Table 3-10: Downloading and linking master-bts-cdma directory files for device loads	
Step	**Action**
	NOTE • If the current LMF code needs to be installed on the LMF PC, or if more information on file management, creating bts directories, or viewing CDF files is needed, refer to the *LMF Users Guide*. • The types of files that can be downloaded include code (.hex or .bin extension) and data (.dds extension) files. Files may be compressed (indicated by a .Z extension).
1	Enter the following UNIX command, from the `/usr/lmf` directory, to create a device load master directory *(if it does not already exist)*. 　　**mkdir bts-master-cdma**
2	Enter the following UNIX command to change to the newly created directory: 　　**cd bts-master-cdma**
3	Obtain the 3.5-in. diskette(s) containing the current release of the BTS operating code and/or data files. **NOTE** File naming conventions for all processor boards and applicable files for each are listed below. Rename files using the **mv** UNIX command as required: **Device**　　　　　**File Name(s)** • GLI　　`<version>-gliboot.hex` & `gli.dds` • BBX　　`<version>-bbxboot.hex` & `bbx.dds` • BDC　　`<version>-bdcboot.hex` & `bdc.dds` • MCC　　`<version>-mccboot.hex.0501` & `mcc.dds.0501` • CSM　　`<version>-csmboot.hex` & `csm.dds` • TSU　　`tsuboot.hex`
4	Insert the first 3.5 inch floppy diskette. Verify disk is loaded with the proper BTS files/versions by typing the following at the `(lmf):` prompt: 　　**seedisk <cr>**
5	To load the BTS files from the disk into the appropriate directory, enter the following at the `(lmf):` prompt: 　　**fromdisk <cr>**
6	*If files are compressed*, use the `uncompress *.Z` command to unpack files. Rename files to match the naming conventions listed above if required.
7	Repeat Steps 4 and 5 for each diskette that is a part of this load.
	NOTE All older versions of files (and links to files) in the `bts-master- bts-<bts#>` subdirectories ***must be removed*** before beginning this procedure.

Table 3-10: Downloading and linking master-bts-cdma directory files for device loads	
Step	**Action**
8	Create softlinks to the device load and data load files in the `bts-master-cdma` directory using the following UNIX commands:
	ln **-s** **/usr/lmf/bts-master-cdma/*.hex** **/usr/lmf/bts-**<bts#>**/**
	ln **-s** **/usr/lmf/bts-master-cdma/*.hex.*** **/usr/lmf/bts-**<bts#>**/**
	ln **-s** **/usr/lmf/bts-master-cdma/*.dds** **/usr/lmf/bts-**<bts#>**/**
	ln **-s** **/usr/lmf/bts-master-cdma/*.dds.*** **/usr/lmf/bts-**<bts#>**/**
	NOTE
	You may need to specify specific file names in the command instead of using the ***** "wildcard" character in order to link multiple versions of files in the same subdirectory. Using *.* will link ALL files in the directory.

3

Create BTS Specific CDF File

Follow the steps outlined in Table 3-11 to create a BTS specific CDF file, if one cannot be obtained from the OMCR/CBSC. (*This is an interim procedure and is subject to change).*

<table>
<tr><td colspan="2" align="center">**Table 3-11:** Create BTS Specific CDF File</td></tr>
<tr><td align="center">**Step**</td><td align="center">**Action**</td></tr>
<tr>
<td></td>
<td>

! CAUTION

If you are not familiar with the UNIX vi editor, create a "dummy" CDF file, and practice making changes to it, prior to altering the "real" one.

NOTE

For more information on file management, creating bts directories, viewing/editing CDF files, refer to *LMF Users Guide.*
</td>
</tr>
<tr>
<td align="center">1</td>
<td>Determine the CDF file, currently loaded on the LMF, is closest to the configuration at the site. Use a generic CDF file that equips all devices, if possible. If this is an OMNI site, use an OMNI CDF file, if SECTOR, use SECTOR CDF file.</td>
</tr>
<tr>
<td align="center">2</td>
<td>List the contents of the `bts-<bts#>` directory by entering the **ls** command at the `(lmf)` prompt followed by a `<cr>`, to verify the CDF file for the site does not already exist.</td>
</tr>
<tr>
<td align="center">3</td>
<td>

Enter the following command to copy an existing CDF file on the LMF hard drive to the new BTS directory.

    cp /usr/lmf/bts-*src_<bts#>***.cdf /usr/lmf/bts-** *dest_<bts#>***.cdf**

NOTE

The following step is for LMF software releases version 5 and 6 only.
</td>
</tr>
<tr>
<td align="center">4</td>
<td>

Globally change the BTS ID in the new CDF file using the following UNIX commands:

    vi bts-*new_<bts#>***.cdf**

    :1,$ s/Id1 = ***old_<bts#>*/Id1 = ***new_<bts#>*

    :1,$ s/*old_<bts#>_***/***new_<bts#>_*

Include the underscore after the old and new bts # in the above command

    :1,$ s/BTS\\[*old_<bts#>***/BTS\\[***new_<bts#>*

    :wq

NOTE

You should now be able to log into the bts using the new CDF file. If you search for the old BTS #, it should be gone. You will have to edit the CDF file (using the vi editor) as far as BBX, MCC, etc. equipage is concerned.
</td>
</tr>
</table>

Update BTS Specific CDF File Device Load Version and Site Type

Follow the steps outlined in Table 3-12 to update the existing BTS specific CDF file *NextLoad* parameter, to reflect the current device load version to be downloaded and verify the correct Site Type. (*This is an interim procedure and is subject to change).*

CAUTION	Device load version in the CDF file *must* match the current version loaded at the OMCR/CBSC.

Step	Action
	Table 3-12: Update BTS Specific CDF File Device Load Version
	! CAUTION If you are not familiar with the UNIX vi editor, create a "dummy" CDF file, and practice making changes to it, prior to altering the "real" one.
	* IMPORTANT CDF files obtained from the OMCR/CBSC are modified by DELTA information being appended to the end of the CDF file. The information in the DELTA fields take precedence over information in the "core CDF file" For example: If NextLoad="1.2.3.4.5" for BBX 1 was specified in the CDF file, and there was a DELTA entry specifying NextLoad="2.3.4.5.6" appended to the CDF file for the same BBX, 2.3.4.5.6 would be the version used. There are two ways resolve this. Edit both the DELTA and "core" areas of the file to reflect the same version, or make sure the delta information is transferred to the main CDF file and delete all DELTA CDF file entries.
1	Globally change the device load version number in the new CDF file using the following UNIX commands: **vi bts-***new_<bts#>***.cdf** **:1,$ s/***x.x.x.x.x***/***y.y.y.y.y*** Where: *x.x.x.x.x* and *y.y.y.y.y* represent the *old* and *new* version number, respectively. **:wq**
	NOTE You should now be able to download all devices at the BTS with the current device load version.

2	Verify the `SiteType` and `SSType` entries in the CDF file (under the BTS subheading) reflect the following information. See example of applicable fields of CDF file below. (*CDMA only; 1900 MHz example shown*):
	
	`BTS[#] = {`
	`....,`
	`SiteType=3,`
	`SSType=16`
	`...`
	`},`
	
	Valid SiteTypes (SC9600=1, SC9600(Mixed)=2, SC2400=3, SC2400(Mixed)=4, SC600=5)
	Valid SSTypes (CDMA800MHz=8, CDMA1900MHz=16, CDMA900MHz=32)

Update Antenna Mapping Files

Earlier release versions may require the `antenna.map` file to be updated. There are two antenna mapping files. These are `antenna.map` and `antenna.asu`.

Follow the steps outlined in Table 3-13 to check the antenna mapping file and update as needed.

Table 3-13: Update Antenna Mapping Files	

Step	Action
	! CAUTION If you are not familiar with the UNIX vi editor, create a "dummy" CDF file, and practice making changes to it, prior to altering the "real" one.
	NOTE For more information on file management, creating bts directories, viewing/editing CDF files, refer to the *LMF Users Guide.*

1	View the antenna.map file (see below) and verify the Xcvrs listed in the CDF file (and that are equipped in the BTS) are *also* listed in the antenna.map file (for both RX and TX tables). Make sure the antenna.map file has enough RX and TX antennas listed to cover the number of sectors indicated by CDF's SiteConf parameter.
	
	Example of Antenna Map File
	<pre>R --- Rx --- -- Sec -- ----- Xcvrs -----
	R 1:M :RX1: 1 :1,4,5,8
	R 2:D :RX2: 1 :1,4,5,8
	R 3:M :RX3: 2 :2,4,6,8
	R 4:D :RX4: 2 :2,4,6,8
	R 5:M :RX5: 3 :3,4,7,8
	R 6:D :RX6: 3 :3,4,7,8
	
	T --- Tx --- -- Sec -- ----- Xcvrs -----
	T 1:O :TX1: 1 :1,4
	T 2:O :TX2: 2 :2,4
	T 3:O :TX3: 3 :3,4
	T 4:O :TX4: 1 :5,8
	T 5:O :TX5: 2 :6,8
	T 6:O :TX6: 3 :7,8</pre>

2	Verify all RX and TX antennas listed in the file antenna.map are also listed in the antenna.asu file. **NOTE** The antenna.asu file is required only if the BTS is equipped with RFDS. Be sure that the information in antenna files matches your actual configuration.

Operating the LMF

Basic Operation

NOTE	The terms "CDMA LMF" and "WinLMF" are interchangeable

The CDMA LMF allows the user to work in the two following operating environments which are accessed using the specified desktop icon:

- Graphical User Interface (GUI) using the WinLMF icon
- Command Line Interface (CLI) using the WinLMF 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 of the LMF GUI includes the following:

- Selecting and deselecting BTS devices
- Enabling devices
- Disabling devices
- Resetting devices
- Obtaining device status
- Sorting a status report window

For detailed information on performing these and other LMF operations, refer to the *CDMA LMF Operator's Guide, 68P64114A78.*

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> **rssi** channel=6 sector=5

Refer to the *LMF CLI Commands (68P09251A59)* for a complete explanation of the CLI commands and their usage.

Logging into a BTS

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

Logging into a BTS establishes a communications link between the BTS and the CDMA LMF. You may be logged into one or more BTS's at a time, but only one LMF may be logged into each BTS.

Before attempting to log into the BTS, confirm the CDMA LMF is properly connected to the BTS (see Figure 3-4). Follow the procedure in Table 3-14 to log into a BTS.

Prerequisites

Before attempting to login to a BTS, *e*nsure the following have been completed:

- The LMF is correctly installed and prepared.

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

- The LMF is correctly installed and prepared, and the LMF computer was connected to the BTS before starting the Windows operating system and LMF software. If necessary, restart the computer after connecting it to the BTS (see Table 3-6 and Figure 3-4).

BTS Login from the GUI Environment

Follow the procedures in Table 3-14 to log into a BTS when using the GUI environment

	Table 3-14: BTS GUI Login Procedure
Step	**Action**

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

2	Click on **Login** tab (if not displayed).
3	If no base stations are displayed in the **Available Base Stations** pick list, double click on the **CDMA** icon.
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. **NOTE** 128.0.0.2 is the default IP address for MGLI-1 in field BTS units. 128.0.0.1 is the default IP address for MGLI-2.
7	Type in the correct IP Port number (normally **9216**) if not correctly displayed in the **IP Port** box.
8	Select the Multi-channel Preselector type from the Multi-channel Preselector drop-down list (default is MPC) to a device corresponding to your BTS configuration if required. **NOTE** When performing RX tests on expansion frames, do not choose EMPC if the test equipment is connected to the starter frame.
9	Click on the **Use a Tower Top Amplifier**, if applicable.
10	Click on **Login**. (A BTS tab with the BTS is displayed.) **NOTE** • If you attempt to log in to a BTS that is already logged on, all devices will be gray. • There may be instances where the BTS initiates a log out due to a system error (i.e., a device failure). • If the MGLI is OOS_ROM (blue), it will have to be downloaded with code before other devices can be seen. • If the MGLI is OOS-RAM (yellow), it must be enabled before other installed devices can be seen.

3

BTS Login from the CLI Environment

Follow the procedures in Table 3-15 to log into a BTS when using the GUI environment

	Table 3-15: BTS CLI Login Procedure
Step	**Action**
1	Double click the WinLMF CLI desktop icon (if the LMF CLI environment is not already running). **NOTE** If a BTS was logged into under a GUI session when the CLI environment was started, the CLI session will be logged into the same BTS, and step 2 is not required.
2	At the /wlmf prompt, enter the following command: **login bts-**<*bts#*> **host=**<*host*> **port=**<*port*> where: host = MGLI card IP address (defaults to address last logged into for this BTS or 128.0.0.2 if this is first login to this BTS). port = IP port of the TS (defaults to port last logged into for this BTS or 9216 if this is first login to this BTS)

Logging Out

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

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

Logging Out of a BTS from the GUI Environment

Follow the procedure in Table 3-16 to logout of a BTS when using the GUI environment.

	Table 3-16: BTS GUI Logout Procedure
Step	**Action**
1	Click on the **BTS** tab menu bar.
2	Click the **Logout** item in the pulldown menu (a **Confirm Logout** pop-up message will appear).
3	Click on **Yes** or press the **Enter** key to confirm logout. You are returned to the **Login** tab. **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** popup message will appear stating the system should 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** popup 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** popup, and click **OK** in the **Logout Error** popup which appears again.
6	If further work is to be done in the GUI, restart it.

Logging Out of a BTS from the CLI Environment

Follow the procedure in Table 3-16 to logout of a BTS when using the CLI environment.

<table>
<tr><td colspan="2" align="center">**Table 3-17:** BTS CLI Logout Procedure</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td></tr>
<tr>
<td>1</td>
<td>

* IMPORTANT

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.

Logout of a BTS by entering the following command:

logout bts- *<bts#>*

A response similar to the following will be displayed:

```
LMF>
12:22:58.028 Command Received and Accepted
          Command=logout bts-33
12:22:58.028 Command Received and Accepted
12:22:58.028 Command Successfully Completed
          REASON_CODE="No Reason"
```
</td>
</tr>
<tr>
<td>2</td>
<td>

If desired, close the CLI interface by entering the following command:

exit

A response similar to the following will be displayed before the window closes:

```
Killing background processes....
```
</td>
</tr>
</table>

Establishing an MMI Communication Session

For those procedures that require MMI communications between the LMF and BTS FRUs, follow the procedure in Table 3-18 to initiate the communication session.

<table>
<tr><td colspan="2" align="center">**Table 3-18:** Establishing MMI Communications</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td></tr>
<tr>
<td>1</td>
<td>Connect the LMF computer to the equipment as detailed in the applicable procedure that requires MMI communication session.</td>
</tr>
<tr>
<td>2</td>
<td>

Start the named HyperTerminal connection for MMI sessions by double clicking on its Windows desktop shortcut.

NOTE

If a Windows desktop shortcut was not created for the MMI connection, access the connection from the Windows Start menu by selecting:

Programs>Accessories>Hyperterminal>HyperTerminal>*Named HyperTerminal Connection (e.g., MMI Session).*
</td>
</tr>
<tr>
<td>3</td>
<td>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.</td>
</tr>
</table>

Figure 3-6: CDMA LMF Computer Common MMI Connections
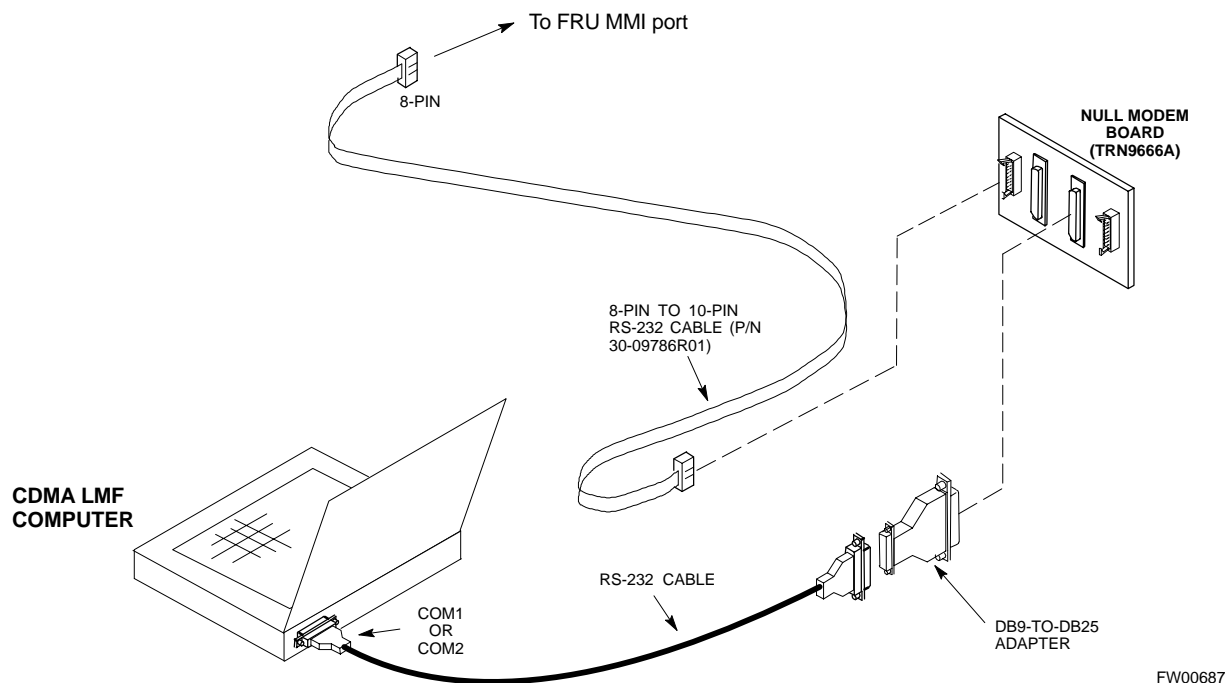
BTS Download Overview

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

ROM Code

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

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

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

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

Procedures to load ROM code are located in Appendix J.

RAM Code

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

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

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

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

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

- Master Group Line Interface (MGLI)

- Redundant GLI

- Clock Synchronization Module (CSM) (*Only if new revision code must be loaded*)

- Multi Channel CDMA (MCC24E, MCC8E, or MCC-1X) cards

- Broadband Transceiver (BBX2 or BBX-1X) cards

- RFDS Test Subscriber Interface Card (TSIC) or RFDS-1X RFDS PROCessor (RPROC) card, if RFDS is installed

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

Verify GLI ROM Code Loads

Devices should not be loaded with a RAM code version which is not compatible with the ROM code with which they are loaded. Before downloading RAM code and data to the processor cards, follow the procedure in Table 3-19 to verify the GLI devices are loaded with the correct ROM code for the software release used by the BSS.

Prerequisite

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

Table 3-19: Verify GLI ROM Code Loads

Step	Action
1	*If it has not already been done*, start a *GUI* LMF session and log into the BTS (refer to Table 3-14).
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 GLI3.
4	If the ROM code loaded in the GLIs is not the correct one for the software release being used on the BSS, log out of the BTS, disconnect the LMF computer, reconnect the span lines as described in Table 5-6, and have the CBSC download the correct ROM code version to the BTS devices.
5	When the GLIs have the correct ROM load for the software release being used, be sure the span lines are disabled as outlined in Table 3-2 and proceed to downloading RAM code and data.

Download RAM Code and Data to MGLI and GLI

Follow the steps outlined in Table 3-20 to download the RAM code and data to the MGLI and other installed GLI devices.

Prerequisites
- Prior to performing these procedures, ensure a code file exists for each of the devices to be loaded (refer to Table 3-3).
- The LMF computer is connected to the BTS (refer toTable 3-6), and is logged in using the *GUI* environment (refer to Table 3-14).

Table 3-20: Download and Enable MGLI and GLI Devices

Step	Action
1	Be sure the LMF will use the correct software release for code and data downloads by performing the following steps:
1a	- Click on **Util** in the BTS menu bar, and select **Tools > Update NextLoad > CDMA** from the pull-down menus.

Table 3-20: Download and Enable MGLI and GLI Devices	
Step	**Action**
1b	- Click on the BTS to be loaded. -- The BTS will be highlighted.
1c	- Click the button next to the correct code version for the software release being used. -- A black dot will appear in the button circle.
1d	- Click **Save.**
1e	- Click **OK** to close each of the advisory boxes which appear.
2	Prepare to download code to the MGLI by clicking on the device.
3	Click **Device** in the BTS menu bar, and select **Download > Code/Data** in the pull-down menus. - A status report is displayed confirming change in the device(s) status.
4	Click **OK** to close the status window. - The MGLI will automatically be downloaded with data and enabled.
5	Once the MGLI is enabled, load and enable additional installed GLIs by clicking on the devices and repeating steps 3 and 4.
6	Click **OK** to close the status window for the additional GLI devices.

Download RAM Code and Data to Non-GLI Devices

Downloads to non-GLI devices can be performed individually for each device or all installed devices can be downloaded with one action. RAM code and data are downloaded to non-GLI devices in separate steps.

NOTE	CSM devices are RAM code-loaded at the factory. RAM code is downloaded to CSMs *only if a newer software version needs to be loaded*.

NOTE	When downloading to multiple devices, the download may fail for some of the devices (a time-out occurs). These devices can be loaded individually after completing the multiple download.

Follow the steps in Table 3-21 to download RAM code and data to non-GLI devices.

Table 3-21: Download RAM Code and Data to Non-GLI Devices	
Step	**Action**
1	Select the target CSM, MCC, and/or BBX device(s) by clicking on them.
2	Click **Device** in the BTS menu bar, and select **Download > Code/Data** in the pull-down menus. - A status report is displayed that shows the results of the download for each selected device.
3	Click **OK** to close the status report window when downloading is completed. **NOTE** After a BBX, CSM, or MCC device is successfully loaded with RAM code and has changed to the OOS_RAM state (yellow), the status LED should be rapidly flashing GREEN.

Step	Action
Table 3-21: Download RAM Code and Data to Non-GLI Devices
4	To download data, select the target CSM, MCC and/or BBX device(s).
5	Click **Device** in the BTS menu bar, and select select **Download > Data** in the pull-down menus. - A status report is displayed showing the results of the download for each selected device.
6	Click **OK** to close the status report window when downloading is completed.

System Tests

Select CSM Clock Source

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

- Local GPS
- Remote GPS
- HSO (only for source 2 & 3)
- HSOX (only for source 2 & 3)
- LFR (only for source 2 & 3)
- 10 MHz (only for source 2 & 3)
- NONE (only for source 2 & 3)

Prerequisites

MGLI=INS_ACT, CSM= OOS_RAM or INS_ACT

Step	Action
	Table 3-22: Select CSM Clock Source
1	Select the applicable CSM(s).
2	Click on the **Device** menu.
3	Click on the **CSM/MAWI** menu item.
4	Click on the **Select Clock Source** menu item. A clock source selection window is displayed.
5	Select the applicable clock source in the **Clock Reference Source** pick lists. Uncheck the related check box if you do not want the displayed pick list item to be used.
6	Click on the **OK** button. A status report window is displayed showing the results of the selection action.
7	Click on the **OK** button to close the status report window.

Enable CSMs

Each BTS CSM system features two CSM boards per site. In a typical operation, the primary CSM locks its Digital Phase Locked Loop (DPLL) circuits to GPS signals. These signals are generated by either an on-board GPS module (RF-GPS) or a remote GPS receiver (R-GPS). The CSM2 card is required when using the R-GPS. The GPS receiver (mounted on CSM 1) is used as the primary timing reference and synchronizes the entire cellular system. CSM 2 provides redundancy (but does not have a GPS receiver).

The BTS may be equipped with a LORAN-C LFR, HSO, or external 10 MHz Rubidium source which the CSM can use as a secondary timing reference. The HSOX is used for expansion frames. In all cases, the CSM monitors and determines what reference to use at a given time.

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

Follow the steps outlined in Table 3-23 to enable the CSMs installed in the C-CCP shelves.

Table 3-23: Enable CSMs	
Step	**Action**
1	Click on the target CSM.
	From the **Device** pull down, select **Enable**.
	NOTE
	If equipped with two CSMs, enable CSM-2 first
	A status report is displayed confirming change in the device(s) status.
	Click **OK** to close the status report window.
	NOTE
	FAIL may be shown in the status table for enable action. If Waiting For Phase Lock is shown in the Description field, the CSM changes to the Enabled state after phase lock is achieved.
	CSM 1 houses the GPS receiver. The enable sequence can take up to *one hour* (see below).
	* IMPORTANT
	The GPS satellite system satellites are not in a geosynchronous orbit and are maintained and operated by the United States Department of Defense (D.O.D.). The D.O.D. 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 CSM will come in service. (In some cases, the GPS receiver needs to track only one satellite, depending on accuracy mode set during the data load).
2	**NOTE**
	If equipped with two CSMs, CSM-1 should be bright green (INS-ACT) and CSM-2 should be dark green (INS-STY)
	If more than an hour has passed, refer to CSM Verification, see Figure 3-7 and Table 3-26 to determine the cause.
	NOTE
	After the CSMs have been successfully enabled, observe the PWR/ALM LEDs are steady green (alternating green/red indicates the card is in an alarm state).

Enable MCCs

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

Follow the steps outlined in Table 3-24 to enable the MCCs installed in the C-CCP shelves.

NOTE	The MGLI and CSM must be downloaded and enabled, before downloading and enabling the MCC.

Table 3-24: Enable MCCs	
Step	**Action**
1	Click on the target MCC(s) or from the **Select** pull down menu choose **MCC**s.
2	From the **Device** menu, select **Enable** A status report is displayed confirming change in the device(s) status.
3	Click **OK** to close the status report window.

3

Clock Synchronization Manager System Time

The primary function of the Clock Synchronization Manager (CSM) boards (slots 1 and 2) is to maintain CDMA system time. The CSM in slot 1 is the primary timing source while slot 2 provides redundancy. The CSM2 card (CSM second generation) is required when using the remote GPS receiver (R-GPS). R-GPS uses a GPS receiver in the antenna head that has a digital output to the CSM2 card. CSM2 can have a daughter card as a local GPS receiver to support an RF-GPS signal.

The CSM2 switches between the primary and redundant units (slots 1 and 2) upon failure or command. CDMA Clock Distribution Cards (CCDs) buffer and distribute even-second reference and 19.6608 MHz clocks. CCD 1 is married to CSM 1 and CCD 2 is married to CSM 2. A failure on CSM 1 or CCD 1 cause the system to switch to redundant CSM 2 and CCD 2.

Each CSM2 board features an ovenized, crystal oscillator that provides 19.6608 MHz clock, even second pulse, and 3 MHz referenced to the selected synchronization source (see Table 3-26):

- GPS: local/RF-GPS or remote/R-GPS
- LORAN-C Frequency Receiver (LFR) or High Stability Oscillator (HSO)
- External reference oscillator sources

Fault management has the capability of switching between the GPS synchronization source and the LFR/HSO backup source in the event of a GPS receiver failure on CSM 1. During normal operation, the CSM 1 board selects GPS as the primary source (see Table 3-26). The source selection can also be overridden via the LMF or by the system software.

Synchronization between the primary and redundant CSM CCD pairs, as well as the LFR or HSO back-up to GPS synchronization, increases reliability.

LFR/HSO

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

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

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

Upgrades and Expansions: LFR2/HSO2/HSOX

LFR2/HSO2 (second generation cards) both export a timing signal to the expansion frames. The associated expansion frames require an HSO-expansion (HSOX) whether the starter frame has an LFR2 or an HSO2. The HSOX accepts input from the starter frame and interfaces with the CSM cards in the expansion frame. LFR and LFR2 use the same source code in source selection (see Table 3-26). HSO, HSO2, and HSOX use the same source code in source selection (see Table 3-26).

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

CSM Frequency Verification

The objective of this procedure is the initial verification of the CSM boards before performing the RF path verification tests. Parts of this procedure will be repeated for final verification *after* the overall optimization has been completed.

Test Equipment Setup (GPS & LFR/HSO Verification)

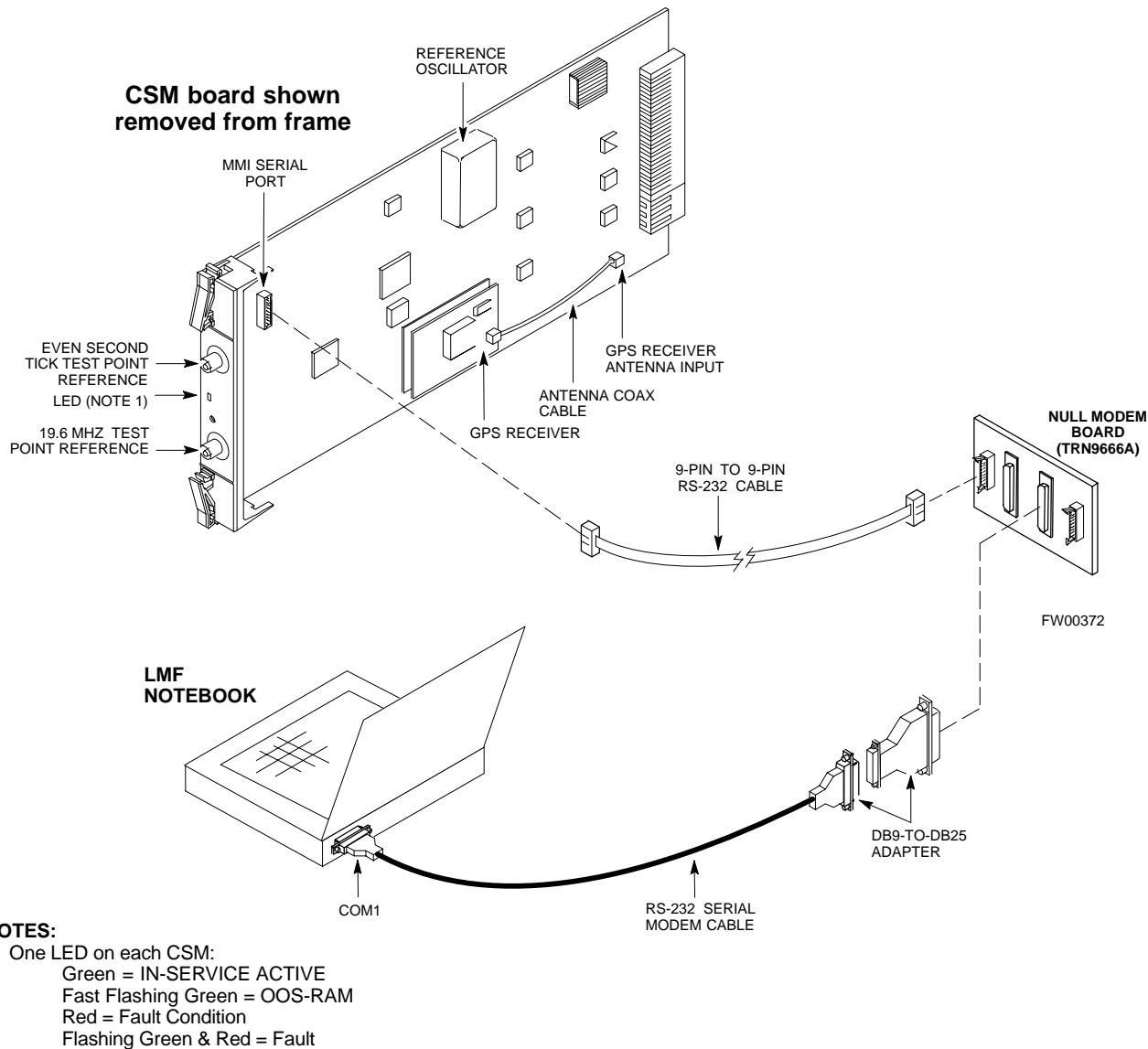Follow the steps outlined in Table 3-25 to set up test equipment.

\<center\>**Table 3-25:** Test Equipment Setup (GPS & LFR/HSO Verification)\</center\>	
Step	**Action**
1a	For **local GPS** (RF-GPS): Verify a CSM board with a GPS receiver is installed in primary CSM slot 1 and that CSM-1 is INS. **NOTE** This is verified by checking the board ejectors for kit number **SGLN1145** on the board in slot 1.
1b	For **Remote GPS** (RGPS):Verify a CSM2 board is installed in primary slot 1 and that CSM-1 is INS. **NOTE** This is verified by checking the board ejectors for kit number **SGLN4132ED** or later.
2	Remove CSM-2 (if installed) and connect a serial cable from the LMF COM 1 port (via null modem board) to the MMI port on CSM-1 (see Figure 3-7).

Table 3-25: Test Equipment Setup (GPS & LFR/HSO Verification)	
Step	**Action**
3	Reinstall CSM-2.
4	Start an MMI communication session with CSM-1 by using the Windows desktop shortcut icon (see Table 3-5) **NOTE** The LMF program must be running when a Hyperterminal session is started.
5	When the terminal screen appears press the **Enter** key until the **CSM>** prompt appears.

3

CAUTION	Connect GPS antenna to the (GPS) RF connector **ONLY**. Damage to the GPS *antenna* and/or *receiver* can result if the GPS antenna is inadvertently connected to any other RF connector.

Figure 3-7: CSM MMI Terminal Connection

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

GPS Initialization/Verification

Follow the steps outlined in Table 3-26 to connect to CSM-1 installed in the C-CCP shelf, verifying that it is functioning normally.

Step	Action
	Table 3-26: GPS Initialization/Verification

1	To verify that `Clock alarms (0000)`, `Dpll is locked and has a reference source`, and `GPS self test passed` messages are displayed within the report, issue the following MMI command
	
	bstatus
	
	- Observe the following typical response:
	
	`CSM Status INS:ACTIVE Slot A Clock MASTER.`
	
	`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`

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

	Table 3-26: GPS Initialization/Verification
Step	**Action**
3	HSO information (underlined text above, verified from left to right) is usually the #1 reference source. If this is not the case, have the *OMCR* determine the correct BTS timing source has been identified in the database by entering the **display bts csmgen** command and correct as required using the **edit csm csmgen refsrc** command.
	* IMPORTANT If any of the above mentioned areas fail, verify: - If LED is RED, verify that HSO had been powered up for at least 5 minutes. After oscillator temperature is stable, LED should go GREEN *Wait for this to occur before continuing !* - If "timed out" is displayed in the Last Phase column, suspect the HSO output buffer or oscillator is defective - Verify the HSO is FULLY SEATED and LOCKED to prevent any possible board warpage
4	Verify the following GPS information (underlined text above): - GPS information is usually the 0 reference source. - At least one Primary source must indicate "Status = good" and "Valid = yes" to bring the site up.

3

Table 3-26: GPS Initialization/Verification	
Step	**Action**
5	Enter the following command at the CSM> prompt to verify that the GPS receiver is in tracking mode. **gstatus** - Observe the following typical response: ``` 24:06:08 GPS Receiver Control Task State: tracking satellites. 24:06:08 Time since last valid fix: 0 seconds. 24:06:08 24:06:08 Recent Change Data: 24:06:08 Antenna cable delay 0 ns. 24:06:08 Initial position: lat 117650000 msec, lon -350258000 msec, height 0 cm (GPS) 24:06:08 Initial position accuracy (0): estimated. 24:06:08 24:06:08 GPS Receiver Status: 24:06:08 Position hold: lat 118245548 msec, lon -350249750 msec, height 20270 cm 24:06:08 Current position: lat 118245548 msec, lon -350249750 msec, height 20270 cm (GPS) 24:06:08 8 satellites tracked, receiving 8 satellites, 8 satellites visible. 24:06:08 Current Dilution of Precision (PDOP or HDOP): 0. 24:06:08 Date & Time: 1998:01:13:21:36:11 24:06:08 GPS Receiver Status Byte: 0x08 24:06:08 Chan:0, SVID: 16, Mode: 8, RSSI: 148, Status: 0xa8 24:06:08 Chan:1, SVID: 29, Mode: 8, RSSI: 132, Status: 0xa8 24:06:08 Chan:2, SVID: 18, Mode: 8, RSSI: 121, Status: 0xa8 24:06:08 Chan:3, SVID: 14, Mode: 8, RSSI: 110, Status: 0xa8 24:06:08 Chan:4, SVID: 25, Mode: 8, RSSI: 83, Status: 0xa8 24:06:08 Chan:5, SVID: 3, Mode: 8, RSSI: 49, Status: 0xa8 24:06:08 Chan:6, SVID: 19, Mode: 8, RSSI: 115, Status: 0xa8 24:06:08 Chan:7, SVID: 22, Mode: 8, RSSI: 122, Status: 0xa8 24:06:08 24:06:08 GPS Receiver Identification: 24:06:08 COPYRIGHT 1991-1996 MOTOROLA INC. 24:06:08 SFTW P/N # 98-P36830P 24:06:08 SOFTWARE VER # 8 24:06:08 SOFTWARE REV # 8 24:06:08 SOFTWARE DATE 6 AUG 1996 24:06:08 MODEL # B3121P1115 24:06:08 HDWR P/N # _ 24:06:08 SERIAL # SSG0217769 24:06:08 MANUFACTUR DATE 6B07 24:06:08 OPTIONS LIST IB 24:06:08 The receiver has 8 channels and is equipped with TRAIM. ```
6	**Verify** the following GPS information (shown above in <u>underlined</u> text): - At least 4 satellites are tracked, and 4 satellites are visible. - GPS Receiver Control Task State is "tracking satellites". ***Do not continue until this occurs!*** - Dilution of Precision indication is not more that 30. **Record** the current position base site latitude, longitude, height and height reference (height reference to Mean Sea Level (MSL) or GPS height (GPS). (GPS = 0 MSL = 1).

Table 3-26: GPS Initialization/Verification	
Step	**Action**
7	**If steps 1 through 6 pass, the GPS is good.**
	* IMPORTANT If any of the above mentioned areas fail, verify that: - If *Initial position accuracy* is "estimated" (typical), at least 4 satellites must be tracked and visible (1 satellite must be tracked and visible if actual lat, log, and height data for this site has been entered into CDF file). - If *Initial position accuracy* is "surveyed," position data currently in the CDF file is assumed to be accurate. GPS will not automatically survey and update its position. - The GPS antenna is not obstructed or misaligned. - GPS antenna connector center conductor measures approximately +5 Vdc with respect to the shield. - There is no more than 4.5 dB of loss between the GPS antenna OSX connector and the BTS frame GPS input. - Any lightning protection installed between GPS antenna and BTS frame is installed correctly.
8	Enter the following commands at the CSM> prompt to verify that the CSM is warmed up and that GPS acquisition has taken place. **debug dpllp** Observe the following typical response if the CSM is not warmed up (15 minutes from application of power) *(If warmed-up proceed to step 9)* ``` CSM>DPLL Task Wait. 884 seconds left. DPLL Task Wait. 882 seconds left. DPLL Task Wait. 880 seconds left. ....etc. ``` **NOTE** The **warm** command can be issued at the MMI port used to force the CSM into warm-up, but the reference oscillator will be unstable.
9	Observe the following typical response if the CSM is warmed up. ``` c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 c:17486 off: -11, 3, 6 TK SRC:0 S0: 3 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 c:17470 off: -11, 1, 6 TK SRC:0 S0: 1 S1:-2013175,-2013175 ```
10	Verify the following GPS information (underlined text above, from left to right): - Lower limit offset from tracked source variable is not less than -60 (equates to 3 μs limit). - Upper limit offset from tracked source variable is not more than +60 (equates to 3 μs limit). - TK SRC: 0 is selected, where SRC 0 = GPS.
11	Enter the following commands at the CSM> prompt to exit the debug mode display. **debug dpllp**

LORAN-C Initialization/Verification

<table>
<tr><td colspan="3" align="center">**Table 3-27:** LORAN-C Initialization/Verification</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td><td align="center">**Note**</td></tr>
<tr>
<td>1</td>
<td>

At the CSM> prompt, enter **lstatus <cr>** to verify that the LFR is in tracking mode. A typical response is:

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

LFR Task State: lfr locked to station 7980W
LFR Recent Change Data:
  Search List: 5930 5990 7980 8290 8970 9940 9610 9960
  PLL GRI: 7980W
LFR Master, reset not needed, not the reference source.
CSM>
```

</td>
<td>

This must be greater than 100 before LFR becomes a valid source.

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

This search list and PLL data must match the configuration for the geographical location of the cell site.

</td>
</tr>
</table>

. . . continued on next page

Table 3-27: LORAN-C Initialization/Verification		
Step	**Action**	**Note**
2	Verify the following LFR information (highlighted above in **boldface** type): - Locate the "dot" that indicates the current phase locked station assignment (assigned by MM). - Verify that the station call letters are as specified in site documentation as well as M X Y Z assignment. - Verify the S/N ratio of the phase locked station is greater than 8.	

3	At the CSM> prompt, enter **sources <cr>** to display the current status of the the LORAN receiver.
	
	- Observe the following typical response.
	
	`Num  Source Name  Type      TO  Good   Status  Last Phase  Target Phase Valid`
	`-------------------------------------------------------------------------`
	`0   Local GPS   Primary  4   Yes    Good      -3           0        Yes`
	`1   LFR ch A    Secondary 4  Yes    Good    -2013177    -2013177    Yes`
	`2   Not used`
	Current reference source number: 1	

4	LORAN LFR information (highlighted above in **boldface** type) is usually the #1 reference source (verified from left to right). *** IMPORTANT** If any of the above mentioned areas fail, verify: - The LFR antenna is not obstructed or misaligned. - The antenna pre-amplifier power and calibration twisted pair connections are intact and < 91.4 m (300 ft) in length. - A dependable connection to suitable Earth Ground is in place. - The search list and PLL station for cellsite location are correctly configured . **NOTE** LFR functionality should be verified using the "source" command (as shown in Step 3). Use the underlined responses on the LFR row to validate correct LFR operation.	
5	Close the hyperterminal window.	

Calibration and Test Equipment

Connecting Test Equipment to the BTS

The following test equipment is required to perform calibration and ATP tests:

- LMF

- Communications system analyzer model supported by the LMF

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

- Non-radiating transmit line termination load

- Directional coupler and in-line attenuator

- RF cables and adapters

Refer to Table 3-28 and Table 3-29 for an overview of connections for test equipment currently supported by the LMF. In addition, see the following figures:

- Figure 3-8 and Figure 3-9 show cable calibration test setup.

- Figure 3-10, Figure 3-11 and Figure 3-13 show the test set connections for TX calibration.

- Figure 3-13 and Figure 3-14 show test set connections for IS-95 A/B optimization/ATP tests

- Figure 3-15 through Figure 3-18 shows test set connections for IS-95 A/B/C optimization/ATP tests.

- Figure 3-19 and Figure 3-20 show typical TX and RX ATP setup with a directional coupler (shown with and without RFDS).

Test Equipment GPIB Address Settings

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

- Signal generator address: **1**

- Power meter address: **13**

- Communications system analyzer: **18**

Using the procedures included in the Setting GPIB Addresses section of Appendix D-1, verify and, if necessary, change the GPIB address of each piece of test equipment used to match the above

Supported Test Sets

CAUTION	To prevent damage to the test equipment, all TX test connections must be through the directional coupler and in-line attenuator as shown in the test setup illustrations.

IS-95 A/B Testing

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

- CyberTest
- Advantest R3267 spectrum analyzer with R3562 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 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

NOTE	E4432B signal generator for 1X FER needs to have the options UN8,1E5, and 201.

Test Equipment Preparation

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

Test Equipment Connection Charts

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

IS-95A/B-only   Test Equipment Connections

Table 3-28 depicts the interconnection requirements for currently available test equipment *supporting IS-95A/B only* which meets Motorola standards and is supported by the LMF.

Table 3-28: 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	LMF	Attenuator & Directional Coupler	BTS
EVEN SECOND SYNCHRONIZATION	EVEN SEC REF	EVEN SEC SYNC IN	EVEN SECOND SYNC IN	EVEN SECOND SYNC IN					SYNC MONITOR
19.6608 MHZ CLOCK	TIME BASE IN	CDMA TIME BASE IN	CDMA TIME BASE IN	CDMA TIME BASE IN					FREQ MONITOR
CONTROL IEEE 488 BUS	IEEE 488	GPIB	HP-IB	HP-IB	HP-IB	GPIB	SERIAL PORT		
TX TEST CABLES	RF IN/OUT	INPUT 50Ω	RF IN/OUT	RF IN/OUT				20 DB ATTEN. BTS PORT	TX1-6
RX TEST CABLES	RF GEN OUT	RF OUT 50Ω	DUPLEX OUT	RF OUT ONLY					RX1-6

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

Table 3-29 depicts the interconnection requirements for currently available test equipment supporting *both* CDMA 2000 1X *and* IS-95A/B which meets Motorola standards and is supported by the LMF.

	Table 3-29: CDMA2000 1X/IS-95A/B Test Equipment Interconnection									
	COMMUNICATIONS SYSTEM ANALYZER			**ADDITIONAL TEST EQUIPMENT**						
SIGNAL	**Agilent 8935 (Option 200 or R2K)**	**Advantest R3267**	**Agilent E4406A**	**Agilent E4432 Signal Gen.**	**Advantest R3562 Signal Generator**	**Power Meter**	**GPIB Interface**	**LMF**	**Attenuator & Directional Coupler**	**BTS**
EVEN SECOND SYNCHRONIZATION	EVEN SECOND SYNC IN	EXT TRIG	TRIGGER IN	PATTERN TRIG IN	EXT TRIG IN					SYNC MONITOR
19.6608 MHZ CLOCK	EXT REF IN			EXT REF IN	MOD TIME BASE IN					FREQ MONITOR
CONTROL IEEE 488 BUS	HP-IB	GP-IB	GPIB	GPIB	GP-IB	HP-IB	GPIB	SERIAL PORT		
10 MHZ	10 MHZ REF OUT	10 MHZ OUT	10 MHZ OUT (SWITCHED)	10 MHZ IN	SYNTHE REF IN					
SIGNAL SOURCE CONTROLLED SERIAL I/O		SERIAL I/O			SERIAL I/O					
TX TEST CABLES	RF IN/OUT	INPUT 50 Ω	RF INPUT 50 Ω						20 DB ATTEN. BTS PORT	TX1-6
RX TEST CABLES	DUPLEX OUT *			RF OUTPUT 50 Ω	RF OUT 50 Ω					RX1-6

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

Equipment Warm-up

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

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

3

Automatic Cable Calibration Set-up

Figure 3-8 and Figure 3-9 show the cable calibration setup for the test sets supported by the LMF. The left side of the diagram depicts the location of the input and output connectors of each test equipment item, and the right side details the connections for each test. Table 3-33 provides a procedure for performing automatic cable calibration.
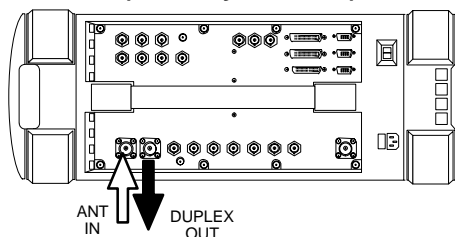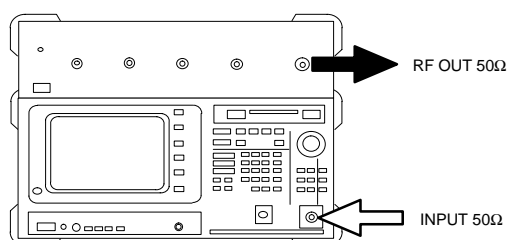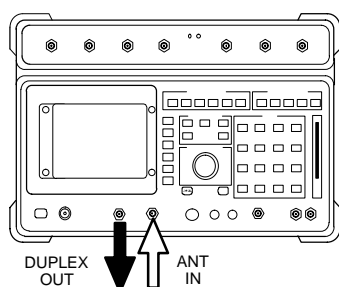
Manual Cable Calibration

If manual cable calibration is required, refer to the procedures in Appendix Figure 3-8.

Figure 3-8: Cable Calibration Test Setup - CyberTest, Agilent 8935, Advantest R3465, and HP 8921A

3

SUPPORTED TEST SETS

Motorola CyberTest

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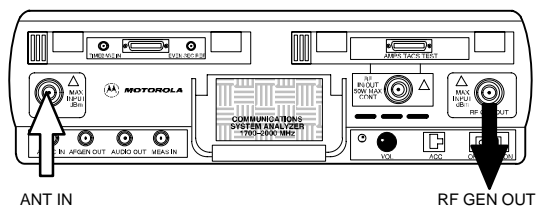
Note: The 30 dB directional coupler is not used with the Cybertest test set. The TX cable is connected directly to the Cybertest test set.

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

Agilent 8935 Series E6380A
(formerly HP 8935)

ANT IN   DUPLEX OUT

Advantest Model R3465

RF OUT 50Ω

INPUT 50Ω

Hewlett Packard Model HP 8921A

DUPLEX OUT   ANT IN

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

CALIBRATION SET UP

A. SHORT CABLE CAL

SHORT CABLE   TEST SET

B. RX TEST SETUP FOR TRDC

N-N FEMALE ADAPTER

RX CABLE

SHORT CABLE

TEST SET

C. TX TEST SETUP AND DRDC RX TEST SETUP

50 Ω TERM.

DIRECTIONAL COUPLER (30 DB)

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

20 DB IN-LINE ATTENUATOR

TX CABLE

SHORT CABLE

N-N FEMALE ADAPTER

TX CABLE FOR TX TEST CABLE CALIBRATION
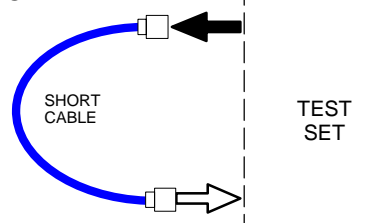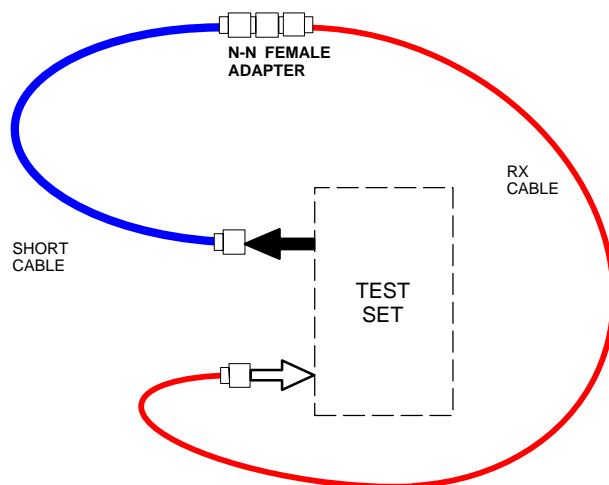
RX CABLE FOR DRDC RX TEST CABLE CALIBRATION
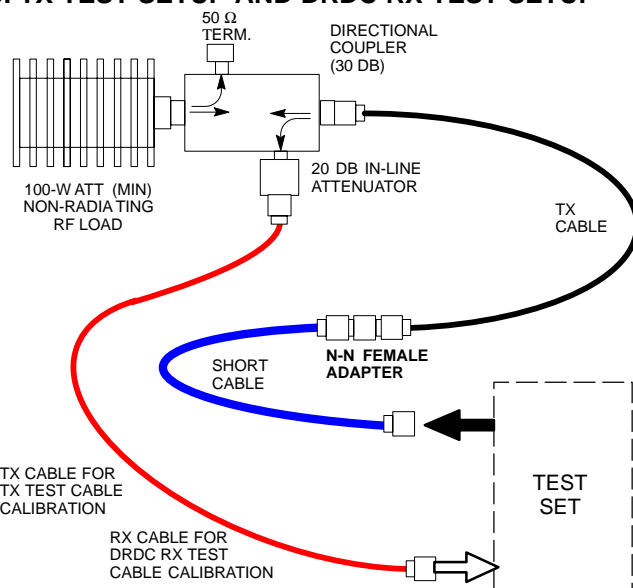
TEST SET

Figure 3-9: Cable Calibration Test Setup - Agilent E4406A/E4432B and Advantest R3267/R3562

| SUPPORTED TEST SETS | CALIBRATION SET UP |

Agilent E4432B (Top) and E4406A (Bottom)

A. SHORT CABLE CAL

SHORT CABLE

TEST SET

RF OUTPUT 50 Ω

RF INPUT 50 Ω
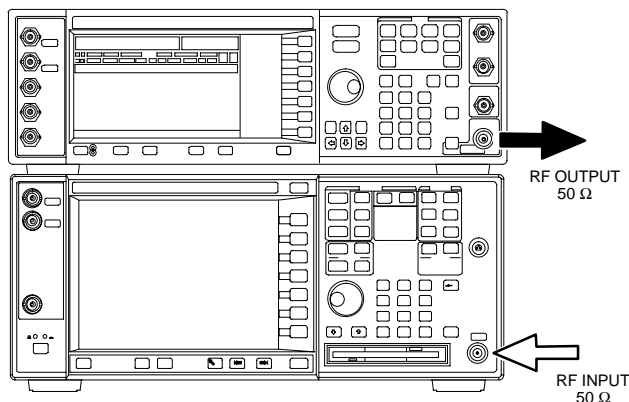
NOTE:

10 MHZ IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO **10 MHZ OUT (SWITCHED)** ON REAR OF TRANSMITTER TESTER (FIGURE F-5).

B. RX TEST SETUP FOR TRDC

N-N FEMALE ADAPTER

RX CABLE

SHORT CABLE

TEST SET

Advantest R3267 (Top) and R3562 (Bottom)

INPUT 50 Ω

RF OUT 50 Ω
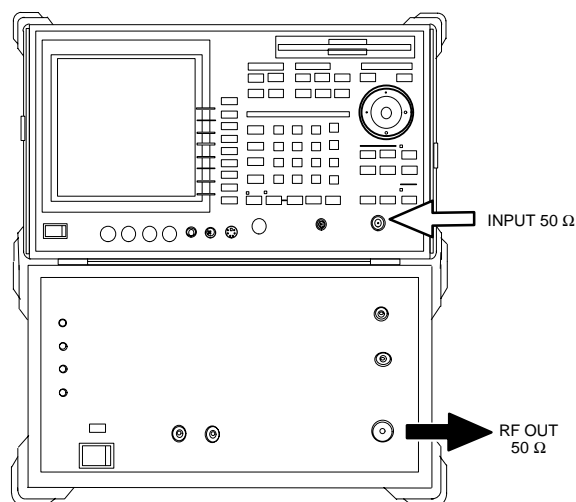
NOTE:

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

D. TX TEST SETUP AND DRDC RX TEST SETUP

50 Ω TERM.

DIRECTIONAL COUPLER (30 DB)

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

20 DB IN-LINE ATTENUATOR

TX CABLE

N-N FEMALE ADAPTER

SHORT CABLE

TEST SET

TX CABLE FOR TX TEST CABLE CALIBRATION

RX CABLE FOR DRDC RX TEST CABLE CALIBRATION

Set-up for TX Calibration

Figure 3-10 and Figure 3-11 show the test set connections for TX calibration.

Figure 3-10: TX Calibration Test Setup - CyberTest (IS-95A/B) and
Agilent 8935 (IS-95A/B and CDMA2000 1X)
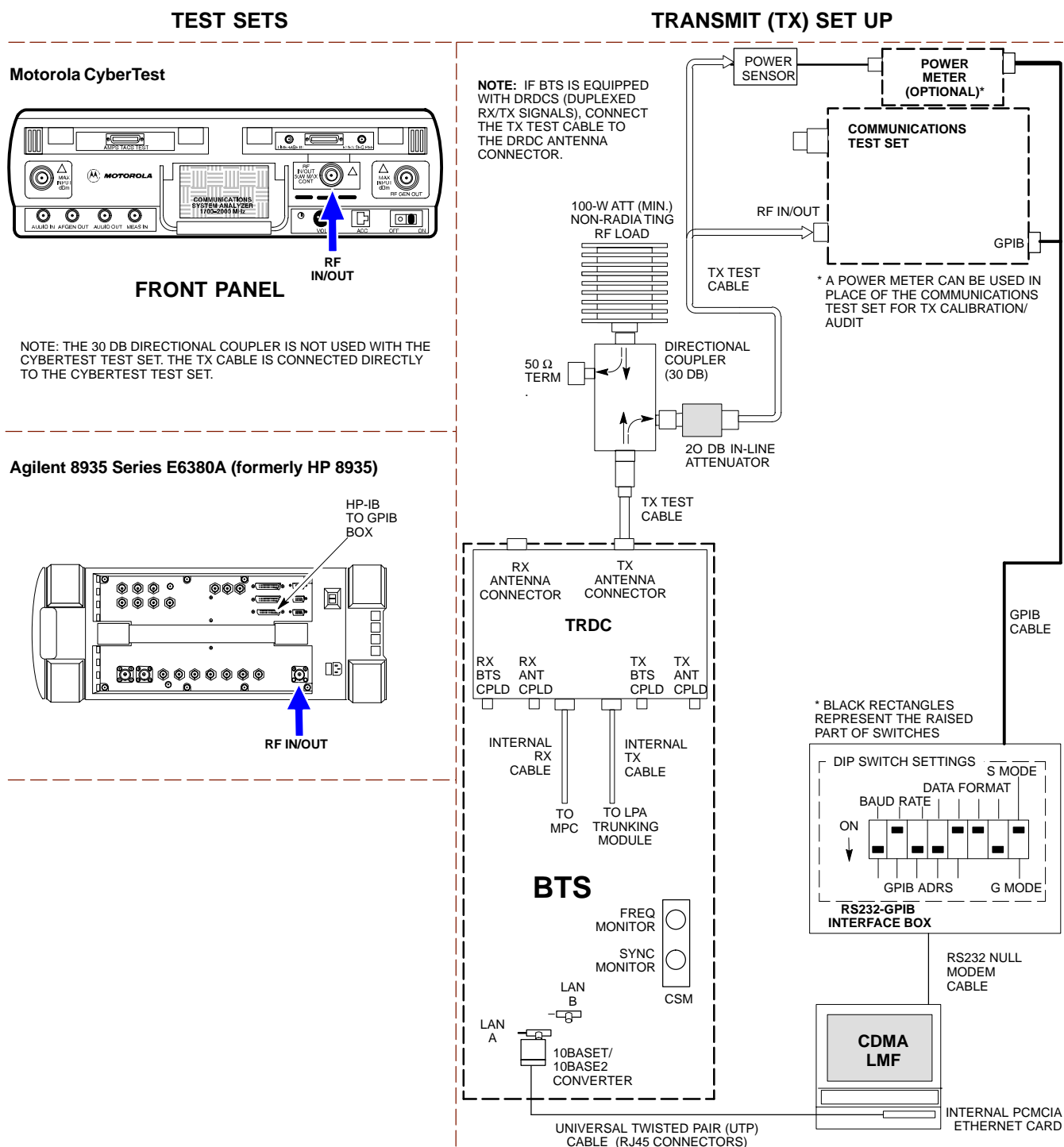
Figure 3-11: TX Calibration Test Setup - Using Power Meter

TEST SETS | **TRANSMIT (TX) SET UP**

NOTE: THE HP8921A AND ADVANTEST R3465 *CANNOT* BE USED FOR TX CALIBRATION. A POWER METER MUST BE USED.
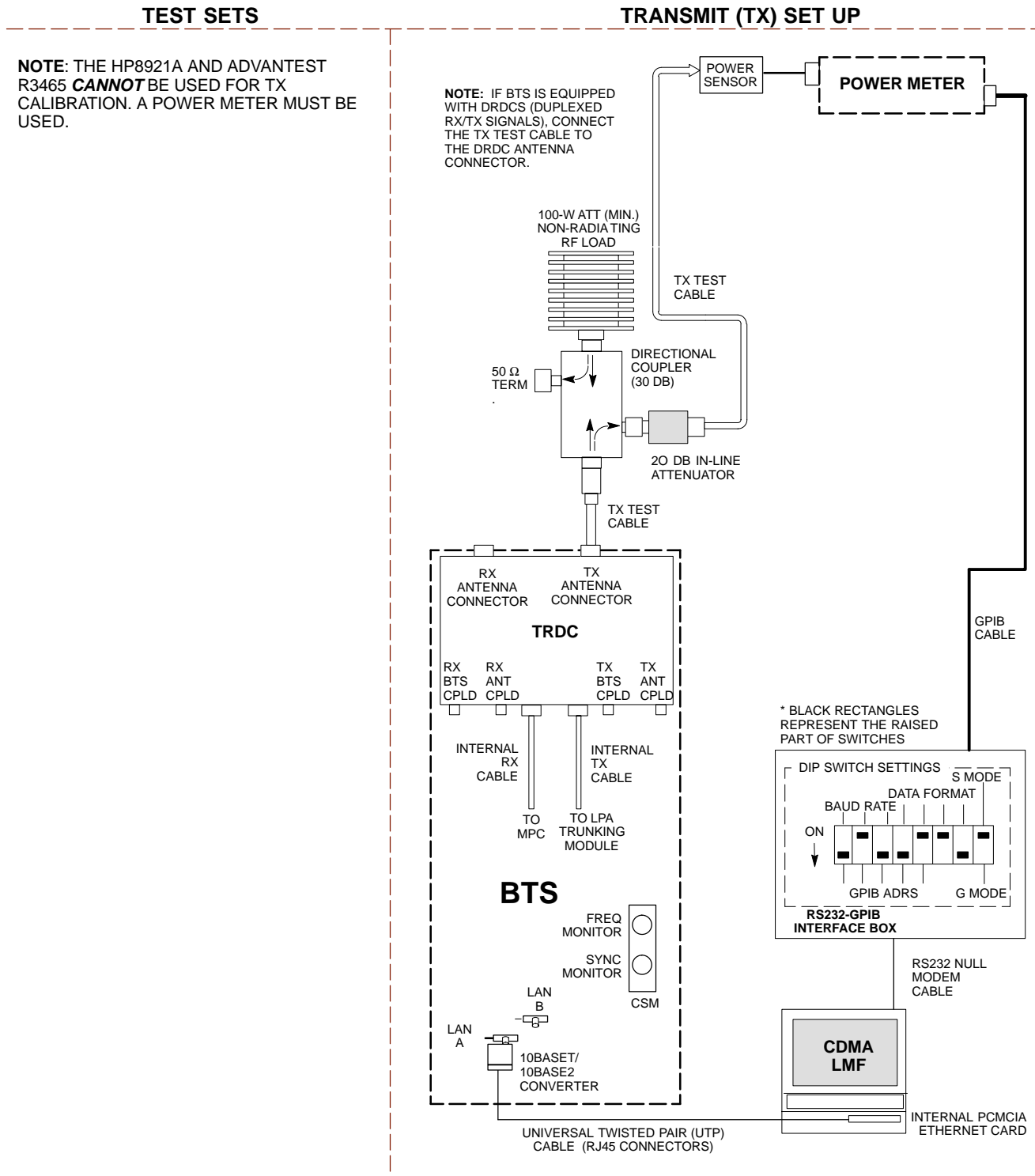
Figure 3-12: TX Calibration Test Setup - Agilent E4406A and Advantest R3567
(IS-95A/B and CDMA2000 1X)

TEST SETS　　　　　　　　　　　　　　　**TRANSMIT (TX) SET UP**
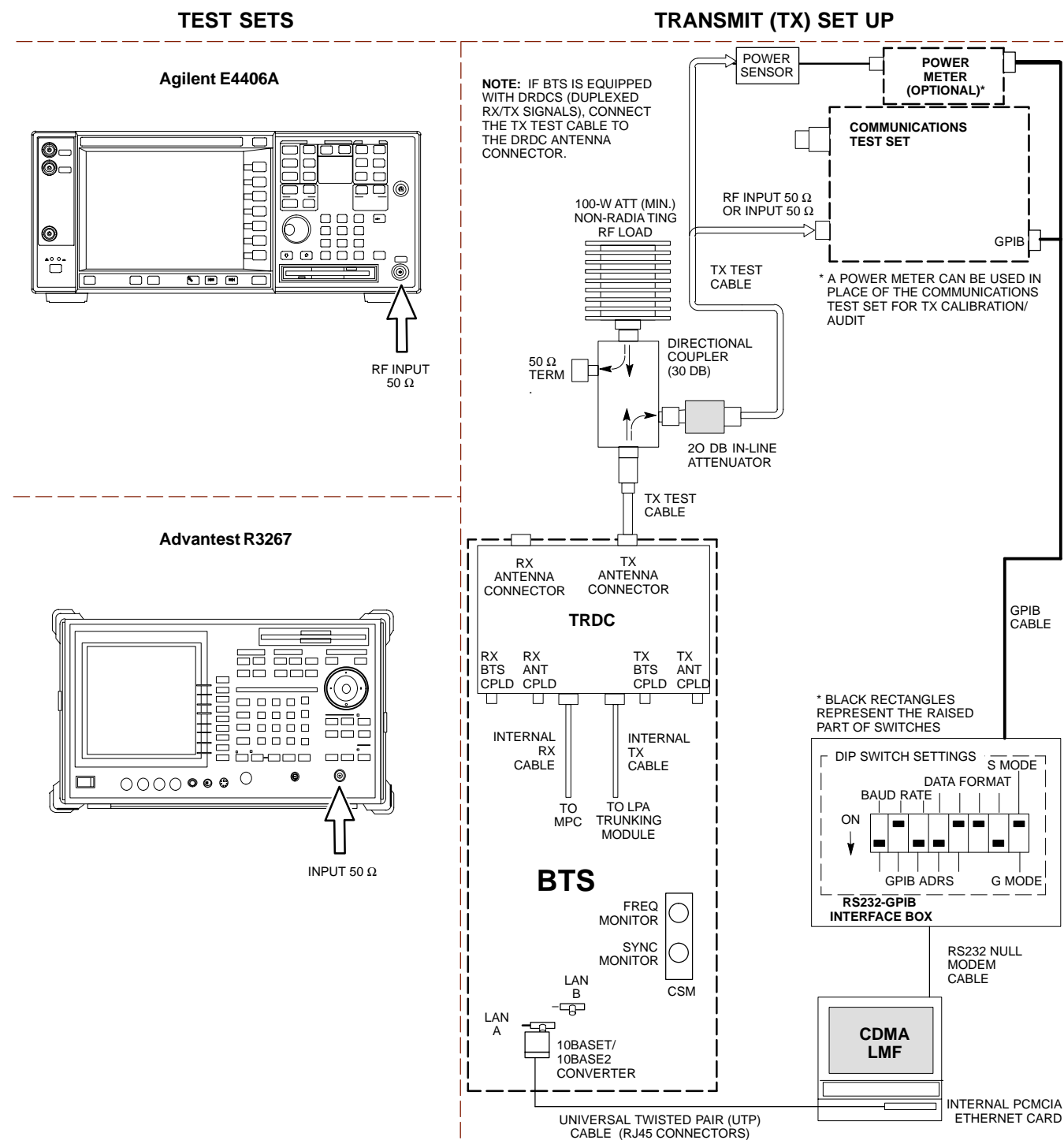
Set-up for Optimization/ATP

Figure 3-13 and Figure 3-14 show the test set connections for optimization/ATP tests.

Figure 3-13: IS-95A/B Optimization/ATP Test Set-up, TRDC Shown - CyberTest and Advantest R3465
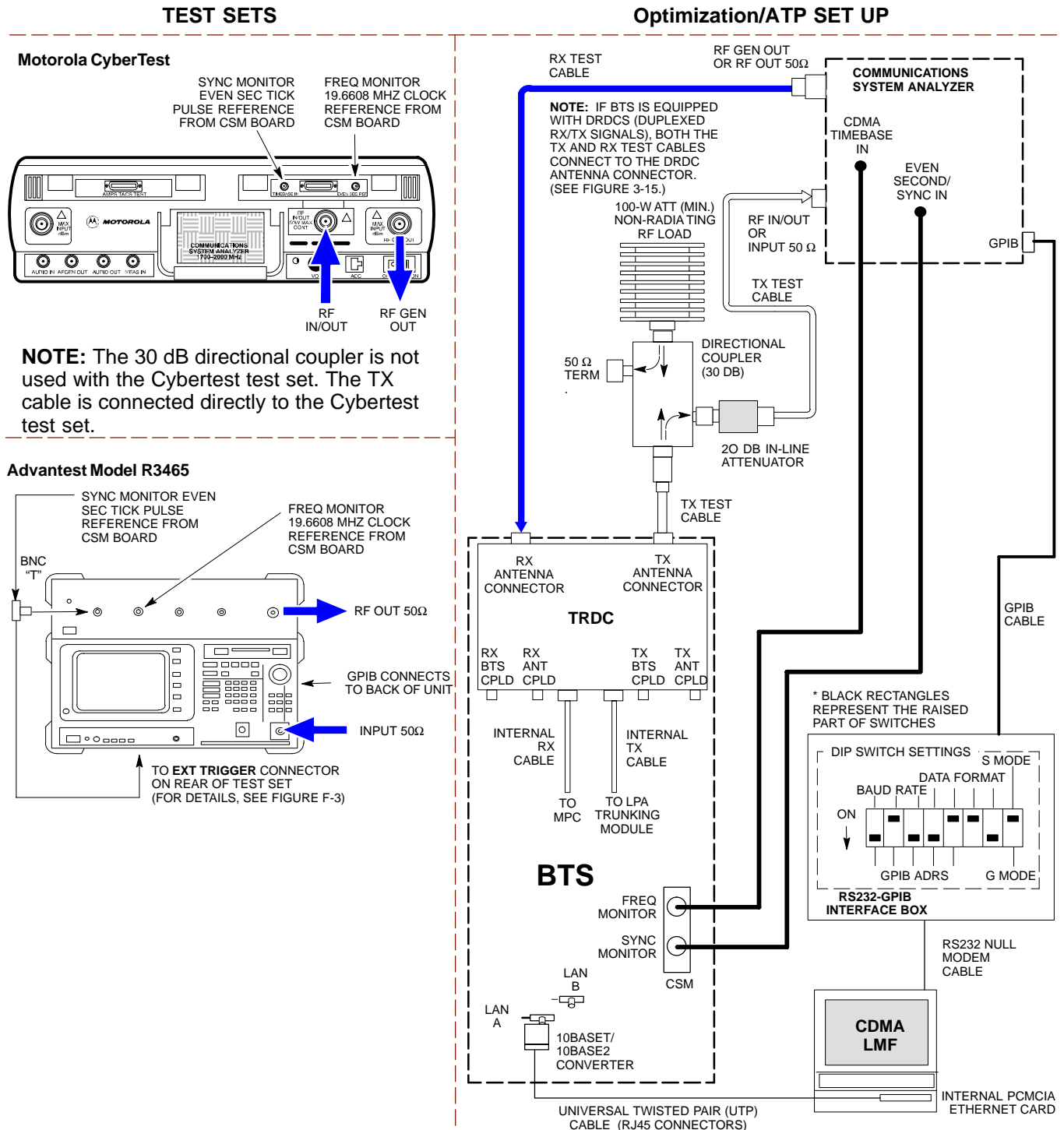
Figure 3-14: IS-95A/B Optimization/ATP Test Setup - HP 8921A
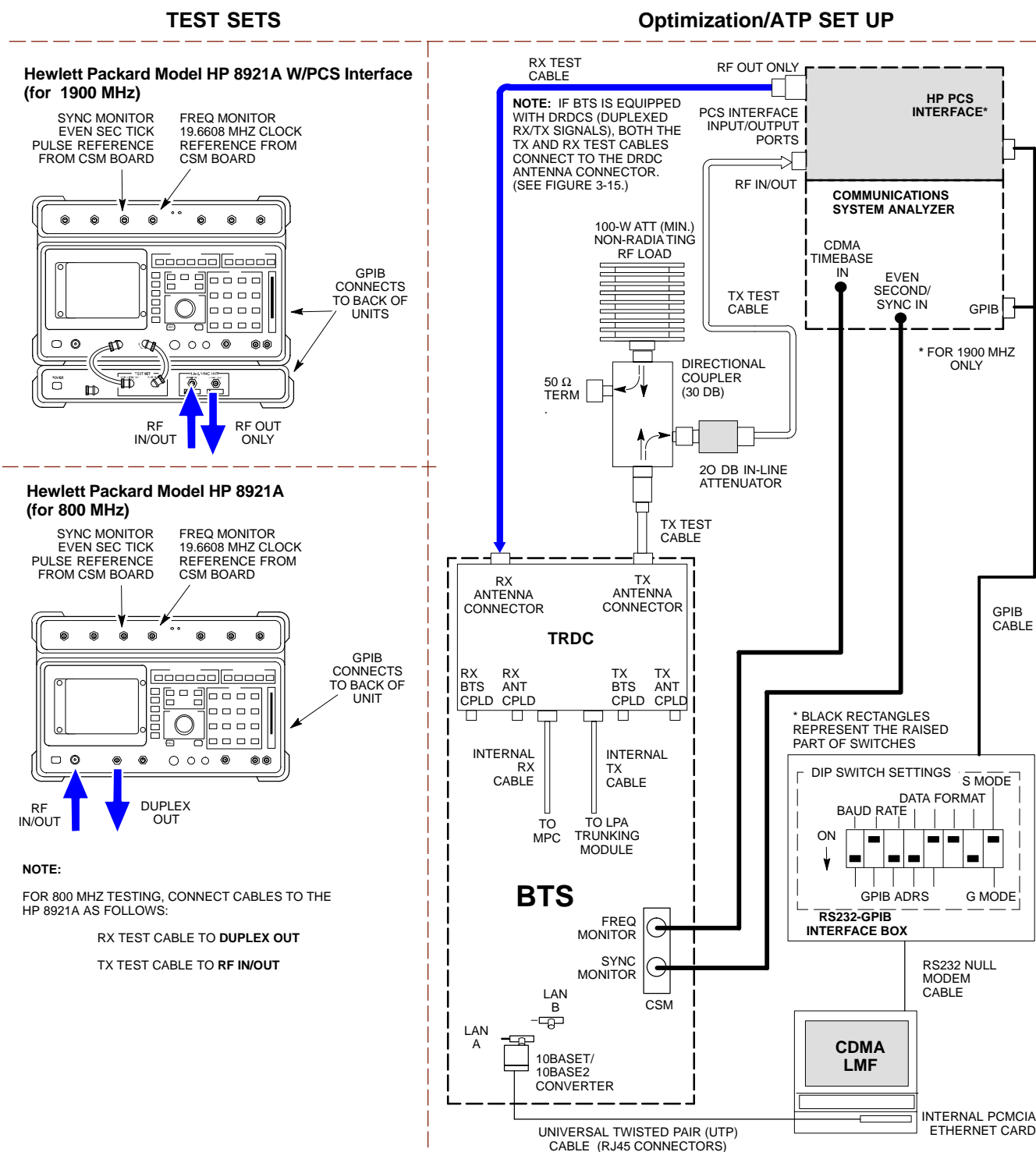
Figure 3-15: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup With DRDCs - Agilent Test Equipment
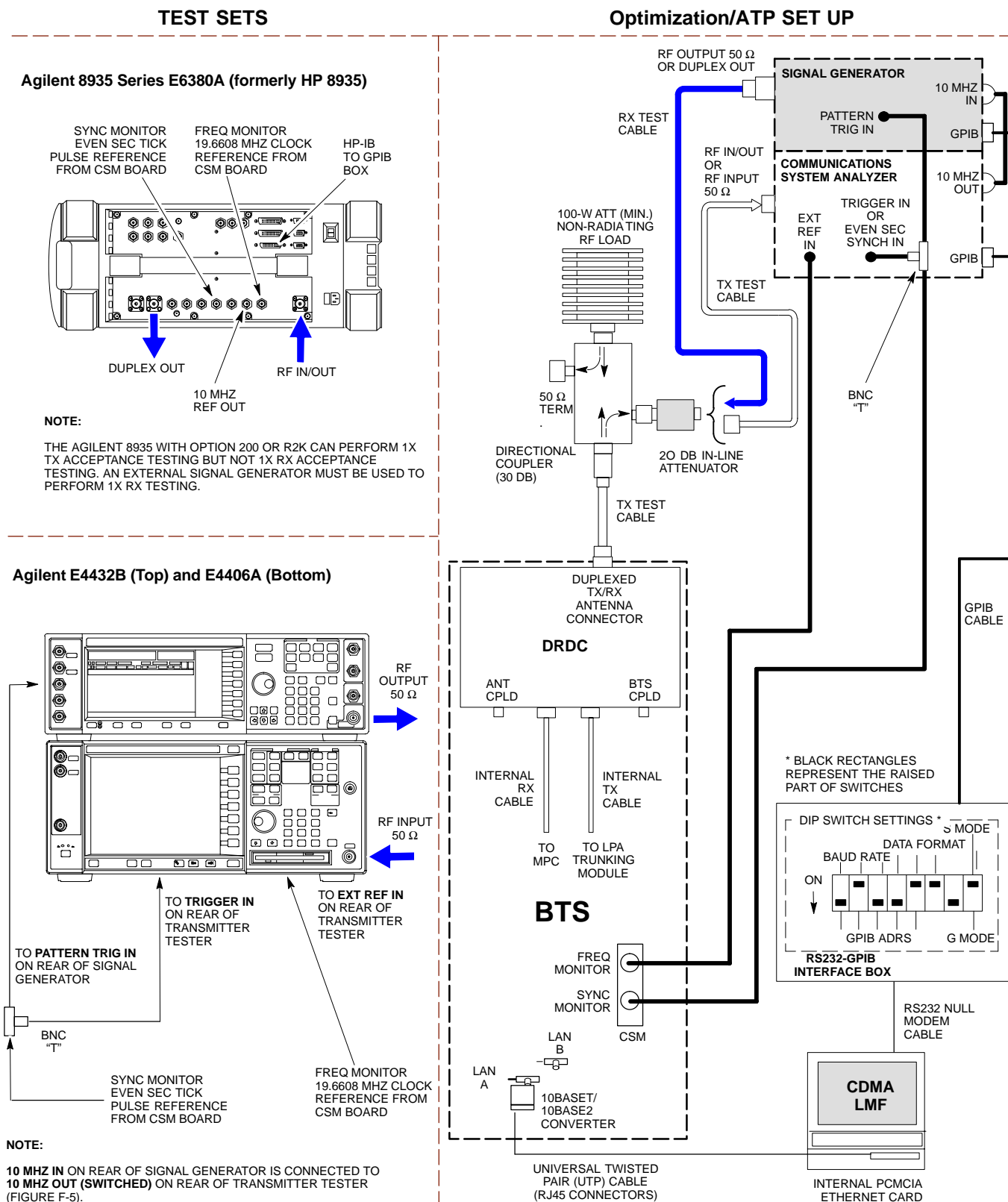
Figure 3-16: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup With DRDCs -
Advantest R3267/3562 Test Equipment
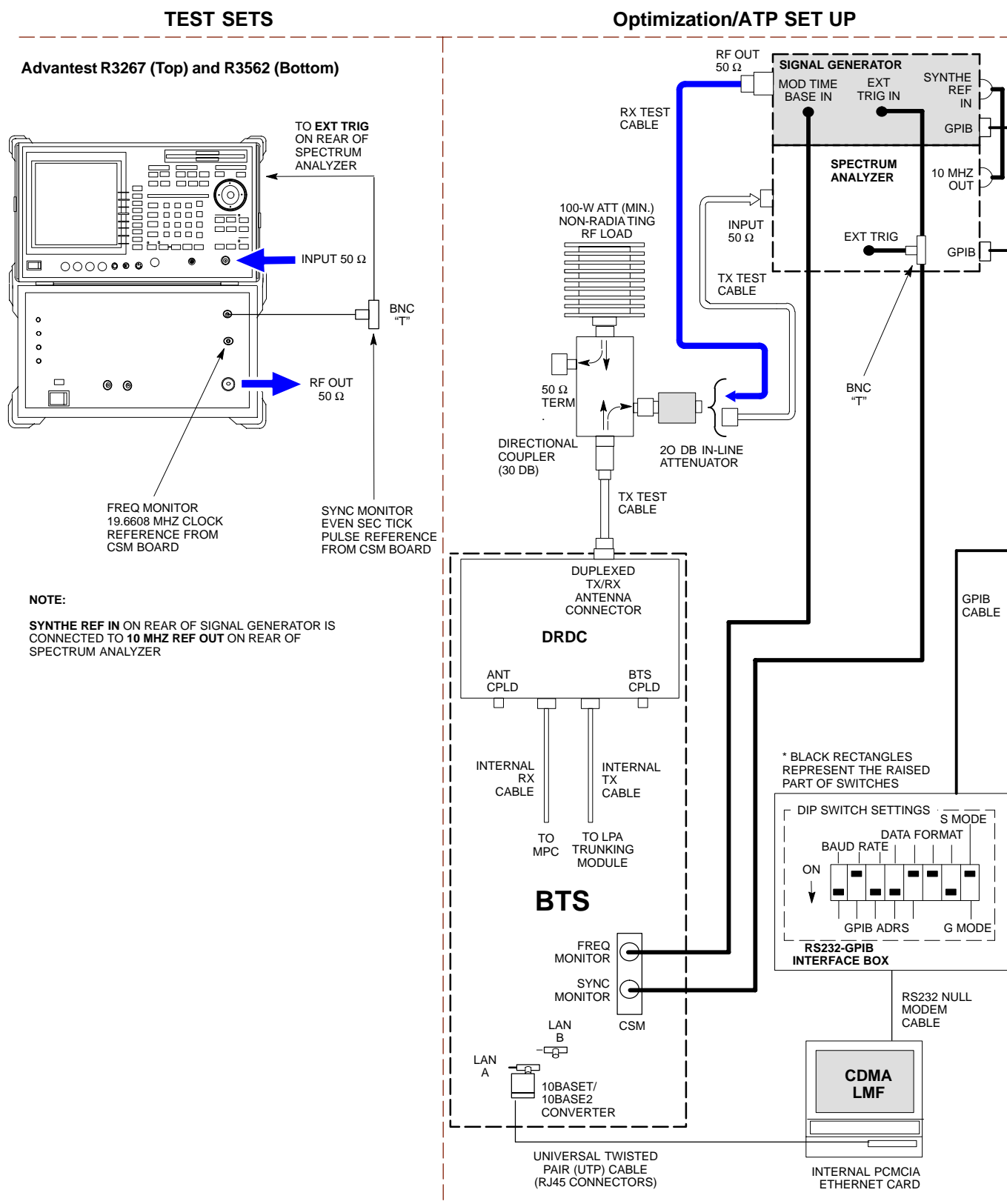
Figure 3-17: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup With TRDCs -
Agilent Test Equipment
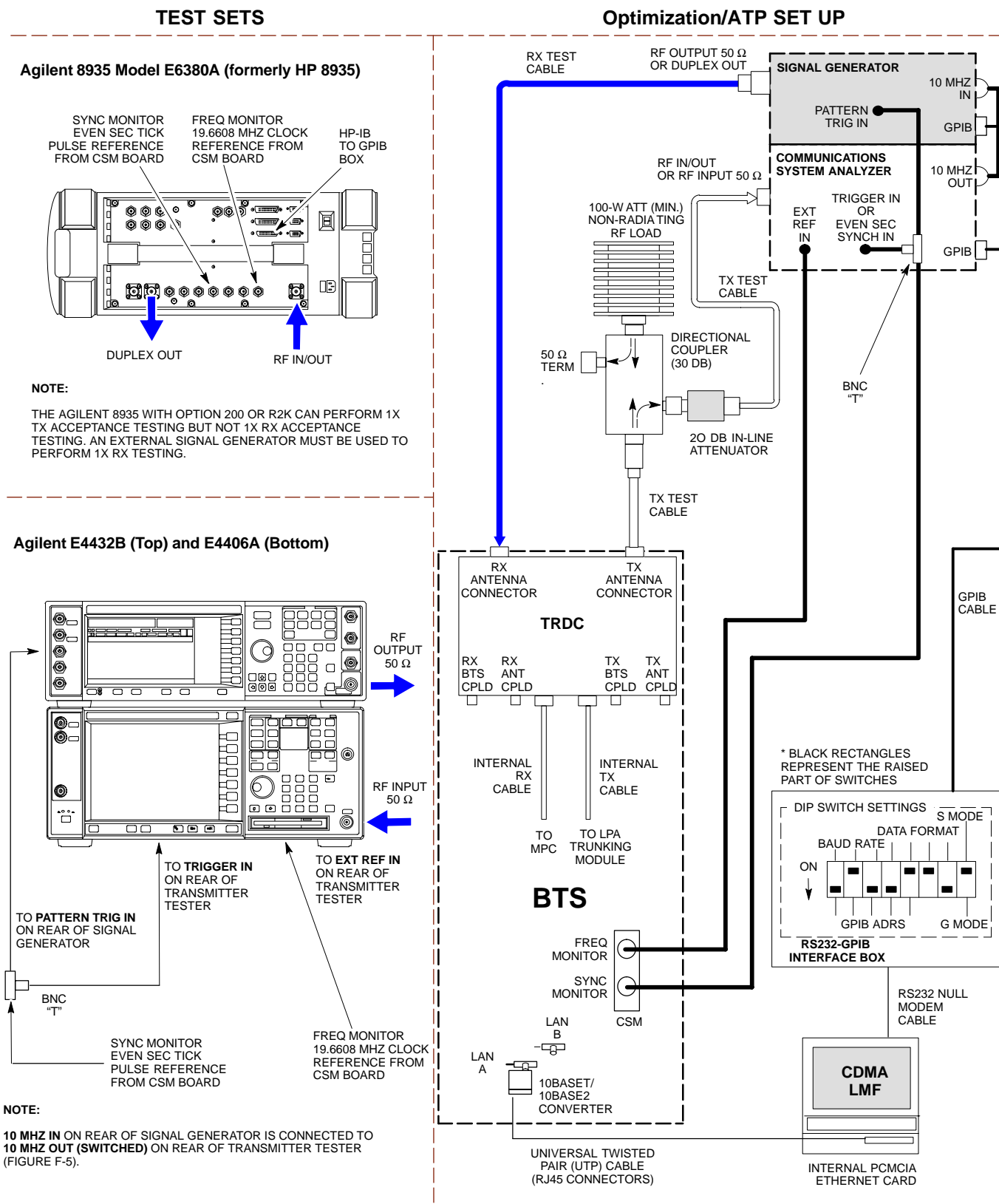
Figure 3-18: IS-95A/B and CDMA2000 1X Optimization/ATP Test Setup With TRDCs - Advantest R3267/3562 Test Equipment
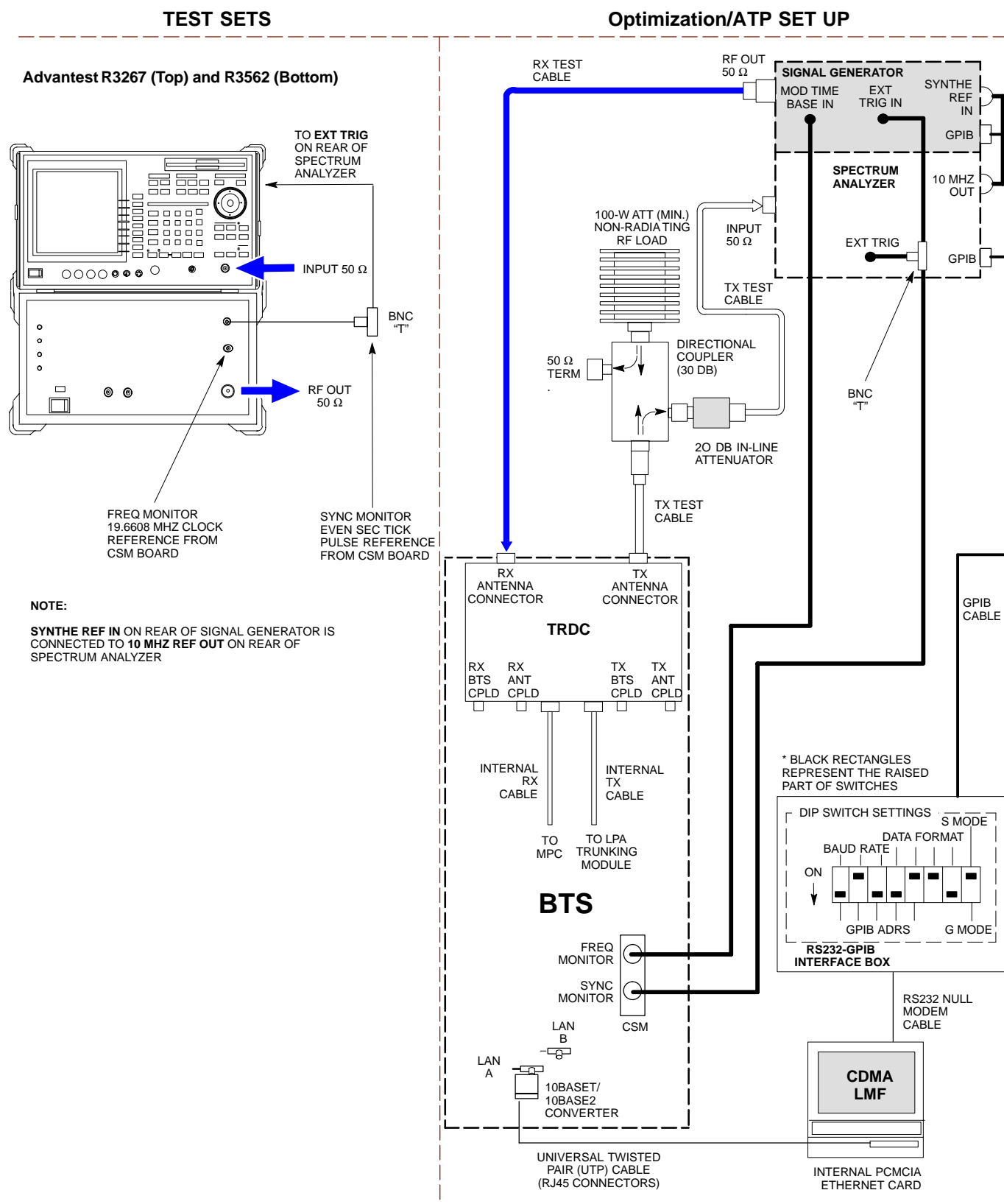
TX ATP Setup

Figure 3-19 shows a typical TX ATP setup.

Figure 3-19: Typical TX ATP Setup with Directional Coupler (shown with and without RFDS)

TX ANTENNA DIRECTIONAL COUPLERS

COBRA RFDS Detail

RX (RFM TX)

TX (RFM RX)

RFDS RX (RFM TX) COUPLER
OUTPUTS TO RFDS FWD(BTS)
ASU2 (SHADED) CONNECTORS

TX RF FROM BTS FRAME

RF FEED LINE TO
DIRECTIONAL
COUPLER
REMOVED

Connect TX test cable between
the directional coupler input port
and the appropriate TX antenna
directional coupler connector.

Appropriate test sets and the port
names for all model test sets are
described in Table 3-28.

**COMMUNICATIONS
TEST SET**

IN

40W NON-RADIATING
RF LOAD

RVS (REFLECTED)
PORT 50-OHM
TERMINATION

30 DB
DIRECTIONAL
COUPLER

OUTPUT
PORT

TEST
DIRECTIONAL
COUPLER

BTS INPUT
PORT

TX TEST
CABLE

NOTE:
THIS SETUP APPLIES TO BOTH
STARTER AND EXPANSION FRAMES.

TX
TEST
CABLE

FWD
(INCIDENT)
PORT

FW00116

ONE 20 DB 20 W IN LINE
ATTENUATOR

Figure 3-20: Typical RX ATP Setup with Directional Coupler (shown with or without RFDS)

RX ANTENNA DIRECTIONAL COUPLERS

COBRA RFDS Detail

RX RF FROM BTS FRAME

RX (RFM TX)

TX (RFM RX)

RFDS TX (RFM RX) COUPLER OUTPUTS TO RFDS FWD(BTS) ASU1 (SHADED) CONNECTORS

RF FEED LINE TO TX ANTENNA REMOVED

Connect RX test cable between the test set and the appropriate RX antenna directional coupler.

Appropriate test sets and the port names for all model test sets are described in Table 3-28.

COMMUNICATIONS TEST SET

OUT

RX Test Cable

NOTE:
THIS SETUP APPLIES TO BOTH STARTER AND EXPANSION FRAMES.

FW00115

Loss/Gain Offset

Background

Proper test equipment setup ensures that the test equipment and associated test cables do not introduce measurement errors, and that measurements are correct.

NOTE	If the test set being used to interface with the BTS has been calibrated and maintained as a set, this procedure does not need to be performed. (Test Set includes LMF terminal, communications test set, additional test equipment, associated test cables, and adapters.)

This procedure must be performed *prior* to beginning the optimization. Verify all test equipment (including all associated test cables and adapters actually used to interface all test equipment 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, re-calibration must be performed. Failure to do so can introduce measurement errors, resulting in incorrect measurements and degradation to system performance.

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

Purpose

These procedures access the CDMA LMF automated calibration routine used to determine the path losses of the supported communications analyzer, power meter, associated test cables, and (if used) antenna switch that make up the overall calibrated test set. After calibration, the gain/loss offset values are stored in a test measurement offset file on the CDMA LMF.

GPIB Addresses

GPIB addresses can range from 1 through 30. The LMF will accept any address in that range, but the numbers entered in the LMF Options window GPIB address box must match the addresses of 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 F.

Selecting Test Equipment

Use **LMF Options** from the **Options** menu list to select test equipment automatically (using the autodetect feature) or manually.

Prerequisites

A **Serial Connection** and a **Network Connection** tab are provided for test equipment selection. The **Serial Connection** tab is used when the test equipment items are connected directly to the CDMA LMF computer via a GPIB box (normal setup). The **Network Connection** tab is used when the test equipment is to be connected remotely via a network connection.

Ensure the following has been completed before selecting test equipment:

- Test equipment is correctly connected and turned on.
- CDMA LMF computer serial port and test equipment are connected to the GPIB box.

Manually Selecting Test Equipment in a Serial Connection Tab

Test equipment can be manually specified before, or after, the test equipment is connected. CDMA LMF does not check to see if the test equipment is actually detected for manual specification.

Step	Action
	Table 3-30: Selecting Test Equipment Manually in a Serial Connection Tab
Step	**Action**
1	From the **Tools** menu, select **Options**. The **LMF Options** window appears.
2	Click on the **Serial Connection** tab (if not in the forefront).
3	Select the correct serial port in the **COMM Port** pick list (normally **COM1**).
4	Click on the **Manual Specification** button (if not enabled).
5	Click on the check box corresponding to the test 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 F for directions on verifying and/or changing test equipment GPIB addresses). Motorola-recommended addresses are: 1 = signal generator 13 = power meter 18 = communications system analyzer *** IMPORTANT** When test equipment items are manually selected by the operator, the LMF defaults to using a power meter for RF power measurements. The LMF will use a communications system analyzer for RF power measurements only if a power meter is not selected (power meter checkbox not checked).
7	Click on **Apply**. (The button will darken until the selection has been committed.)
8	Click on **Dismiss** to close the test equipment window.

Automatically Selecting Test Equipment in a Serial Connection Tab

When using the auto-detection feature to select test equipment, the CDMA LMF examines which test equipment items are actually communicating with CDMA LMF. Follow the procedure in Table 3-31 to use the auto-detect feature.

Step	Action
	Table 3-31: Selecting Test Equipment Using Auto-Detect
1	From the **Tools** menu, select **Options**. The **LMF Options** window appears.
2	Click on the **Serial Connection** tab (if not in the forefront).
3	Select the correct serial port in the **COMM Port** pick list (normally **COM1**).
4	Click on **Auto-Detection** (if not enabled).
5	Type in the GPIB addresses in the box labeled **GPIB address to search** (if not already displayed). **NOTE** Refer to the Setting GPIB addresses section of Appendix F for instructions on verifying or changing test equipment GPIB addresses, if necessary. When both a power meter and analyzer are selected, the first item listed in the **GPIB addresses to search** box will be used for RF power measurements (i.e., TX calibration). The address for a signal generator is normally **1**, a power meter is normally **13** and the address for a CDMA analyzer is normally **18**. If **1, 13,18** are included in the **GPIB addresses to search** box, the power meter (13) will be used for RF power measurements. If the test equipment items are manually selected the CDMA analyzer is used only if a power meter is not selected.
6	Click **Apply.** The button will darken until the selection has been committed. A check mark will appear in the **Manual Configuration** section for detected test equipment items.
7	Click **Dismiss** to close the **LMF Options** window.

Calibrating Test Equipment

The 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, only the power meter is zeroed.

Calibrate Test Equipment from the **Util** menu list is used to calibrate test equipment item *before* being used for testing. The test equipment must be selected before beginning calibration. Follow the procedure in Table 3-32 to calibrate the test equipment.

Step	Action
	Table 3-32: Test Equipment Calibration
1	From the **Util** menu, select **Calibrate Test Equipment**. A **Directions** window is displayed. Follow the instructions provided.
2	Follow the direction provided.

Table 3-32: Test Equipment Calibration	
Step	**Action**
3	Click on **Continue** to close the **Directions** window. A status window is displayed.
4	Click on **OK** to close the status report window.

Calibrating Cables

The cable calibration function is used to measure the loss (in dB) for the TX and RX cables that are to be used for testing. A CDMA analyzer is used to measure the loss of each cable configuration (TX cable configuration and RX cable configuration). The cable calibration consists of the following procedures.

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

- Measure the short cable plus the RX cable configuration loss. The RX cable configuration normally consists only of a coax cable with type-N connectors that is long enough to reach from the BTS RX port the test equipment.

- Measure the short cable plus the TX cable configuration loss is measured. The TX cable configuration normally consists of two coax cables with type-N connectors and a directional coupler, a load, and an additional attenuator if required by the BTS type. The total loss of the path loss of the TX cable configuration must be as required for the BTS (normally 30 or 50 dB). The Motorola Cybertest analyzer is different in that the required attenuation/load is built into the test set so the TX cable configuration consists only of the required length coax cable.

Calibrating Cables with a CDMA Analyzer

The **Cable Calibration** menu item from the **Util** menu list is used to calibrate both TX and RX test cables for use with CDMA LMF.

NOTE	LMF cable calibration cannot be accomplished with an HP8921A analyzer for 1.9 MHz. A different analyzer type or the signal generator and spectrum analyzer method must be used (refer to Table 3-34 and Table 3-35). Cable calibration values must be manually entered if the signal generator and spectrum analyzer method is used. For the HP8921A, refer to Appendix F.

The test equipment must be selected before this procedure can be started. Follow the procedure in Table 3-33 to calibrate the cables.

Table 3-33: Cable Calibration	
Step	**Action**
1	From the **Util** menu, select **Cable Calibration**. A **Cable Calibration** window is displayed.
2	Enter a channel number(s) in the **Channels** box. Multiple channels numbers must be separated with a comma, no space (i.e., 200,800). When two or more channels 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**. Follow the directions displayed for each step. A status report window will be displayed with the results of the cable calibration.

Calibrating TX Cables Using a Signal Generator and Spectrum Analyzer

Follow the procedure in Table 3-34 to calibrate the TX cables using the signal generator and spectrum analyzer. Refer to Figure 3-21 for a diagram of the signal generator and spectrum analyzer.

Table 3-34: Calibrating TX Cables Using Signal Generator and Spectrum Analyzer	
Step	**Action**
1	Connect a short test cable between the spectrum analyzer and the signal generator.
2	Set signal generator to 0 dBm at the customer frequency of 869-894 MHz for 800 MHz CDMA and 1930-1990 MHz band for North American PCS.
3	Use spectrum analyzer to measure signal generator output (see Figure 3-21, "A") and record the value.
4	Connect the spectrum analyzer's short cable to point "B", as shown in the lower portion of the diagram, to measure cable output at customer frequency (869-894 MHz for 800 MHz CDMA and 1930-1990 MHz for North American PCS) and record the value at point "B".
5	Calibration factor = A - B Example: Cal = -1 dBm - (-53.5 dBm) = 52.5 dB **NOTE** The short cable is used for *calibration only*. It is *not* part of the final test setup. After calibration is completed, *do not* re-arrange any cables. Use the equipment setup, as is, to ensure test procedures use the correct calibration factor.

Figure 3-21: Calibrating Test Equipment Setup for TX Cable Calibration
(Using Signal Generator and Spectrum Analyzer)

3

SIGNAL GENERATOR

SPECTRUM ANALYZER

SHORT TEST CABLE

A

100W NON-RADIATING RF LOAD

THIS WILL BE THE CONNECTION TO THE TX PORTS DURING TX CALIBRATION AND TO THE TX/RX PORTS DURING ATP TESTS.

Spectrum Analyzer

50 OHM TERMINATION

Signal Generator

ONE 20DB 20 W IN LINE ATTENUATOR

30 DB DIRECTIONAL COUPLER

SHORT TEST CABLE

THIS WILL BE THE CONNECTION TO THE POWER METER DURING TX CALIBRATION AND TO THE CDMA ANALYZER DURING TX ATP TESTS.

B

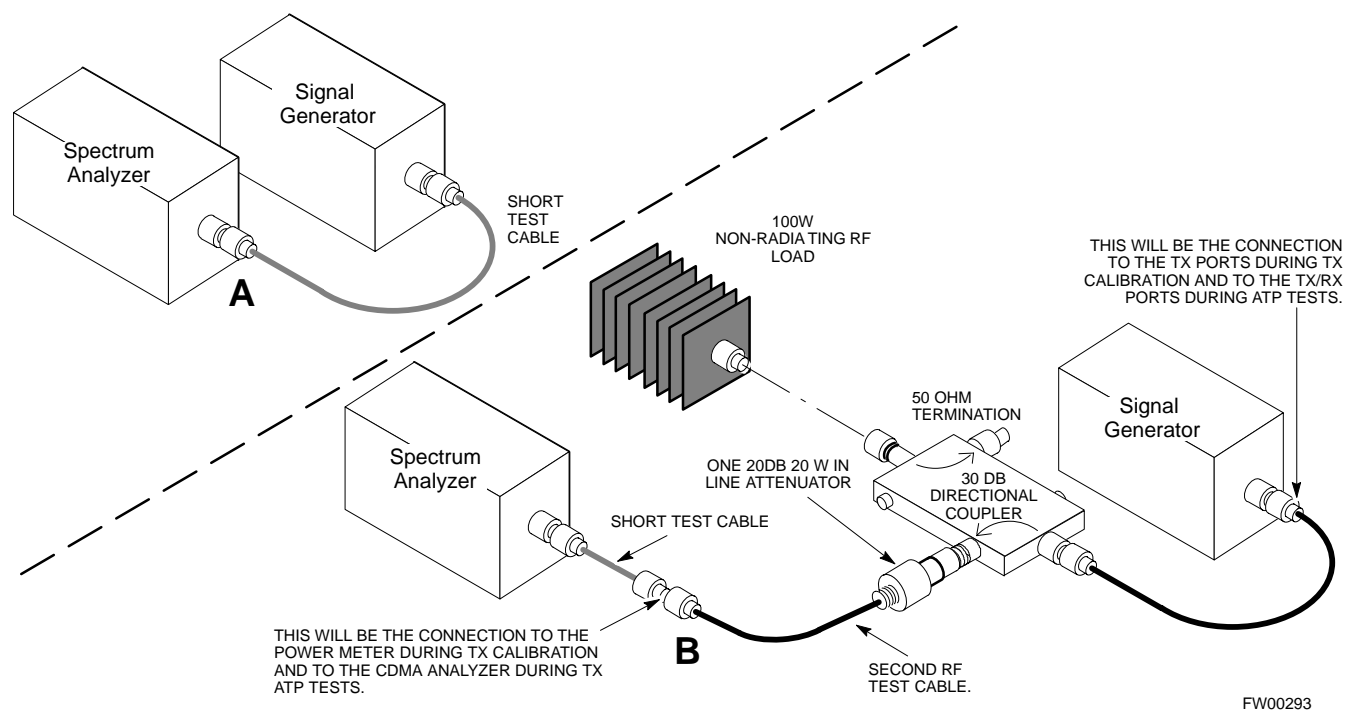SECOND RF TEST CABLE.

FW00293

Calibrating RX Cables Using a Signal Generator and Spectrum Analyzer

Follow the procedure in Table 3-35 to calibrate the RX cables using the signal generator and spectrum analyzer. Refer to Figure 3-22, if required.

Step	Action
Table 3-35: Calibrating RX Cables Using a Signal Generator and Spectrum Analyzer	
1	Connect a short test cable to the spectrum analyzer and connect the other end to the Signal Generator.
2	Set signal generator to -10 dBm at the customer's RX frequency of 824-840 MHz for 800 MHz CDMA and 1850-1910 MHz band for North American PCS.
3	Use spectrum analyzer to measure signal generator output (see Figure 3-22, "A") and record the value for "A".
4	Connect the test setup, as shown in the lower portion of the diagram, to measure the output at the customer's RX frequency in the 1850-1910 MHz band. Record the value at point ''B''.
5	Calibration factor = A - B Example: Cal = -12 dBm - (-14 dBm) = 2 dB **NOTE** The short test cable is used for test equipment setup calibration *only*. It is not be part of the final test setup. After calibration is completed, *do not* re-arrange any cables. Use the equipment setup, as is, to ensure test procedures use the correct calibration factor.

Figure 3-22: Calibrating Test Equipment Setup for RX ATP Test
(Using Signal Generator and Spectrum Analyzer)
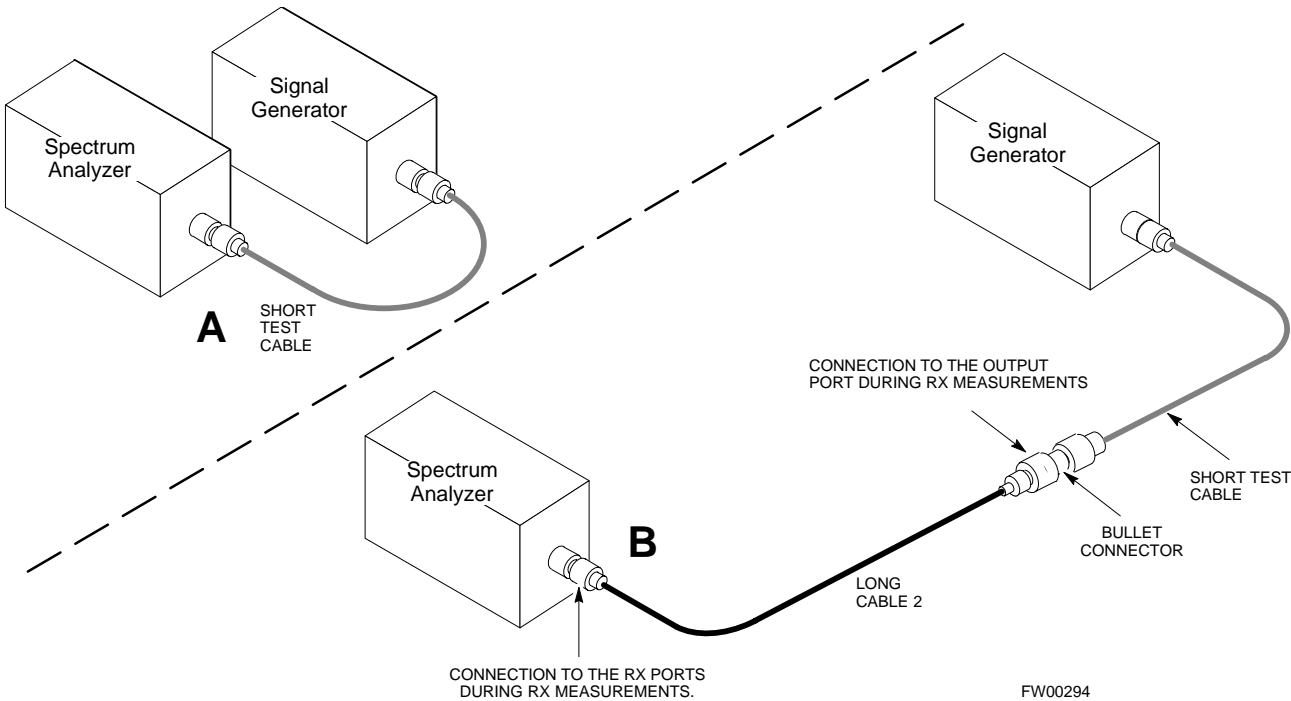
Setting Cable Loss Values

Cable loss values for the TX and RX test cable configurations are normally set by accomplishing cable calibration with use of the applicable test equipment. The resulting values are stored in the cable loss files. The cable loss values can also be set/changed manually.

Prerequisites

- Logged into the BTS

<table>
<tr><td colspan="2" align="center">**Table 3-36:** Setting Cable Loss Values</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td></tr>
<tr><td>1</td><td>Click on the **Util** menu.</td></tr>
<tr><td>2</td><td>Select **Edit >Cable Loss > TX** or **RX**. A data entry pop-up window will appear.</td></tr>
<tr><td>3</td><td>Click on the **Add Row** button to add a new channel number. Then click in the **Channel #** and **Loss (dBm)** columns and enter the desired values.</td></tr>
<tr><td>4</td><td>To edit existing values click in the data box to be changed and change the value.</td></tr>
<tr><td>5</td><td>To delete a row, click on the row and then click on the **Delete Row** button.</td></tr>
<tr><td>6</td><td>Click on the **Save** button to save displayed values.</td></tr>
<tr><td>7</td><td>Click on the **Dismiss** button to exit the window. Values that were entered/changed after the **Save** button was used will not be saved.

NOTE
- If cable loss values exist for two different channels the LMF will interpolate for all other channels.
- Entered values will be used by the LMF as soon as they are saved. You do not have to logout and login.</td></tr>
</table>

Setting Coupler Loss Value

If an in-service coupler is installed the coupler loss (e.g., 30 dB) must be manually entered so it will be included in the LMF TX calibration and audit calculations and the RX FER test.

Prerequisites

- Logged into the BTS

<table>
<tr><td colspan="2" align="center">**Table 3-37:** Setting Coupler Loss Values</td></tr>
<tr><td>**Step**</td><td align="center">**Action**</td></tr>
<tr><td>1</td><td>Click on the **Util** menu.</td></tr>
<tr><td>2</td><td>Select **Edit >Coupler Loss>TX or RX**. A data entry pop-up window will appear.</td></tr>
<tr><td>3</td><td>Click in the **Loss (dBm)** column for each carrier that has a coupler and enter the appropriate value.</td></tr>
<tr><td>4</td><td>To edit existing values click in the data box to be changed and change the value.</td></tr>
<tr><td>5</td><td>Click on the **Save** button to save displayed values.</td></tr>
<tr><td>6</td><td>Click on the **Dismiss** button to exit the window. Values that were entered/changed after the **Save** button was used will not be saved.

NOTE
- The **In-Service Calibration** check box in the **Tools>Options>BTS Options** tab must checked before entered coupler loss values will be used by the TX calibration and audit functions or RX Fer test.
- Entered values will be used by the LMF as soon as they are saved. You do not have to logout and login.</td></tr>
</table>

Adjusting for loss

Introduction

Calibration compensates for normal equipment variations within the BTS and assures maximum measurement accuracy.

RF Path Bay Level Offset Calibration

Calibration identifies the accumulated gain in every transmit path (BBX slot) at the BTS site and stores that value in the CAL file. The BLOs are subsequently downloaded to each BBX.

Each receive path starts at a BTS RX antenna port and terminates at a backplane BBX slot. Each transmit path starts at a BBX backplane slot, travels through the LPA, and terminates at a BTS TX antenna port.

Calibration identifies the accumulated gain in every transmit path (BBX slot) at the BTS site and stores that value in the CAL file. Each transmit path starts at a C-CCP shelf backplane BBX slot, travels through the LPA, and ends at a BTS TX antenna port. When the TX path calibration is performed, the RX path BLO will automatically be set to the default value.

When to Calibrate BLOs

Calibration of BLOs is required after initial BTS installation.

The BLO data of an operational BTS site must be re-calibrated once each year. Motorola recommends re-calibrating the BLO data for all associated RF paths after replacing any of the following components or associated interconnecting RF cabling:

- BBX board
- C-CCP shelf
- CIO card
- CIO to LPA backplane RF cable
- LPA backplane
- LPA
- TX filter / TX filter combiner
- TX thru-port cable to the top of frame

TX Path Calibration

The TX Path Calibration assures correct site installation, cabling, and the first order functionality of all installed equipment. The proper function of each RF path is verified during calibration. The external test equipment is used to validate/calibrate the TX paths of the BTS.

| WARNING | *Before* installing any test equipment directly to any **TX OUT** connector you must *first verify that there are no CDMA channels keyed*. Have the OMC-R place the sector assigned to the LPA under test OOS. Failure to do so can result in serious personal injury and/or equipment damage. |

CAUTION	Always wear a conductive, high impedance wrist strap while handling any circuit card/module. If this is not done, there is a high probability that the card/module could be damaged by ESD.

NOTE	*At new site installations,* to facilitate the complete test of each CCP shelf (if the shelf is not already fully populated with BBX boards), move BBX boards from shelves currently not under test and install them into the empty BBX slots of the shelf currently being tested to insure that all BBX TX paths are tested.
	- This procedure can be bypassed on operational sites that are due for periodic optimization.
	- Prior to testing, view the CDF file to verify the correct BBX slots are equipped. Edit the file as required to include BBX slots not currently equipped (per Systems Engineering documentation).

3

BLO Calibration Data File

During the calibration process, the LMF creates a calibration (BLO) data file. After calibration has been completed, this offset data must be downloaded to the BBXs using the Download BLO function. An explanation of the file is shown below.

NOTE	Due to the size of the file, Motorola recommends that you print out a hard copy of a bts.cal file and refer to it for the following descriptions.

The CAL file is subdivided into sections organized on a per slot basis (a slot Block).

Slot 1 contains the calibration data for the 12 BBX slots. **Slot** 20 contains the calibration data for the redundant BBX (see Table 3-39). Each BBX slot header block contains:

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

• The number of calibration entries - fixed at 720 entries corresponding to 360 calibration points of the CAL file including the slot header and actual calibration data.

• The calibration data for a BBX is organized as a large flat array. The array is organized by branch, BBX slot, and calibration point.

   - The first breakdown of the array indicates which branch the contained calibration points are for. The array covers transmit, main receive and diversity receive offsets as follows:

Table 3-38: BLO BTS.cal file Array Branch Assignments	
Range	**Assignment**
C[1]-C[240]	Transmit
C[241]-C[480]	Receive
C[481]-C[720]	Diversity Receive

- The second breakdown of the array is per sector. Three sectors are allowed.

Table 3-39: BTS.cal File Array (Per Sector)					
BBX	**Sectorization**		**TX**	**RX**	**RX Diversity**
Slot[1] (Primary BBXs 1 through 12)					
1 (Omni)	6 Sector, 1st Carrier	3-Sector, 1st Carrier	C[1]-C[20]	C[241]-C[260]	C[481]-C[500]
2			C[21]-C[40]	C[261]-C[280]	C[501]-C[520]
3			C[41]-C[60]	C[281]-C[300]	C[521]-C[540]
4		3-Sector, 3rd Carrier	C[61]-C[80]	C[301]-C[320]	C[541]-C[560]
5			C[81]-C[100]	C[321]-C[340]	C[561]-C[580]
6			C[101]-C[120]	C[341]-C[360]	C[581]-C[600]
7	6 Sector, 2nd Carrier	3-Sector, 2nd Carrier	C[121]-C[140]	C[361]-C[380]	C[601]-C[620]
8			C[141]-C[160]	C[381]-C[400]	C[621]-C[640]
9			C[161]-C[180]	C[401]-C[420]	C[641]-C[660]
10		3-Sector, 4th Carrier	C[181]-C[200]	C[421]-C[440]	C[661]-C[680]
11			C[201]-C[220]	C[441]-C[460]	C[681]-C[700]
12			C[221]-C[240]	C[461]-C[480]	C[701]-C[720]
Slot[20] (Redundant BBX-13)					
1 (Omni)	6 Sector, 1st Carrier	3-Sector, 1st Carrier	C[1]-C[20]	C[241]-C[260]	C[481]-C[500]
2			C[21]-C[40]	C[261]-C[280]	C[501]-C[520]
3			C[41]-C[60]	C[281]-C[300]	C[521]-C[540]
4		3-Sector, 3rd Carrier	C[61]-C[80]	C[301]-C[320]	C[541]-C[560]
5			C[81]-C[100]	C[321]-C[340]	C[561]-C[580]
6			C[101]-C[120]	C[341]-C[360]	C[581]-C[600]
7	6 Sector, 2nd Carrier	3-Sector, 2nd Carrier	C[121]-C[140]	C[361]-C[380]	C[601]-C[620]
8			C[141]-C[160]	C[381]-C[400]	C[621]-C[640]
9			C[161]-C[180]	C[401]-C[420]	C[641]-C[660]
10		3-Sector, 4th Carrier	C[181]-C[200]	C[421]-C[440]	C[661]-C[680]
11			C[201]-C[220]	C[441]-C[460]	C[681]-C[700]
12			C[221]-C[240]	C[461]-C[480]	C[701]-C[720]

- Refer to the hard copy of the file. As you can see, 10 calibration points per sector are supported for each branch. Two entries are required for each calibration point.
- The first value (all odd entries) refer to the CDMA channel (frequency) the BLO is measured at. The second value (all even entries) is the power set level. The valid range for PwrLvlAdj is from 2500 to 27500 (2500 corresponds to -125 dBm and 27500 corresponds to +125 dBm).
- The 20 calibration entries for each slot/branch combination must be stored in order of increasing frequency. If less than 10 points (frequencies) are calibrated, the largest frequency that is calibrated is repeated to fill out the 10 points.

Example:

C[1]=384,   odd cal entry

                                = *1 "calibration point"*

C[2]=19102,   even cal entry
C[3]=777,
C[4]=19086,
.

.
C[19]=777,
C[20]=19086,   (since only two cal points were calibrated this
               would be repeated for the next 8 points)

- When the BBX is loaded with BLO data, the cal file data for the BBX is downloaded to the device in the order it is stored in the CAL file. TxCal data is sent first, C[1] - C[60]. BBX slot 1's 10 calibration points are sent (C[1] - C[20]), followed by BBX slot 2's 10 calibration points (C[21] - C[40]), etc. The RxCal data is sent next, followed by the RxDCal data.

- Temperature compensation data is also stored in the cal file for each slot.

Test Equipment Setup: RF Path Calibration

Follow the steps in Table 3-40 to set up test equipment.

Table 3-40: Test Equipment Setup (RF Path Calibration)	
Step	**Action**
	NOTE Verify the GPIB is properly connected and turned on.
	! CAUTION To prevent damage to the test equipment, all transmit (TX) test connections must be via the 30 dB directional coupler for 800 MHz or via a 30 dB coupler with a 20 dB in-line attenuator for 1900 MHz.
1	Connect the LMF computer terminal to the BTS LAN A connector on the BTS (if you have not already done so). Refer to the procedure in Table 3-6. - If required, calibrate the test equipment per the procedure in Table 3-32. - Connect the test equipment as shown in Figure 3-16, Figure 3-17 and Figure 3-18.

Transmit (TX) Path Calibration

The assigned channel frequency and power level (as measured at the top of the frame) for transmit calibration is derived from the site CDF file. For each BBX, the channel frequency is specified in the ChannelList CDF file parameter and the power is specified in the SIFPilotPwr CDF file parameter for the sector associated with the BBX (located under the ParentSECTOR field of the ParentCARRIER CDF file parameter).

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

The TX Bay Level Offset at sites WITHOUT the directional coupler option, is approximately 42.0 dB ±3.0 dB.

- At sites WITHOUT RFDS option, BLO is approximately
  42.0 dB ±4.0 dB. A typical example would be TX output power
  measured at BTS (36.0 dBm) minus the BBX TX output level
  (approximately -6.0 dBm) would equate to 42 dB BLO.

The TX Bay Level Offset at sites WITH the directional coupler option,
is approximately 41.4 dB ±3.0 dB. TX BLO = Frame Power Output
minus BBX output level.

- Example: TX output power measured at RFDS TX coupler
  (39.4 dBm) minus the BBX TX output level (approximately
  -2.0 dBm) and RFDS directional coupler/cable (approximately
  -0.6 dBm) would equate to 41.4 dB BLO.

The LMF **Tests** menu list items, **TX Calibration** and **All Cal/Audit**,
perform the TX BLO Calibration test for a XCVR(s). The **All Cal/Audit**
menu item performs TX calibration, downloads BLO, and performs TX
audit if the TX calibration passes. All measurements are made through
the appropriate TX output connector using the calibrated TX cable setup.

Test Pattern Drop-down Pick List

Pilot is shown as the default setting in this pick list box. The full range
of available selections and their descriptions are as follows:

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

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

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

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

Verify BLO

In both the TX Calibration and All Cal/Audit dialog boxes, a Verify
BLO checkbox 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 checkbox should be unchecked or the additional path losses
should be added into each applicable sector using the
Util>Edit>TX Coupler Loss function.

3

Single-Sided BLO

Normally valid values are some value plus-or-minus some offset. If single-sided BLO" is selected, the result will only be considered a success if it's in the lower half of the range. If it was normally success from 37-47 (which is 42± 5), single-sided BLO" would make it a success only if the result was from 37-42.

Prerequisites

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

- CSM-1, GLIs, MCCs, and BBXs have correct code load and data load.

- Primary CSM and MGLI are INS.

- All BBXs are OOS_RAM.

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

- LMF is logged into the BTS.

Connect the test equipment as shown in Figure 3-10 and Figure 3-11 and follow the procedure in Table 3-41 to perform the TX calibration test.

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

		Table 3-41: BTS TX Path Calibration
✔	**Step**	**Action**
	1	Select the BBX(s) to be calibrated. **NOTE** If **STANDARD, CDF** or **CDFPILOT** is selected for **TEST PATTERN**, then at least one MCC must be also selected.
	2	From the **Tests** menu, select **TX>TX Calibration**.
	3	Select the appropriate carrier(s) displayed in the **Channels/Carrier** pick list. (Press and hold the **<Shift>** or **<Ctrl>** key to select multiple items.)
	4	Type the appropriate channel number in the **Carrier n Channels** box.
	5	Select **Verify BLO** (default) or **Single-sided BLO**. **NOTE** **Single-sided BLO** is only used when checking non-redundant transceivers.
	6	From the **Test Pattern** pick list, select a test pattern.

Table 3-41: BTS TX Path Calibration

✔	Step	Action
		NOTE • 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.
	7	Click on **OK**.
	8	Follow the cable connection directions as they are displayed. A status report window displays the test results.
	9	Click on **Save Results** or **Dismiss** 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.

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

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 being downloaded are OOS-RAM (yellow).

• TX calibration is successfully completed.

Follow the steps in Table 3-42 to download the BLO data to the BBXs.

	Table 3-42: Download BLO
Step	**Action**
1	Select the BBX(s) to be downloaded.
2	From the **Device** menu, select **Download>BLO.**
	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 calibrations. 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 is used.

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

Transmit (TX) Path Audit

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

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

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

TX Audit Test

The **Tests** menu item, **TX Audit**, performs the TX BLO Audit test for a BBX(s). All measurements are made through the appropriate TX output connector using the calibrated TX cable setup.

Prerequisites

Before running this test, the following should be done:

- CSM-1,GLI3s, BBXs have correct code load.
- Primary CSM and MGLI3 are INS.
- All BBXs are OOS_RAM.

- Test equipment and test cables are calibrated and connected for TX BLO calibration.
- LMF is logged into the BTS.

Follow the procedure in Table 3-43 to perform the BTS TX Path Audit test.

<table>
<tr><td colspan="3" align="center">**Table 3-43:** BTS TX Path Audit</td></tr>
<tr><td>✓</td><td>**Step**</td><td align="center">**Action**</td></tr>
<tr>
<td></td>
<td>1</td>
<td>Select the BBX(s) to be audited.

NOTE
If **STANDARD** or **CDF** is selected for **Test Pattern**, then at least one MCC must be also selected.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>From the **Tests** menu, select **TX>TX Audit**.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Select the appropriate carrier(s) displayed in the **Channels/Carrier** pick list.

Press and hold the **<Shift>** or **<Ctrl>** key to select multiple items.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Type the appropriate channel number in the **Carrier n Channels** box.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Select **Verify BLO** (default) or **Single-sided BLO**.

NOTE
Single-sided BLO is only used when checking non-redundant transceivers.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>From the **Test Pattern** pick list, select a test pattern.

NOTE
- 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.</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Click on **OK**.</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Follow the cable connection directions as they are displayed.

A status report window displays the test results.</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Click on **Save Results** or **Dismiss** to close the status report window.</td>
</tr>
</table>

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.

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

All Cal/Audit Test

3

The **Tests** menu item, **All Cal/Audit**, performs the TX BLO Calibration and Audit test for a XCVR(s). All measurements are made through the appropriate TX output connector using the calibrated TX cable setup.

NOTE	If the TX calibration portion of the test passed, the BLO data will automatically be downloaded to the BBX(s) before the audit portion of the test is run.

Prerequisites

Before running this test, the following should be done:

- CSM-1, GLI3s, BBXs have correct code and data load.
- Primary CSM and MGLI3 are INS.
- All BBXs are OOS_RAM.
- Test equipment and test cables are calibrated and connected for TX BLO calibration.
- LMF is logged into the BTS.

Follow the procedures in Table 3-44 to perform the All Cal/Audit test.

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.

✓	Step	Action
		Table 3-44: All Cal/Audit Test
	1	Select the BBX(s) to be tested. **NOTE** If **STANDARD**, **CDF** or **CDFPILOT** is selected for TEST PATTERN, then at least one MCC must be also selected.
	2	From the **Tests** menu, select **All Cal/Audit.**
	3	Select the appropriate carrier(s) displayed in the **Channels/Carrier** pick list. Press and hold the **<Shift>** or **<Ctrl>** key to select multiple items.
	4	Type the appropriate channel number in the **Carrier n Channels** box.
	5	Select **Verify BLO** or **Single-sided BLO**. **NOTE** **Single-sided BLO** is only used when checking non-redundant transceivers.
	6	From the **Test Pattern** pick list, select a test pattern. **NOTE** • Selecting **Pilot** (default) performs tests using a pilot signal only. • Selecting **Standard** performs tests using pilot, synch, paging and 6 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 6 traffic channels, however, the gain for the channel elements is specified in the CDF file.
	7	Click on **OK**.
	8	Follow the cable connection directions as they are displayed. A status report window displays the test results.
	9	Click on **Save Results** or **Dismiss** to close the status report window.

Create CAL File

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

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

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

Prerequisites

Before running this test, the following should be done:

- LMF is logged in to the BTS
- BBXs are OOS_RAM with BLO downloaded

<table>
<tr><td colspan="2" align="center">Table 3-45: Create CAL File</td></tr>
<tr><td>Step</td><td align="center">Action</td></tr>
<tr><td>1</td><td>Select the applicable BBXs. The CAL file will only be updated for the selected BBXs.</td></tr>
<tr><td>2</td><td>Click on the Device menu.</td></tr>
<tr><td>3</td><td>Click on the Create Cal File menu item.

The status report window is displays the results of the action.</td></tr>
<tr><td>4</td><td>Click OK.</td></tr>
</table>

RFDS Description

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

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

For complete information regarding the RFDS, refer to the CDMA, and the.*LMF Help function on-line documentation*.

RFDS Parameters

The **bts-#.cdf** file includes RFDS parameter settings that must match the installed RFDS equipment. The paragraphs below describe the editable parameters and their defaults. Table 3-46 explains how to edit the parameter settings.

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

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

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

- **Asu1/2Equip** - valid inputs are 0 or 1
  0 = (default) Not equipped
  1 = Equipped
- **TestOrigDN** - valid inputs are '' (default) or a numerical string up to
  15 characters. (This is the phone number the RFDS dials when
  originating a call. A dummy number needs to be set up by the switch,
  and is to be used in this field.)

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

Checking and Setting RFDS Parameters

Follow the procedure in Table 3-46 to review and/or edit RFDS
parameters.

Table 3-46: RFDS Parameter Settings	
Step	**Action**

1	*** IMPORTANT**
	
	Log out of the BTS prior to perform this procedure.
	
	Using a text editor, verify the following fields are set correctly in the **bts-#.cdf** file:
	
	EXAMPLE:
	
	`Asu1Equip = 1`
	`Asu2Equip = 0 (1 if system is non-duplexed)`
	`Mc1Equip = 0`
	`Mc2Equip = 0`
	`Mc3Equip = 0`
	`Mc4Equip = 0`
	`RfdsEquip = 2`
	`TestOrigDN = '123456789'`
	`TsuEquip = 1`
	
	NOTE
	
	The above is an example of entries extracted from the **bts-#.cdf** file that should have been generated by the OMC-R and copied to the LMF. These fields will have been set by the OMC-R if the RFDSPARM database is modified for the RFDS.

2	Save changes and/or quit the editor.
3	Log into the BTS using an LMF *GUI* session(refer to Table 3-14).
4	If *no* changes were made to the **bts-#.cdf** file fields listed in step 1, proceed to Step 7. If changes *were* made, continue with Step 5.
5	*** IMPORTANT** To make certain the complete data download is accepted, the MGLI should be OOS_RAM (yellow) when RFDS parameter settings are downloaded. When changes are made to RFDS parameters in the **bts-#.cdf** file, data must be downloaded to the MGLI by performing the following:

3

Step	Action
	Table 3-46: RFDS Parameter Settings
5a	- To be sure it does not take control when the MGLI is disabled, *manually* disable the redundant GLI card by unseating it from the backplane connectors and sliding it partially out of the shelf slot.
5b	- Click on the MGLI.
5c	- Click on **Device** in the BTS menu bar, and select **Disable** from the pull-down menu. -- A status report window is displayed showing status of the operation.
5d	- When the operation is complete, click **OK** to close the status report window.
5e	- Click on the MGLI (now OOS_RAM (yellow)).
5f	- Click on **Device** in the BTS menu bar, and select **Download > Data** from the pull-down menus *(selected devices do not change color when data is downloaded)*. -- A status report window is displayed showing status of the download.
5g	- Click **OK** to close the status report window.
5h	- Click on the MGLI.
5i	- Click on **Device** in the BTS menu bar, and select **Enable** from the pull-down menu. -- A status report window is displayed showing status of the operation.
5j	- When the operation is complete, click **OK** to close the status report window.
	! CAUTION When the MGLI changes to INS_ACT, data will automatically be downloaded to the RFDS. During this process, the RFDS LED will slowly begin flashing red and green for approximately 2-3 minutes. **DO NOT** attempt to perform any functions with the RFDS until the LED remains steady green.
5k	- Re-seat the redundant GLI card into the backplane connectors and lock it in place with the ejector tabs.
5l	- Once the redundant GLI initializes, download data to it by selecting the card and, in the BTS menu bar, clicking **Device** and selecting **Download > Data** from the pull-down menus.
6	Any MCCs which were INS_ACT when the MGLI was disabled must be disabled, re-enabled, and downloaded with code as follows:
6a	- Select the devices to be reset by clicking on them or using **Select** from the BTS menu bar and clicking on **MCCs** in the pull-down menu.
6b	- In the BTS menu bar, click on **Device** and select **Disable** from the pull-down menu. -- A status window report window is displayed showing status of the operation.
6c	- Click **OK** to close the status report window.
6d	- Download data to the MCCs by following the procedure in Table 3-21.
6e	- When data download is complete, enable the MCCs by following the procedure in Table 3-24.
7	Click on the RFDS tab.
8	Status the RFDS TSU by performing the following:
8a	- Click on the SUA to select it.

	Table 3-46: RFDS Parameter Settings
Step	**Action**
8b	- Click on **TSU** in the BTS menu bar, and select **Status TSU** from the pull-down menu. -- A status report is displayed showing the software version number for the TSIC and SUA.
8c	- Click **OK** to close the status report window. *** IMPORTANT** If the LMF displays an error message, check the following: • Ensure AMR cable is correctly connected from the BTS to the RFDS. • Verify RFDS has power. • Verify RFDS status LED is green. • Verify entries in RFDS fields of the **bts-#.cdf** file are correct (refer to step 1). • Status the MGLI and ensure it is communicating (by Ethernet) with the LMF, and is in the proper state (INS_ACT (bright green)).

RFDS TSU NAM Programming

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

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

Explanation of Parameters Used When Programming the TSU NAM

Table 3-47 defines the parameters used when editing the tsu.nam file.

Table 3-47: Definition of Parameters	
Access Overload Code Slot Index System ID Network ID	These parameters are obtained from the switch.
Primary Channel A Primary Channel B Secondary Channel A Secondary Channel B	These parameters are the channels which are to be used in operation of the system.
Lock Code Security Code Service Level Station Class Mark	Do *NOT* change.

Table 3-47: Definition of Parameters	
IMSI MCC IMSI 11 12	These fields are obtained at the OMC using the following command: **OMC000>disp bts-# imsi** If the fields are blank, replace the IMSI fields in the NAM file to 0, otherwise use the values displayed by the OMC.
MIN Phone Number	These fields are the phone number assigned to the mobile. The ESN and MIN must be entered into the switch as well. **NOTE** This field is different from the TODN field in the **bts-#.cdf** file. The MIN is the phone number of the RFDS subscriber, and the TODN is the number the subscriber calls.

Valid NAM Ranges

Table 3-48 provides the valid NAM field ranges. If any of the fields are missing or out-of-range, the RFDS will error out.

Table 3-48: Valid NAM Field Ranges		
NAM Field Name	**Valid Range**	
	Minimum	**Maximum**
Access Overload Code	0	15
Slot Index	0	7
System ID	0	32767
Network ID	0	32767
Primary Channel A	25	1175
Primary Channel B	25	1175
Secondary Channel A	25	1175
Secondary Channel B	25	1175
Lock Code	0	999
Security Code	0	999999
Service Level	N/A	N/A
Station Class Mark	0	255
IMSI 11 12	0	99
IMSI MCC	0	999
MIN Phone Number	N/A	N/A

Set Antenna Map Data

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

Prerequisite

- LMF is logged into the BTS

Follow the procedure in Table 3-49 to set antenna map data for the RFDS.

Table 3-49: Set Antenna Map Data	
Step	**Action**
1	Click on **Util** in the BTS menu bar, and select **Edit > Antenna Map...** from the pull-down menus. - A *tabbed* data entry pop-up window will appear.
2	In the data entry pop-up window, click on the **TX Antenna Map** or **RX Antenna Map** tab to select the antenna map to be edited.
3	Locate the carrier and sector number for which data is to be entered or edited, and click in the column where entry or editing is needed.
4	Enter/edit **Antenna #** and **Antenna Label** column data as needed for each carrier. **NOTE** Refer to the **CDMA Help > Utility Menu > Edit-Antenna Map...** section of *LMF Help function on-line documentation* for antenna map examples.
5	*For each tab with changes*, click on the **Save** button to save displayed values.
6	Click on the **Dismiss** button to close the window. **NOTE** • Values entered or changed after the **Save** button was used will be lost when the window is dismissed. • Entered values will be used by the LMF as soon as they are saved. It is not necessary to log out and log back into the LMF for changes to take effect.

Set RFDS Configuration Data

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

Prerequisite

• LMF is logged into the BTS

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

Follow the procedure in Table 3-50 to set RFDS configuration data.

Table 3-50: Set RFDS Configuration Data	
Step	**Action**
1	Click on **Util** in the BTS menu bar, and select **Edit > RFDS Configuration...** from the pull-down menus. - A *tabbed* data entry pop-up window will appear.
2	In the data entry pop-up window, click on the **TX RFDS Configuration** or **RX RFDS Configuration** tab, as required.
3	To add a new antenna number, perform the following:
3a	- Click on the **Add Row** button.
3b	- Click in the **Antenna #**, **Cal Antenna**, **Scap Antenna**, or **Populate [Y/N]** columns, as required.

Step	Action
	Table 3-50: Set RFDS Configuration Data
3c	- Enter the desired data.
4	To edit existing values click in the data box to be changed and change the value. **NOTE** Refer to the **CDMA Help > Utility Menu > Edit-RFDS Configuration...** section of *LMF Help function on-line documentation* for RFDS configuration data examples.
5	To delete a row, click on the row and then click on the **Delete Row** button.
6	*For each tab with changes*, click on the **Save** button to save displayed values.
7	Click on the **Dismiss** button to close the window. **NOTE** • Values entered or changed after the **Save** button was used will be lost when the window is dismissed. • Entered values will be used by the LMF as soon as they are saved. It is not necessary to log out and log back into the LMF for changes to take effect.

RFDS Calibration

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

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

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

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

TSIC channel frequency - For each RFDS TSIC, the channel frequency is determined at the lower third and upper third of the appropriate band using the frequencies listed in Table 3-51.

Table 3-51: RFDS TSIC Calibration Channel Frequencies	
System	**Channel Calibration Points**
800 MHz (A and B)	341 and 682
1.9 GHz	408 and 791

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

RFDS Calibration Procedure

Prerequisites

- Test equipment has been selected.

- Test equipment and test cables have been calibrated.

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

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

- Antenna map data has been entered for the site.

- BBXs are INS_TEST.

Follow the procedure in Table 3-52 to perform RFDS calibration.

	Table 3-52: RFDS Calibration
Step	**Action**
1	In the LMF, select the **FRAME** tab.
2	*If it is not selected (no black dot showing)*, click on the **B** button in the BTS menu bar to select it.
3	Select the BBX(s) assigned to the carrier(s) and sector(s) which will be used in RFDS calibration (refer to Table 1-5 for BBX carrier and sector assignments).
4	Click on **RFDS** in the BTS menu bar, and select **RFDS Calibration...** from the pull-down menu. - An **RFDS Calibration** set-up window will be displayed.
5	In the **Tests to Perform** box, select **TX Calibration** or **RX Calibration**, as required

6	Enter the appropriate channel number(s) (refer to Table 3-51) in the **Channel Field** box.
	• To enter more than one channel number, use the following methods:
	  - Separate *non*-sequential channel numbers with a comma and *no spaces*;
	     for example: 247,585,742.
	  - Enter a range of sequential channels by typing the first and last channel numbers in the range separated by a dash and *no spaces*;
	     for example: 385-395.

7	If the frame is equipped with TX combiners, click in the **Has Combiners** checkbox.
8	Select the appropriate carrier(s) and sector(s) from the **Carriers** pick list (hold down the **Shift** or **Ctrl** key while clicking on pick list items to select multiple carrier(s)-sector(s)).
9	Select the appropriate **RX branch** (**Both**, **Main**, or **Div**ersity) in the drop-down list.
10	In the **Rate Set** box, select the appropriate transfer rate (**1**=9600, **2**=14400) from the drop-down list.
11	Click on the **OK** button. - A status report window is displayed, followed by a **Directions** pop-up window.
12	Follow the cable connection directions as they are displayed.
13	When the test is completed, test results are displayed in the status report window.
14	Click on the **OK** button to close the status report window.
15	Click on the **Frame** tab.
16	Select the MGLI by clicking on it.
17	Download the CAL file, now updated with the RFDS offset data, to the MGLI by clicking on **Device** on the BTS menu bar, and selecting **Download > Data** from the pull-down menus. **NOTE** The MGLI will automatically transfer the RFDS offset data from the CAL file to the RFDS.

Program TSU NAM

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

Prerequisites

• MGLI is INS_ACT (bright green).

• SUA is powered up and has a code load.

Follow the procedure in Table 3-53 to program the TSU NAM.

Table 3-53: Program NAM Procedure	
Step	**Action**
1	In the LMF, select the RFDS tab.
2	Select the SUA by clicking on it.
3	Click on **TSU** in the BTS menu bar, and select **Program TSU NAM** from the pull-down menu. - A NAM programming window will appear.
4	Enter the appropriate information in the boxes (see Table 3-47 and Table 3-48) .
5	Click on the **OK** button to display the status report.
6	Click on the **OK** button to close the status report window.

3

Alarms

The alarms testing should be performed at a convenient point in the optimization/ATP process, since the LMF is necessary to ensure that the RF cabinet is receiving the appropriate alarms from the power cabinet.

The SC 4812ET is capable of concurrently monitoring 10 customer defined input signals and four customer defined outputs, which interface to the 50-pin punchblock. All alarms are defaulted to "Not Equipped" during ATP testing. Testing of these inputs is achieved by triggering the alarms and monitoring the LMF for state-transition messages from the active MGLI3.

All customer alarms are routed through the 50 pair punchblock located in the I/O compartment at the back of the frame. Testing is best accomplished by using a specialized connector that interfaces to the 50-pair punchblock. This connector is wired so that customer return 1 (2 for the B side) is connected to every input, CDI 0 through CDI 17.

Alarm Reporting Display

The Alarm Monitor window can be displayed to list alarms that occur after the window is displayed. To access the Alarm Monitor window, select **Util>Alarm Monitor**.

The following buttons are included:

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

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

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

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

Heat Exchanger Alarm Test

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

Table 3-54: Heat Exchanger Alarm	
Step	**Action**
1	Turn circuit breaker "B" of the Heat Exchanger circuit breakers OFF. This will generate a Heat Exchanger alarm, ensure that the LMF reports the correct alarm condition in the RF Cabinet.
2	Alarm condition will be reported as **BTS Relay #25** - "Heat Exchanger Alarm" makes contact.
3	Turn the circuit breaker "B" ON. Ensure that the alarm condition is now removed. **NOTE** The Heat Exchanger will go through the Start Up sequence.

Door Alarm

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

NOTE	When conducting this test connect the LMF via the LAN port on the back of the frame thru the Rear I/O Door.

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

AC Fail Alarm

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

Table 3-56: AC Fail Alarm	
Step	**Action**
1	**NOTE** The batteries should have a stable charge before performing this test. Turn the Main AC breaker on the power cabinet OFF. The LMF should report an alarm on an AC Fail (Rectifier Fail, Minor Alarm & Major Alarm) condition.
2	Alarm condition will be reported as **BTS Relay #23, BTS # 21, BTS # 24 and BTS Relay # 29 "AC Fail Alarm"** makes contact respectively.
3	Turn the Main AC breaker on the power cabinet ON. The AC Fail alarm should clear.

Minor Alarm

Table 3-57 gives instructions on testing minor alarm.

Table 3-57: Minor Alarm	
Step	**Action**
1	Turn the Temperature Compensation Panel (TCP) power switch OFF. This will generate a minor alarm. Verify that the minor alarm LED (amber) is illuminated on the Meter Alarm Panel and the LMF reports this minor alarm.
2	Alarm condition will be reported as **BTS Relay #24** "Minor Alarm" makes contact.
3	Turn the TCP power switch ON. The alarm condition should clear.

Rectifier Alarms

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

Single Rectifier Failure (Three Rectifier System)

Table 3-58 gives instructions on testing single rectifier failure or minor alarm in a **three rectifier system**.

Table 3-58: Single Rectifier Fail or Minor Alarm	
Step	**Action**
1	Remove a single rectifier module and place it into the unused rectifier shelf #2.
2	Turn the AC breaker OFF, for this 2nd shelf.
3	Verify that a rectifier fail alarm is generated. The single rectifier module will lite two RED fail LED (DC and Power), and the Meter Alarm Panel and LMF will also indicate a minor alarm and rectifier fail status. The RECTIFIER FAIL LED will lite.
4	Check that the LMF reports both of these alarm conditions. **NOTE** Alarm conditions reported as **BTS #24 and BTS #21**, contacts respectively.
5	Turn the AC breaker for the 2nd shelf ON and verify that Rectifier Fail and minor alarm conditions clear on the Meter Alarm Panel and LMF.

Multiple Rectifier Failure

Table 3-59 gives instructions on testing multiple rectifier failure or major alarm in a **three rectifier system**.

Table 3-59: Multiple Rectifier Failure or Major Alarm	
Step	**Action**
1	With the rectifier module still in the unused shelf position fromTable 3-58 test procedures, turn the AC breaker for the 1st shelf OFF.
2	Verify that a rectifier alarm is generated. Each of the two rectifier modules will lite two RED fail LED (DC and Power), and the Meter Alarm Panel and LMF will indicate a major alarm (Rectifier Fail and Major Alarm). The RECTIFIER FAIL LED will lite.

Table 3-59: Multiple Rectifier Failure or Major Alarm	
Step	**Action**
3	Verify that the LMF reports both alarm conditions. (**BTS #29, BTS #21, and BTS #24**)
4	Turn the AC breaker for the 1st shelf ON. Verify that all alarms have cleared.
5	Return the rectifier module to its original location. This completes the alarm test on the power cabinet.

Single Rectifier Failure (Six Rectifier System)

Table 3-60 gives instructions on testing single rectifier failure or minor alarm in a **six rectifier system**.

Table 3-60: Single Rectifier Fail or Minor Alarm	
Step	**Action**
1	Remove two(2) rectifier modules from shelf #2.
2	Turn the AC breaker OFF, for shelf #2.
3	Verify that a rectifier fail alarm is generated. The single rectifier module will lite two RED fail LED (DC and Power), and the Meter Alarm Panel and LMF will also indicate a minor alarm and rectifier fail status. The RECTIFIER FAIL LED will lite.
4	Check that the LMF reports both of these alarm conditions. (**BTS #24 and BTS #21**)
5	Turn the AC breaker for this shelf ON and verify that Rectifier Fail and Minor Alarm conditions have cleared.

Multiple Rectifier Failure (Six Rectifier System)

Table 3-61 gives instructions on testing multiple rectifier failure or major alarm in a **six rectifier system**.

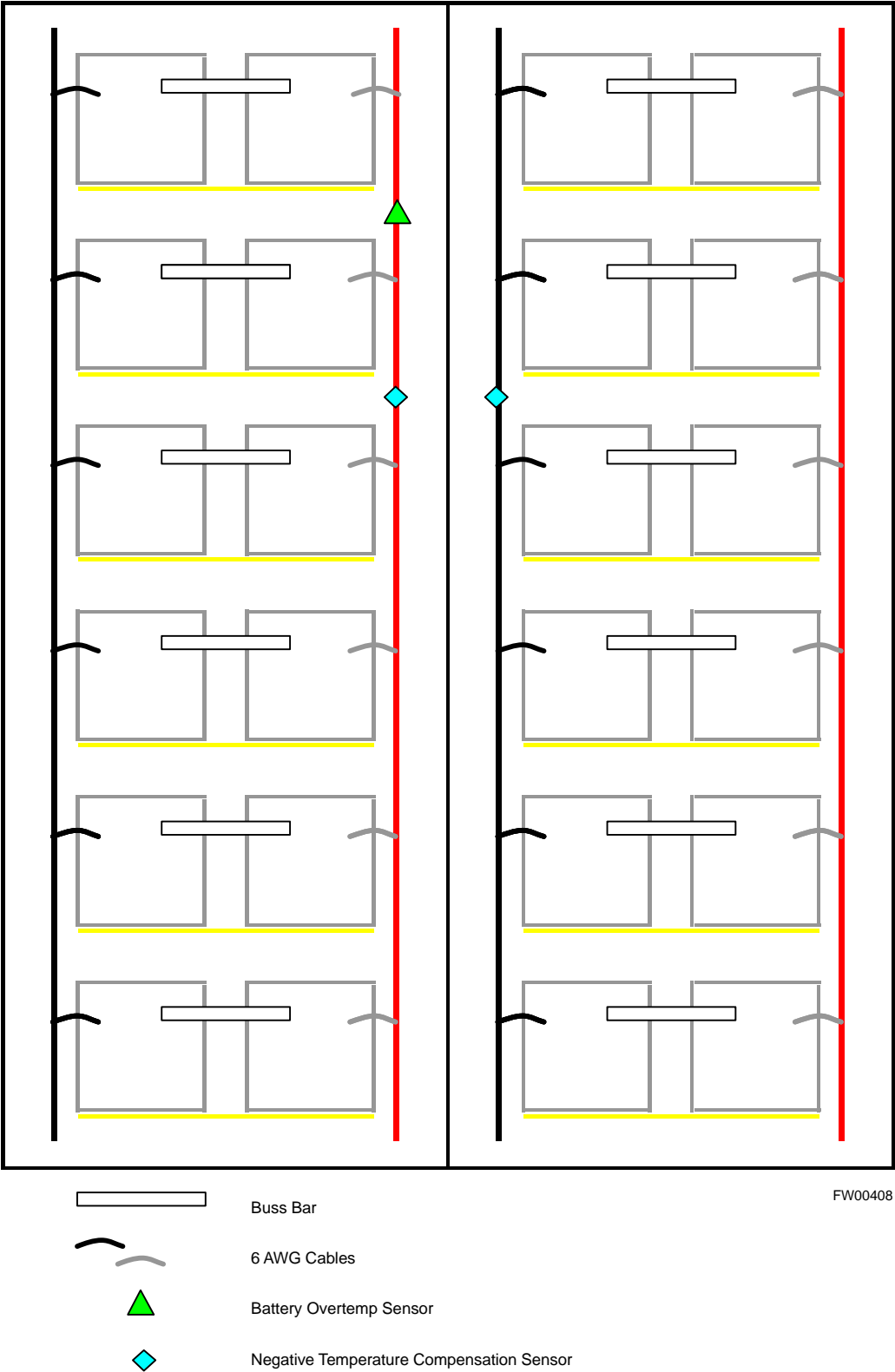| **Table 3-61:** Multiple Rectifier Failure or Major Alarm	
Step	**Action**
1	Replace one rectifier module previously removed and turn the AC breaker for this shelf, OFF.
2	Verify that a rectifier alarm is generated. Each of the two rectifier modules will lite a RED fail LED, and the Meter Alarm Panel will indicate a major alarm (Rectifier Fail, Major and Minor Alarm).The RECTIFIER FAIL LED will lite.
3	Verify that the LMF reports both alarm conditions. (**BTS #29**)
4	Turn the AC breaker for this shelf ON. Verify that all alarms have cleared.
5	Return all rectifier module to their original location. This completes the rectifier alarm tests on the power cabinet.

Battery Over Temperature Alarm (Optional)

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

Table 3-62 gives instructions on testing the battery over temperature alarm system.

Table 3-62: Battery Over Temperature Alarm	
Step	**Action**
1	Use a low powered heat gun and gently heat the battery over temperature sensor (see location in Figure 3-23). Do Not hold the hot air gun closer than 7.6 cm (3 in.) to the sensor. This will avoid burning the cable insulation.
2	When the sensor is heated to approximately 50° C, a battery Over Temperature alarm is generated. **NOTE** An audible click will sound as K1 contact engage and K2 contacts disengage.
3	Visually inspect the K1 and K2 relays to verify state changes. The LMF should be displaying correct alarms. (**BTS #22**)
4	Verify that the CHARGE DISABLE LED (amber) on the Meter Alarm Panel and the BATTERY MAIN LED (green) are both illuminated.
5	Switch the hot air gun to cool. Cool the sensor until the K1 and K2 contact return to normal position (K1 open and K2 closed). Use the LMF verify that all alarms have cleared.

3

Figure 3-23: Battery Over-temperature Sensor

FW00408

|	
▭ Buss Bar	
⌒ 6 AWG Cables	
▲ Battery Overtemp Sensor	
◈ Negative Temperature Compensation Sensor	

Rectifier Over Temperature Alarm

NOTE	This is connector J8 on the rear of the Meter Alarm Panel itself, this is not connector J8 on the connector bulkhead at the rear of the cabinet.

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

	Table 3-63: Rectifier Over Temperature Alarm
Step	**Action**
1	Remove the J8 link on the rear of the Meter Alarm Panel (see Figure 3-24 for J8 location). **NOTE** This is the J8 on the rear of the Meter Alarm Panel itself, this is not connector J8 on the connector bulkhead at the rear of the cabinet.
2	Verify that RECTIFIER OVERTEMP LED (red) is lite. Contacts on K1 and K2 change states (K1 now closed and K2 open).
3	Verify that the LMF has reported an alarm condition. (**BTS #26**)
4	Reinstall J8 connector and verify that all alarm conditions have cleared. K1 and K2 should now be in their normal states (K1 open and K2 closed).
5	This completes the system tests of the SC 4812ET power cabinet.

Figure 3-24: Location of Connector J8 on the Meter Alarm Panel
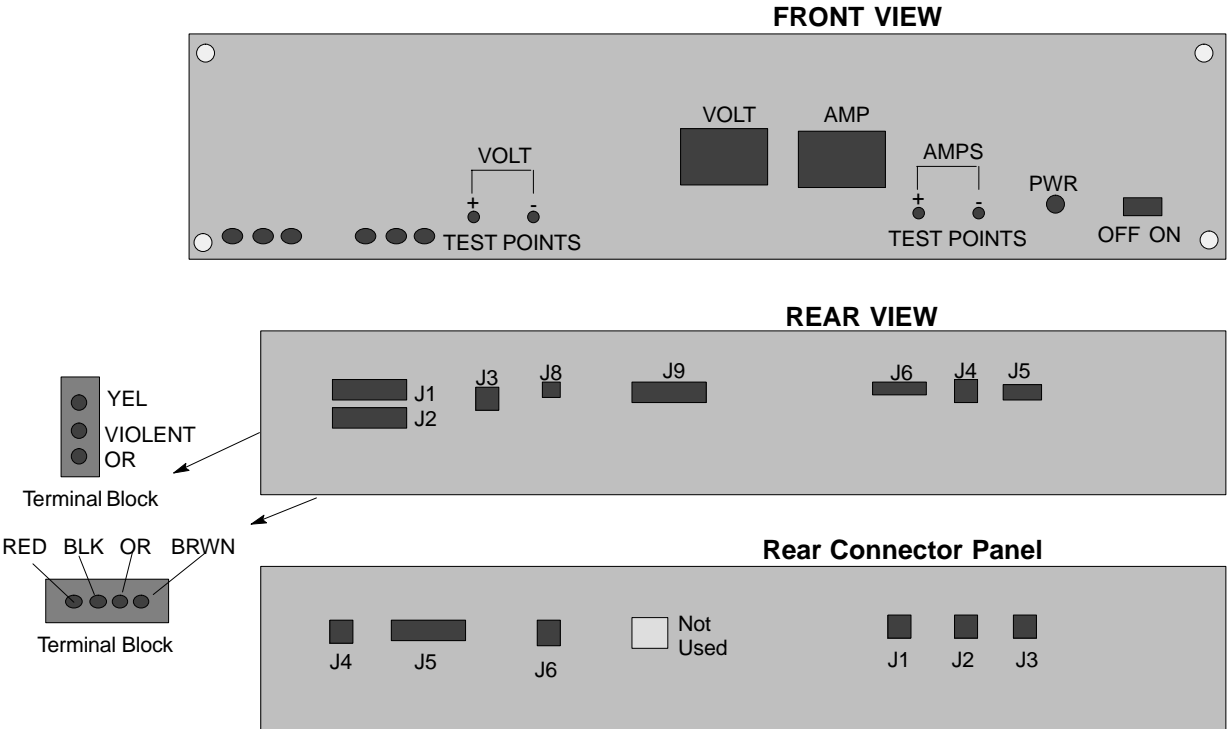
FW00245

Before Leaving the site

Table 3-64 gives instructions on what to check before leaving the site.

Step	Action
	Table 3-64: Check Before Leaving the Site
Step	**Action**
1	Verify that ALL battery circuit breakers (for occupied shelves) are CLOSED (pushed in).
2	Verify that the Heat Exchanger is running.
3	Verify that the Meter Alarm Panel and TCP modules are switched ON.
4	Verify that the Battery Test Switch on the Meter Alarm Panel is in the OFF position.
5	Verify that no alarm conditions are being reported (with all doors closed).

3

Notes

3

Chapter 4

Automated Test Procedures (ATP)

ATP Tests

Introduction

The Automated Acceptance Test Procedure (ATP) allows Motorola Cellular Field Engineers (CFEs) to run automated acceptance tests on all equipped BTS subsystem devices using the Local Maintenance Facility (LMF) and supported test equipment per the current Cell Site Data File (CDF) assignment.

The results of these tests (at the option of the operator) are written to a file that can be printed. All tests are controlled via the LMF platform using the GPIB interface, therefore, only recommended test equipment supported by the LMF can be used.

This chapter describes the tests run from the GUI environment, which is the recommended method. The GUI provides the advantages of simplifying the LMF user interface, reducing the potential for miskeying commmands and associated parameters, and speeding up the execution of complex operations involving multiple command strings. If you feel the command line interface (CLI) will provide additional insight into the progress of ATPs and problems that could possibly be encountered, refer to *LMF CLI Commands.*

NOTE	Before using the LMF, use an editor to view the "CAVEATS" section in the "readme.txt" file in the c:\wlmf folder for any applicable information.
	The ATP test is to be performed on out-of-service sectors *only.*
	DO NOT substitute test equipment with other models not supported by the LMF.

Reduced ATP

NOTE	Equipment has been factory-tested for FCC compliance. If license-governing bodies require documentation supporting SITE compliance with regulations, a full ATP may be necessary. Perform the Reduced ATP only if reports for the specific BTS site are NOT required.

After downloading the proper operational software to the BTS, the Cellular Field Engineer (CFE) must perform these procedures (minimal recommendation):

1   Verify the TX/RX paths by performing TX Calibration, TX Audit and FER tests.

2   Retrieve Calibration Data required for normal site operation.

Should failures occur while performing the specified tests, refer to the Basic Troubleshooting section of this manual for help in determining the failure point. Once the point of failure has been identified and corrected, refer to the BTS Optimization and ATP Test Matrix section (Table B-1) to determine the applicable test that must be performed.

In the unlikely event that the BTS passes these tests but has a forward link problem during normal operation, the CFE should then perform the additional TX tests for troubleshooting: TX spectral mask, TX rho, and TX code domain.

NOTE	Refer to Chapter 3 for detailed information on test set connections for calibrating equipment, cables and other test set components, if required.

Customer requirements determine which ATP tests are to be performed and the field engineer selects the appropriate ATP tests to run.

The tests can be run individually or as one of the following groups:

- **All TX:** TX tests verify the performance of the BTS transmit line up. These include the GLI3, MCC, BBX, and CIO cards, the LPAs and passive components including splitters, combiners, bandpass filter, and RF cables.

- **All RX:** RX tests verify the performance of the BTS receiver line up. These includes the MPC (for starter frames), EMPC (for expansion frames), CIO, BBX, MCC, and GLI3 cards and the passive components including RX filter (starter frame only), and RF cables.

- **All TX/RX:** Executes all the TX and RX tests.

- **Full Optimization:** Executes the TX calibration, download BLO, and TX audit before running all of the TX and RX tests.

ATP Test Prerequisites

Before attempting to run *any* ATP tests, ensure the following:

- BTS has been optimized and calibrated (see Chapter 3).

- LMF is logged into the BTS.

- CSMs, GLI3s, BBXs, MCCs and TSU (if the RFDS is installed)have correct code load and data load

- Primary CSM and GLI3 are INS_ACT

- MCCs are INS_ACT.

- BBXs are OOS-RAM.

- BBXs are calibrated and BLOs are downloaded.

- Test cables are calibrated.

- Test equipment is selected.

- Test equipment is connected for ATP tests.

- Test equipment has been warmed up 60 minutes and calibrated.

- GPIB is on.

WARNING	Before the FER is run, be sure that all LPAs are turned OFF (circuit breakers pulled) or that all transmitter ports are properly terminated.
	All transmit ports must be properly terminated for all ATP tests.
	Failure to observe these warnings may result in bodily injury or equipment damage.

TX/RX OUT Connections

NOTE	Table:note. Note 10pt Helvetica
	Many of the acceptance test procedures require taking measurements at the **TX OUT** (BTS/RFDS) connector. At sites with RFDS, all measurements are through the RFDS directional coupler **TX OUT** connector.

ATP Test Procedure

There are three different ATP testing options that can be performed to completely test a BTS. Depending on your requirements, one of the following ATP testing options should be run. Table 4-1 provides the procedure to execute an ATP test. To completely test a BTS, run the ATP tests according to one of the following ATP testing options.

ATP Testing Option 1

- **All TX/RX** test

ATP Testing Option 2

- **All TX** test
- **All RX** test

ATP Testing Option 3

- **TX Mask** test
- **Rho** test
- **Pilot Time Offset** test
- **Code Domain Power** test
- **FER** test

NOTE	The Full Optimization test can be run if you want the TX path calibrated before all the TX and RX tests are run.

NOTE	If manual testing has been performed with the HP analyzer, remove the manual control/system memory card from the card slot and set the **IO CONFIG** to the **Talk & Listen** mode before starting the automated testing.

CDMA 2000 Testing

Software release 2.16.x supports two new pieces of test equipment. These are the Agilent E4406A with E4432B, as well as the Advantest R3267 with R3562. The E4406A/E4432B pair, or the R3267/R3562 pair, should be connected together using a GPIB cable. This test equipment is capable of performing tests in both IS95 mode as well as cdma2000 mode if the required options are installed:

The HP 8935 with option 200 or R2k for 1X TX and with Agilent E4432B Signal Generator for 1X FER (see note for options).

NOTE	E4432B Signal Generator" for 1X FER. The options are:
	UN8-Real Time I/Q Baseband Generator
	1E5-High Stability Timebase
	201-Real Time CDMA2000

Individual Acceptance Tests

The following individual ATP tests can be used to verify the results of specific tests:

Spectral Purity TX Mask

This test verifies that the transmitted CDMA carrier waveform, generated on each sector, meets the transmit spectral mask specification with respect to the assigned CDF file values.

Waveform Quality (rho)

This test verifies that the transmitted Pilot channel element digital waveform quality (rho) exceeds the minimum specified value in ANSI-J_STD-019. "*Rho*" represents the correlation between actual and perfect CDMA modulation spectrum. A rho value of 1.0000 represents 100% (or perfect correlation).

Pilot Time Offset

The Pilot Time Offset is the difference between the CDMA analyzer measurement interval (based on the BTS system time reference) and the incoming block of transmitted data from the BTS (Pilot only, Pilot Gain = 262, PN Offset = 0).

Code Domain Power

This test verifies code domain power levels, which have been set for all ODD numbered Walsh channels, using the OCNS command. This is done by verifying that the ratio of PILOT divided by OCNS is equal to **10.2 $\pm$ 2 dB**, and, that the noise floor of all EVEN numbered "OFF" Walsh channels measures $\leq$ **-27 dB** .

Frame Error Rate

The Frame Error Rate (FER) test verifies RX operation of the entire CDMA Reverse Link using all equipped MCCs assigned to all respective sector/antennas. The test verifies the BTS sensitivity on all traffic channel elements currently configured on all equipped MCCs at an RF input level of -119 dBm (or -116 dBm if using TMPC). Follow the procedure in Table 4-1 to perform any ATP test.

NOTE	The **STOP** button can be used to stop the testing process.

ATP Test Procedure

Table 4-1 describes the step-by-step procedures to run any APT Test.

<table>
<tr><td colspan="2" align="center">Table 4-1: ATP Test Procedure</td></tr>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select the device(s) to be tested.</td></tr>
<tr><td>2</td><td>From the Tests menu, select the desired test.</td></tr>
<tr><td>3</td><td>Select the appropriate carrier(s) (carrier - bts# - sector# - carrier#) displayed in the Channels/Carrier pick list.

To select multiple items, hold down the <Shift> or <Ctrl> key while making the selections.</td></tr>
<tr><td>4</td><td>Type the appropriate channel number in the Carrier n Channels box.

The default channel number displayed is determined by the CdmaChans[n] number in the cbsc-n.cdf file for the BTS.</td></tr>
<tr><td>5</td><td>If applicable, select Verify BLO (default) or Single-sided BLO.

NOTE
Single-sided BLO is only used when checking non-redundant transceivers.</td></tr>
<tr><td>6</td><td>For RX select the appropriate RX branch (Both, Main, or Diversity) in the drop-down list.</td></tr>
<tr><td>7</td><td>In the Rate Set box, select the appropriate data rate (1=9600, 2=14400, 3=9600 1X) from the drop-down list.

NOTE
The Rate Set selection of 3 is only available if 1X cards are selected for the test.</td></tr>
<tr><td>8</td><td>In the Test Pattern box, select the test pattern to use for the calibration from the drop-down list: Pilot (default), CDF, CDFPilot or Standard.</td></tr>
<tr><td>9</td><td>Click OK.

The status report window and a Directions pop-up are displayed.</td></tr>
<tr><td>10</td><td>Follow the cable connection directions as they are displayed.</td></tr>
<tr><td>11</td><td>Click Save Results or Dismiss to close the status report window.

If Dismiss is used the test results will not be saved in the test report file.</td></tr>
</table>

Background: Tx Mask Test

This test verifies the spectral purity of each BBX2 carrier keyed up at a specific frequency, *per the current CDF file assignment*. All tests are performed using the external calibrated test set, controlled by the same command. All measurements are through the appropriate **TX OUT** (BTS/RFDS) connector.

The Pilot Gain is set to 541 for each antenna and all channel elements from the MCCs are forward-link disabled. The BBX2 is keyed up, using both bbxlvl and bay level offsets, to generate a CDMA carrier (with pilot channel element only). BBX2 power output is set to obtain +40 dBm as measured at the **TX OUT** connector (on either the BTS or RFDS directional coupler).

NOTE	TX output power is set to +40 dBm by setting BTS power level to +33.5 dBm to compensate for 6.5 dB increase from pilot gain set to 541.

The calibrated communications test set measures and returns the attenuation level of all spurious and IM products in a 30 kHz resolution bandwidth with respect to the mean power of the CDMA channel, measured in a 1.23 MHz bandwidth, in dB, verifying that results meet system tolerances at the following test points:

- 1.9 GHz
  - at least **-45 dB @ + 885 kHz** from center frequency
  - at least **-45 dB @ - 885 kHz** from center frequency

- 800 MHz:
  - at least **-55 dB @ + 750 kHz** from center frequency
  - at least **-55 dB @ - 750 kHz** from center frequency
  - at least **-60 dB @ + 1980 kHz** from center frequency
  - at least **-60 dB @ - 1980 kHz** from center frequency

The BBX2 then de-keys, and, if selected, the MCC is re-configured to assign the applicable redundant BBX2 to the current TX antenna path under test. The test is then repeated.

Figure 4-1: TX Mask Verification Spectrum Analyzer Display
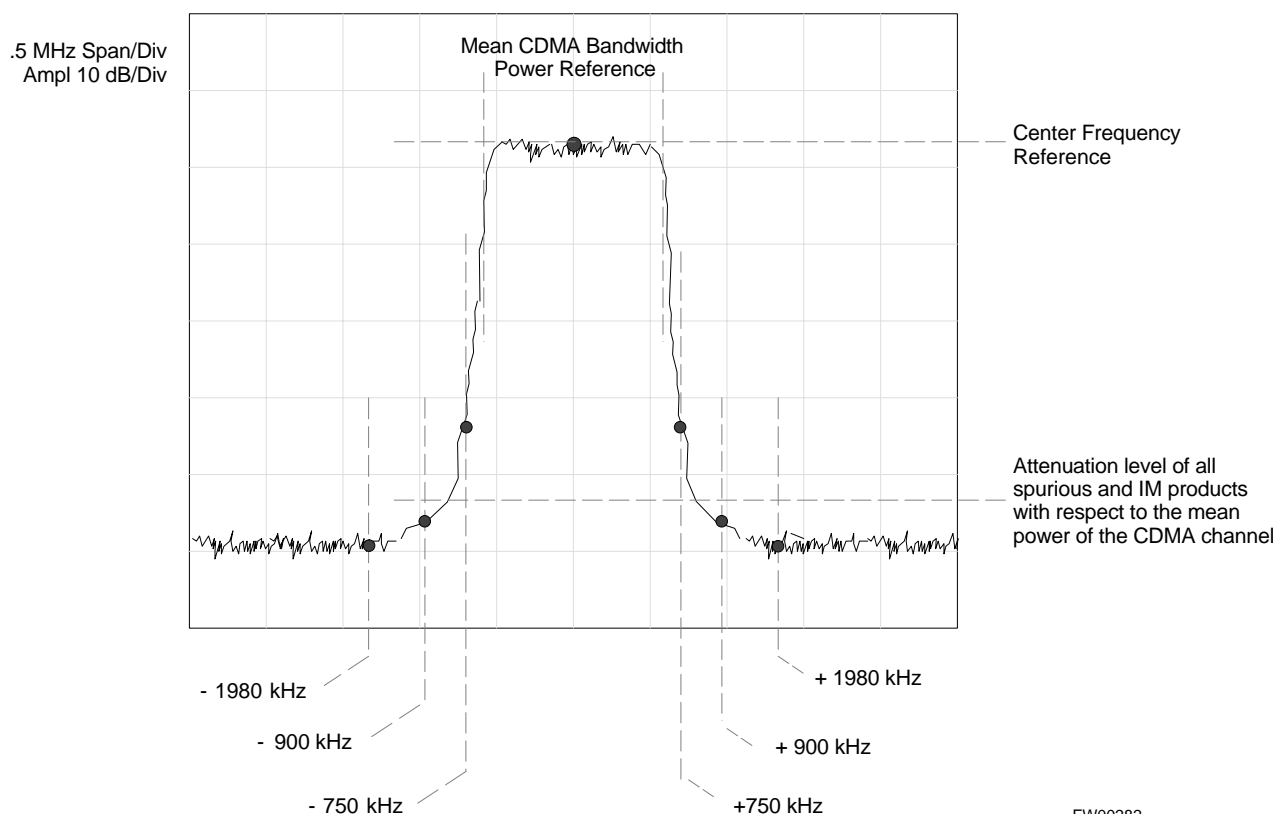
Background: Rho Test

This test verifies the transmitted Pilot channel element digital waveform quality of each BBX2 carrier keyed up at a specific frequency *per the current CDF file assignment*. All tests are performed using the external calibrated test set controlled by the same command. All measurements are via the appropriate **TX OUT** (BTS/RFDS) connector.

The Pilot Gain is set to 262 for each antenna, and all channel elements from the MCCs will be forward link disabled. The BBX2 is keyed up using both bbxlvl and bay level offsets, to generate a CDMA carrier (with pilot channel element only, Walsh code 0). BBX2 power output is set to 40 dBm as measured at the **TX OUT** connector (on either the BTS or RFDS directional coupler).

The calibrated communications test set measures and returns the Pilot channel element digital waveform quality (rho) in dB, verifying that result meets system tolerances. Waveform quality (rho) should be

$\geq$ **0.912 (-0.4 dB).**

The BBX2 then de-keys and the applicable redundant BBX2 is assigned to the current TX antenna path under test. The test is then repeated.

The LMF Tests menu list item, **Rho,** performs the waveform quality test for a XCVR(s). All measurements are made through the appropriate TX output connector using the calibrated TX cable setup.

Background: Pilot Offset Acceptance Test

This test verifies the transmitted Pilot channel element Pilot Time Offset of each BBX2 carrier keyed up at a specific frequency *per the current CDF file assignment*. All tests are performed using the external calibrated test set controlled by the same command. All measurements will be via the appropriate **TX OUT** (BTS/RFDS) connector.

The Pilot Gain is set to 262 for each antenna and all TCH elements from the MCCs are forward link disabled. The BBX is keyed up using both bbxlvl and bay level offsets to generate a CDMA carrier (with pilot channel element only, Walsh code 0). BBX power output is set to 40 dBm as measured at the **TX OUT** connector (on either the BTS or RFDS directional coupler).

The calibrated communications test set measures and returns the Pilot Time Offset in uS, verifying results meet system tolerances. Pilot Time Offset should be within $\leq$ **3 μs** of the target PT Offset (0 μS).

The BBX2 then de-keys, and the applicable redundant BBX2 is assigned to the current TX antenna path under test. The test is then repeated.

Background: Code Domain Power Test

This test verifies the Code Domain Power/Noise of each BBX2 carrier keyed up at a specific frequency *per the current CDF file assignment*. All tests are performed using the external calibrated test set controlled by the same command. All measurements are via the appropriate **TX OUT** (BTS/RFDS) connector.

For each sector/antenna under test, the Pilot Gain is set to 262 and all MCC channel elements under test are configured to generate Orthogonal Channel Noise Source (OCNS) on different odd Walsh codes, and are assigned a full-rate gain of 81. The maximum number of MCC/CEs to be tested at any one time is 32 (32 odd Walsh codes). If more than 32 CEs exist, then multiple sets of measurements are made, so all channel elements are verified on all sectors.

BBX2 power output is set to 40 dBm as measured at the **TX OUT** connector (on either the BTS or RFDS directional coupler).

Code domain power levels, which have been set for all ODD numbered Walsh channels, are verified using the OCNS command. This is done by verifying that Pilot Power (dBm) minus OCNS Power (dBm) is equal to **10.2 $\pm$ 2 dB** and that the noise floor of all "OFF" Walsh channels measures $\leq$ **-27 dB** (with respect to total CDMA channel power).

The BBX2 then de-keys and, the applicable redundant BBX2 is assigned to the current TX antenna path under test. The test is then repeated. Upon completion of the test, OCNS is disabled on the specified MCC/CE.

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Figure 4-2: Code Domain Power and Noise Floor Levels

Showing all OCNS Passing

Indicating Failures

FW00283
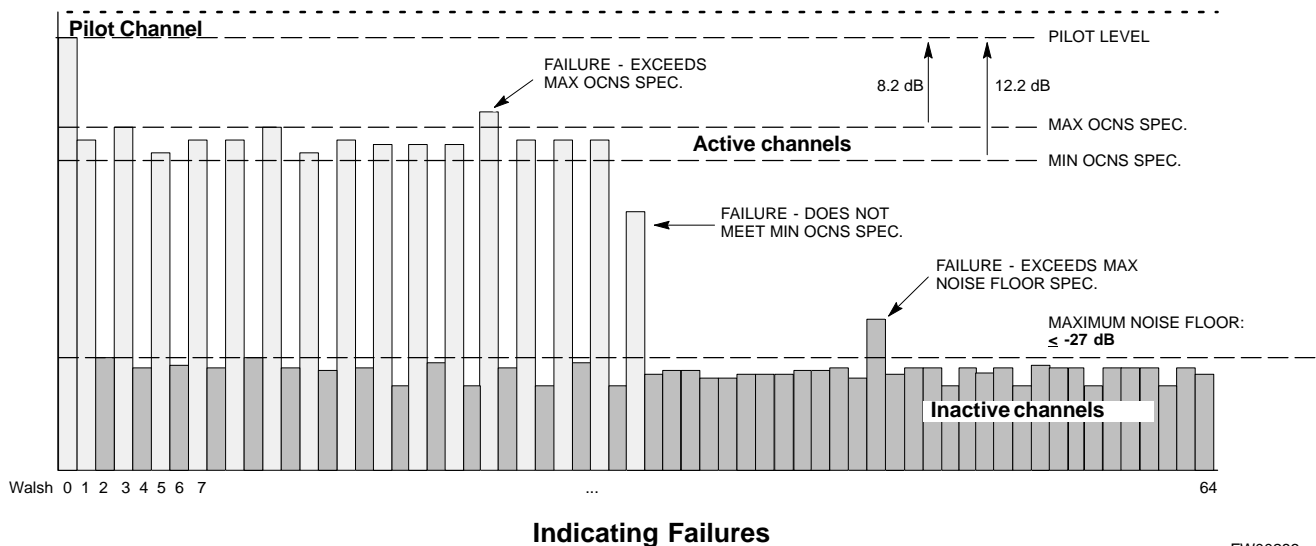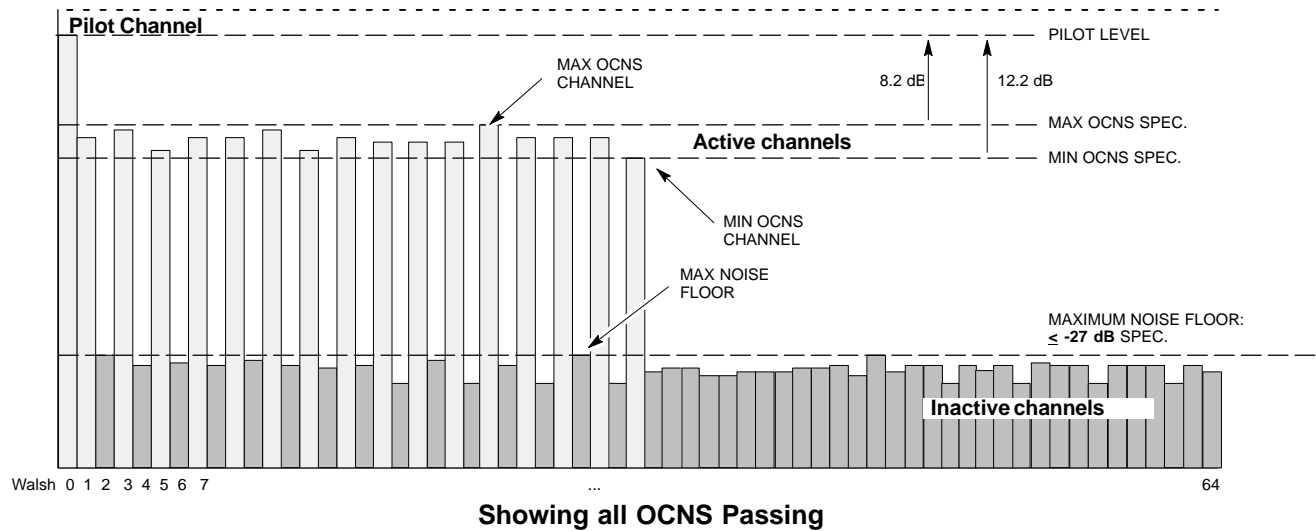
Background: FER Test

This test verifies the BTS FER on *all* traffic channel elements currently configured on *all* equipped MCCs (full rate at 1% FER) at an RF input level of -119 dBm [or -116 dBm if using Tower Top Amplifier (TMPC)]. All tests are performed using the external calibrated test set as the signal source controlled by the same command. All measurements will be via the LMF.

The pilot gain is set to 262 for each TX antenna and all channel elements from the MCCs are forward-link disabled. The BBX2 is keyed up using only bbxlvl level offsets, to generate a CDMA carrier (with pilot channel element only). BBX2 power output is set to -20 dBm as measured at the **TX OUT** connector (on either the BTS or RFDS directional coupler). The BBX2 must be keyed in order to enable the RX receive circuitry.