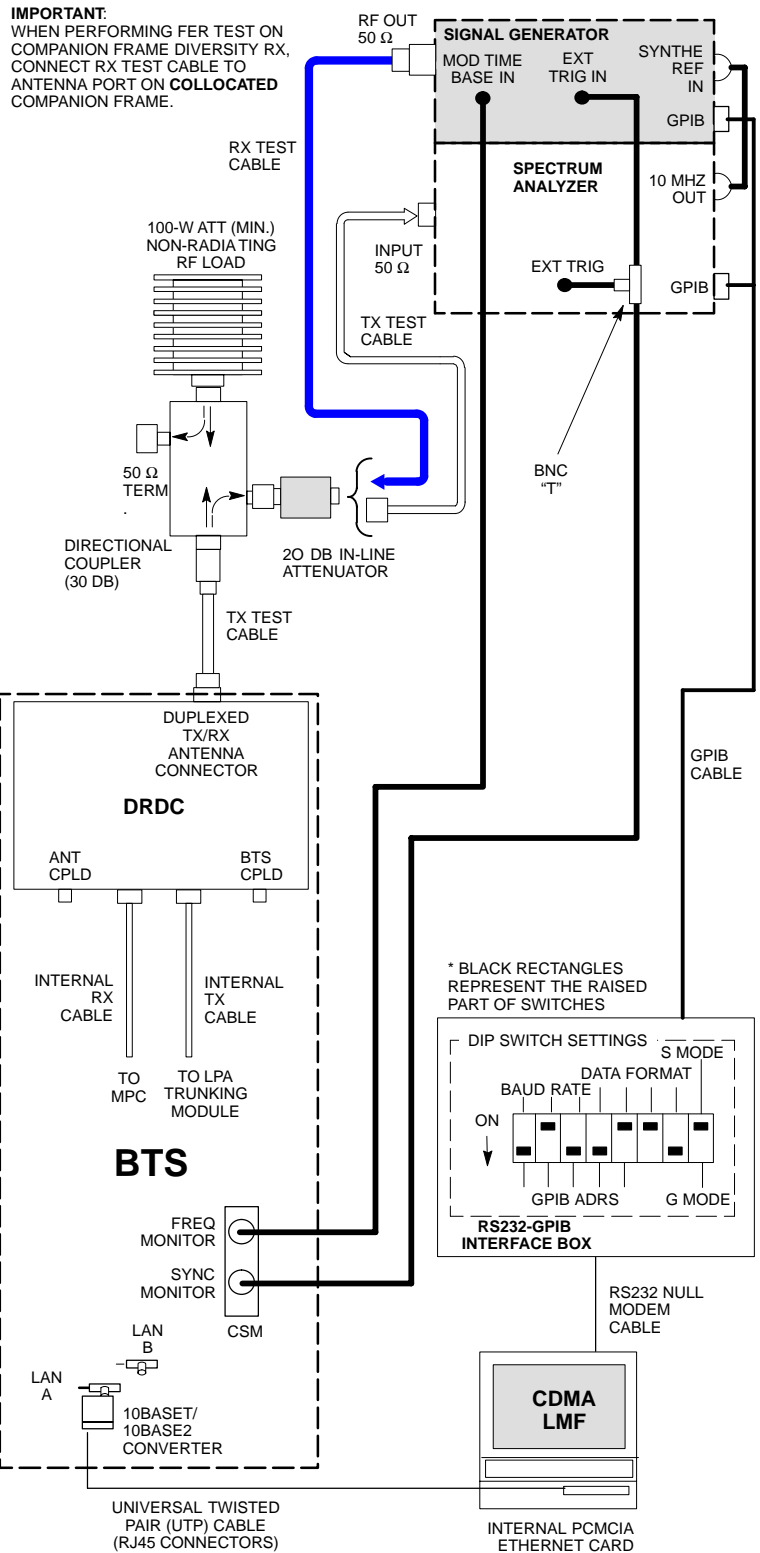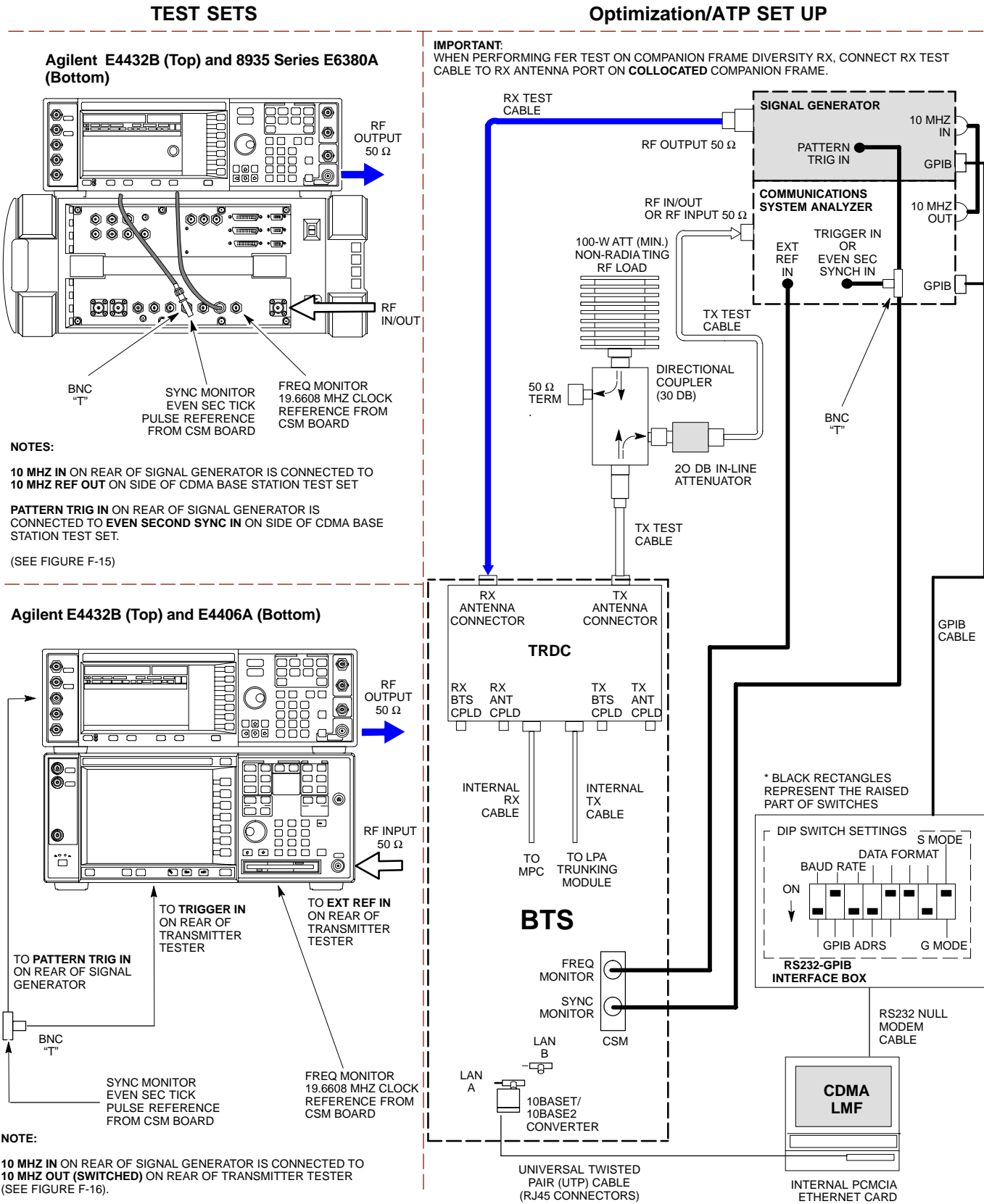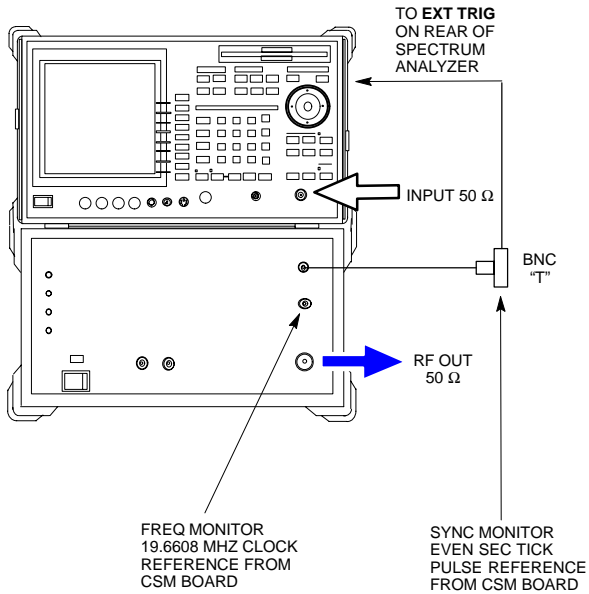
INTERNAL PCMCIA ETHERNET CARD

Figure 3-20: IS-95A/B and CDMA2000 1X ATP Test Setup With TRDCs - Agilent Test Equipment

Figure 3-21: IS-95A/B and CDMA2000 1X ATP Test Setup With TRDCs - Advantest R3267/3562 Test Equipment
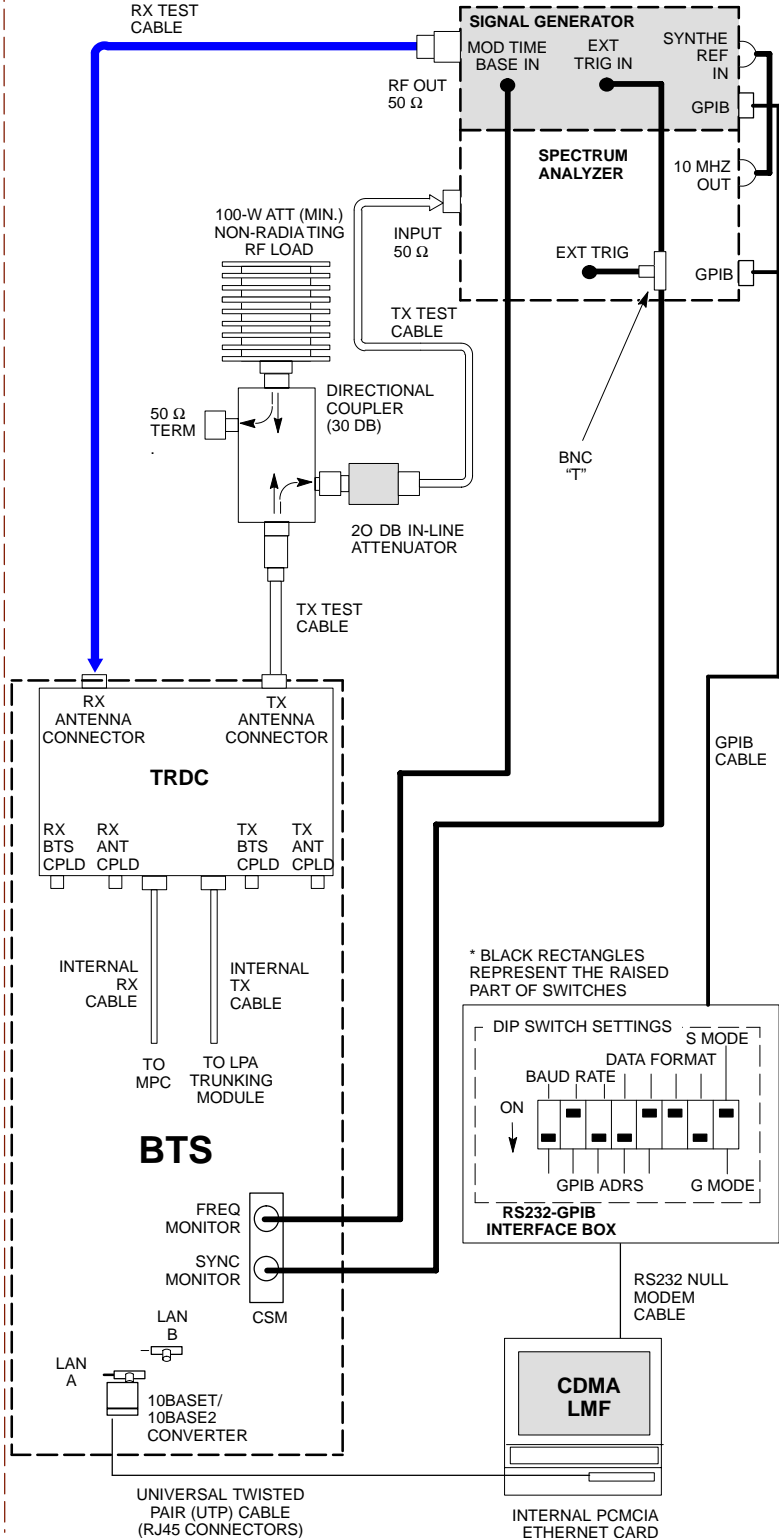
Test Set Calibration

Background

Proper test equipment calibration helps to ensure accurate BTS optimization and acceptance testing by assuring that the test equipment and associated cables do not introduce measurement errors.

NOTE	If the *test equipment set* (see the Terms and Abbreviations section of Chapter 1) being used to optimize or test the BTS has been calibrated and maintained as a set, this procedure does not need to be performed.

This procedure must be performed *before* the optimization. Verify all test equipment (including all associated cables and adapters actually used to interconnect test equipment items and the BTS) has been calibrated and maintained as a set.

CAUTION	If any piece of test equipment, test cable, or RF adapter, that makes up the calibrated *test equipment set* has been replaced, the *set* must be re-calibrated. Failure to do so can introduce measurement errors, resulting in incorrect measurements and degradation to system performance. Motorola recommends repeating cable calibration before testing at each BTS site.

NOTE	Calibration of the communications system analyzer (or equivalent test equipment) must be performed at the site before calibrating the overall *test equipment set*. Calibrate the test equipment *after* it has been allowed to warm-up and stabilize for a *a minimum of 60 minutes*.

Calibration Procedures Included

Automatic

Procedures included in this section use the LMF automated calibration routine to determine path losses of the supported communications analyzer, power meter, associated test cables, adapters, and (if used) antenna switch that make up the overall calibrated *test equipment set*. After calibration, the gain/loss offset values are stored in a test measurement offset file on the LMF computer.

Manual

Agilent E4406A Transmitter Tester - The E4406A does not support the power level zeroing calibration performed by the LMF. If this instrument is to be used for Bay Level Offset calibration and calibration is attempted with the LMF **Calibrate Test Equipment** function, the LMF will return a status window failure message stating that zeroing power is not supported by the E4406A. Refer to the Equipment Calibration section of Appendix F for instructions on using the instrument's self-alignment (calibration) function prior to performing Bay Level Offset calibration.

Power Meters - Manual power meter calibration procedures to be performed prior to automated calibration are included in the Equipment Calibration section of Appendix F**.**

Cable Calibration - Manual cable calibration procedures using the HP 8921A and Advantest R3465 communications system analyzers are provided in the Manual Cable Calibration section of Appendix F, if needed.

GPIB Addresses

GPIB addresses can range from 1 through 30. The LMF will accept any address in that range, but the numbers entered in the LMF Options window GPIB address boxes (Table 3-28 and Table 3-29) must match the addresses set in the test equipment. Motorola recommends using **1** for a CDMA signal generator, **13** for a power meter, and **18** for a communications system analyzer. To verify and, if necessary, change the GPIB addresses of the test equipment, refer to the Setting GPIB Addresses section of Appendix NO TAG.

Selecting Test Equipment

Serial Connection and **Network Connection** tabs are provided in the **LMF Options** window to specify the test equipment connection method. The **Serial Connection** tab is used when the test equipment items are connected directly to the LMF computer through a GPIB box (normal setup). The **Network Connection** tab is used when the test equipment is to be connected remotely via a network connection.

Prerequisites

Be sure the following have been completed before selecting test equipment:

- Test equipment is turned on.

- GPIB addresses set in the test equipment have been verified as correct using the applicable procedures in Appendix NO TAG.

- LMF computer serial port and test equipment are connected to the GPIB box.

Selecting Test Equipment

Test equipment may be selected either manually with operator input or automatically using the LMF autodetect feature.

Manually Selecting Test Equipment in a Serial Connection Tab

Test equipment can be manually specified before or after the test equipment is connected. The LMF does not attempt to verify the test equipment is actually detected when manual selection is specified. Follow the procedure in Table 3-28 to manually select test equipment.

Step	Action
	Table 3-28: Selecting Test Equipment Manually in the Serial Connection Tab
1	In the LMF window menu bar, click **Tools** and select **Options...** from the pull-down menu. - The **LMF Options** window appears.
2	If it is not in the forefront, click on the **Serial Connection** tab.
3	Select the correct serial port in the **COMM Port:** pick list (normally **COM1**).
4	*If it is not selected (black dot showing)*, click on the **Manual Specification** button.
5	Click on the check box(es) corresponding to the test equipment item(s) to be used.
6	Type the GPIB address in the corresponding **GPIB address** box (refer to the Setting GPIB Addresses section of Appendix NO TAG for directions on verifying and/or changing test equipment GPIB addresses). ***Motorola-recommended addresses are:*** **1** = signal generator **13** = power meter **18** = communications system analyzer **NOTE** When test equipment items are manually selected by the operator, the LMF defaults to using a power meter for RF power measurements. The LMF will use a communications system analyzer for RF power measurements only if a power meter is not selected (power meter checkbox *not* checked).
7	Click on **Apply**. - The button will darken until the selection has been recorded. **NOTE** With manual selection, the LMF does not attempt to detect the test equipment to verify it is connected and communicating with the LMF.
8	Click on **Dismiss** to close the **LMF Options** window.

Automatically Selecting Test Equipment in the Serial Connection Tab

When using the auto-detection feature to select test equipment, the LMF determines which test equipment items are actually communicating with LMF. Follow the procedure in Table 3-29 to use the auto-detection feature.

Step	Action
	Table 3-29: Selecting Test Equipment Using Auto-Detect
1	In the LMF window menu bar, click **Tools** and select **Options...** from the pull-down menu. - The **LMF Options** window appears.
2	If it is not in the forefront, click on the **Serial Connection** tab.
3	Select the correct serial port in the **COMM Port:** pick list (normally **COM1**).
4	*If it is not selected (no black dot showing)*, click on the **Auto-Detection** button.
5	*If they are not already displayed* in the box labeled **GPIB address to search**, click in the box and type in the GPIB addresses for the test equipment to be used, separating each address *with commas and no spaces*. (Refer to the Setting GPIB Addresses section of Appendix NO TAG for instructions on verifying and/or changing test equipment GPIB addresses.) **NOTE** During the GPIB address search for a test equipment item to perform RF power measurements (that is, for TX calibration), the LMF will select the first item it finds with the capability to perform the measurement. If, for example, the address sequence **13,18,1** is included in the **GPIB addresses to search** box, the power meter (GPIB address 13) will be used for RF power measurements. If the address sequence **18,13,1** is included, the LMF will use the communications system analyzer (GPIB address 18) for power measurements.
6	Click **Apply.** - The button will darken until the selection has been recorded. - A check mark will appear in the applicable **Manual Configuration** section check boxes for detected test equipment items.
7	Click **Dismiss** to close the **LMF Options** window.

Calibrating Test Equipment

The LMF **Calibrate Test Equipment** function zeros the power measurement level of the test equipment item that is to be used for TX calibration and audit. If both a power meter and an analyzer are connected (for example, an HP 437 and an HP8921A/600), only the power meter is zeroed.

NOTE	The Agilent E4406A transmitter tester does not support power measurement level zeroing. Refer to the Equipment Calibration section of Appendix F for E4406A calibration.

Prerequisites

- LMF computer serial port and test equipment are connected to the GPIB box.
- Test equipment is turned on and has warmed up for at least 60 minutes.
- Test equipment has been selected in the LMF (Table 3-28 or Table 3-29)

Follow the procedure in Table 3-30 to calibrate the test equipment.

Table 3-30: Test Equipment Calibration	
Step	**Action**
1	Click **Util** in the BTS menu bar, and select **Calibrate Test Equipment** from the pull-down menu. - A **Directions** window will be displayed.
2	Follow the direction provided.
3	Click on **Continue** to close the **Directions** window and start the calibration process. - A status report window is displayed.
4	Click on **OK** to close the status report window.

Calibrating Cables - Overview

The LMF C**able Calibration** function is used to measure the path loss (in dB) for the TX and RX cables, adapters, directional couplers, and attenuators that make up the cable configurations used for testing. A communications system analyzer is used to measure the loss of both the TX test cable and the RX test cable configurations. LMF cable calibration consists of the following processes:

1. Measure the loss of a short cable. This is done to compensate for any measurement error of the communications system analyzer. The short cable, which is used only for the calibration process, is connected in series with both the TX and RX test cable configurations when they are measured. The measured loss of the short cable is deducted from the measured loss of the TX and RX test cable configurations to determine the actual loss of the configurations. This deduction is done so any error in the analyzer measurement will be adjusted out of both the TX and RX measurements.

2. Measure the loss of the short cable plus the RX test cable configuration. The RX test cable configuration normally consists only of a coax cable with type-N connectors that is long enough to reach from the BTS RX connector to the test equipment. When the BTS antenna connectors carry *duplexed TX and RX* signals, a directional coupler and, if required by BTS type, an additional attenuator are also required for the RX test cable configuration. These additional items must be included in the path loss measurement.

3. Measure the loss of the short cable plus the TX test cable configuration. The TX test cable configuration normally consists of two coax cables with type-N connectors, a directional coupler, a termination load with sufficient rating to dissipate the BTS output power, and an additional attenuator, if required by the BTS type. The total path loss of the TX test configuration must be as required for the BTS (normally 30 or 50 dB). The Motorola Cybertest analyzer is different from other communications system analyzers because the required attenuation/load is built into the test set. Because of this, the Cybertest TX test configuration consists only of the required length coax cable.

Calibrating Test Cable Configurations with a Communications System Analyzer

NOTE	LMF cable calibration cannot be accomplished with an HP8921A analyzer for 1.9 MHz. A different analyzer type or the signal generator and spectrum analyzer method (Table 3-32 and Table 3-33) must be used. Cable calibration values must be manually entered into the LMF cable loss file if the signal generator and spectrum analyzer method is used. To use the HP8921A for *manual* test cable configuration calibration for 800 MHz BTSs, refer to the Manual Cable Calibration section of Appendix F.

Prerequisites

- Test equipment is turned on and has warmed up for at least 60 minutes.
- Test equipment has been selected in the LMF (Table 3-28 or Table 3-29).
- Test equipment has been calibrated and correctly connected for the type of test cable configuration to be calibrated.

Refer to Figure 3-10 or Figure 3-11 and follow the procedure in Table 3-31 to calibrate the test cable configurations.

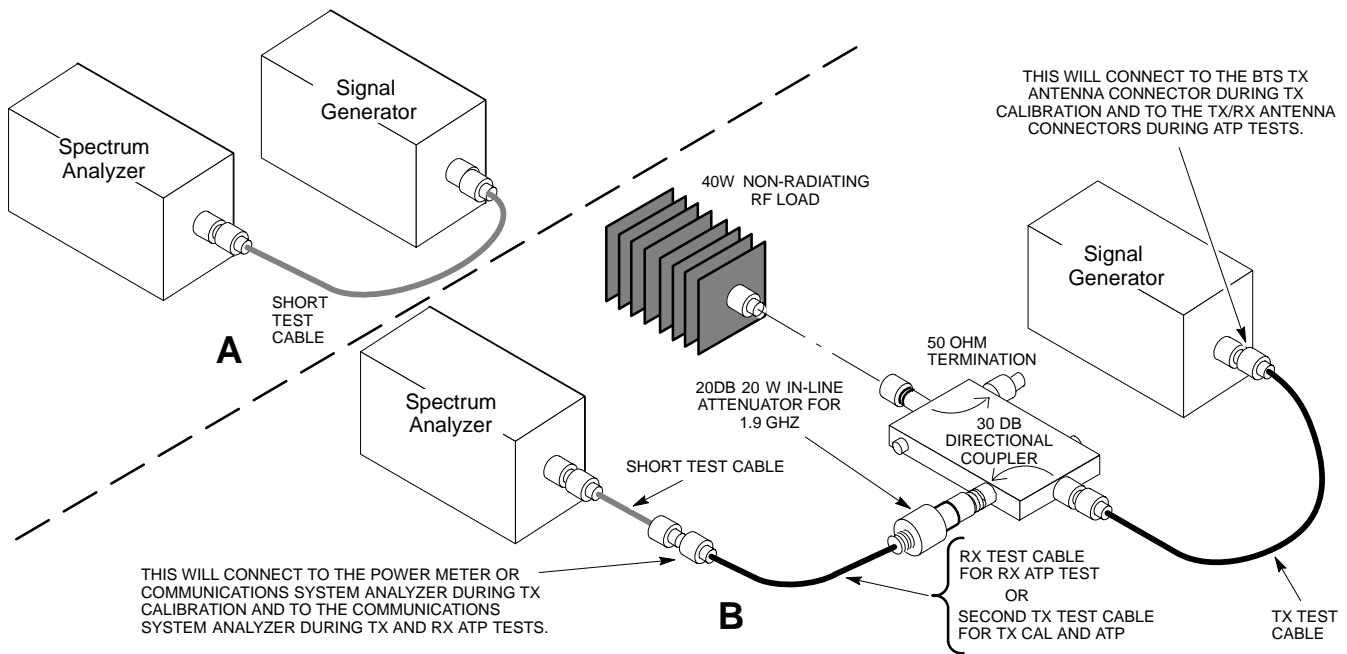|	**Table 3-31:** Test Cable Configuration Calibration with a Communications System Analyzer
Step	**Action**
1	Click **Util** in the BTS menu bar, and select **Cable Calibration...** in the pull-down menu.
	- A **Cable Calibration** window is displayed.

Table 3-31: Test Cable Configuration Calibration with a Communications System Analyzer

Step	Action
2	Enter one or more channel numbers in the **Channels** box. **NOTE** Multiple channel numbers must be separated by a comma with no spaces (for example, `200,800`). When two or more channel numbers are entered, the cables will be calibrated for each channel. Interpolation will be accomplished for other channels, as required, for TX calibration.
3	Select **TX and RX CABLE CAL**, **TX CABLE CAL** or **RX CABLE CAL** in the **Cable Calibration** picklist.
4	Click **OK**, and follow the directions displayed for each step. - A status report window will be displayed with the results of the cable calibration.

3

Calibrating TX and Duplexed RX ATP Test Cable Configurations Using a Signal Generator and Spectrum Analyzer

Refer to Figure 3-22 and follow the procedure in Table 3-32 to calibrate the TX test cable configuration for all BTSs or the RX ATP test cable configuration for BTSs with *duplexed TX/RX* using the signal generator and spectrum analyzer.

Table 3-32: Calibrating the TX Test Cable Configuration or the Duplexed RX Test Cable Configuration Using Signal Generator and Spectrum Analyzer

Step	Action
1	Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 3-22, detail "A" (top portion of figure).
2	Set signal generator to 0 dBm at the customer frequency of the 869.7-893.31 MHz band for North American cellular and 1930-1990 MHz band for North American PCS.
3	Use spectrum analyzer to measure signal generator output and record the value for the detail "A" setup.
4	Change the test setup to the one shown in detail "B" (lower portion of Figure 3-22), to measure cable output at customer frequency (869.7-893.31 MHz band for North American cellular and 1930-1990 MHz for North American PCS) and record the value measured using the detail "B" test setup.
5	Calibration factor = (value measured with detail "A" setup) - (value measured with detail "B" setup) Example: Cal factor = -1 dBm - (-53.5 dBm) = 52.5 dB **NOTE** The short cable is used for *calibration only*. It is *not* part of the final test setup. After calibration is completed, *do not* re-arrange any cables. Use the test cable configuration as-is to ensure test procedures use the correct calibration factor.

Figure 3-22: Calibration Setup for TX Test Cable Configuration and Duplexed RX Test Cable Configuration Using Signal Generator and Spectrum Analyzer

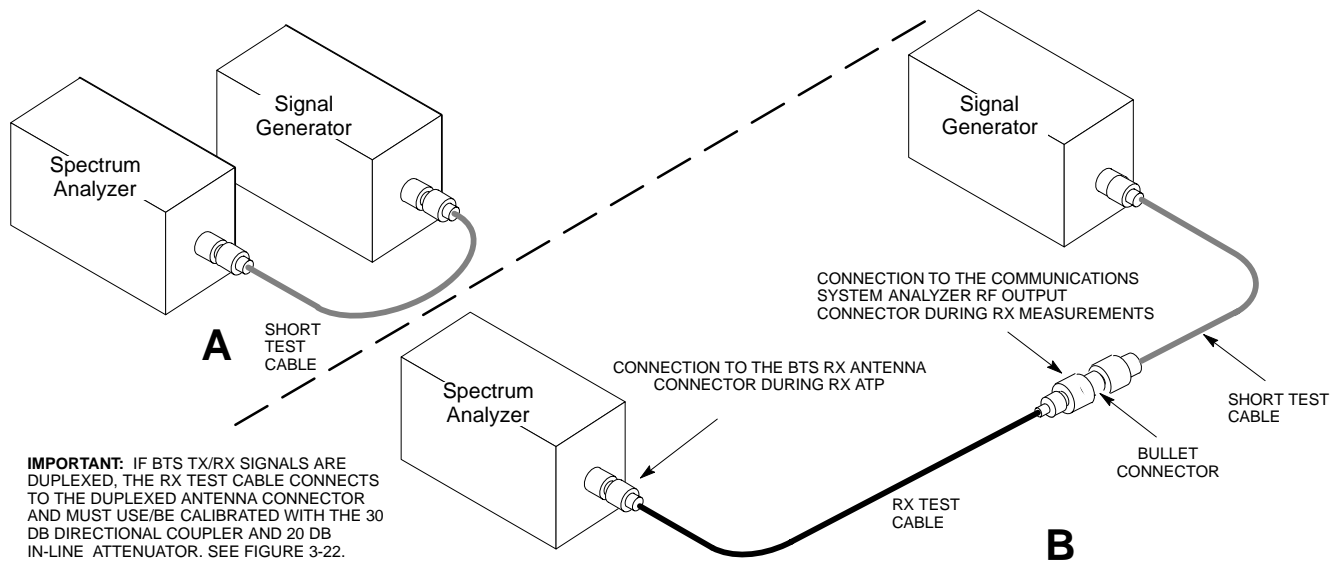## Calibrating Non-Duplexed RX Test Cable Configuration Using a Signal Generator and Spectrum Analyzer

Refer to Figure 3-23 and follow the procedure in Table 3-33 to calibrate the test cable configuration for *non*-duplexed RX using the signal generator and spectrum analyzer.

Table 3-33: Calibrating *Non*-Duplexed RX Test Cable Configuration Using a Signal Generator and Spectrum Analyzer	
Step	**Action**
1	**NOTE** When preparing to calibrate a BTS with *duplexed TX and RX* the RX cable calibration must be done using calibration setup in Figure 3-22 and the procedure in Table 3-32. Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 3-23, detail "A" (top portion of figure).
2	Set signal generator to -10 dBm at the customer's RX frequency of 824.7-848.31 MHz for North American cellular or 1850-1910 MHz band for North American PCS.
3	Use the spectrum analyzer to measure signal generator output and record the value for the detail "A" setup.
4	Change the test setup to the one shown in detail "B" (lower portion of Figure 3-23) to measure the output at the customer's RX frequency (824.7-848.31 MHz for North American cellular or 1850-1910 MHz band for North American PCS). Record the value measured with the detail "B" test setup.

Table 3-33: Calibrating *Non*-Duplexed RX Test Cable Configuration Using a Signal Generator and Spectrum Analyzer

Step	Action
5	Calibration factor = (value measured with detail "A" setup) - (value measured with detail "B" setup) Example: Cal factor = -12 dBm - (-14 dBm) = 2 dB **NOTE** The short test cable is used for test equipment setup calibration *only*. It is not part of the final test setup. After calibration is completed, *do not* re-arrange any cables. Use the test cable configuration as-is to ensure test procedures use the correct calibration factor.

Figure 3-23: Calibration Setup for *Non-Duplexed TX/RX Antenna Connection* RX Test Cable Configuration Using Signal Generator and Spectrum Analyzer

Setting Cable Loss Values

Cable loss values for TX and RX test cable configurations are normally set by accomplishing automatic cable calibration using the LMF and the applicable test equipment. The LMF stores the measured loss values in the cable loss files. The cable loss values can also be set or changed manually.

CAUTION	If cable calibration was performed without using the LMF, cable loss values *must* be manually entered in the LMF database. Failure to do this will result in inaccurate BTS calibration and reduced site performance.

3

Prerequisites

• LMF is logged into the BTS

	Table 3-34: Setting Cable Loss Values
Step	**Action**
1	Click **Util** in the BTS menu bar, and select **Edit > Cable Loss** in the pull-down menus. - A *tabbed* data entry pop-up window will appear.
2	Click on the **TX Cable Loss** tab or the **RX Cable Loss** tab, as required.
3	To add a new channel number, perform the following:
3a	- Click on the **Add Row** button.
3b	- Click in the **Channel #** or **Loss (dBm)** column, as required.
3c	- Enter the desired value.
4	To edit existing values, click in the data box to be changed and change the value.
5	To delete a row, click on the row and then click on the **Delete Row** button.
6	*For each tab with changes*, click on the **Save** button to save displayed values.
7	Click on the **Dismiss** button to close the window. **NOTE** • Values entered or changed after the **Save** button was used will be lost when the window is dismissed. • If cable loss values exist for two different channels the LMF will interpolate for all other channels. • Entered values will be used by the LMF as soon as they are saved. It is not necessary to log out and log back into the LMF for changes to take effect.

Setting TX Coupler Loss Value

If an in-service TX coupler is installed, the coupler loss must be manually entered so it will be included in the LMF TX calibration and audit calculations.

Prerequisites

- LMF is logged into the BTS
- Path loss, in dB, of the TX coupler must be known

<table>
<tr><td colspan="2" align="center">**Table 3-35:** Setting TX Coupler Loss Values</td></tr>
<tr><td align="center">**Step**</td><td align="center">**Action**</td></tr>
<tr><td align="center">1</td><td>Click **Util** in the BTS menu bar, and select **Edit > Coupler Loss...** in the pull-down menus.

- A *tabbed* data entry pop-up window will appear.</td></tr>
<tr><td align="center">2</td><td>Click on the **TX Coupler Loss** tab or the **RX Coupler Loss** tab, as required</td></tr>
<tr><td align="center">3</td><td>Click in the **Loss (dBm)** column for each carrier that has a coupler and enter the appropriate value.</td></tr>
<tr><td align="center">4</td><td>To edit existing values, click in the data box to be changed and change the value.</td></tr>
<tr><td align="center">5</td><td>*For each tab with changes*, click on the **Save** button to save displayed values.</td></tr>
<tr><td align="center">6</td><td>Click on the **Dismiss** button to close the window.

NOTE
- Values entered or changed after the **Save** button is used will be lost when the window is dismissed.
- The **In-Service Calibration** check box in the **Tools > Options > BTS Options** tab must be checked before entered TX coupler loss values will be used by the TX calibration and audit functions.
- New or changed values will be used by the LMF as soon as they are saved. Logging out and logging in again *are not required* to cause saved changes to take effect.</td></tr>
</table>

3

Bay Level Offset Calibration

Purpose of Bay Level Offset Calibration

Bay Level Offset (BLO) calibration is the central activity of the optimization process. BLO calibration compensates for normal equipment variations within the BTS RF paths and assures the correct transmit power is available at the BTS antenna connectors to meet site performance requirements.

What is BLO Calibration?

Description

BLO calibration is the complete title of what is normally referred to as "calibration." Calibration identifies the accumulated gain in every *transmit* path at the BTS site. The transmit path BLO values determined during calibration are stored in the LMF calibration data file, and are subsequently downloaded to each BBX. When transmit path calibration is performed, *receive* path BLO values will automatically be set to the default value in the LMF calibration file and downloaded.

BTS RF Path Descriptions

Transmit (TX) path - A TX path starts at an SCCP shelf BBX backplane slot, travels through the CIO card, is routed to the Linear Power Amplifier (LPA) trunking module for sector phase shifting, through the LPAs, back through the LPA trunking module for sector phase selection, through the TX bandpass filter (starter frames) or 2:1 TX combiner (companion frames), through the Transmit & Receive Dual Directional Coupler (TRDC) or Duplexer Directional Coupler (DRDC), and ends at the TRDC TX or DRDC antenna connector.

Receive (RX) main path - A main RX path starts at ANTENNAS connectors 1A, 2A, or 3A and travels through the associated TRDC or DRDC, the MPC in SCCP cage slot MPC-1, the CIO card, and terminates at a backplane BBX slot in the SCCP shelf.

Diversity RX path - Diversity RX paths differ for SC4812ET Lite starter (stand-alone) and companion frames. The following describe each type of path:

- **Starter frame diversity RX path** - A starter frame diversity RX path is the same as a main RX path except that it starts at ANTENNAS connectors 1B, 2B, or 3B, travels through the associated TRDC or DRDC, and the MPC card in SCCP cage slot MPC-2 (refer to Table 1-5).

- **Companion frame diversity RX path** - The companion frame main RX signal is used for the collocated companion frame diversity RX signal. A companion frame's diversity RX path starts at ANTENNAS connectors 1A, 2A, or 3A *in the collocated companion frame*. It travels through the associated TRDC or DRDC, the MPC in SCCP cage slot MPC-1, and the CIO card where it is then routed out of the

frame through the RX expansion *out* connectors (RX EXPANSION
1A, 2A, or 3A in Figure 1-9 or Figure 1-10). The signal travels
through the inter-frame diversity RX cables, into the RX expansion *in*
ports (RX EXPANSION 1B, 2B, or 3B in Figure 1-9 or Figure 1-10)
of the companion frame, through the Expansion MPC (EMPC) in
SCCP cage slot MPC-2, the CIO, and terminates at a backplane BBX
slot in the SCCP shelf.

- **RFDS sampling paths** - Directional couplers for RFDS signal
  sampling are integral to the SC4812ET Lite transmit and receive paths
  in the DRDCs and TRDCs. Cables connect from these directional
  couplers to the RFDS input connectors.

Component Verification During Calibration

TX Path Calibration

TX path calibration supports verification of correct BTS installation, RF
cabling installation and performance, functionality of all equipment
installed in the transmit RF chain, and the proper functioning of each
transmit RF path. External test equipment is used to calibrate and audit
the TX paths of the BTS.

RX Path Calibration

RX path calibration is not required or supported on CDMA BTS
systems. Default RX calibration values are written to the RX calibration
data files during the TX calibration process. RX functionality is verified
during Frame Erasure Rate (FER) testing.

When to Calibrate

Calibration to determine BLO:

1. Is required after initial BTS installation.
2. Must be done once each year for an operational BTS site.
3. Is recommended by Motorola for all associated RF paths after
   replacing any of the following components:
   - BBX card
   - SCCP shelf
   - CIO card
   - CIO-to-LP A trunking module RF cable
   - LPA trunking module
   - LPA
   - Trunking module-to-TX filter/filter combiner RF cable
   - TX filter or TX filter combiner
   - TX filter/filter combiner-to-DRDC/TRDC cable
   - DRDC or TRDC

BLO Calibration Data File

During the calibration process, the LMF creates a calibration (CAL) data
file where BLO values are stored. After calibration has been completed,
these offset values must be downloaded to the BBXs using the LMF
BLO download function. A detailed description of the file organization
and content is provided in the following paragraphs

NOTE	Due to the size of the file, Motorola recommends printing out a copy of a **bts-#.cal** file and referring to it for the following descriptions.

CAL File Organization

The CAL file is subdivided into three sections called "slot Blocks". These are:

1. **Slot[1] Block** which contains the calibration data for the six primary BBX slots.
2. **Slot[20] Block** which contains the calibration data for the redundant BBX (see Table 3-37).
3. **Slot[385] Block** which contains the calibration data for the RFDS.

BBX Slot Block Parts

BBX slot Blocks are further subdivided into the parts described in the following:

Slot Block Header - Each BBX slot Block has a header section (slot header) which contains:

- A creation Date and Time - broken down into separate parameters of createMonth, createDay, createYear, createHour, and createMin.

- The number of *calibration entries* in the file - the numBayLevelPts parameter. The parameter is fixed at 720 entries for SC4812-series frames. These 720 entries are combined to define the 360 *calibration points* of the CAL file.

- The slot Block format parameter.

Slot Block Bay Level Calibration Data - Each BBX slot Block has a Bay Level Calibration data section (BayLevelCal) which is organized as a large flat array. The array is organized by branch, SCCP cage BBX slot, and calibration *entries*. There are several ways to look at the array contents. Two different views are provided in the following to illustrate the significant features of BayLevelCal section content and organization:

- The first view of the array is shown in Table 3-36. This view shows the three *branches* of the array, transmit, main receive, and diversity receive offsets, and the *calibration entry* ranges which apply to each.

Table 3-36: BLO **bts-#.cal** File Array Branch Assignments	
Range	**Branch Assignment**
C[1]-C[120]	Transmit
C[121]-C[240]	No SC4812ET Lite BLO cal point entries (default only)
C[241]-C[360]	Receive
C[361]-C[480]	No SC4812ET Lite BLO cal point entries (default only)
C[481]-C[600]	Diversity Receive
C[601]-C[720]	No SC4812ET Lite BLO cal point entries (default only)

- The second view of the array is shown in Table 3-37. This view shows the assignment of *calibration entries* in each branch to each BBX slot, carrier, and sectorization. Three sectors are allowed for an SC4812ET Lite frame.

Table 3-37: SC4812ET Lite **bts-** #**.cal** File Array (By BBX/Sector)				
BBX	**Sectorization**	**TX Branch**	**RX Branch**	**RX Diversity Branch**
Slot[1] (Primary BBXs 1 through 6)				
1 (Omni)	3-Sector, 1st Carrier	C[1]-C[20]	C[241]-C[260]	C[481]-C[500]
2		C[21]-C[40]	C[261]-C[280]	C[501]-C[520]
3		C[41]-C[60]	C[281]-C[300]	C[521]-C[540]
4	3-Sector, 2nd Carrier	C[61]-C[80]	C[301]-C[320]	C[541]-C[560]
5		C[81]-C[100]	C[321]-C[340]	C[561]-C[580]
6		C[101]-C[120]	C[341]-C[360]	C[581]-C[600]
Not Used in SC4812ET Lite (CAL file entries are Channel 0 with default power set level.)		C[121]-C[140]	C[361]-C[380]	C[601]-C[620]
		C[141]-C[160]	C[381]-C[400]	C[621]-C[640]
		C[161]-C[180]	C[401]-C[420]	C[641]-C[660]
		C[181]-C[200]	C[421]-C[440]	C[661]-C[680]
		C[201]-C[220]	C[441]-C[460]	C[681]-C[700]
		C[221]-C[240]	C[461]-C[480]	C[701]-C[720]
Slot[20] (Redundant BBX-R1)				
1 (Omni)	3-Sector, 1st Carrier	C[1]-C[20]	C[241]-C[260]	C[481]-C[500]
2		C[21]-C[40]	C[261]-C[280]	C[501]-C[520]
3		C[41]-C[60]	C[281]-C[300]	C[521]-C[540]
4	3-Sector, 2nd Carrier	C[61]-C[80]	C[301]-C[320]	C[541]-C[560]
5		C[81]-C[100]	C[321]-C[340]	C[561]-C[580]
6		C[101]-C[120]	C[341]-C[360]	C[581]-C[600]
Not Used in SC4812ET Lite (CAL file entries are Channel 0 with default power set level.)		C[121]-C[140]	C[361]-C[380]	C[601]-C[620]
		C[141]-C[160]	C[381]-C[400]	C[621]-C[640]
		C[161]-C[180]	C[401]-C[420]	C[641]-C[660]
		C[181]-C[200]	C[421]-C[440]	C[661]-C[680]
		C[201]-C[220]	C[441]-C[460]	C[681]-C[700]
		C[221]-C[240]	C[461]-C[480]	C[701]-C[720]

- When referring to the CAL file print-out and Table 3-37, it can be seen that there is one BBX slot per sector with 20 "calibration *entries*" per BBX (sector) for each branch. *Two* calibration *entries* define a single "calibration *point*;" therefore there are *ten* calibration *points* in each branch for each BBX.

  - The first entry for a calibration point (all odd entries) identifies the CDMA channel (frequency) where the BLO is measured. The second calibration entry (all even entries) is the power set level (PwrLvlAdj) for that frequency. The valid range for PwrLvlAdj is

from 2500 to 27500 (2500 corresponds to -125 dBm and 27500 corresponds to +125 dBm).

- The ten calibration points for each slot-branch combination must be stored in order of increasing frequency. If less than ten points (frequencies) are calibrated, the BLO data for the highest frequency calibrated is written into the remainder of the ten points for that slot-branch.

Example:

$C[1]=384$ (odd cal entry)
$C[2]=19102$ (even cal entry) $\Big\} = 1$ *"calibration point"*

$C[3]=777$ (odd cal entry)
$C[4]=19086$ (even cal entry) $\Big\} = 1$ *"calibration point"*

.
.
.

$C[19]=777$ (odd cal entry)
$C[20]=19086$ (even cal entry) $\Big\} = 1$ *"calibration point"*

In the example above, BLO was measured at only two frequencies (channels 384 and 777) for SCCP slot BBX-1 transmit (Table 3-37). The BLO data for the highest frequency measured (channel 777) will be written to the remaining eight transmit calibration points (defined by entries C[5] through C[20]) for BBX-1.

Slot Block Temperature Compensation - Each BBX slot Block also has a temperature compensation data section (TempLevelCal) where power level compensation factors for temperature variations are stored.

CAL File and BLO Data Download

When BLO data is downloaded to the BBXs after calibration, the data is downloaded to the devices in the order it is stored in the CAL file. TX calibration data (entries C[1] - C[60]) are sent first. Data for the ten BBX slot 1 calibration points (entries C[1] - C[20]) are sent initially, followed by data for the ten BBX slot 2 calibration points (entries C[21] - C[40]), and so on. The RX calibration data is sent next in BBX slot sequence, followed by RX Diversity calibration data.

Test Equipment Setup for RF Path Calibration

Follow the steps outlined in Table 3-38 and refer as needed to Figure 3-13 or Figure 3-14 to set up test equipment.

	Table 3-38: Set Up Test Equipment for RF Path Calibration	
Step	**Action**
1	*If it has not already been done*, refer to the procedure in Table 3-10 to interface the LMF computer terminal to the frame LAN A connector.
2	*If it has not already been done*, refer to Table 3-11 to start a *GUI* LMF session.
3	If required, calibrate the test equipment per the procedure in Table 3-30.

Table 3-38: Set Up Test Equipment for RF Path Calibration	
Step	**Action**
4	**! CAUTION** To prevent damage to the test equipment, all transmit (TX) test connections must be via the 30 dB directional coupler for 800 MHz or via a 30 dB coupler with a 20 dB in-line attenuator for 1900 MHz. *For TX path calibration*, connect the test equipment as shown in Figure 3-13, Figure 3-14, or Figure 3-15, depending on the communications analyzer being used.

Transmit (TX) Path Calibration Description

The assigned channel frequency and desired power level at the frame TX ports for transmit calibration are derived from the BTS CDF file. Each BBX at the site is assigned to a sector and carrier. These are specified respectively in the sector and carrier *fields* of the ParentCARRIER parameter in each BBXs CDF file block. The channel frequency and desired power for the assigned *sector* are specified respectively in the ChannelList and SIFPilotPwr parameters of the CDF block for the CARRIER to which the BBX is assigned.

NOTE	Be sure the **bts-#.cdf** and **cbsc-#.cdf** files loaded on the LMF computer are current. The LMF will obtain carrier and channel information from these files and insert it into the appropriate CDMA Test Parameter screen. Failure to have the most current files from the CBSC can result in incorrect channel information being used to calibrate the BTS and unfavorable affects on BTS performance. Carrier and channel numbers should only be entered manually for special test cases or as a last resort.

The calibration process attempts to adjust the measured power to within ± 0.5 dB of the desired power. The calibration will pass if the error is less than ± 1.5 dB.

The TX BLO for the SC4812ET Lite is approximately 42.0 dB ± 5.0 dB. BLO is the gain in dB between the known power output of the BBX and the measured power at the TX port. BLO is derived by deducting the known BBX power output from the power measured at the TX port or (Measured Power) - (BBX TX Power Output).

Example:

    Measured Power (at TX port) = 36.0 dBm

    Known BBX TX Power Output = -6.0 dBm

    BLO = (36.0) - (-6.0) = 42.0 dB gain

TX Calibration and the LMF

The LMF **Tests > TX > TX Calibration...** and **Tests > All Cal/Audit...** selections perform TX BLO calibration testing for installed BBX(s). The **All Cal/Audit...** selection initiates a series of actions to perform TX calibration, and if calibration is successful, download BLO and perform TX audit. The **TX Calibration...** selection performs only TX calibration. When **TX Calibration...** is used, BLO download and TX audit *must be performed as separate activities*. The CDMA Test Parameters window which opens when **TX Calibration...** or **All Cal/Audit...** is selected contains several user-selectable features which are described in the following subsections.

Rate Set Drop-down Pick List

The Rate Set Drop-down Box is enabled if at least one MCC card is selected for the test. The available options for TX tests are 1 = 9600, and 3 = 9600 1X. Option 3 is only available if 1X cards are selected for the test. The available transfer rate options for RX tests are 1 = 9600 and 2 = 14400. Option 2 is only available if no 1X cards are selected.

Verify BLO Checkbox

A **Verify BLO** checkbox is provided and checked by default. After the actual TX calibration is completed, the BLO derived from the calibration is compared to a standard, acceptable BLO tolerance for the BTS. In some installations, additional items may be installed in the transmit path. The additional change in gain from these items could cause BLO verification failure and, therefore, failure of the entire calibration. In these cases, either the **Verify BLO** checkbox should be *un*checked or the additional path losses should be added into each applicable sector using the **Util > Edit > TX Coupler Loss...** function.

Single-Sided BLO Checkbox

An acceptable range of BLO values for each type of BTS is established to allow for tolerance variations in all the components of the RF chain. This acceptable range, 42±5 dB for example, is very wide to accommodate the redundant BBX in the BTS. This is a much wider tolerance than necessary for the primary BBXs. Primary BBXs normally will have BLOs in the lower half of the range. Using the example range, this would be from 37 to 42 dB. Checking the **Single-Sided BLO** checkbox should only be done when calibrating primary BBXs because it will reduce the acceptable BLO value variations to the lower half of the range. Because this is a much more stringent tolerance, calibrations run with **Single-Sided BLO** are more likely to fail and should only be attempted by an experienced CFE. Never select **Single-Sided BLO** when calibrating a *redundant* BBX.

Test Pattern Drop-down Pick List

Test Pattern Default and Descriptions - Pilot is shown as the default
setting in this picklist box. The full range of available selections and
their descriptions are as follows:

- **Standard** - performs calibration or audit using pilot, paging, synch,
  and six traffic channels with IS-97-specified gain. This pattern setting
  should be used for all *non*-in-service calibrations and audits. Using
  this pattern setting requires the selection of both a BBX *and* at least
  one MCC.

- **Pilot** (default) - performs calibration using only the pilot channel.
  This pattern setting should be used for in-service calibrations, and
  requires selection of only a BBX.

- **CDFPilot** - This pattern setting is for advanced users. It performs
  calibration or audit using the CDF value for pilot gain and IS-97 gain
  values for all the other channels included in the **Standard** pattern
  setting (paging, synch, and six traffic). Using this pattern setting
  requires the selection of both a BBX *and* at least one MCC.

- **CDF** - This pattern setting is for advanced users who need to use
  CDF gain settings for *all* channels included in the **Standard** pattern
  setting (pilot, paging, synch, and six traffic). Using this pattern setting
  requires the selection of both a BBX *and* at least one MCC.

Test Pattern Channels and Gain Settings - The CDMA channels and
their respective digital gain settings used for each test pattern are listed
in Table 3-39.

Table 3-39: Test Patterns with Channels and Gain Settings Used		
Test Pattern	**Channel(s)**	**Gain Setting**
Pilot	Pilot channel only	541
Standard	Pilot	117
	Synch channel (SCH)	57
	Paging (PCH)	114
	Traffic (TCH)	80 for each of 6 Walsh codes used (6*80)
CDF Pilot	Pilot	Uses CDF-specified pilot gain
	SCH	57
	PCH	114
	TCH	6*80
CDF	Pilot	All channels use CDF-specified gains
	SCH	
	PCH	
	TCH (6)	

TX Calibration

WARNING	*Before* installing any test equipment directly to any BTS **TX OUT** connector, *first verify no CDMA channels are keyed*. Failure to do so can result in serious personal injury and/or equipment damage.

CAUTION	Always wear an approved anti-static wrist strap while handling any circuit card or module. If this is not done, there is a high probability that the card or module could be damaged by ESD.

NOTE	*At new site installations,* to facilitate the complete test of each SCCP shelf (if the shelf is not already fully populated with BBX boards), move BBX boards from shelves currently not under test and install them into the empty BBX slots of the shelf currently being tested to insure that all BBX TX paths are tested.

- This procedure can be bypassed on operational sites that are due for periodic optimization.

- Prior to testing, view the CDF file to verify the correct BBX slots are equipped. Edit the file as required to include BBX slots not currently equipped (per Systems Engineering documentation).

All Cal/Audit Procedure

The LMF All Cal/Audit procedure performs the combination of the TX calibration, TX audit, and BLO download functions with one command.

Prerequisites

Before running this procedure, be sure that the following have been done:

- The card in slot CSM 1, GLIs, MCCs, and BBXs have correct code and data loads.

- Primary CSM and MGLI are INS_ACT (bright green).

- All BBXs are OOS_RAM (yellow).

- If running calibration or audit using a test pattern *other than **Pilot***, MCCs are INS_ACT (bright green).

- Test equipment and test cables are calibrated and connected for TX calibration.

- LMF is logged into the BTS in the *GUI* environment.

NOTE	Verify all BBX boards removed and repositioned have been returned to their assigned shelves/slots. Any BBX boards moved since they were downloaded will have to be downloaded again.

Follow the procedure in Table 3-40 to perform BLO calibration on the TX paths, download BLO values to the BBXs, and perform TX path audit in one operation.

Step	Action
	Table 3-40: All Cal/Audit Procedure
1	*If it has not already been done*, configure test equipment for TX calibration by following the procedure in Table 3-38.
2	Click on the BBX(s) to be calibrated.
3	If the **Test Pattern** to be used is **Standard**, **CDFPilot**, or **CDF**, select at least one MCC (refer to "Test Pattern Drop-down Pick List" under "TX Calibration and the LMF" in this section).
4	Click **Tests** in the BTS menu bar, and select **TX > All Cal/Audit...** from the pull-down menus. - A CDMA Test Parameters window will appear.
5	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the **Channels/Carrier** pick list. **NOTE** To select multiple items, hold down the **Shift** or **Ctrl** key while clicking on pick list items to select multiple carrier(s)-sector(s).
6	Verify that the correct channel number for the selected carrier is shown in the **Carrier # Channels** box. - If it is not, obtain the latest **bts-#.cdf** and **cbsc-#.cdf** files from the CBSC. **NOTE** If necessary, the correct channel number may be manually entered into the **Carrier # Channels** box.
7	If at least one MCC was selected in Step 3, select the appropriate transfer rate (**1** = 9600, **3** = 9600 1X) from the drop-down list in the **Rate Set** box. **NOTE** The rate selection of **3** is only available if 1X cards are selected for the test.
8	If **Verify BLO** is to be used during the calibration, leave the checkbox checked (default).
9	If **Single-Sided BLO** is to be used during the calibration, click on the checkbox. *** IMPORTANT** **Single-Sided BLO** should only be used for primary BBXs. Do not check the box when calibrating the *redundant* BBX.
10	In the **Test Pattern** box, select the test pattern to use for the calibration from the drop-down list (refer to "Test Pattern Drop-down Pick List" under "TX Calibration and the LMF" in this section).
11	Click **OK** to display the status report window followed by a **Directions** pop-up window.
12	Follow cable connection directions as they are displayed. - When the calibration process is completed, results will be displayed in the status report window.
13	Click **OK** to close the status report window.

TX Calibration Procedure

The LMF TX calibration procedure performs only the BLO calibration on the TX paths. The BLO download and TX audit functions must be performed separately when this method is chosen to perform calibration.

Prerequisites

Before running this test, be sure that the following have been done:

- The card in slot CSM 1, GLIs, MCCs, and BBXs have correct code and data loads.

- Primary CSM and MGLI are INS_ACT (bright green).

- All BBXs are OOS_RAM (yellow).

- If running calibration or audit using a test pattern *other than **Pilot***, MCCs are INS_ACT (bright green).

- Test equipment and test cables are calibrated and connected for TX calibration.

- LMF is logged into the BTS in the *GUI* environment.

NOTE	Verify all BBX boards removed and repositioned have been returned to their assigned shelves/slots. Any BBX boards moved since they were downloaded will have to be downloaded again.

Follow the procedure in Table 3-41 to perform BLO calibration on the TX paths.

__	**Table 3-41:** TX Calibration Procedure
Step	**Action**
1	***If it has not already been done***, configure test equipment for TX calibration by following the procedure in Table 3-38.
2	Click on the BBX(s) to be calibrated.
3	If the **Test Pattern** to be used is **Standard**, **CDFPilot**, or **CDF**, select at least one MCC (refer to "Test Pattern Drop-down Pick List" under "TX Calibration and the LMF" in this section).
4	Click **Tests** in the BTS menu bar, and select **TX > TX Calibration...** from the pull-down menus. - A CDMA Test Parameters window will appear.
5	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the **Channels/Carrier** pick list (press and hold the **Shift** or **Ctrl** keyboard key to select multiple items). **NOTE** To select multiple items, hold down the **Shift** or **Ctrl** key while clicking on pick list items to select multiple carrier(s)-sector(s).
6	Verify that the correct channel number for the selected carrier is shown in the **Carrier # Channels** box. - If it is not, obtain the latest **bts-#.cdf** and **cbsc-#.cdf** files from the CBSC. **NOTE** If necessary, the correct channel number may be manually entered into the **Carrier # Channels** box.

Step	Action
	Table 3-41: TX Calibration Procedure
7	If at least one MCC was selected in Step 3, select the appropriate transfer rate (**1** = 9600, **3** = 9600 1X) from the drop-down list in the **Rate Set** box. **NOTE** The rate selection of **3** is only available if 1X cards are selected for the test.
8	If **Verify BLO** is to be used during the calibration, leave the checkbox checked (default).
9	If **Single-Sided BLO** is to be used during the calibration, click on the checkbox. **NOTE** **Single-Sided BLO** should only be used for primary BBXs. Do not check the box when calibrating the *redundant* BBX.
10	In the **Test Pattern** box, select the test pattern to use for the calibration from the drop-down list (refer to "Test Pattern Drop-down Pick List" under "TX Calibration and the LMF" in this section).
11	Click **OK** to display the status report window followed by a **Directions** pop-up window.
12	Follow the cable connection directions as they are displayed. - When the calibration process is completed, results will be displayed in the status report window.
13	Click **OK** to close the status report window.

Exception Handling

In the event of a failure, the calibration procedure displays a **FAIL** message in the status report window and provides information in the **Description** field.

Re-check the test setup and connection and re-run the calibration. If the calibration fails again, note specifics about the failure, and refer to Chapter 6, *Troubleshooting*.

Download BLO Procedure

After a successful TX path calibration, the BLO calibration file data must be downloaded to the BBXs. In the download process, BLO data is extracted from the CAL file for the BTS and downloaded to the selected BBX devices.

Prerequisites

Ensure the following prerequisites have been met before proceeding.

- BBXs to receive the download are OOS_RAM (yellow).

- TX calibration was successfully completed

After a TX calibration has been performed using the procedure in Table 3-41, follow the steps in Table 3-42 to download the BLO data to the BBXs.

Table 3-42: Download BLO	
Step	**Action**
1	Select the BBX(s) to be downloaded.
2	Click **Device** in the BTS menu bar, and select **Download > BLO** from the pull-down menus. - A status report window displays the result of the download. **NOTE** Selected device(s) do not change color when BLO is downloaded.
3	Click **OK** to close the status report window.

3

Calibration Audit Introduction

The BLO calibration audit procedure confirms the successful generation and storage of the BLO calibration values. The calibration audit procedure measures the path gain or loss of every BBX transmit path at the site. In this test, actual system tolerances are used to determine the success or failure of a test. The same external test equipment set-up required for TX calibration is used for TX audit.

⚠**⁕** **IMPORTANT**

RF path verification, BLO calibration, and BLO data download to BBXs must have been successfully completed prior to performing the calibration audit.

TX Path Audit

Perform the calibration audit of the TX paths of all equipped BBX slots, per the steps in Table 3-43.

⚠ **WARNING**

Before installing any test equipment directly to any **TX OUT** connector, *first verify there are no CDMA BBX channels keyed*. Failure to do so can result in serious personal injury and/or equipment damage.

NOTE

If a successful **All Cal/Audit** was completed, this procedure does not need to be performed, as BLO is downloaded as part of the **All Cal/Audit**.

TX Audit Test

The **Tests** menu item, **TX Audit**, performs the TX BLO Audit test for BBXs. All measurements are made through the appropriate TX output connector using the TX calibration setup.

Prerequisites

Before running this test, the following should be done:

- The card in slot CSM 1, GLIs, BBXs have correct code load.
- Primary CSM and MGLI are INS_ACT (bright green).
- All BBXs are OOS_RAM (yellow).
- Test equipment and test cables are calibrated and connected for TX BLO calibration.
- LMF is logged into the BTS.

After a TX calibration has been performed using the procedure in Table 3-41, or if verification of BLO data in the CAL file is required, follow the procedure in Table 3-43 to perform a BTS TX path audit.

Step	Action
	Table 3-43: TX Path Audit
1	*If it has not already been done*, configure test equipment for TX path audit by following the procedure in Table 3-38 (TX audit uses the same configuration as TX calibration).
2	Select the BBX(s) to be audited.
3	If the **Test Pattern** to be used is **Standard**, **CDFPilot**, or **CDF**, select at least one MCC (refer to "Test Pattern Drop-down Pick List" under "TX Calibraton and the LMF" in this section).
4	Click **Tests** in the BTS menu bar, and select **TX > TX Audit...** from the pull-down menus. - A CDMA Test Parameters window will appear.
5	Select the appropriate carrier(s) (carrier-bts#-sector#-carrier#) from those displayed in the **Channels/Carrier** pick list (press and hold the **<Shift>** or **<Ctrl>** key to select multiple items). **NOTE** To select multiple items, hold down the **Shift** or **Ctrl** key while clicking on pick list items to select multiple carrier(s)-sector(s).
6	Verify that the correct channel number for the selected carrier is shown in the **Carrier # Channels** box. - If it is not, obtain the latest **bts-#.cdf** and **cbsc-#.cdf** files from the CBSC. **NOTE** If necessary, the correct channel number may be manually entered into the **Carrier # Channels** box.
7	If at least one MCC was selected in Step 3, select the appropriate transfer rate (**1** = 9600, **3** = 9600 1X) from the drop-down list in the **Rate Set** box. **NOTE** The rate selection of **3** is only available if 1X cards are selected for the test.
8	In the **Test Pattern** box, select the test pattern to use for the calibration from the drop-down list (refer to "Test Pattern Drop-down Pick List" under "TX Calibration and the LMF" in this section).
9	Click **OK** to display the status report window followed by a **Directions** pop-up window.
10	Follow the cable connection directions as they are displayed. - When the calibration process is completed, results will be displayed in the status report window.
11	Click on the **Save Results** or **Dismiss** button, as desired, to close the status report window.

Exception Handling

In the event of a failure, the calibration procedure displays a **FAIL** message in the status report window and provides information in the **Description** field.

Re-check the test setup and connections and re-run the test. If the tests fail again, note specifics about the failure, and refer to Chapter 6, *Troubleshooting*.

Create CAL File

3

The LMF Create Cal File function gets the BLO data from BBXs and creates/updates the CAL file for the BTS. If a CAL file does not exist a new one is created. If a CAL file already exists it is updated. After a BTS has been fully optimized a copy of the CAL file must exist so it can be transferred to the CBSC. If TX calibration has been successfully performed for all BBXs and BLO data has been downloaded, a CAL file will exist. Note the following:

- The Create Cal File function only applies to selected (highlighted) BBXs.

CAUTION	Editing the CAL file is not encouraged as this action can cause interface problems between the BTS and the LMF. To manually edit the CAL file you must first logout of the BTS. If you manually edit the CAL file and then use the Create Cal File function the edited information will be lost.

Prerequisites

Before running this procedure, the following should be done:

- LMF is logged into the BTS
- BBXs are OOS_RAM (yellow)
- BLO has been downloaded to the BBXs

Table 3-44: Create CAL File	
Step	**Action**
1	Select the applicable BBXs. - The CAL file will be updated for the selected BBXs *only*.
2	Click on **Device** in the BTS menu bar, and select **Create Cal File** from the pull-down menu. - A status report window will appear and display the results of the action.
3	Click the **OK** button to close the status report window.

RFDS Set-up and Calibration

RFDS Description

The optional RFDS is used to perform RF tests of the site from the CBSC or from the LMF. The RFDS contains the following FRUs:

- Antenna Select Unit (ASU)
- Fixed Wireless Terminal Interface Card (FWTIC)
- Subscriber Unit Assembly (SUA)

For complete information regarding the RFDS, refer to the CDMA *CDMA RFDS Hardware Installation; 68P64113A93*, *CDMA RFDS User's Guide; 68P64114A51*, and the *LMF Help function on-line documentation*.

3

RFDS Parameters

The **bts-#.cdf** file includes RFDS parameter settings that must match the installed RFDS equipment. The paragraphs below describe the editable parameters and their defaults. Table 3-45 explains how to edit the parameter settings.

- **RfdsEquip** - valid inputs are 0 through 2.
  0 = (default) RFDS is not equipped
  1 = Non-Cobra/Patzer box RFDS
  2 = Cobra RFDS

- **TsuEquip** - valid inputs are 0 or 1
  0 = (default) TSU not equipped
  1 = TSU is equipped in the system

- **MC1....4** - valid inputs are 0 or 1
  0 = (default) Not equipped
  1 = Multicouplers equipped in RFDS system
       (SC9600 internal RFDS only)

- **Asu1/2Equip** - valid inputs are 0 or 1
  0 = (default) Not equipped
  1 = Equipped

- **TestOrigDN** - valid inputs are ''' (default) or a numerical string up to 15 characters. (This is the phone number the RFDS dials when originating a call. A dummy number needs to be set up by the switch, and is to be used in this field.)

NOTE	Any text editor may be used to open the **bts-#.cdf** file to verify, view, or modify data. Because the **bts-#.cdf** file is generated on a Unix system, a more sophisticated editor, such as *MicroSoft* WordPad, will display file content in a more easily-read format than many simple text editors.

Checking and Setting RFDS Parameters

Follow the procedure in Table 3-45 to review and/or edit RFDS parameters.

<table>
<tr><td colspan="2" align="center">Table 3-45: RFDS Parameter Settings</td></tr>
<tr><td align="center">Step</td><td align="center">Action</td></tr>
<tr>
<td>1</td>
<td>

NOTE

Log out of the BTS prior to perform this procedure.

Using a text editor, verify the following fields are set correctly in the **bts-#.cdf** file:

EXAMPLE:

```
Asu1Equip = 1
Asu2Equip = 0 (1 if system is non-duplexed)
Mc1Equip = 0
Mc2Equip = 0
Mc3Equip = 0
Mc4Equip = 0
RfdsEquip = 2
TestOrigDN = '123456789'
TsuEquip = 1
```

NOTE

The above is an example of entries extracted from the **bts-#.cdf** file that should have been generated by the OMC-R and copied to the LMF. These fields will have been set by the OMC-R if the RFDSPARM database is modified for the RFDS.
</td>
</tr>
<tr>
<td>2</td>
<td>Save changes and/or quit the editor.</td>
</tr>
<tr>
<td>3</td>
<td>Log into the BTS using an LMF *GUI* session(refer to Table 3-11).</td>
</tr>
<tr>
<td>4</td>
<td>If *no* changes were made to the **bts-#.cdf** file fields listed in step 1, proceed to Step 7. If changes *were* made, continue with Step 5.</td>
</tr>
<tr>
<td>5</td>
<td>

NOTE

To make certain the complete data download is accepted, the MGLI should be OOS_RAM (yellow) when RFDS parameter settings are downloaded.

When changes are made to RFDS parameters in the **bts-#.cdf** file, data must be downloaded to the MGLI by performing the following:
</td>
</tr>
<tr>
<td>5a</td>
<td>- To be sure it does not take control when the MGLI is disabled, *manually* disable the redundant GLI card by unseating it from the backplane connectors and sliding it partially out of the shelf slot.</td>
</tr>
<tr>
<td>5b</td>
<td>- Click on the MGLI.</td>
</tr>
<tr>
<td>5c</td>
<td>- Click on **Device** in the BTS menu bar, and select **Disable** from the pull-down menu.
　-- A status report window shows the status of the operation.</td>
</tr>
<tr>
<td>5d</td>
<td>- When the operation is complete, click **OK** to close the status report window.</td>
</tr>
<tr>
<td>5e</td>
<td>- Click on the MGLI (now OOS_RAM (yellow)).</td>
</tr>
<tr>
<td>5f</td>
<td>- Click on **Device** in the BTS menu bar, and select **Download > Data** from the pull-down menus *(selected devices do not change color when data is downloaded)*.
　-- A status report window shows the status of the download.</td>
</tr>
</table>

Step	Action
	Table 3-45: RFDS Parameter Settings
5g	- Click **OK** to close the status report window.
5h	- Click on the MGLI.
5i	- Click on **Device** in the BTS menu bar, and select **Enable** from the pull-down menu. -- A status report window shows the status of the operation.
5j	- When the operation is complete, click **OK** to close the status report window. **! CAUTION** When the MGLI changes to INS_ACT, data will automatically be downloaded to the RFDS. During this process, the RFDS LED will slowly begin flashing red and green for approximately 2-3 minutes. **DO NOT** attempt to perform any functions with the RFDS until the LED remains steady green.
5k	- Re-seat the redundant GLI card into the backplane connectors and lock it in place with the ejector tabs.
5l	- Once the redundant GLI initializes, download data to it by selecting the card and, in the BTS menu bar, clicking **Device** and selecting **Download > Data** from the pull-down menus.
6	Any MCCs that were INS_ACT when the MGLI was disabled must be disabled, downloaded with data, and re-enabled as follows:
6a	- Select the devices to be reset by clicking on them or using **Select** from the BTS menu bar and clicking on **MCCs** in the pull-down menu.
6b	- In the BTS menu bar, click on **Device** and select **Disable** from the pull-down menu. -- A status report window shows the status of the operation.
6c	- Click **OK** to close the status report window.
6d	- Repeat Step 6a to select the MCCs.
6e	- Click on **Device** in the BTS menu bar and select **Download > Data** from the pull-down menu. (Selected devices do not change colot when data is downoaded.) - A status report window shows the status of the download.
6f	- Click on **OK** to close the status report window.
6g	- When data download is complete, enable the MCCs by following the procedure in Table 3-22.
7	Click on the RFDS tab.
8	Status the RFDS TSU by performing the following:
8a	- Click on the SUA to select it.
8b	- Click on **TSU** in the BTS menu bar, and select **Status TSU** from the pull-down menu. -- A status report shows the software version number for the TSIC and SUA.

3

Table 3-45: RFDS Parameter Settings	
Step	**Action**
8c	- Click **OK** to close the status report window. **NOTE** If the LMF displays an error message, check the following: • Ensure AMR cable is correctly connected from the BTS to the RFDS. • Verify RFDS has power. • Verify RFDS status LED is green. • Verify entries in RFDS fields of the **bts-#.cdf** file are correct (refer to step 1). • Status the MGLI and ensure it is communicating (by Ethernet) with the LMF, and is in the proper state (INS_ACT (bright green)).

RFDS TSU NAM Programming

The Number Assignment Module (NAM) information needs to be programmed into the TSU before it can receive and process test calls, or be used for any type of RFDS test. The RFDS TSU NAM must be programmed with the appropriate system parameters and phone number during hardware installation. The TSU phone and TSU MSI must be recorded for each BTS used for OMC-R RFDS software configuration.

NOTE	The user will only need to program the NAM for the initial installation of the RFDS.

Explanation of Parameters Used When Programming the TSU NAM

Table 3-46 defines the parameters used when editing the tsu.nam file.

Table 3-46: Definition of Parameters	
Access Overload Code Slot Index System ID Network ID	These parameters are obtained from the switch.
Primary Channel A Primary Channel B Secondary Channel A Secondary Channel B	These parameters are the channels which are to be used in operation of the system.
Lock Code Security Code Service Level Station Class Mark	Do *NOT* change.
IMSI MCC IMSI 11 12	These fields are obtained at the OMC using the following command: **OMC000>disp bts-# imsi** If the fields are blank, replace the IMSI fields in the NAM file to 0, otherwise use the values displayed by the OMC.
MIN Phone Number	These fields are the phone number assigned to the mobile. The ESN and MIN must be entered into the switch as well. **NOTE** This field is different from the TODN field in the **bts-#.cdf** file. The MIN is the phone number of the RFDS subscriber, and the TODN is the number the subscriber calls.

3

Valid NAM Ranges

Table 3-47 provides the valid NAM field ranges. If any of the fields are missing or out-of-range, the RFDS will error out.

Table 3-47: Valid NAM Field Ranges		
NAM Field Name	**Valid Range**	
	Minimum	**Maximum**
Access Overload Code	0	15
Slot Index	0	7
System ID	0	32767
Network ID	0	32767
Primary Channel A	25	1175
Primary Channel B	25	1175
Secondary Channel A	25	1175
Secondary Channel B	25	1175
Lock Code	0	999
Security Code	0	999999
Service Level	N/A	N/A
Station Class Mark	0	255
IMSI 11 12	0	99
IMSI MCC	0	999
MIN Phone Number	N/A	N/A

3

Set Antenna Map Data

The antenna map data must be entered manually if an RFDS is installed. Antenna map data does not need to be entered if an RFDS is not installed. The antenna map data is only used for RFDS tests and is required if an RFDS is installed.

Prerequisite

- LMF is logged into the BTS

Follow the procedure in Table 3-48 to set antenna map data for the RFDS.

Table 3-48: Set Antenna Map Data

Step	Action
1	Click on **Util** in the BTS menu bar, and select **Edit > Antenna Map...** from the pull-down menus. - A *tabbed* data entry pop-up window will appear.
2	In the data entry pop-up window, click on the **TX Antenna Map** or **RX Antenna Map** tab to select the antenna map to be edited.
3	Locate the carrier and sector number for which data is to be entered or edited, and click in the column where entry or editing is needed.
4	Enter/edit **Antenna #** and **Antenna Label** column data as needed for each carrier. **NOTE** Refer to the **CDMA Help > Utility Menu > Edit-Antenna Map...** section of *LMF Help function on-line documentation* for antenna map examples.
5	*For each tab with changes*, click on the **Save** button to save displayed values.
6	Click on the **Dismiss** button to close the window. **NOTE** - Values entered or changed after the **Save** button was used will be lost when the window is dismissed. - Entered values will be used by the LMF as soon as they are saved. It is not necessary to log out and log back into the LMF for changes to take effect.

Set RFDS Configuration Data

If an RFDS is installed, the RFDS configuration data must be manually entered.

Prerequisite

- LMF is logged into the BTS

NOTE	The entered **antenna#** index numbers must correspond to the **antenna#** index numbers used in the antenna maps.

Follow the procedure in Table 3-49 to set RFDS configuration data.

Table 3-49: Set RFDS Configuration Data	
Step	**Action**
1	Click on **Util** in the BTS menu bar, and select **Edit > RFDS Configuration...** from the pull-down menus. - A *tabbed* data entry pop-up window will appear.
2	In the data entry pop-up window, click on the **TX RFDS Configuration** or **RX RFDS Configuration** tab, as required.
3	To add a new antenna number, perform the following:
3a	- Click on the **Add Row** button.
3b	- Click in the **Antenna #**, **Cal Antenna**, **Scap Antenna**, or **Populate [Y/N]** columns, as required.
3c	- Enter the desired data.
4	To edit existing values click in the data box to be changed and change the value. **NOTE** Refer to the **CDMA Help > Utility Menu > Edit-RFDS Configuration...** section of *LMF Help function on-line documentation* for RFDS configuration data examples.
5	To delete a row, click on the row and then click on the **Delete Row** button.
6	*For each tab with changes*, click on the **Save** button to save displayed values.
7	Click on the **Dismiss** button to close the window. **NOTE** • Values entered or changed after the **Save** button was used will be lost when the window is dismissed. • Entered values will be used by the LMF as soon as they are saved. It is not necessary to log out and log back into the LMF for changes to take effect.

3

RFDS Calibration

The RFDS Calibration option is used to calibrate the RFDS TX and RX paths.

TX Path Calibration - For a TX antenna path calibration the BTS XCVR is keyed at a pre-determined power level and the BTS power output level is measured by the RFDS. The power level is then measured at the TX antenna directional coupler by the power measuring test equipment item being used (power meter or analyzer). The difference (offset) between the power level at the RFDS and the power level at the TX antenna directional coupler is used as the TX RFDS calibration offset value.

RX Path Calibration - For an RX antenna path calibration the RFDS is keyed at a pre-determined power level and the power input level is measured by the BTS BBX. A CDMA signal at the same power level measured by the BTS BBX is then injected at the RX antenna directional coupler by the communications system analyzer. The difference (offset) between the RFDS-keyed power level and power level measured at the BTS BBX is the RFDS RX calibration offset value.

RFDS calibration and the CAL file - The TX and RX RFDS calibration offset values are written to the CAL file in the slot[385] Block.

TSIC channel frequency - For each RFDS TSIC, the channel frequency is determined at the lower third and upper third of the appropriate band using the frequencies listed in Table 3-50.

Table 3-50: RFDS TSIC Calibration Channel Frequencies	
System	**Channel Calibration Points**
800 MHz (A and B)	341 and 682
1.9 GHz	408 and 791

⚠ **WARNING**

Before installing any test equipment directly to any **TX OUT** connector, *verify that there are no CDMA channels keyed*. Failure to do so can result in serious personal injury and/or equipment damage.

RFDS Calibration Procedure

Prerequisites

- Test equipment has been selected.

- Test equipment and test cables have been calibrated.

- TX calibration has been performed and BLO data has been downloaded to the BBXs.

- Test equipment and test cables are connected for TX calibration.

- Antenna map data has been entered for the site.

- BBXs are OOS-RAM.

Follow the procedure in Table 3-51 to perform RFDS calibration.

3

Table 3-51: RFDS Calibration
Step	**Action**
1	In the LMF, select the **BTS** tab.
2	*If the BTS Control button is not selected (no black dot showing)*, click on the **B** button in the BTS menu bar to select it.
3	Select the BBX(s) assigned to the carrier(s) and sector(s) which will be used in RFDS calibration (refer to Table 1-5 for BBX carrier and sector assignments).
4	Click on **RFDS** in the BTS menu bar, and select **RFDS Calibration...** from the pull-down menu. - An **RFDS Calibration** set-up window will be displayed.
5	In the **Tests to Perform** box, select **TX Calibration** or **RX Calibration**, as required
6	Enter the appropriate channel number(s) (refer to Table 3-50) in the **Channel Field** box. • To enter more than one channel number, use the following methods: - Separate *non*-sequential channel numbers with a comma and *no spaces*; for example: 247,585,742. - Enter a range of sequential channels by typing the first and last channel numbers in the range separated by a dash and *no spaces*; for example: 385-395.
7	If the frame is equipped with TX combiners, click in the **Has Combiners** checkbox.
8	Select the appropriate carrier(s) and sector(s) from the **Carriers** pick list (hold down the **Shift** or **Ctrl** key while clicking on pick list items to select multiple carrier(s)-sector(s)).
9	Select the appropriate **RX branch** (**Both**, **Main**, or **Div**ersity) in the drop-down list if performing RX calibration.
10	Click on the **OK** button. - A status report window is displayed, followed by a **Directions** pop-up window.
11	Follow the cable connection directions as they are displayed.
12	When the test is completed, test results are displayed in the status report window.
13	Click on the **OK** button to close the status report window.
14	Click on the **Frame** tab.
15	Select the MGLI by clicking on it.
16	Download updated RFDS offset data to the MGLI (see Step 5 in Table 3-45).

Program TSU NAM

The NAM must be programmed before it can receive and process test calls, or be used for any type of RFDS test.

Prerequisites

- MGLI is INS_ACT (bright green).
- SUA is powered up and has a code load.

Follow the procedure in Table 3-52 to program the TSU NAM.

Step	Action
	Table 3-52: Program NAM Procedure
1	In the LMF, select the RFDS tab.
2	Select the SUA by clicking on it.
3	Click on **TSU** in the BTS menu bar, and select **Program TSU NAM** from the pull-down menu. - A NAM programming window will appear.
4	Enter the appropriate information in the boxes (see Table 3-46 and Table 3-47) .
5	Click on the **OK** button to display the status report.
6	Click on the **OK** button to close the status report window.

Alarms Testing

Alarm Verification

Alarms testing should be performed at a convenient point in the optimization/ATP process, since the LMF is necessary to ensure that the SC4812ET Lite is generating the appropriate alarms.

The SC 4812ET Lite is capable of concurrently monitoring 10 customer defined input signals and four customer defined outputs, which interface to the 50-pair punchblock. All alarms are defaulted to "Not Equipped" during ATP testing. Testing of these inputs is achieved by triggering the alarms and monitoring the LMF for state-transition messages from the MGLI.

Alarm Reporting Display

The **Alarm Monitor** window can be displayed to list alarms that occur after the window is displayed. The Alarm Monitor window is accessed from the BTS menu bar.

The following buttons are included in the **Alarm Monitor** window:

- The **Options** button allows for a severity level (**Warning**, **Minor**, **Major**, **Critical**, and **Unknown**) selection. The default is all levels. To change the level of alarms reported click on the **Options** button and highlight the desired alarm level(s). To select multiple levels press the Ctrl key (for individual selections) or Shift key (for a range of selections) while clicking on the desired levels.

- The **Pause** button can be used to pause/stop the display of alarms. When the **Pause** button is clicked the name of the button changes to **Continue**. When the **Continue** button is click the display of alarms will continue. Alarms that occur between the time the **Pause** button is clicked and the **Continue** button is clicked will not be displayed.

- The **Clear** button can be used to clear the Alarm Monitor display. New alarms that occur after the **Clear** button is clicked will be displayed.

- The **Dismiss** button is used to dismiss/close the Alarm Monitor display.

Alarm Testing Set-up

Prepare for any alarm testing by following the procedures in Table 3-53.

Step	Action
	Table 3-53: Alarm Testing Preparation
1	*If it has not already been done*, refer to the procedure in Table 3-10 to connect the LMF computer terminal to the frame LAN A connector.
2	*If it has not already been done*, refer to Table 3-11 to start a *GUI* LMF session.
3	Click on **Util** in the BTS menu bar, and select **Alarm Monitor...** from the pull-down menu. - An **Alarm Monitor** window will open.

3

Heat Exchanger Alarm Test

Table 3-54 gives instructions on testing the Heat Exchanger alarm.

Step	Action
	Table 3-54: Heat Exchanger Alarm
1	Set one of the two DC PDA heat exchanger circuit breakers to **OFF**. This will generate a heat exchanger alarm. Be sure that the LMF reports the correct alarm condition.
2	Alarm condition will be reported as **BTS Relay #14**, **BTS Relay #15**, **BTS Relay #16**, **BTS Relay #17**, **BTS Relay #18**, with **Contact Alarm Open*Clear***, respectively.
3	Set the circuit breaker turned off in step 1 to **ON**. Ensure that the alarm conditions have cleared on the LMF with **Contact Alarm Closed*Clear*** for each reported BTS relay. **NOTE** The heat exchanger will go through the start-up sequence.

Door Alarm

Table 3-55 gives instructions on testing the door alarms.

Step	Action
	Table 3-55: ACLC and Power Entry Door Alarm
1	Close the ACLC and power entry compartment doors on the frame. Ensure that no alarms are reported on the LMF.
2	Individually open and then close the ACLC and power entry compartment door. Ensure that the LMF reports an alarm when each door is opened.
3	Alarm condition will be reported as **BTS Relay #27** contact.

AC Fail Alarm

Table 3-56 gives instructions on testing the AC Fail Alarm.

Step	Action
	Table 3-56: AC Fail Alarm
1	**NOTE** - Back-up batteries *must be installed* when performing this test. - To prevent inadvertently shutting down the RF compartment electronics, the batteries should be charged before performing this test. Set the ACLC MAIN circuit breaker to **OFF**. - The LMF should report an alarm for an AC Fail condition as **BTS Relay #21**, **BTS Relay #23**, **BTS Relay #24**, and **BTS Relay #29** contacts, respectively. - On the MAP, the MAJOR ALARM (red), MINOR ALARM (amber), and RECTIFIER FAIL (red) LEDs should light. - On the rectifiers, the DC and PWR LEDs should light red.
2	Set the ACLC MAIN circuit breaker to **ON**. - On the LMF, the AC Fail alarm should clear. - On the MAP, the MAJOR ALARM, MINOR ALARM, and RECTIFIER FAIL LEDs should extinguish. - On the rectifiers, the DC and PWR LEDs should change to green.

Minor Alarm

Table 3-57 gives instructions on performing a test to display a minor alarm.

Step	Action
	Table 3-57: Minor Alarm
1	Set the TCP switch on the MAP to **OFF**. This will generate a minor alarm. - The LMF should report the minor alarm as **BTS Relay #24** contacts. - The TC DISABLE (red) and MINOR ALARM (amber) LEDs on the MAP should light.
2	Set the TCP switch to **ON**. - The alarm condition indications should clear.

Rectifier Alarms

The following series of tests are for single rectifier modules in a multiple rectifier system. The systems include a three rectifier and a four rectifier system.

Single Rectifier Failure (Three Rectifier System)

Table 3-58 gives instructions on testing single rectifier failure or minor alarm in a **three (3) rectifier system** (single-carrier system). Procedures in this test are for a frame configured for single carrier operation with rectifiers installed in rectifier shelf positions 1, 2, and 3, from left to right when facing the frame.

Step	Action
	Table 3-58: Single Rectifier Fail or Minor Alarm, Single-Carrier System
1	**! CAUTION** Only perform this test if the rectifier current load displayed on the AMP indicator on the MAP is *125 amps or less*. Sufficient current capability to support a greater load may not be available when one rectifier is removed from the bus. On the ACLC, set the RECT. 2/4 circuit breaker to **OFF**. - The DC and PWR LEDs should light red on the rectifier in shelf position 2. - The MINOR ALARM (amber) and RECTIFIER FAIL (red) LEDs on the MAP should light. - The LMF should report an alarm condition as **BTS Relay #21** and **BTS Relay #24** contacts, respectively.
2	Set the RECT. 2/4 circuit breaker on the ACLC to **ON**. - All alarm indications should clear on the rectifier, MAP, and LMF.

Multiple Rectifier Failure (Three Rectifier System)

Table 3-59 gives instructions on testing multiple rectifier failure or major alarm in a **three (3) rectifier system** (single-carrier system). Procedures in this test are for a frame configured for single carrier operation with rectifiers installed in rectifier shelf positions 1, 2, and 3, from left to right when facing the frame.

Step	Action
	Table 3-59: Multiple Rectifier Failure or Major Alarm, Single-Carrier System
1	**! CAUTION** Only perform this test if the rectifier current load displayed on the AMP indicator on the MAP is *65 amps or less*. Sufficient current capability to support a greater load may not be available when two rectifiers are removed from the bus. On the ACLC, set the RECT. 1/3 circuit breaker to **OFF**. - The DC and PWR LEDs should light red on the rectifiers in shelf positions 1 and 3. - The MAJOR ALARM (red), MINOR ALARM (amber), and RECTIFIER FAIL (red) LEDs on the MAP should light. - The LMF should report an alarm condition as **BTS Relay #21**, **BTS Relay #24**, and **BTS Relay #29** contacts, respectively.
2	Set the RECT. 1/3 circuit breaker on the ACLC to **ON**. - All alarm indications should clear on the rectifiers, MAP, and LMF.

Single Rectifier Failure
(Four Rectifier System)

Table 3-60 gives instructions on testing single rectifier failure or minor alarm in a **four (4) rectifier system** (two-carrier system).

Step	Action
	Table 3-60: Single Rectifier Fail or Minor Alarm, Two-Carrier System
1	**! CAUTION** Only perform this test if the rectifier current load displayed on the AMP indicator on the MAP is *125 amps or less*. Sufficient current capability to support a greater load may not be available when two rectifiers are removed from the bus in the following steps. Unseat the rectifier in shelf position 4 from its connection at the rear of the shelf, but do not completely remove it from the shelf. - The rectifier 4 DC and PWR LEDs may light red momentarily and extinguish. There should be no other indications on the frame or LMF.
2	On the ACLC, set the RECT. 2/4 circuit breaker to **OFF**. - The rectifier 2 DC and PWR LEDs should light red. - The MINOR ALARM (amber) and RECTIFIER FAIL (red) LEDs on the MAP should light. - The LMF should report an alarm condition as **BTS Relay #21** and **BTS Relay #24** contacts, respectively.
3	Re-seat the rectifier in shelf position 4 into its connection at the rear of the shelf.
4	On the ACLC, set the RECT. 2/4 circuit breaker to **ON**. - The rectifier DC and PWR LEDs should light green. - All alarm indications should clear on the rectifiers, MAP, and LMF.

Multiple Rectifier Failure (Four Rectifier System)

Table 3-61 gives instructions on testing multiple rectifier failure or major alarm in a **four (4) rectifier system** (two-carrier system).

Step	Action
	Table 3-61: Multiple Rectifier Failure or Major Alarm, Two-Carrier System

1	**! CAUTION**
	Only perform this test if the rectifier current load displayed on the AMP indicator on the MAP is *125 amps or less*. Sufficient current capability to support a greater load may not be available when two rectifiers are removed from the bus.
	
	On the ACLC, set the RECT. 2/4 circuit breaker to **OFF**.
	  - The DC and PWR LEDs should light red on the rectifiers in shelf positions 2 and 4.
	  - The MAJOR ALARM (red), MINOR ALARM (amber), and RECTIFIER FAIL (red) LEDs on the MAP should light.
	  - The LMF should report an alarm condition as **BTS Relay #21**, **BTS Relay #24**, and **BTS Relay #29** contacts, respectively.

2	Set the RECT. 2/4 circuit breaker on the ACLC to **ON**. - All alarm indications should clear on the rectifiers, MAP, and LMF.

3

Battery Over Temperature Alarm (Optional)

| CAUTION	Use special care to avoid damaging insulation on cables, or damaging battery cases when using a heat gun.

Table 3-62 gives instructions on testing the battery over-temperature alarm system.
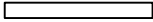
Table 3-62: Battery Over-Temperature Alarm	
Step	**Action**
1	Use a low-powered heat gun to gently heat the battery over-temperature sensor (see location in Figure 3-24). **! CAUTION** To avoid damaging the cable insulation, do not hold the hot air gun closer than three (3) inches from the sensor.
2	**NOTE** When the over-temperature alarm point is reached, an audible click will sound as DC PDA relay K1 contacts engage and relay K2 contacts disengage (make-before-break operation). When the sensor is heated to approximately 51° C, a battery over-temperature alarm is generated with the following indications. - On the MAP, the CHARGE DISABLE LED (red) should light and the MAIN CONN. ENABLE LED (green) should extinguish. - The LMF should display an alarm condition as **BTS Relay #22** contacts.
3	Switch the hot air gun to cool. Cool the sensor until the K1 and K2 contacts return to normal position (K1 open and K2 closed). The following indications that alarms have cleared should occur: - On the MAP, the CHARGE DISABLE LED (red) should extinguish and the MAIN CONN. ENABLE (green) LED should light. - The alarm reported on LMF will clear

3

Figure 3-24: Battery Over-Temperature Sensor
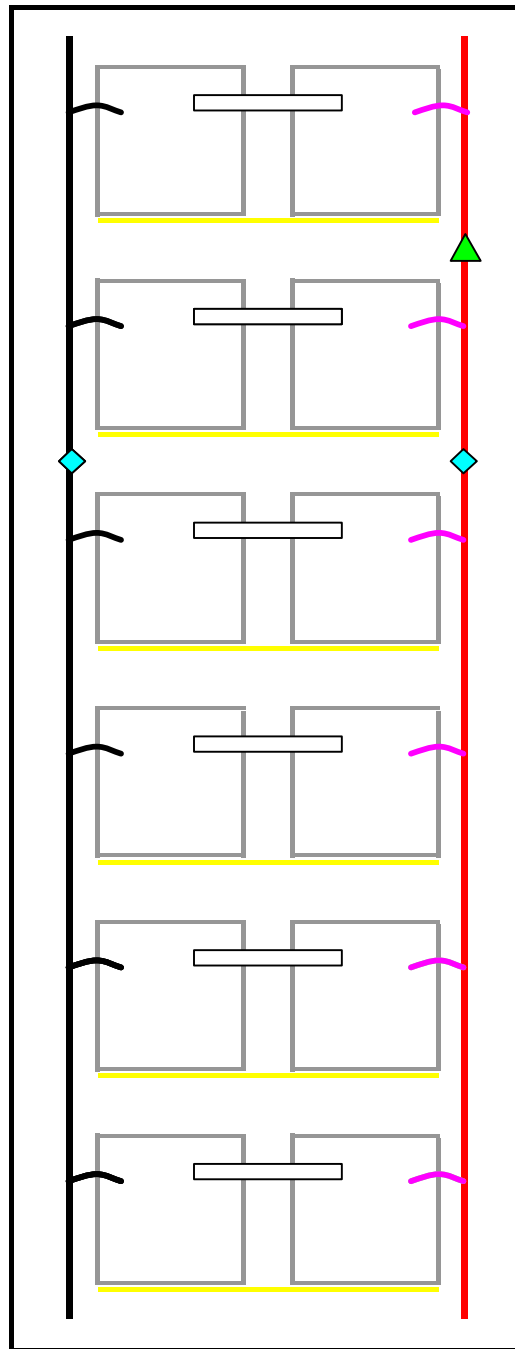
Bus Bar

6 AWG Cables

Battery Overtemp Sensor

Negative Temperature Compensation Sensor
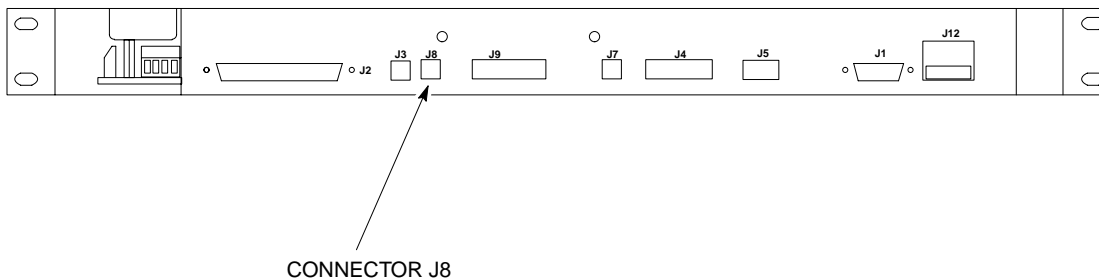
SC4812ETL0014-1

Rectifier Over Temperature Alarm

Table 3-63 gives instructions on testing the rectifier over-temperature alarm system.

CAUTION	Do not attempt to remove the MAP from the front of the frame to perform the following procedure, *even if the frame is equipped with a MAP cable tray.* MAP removal from the front requires complete site shut-down to avoid accidently shorting 27 Vdc to ground during the removal process.

Table 3-63: Rectifier Over-Temperature Alarm	
Step	**Action**
1	Remove the 14 tamper-resistant TORX fasteners securing the rear access panel to the rear of the frame (Figure 2-1), and remove the rear access panel. **NOTE** Panel fastener type can be either T-27 button head or T-30 pan head.
2	Looking up through the frame rear access opening, locate the rear of the MAP.
3	Remove the jumper plug from connector J8 on the rear panel of the MAP (Figure 3-25). The following conditions should occur: - Contacts on K1 and K2 change states (K1 now closed and K2 open). - The LMF reports an alarm condition as **BTS Relay #26** contacts.
4	Reinstall the jumper plug in connector J8, and verify that all alarm conditions have cleared.
5	Reinstall the frame rear access panel, securing it with the 14 tamper-resistant TORX fasteners removed in step 1.

Figure 3-25: MAP Connector J8 (Rear of MAP)

CONNECTOR J8

SC4812ETL0021-2

Before Leaving the Site

If no further operations are required after performing the alarm tests, complete the requirements in Table 5-8 before leaving the site.

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