

Chapter 6: Optimization and Calibration

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Preliminary Operations: Overview

Introduction

This section first verifies proper frame equipment against the site-specific documentation supplied for each BTS application.

Circuit Backhaul Operation

If circuit backhaul operation is being used, perform the procedures described in this chapter. Refer to the *LMF Help*, if further information is needed.

Packet Backhaul Operation

If packet backhaul configuration is being used, perform the procedures described in Appendix I.

Perform the IBR procedures described in Appendix G and Appendix H if GLI3 data load and span parameters need to be verified.

Cell-site Types

The site is configured as Omni with one carrier. The BTS can handle two carriers.

CDF/NECF

The Configuration Data File (CDF) or Network Element Configuration File (NECF) contains information that defines the BTS and data used to download files to the devices. The BTS CDF (`bts-#.cdf`) and CBSC CDF (`cbsc-#.cdf`) files are used by circuit BTSs. The NEC Base (`NECB - NECB*bts#.xml`) and NEC Journaling (`NECJ - NECJ*bts#.xml`) files are used by packet BTSs. CDF or NEC files must be placed in the applicable BTS folder before the LMF can be used to log into that BTS. CDF and NEC files are normally obtained from the CBSC using a floppy disk. A file transfer protocol (ftp) method can be used if the LMF computer has that capability.

The CDF and NEC files include the following information:

- Download instructions and protocol
- Site specific equipment information
- CCP2 Shelf allocation plan
 - BBX equipment
 - CSA equipment
 - MCC-1X (16, 24, 32, 64) channel element allocation plan. This plan indicates how the CCP2 shelf is configured, and how paging, synchronization, traffic, and access channel elements (and associated gain values) are assigned among the (up to 3) MCC-1Xs in the shelf.
- CSA equipment

- Effective Rate Power (ERP) table for all TX channels to antennas respectively. Motorola System Engineering specifies the ERP of a transmit antenna based on the site geography, antenna placement, and government regulations. Working from this ERP requirement, the antenna gain, (dependent on the units of measurement specified) and antenna feed line loss can be combined to determine the required power of the BTS. The corresponding BBX-1X output level required to achieve that power level on any channel/sector can also be determined.

NOTE

Refer to the *LMF Help function on-line documentation* for additional information on the layout of the LMF directory structure (including CDF or NEC file locations and formats).

Site Equipage Verification

Review the site documentation. Match the site engineering equipage data to the actual boards and modules shipped to the site. Physically inspect and verify the equipment provided for the frame.



CAUTION

Always wear an approved anti-static wrist strap while handling any circuit card/module to prevent damage by ESD. After removal, the card/module should be placed on a conductive surface or back into the anti-static packaging in which it was shipped.

Initial Installation of Boards/Modules

Table 6-1: Initial Installation of Boards/Modules

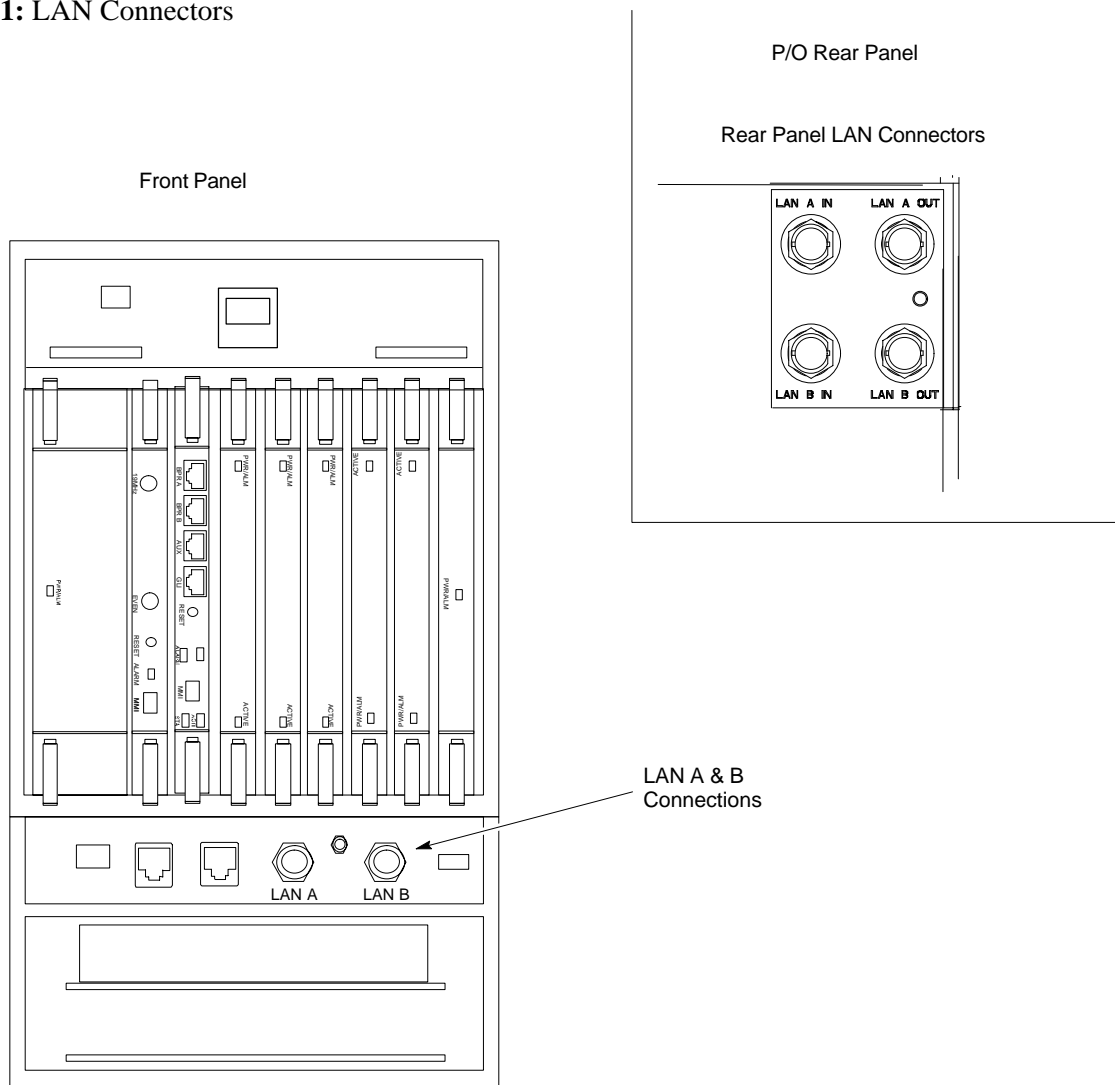
Step	Action
1	Refer to the site documentation and, if it was not previously done, slide all boards and modules into the appropriate shelves as required. DO NOT SEAT the boards and modules at this time.
2	As the actual site hardware is installed, record the serial number of each module on a “Serial Number Checklist” in the site logbook.

Ethernet LAN Termination

For proper operation, the BTS Ethernet Local Area Network (LAN) connections must be terminated with a 50-ohm loads. This is done by placing four (4) 50-ohm BNC terminations on the LAN A and B external IN and OUT connectors located on the rear of the BTS. This is only done on stand-alone BTSs. The front panel LAN connections are not terminated with loads.

Verify that the LAN A and B external IN and OUT connectors at the rear of the BTS have terminations installed. See Figure 6-1 for locations.

Figure 6-1: LAN Connectors



Introduction to Optimization and Calibration

Overview

This section describes procedures for isolating the BTS from the span lines, preparing and using the WinLMF, downloading system operating software, CSA reference verification/optimization, set up and calibration of the supported test equipment, and transmit/receive paths are functioning properly.

NOTE

Before using the WinLMF, use an editor to view the “CAVEATS” section in the “readme.txt” file in the c:\wlmf folder for any applicable information.

Optimization Process Summary

After a BTS is physically installed and the preliminary operations, such as power up, have been completed, the WinLMF is used to optimize the BTS. The basic optimization process consists of the following:

1. Download GLI3 (GLI-*bts#-1*) with application code and data and then enable GLI3.
2. Use the WinLMF status function and verify that all of the installed devices of the following types respond with status information: CSA, BBX, GLI3, and MCC. If a device is installed and powered up but is not responding and is colored gray in the BTS display, the device is not listed in the CDF file. The CDF/NECF file must be corrected before the device can be accessed by the WinLMF.
3. Download device application code and data to all devices of the following types:
 - CSA
 - BBX-1X
 - MCC-1X
4. Verify the operation of the GPS and HSO/MSO signals.
5. Using the WinLMF test equipment selection function, select the test equipment to be used for the calibration.
6. Calibrate the TX and RX test cables if they have not previously been calibrated with the WinLMF computer and software build which will be used for the optimization/calibration. Cable calibration values can be entered manually, if required.
7. Connect the required test equipment for a full optimization.
8. Select all of the BBXs and all of the MCCs and use the full optimization function. The full optimization function performs TX calibration, BLO download, TX audit, all TX tests, and all RX tests for all selected devices.
9. If the TX calibration fails, repeat the full optimization for any failed paths.

10. If the TX calibration fails again, troubleshoot and correct the problem causing the failure, and repeat the full optimization for the failed path.
11. If the TX calibration and audit portion of the full optimization passes for a path but some of the TX or RX tests fail, troubleshoot and correct the problem causing the failure, and run the individual tests as required until all TX and RX tests have passed for all paths.

Cell-site Types

The site is configured as Omni/Omni. Each cell site type has unique characteristics and must be optimized accordingly.

CDF/NECF

The CDF/NECF (Configuration Data File/Network Element Configuration File) contains information that defines the BTS and data used to download files to the devices. A CDF/NECF file must be placed in the applicable BTS folder before the WinLMF can be used to log into that BTS. CDF/NECF files are normally obtained from the CBSC using a floppy disk. A file transfer protocol (ftp) method can be used if the WinLMF computer has that capability. Refer to the *WinLMF Help function on-line documentation* for more information.

The CDF/NECF includes the following information:

- Download instructions and protocol
- Site specific equipage information
- CCP2 Shelf allocation plan
 - BBX equipage (based on cell-site type) including IS-95A/B or CDMA2000 1X capability and redundancy
 - CSA equipage including redundancy
 - Multi-Channel CDMA Card 1X channel element allocation plan. This plan indicates how the CCP2 Shelf is configured, and how the paging, synchronization, traffic, and access channel elements (and associated gain values) are assigned among the (up to 3) MCC-1Xs in the shelf.
- Effective Rated Power (ERP) table for all TX channels to antennas respectively. Motorola System Engineering specifies the ERP of a transmit antenna based on site geography, antenna placement, and government regulations. Working from this ERP requirement, antenna gain and antenna feed line loss can be combined to calculate the required transmit power at the frame antenna connections. The corresponding BBX output power required to achieve that power level on any channel/sector can then be determined based on Bay Level Offset (BLO) data established during the optimization process.

NOTE

Refer to Figure 6-2 and the *WinLMF Help function on-line documentation* for additional information on the layout of the WinLMF directory structure (including CDF/NECF file locations and formats).

BTS System Software Download

BTS system software must be successfully downloaded to the BTS processor boards before optimization can be performed. BTS operating code is loaded from the WinLMF computer terminal.

The BTS is configured for Circuit Backhaul and uses *bts.cdf* files. BTSs configured for Packet Backhaul use *bts.necf* files (*bts-xxx.xml*) located on the OMC-R.

NOTE

Before using the WinLMF for optimization/ATP, the correct ***bts-#.cdf*** (or ***bts-#.necf***) and ***cbsc-#.cdf*** files for the BTS must be obtained from the CBSC and put in a ***bts-#*** folder in the WinLMF. Failure to use the correct CDF/NECF files can cause wrong results. **Failure to use the correct CDF/NECF files to log into a live (traffic carrying) site can shut down the site.**

The CDF/NECF is normally obtained from the CBSC on a DOS formatted diskette, or through a file transfer protocol (ftp) if the WinLMF computer has ftp capability. Refer to the *WinLMF Help function on-line documentation* for the procedure.

Site Equipage Verification

If you have not already done so, use an editor to view the CDF/NECF, and review the site documentation. Verify the site engineering equipage data in the CDF/NECF matches the actual site hardware using a CDF/NECF conversion table.



CAUTION

Use extreme care not to make any changes to the CDF/NECF content while viewing the file. Changes to the CDF/NECF can cause the site to operate unreliably or render it incapable of operation.

Always wear a conductive, high impedance wrist strap while handling any circuit card/module to prevent damage by ESD. Extreme care should be taken during the removal and installation of any card/module. After removal, the card/module should be placed on a conductive surface or back into the anti-static bag in which it was shipped.

Overview of Packet BTS files

R16.0 and earlier releases had the configuration file called CDF for each BTS and CBSC used by WinLMF. In 16.1 Packet BTS, BTS with GLI3 booting in packet binary, the CDF is replaced by two new configuration files called Network Element Configuration Base (NECB) and Network Element Change Journal (NECJ). The NECB contains the baseline configuration and is analogous to the CDF, while the NECJ contains all the changes made to the configuration since the last time the NECB was re-generated. Once the NECJ gets to 80% of its maximum size, the NECB is re-generated and all the updates are rolled into it.

These files play much broader and vital role than previous CDF files. GLI3 booting in circuit binaries works similar to R16.0.

A few WinLMF related important facts about these files are listed below.

- Both files (NECB and NECJ) are in XML format.
- NECB contains all the up-to-date static configuration information and NECJ contains all the recent changes (including operations) which are not updated in the NECB.
- Both files can be viewed in any XML viewer (most easily available is Internet Explorer V5.0 and higher). They can be also viewed by any other word processor, but the XML tags will also be seen with them.
- These files will be created by OMC-R from MIB as per the BTS provisioning.
- These files will be regenerated for each software release upgrade on the system for each BTS.
- These files will reside on both OMC-R and Packet-GLI3 (unlike CDF) and will be synchronized periodically between them.
- Both NECB and NECJ file contain a “SoftwareVersion” field in their header section indicating the system release version of these files.
- Instead of the bts#.cdf file, the packet WinLMF uses a bts#.XML file, which is a copy of the NECB.XML file.
- Packet-GLI3 will need these files for site initialization.
- The scope of NECB has grown much broader than CDF and has much more BTS centric information. The use of generic version of these files should be strictly avoided for the correct site initialization.

WinLMF Features and Installation Requirements

Before optimization can be performed, the WinLMF application software must be installed and configured on a computer platform meeting Motorola-specified requirements.

NOTE

For the WinLMF graphics to display properly, the computer platform must be configured to display more than 256 colors. See the operating system software instructions for verifying and configuring the display settings.

Software and files for installing and updating the WinLMF are provided on CD ROM disks. The following items must be available:

- WinLMF application program on CD ROM
- CDF/NECF for each supported BTS (on diskette or available from the CBSC)
- CBSC File for each supported BTS (on floppy disk or CD ROM)

FTP Server

To be able to download files to the GLI3, the WinLMF now runs FTP server on the WinLMF laptop. The WinLMF FTP server runs from the LMFs home directory. All the files necessary to run the WinLMF FTP server are installed from the WinLMF CD. The FTP server is automatically started by the WinLMF upon successful Login to a Packet BTS.

In addition, the WinLMF provides a new option in the Tools menu called FTP Server. The option starts the LMFs FTP server if **Start** is selected, and stops the server if **Stop** is selected. The LMFs FTP server runs on port 21. If any other process is using that port, the error message is displayed to the user stating that the port is occupied. There is another option under FTP Server menu called FTP Monitor, which allows the user to watch FTP activity b/w the WinLMF and GLI.

Firewalls

Firewalls will block the FTP requests from the Packet GLI to the WinLMF laptop. You must disable your firewall before attempting the BTS Synch command. Some common firewall programs to look for include Network ICE, BlackICE, Norton's Desktop Firewall, Enterprise Firewall, and Personal Firewall.

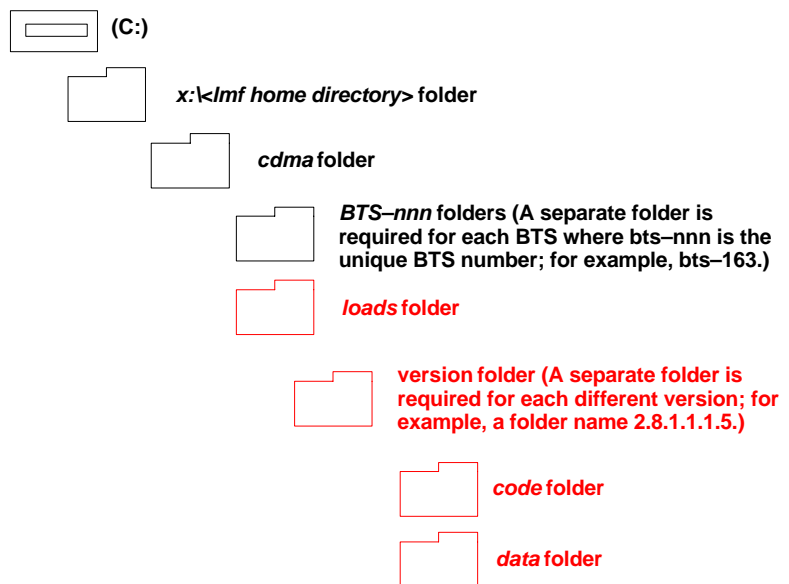
FTP Server Port in use

On some Windows 2000 installations, a process called “inetd.exe” makes the FTP server port 21 unusable by the WinLMF. If the WinLMF reports that the FTP server could not start because the port is in use, make sure the inetd.exe is not running by using the Task Manager’s process list. If inetd.exe is running, end the process by selecting it and clicking the “End Process” button. Inetd32.exe is NOT the same and ending it will not resolve this problem.

WinLMF File Structure Overview

The WinLMF 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 WinLMF. Except for the *bts-*nnn** folders, these folders are created as part of the WinLMF installation. Refer to the *CDMA WinLMF Operator’s Guide* for a complete description of the folder structure.

Figure 6-2: WinLMF Folder Structure



NOTE

The “loads” folder and all the folders below it are not available from the WinLMF for Software Release 2.16.3.x. These folders may be present as a legacy from previous software versions or downloaded from the OMC-R/CBSC.

WinLMF Home Directory

The WinLMF installation program creates the default home directory, **c:\wlmf**, and installs the application files and subdirectories (folders) in it. Because this can be changed at installation, the CDMA WinLMF home directory will be referred to with the generic convention of:

<x>:\<lmf home directory>

Where:

<x> = the WinLMF computer drive letter where the CDMA WinLMF home directory is located.

<lmf home directory> = the directory path or name where the CDMA WinLMF is installed.

NECF Filename Conventions and Directory Location

NECF

The NECF actually consists of two files: the NECB and NECJ. The naming convention for the NECB and NECJ is:

NECB*bts#.xml

NECJ*bts#.xml

Where:

* = any characters can be substituted there

= the actual integer BTS number

The NECB and its corresponding NECJ must have the exact same name, except for the “B” and “J” difference after the initial NEC characters.

The NECB and the NECJ must reside in the <WinLMF_HOME>\cdma\bts-# directory corresponding to the BTS frame they are for.

Load Information File (LIF)

The LIF contains all the devices binaries available for the specified System Software Release. It is the functional equivalent of the OLF file that was used pre-Packet.

The naming convention for the LIF is:

NE_LIF.xml

The LIF must reside in the <WinLMF_HOME>\cdma\loads\<Software Release Number> directory, where <WinLMF_HOME> = the home directory in which the WinLMF is installed, usually C:\wlmf <Software Release Number> = the System Software Release Number (e.g. 2.16.1.0.10).

Cal File

The Cal File still resides in the <WinLMF_HOME>\cdma\bts-# directory and is named bts-#.cal, where # is the actual integer number of the BTS.

**WinLMF Operating System
Installation**

This section provides information and instructions for installing and updating the WinLMF software and files.

First Time Installation Sequence

- Install Java Runtime Environment (JRE)
- Install U/WIN K-shell emulator
- Install WinLMF application programs
- Install/create BTS folders

NOTE

Any time you install U/WIN, you must install the WinLMF software because the installation of the WinLMF modifies some of the files that are installed during the U/Win installation. Installing U/Win over-writes these modifications.

There are multiple binary image packages for installation on the CD-ROM. When prompted, choose the load that corresponds to the switch release that you currently have installed. Perform the Device Images install after the WinLMF installation.

If applicable, a separate CD ROM of BTS Binaries may be available for binary updates.

Follow the procedure in Table 6-2 to install the WinLMF application program using the WinLMF CD ROM.

Table 6-2: Install WinLMF using CD ROM

✓	Step	Action
	1	Insert the WinLMF CD ROM disk into your disk drive and perform the following as required:
	1a	– If the Setup screen appears, follow the instructions displayed on the screen.
	1b	– If the Setup screen is not displayed, proceed to Step 2.
	2	Click on the Start button
	3	Select Run .
	4	Enter d:\autorun in the Open box and click OK .
		NOTE If applicable, replace the letter d with the correct CD ROM drive letter.

**Copy BTS CDF (or NECF) and
CBSC CDF Files to the WinLMF
Computer**

Before logging on to a BTS with the WinLMF computer to execute optimization/ATP procedures, the correct **bts-#.cdf** (or **bts-#.necf**) and **cbsc-#.cdf** files must be obtained from the CBSC and put in a **bts-#** folder in the WinLMF computer. This requires creating versions of the CBSC CDF files on a DOS-formatted floppy diskette and using the diskette to install the CDF files on the WinLMF computer.

NOTE

If the WinLMF has ftp capability, the ftp method can be used to copy the CDF or NECF files from the CBSC. On Sun OS workstations, the **unix2dos** command can be used in place of the **cp** command (e.g., `unix2dos bts-248.cdf bts-248.cdf`). This should be done using a copy of the CBSC CDF file so the original CBSC CDF file is not changed to DOS format.

When copying CDF or NECF files, comply with the following to prevent BTS login problems with the Windows WinLMF:

- The numbers used in the **bts-#.cdf** (or **bts-#.necf**) and **cbsc-#.cdf** filenames must correspond to the locally-assigned numbers for each BTS and its controlling CBSC.
- The generic **cbsc-1.cdf** file supplied with the Windows WinLMF will work with locally numbered BTS CDF files. Using this file *will not provide a valid optimization* unless the generic file is edited to replace default parameters (e.g., channel numbers) with the operational parameters used locally.

The procedure in Table 6-3 lists the steps required to transfer the CDF files from the CBSC to the WinLMF computer. For further information, refer to the *WinLMF Help function on-line documentation*.

Table 6-3: Copying CDF or NECF Files to the WinLMF Computer

✓	Step	Action
AT THE CBSC:		
	1	Login to the CBSC workstation.
	2	Insert a DOS-formatted floppy diskette in the workstation drive.
	3	Type eject -q and press the Enter key.

... continued on next page

Table 6-3: Copying CDF or NECF Files to the WinLMF Computer

✓	Step	Action
	4	Type mount and press the Enter key. NOTE <ul style="list-style-type: none"> • Look for the “<i>floppy/no_name</i>” message on the last line displayed. • If the eject command was previously entered, <i>floppy/no_name</i> will be appended with a number. Use the explicit <i>floppy/no_name</i> reference displayed when performing step 7.
	5	Change to the directory, where the files to be copied reside, by typing cd <directoryname> (e.g., cd bts-248) and pressing the Enter key.
	6	Type ls and press the Enter key to display the list of files in the directory.
	7	With <i>Solaris versions of Unix</i> , create <i>DOS-formatted versions</i> of the bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files on the diskette by entering the following command: unix2dos <source filename> /floppy/no_name/<target filename> (e.g., unix2dos bts-248.cdf /floppy/no_name/bts-248.cdf).
		NOTE <ul style="list-style-type: none"> • Other versions of Unix do not support the unix2dos and dos2unix commands. In these cases, use the Unix cp (copy) command. The <i>copied</i> files will be difficult to read with a DOS or Windows text editor because Unix files do not contain line feed characters. Editing <i>copied</i> CDF files on the WinLMF computer is, therefore, not recommended. • Using cp, multiple files can be <i>copied</i> in one operation by separating each filename to be copied with a space and ensuring the destination directory (<i>floppy/no_name</i>) is listed at the end of the command string following a space (e.g., cp bts-248.cdf cbsc-6.cdf /floppy/no_name).
	8	Repeat Steps 5 through 7 for each bts-# that must be supported by the WinLMF computer.
	9	When all required files have been copied to the diskette type eject and press the Enter key.
	10	Remove the diskette from the CBSC drive.
AT THE WinLMF:		
	11	If it is not running, start the <i>Windows</i> operating system on the WinLMF computer.
	12	Insert the diskette containing the bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files into the WinLMF computer.
	13	Using <i>MS Windows Explorer</i> , create a corresponding bts-# folder in the <x>:\<lmf home directory>\cdma directory for each bts-#.cdf/cbsc-#.cdf (or bts-#.necf/cbsc-#.cdf) file pair copied from the CBSC.
	14	Use <i>MS Windows Explorer</i> to transfer the bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files from the diskette to the corresponding <x>:\<lmf home directory>\cdma\bts-# folders created in Step 13.

Creating a Named HyperTerminal Connection for MMI Communication

Confirming or changing the configuration data of certain BTS Field Replaceable Units (FRU) requires establishing an MMI communication session between the WinLMF and the FRU. Using features of the *Windows* operating system, the connection properties for an MMI session can be saved on the WinLMF computer as a named *Windows* HyperTerminal connection. This eliminates the need for setting up connection parameters each time an MMI session is required to support optimization.

Once the named connection is saved, a shortcut for it can be created on the *Windows* desktop. Double-clicking the shortcut icon will start the connection without the need to negotiate multiple menu levels.

Follow the procedures in Table 6-4 to establish a named HyperTerminal connection and create a *Windows* desktop shortcut for it.

Table 6-4: Create HyperTerminal Connection

Step	Action
1	From the Windows Start menu, select: Programs>Accessories>
2	Perform one of the following: <ul style="list-style-type: none"> • For <i>Win NT</i>, select Hyperterminal and then click on HyperTerminal or • For <i>Win 98</i>, select Communications, double click the Hyperterminal folder, and then double click on the Hyperterm.exe icon in the window that opens. <p>NOTE</p> <ul style="list-style-type: none"> • If a Location Information Window appears, enter the required information, then click on the Close button. (This is required the first time, even if a modem is not to be used.) • If a You need to install a modem..... message appears, click on NO.
3	When the Connection Description box opens: <ul style="list-style-type: none"> – Type a name for the connection being defined (e.g., MMI Session) in the Name: window, – Highlight any icon preferred for the named connection in the Icon: chooser window, and – Click OK.
4	From the Connect using: pick list in the Connect To box displayed, select COM1 or COM2 (<i>Win NT</i>) – or Direct to Com 1 or Direct to Com 2 (<i>Win 98</i>) for the RS-232 port connection and click OK .
	NOTE For WinLMF computer configurations where COM1 is used by another interface such as test equipment and a physical port is available for COM2, select COM2 in the following step to prevent conflicts.

... continued on next page



Table 6-4: Create HyperTerminal Connection

Step	Action
5	In the Port Settings tab of the COM# Properties window displayed, configure the RS–232 port settings as follows: <ul style="list-style-type: none"> • Bits per second: 9600 • Data bits: 8 • Parity: None • Stop bits: 1 • Flow control: None
6	Click OK .
7	Save the defined connection by selecting: File > Save
8	Close the HyperTerminal window by selecting: File > Exit
9	Click the Yes button to disconnect when prompted.
10	Perform one of the following: <ul style="list-style-type: none"> • If the Hyperterminal folder window is still open (<i>Win 98</i>) proceed to step 12 • From the Windows Start menu, select Programs > Accessories.
11	Perform one of the following: <ul style="list-style-type: none"> • For <i>Win NT</i>, select Hyperterminal and release any pressed mouse buttons. • For <i>Win 98</i>, select Communications and double click the Hyperterminal folder. • For <i>Win-XP</i>, select Communications and double click the Hyperterminal folder.
12	Highlight the newly–created connection icon by clicking on it.
13	<i>Right click and drag</i> the highlighted connection icon to the Windows desktop and release the right mouse button.
14	From the popup menu which appears, select Create Shortcut(s) Here .
15	If desired, reposition the shortcut icon for the new connection by dragging it to another location on the Windows desktop.
16	Close the Hyperterminal folder window by selecting: File > Close

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.

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

T1/E1 Span Isolation

Table 6-5 describes the action required for span isolation.

Table 6-5: T1/E1 Span Isolation	
Step	Action
1	Have the OMC-R/CBSC operator place the BTS OOS.
2	To disable the span lines, disconnect the span or spans from the CBIO Network Span-1X or Group 1 Span-EVDO sockets. If in an outdoor configuration, then unlock and open TME left side door to gain access to rear of BTS.

LMF to BTS Connection

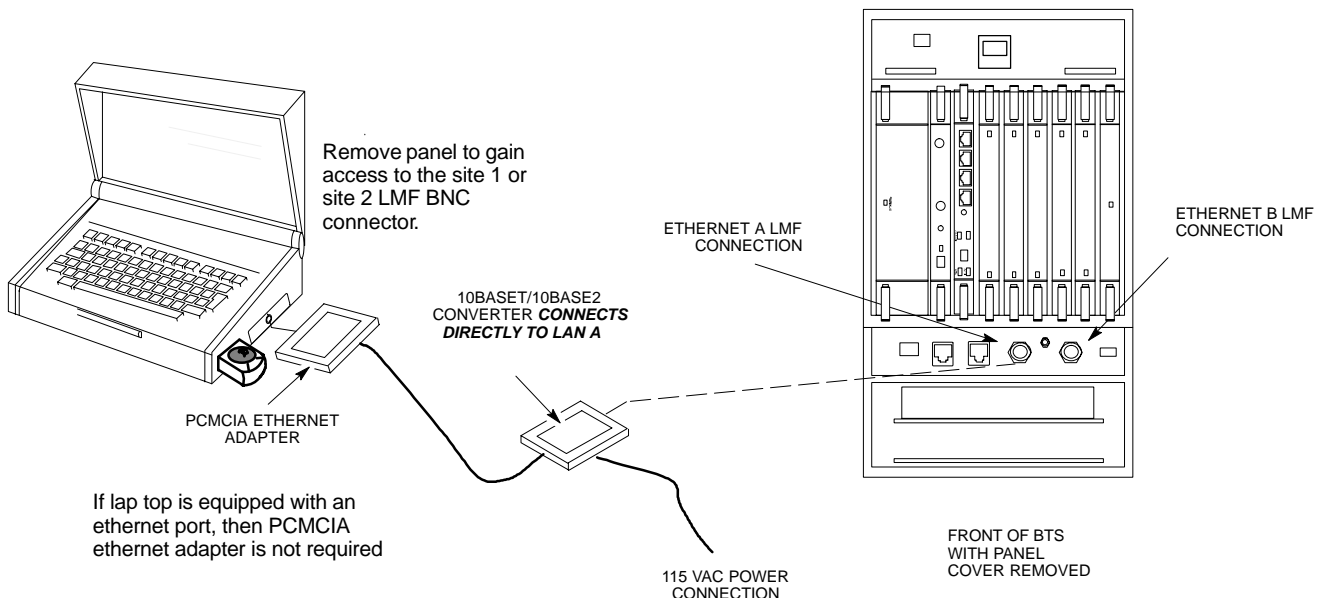
Connect the WinLMF to the BTS

The WinLMF computer may be connected to the LAN A or B connector located on the front panel or at the rear of the BTS. Figure 6-3 below shows the general location of these connectors. LAN A is considered the primary LAN.

Table 6-6: Connecting the WinLMF to the BTS

Step	Action
1	For indoor configuration, remove BTS front panel cover. For outdoor configuration, unlock and open TME right side door and remove BTS front panel cover. NOTE Xircom Model PE3-10B2 or equivalent can also be used to interface the WinLMF Ethernet connection to the BTS frame connected to the PC parallel port, powered by an external AC/DC transformer. In this case, <i>the BNC cable must not exceed 91 cm (3 ft) in length.</i>
2	Connect the WinLMF computer to the LAN A (left-hand) BNC connector . (See Figure 6-3)
	* 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 6-3: WinLMF Connection Detail



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 BTS frames. 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 there is only one frame for the BTS, there will only be one tab.

CDF/NECF Requirements – For the LMF to recognize the devices installed in the BTS, a BTS CDF/NECF 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.

Graphical User Interface Overview

The LMF uses a GUI, which works in the following way:

- Select the device or devices.
- Select the action to apply to the selected device(s).
- While action is in progress, a status report window displays the action taking place and other status information.
- The status report window indicates when the the action is complete and displays other pertinent information.
- Clicking the **OK** button closes the status report window.

Understanding GUI Operation

The following screen captures are provided to help understand how the GUI operates:

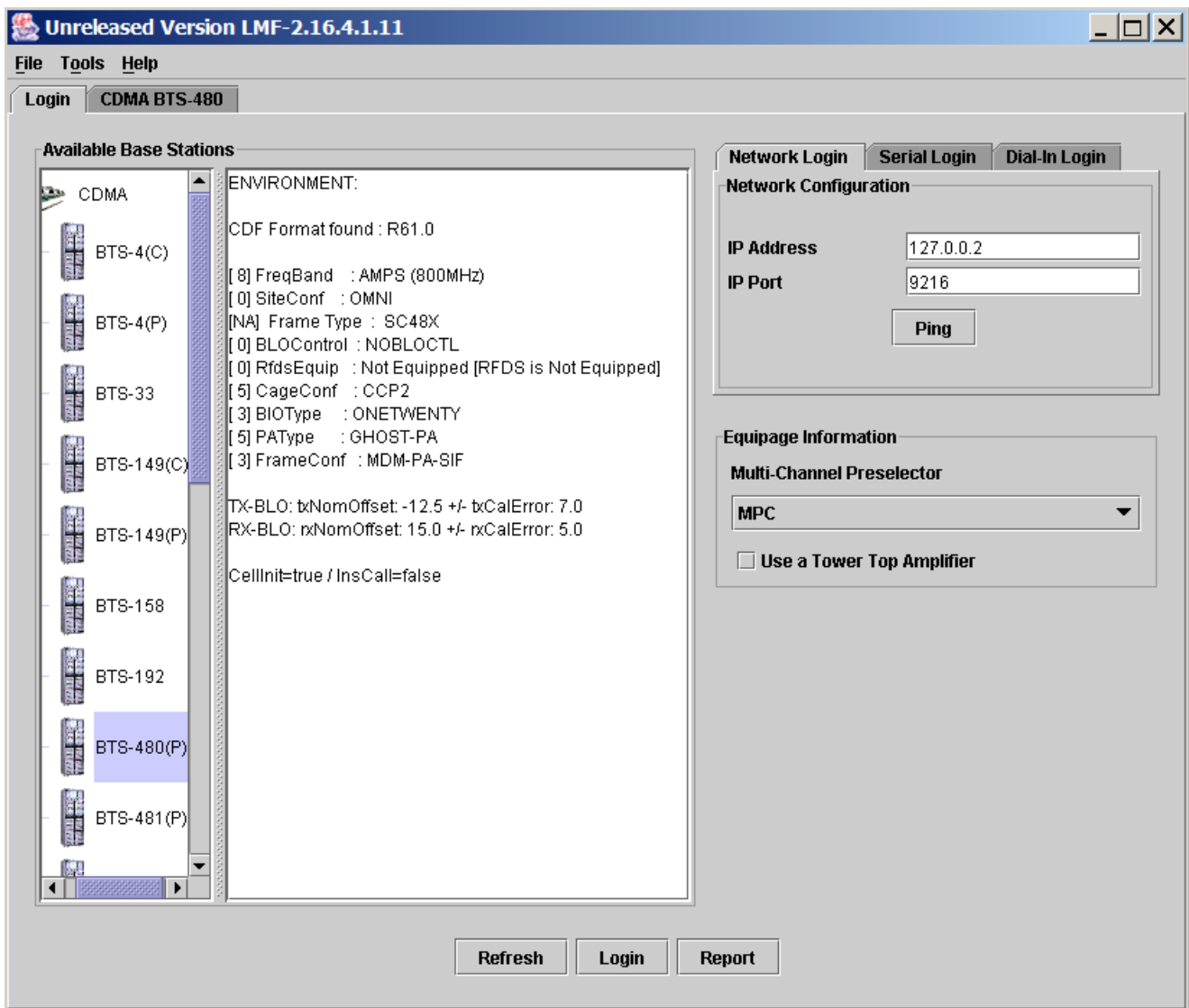
- Figure 6-4 depicts the differences between packet and circuit CDMA “cdf” file identification. Note that if there is a packet version “bts” file, the “(P)” is added as a suffix. There is a corresponding “(C)” for the circuit mode version.
- Figure 6-5 depicts the Self-Managed Network Elements (NEs) state of a packet mode. Note that an “X” is on the front of each card that is under Self-Managed Network Elements (NEs) control by the GLI3 card.
- Figure 6-6 depicts three of the available packet mode commands. Normally the GLI3 has Self-Managed Network Elements (NEs) control of all cards as shown in Figure 6-5 by an “(X)”. In that state the LMF may only status a card. In order to download code or test a card, the LMF must request Self-Managed Network Elements (NEs) control of the card by using the shown dropdown menu. It also uses this menu to release control of the card back to the GLI3. The GLI3 will also assume control of the cards after the LMF logs out of the BTS. The packet mode GLI3 normally is loaded with a tape release

and NECB and NECJ files which point to a tape release stored on the GLI3. When the GLI3 has control of a card it will maintain that card with the code on that tape release.

- Figure 6-7 depicts a packet mode site that has the MCC-1 and the BBX-1 cards under LMF control. Notice that the “X” is missing from the front of these two cards.

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

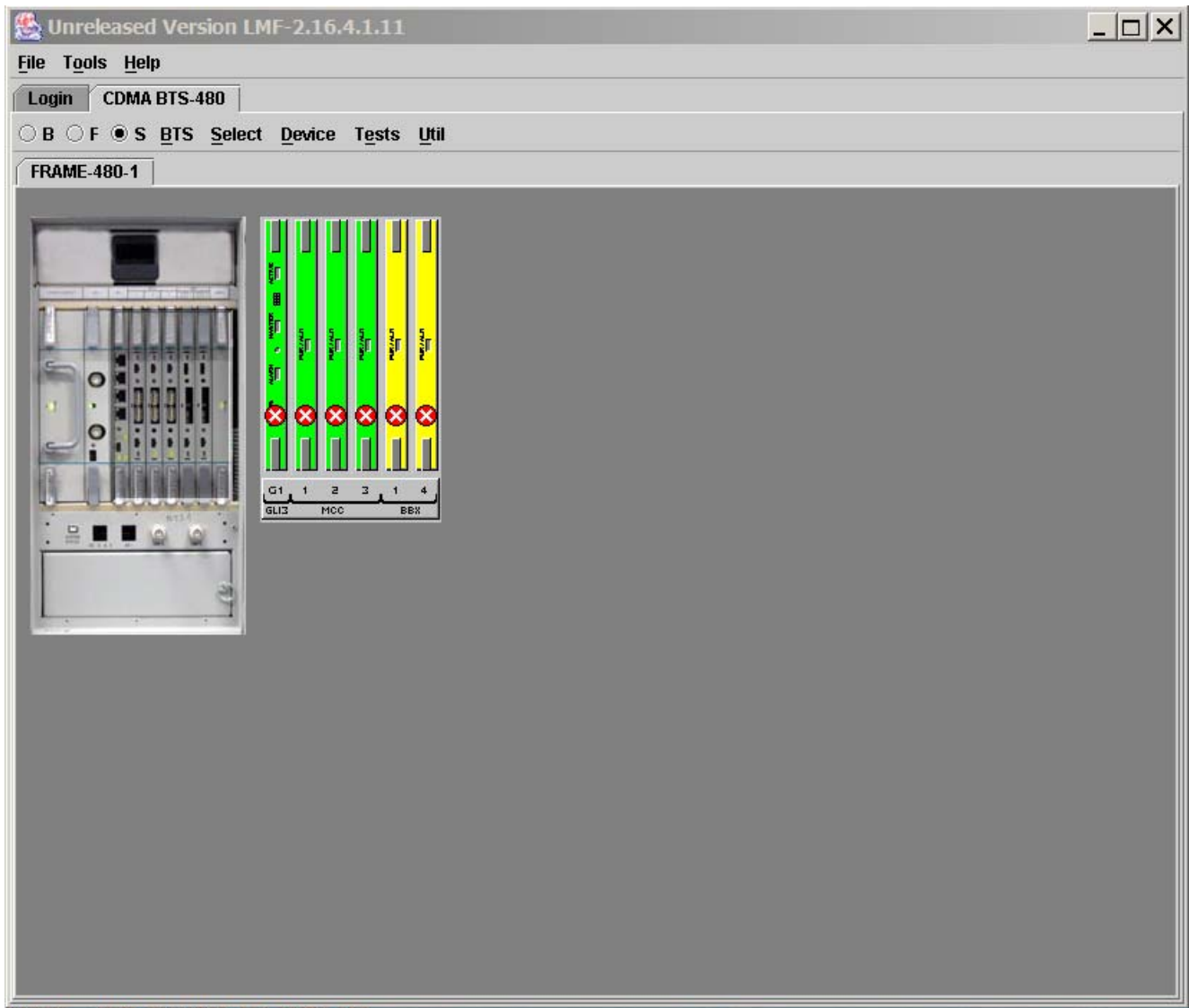
Figure 6-4: BTS Login Screen – Identifying Circuit and Packet BTS Files



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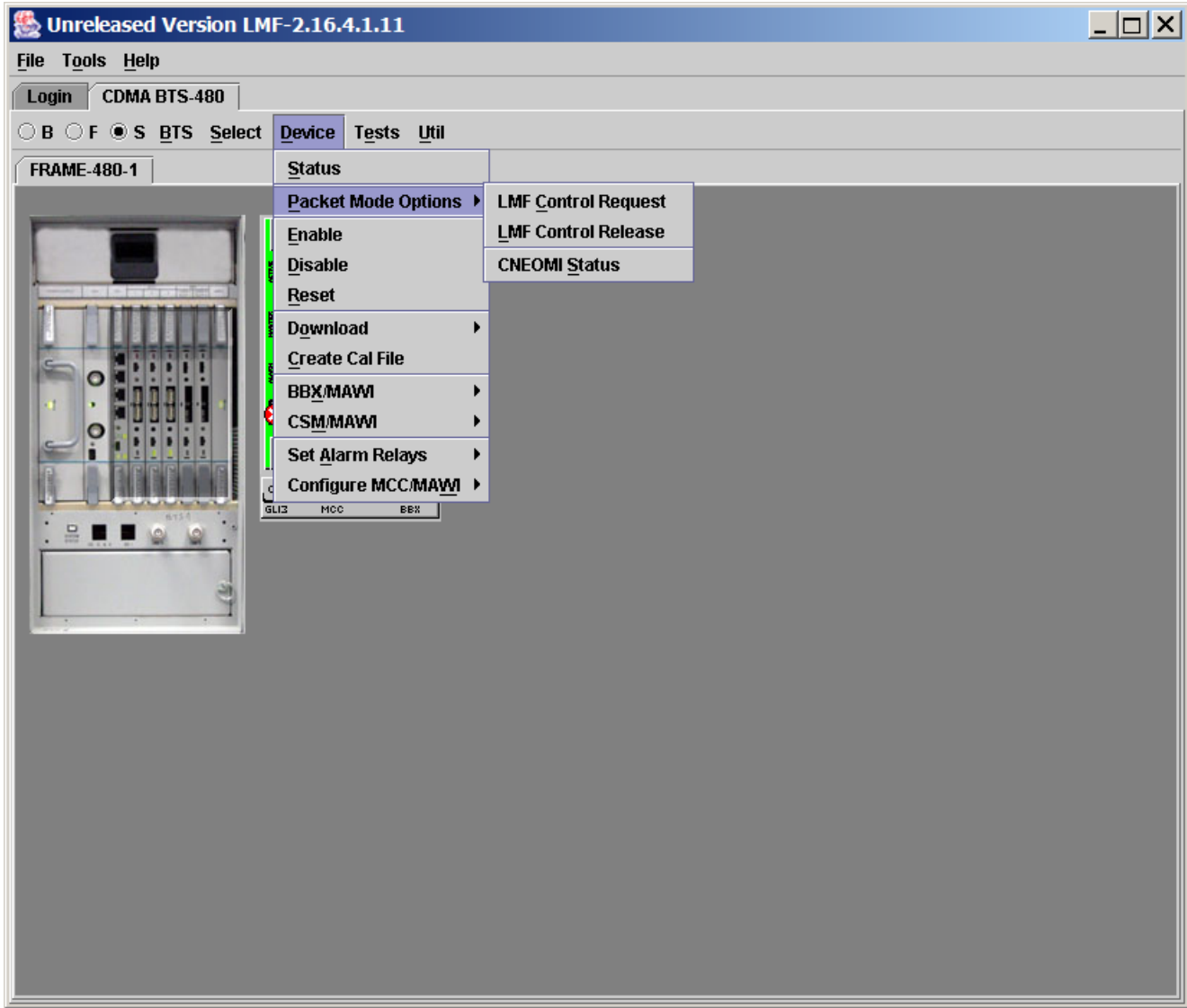
Using the LMF – continued

Figure 6-5: Self-Managed Network Elements (NEs) State of a Packet Mode



Using the LMF – continued

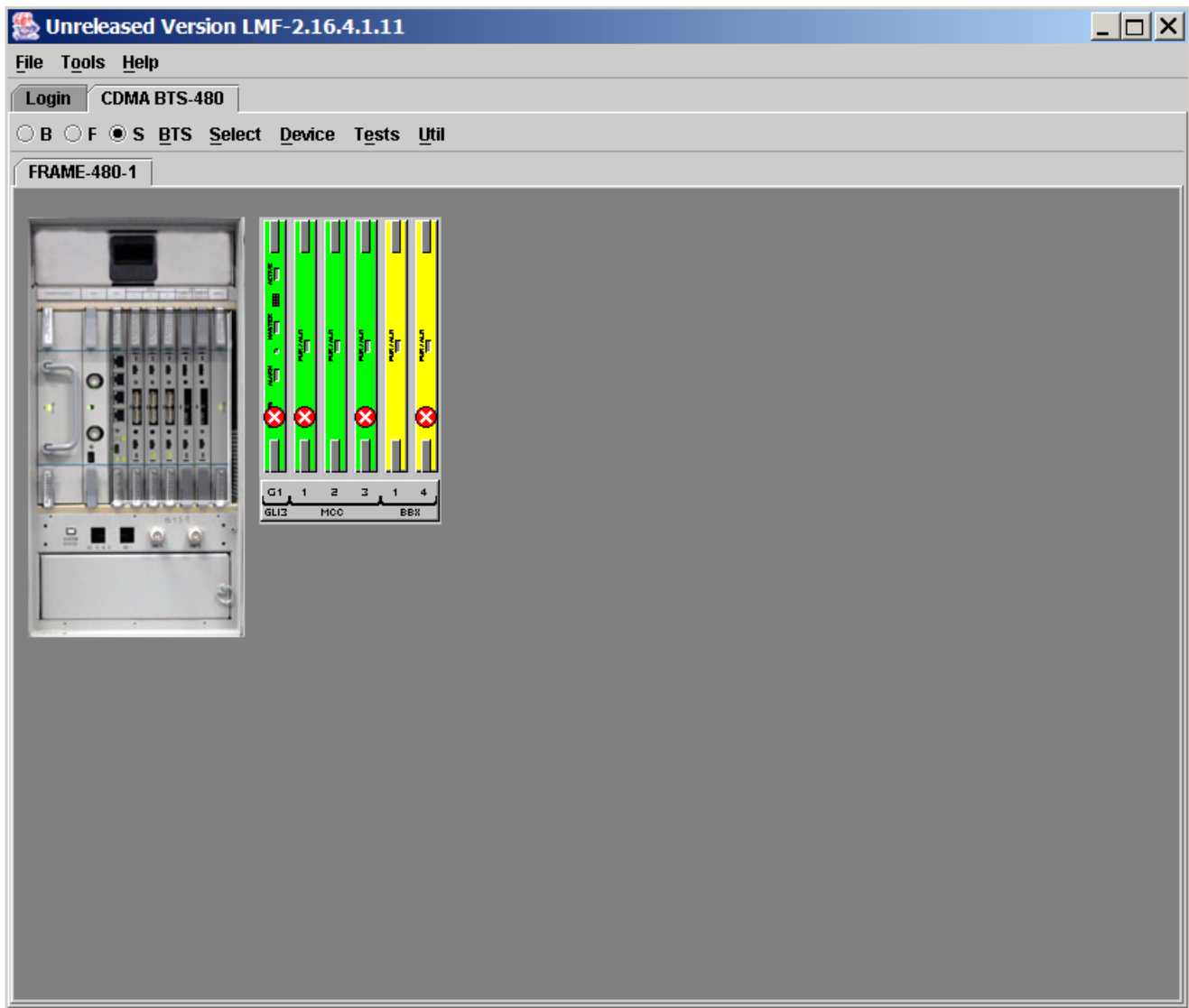
Figure 6-6: Available Packet Mode Commands



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Using the LMF – continued

Figure 6-7: Packet Mode Site with MCC-1 and BBX-1 under LMF Control



Command Line Interface Overview

The LMF also provides Command Line Interface (CLI) capability. Activate the CLI by clicking on a shortcut icon on the desktop. The CLI can not be launched from the GUI, only from the desktop icon.

Both the GUI and the CLI use a program known as the handler. Only one handler can be running at one time. The architectural design is such that the GUI must be started before the CLI if you want the GUI and CLI to use the same handler.

When the CLI is launched after the GUI, the CLI automatically finds and uses an in-progress login session with a BTS initiated under the GUI. This allows the use of the GUI and the CLI in the same BTS login session.

If a CLI handler is already running when the GUI is launched (this happens if the CLI window is already running when the user starts the GUI, or if another copy of the GUI is already running when the user starts the GUI), a dialog window displays the following warning message:

The CLI handler is already running.
This may cause conflicts with the LMF.
Are you sure that you want to start the application?

This window also contains **yes** and **no** buttons. Selecting **yes** starts the application. Selecting **no** terminates the application.

CLI Format Conventions

The CLI command can be broken down in the following way:

- Verb
- Device including device identifier parameters
- Switch
- Option parameters consisting of:
 - Keywords
 - Equals sign (=) between the keyword and the parameter value
 - Parameter values

Spaces are required between the verb, device, switch, and option parameters. A hyphen is required between the device and its identifiers. Following is an example of a CLI command.

measure bbx–<bts_id>–<bbx_id> **rss**i channel=6 sector=5

Refer to the *LMF CLI Commands* for a complete explanation of the CLI commands and their usage.

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/NECF 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 6-6 and Figure 6-3.



CAUTION

Be sure that the correct **bts-#.cdf/necf** and **cbsc-#.cdf** file are used for the BTS. These should be the CDF/NECF files that are provided for the BTS by the CBSC. Failure to use the correct CDF/NECF files can result in invalid optimization. **Failure to use the correct CDF/NECF 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 6-7 to log into a BTS when using the GUI environment.

Table 6-7: BTS GUI Login Procedure

✓ Step	Action
1	Start the LMF GUI environment by double-clicking on the WinLMF desktop icon (if the LMF is not running). <ul style="list-style-type: none"> – An LMF window will open and display the LMF build number in the title bar.
	<p>NOTE</p> <p>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:</p> <pre style="font-family: monospace; padding-left: 20px;"> The CLI handler is already running. This may cause conflicts with the LMF. Are you sure you want to start the application? Yes No </pre>
2	Click on Login tab (if not displayed).
3	Double click on CDMA (in the Available Base Stations pick list).

... continued on next page

Table 6-7: BTS GUI Login Procedure

✓	Step	Action
	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	<p>Click on Ping.</p> <ul style="list-style-type: none"> – If the connection is successful, the Ping Display window shows text similar to the following: <pre>Reply from 128 128.0.0.2: bytes=32 time=3ms TTL=255</pre> – If there is no response the following is displayed: <pre>128.0.0.2:9216:Timed out</pre> <p>If the GLI fails to respond, reset and perform the ping process again. If the GLI 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 GLI itself.</p>
	9	If required, match the device corresponding to the BTS configuration by selecting Multi-channel Preselector type from the Multi-channel Preselector drop-down list (default is MPC).
	10	Click on Login . (A BTS tab with the BTS and frame numbers is displayed.)
		<p>NOTE</p> <ul style="list-style-type: none"> • 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 GLI is OOS-ROM (blue), it must be downloaded with RAM code before other devices can be seen. • If the GLI is OOS-RAM (yellow), it must be enabled before other installed devices can be seen.

BTS Login from the CLI Environment

Follow the procedures in Table 6-8 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 6-7 to start the GUI environment and log into a BTS.

Table 6-8: BTS CLI Login Procedure

✓	Step	Action
	1	Double-click the WinLMF CLI desktop icon (if the LMF CLI environment is not already running).
		<p>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.</p>
	2	<p>At the /wlmf prompt, enter the following command:</p> <p>login bts-<i><bts#></i> host=<i><host></i> port=<i><port></i></p> <p>where:</p> <p>host = GLI 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)</p> <p>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)</p> <p>A response similar to the following will be displayed:</p> <pre>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"</pre>

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 GUI and the CLI session are running for the same BTS 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.

Logging Out of a BTS from the GUI Environment

Follow the procedure in Table 6-9 to logout of a BTS when using the GUI environment.

Table 6-9: BTS GUI Logout Procedure

✓	Step	Action
	1	Click on BTS in the BTS menu bar.
	2	Click the Logout item in the pull-down menu (a Confirm Logout pop-up message will appear).
	3	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.
	4	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.
	5	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.
	6	If further work is to be done in the GUI, restart it.
		NOTE <ul style="list-style-type: none"> • 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.

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Logging Out of a BTS from the CLI Environment

Follow the procedure in Table 6-10 to logout of a BTS when using the CLI environment.

Table 6-10: BTS CLI Logout Procedure

✓	Step	Action
		<p>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.</p>
	1	<p>Log out of a BTS by entering the following command: logout bts-<bts#></p> <p>A response similar to the following will be displayed:</p> <pre>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"</pre>
	2	<p>If desired, close the CLI interface by entering the following command: exit</p> <p>A response similar to the following will be displayed before the window closes:</p> <pre>Killing background processes....</pre>

**Establishing an MMI
Communication Session**

Equipment Connection – Figure 6-8 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.

If the Motorola SLN2006A MMI Interface Kit is not available, an MMI cable can be made, refer to Appendix D for more information.

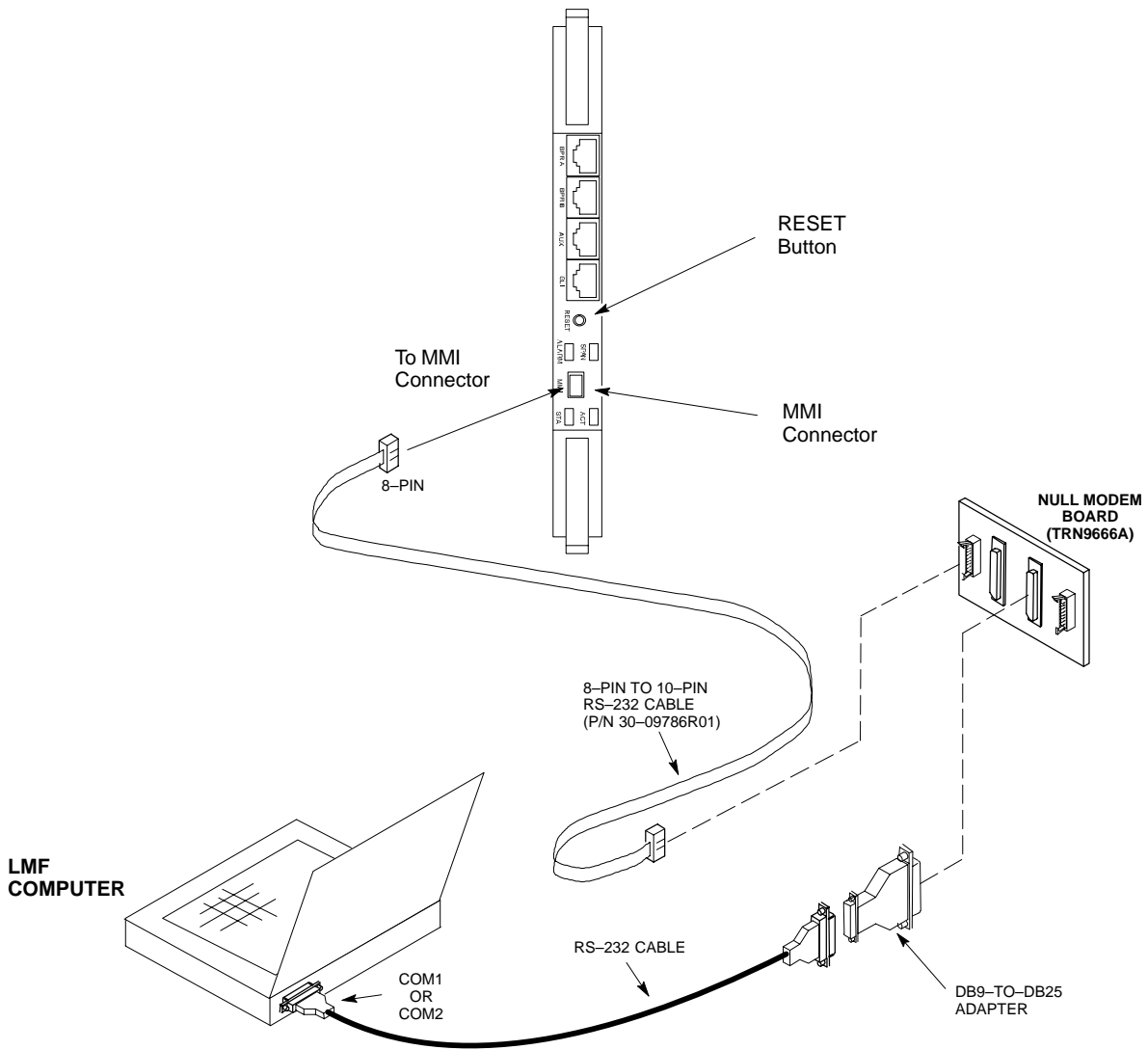
Initiate MMI Communication – For those procedures which require MMI communication between the LMF and BTS FRUs, follow the procedures in Table 6-11 to initiate the communication session.

Table 6-11: Establishing MMI Communication

Step	Action
1	Connect the LMF computer to the equipment as detailed in the applicable procedure which requires the MMI communication session. Refer to Figure 6-8 or Figure 6-9 using the GLI3 as an example.
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: <ul style="list-style-type: none"> <li data-bbox="175 997 1476 1060">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. <li data-bbox="175 1081 1476 1123">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 <i>Windows</i> desktop shortcut. <p>NOTE</p> If a <i>Windows</i> desktop shortcut was not created for the MMI connection, access the connection from the <i>Windows</i> 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.

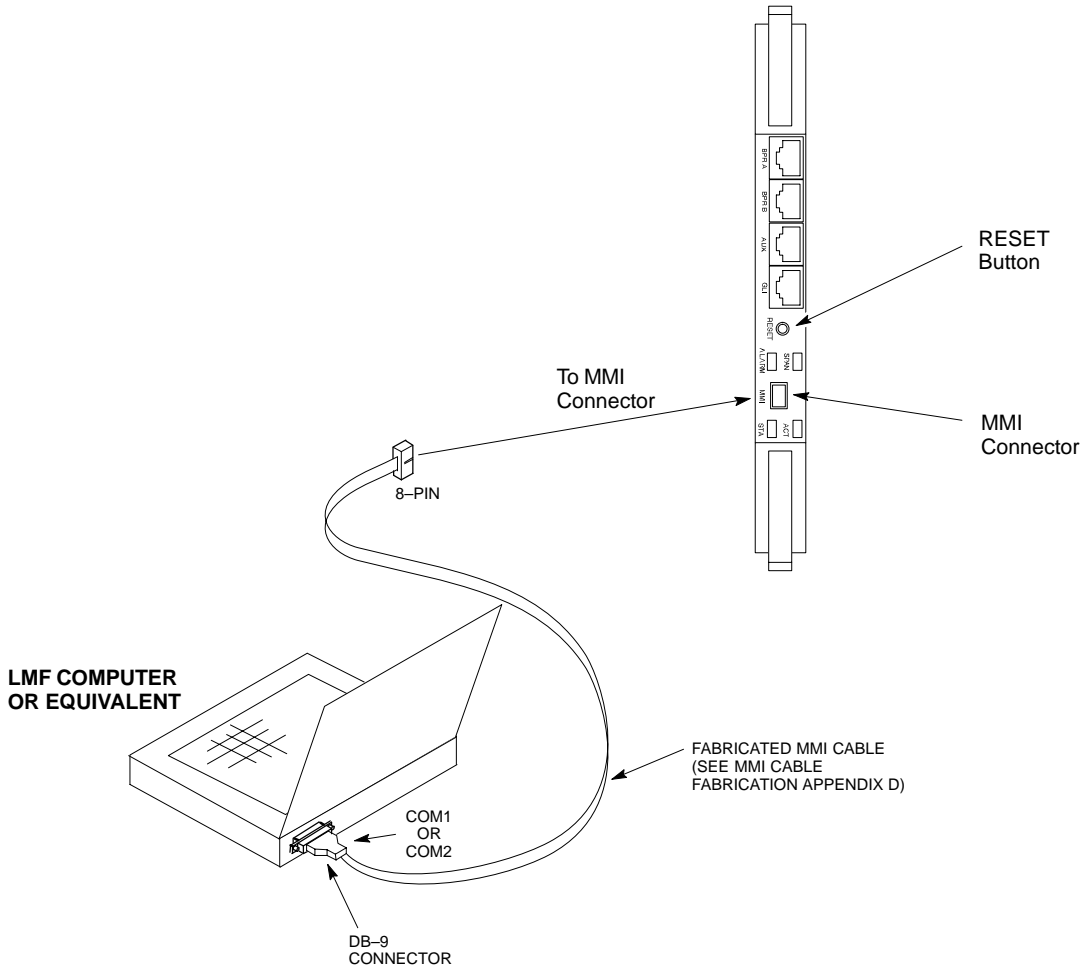
6

Figure 6-8: LMF Computer Common MMI Connections – Motorola MMI Interface Kit, SLN2006A



FW00687

Figure 6-9: MMI Connection Detail – Fabricated MMI Cable



6

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 BTS

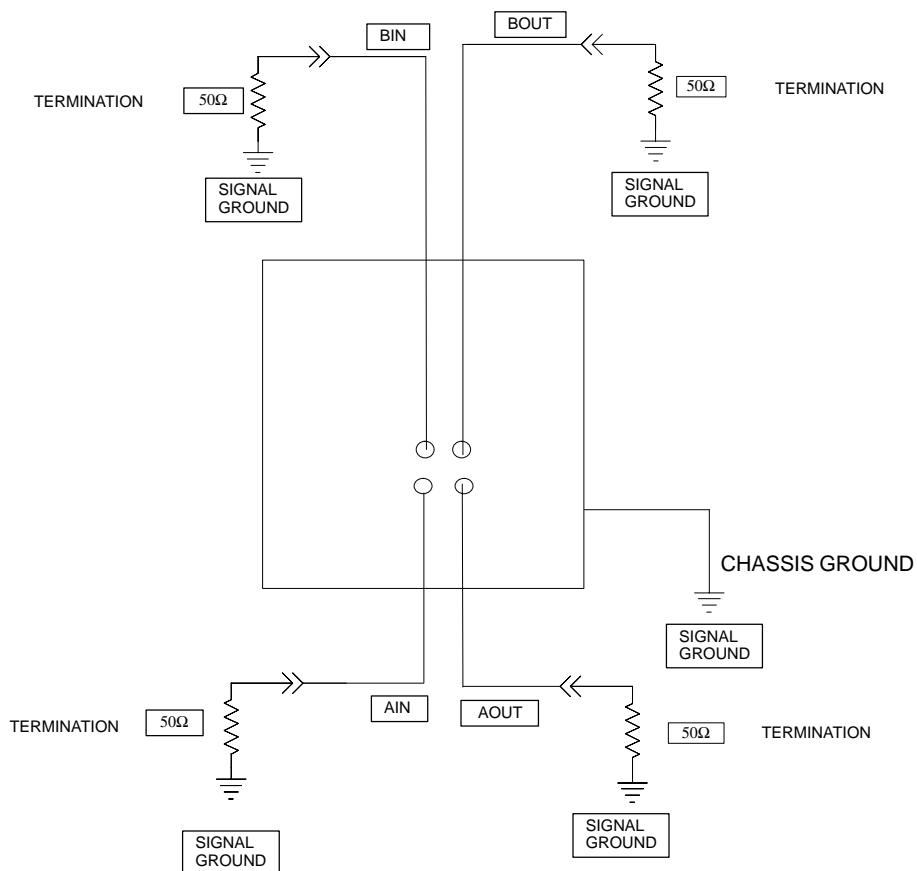
For proper operation, the integrity of the Ethernet LAN A and B links must be verified. Figure 6-10 represents a typical BTS Ethernet configuration. The drawing depicts cabling and termination for both the A and B LANs.

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 6-12 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 ESD.

Figure 6-10: 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 6-12: Pinging the Processors

Step	Action
1	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 11-3 and then return to step 2.
2	Be sure any uncabled LAN A and B IN and OUT connectors at the rear of BTS are terminated with 50 Ω loads.
3	<i>If it has not already been done</i> , connect the LMF computer to the BTS.
4	<i>If it has not already been done</i> , start a <i>GUI</i> LMF session and log into the BTS (refer to Table 6-7).
5	Remove the 50Ω termination on the BTS LAN B IN connector. – The LMF session should remain active.
6	Replace the 50Ω termination on the BTS LAN B IN connector.
7	From the <i>Windows</i> desktop, click the Start button and select Run .
8	In the Open box, type ping and the GLI IP address (for example, ping 128.0.0.2). NOTE 128.0.0.2 is the default IP address for the GLI card in slot GLI-1 in field BTS units.
9	Click on OK .
10	If the targeted module responds, a DOS window will appear with a display similar to the following: Reply from 128.0.0.2: bytes=32 time=3ms TTL=255 – If the device responds, <i>proceed to step 18</i> . If there is no response, the following is displayed: Request timed out – 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.
11	Logout of the BTS as described in Table 6-9, exit from the LMF program, and restart the <i>Windows</i> operating system on the LMF computer.
12	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 6-7.
13	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> .

... continued on next page

Table 6-12: Pinging the Processors

Step	Action
14	If ping was unsuccessful after restarting the LMF computer, press the GLI front panel reset pushbutton and perform steps 7 through 10 again.
15	After the BTS has been successfully pinged, be sure the 50Ω termination was replaced on the BTS LAN B IN connector at the rear of the BTS. Disconnect the LMF cable from the front LAN A connector, and connect it to front LAN B (right-hand connector).
16	Remove the 50Ω termination on the BTS 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 BTS LAN A IN connector.
19	Disconnect the LMF cable from the LAN B and connect it to LAN A.
20	Remove and replace the 50Ω termination on the LAN B IN connector to force the GLI to switch to primary LAN A.
21	Repeat steps 5 through 9 to ensure proper primary LAN operation.

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.

If you must download ROM code, the procedures are located in **Appendix C**.

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 Base Station System (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).

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 a GLI, the LMF automatically also downloads data and then enables the GLI. When enabled, the GLI will change to INS_ACT (bright 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).

If an MCC–DO card is in use, it can only be loaded using the Local Maintenance Tool (LMT). LMT is software designed specifically for the MCC–DO card. To avoid confusion and duplication of effort, refer to Motorola Lifecycles website at

<http://www.motorola.com/networkoperators/CDMA–1xEV–DO.htm> for further information on LMT or MCC–DO.

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

- Group Line Interface III (GLI3)
- Clock Synchronization and Alarm card (CSA) (*Only if new revision code must be loaded*)
- Multi–Channel CDMA (MCC–1X) cards
- Broad Band Transceiver (BBX–1X) cards

NOTE

The GLI *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 GLI automatically downloads data and then enables the GLI.

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 6-13 to verify the GLI devices are loaded with the correct ROM code for the software release used by the Base Station System.

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 6-13: Verify GLI ROM Code Loads

Step	Action
1	<i>If it has not already been done</i> , start a GUI LMF session and log into the BTS (refer to Table 6-7).
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 <i>not</i> the correct one for the software release being used on the BSS, perform the following:
4a	– Log out of the BTS as described in Table 6-9 or Table 6-10, as applicable.
4b	– Disconnect the LMF computer.
4c	– Reconnect the span lines as described in Table 8-6.
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 6-5 and proceed to downloading RAM code and data.

Download RAM Code and Data to GLI

Prerequisites

- Prior to performing these procedures, ensure a code file exists for each of the devices to be loaded.
- The LMF computer is connected to the BTS (refer to Table 6-6), and is logged in using the *GUI* environment (refer to Table 6-7).

Procedure

Follow the procedure in Table 6-14 to download the firmware application code for GLI. The download code action downloads data and also enables the GLI.

Table 6-14: Download and Enable GLI Device		
✓	Step	Action
	1	Note the active LAN to which the LMF computer is connected.
	2	At the rear of the BTS, remove the 50-ohm termination from the LAN OUT connector of the LAN to which the LMF is <i>not</i> connected.
	3	Select Tools > Update Next Load > CDMA function to ensure the Next Load parameter is set to the correct code version level.
	4	Note the LAN IP address in the Network Login section of the LMF Login tab, and verify the Win LMF is logged into the following IP address: <ul style="list-style-type: none">– GLI : 128.0.0.2
	5	Download code to the GLI by clicking on the GLI. <ul style="list-style-type: none">– From the Device pull down menu, select Download > Code/Data A status report confirms change in the device status. <ul style="list-style-type: none">– Click OK to close the status window. (<i>The GLI should automatically be downloaded with data and enabled.</i>)
	6	If the card accepts the download and enables, proceed to step 8.
	7	If the BTS connection is lost during or after the download process, repeat step 4 and step 5 again.
	8	Re-install the 50 ohm termination removed from the LAN connector in step 2.

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

CSA devices are RAM code-loaded at the factory. RAM code is downloaded to CSA *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 6-15 to download RAM code and data to non-GLI devices.

Table 6-15: Download RAM Code and Data to Non-GLI Devices

✓ Step	Action
1	Select the target CSA, 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, CSA, 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.
	NOTE The command in Step 2 loads both code and data. Data can be downloaded without doing a code download anytime a device is OOS-RAM using the command in Step 4.
4	To download just the firmware application data to each device, select the target device and select: Device>Download>Data

Selecting CSA Clock Source and Enabling CSAs

CSA 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 CSA sub-system, see “Clock Synchronization and Alarm (CSA) in the CSA System Time – GPS & HSO/MSO Verification section of this chapter.

Select CSA Clock Source

A CSA can have three different clock sources. The CSA 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 CSA needs to be changed. The Clock Source function provides the following clock source options.

- Local GPS
- Remote GPS
- HSO/MSO



Prerequisites

- GLI is INS_ACT (bright green)
- CSA is OOS_RAM (yellow) or INS_ACT (bright green)

Follow the procedure in Table 6-16 to select a CSA Clock Source.

Table 6-16: Select CSA Clock Source		
✔	Step	Action
	1	Select the CSA for which the clock source is to be selected.
	2	Click on Device in the BTS menu bar, and select CSA > Select Clock Source... in the pull-down menu list. – A CSA clock reference source selection window will appear.
	3	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.
	4	Click on the OK button. – A status report is displayed showing the results of the operation.
	5	Click on the OK button to close the status report window.

NOTE

For Local GPS (RF-GPS), verify the CSA configured with the GPS receiver “daughter board” is installed in the BTS’s CSA slot before continuing.



Enable CSA

Follow the steps outlined in Table 6-17 to enable the CSA.

Table 6-17: Enable CSA		
✔	Step	Action
	1	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. – Click OK to close the status report window.
		<p>* IMPORTANT</p> <ul style="list-style-type: none"> – 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 “almanac” 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 “almanac” 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 CSA 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).

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Table 6-17: Enable CSA		
✓	Step	Action
		<p>NOTE</p> <ul style="list-style-type: none"> – After CSA have been successfully enabled, be sure the STA/ALM LED is steady green (alternating green/red indicates the card is in an alarm state).
	2	If more than an hour has passed without the CSA enabling, refer to the CSA System Time – GPS & HSO/MSO Verification section of this chapter (see Table 6-19, Figure 6-11, and Table 6-20) to determine the cause.

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 in Table 6-18 to enable the MCCs installed in the CCP2 shelf.

NOTE

The GLI and primary CSA must be downloaded and enabled (IN-SERVICE ACTIVE), prior to downloading and enabling an MCC.

Table 6-18: 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 CCP2 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. <ul style="list-style-type: none"> – A status report is displayed showing the results of the enable operation.
	4	Click OK to close the status report window.



Clock Synchronization and Alarm (CSA) Sub-system Description

Overview

The primary function of the CSA card is to maintain CDMA system time. A GPS receiver provides the primary timing reference for all CDMA BTS's. During normal operation, the CSA clocking outputs are phase locked to the GPS receiver timing reference. The CSA supports either an on-board GPS receiver module (RF GPS) or Remote GPS (RGPS) receiver. The RGPS receiver consists of a combined GPS receiver and antenna with a digital interface to the CSA.

Backup Timing References

Timing signals from the High Stability Oscillator (HSO) or Medium Stability Oscillator (MSO) are used in the event that the primary (GPS) reference should become unavailable. The HSO or MSO clock is calibrated against the GPS timing signal when a valid GPS timing signal is available to provide the longest possible backup timing performance. The CSA continuously monitors each available timing reference and utilizes the most suited reference to maintain system synchronization.

Timing Source Fault Management

Fault management has the capability of switching between the GPS synchronization source and the HSO/MSO backup source in the event of a GPS receiver failure. During normal operation, the CSA selects GPS as the primary timing source (Table 6-20). The source selection can also be overridden via the WinLMF or by the system software.

Front Panel LEDs

The status of the LEDs on the CSA boards are as follows:

- Steady Green – CSA locked to GPS.
- Rapidly Flashing Green – Standby CSA locked to GPS.
- Flashing Green/Rapidly Flashing Red – CSA OOS-RAM attempting to lock on GPS signal.
- Rapidly Flashing Green and Red – Alarm condition exists. Trouble Notifications (TNs) are currently being reported to the GLI.

**High Stability Oscillator /
Medium Stability Oscillator
(HSO/MSO)**

General

CSA and HSO/MSO

The CSA utilizes timing signals provided by either an HSO or MSO to maintain BTS synchronization during the absence of valid GPS timing information. When a GPS timing signal is available the CSA is responsible for calibration of the HSO or MSO clock to maximize the backup timing interval. A minimum period of 24 hours of operation with a valid GPS reference is required to fully calibrate the HSO backup reference such that a 24 hour backup interval may be provided.

HSO

The HSO is a free-running backup oscillator that is capable of providing a minimum backup interval of 24 hours.

MSO

The MSO is a free-running backup oscillator that is capable of providing a minimum backup interval of 8 hours.

NOTE	Allow the base site and test equipment to warm up for 60 minutes after any interruption in oscillator power. CSA 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.
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6

CSA Frequency Verification

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

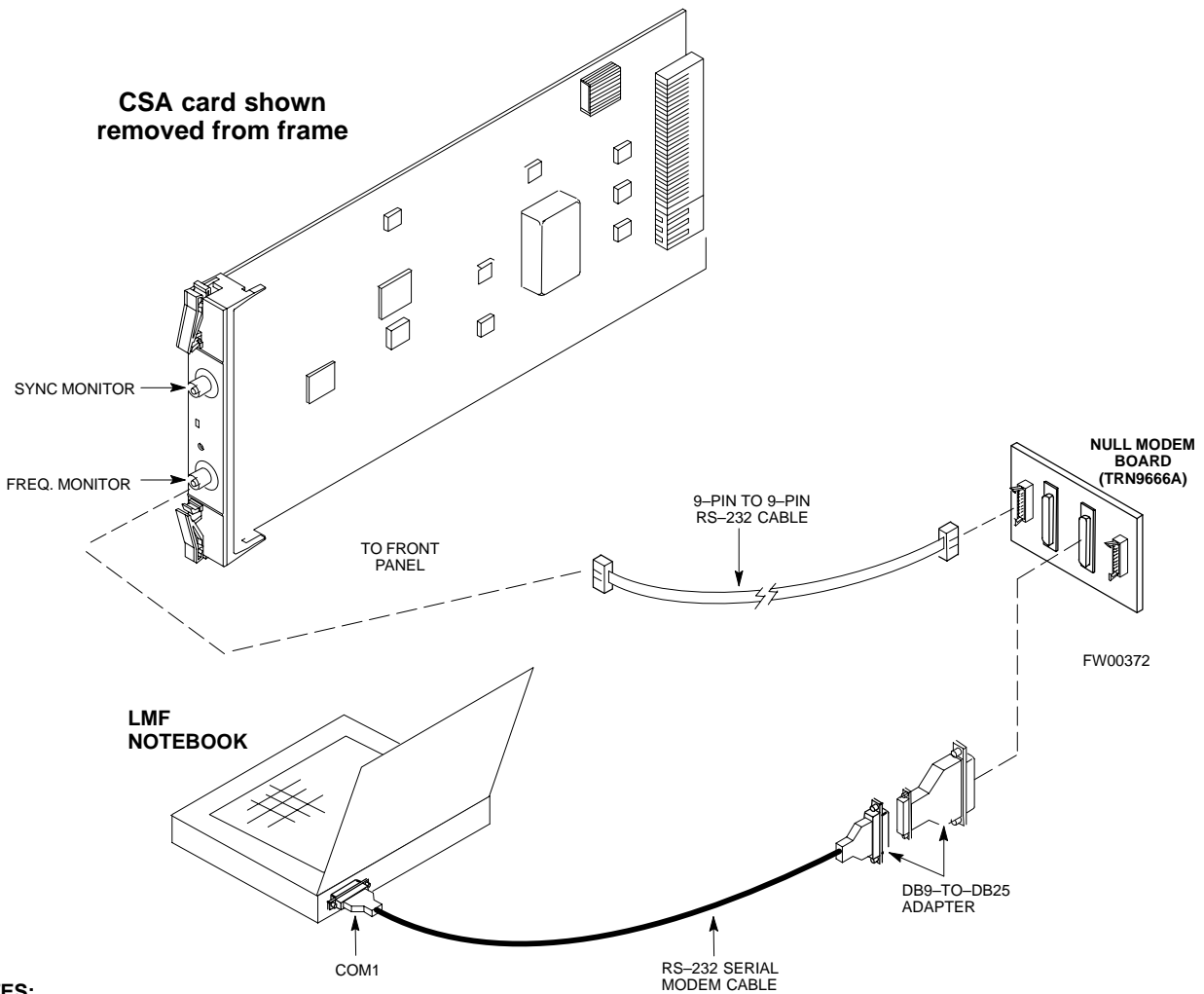
Test Equipment Setup (GPS & HSO/MSO Verification)

Follow the steps outlined in Table 6-19 to set up test equipment.

Table 6-19: Test Equipment Setup (GPS & HSO/MSO Verification)	
Step	Action
1	Perform one of the following as required by installed equipment:
1a	– Verify a CSA card is installed in the CSA slot, and that the card is INS_ACT (bright green).
2	Connect a serial cable from the LMF COM 1 port (via null modem card) to the MMI port on the CSA (see Figure 6-11).
3	Start an MMI communication session with the CSA by using the <i>Windows</i> desktop shortcut icon (see Table 6-11) .
4	When the terminal screen appears press the Enter key until the CSA> prompt appears.

CAUTION	If the RF GPS module is used to take care to ensure that the GPS antenna is properly connected to the GPS antenna connector within the power entry compartment only. Damage to the GPS antenna and/or GPS receiver can result if the GPS antenna is inadvertently connected to any other RF connector.
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Figure 6-11: CSA MMI Terminal Connection



NOTES:

1. One LED on each CSA:
 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 CSA and HSO/MSO (if equipped) has been warmed up for at least 15 minutes.
- The LMF computer is connected to the MMI port of the CSA as shown in Figure 6-11.
- An MMI communication session has been started (Table 6-11), and the `CSA>` prompt is present in the HyperTerminal window (Table 6-19).

Follow the steps outlined in Table 6-20 to initialize and verify proper GPS receiver functioning.

Table 6-20: GPS Initialization/Verification

Step	Action
1	<p>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</p> <p>bstatus</p> <ul style="list-style-type: none"> The system will display a response similar to the following: <pre> Clock Alarms (0000): DPLL is locked and has a reference source. GPS receiver self test result: passed Time since reset 0:33:11, time since power on: 0:33:11 </pre>
2	<p>Enter the following command at the CSA> prompt to display the current status of the GPS receiver and HSO or MSO backup reference:</p> <p>sources</p> <ul style="list-style-type: none"> When equipped with HSO, the system will generate a response similar to the following: <pre> N Source Name Type TO Good Status Last Phase Target Phase Valid ----- 0 LocalGPS Primary 4 YES Good 0 0 Yes 1 HSO Backup 4 YES Good -2013177 -2013177 Yes 2 Not Used </pre> <p>*NOTE “Timed-out” should only be displayed while the HSO is warming up. 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 CSA> prompt:</p> <p>ss 1 12</p> <p>The HSO or MSO must complete an initial warmup and calibration cycle before being usable as a backup reference source. The initial warmup cycle should be completed in less than 15 minutes. During the warmup cycle, the HSO clock output is disabled and indicated as being “timed out” in the following response to the “sources command:</p> <pre> 43:26:15 CSA>sources 43:26:35 43:26:35 N Source Name Type TO Good Status Last Phase Target Phase Valid 43:26:35----- 43:26:35 0 Local GPS Primary 59 Yes Good 0 0 Yes 43:26:35 1 HSO Backup -25 No Bad timed out unknown No 43:26:35 2 Not Used 43:26:35 Current reference source number: 0 </pre> <p>See 2-Cont.</p>

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Table 6-20: GPS Initialization/Verification

Step	Action
2– Cont	<p>At the completion of the HSO warmup cycle, the HSO clock output is enabled allowing califd clock pulses to be detected by the CSA. An integer value should then be displayed in the HSO “Last Phase” entry of the “sources” command as show below. If the HSO or MSO calibration cycle is not completed within 2 hours it will be necessary to inspect the HSO or MSO hardware.</p> <pre>43:29:33 CSA>sources 43:29:43 43:29:43 N Source Name Type TO Good Status Last Phase Target Phase Valid 43:29:43 _____ 43:29:43 0 Local GPS Primary 59 Yes Good 0 0 Yes 43:29:43 1 HSO Backup 3 Yes Bad -xxxxxx -xxxxxx No 43:29:43 2 Not Used 43:29:43 Current reference source number: 0</pre> <p>The HSO or MSO calibration cycle can take as long as 2 hours to complete. The completion of the HSO or MSO calibration is indicated by a “yes” value in the valid column of the “sources” command response as shown below. If the HSO or MSO calibration cycle is not complete within 2 hours it will be necessary to inspect the HSO or MSO hardware.</p> <pre>26:09:33 CSA>sources 26:09:35 26:09:35 N Source Name Type TO Good Status Last Phase Target Phase Valid 26:09:35 _____ 26:09:35 0 Local GPS Primary 59 Yes Good 0 0 Yes 26:09:35 1 <u>HSO</u> Backup 3 Yes Bad 8683466 8683466 Yes 26:09:35 2 Not Used 26:09:35 Current reference source number: 0</pre>
3	<p>HSO information (underlined text above, verified from left to right) is usually the #1 reference source. If this is not the case, have the <i>OMC-R</i> 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.</p> <p>NOTE</p> <p>If any of the above areas fail, verify:</p> <ul style="list-style-type: none"> – Verify that HSO had been powered up for at least 15 minutes. – 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.
4	<p>Verify the following GPS information (underlined text above):</p> <ul style="list-style-type: none"> – GPS information is usually the 0 reference source. – At least one Primary source must indicate “Status = good” and “Valid = yes” to bring site up.

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Table 6-20: GPS Initialization/Verification

Step	Action
5	<p>Enter the following command at the CSA> prompt to verify that the GPS receiver is in tracking mode.</p> <p>gstatus</p> <ul style="list-style-type: none"> – Observe the following typical response: <pre> 27:27:11 CSA>gstatus 27:27:14 GPS Receiver Control Task State: tracking satellites. 27:27:14 Time since last valid fix: 0 seconds 27:27:14 Frame type (0): master 27:27:14 27:27:14 Recent Change Data: 27:27:14 GPS time offset 0 ns. 27:27:14 Initial position: lat 151679000 msec, lon: -316798000 msec, height 0 cm (GPS) 27:27:14 Initial position accuracy (0): estimated. 27:27:14 27:27:14 GPS Receiver Status 27:27:14 Position hold: lat 151679326 msec, lon: -316798498 msec, hgt 21955 cm 27:27:14 Current position: lat 151679326 msec, lon: -316798498 msec, hgt 21955 cm (GPS) 27:27:14 <u>8 satellites tracked, receiving 8 satellites, 8 satellites visible.</u> 27:27:14 Current Dilution of Precision (PDOP or HDOP): 0 27:27:14 Date & Time: 2004:03:16:21:37:48 LS:13 27:27:14 GPS Receiver Status Byte:0x8400 27:27:14 Chan:0, SVID: 24, Mode: 8, RSSI: 42, Status: 0x08a1 27:27:14 Chan:1, SVID: 10, Mode: 8, RSSI: 49, Status: 0x08a0 27:27:14 Chan:2, SVID: --, Mode: -, RSSI: ---, Status: 0x0000 27:27:14 Chan:3, SVID: 21, Mode: 8, RSSI: 48, Status: 0x08a1 27:27:14 Chan:4, SVID: 26, Mode: 8, RSSI: 50, Status: 0x08a0 27:27:14 Chan:5, SVID: 29, Mode: 8, RSSI: 48, Status: 0x08a0 27:27:14 Chan:6, SVID: 18, Mode: 8, RSSI: 42, Status: 0x08a0 27:27:14 Chan:7, SVID: 17, Mode: 8, RSSI: 50, Status: 0x08a0 27:27:14 Chan:8, SVID: 6, Mode: 8, RSSI: 49, Status: 0x08a0 27:27:14 Chan:9, SVID: --, Mode: -, RSSI: ---, Status: 0x0000 27:27:14 Chan:10, SVID: --, Mode: -, RSSI: ---, Status: 0x0000 27:27:14 Chan:11, SVID: --, Mode: -, RSSI: ---, Status: 0x0000 27:27:14 </pre>
6	<p>Verify the following GPS information (shown above in <u>underlined</u> text):</p> <ul style="list-style-type: none"> – At least 4 satellites are tracked, and 4 satellites are visible. – GPS Receiver Control Task State is “tracking satellites”. <i>Do not continue until this occurs!</i> – Dilution of Precision indication is not more that 30. <p>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).</p>

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Table 6-20: GPS Initialization/Verification

Step	Action
7	<p>If steps 1 through 6 pass, the GPS is good.</p>
	<p>NOTE If any of the above mentioned areas fail, verify that:</p> <ul style="list-style-type: none"> – If <i>Initial position accuracy</i> 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 <i>Initial position accuracy</i> is “surveyed,” position data must be of sufficient accuracy or improper GPS receiver timing may occur. – 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 15 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	<p>Enter the following commands at the CSA> prompt to verify that the CSA is warmed up and that GPS acquisition has taken place.</p> <p>debug dpllp</p> <p>Observe the following typical response if the CSA is not warmed up (15 minutes from application of power) (<i>If warmed-up proceed to step 9</i>)</p> <pre>CSA>DPLL Task Wait. 884 seconds left. DPLL Task Wait. 882 seconds left. DPLL Task Wait. 880 seconds left.etc.</pre>
	<p>NOTE The warm command can be issued at the MMI port used to force the CSA into warm-up, but the reference oscillator will be unstable.</p>
9	<p>Observe the following typical response if the CSA is warmed up.</p> <pre>c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175</pre>
10	<p>Verify the following GPS information (underlined text above, from left to right):</p> <ul style="list-style-type: none"> – 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	<p>Enter the following commands at the CSA> prompt to exit the debug mode display.</p> <p>debug dpllp</p>

6

Test Equipment Setup

Connecting Test Equipment to the BTS

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

- WinLMF
- Communications system analyzer model supported by the WinLMF
- Power meter model supported by the WinLMF (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 6-21 for an overview of connections for test equipment currently supported by the WinLMF. In addition, see the following figures:

- Figure 6-15, Figure 6-17, and Figure 6-18 show the test set connections for TX calibration
- Figure 6-19 through Figure 6-22 show the test set connections for optimization/ATP tests

Test Equipment GPIB Address Settings

All test equipment is controlled by the WinLMF through an IEEE-488/GPIB bus. To communicate on the bus, each piece of test equipment must have a GPIB address set which the WinLMF will recognize. The standard address settings used by the WinLMF 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 Verifying and Setting GPIB Addresses section of Appendix B, 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 in high power configurations, all transmit (TX) test connections must be through a 30 dB directional coupler <i>plus</i> a 20 dB in-line attenuator for the 800 MHz BTSs. Attenuators are not required for low power configurations.
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IS-95A/B Operation

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

- CyberTest (High Power Configurations only)
- 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
- Agilent E7495A communications test set

Test Equipment Preparation

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

Agilent E7495A communications test set requires additional setup and preparation. This is described in detail in Appendix B.

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.

IS-95A/B-only Test Equipment Connections

Table 6-21 depicts the interconnection requirements for currently available test equipment *supporting IS-95A/B only* which meets Motorola standards and is supported by the WinLMF.

Table 6-21: IS-95A/B-only Test Equipment Interconnection

SIGNAL	COMMUNICATIONS SYSTEM ANALYZER				ADDITIONAL TEST EQUIPMENT				BTS
	Cyber-Test	Advantest R3465	HP 8921A	HP 8921 W/PCS	Power Meter	GPIB Interface	WinL MF	Attenuator & Directional Coupler	
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-I B	HP-IB	HP-IB	GPIB	SERIAL PORT		
TX TEST CABLES	RF IN/OUT	INPUT 50Ω	RF IN/OUT	RF IN/OUT				20 DB ATTEN. PORT	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 6-22 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 WinLMF.

Table 6-22: CDMA2000 1X/IS-95A/B Test Equipment Interconnection

SIGNAL	COMMUNICATIONS SYSTEM ANALYZER				ADDITIONAL TEST EQUIPMENT							BTS
	Agilent 8935 (Option 200 or R2K)	Agilent E7495A	Advantest R3267	Agilent E4406A	Agilent E4432B Signal Generator	Advantest R3562 Signal Generator	Power Meter	GPIO Interface	WinLMF	30 dB Directional Coupler & 20 dB Pad*		
EVEN SECOND SYNCHRONIZATION	EXT TRIG IN	EVEN SECOND SYNC IN	EXT TRIG	TRIGGER IN	PATTERN TRIG IN	EVEN SECOND SYNC IN						SYNC MONITOR
19.6608 MHZ CLOCK	MOD TIME BASE IN			EXT REF IN		EXT REF IN						FREQ MONITOR
CONTROL IEEE 488 BUS	IEEE 488		GPIO	HP-IB	GPIO	HP-IB	HP-IB	GPIO	SERIAL PORT			
10 MHZ	10 MHZ IN		10 MHZ OUT	10 MHZ OUT (SWITCHED)	10 MHZ IN	SYNTH REF IN						
SIGNAL SOURCE CONTROLLED SERIAL I/O			SERIAL I/O			SERIAL I/O						
TX TEST CABLES	RF IN/OUT	PORT 2 RF IN	RF IN	RF INPUT 50 OHM	RF OUTPUT 50 OHM	RF IN/OUT				30 DB COUPLER AND 20 DB PAD		TX1-6
RX TEST CABLES	DUPLEX OUT *	PORT 1 RF OUT	RF OUT 50-OHM	RF OUT ONLY	RF OUTPUT 50-OHM	RF OUT 50 OHM						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.

6

Equipment Warm-up



IMPORTANT

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.

- Agilent E7495A for a minimum of 30 minutes
- All other test sets for a minimum of 60 minutes
- 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 6-21 and Figure 6-22 show the cable calibration setup for the test sets supported by the WinLMF. 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 6-24 provides a procedure for performing automatic cable calibration.

Manual Cable Calibration

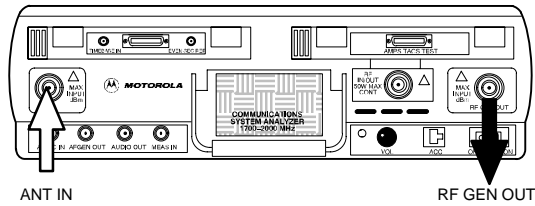
If manual cable calibration is required, refer to the procedures in Appendix B.

Test Equipment Setup – continued

Figure 6-12: IS-95A/B and CDMA 2000 1X Cable Calibration Test Setup – Agilent E4406A/E4432B and Advantest R3267/R3562

SUPPORTED TEST SETS

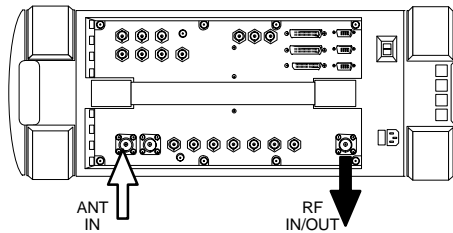
Motorola CyberTest



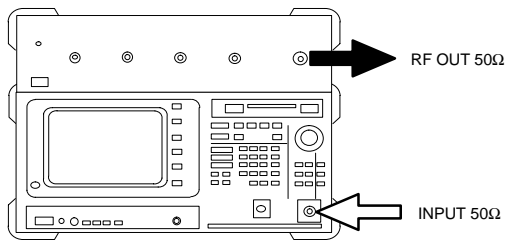
Note: The 30 dB directional coupler is not used with the CyberTest test set. The TX cable is connected directly to the CyberTest test set.

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.

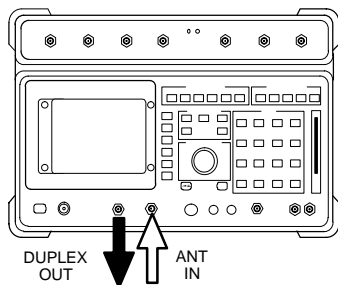
Agilent 8935 Series E6380A (formerly HP 8935)



Advantest Model R3465



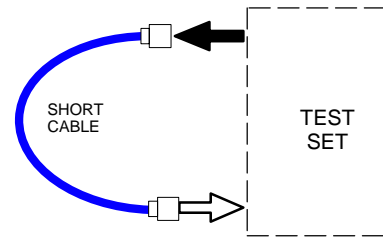
Hewlett Packard Model HP 8921A



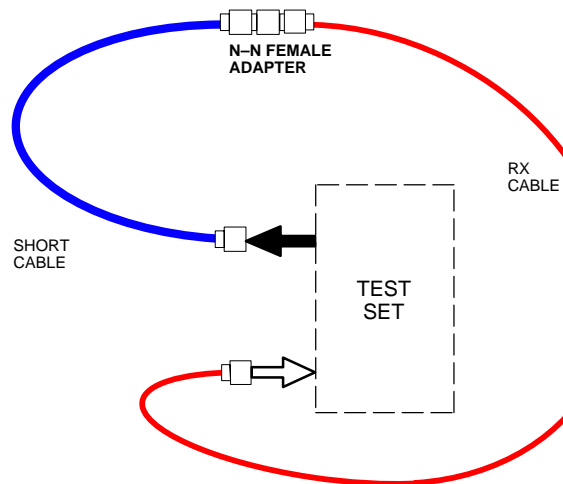
Note: For 800 MHz only. The HP8921A cannot be used to calibrate cables for PCS frequencies.

CALIBRATION SET UP

A. SHORT CABLE CAL



B. RX TEST CAL SETUP



C. TX TEST AND RX TEST CAL SETUP

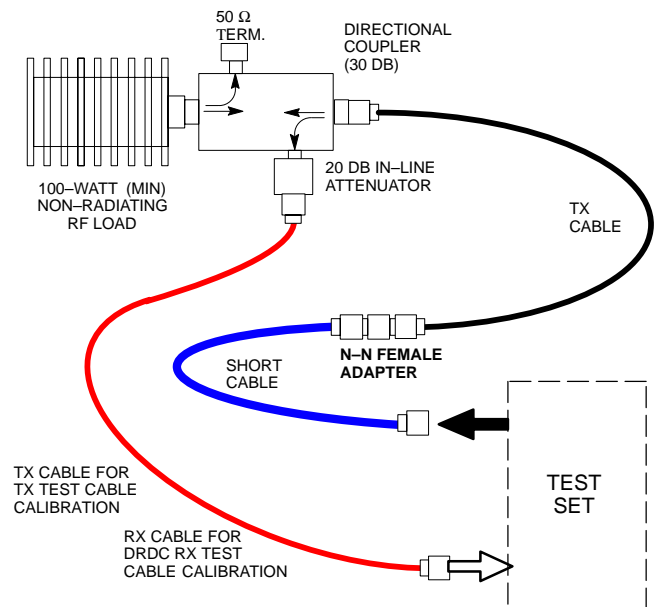
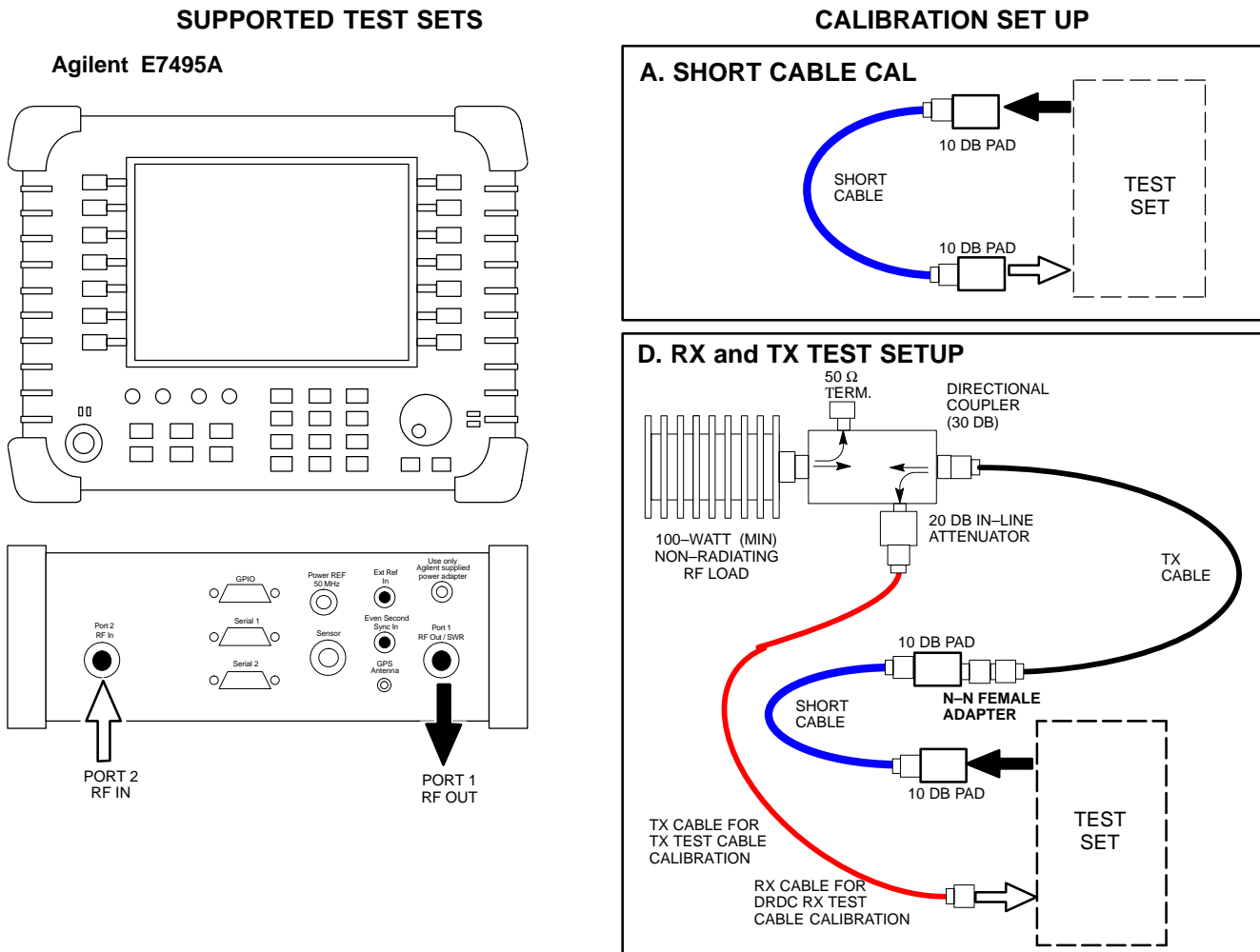


Figure 6-13: CDMA2000 1X Cable Calibration Test Setup – Agilent E7495A

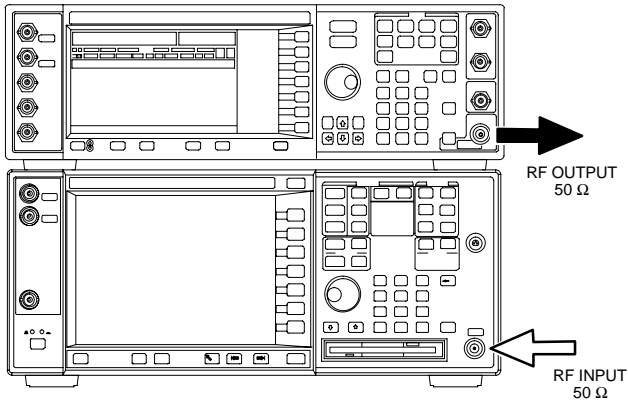


Test Equipment Setup – continued

Figure 6-14: IS-95A/B and CDMA 2000 1X Cable Calibration Test Setup – Agilent E4406A/E4432B and Advantest R3267/R3562

SUPPORTED TEST SETS

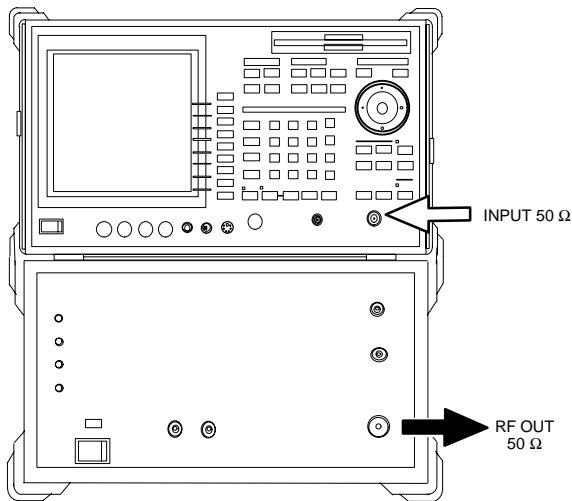
Agilent E4432B (Top) and E4406A (Bottom)



NOTE:

10 MHZ IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO 10 MHZ OUT (SWITCHED) ON REAR OF TRANSMITTER TESTER (FIGURE B-18).

Advantest R3267 (Top) and R3562 (Bottom)

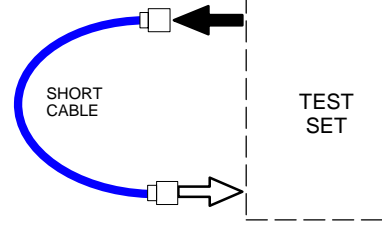


NOTE:

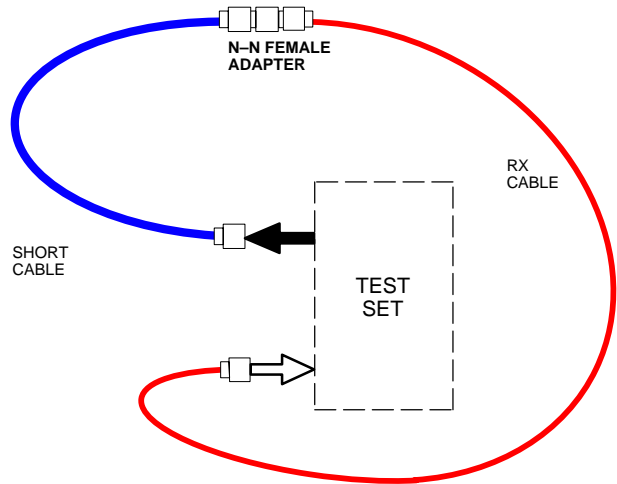
SYNTH REF IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO 10 MHZ OUT ON REAR OF SPECTRUM ANALYZER

CALIBRATION SET UP

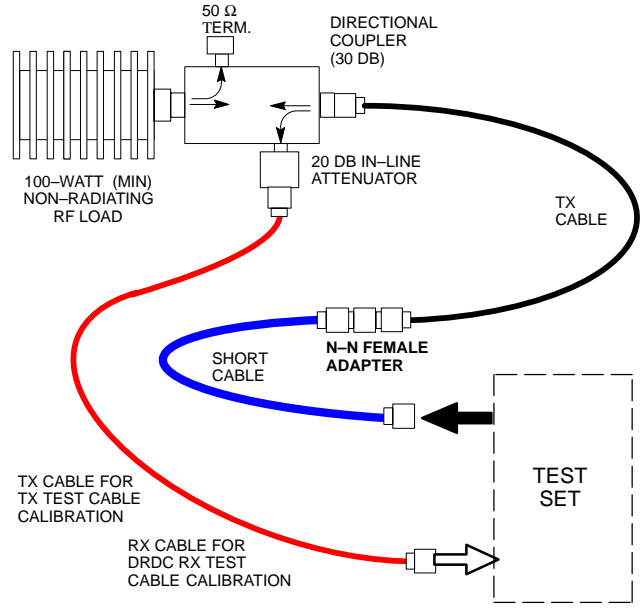
A. SHORT CABLE CAL



B. RX TEST SETUP



D. TX TEST SETUP AND RX TEST SETUP



6

Set-up for TX Calibration

Figure 6-15 and Figure 6-17 show the test set connections for TX calibration.

Figure 6-15: TX Calibration Test Setup –
CyberTest (IS-95A/B) and Agilent 8935 (IS-95A/B and CDMA2000 1X)

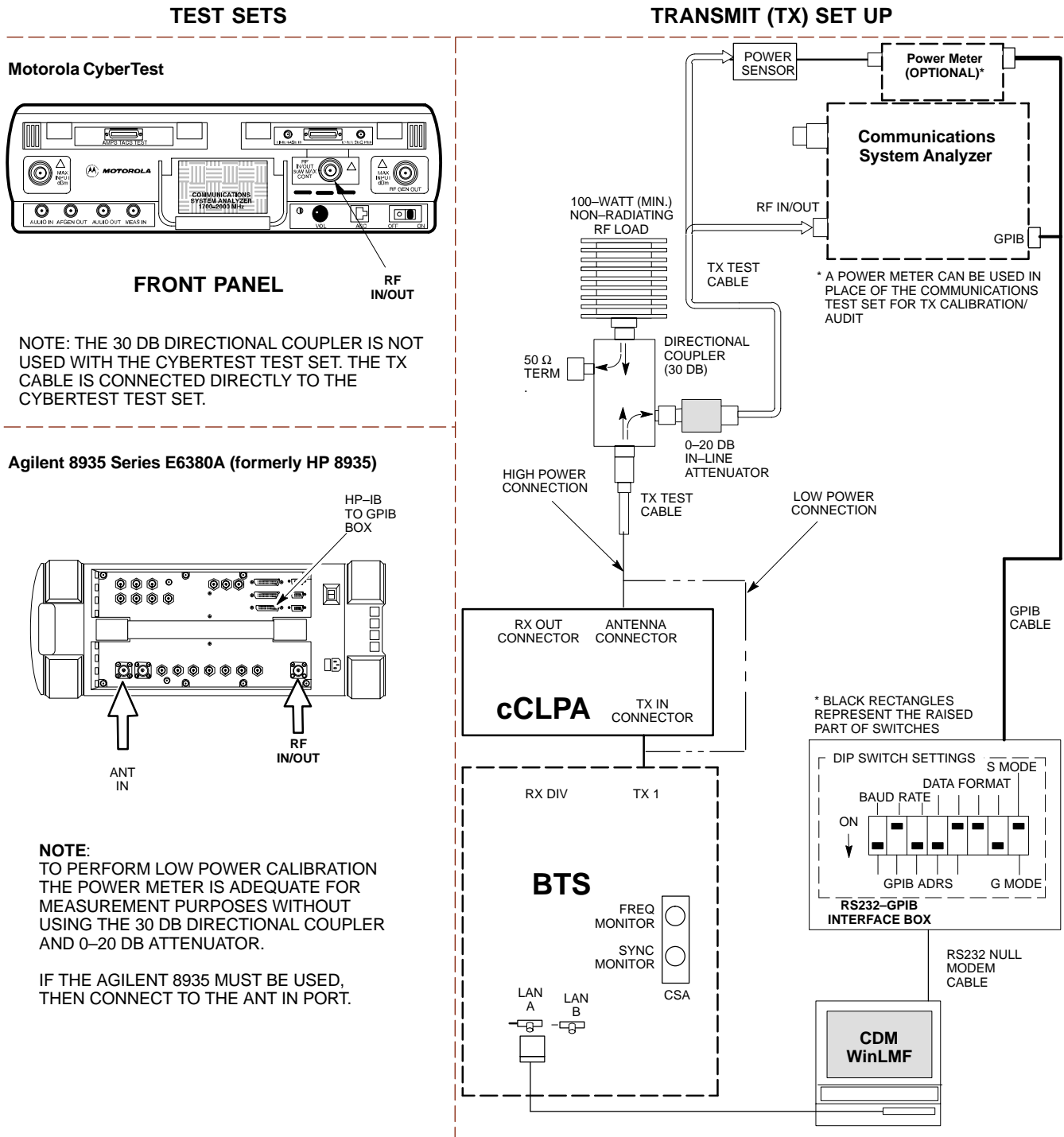
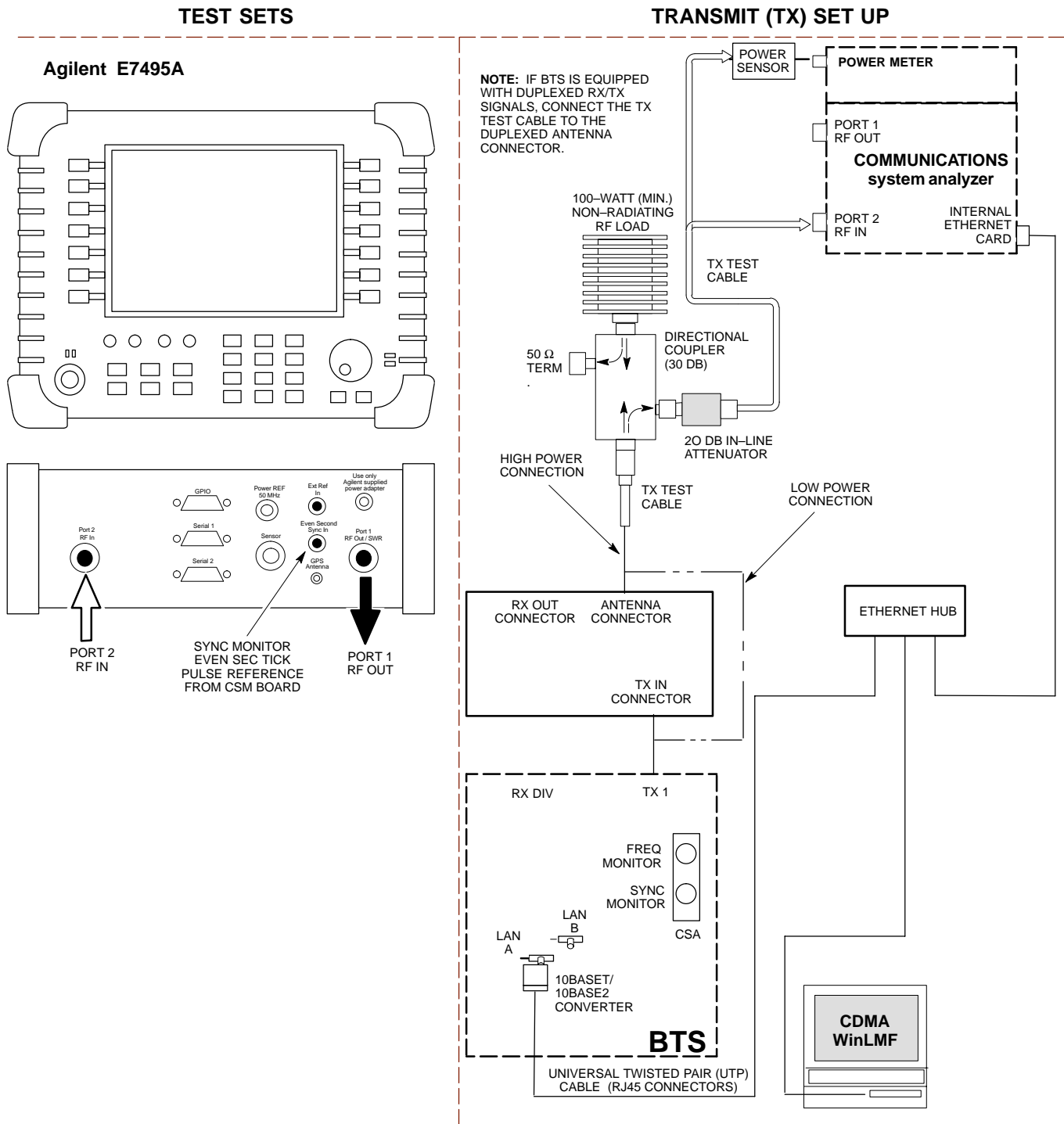
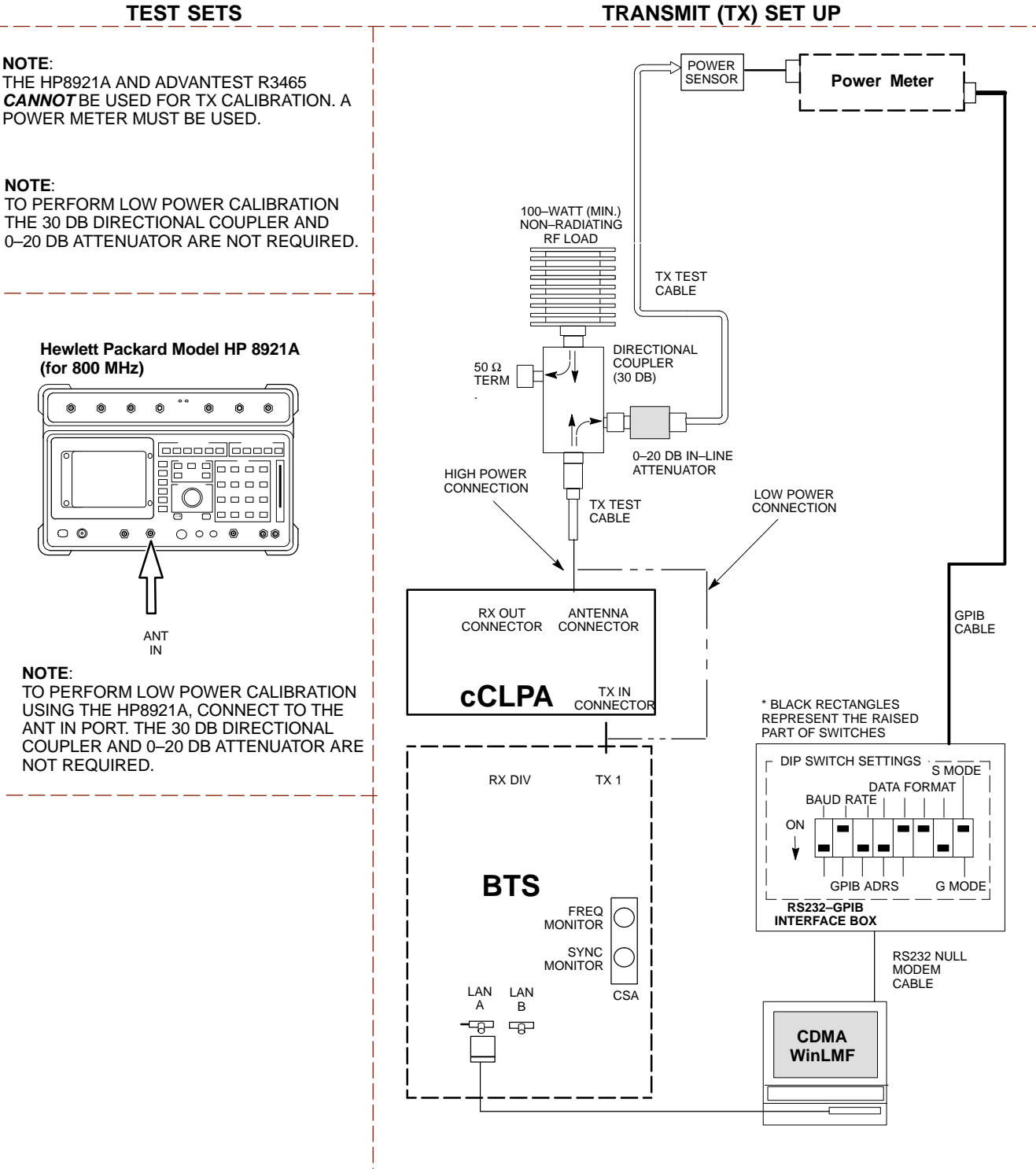


Figure 6-16: TX Calibration Test Setup – Agilent E7495A (IS-95A/B and CDMA2000 1X)



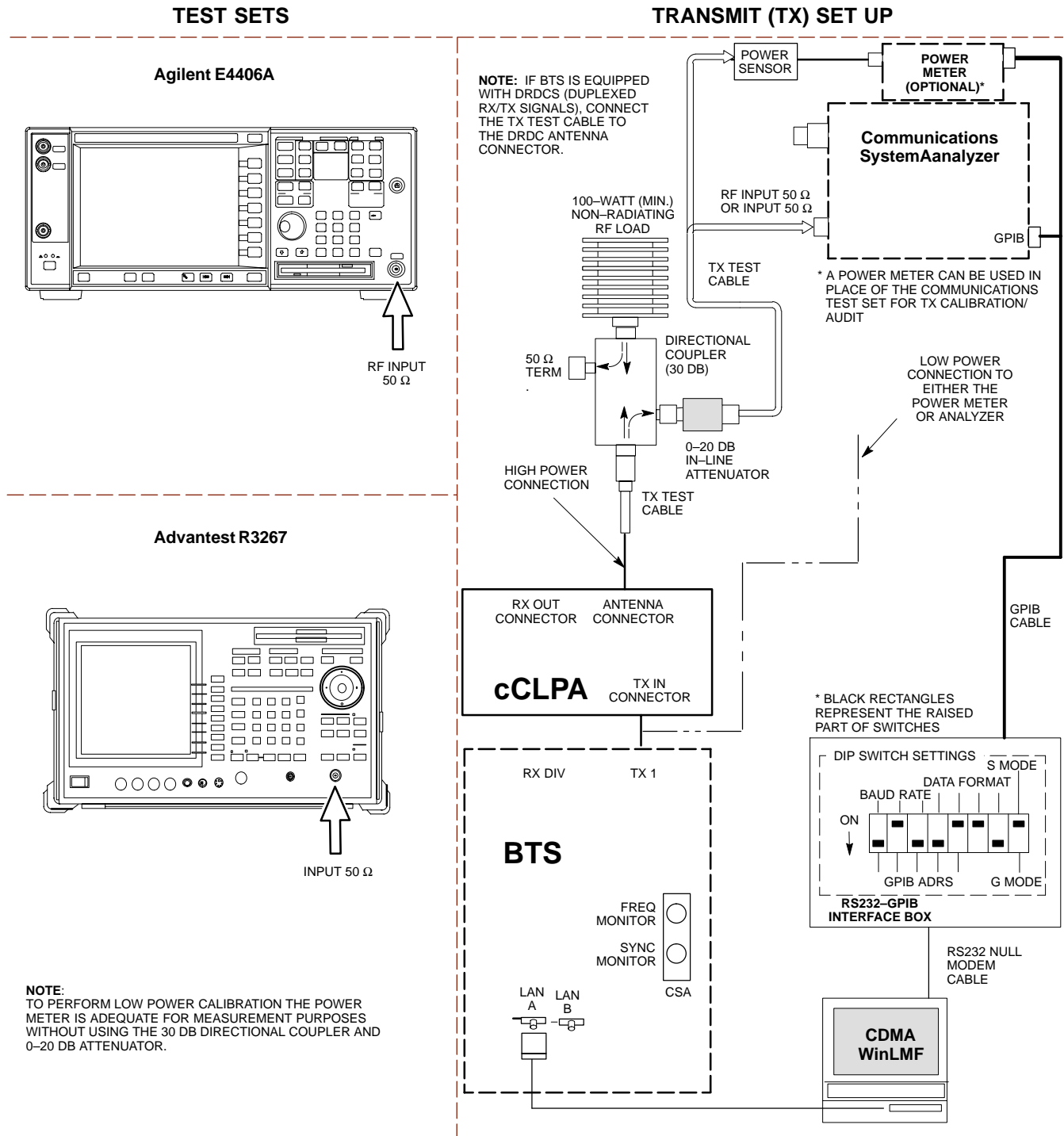
Test Equipment Setup – continued

Figure 6-17: TX Calibration Test Setup – Using Power Meter



Test Equipment Setup – continued

Figure 6-18: TX Calibration Test Setup –
Agilent E4406A and Advantest R3567 (IS-95A/B and CDMA2000 1X)

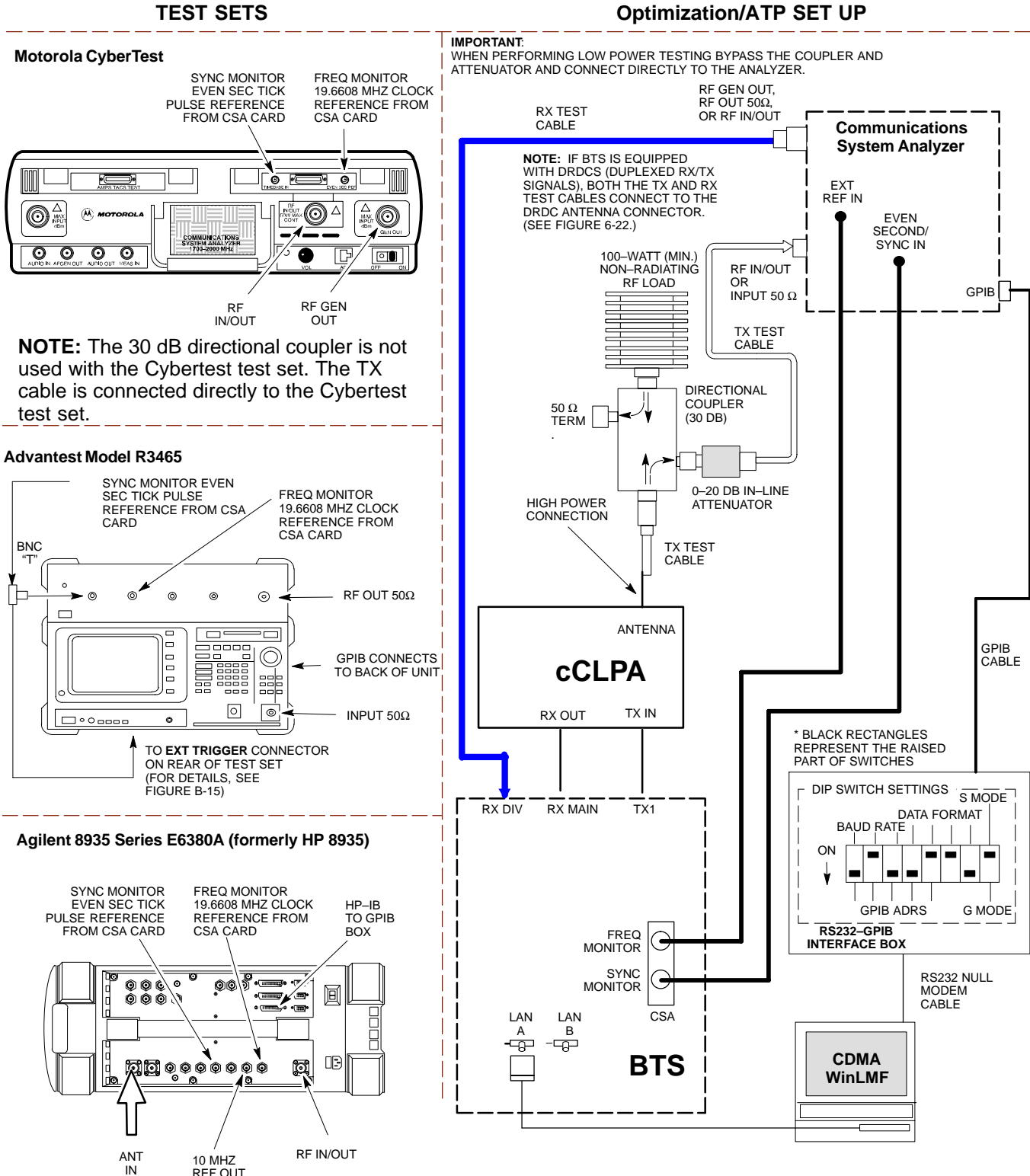


6

Set-up for ATP

Figure 6-19 and Figure 6-20 show the test set connections for ATP tests.

Figure 6-19: IS-95A/B ATP Test Set-up—CyberTest, Advantest R3465, and Agilent 8935

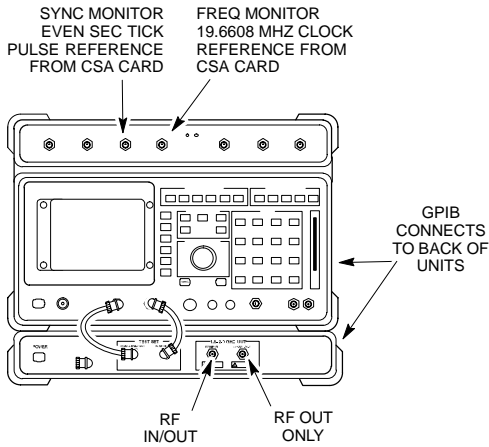


Test Equipment Setup – continued

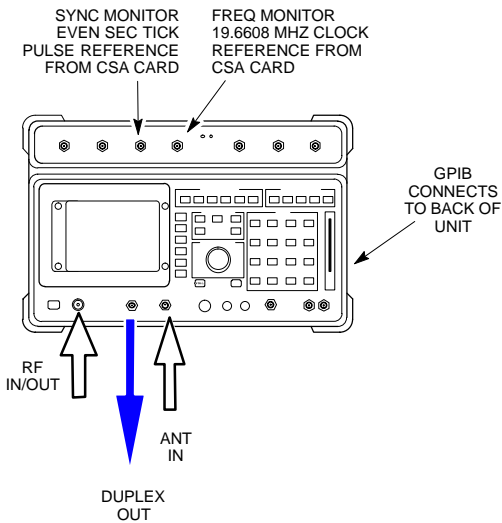
Figure 6-20: IS-95A/B ATP Test Setup – HP 8921A

TEST SETS

Hewlett Packard Model HP 8921A W/PCS Interface (for 1900 MHz)



Hewlett Packard Model HP 8921A (for 800 MHz)



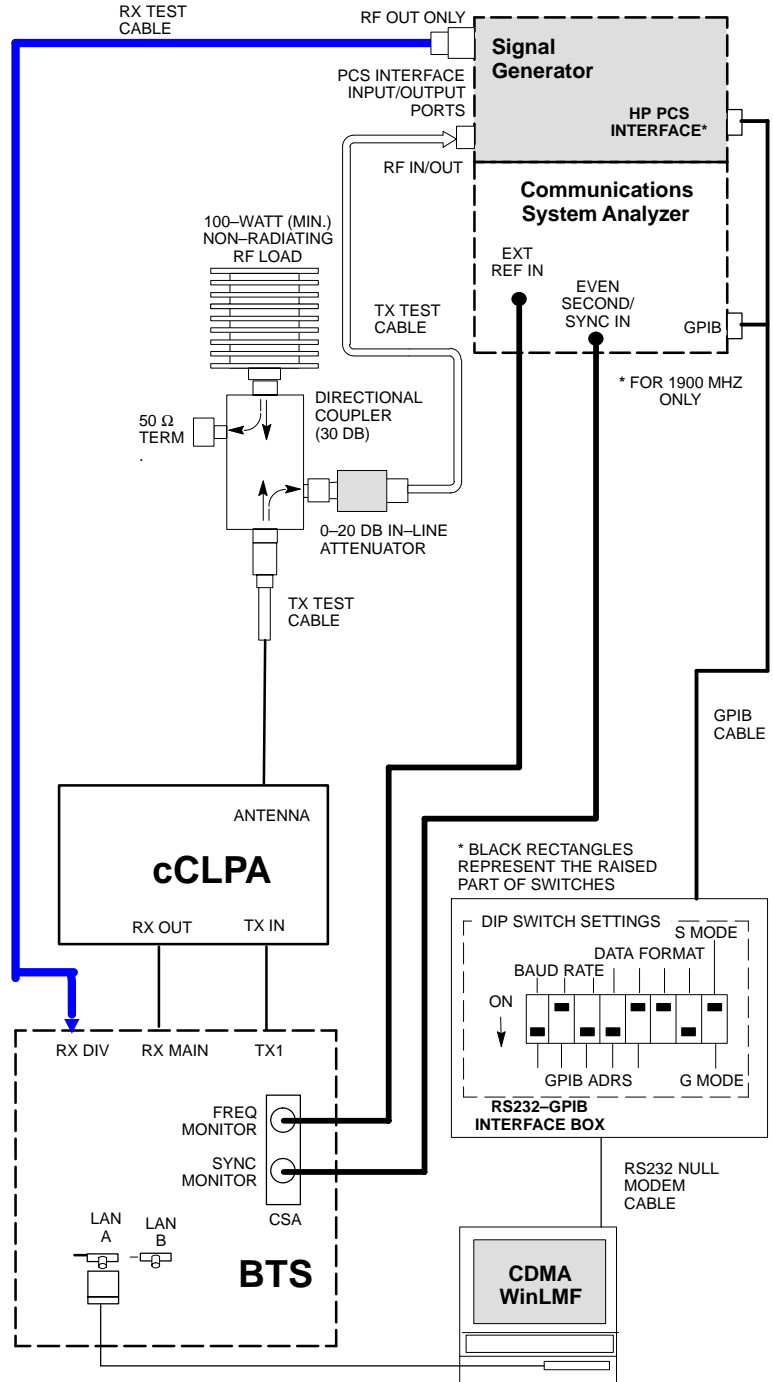
NOTE:

FOR 800 MHZ TESTING, CONNECT CABLES TO THE HP 8921A AS FOLLOWS:

RX TEST CABLE TO DUPLEX OUT

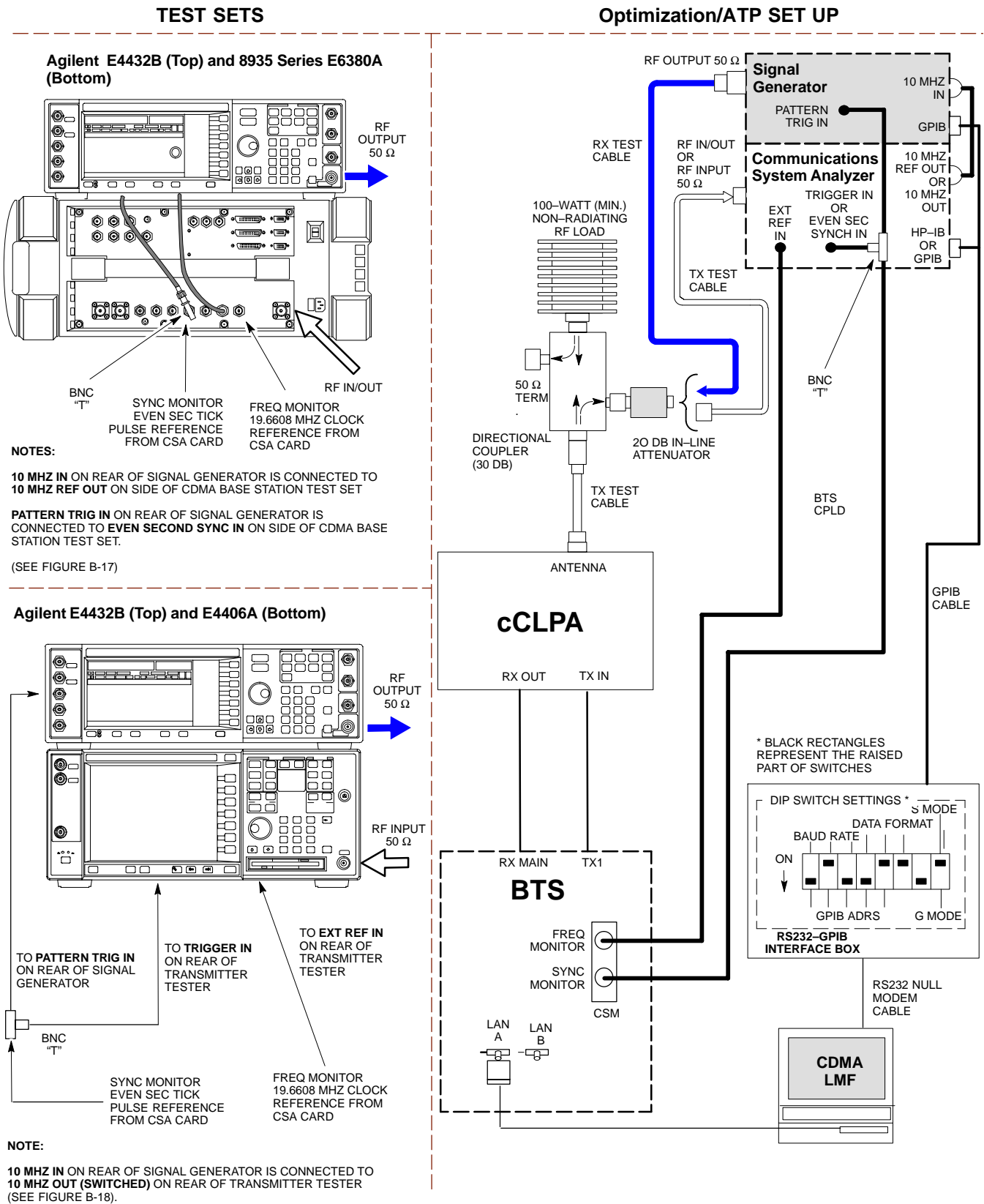
TX TEST CABLE TO RF IN/OUT

Optimization/ATP SET UP



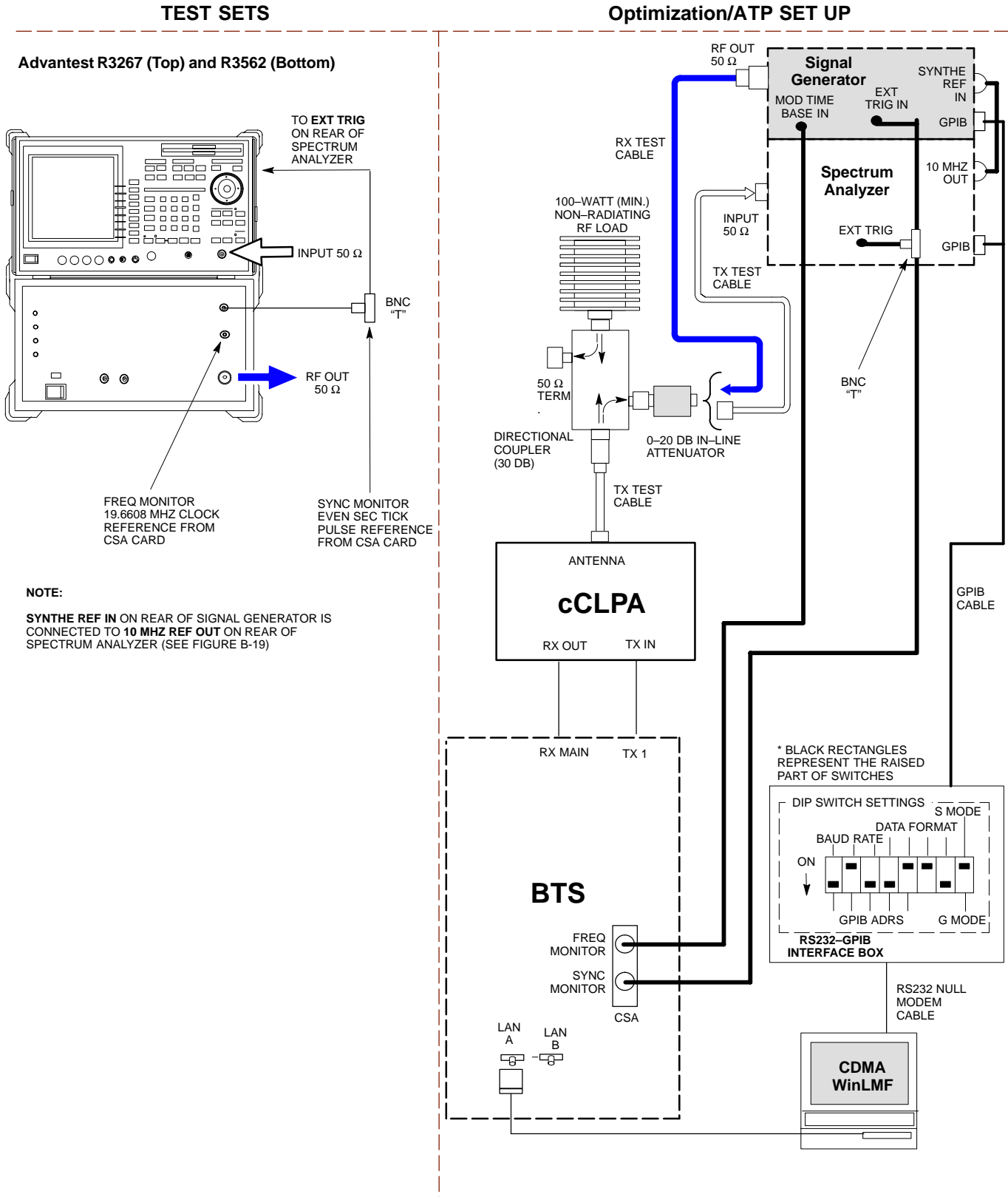
Test Equipment Setup – continued

Figure 6-21: IS-95A/B and CDMA2000 1X ATP Test Setup Agilent Test Equipment



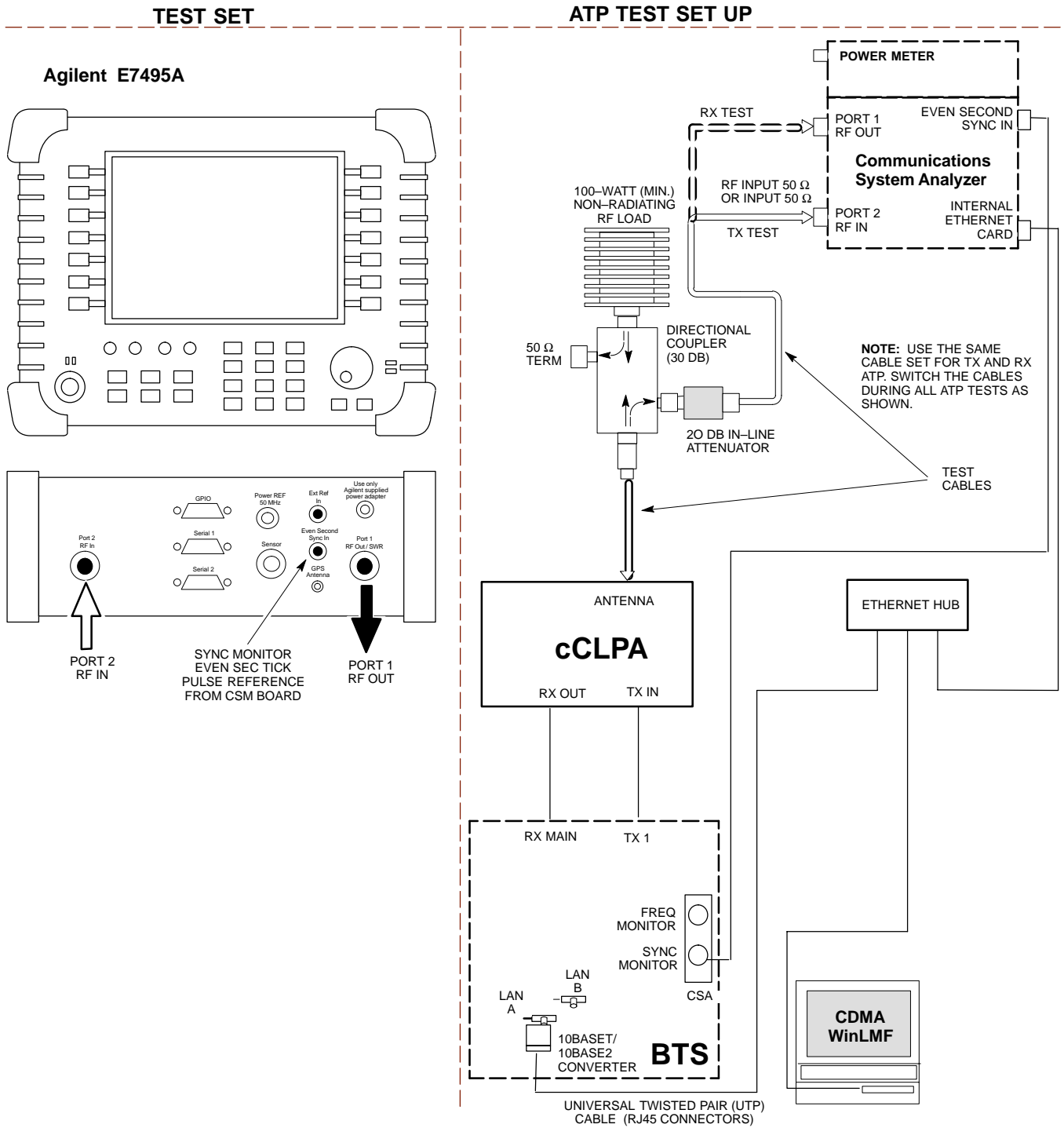
Test Equipment Setup – continued

Figure 6-22: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup – Agilent E4432B/8935 Series E6380A and E4432B/E4406A Test Equipment



Test Equipment Setup – continued

Figure 6-23: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup – Agilent E7495A



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* 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 *prior to* beginning 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 *minimum of 60 minutes*.

Calibration Procedures Included

Automatic

Procedures included in this section use the WinLMF 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 WinLMF computer.

Manual

Agilent E4406A Transmitter Tester – The E4406A does not support the power level zeroing calibration performed by the WinLMF. If this instrument is to be used for Bay Level Offset calibration and calibration is attempted with the WinLMF **Calibrate Test Equipment** function, the WinLMF 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 B 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 B .

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 B, if needed.

GPIB Addresses

GPIB addresses can range from 1 through 30. The WinLMF will accept any address in that range, but the numbers entered in the WinLMF Options window GPIB address boxes (Table 6-23 and Table 6-24) 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 B.

Selecting Test Equipment

Serial Connection and **Network Connection** tabs are provided in the **WinLMF 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 WinLMF 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 or the Agilent E7495A Communications Test Set is used.

Prerequisites

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

- Test equipment is correctly connected and turned on.
- GPIB addresses set in the test equipment have been verified as correct using the applicable procedures in Appendix B.
- WinLMF 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 WinLMF 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 WinLMF does not attempt to verify the test equipment is actually detected when manual selection is specified. Follow the procedure in Table 6-23 to manually select test equipment.

Table 6-23: Procedure for Selecting Test Equipment Manually in the Serial Connection Tab

Step	Action
1	In the WinLMF window menu bar, click Tools and select Options... from the pull-down menu. The WinLMF 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	<i>If it is not selected (black dot showing)</i> , 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 B for directions on verifying and/or changing test equipment GPIB addresses). <i>Motorola-recommended addresses are:</i> 1 = signal generator 13 = power meter 18 = communications system analyzer * IMPORTANT When test equipment items are manually selected by the operator, the WinLMF defaults to using a power meter for RF power measurements. The WinLMF will use a communications system analyzer for RF power measurements only if a power meter is not selected (power meter checkbox <i>not</i> checked).
7	Click on Apply . (The button will darken until the selection has been committed.) NOTE With manual selection, the WinLMF does not attempt to detect the test equipment to verify it is connected and communicating with the WinLMF. To verify and, if necessary, change the GPIB address of the test equipment, refer to Appendix B.
8	Click on Dismiss to close the WinLMF Options window.

6

Automatically Selecting Test Equipment in the Serial Connection Tab

When using the auto-detection feature to select test equipment, the WinLMF determines which test equipment items are actually communicating with WinLMF. Follow the procedure in Table 6-24 to use the auto-detection feature.

Table 6-24: Procedure for Selecting Test Equipment Using Auto-Detect

Step	Action
1	In the WinLMF window menu bar, click Tools and select Options... from the pull-down menu. The WinLMF 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	<i>If it is not selected (no black dot showing)</i> , click on the Auto-Detection button.
5	<p><i>If they are not already displayed</i> 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 <i>with commas and no spaces</i>. (Refer to the Setting GPIB Addresses section of Appendix B for instructions on verifying and/or changing test equipment GPIB addresses.)</p> <p>NOTE During the GPIB address search for a test equipment item to perform RF power measurements (that is, for TX calibration), the WinLMF 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 WinLMF will use the communications system analyzer (GPIB address 18) for power measurements.</p>
6	Click Apply . The button will darken until the selection has been committed. A check mark will appear in the applicable Manual Configuration section check boxes for detected test equipment items.
7	Click Dismiss to close the WinLMF Options window.

Calibrating Test Equipment

The WinLMF **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 B for E4406A calibration.

Prerequisites

- WinLMF 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 WinLMF (Table 6-23 or Table 6-24)

Follow the procedure in Table 6-25 to calibrate the test equipment.

Table 6-25: Procedure for Test Equipment Calibration	
Step	Action
1	From the Util menu, select Calibrate Test Equipment from the pull-down menu. A Directions window is displayed.
2	Follow the directions 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 WinLMF Cable 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. WinLMF 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

Cable Calibration is used to calibrate both TX and RX test cables.

NOTE

WinLMF cable calibration cannot be accomplished with an HP8921A analyzer for 1.9 GHz. A different analyzer type or the signal generator and spectrum analyzer method (Table 6-27 and Table 6-28) must be used. Cable calibration values must be manually entered into the WinLMF 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 B.



Prerequisites

- Test equipment is turned on and has warmed up for at least 60 minutes. Agilent E7495A requires only 30 minute warmup.
- Test equipment has been selected in the WinLMF (Table 6-23 or Table 6-24).
- Test equipment has been calibrated and correctly connected for the type of test cable configuration to be calibrated.

Calibrating cables

Refer to Figure 6-21 or Figure 6-22 and follow the procedure in Table 6-26 to calibrate the test cable configurations.

Table 6-26: Procedure to Test Cabling Calibration using Communication 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.

... continued on next page

Table 6-26: Procedure to Test Cabling Calibration using Communication 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.

Calibrate Test Cabling Using Signal Generator & Spectrum Analyzer

Refer to Figure 6-24 and follow the procedure in Table 6-27 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. Refer to Figure 6-25 and follow the procedure in Table 6-28 to calibrate the test cable configuration for *non-duplexed RX* using the signal generator and spectrum analyzer.

Table 6-27: Procedure to Calibrate TX/Duplexed RX Test Cabling Using Signal Generator & Spectrum Analyzer	
Step	Action
1	Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 6-24, detail “A” (top portion of figure).
2	Set signal generator to 0 dBm at the customer frequency of: 869–894 MHz or 1930–1990 MHz
3	Use spectrum analyzer to measure signal generator output (see Figure 6-24, A) and record the value.
4	Connect the spectrum analyzer’s short cable to point B , (as shown in the lower right portion of the diagram) to measure cable output at customer frequency of: 869–894 MHz or 1930–1990 MHz Record the value at point B .
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 <i>calibration only</i> . It is <i>not</i> part of the final test setup. After calibration is completed, <i>do not</i> re-arrange any cables. Use the test cable configuration as is to ensure test procedures use the correct calibration factor.

Test Set Calibration – continued

Figure 6-24: Cal Setup for TX/Duplexed RX Test Cabling Using Signal Generator & Spectrum Analyzer

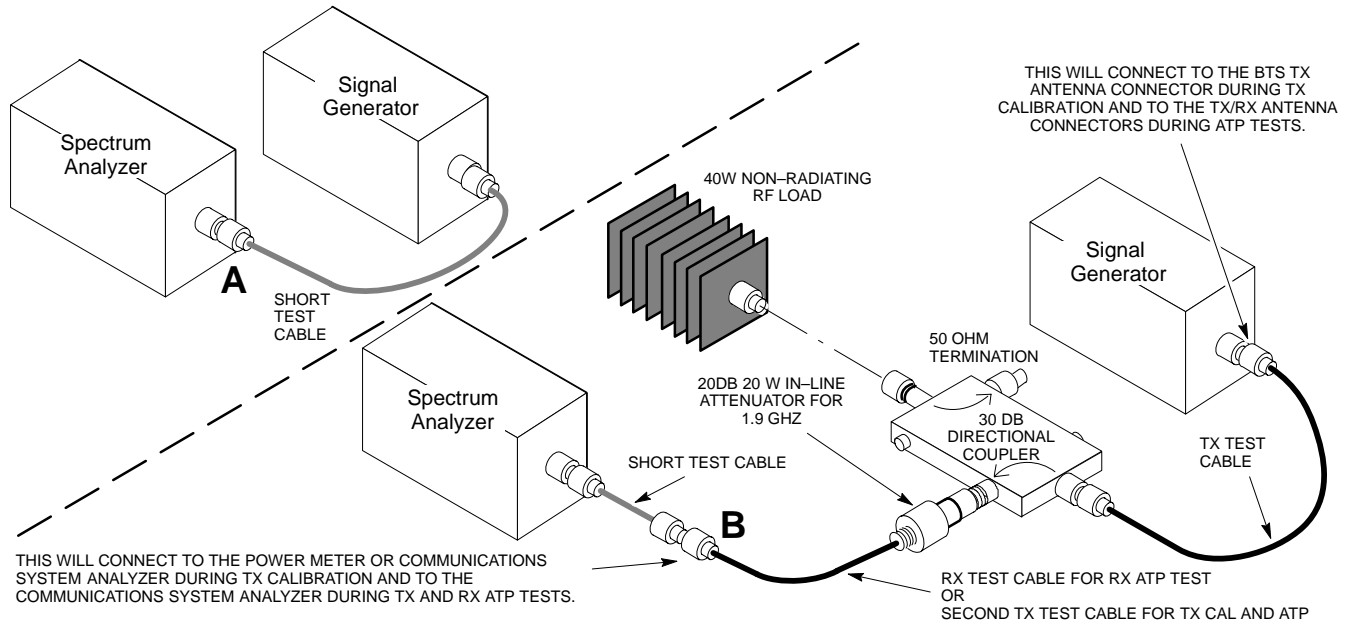
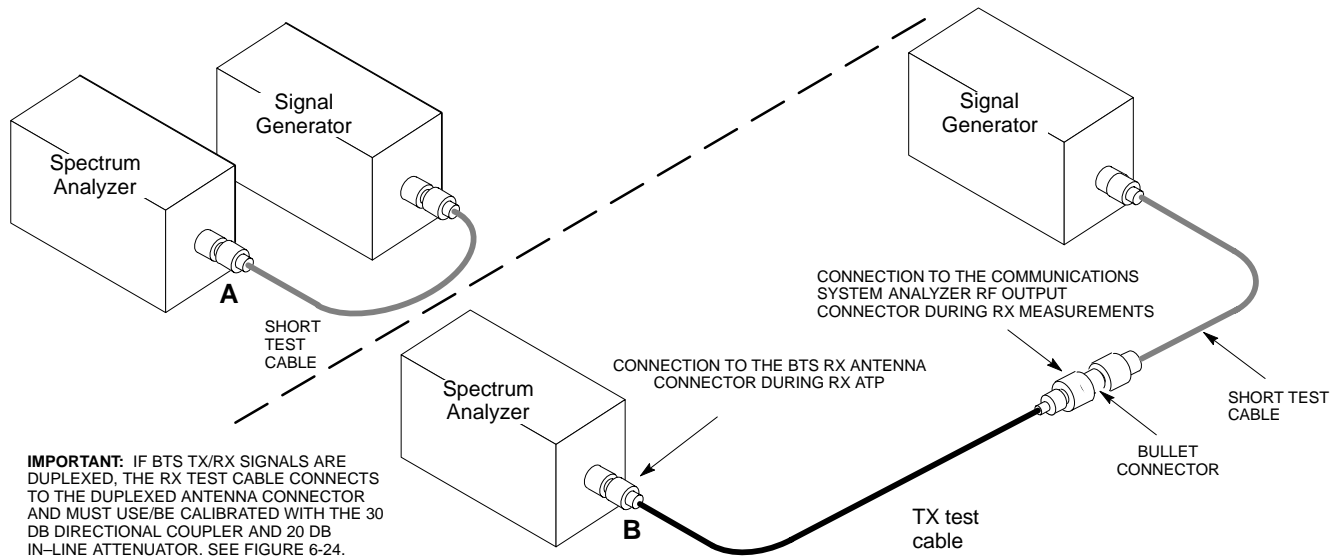


Table 6-28: Procedure for Calibrating **Non-Duplexed RX** Test Cabling Using Signal Generator & Spectrum Analyzer

Step	Action
	<p>NOTE</p> <p>When preparing to calibrate a BTS with Duplexed TX and RX the RX cable calibration must be done using calibration setup in Figure 6-24 and the procedure in Table 6-27.</p>
1	Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 6-25, detail “A” (top portion of figure).
2	Set signal generator to -10 dBm at the customer’s RX frequency of: 824–849 for North American Cellular or 1850–1910 MHz band for North American PCS
3	Use spectrum analyzer to measure signal generator output (see Figure 6-25, A) and record the value.
4	Connect the test setup, as shown in the lower portion of the diagram (see Figure 6-25, B) to measure the output at the customer’s RX frequency of: 824–849 for North American Cellular or 1850–1910 MHz band for North American PCS Record the value at point B .
5	<p>Calibration factor = (value measured with detail “A” setup) – (value measured with detail “B” setup)</p> <p>Example: Cal factor = -12 dBm – $(-14$ dBm) = 2 dB</p> <p>NOTE</p> <p>The short test cable is used for test equipment setup calibration <i>only</i>. It is not part of the final test setup. After calibration is completed, <i>do not</i> re-arrange any cables. Use the test cable configuration as-is to ensure test procedures use the correct calibration factor.</p>

Figure 6-25: Cal Setup for Non-Duplexed RX Test Cabling Using Signal Generator & 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 WinLMF and the applicable test equipment. The WinLMF stores the measured loss values in the cable loss files. The cable loss values can also be set or changed manually. Follow the procedure in Table 6-29 to set cable loss values.

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

Prerequisites

- WinLMF is logged into the BTS

Table 6-29: Procedure for 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 <i>tabbed</i> 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.

... continued on next page

Table 6-29: Procedure for Setting Cable Loss Values

Step	Action
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	<i>For each tab with changes</i> , click on the Save button to save displayed values.
7	Click on the Dismiss button to close the window. NOTE <ul style="list-style-type: none"> • 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 WinLMF will interpolate for all other channels. • Entered values will be used by the WinLMF as soon as they are saved. It is not necessary to log out and log back into the WinLMF for changes to take effect.

Setting TX and RX Directional Coupler Loss Value

If an in-service TX or RX directional coupler is installed in the RF path, the loss due to the added coupler (e.g., 30 dB) must be manually entered so it will be included in the WinLMF TX calibration and audit calculations and the RX FER test. Follow the procedure in Table 6-30 to enter directional coupler loss values.

Prerequisites

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

Table 6-30: Procedure for Setting TX and RX Directional Coupler Loss Values

Step	Action
1	Click Util in the BTS menu bar, and select Edit > Coupler Loss... in the pull-down menus. – A <i>tabbed</i> data entry pop-up window will appear.
2	Click on the TX Coupler Loss tab or the RX Coupler Loss tab, as required
3	Click in the Loss (dBm) column for each carrier that has a coupler and enter the appropriate value.
4	To edit existing values, click in the data box to be changed and change the value.
5	<i>For each tab with changes</i> , click on the Save button to save displayed values.

. . . continued on next page



Table 6-30: Procedure for Setting TX and RX Directional Coupler Loss Values

Step	Action
6	<p>Click on the Dismiss button to close the window.</p> <p>NOTE</p> <ul style="list-style-type: none">• 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 <i>are not required</i> to cause saved changes to take effect.

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.

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 BLOs

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
 - CCP2 shelf
 - cCLPA

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.

- When referring to the CAL file print-out it can be seen that there is one BBX slot 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:

$$\begin{array}{l} C[1]=384 \quad (\text{odd cal entry}) \\ C[2]=19102 \quad (\text{even cal entry}) \end{array} \left. \vphantom{\begin{array}{l} C[1]=384 \\ C[2]=19102 \end{array}} \right\} = 1 \text{ “calibration point”}$$
$$\begin{array}{l} C[3]=777 \quad (\text{odd cal entry}) \\ C[4]=19086 \quad (\text{even cal entry}) \end{array} \left. \vphantom{\begin{array}{l} C[3]=777 \\ C[4]=19086 \end{array}} \right\} = 1 \text{ “calibration point”}$$

⋮

$$\begin{array}{l} C[19]=777 \quad (\text{odd cal entry}) \\ C[20]=19086 \quad (\text{even cal entry}) \end{array} \left. \vphantom{\begin{array}{l} C[19]=777 \\ C[20]=19086 \end{array}} \right\} = 1 \text{ “calibration point”}$$

In the example above, BLO was measured at only two frequencies (channels 384 and 777) for CCP2 slot BBX–1 transmit. 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.

BLO for Expansion BTS

The BLO Ranges for expansion BTS configurations are listed below:

Low Power

- 1.9 GHz: 1 to 4 carriers: -15 ± 7 dB
- 1.9 GHz: 5 to 8 carriers: -19 ± 7 dB

High Power (1 or 2 cCLPAs)

- 1.9 GHz: 1 to 2 carriers: 46 ± 7 dB
- 1.9 GHz: 3 to 4 carriers: 42 ± 7 dB
- 1.9 GHz: 5 to 8 carriers: 40 ± 7 dB

Test Equipment Setup for RF Path Calibration

Follow the procedure in Table 6-31 and refer as needed to Figure 6-15 or Figure 6-17 to set up test equipment.

Table 6-31: Procedure to Set Up Test Equipment for RF Path Calibration

Step	Action
1	<i>If it has not already been done</i> , refer to the procedure in Table 6-6 (on page 6-17) to interface the LMF computer terminal to the frame LAN A connector.
2	<i>If it has not already been done</i> , refer to Table 6-7 (on page 6-25) to start a GUI LMF session.
3	<i>If not already done</i> , select test equipment per the procedure in Table 6-23 or Table 6-24.
4	If required, calibrate the test equipment per the procedure in Table 6-25.
	! CAUTION To prevent damage to the test equipment in high power configurations, all transmit (TX) test connections must be via the 30 dB directional coupler for 1.9 GHz. Attenuators are not required for low power configuration.
5	<i>For TX path calibration</i> , connect the test equipment as shown in Figure 6-15, Figure 6-17, or Figure 6-18, 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 carrier. These are specified respectively in the carrier *field* of the `ParentCARRIER` parameter in each BBXs CDF file block. The channel frequency for the assigned *sector* is specified in the `ChannelList` parameter of the CDF block for the CARRIER to which the BBX is assigned.

For Low Power optimization of the SC480, the following adjustments must be made to the CDF.

- In the *Carrier section* of the CDF, verify that the **SifPilotPwr** is set to **-200**.
- In the *BTS section* of the CDF, verify that the **CageConf** is set to **5** (CCP2), and that **BIOType** is set to **3**.

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.

Table 6-32 lists the maximum and minimum power with and without the cCLPA. The numbers presented may change at a later date.

TX Configuration	Max Power	Min Power
Indoor / Low Power	-6.0 dBm	-16.0 dBm
Outdoor / Low Power	-6.0 dBm	-16.0 dBm
Indoor / High Power	43.0 dBm / 41.76 dBm*	33.0 dBm
Outdoor / High Power	43.0 dBm / 41.76 dBm*	33.0 dBm
* Non-domestic maximum high power is 41.76 due to TX GSM Elimination filter.		

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 Check Box

In both the TX Calibration and All Cal/Audit dialog boxes, a **Verify BLO** check box is provided and checked by default. After the actual TX calibration is completed during either the TX Calibration or All Cal/Audit process, 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** check box should be unchecked or the additional path losses should be added.

Single-Sided BLO Check Box

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 a much wider tolerance than necessary for the BBXs. Single-Sided BLO calibration restricts the allowable BLO variations to the lower half of the range (i.e., 37 to 42 dB). 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.

The **Tests > TX > TX Calibration...** menu window has a **Test Pattern** pull-down menu. This menu has the following choices:

- **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 6-33.

Test Pattern	Channel(s)	Gain Setting
Pilot	Pilot channel only	262
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)	

Set-up for TX Calibration

The work-around in Table 6-34 allows the user to manually set the BLO limits .



Table 6-34: Procedure for Initial Set-up for TX Calibration

Step	Action
1	Delete the existing calibration file (if any) from the BTS folder on LMF laptop from the location C:\wlmf\cdma\bts-# , where # is the BTS number.
2	To edit the nominal TX BLO, from the Util menu, select Edit > TX Nominal Offset . In the TX Cal Parameter window, make any necessary changes to ensure the TX BLO Nominal Offset (in dB) is set to the following: <ul style="list-style-type: none"> – For 1.9 GHz, TX Nominal Offset value is 44.0 (dB), and the Allowed error range, plus or minus (in dB) is 1.5
3	Download the data, which includes BLO values, to all the BBXs. From the Device menu, select Download > Data

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 the CCP2 Shelf empty BBX slots may be populated to ensure 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 (or NECF) 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 and TX Calibration Procedure

The LMF All Cal/Audit and TX calibration procedures are essentially identical, except for the step that selects the type of procedure desired (Refer to Step 4 in Table 6-35).

Prerequisites

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

- The card in slot CSA, GLI, MCCs, and BBXs have correct code and data loads.
- 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 cards removed and repositioned have been returned to their assigned shelves/slots. Any BBX cards moved since they were downloaded will have to be downloaded again.

Follow the procedure in Table 6-35 to perform BLO calibration on the TX paths, download BLO values to the BBXs, and perform TX path audit in one operation.

Table 6-35: Procedure for All Cal/Audit and TX Calibration

Step	Action
1	<i>If it has not already been done</i> , configure test equipment for TX calibration by following the procedure in Table 6-31.
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	<p>For All Cal Audit...</p> <ul style="list-style-type: none"> – 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. <p>For TX Calibration</p> <ul style="list-style-type: none"> – 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	<p>Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list.</p> <p>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).</p>
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 (or bts-#.necf) and cbsc-#.cdf files from the CBSC.

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Table 6-35: Procedure for All Cal/Audit and TX Calibration

Step	Action
	<p>NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.</p>
7	<p>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.</p> <p>NOTE The rate selection of 3 is only available if 1X cards are selected for the test.</p>
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.
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	<p>Follow cable connection directions as they are displayed.</p> <ul style="list-style-type: none"> – 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.

Download BLO Procedure

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

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**.

Prerequisites

Ensure the following prerequisites have been met before proceeding.

- BBXs to receive the download are OOS_RAM (yellow).
- TX calibration was successfully completed

Bay Level Offset Calibration – continued

Follow the steps in Table 6-36 to download the BLO data to the BBXs.

Table 6-36: Procedure to 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.

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.

NOTE

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

6

TX Path Audit

Perform the calibration audit of the TX paths of all equipped BBX slots, per the steps in Table 6-37.



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 CSA, GLIs, BBXs have correct code load.
- The CSA and GLI 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.

TX Path Audit procedure

After a TX calibration has been performed, or if verification of BLO data in the CAL file is required, follow the procedure in Table 6-37 to perform a BTS TX path audit.

Table 6-37: Procedure for BTS TX Path Audit

✓	Step	Action
	1	<i>If it has not already been done</i> , configure test equipment for TX path audit by following the procedure in Table 6-31 (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 Calibration 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. 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 (or bts-#.necf) 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.

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Table 6-37: Procedure for BTS TX Path Audit

Step	Action
8	From the Test Pattern pick list, select a test pattern. <ul style="list-style-type: none"> – Selecting Pilot (default) performs tests using a pilot signal only. – Selecting Standard performs tests using pilot, synch, paging and six traffic channels. This requires an MCC to be selected. – Selecting CDFPilot performs tests 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. – Selecting CDF performs tests using pilot, synch, paging and six traffic channels, however, the gain for the channel elements is specified in the CDF file.
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.

Create CAL File

The LMF Create CAL File function gets the BLO data from BBXs and creates or updates the CAL file for the BTS. 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, the BLO data must be saved to the CAL file in the BTS folder. If this is a first time calibration and no CAL file is stored in the BTS folder, the procedure in Table 6-38 will create the file and store the BLO data in it. If the CAL file already exists, this procedure will update it with the new BLO data. 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 the procedure in Table 6-38, the following should be done:

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

Table 6-38: Create CAL File

Step	Action
1	Select the applicable BBXs. – The CAL file will be updated for the selected BBXs <i>only</i> .
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.

