

**Technical
Information**



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1X SC 4812T Lite BTS Optimization/ATP

Software Release R2.16.1.x

800 Mhz

CDMA

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FCC Requirements

Content

This section presents Federal Communications Commission (FCC) Rules Parts 15 and 68 requirements and compliance information for the SC™ 4812T/ET/ET Lite series Radio Frequency Base Transceiver Stations.

FCC Part 15 Requirements

Part 15.19a(3) – INFORMATION TO USER

NOTE	This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation.
-------------	---

Part 15.21 – INFORMATION TO USER

CAUTION	Changes or modifications not expressly approved by Motorola could void your authority to operate the equipment.
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15.105(b) – INFORMATION TO USER

NOTE	This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures: • Reorient or relocate the receiving antenna. • Increase the separation between the equipment and receiver. • Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. • Consult the dealer or an experienced radio/TV technician for help.
-------------	--

FCC Part 68 Requirements

This equipment complies with Part 68 of the Federal Communications Commission (FCC) Rules. A label on the GLI3 board, easily visible with the board removed, contains the FCC Registration Number for this equipment. If requested, this information must be provided to the telephone company.

FCC Part 68 Registered Devices	
Device	FCC Part 68 ID
Group Line Interface (GLI3) See Note	US: IHEXDNANGLI3-1X
Cisco Model 1900-27 Router	US: 5B1DDNDN0006
ADC KENTROX Model 537	US: F81USA-31217-DE-N
NOTE The BTS equipment is always equipped with the GLI3, < US: IHEXDNANGLI3-1X>, and may be used in conjunction with one or both of the listed registered CSU devices, or another registered CSU device not listed above.	

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of your T1. If this happens, the telephone company will provide advance notice so that you can modify your equipment as required to maintain uninterrupted service.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify you as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

If you experience trouble operating this equipment with the T1, please contact:

Global Customer Network Resolution Center (CNRC)
 1501 W. Shure Drive, 3436N
 Arlington Heights, Illinois 60004
 Phone Number: (847) 632-5390

for repair and/or warranty information. You should not attempt to repair this equipment yourself. This equipment contains no customer or user-serviceable parts.

Changes or modifications not expressly approved by Motorola could void your authority to operate this equipment.

Foreword

Scope of manual

This manual is intended for use by cellular telephone system craftspersons in the day-to-day operation of Motorola cellular system equipment and ancillary devices.

This manual is not intended to replace the system and equipment training offered by Motorola, although it can be used to supplement or enhance the knowledge gained through such training.

Obtaining Manuals

To view, download, order manuals (original or revised), visit the Motorola Lifecycles Customer web page at <http://services.motorola.com>, or contact your Motorola account representative.

If Motorola changes the content of a manual after the original printing date, Motorola publishes a new version with the same part number but a different revision character.

Text conventions

The following special paragraphs are used in this manual to point out information that must be read. This information may be set-off from the surrounding text, but is always preceded by a bold title in capital letters. The three categories of these special paragraphs are:

NOTE	Presents additional, helpful, non-critical information that you can use. Bold-text notes indicate information to help you avoid an undesirable situation or provides additional information to help you understand a topic or concept.
-------------	---

CAUTION	Presents information to identify a situation in which equipment damage could occur, thus avoiding damage to equipment.
----------------	--

WARNING	Presents information to warn you of a potentially hazardous situation in which there is a possibility of personal injury.
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The following typographical conventions are used for the presentation of software information:

- In text, sans serif **BOLDFACE CAPITAL** characters (a type style without angular strokes: i.e., SERIF versus **SANS SERIF**) are used to name a command.
- In text, typewriter style characters represent prompts and the system output as displayed on an operator terminal or printer.
- In command definitions, sans serif **boldface** characters represent those parts of the command string that must be entered exactly as shown and typewriter style characters represent command output responses as displayed on an operator terminal or printer.
- In the command format of the command definition, typewriter style characters represent the command parameters.

Reporting manual errors

To report a documentation error, call the CNRC (Customer Network Resolution Center) and provide the following information to enable CNRC to open an MR (Modification Request):

- the document type
 - the manual title, part number, and revision character
 - the page number(s) with the error
 - a detailed description of the error and if possible the proposed solution
- Motorola appreciates feedback from the users of our manuals.

Contact us

Send questions and comments regarding user documentation to the email address below:

cdma.documentation@motorola.com

Motorola appreciates feedback from the users of our information.

Manual banner definitions

A banner (oversized text on the bottom of the page, for example, **PRELIMINARY**) indicates that some information contained in the manual is not yet approved for general customer use.

24-hour support service

If you have problems regarding the operation of your equipment, please contact the Customer Network Resolution Center for immediate assistance. The 24 hour telephone numbers are:

NA CNRC	+1-800-433-5202
EMEA CNRC	+44- (0) 1793-565444
ASPAC CNRC	+86-10-88417733
Japan & Korea CNRC	+81-3-5463-3550
LAC CNRC	+51-1-212-4020

For further CNRC contact information, contact your Motorola account representative.

General Safety

Remember! . . . Safety depends on you!!

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Motorola, Inc. assumes no liability for the customer's failure to comply with these requirements. The safety precautions listed below represent warnings of certain dangers of which we are aware. You, as the user of this product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Ground the instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. If the equipment is supplied with a three-conductor ac power cable, the power cable must be either plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter. The three-contact to two-contact adapter must have the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.

NOTE

Refer to *Grounding Guideline for Cellular Radio Installations – 68P81150E62*.

Do not operate in an explosive atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Keep away from live circuits

Operating personnel must:

- not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly, or component replacement, or any internal adjustment.
- not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed.
- always disconnect power and discharge circuits before touching them.

Do not service or adjust alone

Do not attempt internal service or adjustment, unless another person, capable of rendering first aid and resuscitation, is present.

Use caution when exposing or handling the CRT

Breakage of the Cathode-Ray Tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the equipment. The CRT should be handled only by qualified maintenance personnel, using approved safety mask and gloves.

Do not substitute parts or modify equipment

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of equipment. Contact Motorola Warranty and Repair for service and repair to ensure that safety features are maintained.

Dangerous procedure warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions that you deem necessary for the operation of the equipment in your operating environment.

WARNING	Dangerous voltages, capable of causing death, are present in this equipment. Use extreme caution when handling, testing, and adjusting.
----------------	---

Revision History

Manual Number

68P64115A18–1

Manual Title

1X SC 4812T Lite BTS Optimization/ATP Software Release R2.16.1.x

Version Information

The following table lists the manual version, date of version, and remarks on the version. Revision bars printed in page margins (as shown to the side) identify material which has changed from the previous release of this publication.

Version Level	Date of Issue	Remarks
1	Mar 2003	Initial draft t

Chapter 1

Introduction

Optimization Manual Scope and Layout

Manual Scope and Layout

This document provides information pertaining to the optimization and audit tests of the Motorola 1X SC™ 4812T–Lite BTS frame. The following subjects are addressed: preliminary background information; optimization and alarm/redundancy tests; Acceptance Test Procedures (ATP) to verify site operation and regulation compliance; site turnover; troubleshooting.

This optimization procedure consists of a group of task-oriented tests. Each major test category (Audit, Initial power-up, Calibration, etc.) is described in chapters which are broken down into multi-page information “maps.”

Each “map” contains the information necessary to perform the test or operation. Included are all required input levels, output levels, Local Maintenance Facility (LMF) application software commands, and test point identification. Also described are important test process concepts and equipment operation which should be understood by the operator. Whenever possible, graphics, flowcharts, or written examples complement the information or procedural steps.

Assumptions and Prerequisites

This document assumes that the BTS frames and cabling have been installed per the *1X SC 4812T–Lite BTS Hardware Installation*, 68P64115A16 which covers both the physical “bolt down” of the SC 3812T–Lite frame and the specific cabling configurations.

Document Composition

This document covers the following major areas:

- Introduction, consisting of preliminary background information (such as component and subassembly locations and frame layouts) to be considered by the Cellular Field Engineer (CFE) before performing optimization or tests.
- Preliminary Operations, consisting of jumper configuration of BTS sub-assemblies, pre-power-up tests, initial application of power to the BTS equipment frames, and initial power-up tests.
- Optimization/Calibration, consisting of procedures for downloading all BTS processor boards, test equipment set-up, RF path verification, BLO calibration and calibration audit, and Radio Frequency Diagnostic System (RFDS) calibration.
- Acceptance Test Procedures (ATP), consisting of automated ATP tests, executed by the LMF, and used to verify all major transmit (TX) and receive (RX) performance characteristics on all BTS equipment. This chapter also covers generating an ATP report.
- Prepare to Leave the Site, discussing site turnover after ATP is completed.
- Basic Troubleshooting, consisting of procedures to perform when an ATP fails, as well as when incorrect results are obtained during logon, test equipment operation, calibration, and Global Positioning System (GPS) operation.
- Appendices include:
 - Data sheets for CFE's recording at the site
 - Pseudorandom Noise (PN) Offset information
 - Optimization/ATP matrix
 - BBX Gain set point vs BTS output
 - CDMA operating frequency programming information
 - Manual test setup information
 - Downloading ROM and RAM code
 - In-service ATP procedures

Purpose of the Optimization

Why Optimize?

Proper optimization and calibration ensures that:

- Accurate downlink RF power levels are transmitted from the site.
- Accurate uplink signal strength determinations are made by the site.

What Is Optimization?

Optimization compensates for the site-specific cabling and normal equipment variations. Site optimization guarantees that the combined losses of the new cables and the gain/loss characteristics and built-in tolerances of each BTS frame do not accumulate and cause improper site operation.

What Happens During Optimization?

Overview – During optimization, the accumulated path loss or gain is first determined for each RF transmit path in the BTS. These transmit path loss or gain values are then stored in a database along with RF receive path default values.

RF path definitions – For definitions of the BTS transmit (TX) and receive (RX) paths, see “What is Bay Level Offset Calibration?” in the Bay Level Offset Calibration section of Chapter 3.

RF paths and transceiver optimization – Six of the seven Broad Band Transceiver (BBX) boards in each CCP shelf are optimized to specific RX and TX antenna connectors. The seventh BBX board acts in a redundant capacity for BBX boards 1 through 6, and is optimized to *all* antenna connectors. A single optimization value is generated for each complete path. This eliminates the accumulation of error that would occur from individually measuring and summing the gain and loss of each element in the path.

Using RF path gain/loss values – BTS equipment factors in the derived optimization values internally to adjust transceiver power levels, leaving only site-specific antenna feedline loss and antenna gain characteristics to be factored in by the CFE when determining required site Effective Radiated Power (ERP) output power levels.

When to Optimize

New Installations

The following operations and optimization/test actions should be accomplished for a new BTS or frame installation:

1. After the initial site installation, it must be prepared for operation. This preparation includes verifying hardware installation, initial power-up, downloading of operating code, verifying GPS operation, and verifying transmit and receive paths.
2. Next, the optimization is performed. Optimization includes performance verification and calibration of all transmit and receive RF paths, and download of accumulated calibration data.
3. A calibration audit of all RF transmit paths may be performed any time after optimization to verify BTS calibration.
4. After optimization, a series of manual pre-Acceptance Test Procedure (ATP) verification tests are performed to verify alarm/redundancy performance.
5. After manual pre-ATP verification tests, an ATP is performed to verify BTS performance. An ATP is also required to demonstrate regulation compliance before the site can be placed in service.

Site Expansion

Optimization is required after expansion of a site with additional BTS frames.

Periodic Optimization

Periodic optimization of a site may also be required, depending on the requirements of the overall system.

Repaired Sites

Refer to Appendix C for a detailed FRU Optimization/ATP Test Matrix outlining the minimum tests that must be performed *any time* a BTS RF subassembly or cable associated with an RF path is replaced.

Required Test Equipment and Software

Overview

Test equipment and software described in this section is required for the optimization procedure. Common assorted tools such as screwdrivers and frame keys are also needed. Read the owner's manual for all of the test equipment to understand its individual operation before using the tool in the optimization.

Policy

To ensure consistent, reliable, and repeatable optimization test results, test equipment and software meeting the following technical criteria should be used to optimize the BTS equipment. Test equipment can, of course, be substituted with other test equipment models *if the equipment meets the same technical specifications*.

NOTE

During manual testing, you can, of course, substitute test equipment with other test equipment models not supported by the LMF, ***but those models must meet the same technical specifications***.

It is the responsibility of the customer to account for any measurement variances and/or additional losses/inaccuracies that can be introduced as a result of these substitutions. Before beginning optimization or troubleshooting, make sure that the test equipment needed is on-hand and operating properly.

Test Equipment Calibration

Optimum system performance and capacity depend on regular equipment service and calibration prior to BTS optimization. Follow the original equipment manufacturer (OEM) recommended maintenance and calibration schedules closely.

Test Cable Calibration

Test cables can make critical differences in optimization accuracy. It is recommended that cable calibration be run at every BTS with the complete *test equipment set*. This method compensates for test cable insertion loss within the test equipment itself. No other allowance for test cable insertion loss needs to be made during the performance of tests.

Another method to account for cable loss is by entering it into the LMF during the optimization procedure. This method requires accurate test cable characterization using shop test equipment. Characterized cables should be tagged with the characterization information, and the measured losses entered into the LMF before field optimization.

Equipment Warm-up

After arriving at a site, test equipment should be plugged in and turned on immediately to provide the longest possible time for warm up and stabilization. The following pieces of test equipment must be warmed up for *a minimum of 60 minutes* prior to use for BTS optimization or RFDS calibration:

- Communications test set.
- Rubidium time base.
- Power meter.

LMF computer and software

LMF Hardware Requirements

An LMF computer platform that meets the following requirements (or better) is recommended:

- Notebook computer
- 266 MHz (32 bit CPU) Pentium processor
- MS® Windows 98® Second Edition (SE) or Windows 2000 operating system
- 4 GB internal hard disk drive
- SVGA 12.1-inch active matrix color display with 1024 x 768 (recommended) or 800 x 600 pixel resolution and capability to display more than 265 colors

NOTE

If 800 x 600 pixel resolution is used, the LMF window must be maximized after it is displayed.

- Memory requirements:
 - Minimum required RAM: 96 MB
 - Recommended RAM:
 - 128 MB for Windows 98 SE
 - 256 MB for Windows 2000
- 20X CD-ROM drive
- 3 1/2 inch floppy drive
- 56kbps V.90 modem
- Serial port (COM 1)
- Parallel port (LPT 1)
- PCMCIA Ethernet interface card (for example, 3COM Etherlink III) with a 10BaseT-to-coax adapter

LMF Software

The Local Maintenance Facility (LMF) application program is a graphical user interface (GUI)-based software tool. This product is specifically designed to provide cellular communications field personnel with the capability to support the following CDMA Base Transceiver Station (BTS) operations:

- Installation
- Maintenance
- Calibration
- Optimization

Ethernet LAN Transceiver

- PCMCIA Ethernet Adapter + Ethernet UTP Adapter
3COM Model – Etherlink III 3C589B

10BaseT/10Base2 Converter

- Transition Engineering Model E-CX-TBT-03 10BaseT/10Base2 Converter (or equivalent)

NOTE	Xircom Model PE3-10B2 or its equivalent can also be used to interface the LMF Ethernet connection to the frame.
-------------	---

Ethernet LAN External In/Out Port Adapter

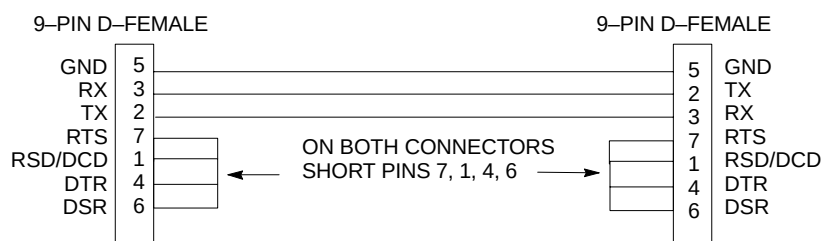
Trompeter Electronics, Inc., ADBJ20-E1-PL75 or equivalent BNC (F) to TRB (M) adapter is required if it is necessary to connect the LMF computer to the LAN external interface triaxial connectors located in the power entry compartment.

RS-232 to GPIB interface

- National Instruments GPIB-232-CT with Motorola CGDSEDN04X RS232 serial cable or equivalent; used to interface the LMF to the test equipment.
- A standard RS-232 cable can be used with the modifications shown in Figure 1-1.

NOTE	Pin 8 (CTS) does not have to be jumpered/shorted to the others as it is a driver output. The DTR is already a driver output signal. The other pins are to receivers. Short pins 7, 1, 4, 6 on each cable end.
-------------	---

Figure 1-1: Null Modem Cable Detail



Model SLN2006A MMI interface kit

- Motorola Model TRN9666A null modem board. Connectors on opposite sides of the board must be used as this performs a null modem transformation between cables. This board can be used for 25-pin to 8-pin, 25-pin to 25-pin, and 10-pin to 10-pin conversions.
- Motorola 30-09786R01 MMI cable or equivalent; used to interface the LMF computer serial port connection to the Group Line Interface (GLI), Clock Synchronization Manager (CSM), External Trunked Interface Board (ETIB), and module debug serial ports.

Communications system analyzer CDMA/analog**Table 1-1: CDMA LMF Test Equipment Support Table**

Item	Description	Test Capability
Test Sets		
Hewlett Packard, model HP 8921A (with 83203B)	Communications analyzer (includes 83203B CDMA interface option)	IS-95A/B only
Motorola CyberTest	Communications analyzer	IS-95A/B only
Advantest R3465 (with 3561L)	Communications analyzer (with 3561 CDMA option)	IS-95A/B only
Agilent E4406A (with E4432B)	Communications analyzer (with Generator)	IS-95A/B and CDMA 2000 testing
Advantest R3267 Analyzer (with R3562)	Communications Analyzer with Advantest R3562 Generator	IS-95A/B and CDMA 2000 testing
Agilent 8935 series E6380A (formerly HP 8935) with option 200 or R2K	Communications test set	IS-95A/B and CDMA 2000 testing
Power Meters		
Gigatronix 8541C	Power meter	
HP437B (with HP8481A sensor)	Power meter with sensor – capable of measuring –30 dBm to 20 dBm	

A combination of test equipment supported by the LMF may also be used during optimization and testing of the RF communications portion of BTS equipment when the communications system analyzer does not perform all of the following functions:

- Frequency counter
- Deviation meter
- RF power meter (average and code domain)
- RF signal generator (capable of DSAT/CDMA modulation)
- Audio signal generator
- AC voltmeter (with 600-ohm balanced audio input and high impedance input mode)
- Noise measurement meter
- C-Message filter
- Spectrum analyzer
- CDMA code domain analyzer

GPIB cables

Hewlett Packard 10833A or equivalent; one or two meters long, used to interconnect test equipment and LMF computer.

Timing reference cables

- Two Huber & Suhner 16MCX/11BNC/K02252D or equivalent; right angle MCX–male to standard BNC–male RG316 cables; 10 ft. long are required to interconnect the communications system analyzer to SGLN4132A and SGLN1145A CSM board timing references

or

- Two BNC–male to BNC–male RG316 cables; 3 meters (10 feet) long, used to interconnect the communications system analyzer to SGLN4132B and SGLN1145B (and later) CSM front panel timing references in the RF Modem Frame

Digital multimeter

Fluke Model 8062A with Y8134 test lead kit or equivalent; used for precision DC and AC measurements to four decimal places.

Directional coupler

Narda Model 3020A 20 dB coupler terminated with two Narda Model 375BN–M loads, or equivalent.

RF attenuators

- 20 dB Fixed attenuator, 20 Watt (Narda 768–20), used in conjunction with calibration of test cables or during general troubleshooting procedures.
- 10 dB Fixed attenuator, 20 Watt (Narda 768–10), for cable calibration with a Cybertest CDMA analyzer.

Clamp–on DC current probe

Amprobe CT600, or equivalent, 600 A capability with jaw size which accommodates 2/0 cable. Used with the DMM for back–up battery charging testing.

Miscellaneous RF adapters, loads, etc.

As required to interface test cables and BTS equipment and for various test setups. Should include at least (2) 50 Ohm loads (type N) for calibration and (1) RF short.

RF load

100W non–radiating RF load used (as required) to provide dummy RF loading during BTS transmit tests.

High–impedance conductive wrist strap

Motorola Model 42–80385A59; used to prevent damage from ESD when handling or working with modules.

Driver bit for tamper-resistant fasteners

Star fastener tamper-resistant insert bit set, Grainger 5F530 or equivalent, to remove tamper-resistant fasteners securing the frame rear access cover.

Optional Equipment

This section provides a list of additional equipment that might be required during maintenance and troubleshooting operations.

NOTE	Not all optional equipment specified in this section will be supported by the LMF in automated tests.
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Duplexer

Filtrionics Low IM Duplexer (Cm035-f2) or equivalent; used during Spectral Purity Receive band noise tests.

Frequency counter

Stanford Research Systems SR620 or equivalent; used if direct measurement of the 3 MHz or 19.6608 MHz references is required.

Spectrum analyzer

Spectrum Analyzer (HP8594E with CDMA personality card) or equivalent; required for *manual* tests other than standard Receive band spectral purity tests performed by the LMF.

LAN tester

Model NETcat 800 LAN troubleshooter (or equivalent); used to supplement LAN tests using the ohm meter.

Span line (T1/E1) verification equipment

As required for the local application.

RF test cable (if not provided with test equipment)

Motorola Model TKN8231A; used to connect test equipment to the BTS transmitter output during optimization or during general troubleshooting procedures.

Oscilloscope

Tektronics Model 2445 or equivalent; used for waveform viewing, timing, and measurements, or during general troubleshooting procedures.

2-way splitter

Mini-Circuits Model ZFSC-2-2500 or equivalent; used to provide the diversity receive input to the BTS.

CDMA subscriber mobile or portable radiotelephone

Safco Model 2136–150 with power supply and antenna; used to provide test transmission and reception during BTS maintenance and troubleshooting. *Do not substitute other models that do not feature special test modes.* Two radios will be required for system and drive-around testing *after* optimization and BTS ATP are completed.

RF circulator

Circulator (FERROCOM 5809866C01) or equivalent; can substitute for a duplexer during Receive sensitivity Frame Erasure Rate (FER) testing in conjunction with Safco CDMA mobile.

High stability 10 MHz rubidium standard

Stanford Research Systems SR625 or equivalent. Required for CSM and Low Frequency Receiver (LFR)/High Stability Oscillator (HSO) frequency verification.

Required Documents and Related Publications

Required Documents

The following documents are required to perform optimization of the cell site equipment:

- Site Document (generated by Motorola Systems Engineering), which includes:
 - General site information
 - Floor plan
 - RF power levels
 - Frequency plan (includes Site PN and operating frequencies)
 - Channel allocation (paging, traffic, etc.)
 - Board placement
 - Site wiring list
 - CDF or NECF files (bts-#.cdf and cbsc-#.cdf or bts-#.necf and cbsc-#.necf)
- Demarcation Document (Scope of Work Agreement)
- Equipment manuals for non-Motorola test equipment

Related Publications

Additional, detailed information about the installation, operation, and maintenance of the 1X SC™ 4812T-Lite BTS and its components is included in the following publications:

- *CDMA RFDS User's Guide*; 68P64114A51
- *LMF Help function on-line documentation*
- *LMF CLI Reference*; 68P09253A56
- *CDMA RFDS Hardware Installation*; 68P64113A93
- *1X SC 4812T-Lite BTS Hardware Installation* ; 68P64115A16
- *1X SC 4812T-Lite BTS FRU Guide* ; 68P64115A17
- *SC4812T/T-Lite/ET/ET Lite Troubleshooting*; 68P09253A65
- *Cellular Glossary of Terms and Acronyms*; 68P09213A95

Terms and Abbreviations

Standard and Non–standard Terms and Abbreviations

Standard terms and abbreviations used in this manual are defined in *Cellular Glossary of Terms and Acronyms*; 68P09213A95. Any non–standard terms or abbreviations included in this manual are listed in Table 1-2.

Table 1-2: Non–Standard Terms and Abbreviations	
Term or Abbreviation	Definition
1X	One of two bandwidths currently defined in the IS–2000 CDMA specification, which extends the capability of the IS–95A and B specifications. 1X bandwidth provides wireless packet voice and data transmission capability at up to 144 Mbps.
BBX–1X	Broad Band Transceiver, 1X. Third generation BBX card with CDMA2000 1X packet as well as IS–95A/B capability.
BBX2	Broadband Transceiver, 2nd Generation supports IS–95A/B
BBXR	Redundant BBX for a CCP shelf or cage.
CCD	Clock Combining and Distribution. CCP shelf module which accepts timing signals from the active source and distributes them to other CCP shelf modules.
CIO	Combiner Input/Output
companion frame	A BTS frame configured to operate at the same site with another companion frame. Companion frames may share antenna signals, but are not inter–connected on the same LAN. Companion frames are managed as <i>separate</i> BTSs in the Base Station System (BSS).
DBPF	Dual Bandpass Filter
DBM	Debug Monitor
DLM	DownLoad Manager. Software application resident on the GLI card which permits download of software upgrades from the Centralized Base Station Controller (CBSC) to BTSs without the need for a site visit.
DMAC	Digital Metering, Alarm, Control. Part of the Meter Alarm Panel (MAP) which provides control of and status information for the AC power rectifiers as well as back–up battery monitoring and test capability. Term is used interchangeably with MAP (see below).
DPLL	Digital Phase–Locked Loop
DRDC	Duplexer, Receive Filter, Dual Directional Coupler. Provides duplexing of BTS transmit and receive signals to a single antenna and antenna signal sampling in either the forward (transmit) or reflected (receive) direction for use by an RF Diagnostic Subsystem (RFDS).
EMPC	Expansion Multi–coupler Preselector Card. BTS expansion frame MPC module which is used to receive, amplify, and distribute RX signals from the starter frame MPC.
GLI2	Group Line Interface card, second generation
HSO	High Stability Oscillator. Module providing backup timing source for a BTS when the timing signal from the GPS or Remote GPS module is unavailable.
HSO2	HSO card, second generation

. . . continued on next page

Table 1-2: Non-Standard Terms and Abbreviations

Term or Abbreviation	Definition
HSOX	HSO Expansion. Module used in a BTS expansion frame to interface with the starter frame HSO or LFR and distribute the timing signals to the expansion frame CSM modules.
ISC	In-Service Calibration. Technique for performing calibration sector by sector on a BTS to avoid completely removing the site from service.
LPAC	Linear Power Amplifier Controller
LFR2	Low Frequency Receiver, second generation. Low-cost LFR card with capability to distribute synchronization signals to multiple RF modem frames.
MAP	Meter Alarm Panel. SC4812ET Lite Field Replaceable Unit (FRU) which contains the functions of both the Temperature Compensation Panel (TCP) and the DMAC. Term is used interchangeably with DMAC.
MCC8E	Multichannel CDMA Card supporting 8 IS-95A/B channels.
MCC24E	Multichannel CDMA Card supporting 24 IS-95A/B channels.
MCC-1X	Multichannel CDMA Card supporting 16 or 48 CDMA2000 1X or (with Software Release 2.16.0.84.3 and higher) IS-95A/B channels.
MPC	Multi-coupler Preselector Card. BTS CCP shelf module used to amplify and distribute RX signals to BBX modules.
NECB	Network Element Configuration Baseline
NECF	Network Element Configuration File
NECJ	Network Element Configuration Journal
OLF	Object List File. File containing a list of the ROM and RAM code versions which should be operating on every device installed in a BTS. The file is resident on the Central Base Station Controller (CBSC) Mobility Manager (MM) and is passed to the GLI after a DLM job is invoked. The GLI uses the OLF to determine which devices require code download to meet the OLF-specified version.
PDA	Power Distribution Assembly. Assembly in an SC4812ET Lite BTS providing internal DC power distribution and circuit protection.
RFMF	RF Modem Frame
RGD	Remote Global Positioning System (GPS) Distribution. Module which provides distribution of digital timing information to up to four BTS RF modem frames (RFMFs) from a single Remote GPS receiver.
RGPS	Remote Global Positioning System. GPS receiver and signal distribution subsystem which provides digital timing information for up to four BTS RFMFs at a cell site.
RGPS expansion primary frame	BTS frame where the RGD is located and which serves as the distribution point for RGPS digital timing signals to other (<i>secondary</i>) BTS frames at a cell site.
RGPS expansion secondary frame	BTS frame which receives RGPS digital timing signals distributed from the <i>primary</i> RGPS expansion frame at a cell site.
RHSO	Remote High-Stability Oscillator. Subsystem which generates and distributes synchronization signals from a single HSO to up to four RF modem frames.

... continued on next page

Table 1-2: Non–Standard Terms and Abbreviations

Term or Abbreviation	Definition
SCCP	Small CDMA Channel Processor. The type of CCP shelf used in the SC4812ET Lite BTS.
TCP	Temperature Compensation Panel. A function of the SC4812ET Lite MAP which provides the capability to adjust DC voltage output of the rectifiers to compensate for variations resulting from temperature changes.
TRDC	Transmit & Receive Dual Directional Coupler (Non–duplexed, Receive Filter). TRDCs contains separate transmit and receive paths and bandpass filters which are not connected electrically. Transmit and receive antenna signals are not duplexed and must be handled by separate antennas. Each RF path contains a dual directional coupler on the antenna port which allows sampling of antenna signals in the forward (transmit) and reflected (receive) directions for use by an RFDS.

BTS Equipment Identification

Equipment Overview

The 1X SC™ 4812T-Lite BTS frame consists of a single cabinet containing RF and power amplifier components. The BTS may be powered powered by:

- 220 Vac (rectified internally to +27 Vdc)
- -48 Vdc (power converted internally to +27Vdc)
- +27 Vdc

Each frame can support up to two carriers in a 3-sector configuration. Six-sector operation is not supported with any SC4812T Lite configuration.

Figure 1-2 illustrates the external features of the BTS frame, the single major component of the Motorola SC4812T Lite. The frame cabinet is identical for starter and expansion frames except for the I/O interconnect plate.

Frame Configurations

The SC4812T Lite is available in starter and expansion frame configurations. Following are brief descriptions of each.

Starter frame configuration supports one or two carriers, each with separate antenna sets. It can operate as a stand-alone BTS, or can be modified in the field to the expansion frame configuration.

Expansion Frame configuration supports one or two carriers using 2:1 TX combiners and a single antenna set for the frame. It operates with an SC4812T Lite starter frame which has its own antennas and different carriers. Expansion frames share RX signals to provide diversity RX for the opposite frame. Expansion frames allow equipping a single SC4812T Lite site with up to four carriers.

Logical BTS

The BTS software implements the logical BTS capability. Previously, all BTS frames co-located at a single site had to be identified in the network with separate and distinct BTS ID numbers. In the Logical BTS feature, all frames located at a single BTS site are identified with unique Frame ID numbers (Frame ID Numbers 1, 101, 201, 301) under a single (site) BTS ID number. A logical BTS can consist of up to four SC 4812T frames. When the LMF is connected to frame 1 of a logical BTS, you can access all devices in all of the frames that make up the logical BTS. A logical BTS requires a CDF/NECF file that includes equipage information for all of the logical BTS frames and their devices and a CBSC file that includes channel data for all of the logical BTS frames.

Logical BTS Numbering

The first frame of a logical BTS has a **-1** suffix (e.g., **BTS-812-1**). Other frames of the logical BTS are numbered with suffixes, **-101**, **-201**, and **-301** (e. g. **BTS-812-201**). When you log into a BTS, a **FRAME** tab is displayed for each frame. If there is only one frame for the BTS, there is only one tab (e.g., **FRAME-282-1**) for BTS-282. If a logical BTS has more than one frame, there is a separate **FRAME** tab for each frame (e.g. **FRAME-438-1**, **FRAME-438-101**, and **FRAME-438-201** for a **BTS-438** that has three frames). If an RFDS is included in the CDF/NECF file, an **RFDS** tab (e.g., **RFDS-438-1**) is displayed.

Actions (e.g., ATP tests) can be initiated for selected devices in one or more frames of a logical BTS. Refer to the Select devices help screen for information on how to select devices.

SCCP Shelf Card/Module Device ID Numbers

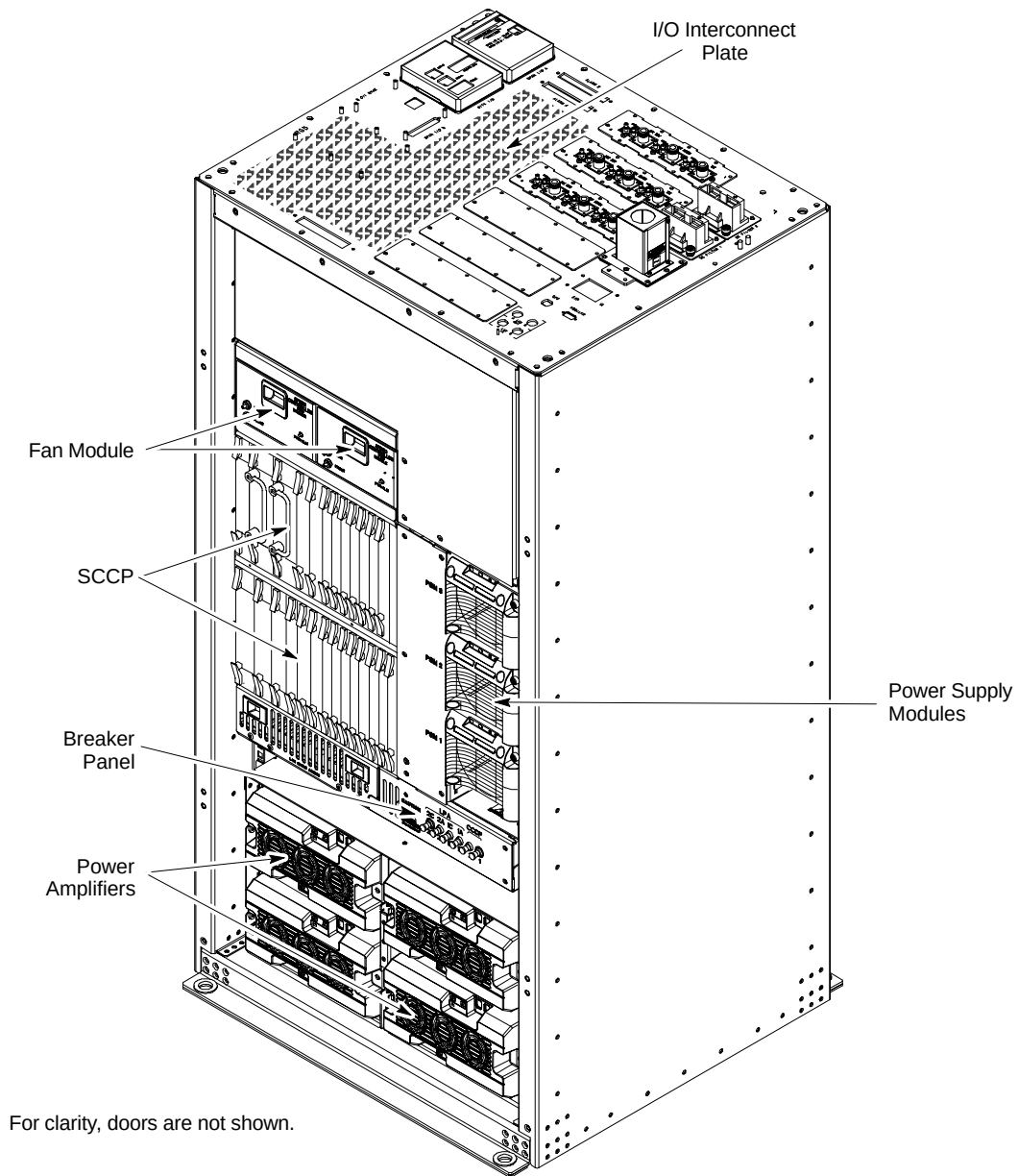
All cards/modules/boards in the frames at a single site, assigned to a single BTS number, are also identified with unique Device ID numbers dependent upon the Frame ID number in which they are located. Refer to Table 1-3 and Table 1-4 and Figure 1-4 for specific device ID numbers.

Table 1-3: SCCP Shelf/Cage Card/Module Device ID Numbers (Top Shelf)

Frame #	Card/Module ID Number (Left to Right)										MPC/EMPC-1
	Power (PS-1)	Power (PS-2)	AMR-1	GLI2-1	MCC		BBX			BBX-R (Optional)	
1	–	–	1	1	1	2	1	2	3	R1	–
101	–	–	101	101	101	102	101	102	103	R101	–
201	–	–	201	201	201	202	201	202	203	R201	–
301	–	–	301	301	301	302	301	302	303	R301	–

Table 1-4: SCCP Shelf/Cage Card/Module Device ID Numbers (Bottom Shelf)

Table 1-4: SCCP Shelf/Cage Card/Module Device ID Numbers (Bottom Shelf)															
Frame #	Card/Module ID Number (Left to Right)														
	HSO/LFR	CSM –1	CSM –2	CCD A	CCD B		AMR–2	GLI2–2	MCC		BBX			SW	MPC/EMPC–2
1	–	1	2	–	–	–	2	2	3	4	4	5	6	–	–
101	–	101	102	–	–	–	102	102	103	104	104	105	106	–	–
201	–	201	202	–	–	–	202	202	203	204	204	205	206	–	–
301	–	301	302	–	–	–	302	302	303	304	304	305	306	–	–

Figure 1-2: 1X SC™ 4812T-Lite BTS Frame

ti-CDMA-WP-00213-v01-ildoc-ftw

Internal Assemblies and FRUs

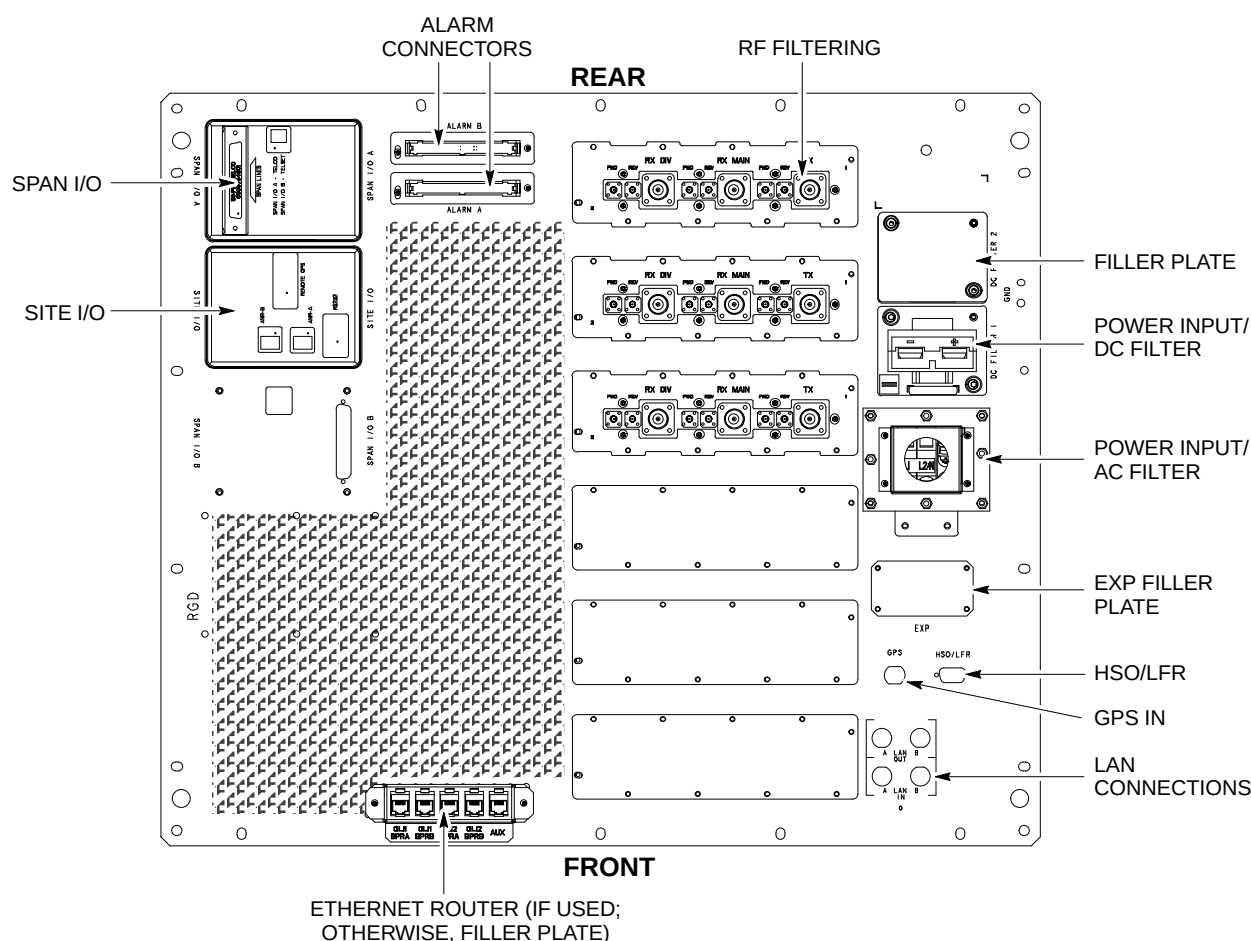
The BTS frame houses the fan modules, Small CDMA Channel Processor (SCCP) shelf, RF Power Amplifier modules, PA trunking modules, 2:1 combiners.

RF filtering includes: DRF – Duplexers with TX Filter, RX Filter, and Diversity RX Filter and TRF – Non-Duplexed TX Filter, RX Filter, and Diversity RX Filter.

Power system components include an AC Power Input/Filter, DC Filters, +27 Vdc Power Distribution Assembly (PDA).

Figure 1-2 and Figure 1-3 show the location of the internal assemblies and Field Replaceable Units (FRU). A brief description of each item is found in the following paragraphs.

Figure 1-3: I/O Interconnect Plate



ti-CDMA-WP-00214-v01-ildoc-ftw

DC Power Distribution Assembly (PDA)

Both rectifier output voltage and back-up battery voltage are routed to the PDA (Figure 1-3) where they are combined into system DC bus voltage. The PDA provides distribution of DC power and system DC bus protection from the loads with MAIN BREAKER and the smaller post-distribution circuit breakers. MAIN BREAKER permits removal of *all* frame loading from the bus. The 13 post-distribution circuit breakers permit removal of individual loads.

Filter/Combiner Shelf (Bandpass Filters or 2:1 Combiners)

The filter/combiner shelf (Figure 1-3) holds the transmit bandpass filters or 2:1 combiners, depending on system configuration.

Span I/O Board

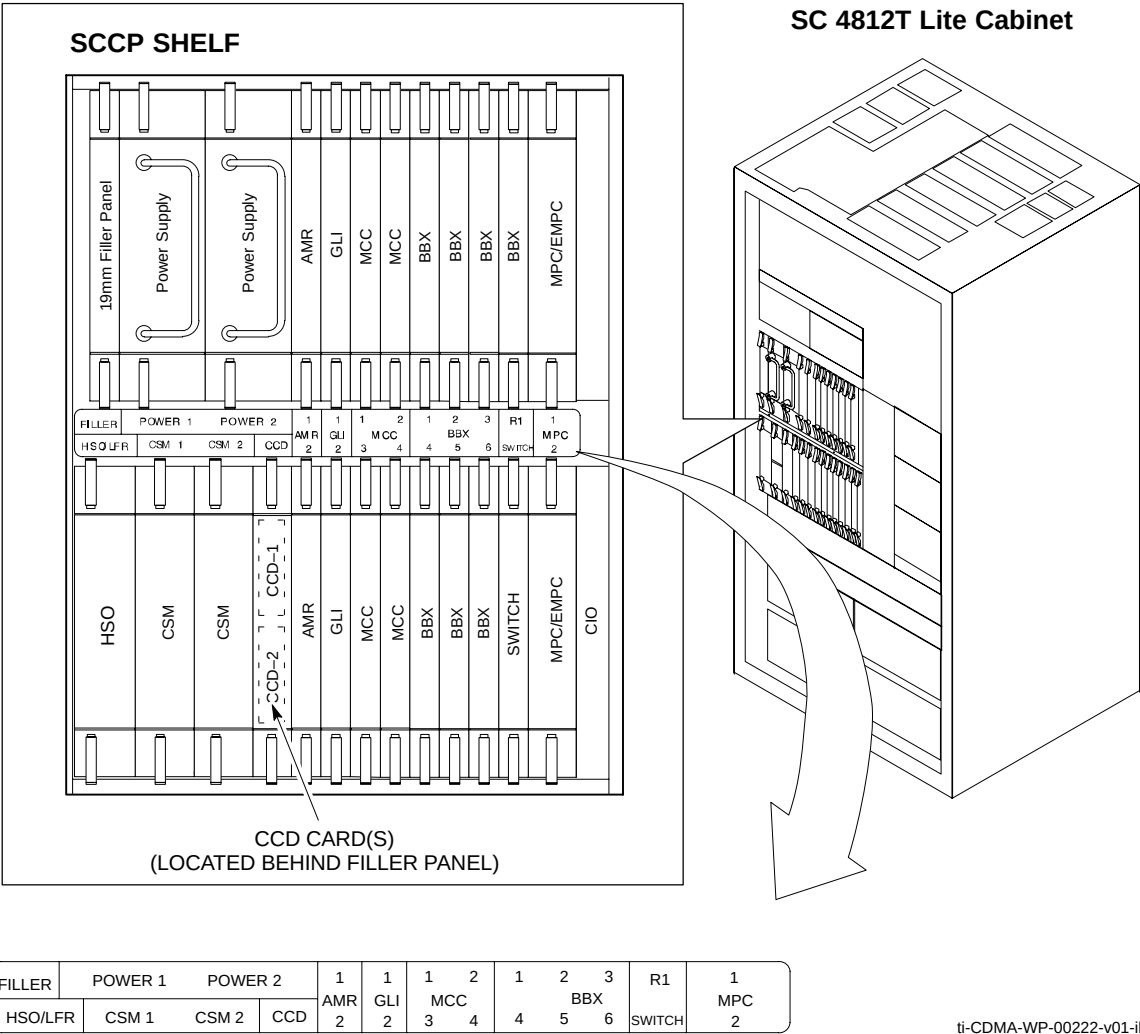
The span I/O board (Figure 1-3) provides the span line interface to the SCCP backplane.

Small CDMA Channel Processor (SCCP) Shelf

The SCCP shelf has provisions for the following types and quantities of modules (Figure 1-3 and Figure 1-4):

- Alarm Monitoring and Reporting (AMR) cards (2)
- Broad Band Transceiver, second generation or 1X, (BBX2 or BBX-1X) cards, primary (6)
- BBX2 or BBX-1X card, redundant (1)
- CDMA Clock Distribution (CCD) cards (2)
- Clock Synchronization Manager (CSM) on two cards (one with GPS receiver, if ordered)
- Combiner Input/Output (CIO) card (1)
- Fan modules (2)
- Filler panel (as required)
- Group Line Interface, second generation, (GLI2) cards (2)
- High Stability Oscillator (HSO)/Low Frequency Receiver (LFR) card (Optional) (1)
- Multi-coupler Preselector Cards (MPC) (2 per starter frame; 1 per companion frame)
- Expansion Multi-coupler Preselector Card (EMPC) (1 per companion frame)
- Multi-Channel CDMA (MCC8E, MCC24E, or MCC-1X) cards (4)
- Power supply cards (2)
- Switch card (1)

Figure 1-4: SSCP Shelf



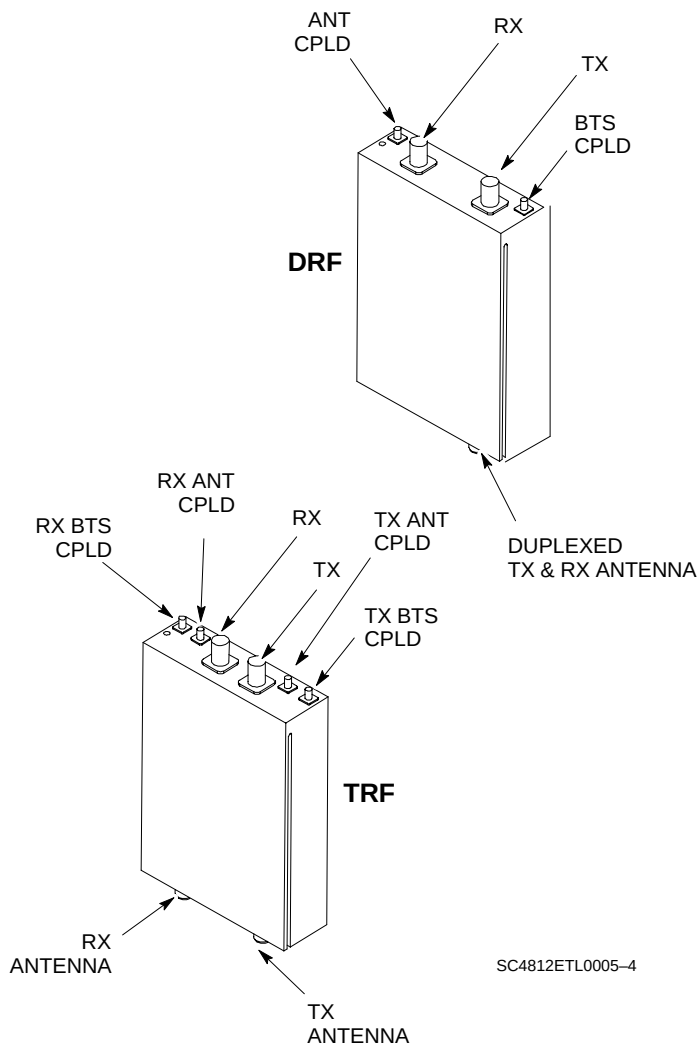
2:1 Combiners

In the SC4812T Lite BTS, one 2:1 combiner is used per sector to combine the trunked LPA-amplified TX signals for two carriers into one signal for input to the applicable sector DRDC or TRDC.

Transmit & receive, non-duplexed, Receive filter, Dual Directional Coupler (TRF)

TRFs provide separate, bandpass-filtered sector transmit and receive paths. When TRFs are used, separate transmit and receive antennas are required for each sector. As with DRFs, dual directional couplers for each antenna path are incorporated in TRFs to permit signal monitoring by the RFDS.

Figure 1-5: DRF and TRF Details



SCCP Cage Configuration and 1X Devices

SC 4812T Lite frames have one SCCP cage which will support up to four MCC cards and six BBX cards.

MCC Cards

A BTS may be configured with a mix of MCC-8E, MCC-24E, and MCC-1X cards. Any SCCP cage MCC card slot will support any of the three MCC types. For 1X capability under R16.0, at least one MCC card must be an MCC-1X which can be installed in any MCC card slot. In a BSS operating with Software Release 2.16.0.84.3 and higher, MCC-1X cards will support IS-95A and B traffic as well as CDMA2000 1X. When operating with Software Release 2.16.0.5x.x, the MCC-1X cards do not support IS-95A/B operation. For additional software release compatibility and capability information, contact the local Motorola account team.

BBX Cards

Up to six BBX cards of mixed BBX2s and BBX-1Xs can also be supported. SCCP cage BBX2 card slots 1 through 6 are carrier- and sector-dependent. As a result, the BBX slots dedicated to the sectors for one carrier should be populated with the same type of cards. Refer to Table 1-6 for BBX card slot carrier and sector correlations.

The SCCP cage R1 card slot is dedicated to the *redundant* BBX. This slot will support either a BBX2 or a BBX-1X. If a cage has BBX-1X carriers, the redundant BBX (BBXR) *must* be a BBX-1X card to provide 1X redundancy.

BBX-1X and BBX2 Interchangeability

In a BSS operating with R16.0 software, BBX-1X cards can be used as direct replacements for BBX2 cards; however, *different types of BBXs should not be mixed on the same carrier*. Therefore, if a BBX2 card is replaced with a BBX-1X, all remaining BBX2 cards for the carrier supported by the replaced card must also be replaced with BBX-1X cards.

BTS Sector Configurations

There are a number of ways to configure the BTS frame. Table 1-5 outlines the basic requirements. For more detailed information also see Table 1-6, Figure 1-6 and Figure 1-7. Bandpass filters are used for single-carrier configurations and two-carrier systems when carriers are either *adjacent* or *not adjacent*

Table 1-5: BTS Sector Configuration			
Number of Carriers	Number of Sectors	Channel Spacing	Filter Requirements
1	3	N/A	Bandpass Filter or 2:1 Combiner
2	3	Adjacent or Non-adjacent	Bandpass Filter
2	3	Non-adjacent	2:1 Combiner

The matrix in Table 1-6 shows the correlation between the various sector configurations and BBX cards.

Table 1-6: Sector Configurations

Configuration	Description						
1	3-Sector / 1 Carrier						
	The configuration below maps RX and TX with bandpass filters for a 3-sector/1-carrier frame.						
	ANT 1A	ANT 2A	ANT 3A	ANT 1B	ANT 2B	ANT 3B	
	TX1 / RX1A	TX2 / RX2A	TX3 / RX3A	RX1B	RX2B	RX3B	Carrier #
2	BBX-1	BBX-2	BBX-3	BBX-1 (diversity RX)	BBX-2 (diversity RX)	BBX-3 (diversity RX)	1
	3-Sector / 1 Carrier						
	The configuration below maps RX and TX with 2:1 combiners for 3-sector/1-carrier frames in <i>companion</i> configuration.						
	ANT 1A	ANT 2A	ANT 3A	ANT 1B	ANT 2B	ANT 3B	
3	TX1 / RX1A	TX2 / RX2A	TX3 / RX3A				Carrier #
	BBX-1	BBX-2	BBX-3				1
	NOTE						
	Diversity RX (RX1B, 2B, and 3B) is received from the opposite companion frame through RX EXPANSION connectors 1B, 2B, and 3B.						
4	Diversity RX is provided to the opposite companion frame from antenna connectors 1A, 2A, and 3A through RX EXPANSION connectors 1A, 2A, and 3A.						
	3-Sector / 2-ADJACENT or 2-NON-ADJACENT Carriers						
	The configuration below maps RX and TX with bandpass filters for 3-sectors/2-carriers for both <i>adjacent</i> and <i>non-adjacent</i> channels.						
	ANT 1A	ANT 2A	ANT 3A	ANT 1B	ANT 2B	ANT 3B	
4	TX1 / RX1A	TX2 / RX2A	TX3 / RX3A	TX4 / RX1B	TX5 / RX2B	TX6 / RX3B	Carrier #
	BBX-1	BBX-2	BBX-3	BBX-1 (diversity RX)	BBX-2 (diversity RX)	BBX-3 (diversity RX)	1
	BBX-4 (RX)	BBX-5 (RX)	BBX-6 (RX)	BBX-4 (TX & diversity RX)	BBX-5 (TX & diversity RX)	BBX-6 (TX & diversity RX)	2
	3-Sector / 2-NON-ADJACENT Carriers						
4	The configuration below maps RX and TX with 2:1 combiners for 3-sectors/2-carriers for <i>non-adjacent</i> channels for frames in <i>companion</i> configuration.						
	ANT 1A	ANT 2A	ANT 3A	ANT 1B	ANT 2B	ANT 3B	
	TX1 & 4 / RX1A & 4A	TX2 & 5 / RX2A & 5A	TX3 & 6 / RX3A & 6A				Carrier #
	BBX-1	BBX-2	BBX-3				1
4	BBX-4	BBX-5	BBX-6				2
	NOTE						
	Diversity RX (RX1B, 2B, 3B and RX4B, 5B, 6B) is received from the opposite companion frame through RX EXPANSION connectors 1B, 2B, and 3B (see NO TAG or NO TAG).						
	Diversity RX is provided to the opposite companion frame from antenna connectors 1A, 2A, and 3A through RX EXPANSION connectors 1A, 2A, and 3A.						

Figure 1-6: SC4812T Lite Stand-alone PA Configuration with Bandpass Filters

NOTE	See Table 1-6 Configuration Numbers 1 and 3.
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Bandpass Filters
3-Sector

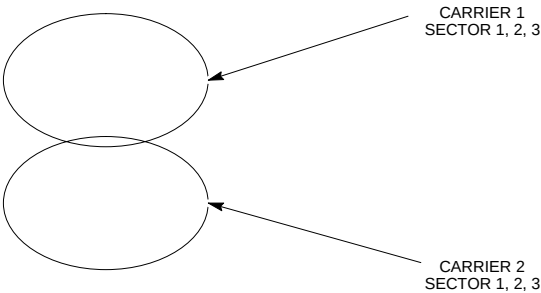
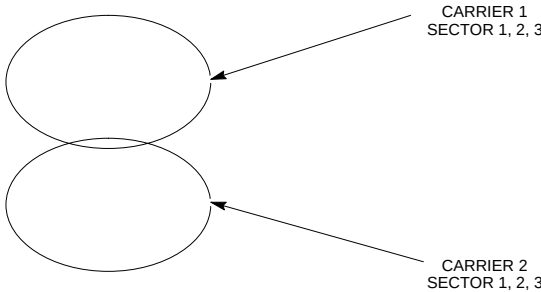


Figure 1-7: SC4812T Lite Companion Frame LPA Configuration with 2:1 Combiners

NOTE	See Table 1-6 Configuration Numbers 2 and 4.
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2:1 Combiners
3-Sector



SC4812ETL0011-4

[illegible]

Chapter 2

Preliminary Operations

Preliminary Operations: Overview

Introduction

This section first verifies proper frame equipage against the site-specific documentation supplied for each BTS application. This includes verifying module placement, jumper, and dual in-line package (DIP) switch settings. Next, pre-power up and initial power-up procedures are presented. Finally, power-down and normal power-up procedures are covered.

Cell-site Types

Sites are configured as omni or up to 3-sectors – one or two carriers. Each type has unique characteristics and must be optimized accordingly.

CDF/NECF

The Configuration Data File (CDF) or Network Element Configuration File (NECF) contains site type and equipage data information and passes it directly to the LMF during optimization. The number of modem frames, number and types of BBX and MCC boards, and linear power amplifier assignments are some of the equipage data included in the CDF/NECF.

NOTE	Be sure that the correct bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files are used for the BTS. These should be the CDF/NECF files that are provided for the BTS by the CBSC. Failure to use the correct CDF/NECF files can cause system errors. <u>Failure to use the correct CDF/NECF files to log into a live (traffic carrying) site can shut down the site.</u>
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Site Equipage Verification

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

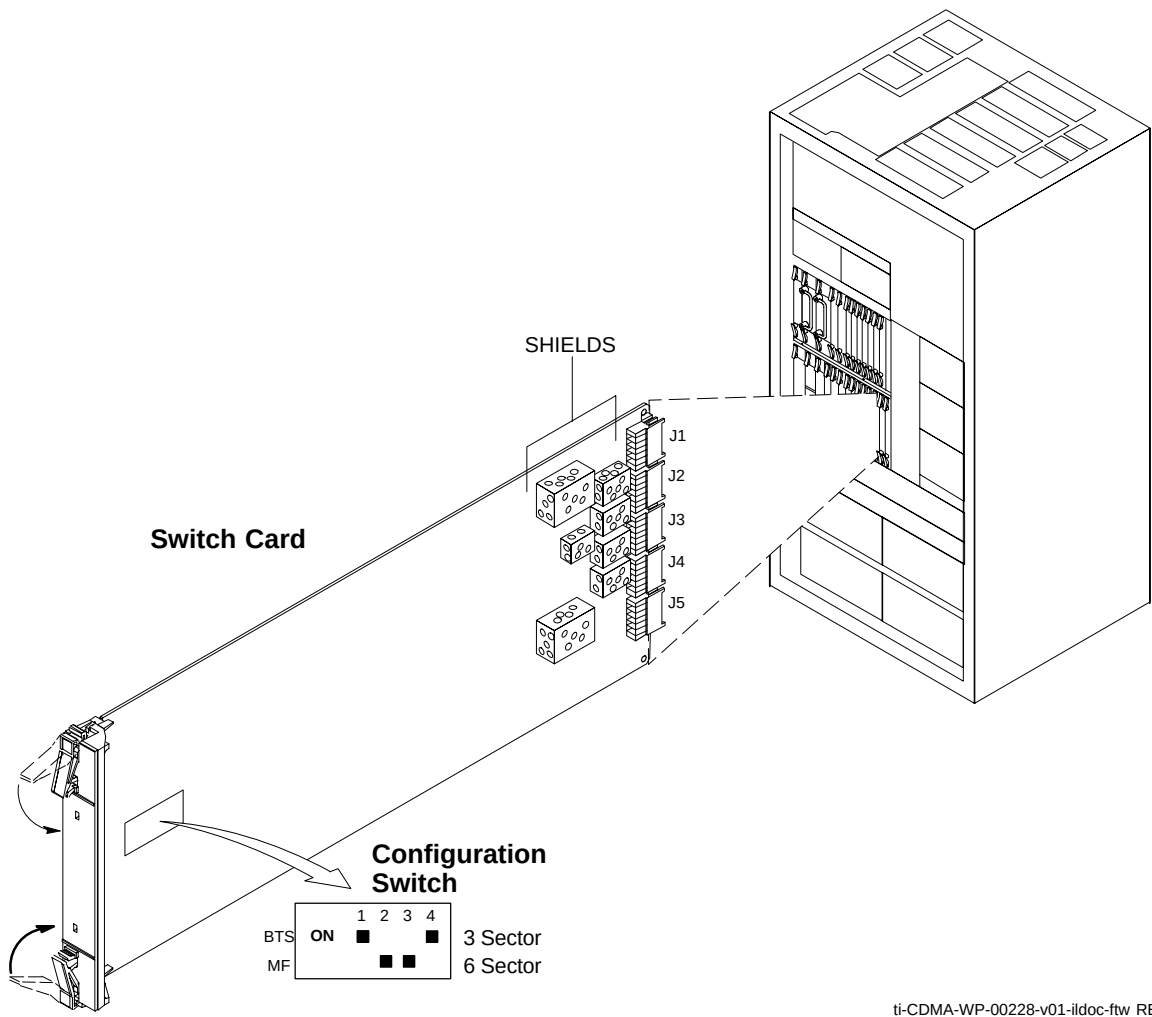
CAUTION	Always wear an approved anti-static wrist strap while handling any circuit card/module to prevent damage by ESD. After removal, the card/module should be placed on a conductive surface or back into the anti-static packaging in which it was shipped.
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Initial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

Table 2-1: Initial Installation of Boards/Modules	
Step	Action
1	Refer to the site documentation and, if it was not previously done, slide all boards and modules into the appropriate shelves as required. DO NOT SEAT the boards and modules at this time.
	NOTE On 800 MHz systems, the Switch Card has a configuration switch that must match the site configuration (see Figure 2-1).
2	As the actual site hardware is installed, record the serial number of each module on a “Serial Number Checklist” in the site logbook.

Figure 2-1: 800 MHz Configuration Switch Card

NOTE Configuration Switch (shown in Figure 2-1) is a feature on the newer versions of the 800 Mhz switch card (some earlier cards do not have the switch). Configuration shown is for 3 Sector BTS. Switch 1 chooses BTS or MF. Switch 4 chooses 3-sector or 6 sector. Switches 2 and 3 are not used.



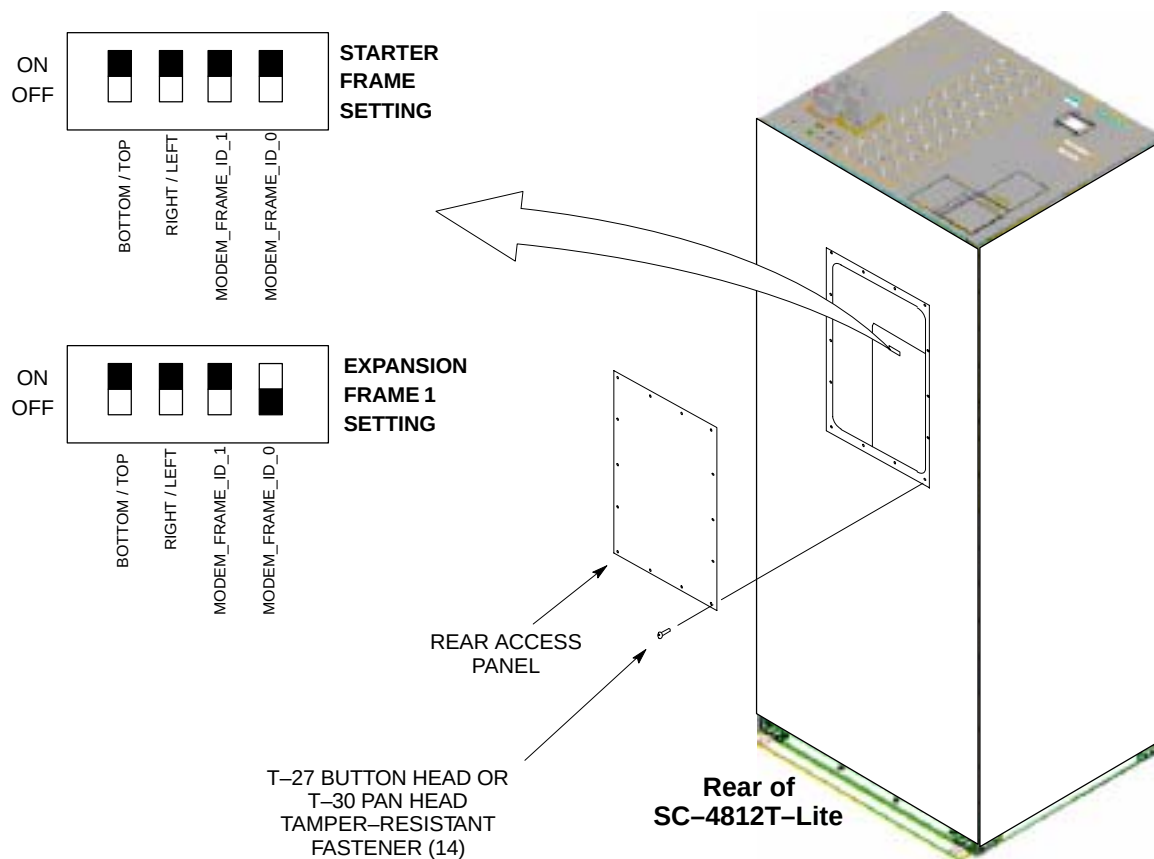
ti-CDMA-WP-00228-v01-ildoc-ftw REF

Setting Frame SCCP Configuration Switch

The backplane configuration switch is located behind the frame rear access panel. It must be set for the frame type as shown in Figure 2-2.

The switch setting must be verified and set before power is applied to the BTS equipment.

Figure 2-2: Backplane DIP Switch Settings



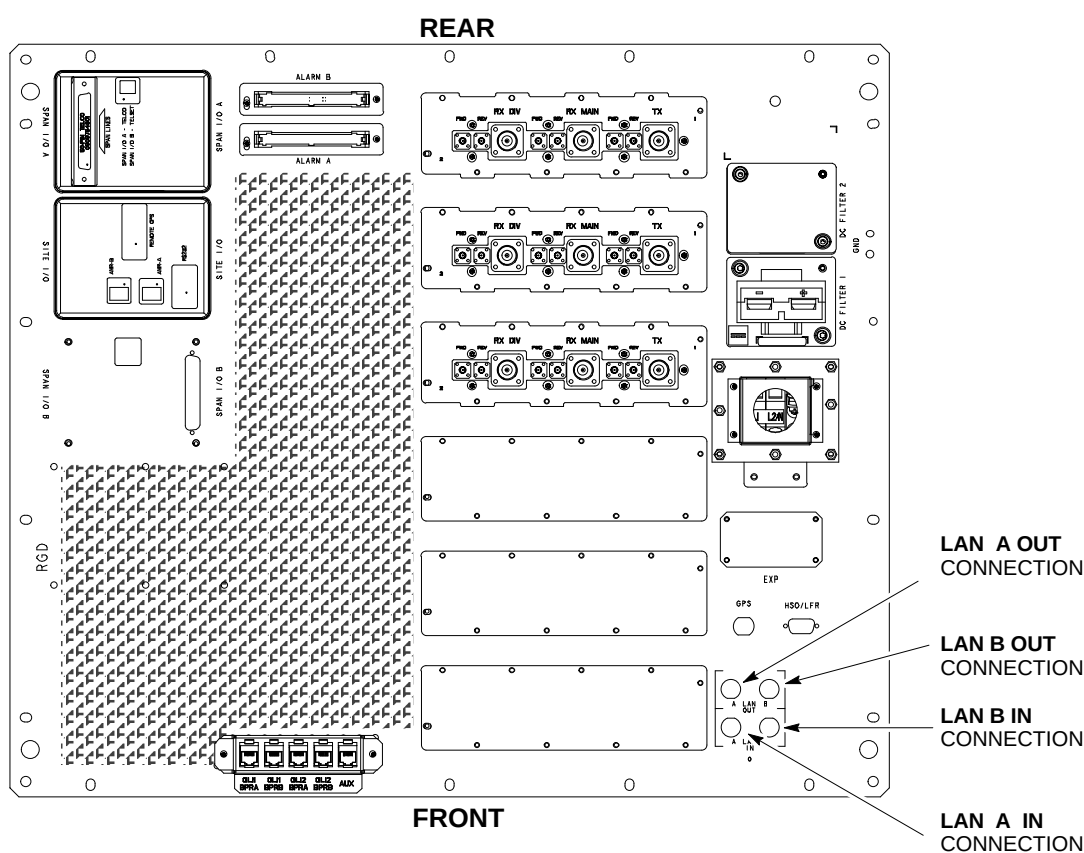
Ethernet LAN

Ethernet LAN Termination

For proper operation, each end of the primary and redundant BTS Ethernet Local Area Networks (LAN) must be terminated with a 50-ohm load. For a BTS consisting of a stand-alone or an expansion frame, this is done by placing 50-ohm triaxial terminations on the LAN A and B external IN and OUT connectors.

Check the LAN A and B external IN and OUT connectors on the I/O plate of each frame (see Figure 2-3) and be sure terminations are installed on all the uncabled external LAN connectors.

Figure 2-3: External Ethernet LAN Connectors



ti-CDMA-WP-00214-v01-ildoc-ftw REF

Pre-Initial Power-up Tests

Introduction

The following information is used to check for any electrical short circuits and to verify the operation and tolerances of each frame at the site before applying power *for the first time*. It contains instructional information on the proper *initial* power up procedures for the SC4812T Lite stand-alone and expansion frames for both the North American version and the International version. If directions are different for either version, they are called out within the procedure. Please pay attention to all cautions and warning statements in order to prevent accidental injury to personnel.

NOTE	Unless otherwise noted, all procedures in this section are to be followed for <i>each frame</i> at a site.
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Required Tools

The following tools are used in the procedures.

- Clamp-on DC current probe (600 A capability with jaw size to accommodate 2/0 cable).
- Digital Multimeter (DMM) with standard 2mm (.080”) tip probes
- Hot Air Gun – (optional for part of the Alarm Verification)

Cabling Inspection

Using the site-specific documentation generated by Motorola Systems Engineering, verify that the following cable systems are properly connected:

- Receive RF cabling – up to six RX cables
- Transmit RF cabling – up to six TX cables
- For expansion frame installations, inter-frame RX diversity cabling – six RX cables

NOTE	For DC power applications (+27 V): • The positive power cable is red. • The negative power cable is black. (The black power cable is at ground potential.)
-------------	---

Initial Inspection and Setup

Table 2-2: Initial Inspection and Setup	
Step	Action
1	Be sure that the facility circuit breaker controlling external AC power supplied to the frame is set to OFF .
2	Verify that the external AC power supply is correctly connected to the ACLC input by performing the procedure in Table 2-4.

DC Power System Pre-power Application Test

Before applying any power to the BTS frame, follow the procedure in Table 2-3 to verify there are no shorts in the DC power distribution system.

NOTE

The procedure in Table 2-3 is required only on initial frame power-up or following maintenance when any major power components (e.g., ACLC, DC PDA, Meter Alarm Panel) were replaced or internal DC power cables were disconnected.

Table 2-3: DC Power System Pre-Power Application Test

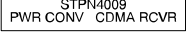
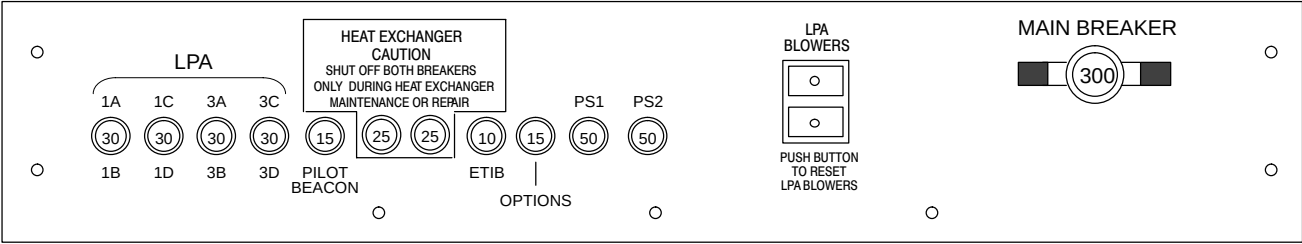
Step	Action
1	<i>Physically verify all AC power to the BTS is OFF and all DC PDA circuit breakers (Figure 2-4) are set to OFF (pulled out).</i>
2	On the DC PDA, set the MAIN BREAKER to the ON position by pushing it in. Resistance between the MAP (–) VOLT TEST POINT and the (–) AMP TEST POINT should measure between 300 Ω minimum 900 Ω maximum.
3	Before proceeding, be sure the SCCP shelf power/converter modules PS1 and PS2 are correct by verifying that the locking/retracting tabs appear as follows: –  (in +27 volt systems) ! CAUTION Using the incorrect type of power/converter modules will damage the module, the SCCP shelf, and other modules installed in the SCCP shelf.
4	NOTE In the following steps, if the DMM reads between 300 Ω minimum and 900 Ω maximum after inserting any board/module, a low impedance problem probably exists in that board/module. Replace the suspect board/module and repeat the test. If test still fails, isolate the problem before proceeding. Insert and lock the PS1 DC–DC converter module into its slot, and turn ON the PS1 DC circuit breaker on the DC PDA.
5	Resistance between the MAP (–) VOLT TEST POINT and the (–) AMP TEST POINT should typically increase as capacitors charge, finally measuring between 300 Ω minimum and 900 Ω maximum.
6	Repeat steps 4 and 5 for the PS2 converter module/circuit breaker and all other remaining modules in the SCCP shelf.
7	On the DC PDA, set the PA 1A–1B circuit breaker to the ON position <i>by pushing it in</i> , and repeat step 5.
8	Repeat step 7 for each of the three remaining PA circuit breakers.
9	<i>Carefully</i> reconnect each PA cable <i>one at a time</i>. Repeat step 5 after reconnecting each cable. – A typical response is that the ohmmeter will steadily climb in resistance as module input capacitors charge, finally indicating between 300 Ω minimum and 900 Ω maximum.
10	Set the Pilot Beacon, <i>both</i> Heat Exchanger, ETIB, and Options circuit breakers to ON <i>one at a time</i> . Repeat step 5 after pushing in each circuit breaker.
11	Set all DC PDA circuit breakers to OFF (pulled out).

Figure 2-4: DC PDA



SC4812TL0009-3

External AC Power Connection Verification

Following verification of frame DC power system integrity, external AC power connections must be verified. To accomplish this, the series of AC voltage measurements specified in Table 2-4 is required.

CAUTION	Failure to properly connect the external AC power cable will damage the surge protection module inside the ACLC.
----------------	--

Table 2-4: AC Voltage Measurements

Step	Action
1	NOTE This procedure is required only after external AC power wiring has been initially connected or removed and reconnected to the frame. Δ WARNING Ensure the frame is <i>unpowered</i> by setting the facility circuit breaker controlling external AC power supplied to the frame to OFF. <i>Physically verify all</i> DC PDA circuit breakers are set to OFF (pulled out), and <i>all</i> battery shelf circuit breakers are OFF (pulled out).
2	Open the ACLC circuit breaker access door, and set all ACLC circuit breakers to OFF (down).
3	Remove the four screws securing the ACLC front panel assembly, and remove the ACLC front panel assembly to gain access to the AC circuit breaker input terminals (NO TAG).
4	Apply external AC power to the frame by setting the facility circuit breaker to ON .
5	Δ WARNING <i>Do not</i> perform the following steps while wearing an anti-static wrist strap. Serious personal injury can result from accidentally shorting high voltage or high current circuits to ground. ! CAUTION North AMERICAN Cabinet only: If the AC voltages measured in the following steps exceed 120 V when measuring from terminals L1 or L2 to neutral or ground, STOP and DO NOT proceed until the cause of the higher voltages are determined. The frame will be damaged if the Main breaker is turned on with excessive voltage on the inputs. Measure the AC voltage from terminal L1 to neutral. North American Cabinet: – Voltage should be in the nominal range of 115 to 120 Vac. International Cabinet: – Voltage should be in the nominal range of 210 to 240 Vac.
6	Measure the AC voltage from terminal L1 to ground. North American Cabinet: – Voltage should be in the nominal range of 115 to 120 Vac. International Cabinet: – Voltage should be in the nominal range of 210 to 240 Vac.
7	Steps 7a through 7c apply to the North American cabinet only. If working on a International cabinet continue to step 8.

... continued on next page

Table 2-4: AC Voltage Measurements

Step	Action
7a	– Measure the AC voltage from terminal L2 to neutral on the North American cabinet. — Voltage should be in the nominal range of 115 to 120 Vac.
7b	– Measure the AC voltage from terminal L2 to ground on the North American cabinet. — Voltage should be in the nominal range of 115 to 120 Vac.
7c	! CAUTION If the AC voltages measured (on the North American cabinet) in the following step exceeds 240 V when measuring between terminals L1 and L2, STOP and DO NOT proceed until the cause of the higher voltages are determined. The frame will be damaged if the Main breaker is turned on with excessive voltage on the inputs. – Measure from terminal L1 to terminal L2. — Voltage should be in the nominal range from 208 to 240 Vac.
8	Remove external AC power from the frame by setting the facility circuit breaker to OFF .
9	Install the ACLC front panel assembly and secure with the four screws removed in step 1.
10	Apply external AC power to the frame by setting the facility circuit breaker to ON .

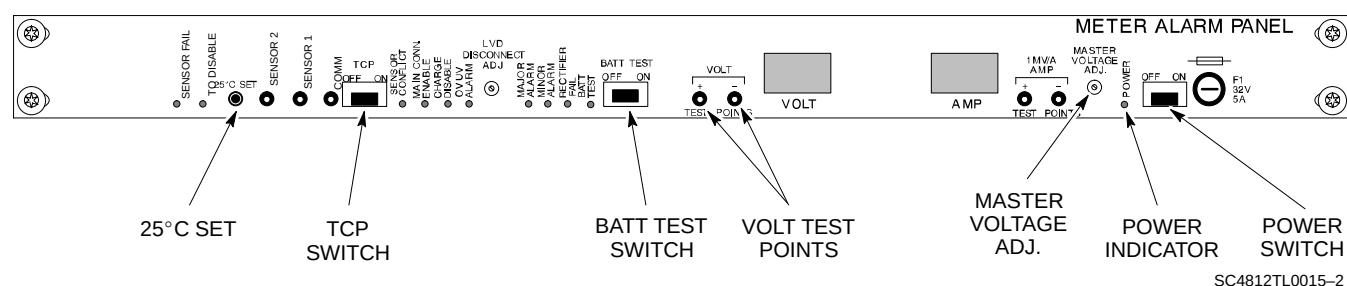
Applying AC Power

Once the external AC power connections are verified, AC power may be applied internally to the frame. Table 2-5 provides the procedure for applying internal AC power.

Table 2-5: Applying Internal AC Power

Step	Action
1	Be sure the requirements of Table 2-4 for AC input power connection verification have been met.
2	Be sure <i>all</i> DC PDA circuit breakers are set to OFF (pulled out), <i>all</i> ACLC front-panel circuit breakers are OFF (down), and <i>all</i> battery shelf circuit breakers are OFF (pulled out).
3	Be sure the MAP power switch, TCP switch, and BATT TEST switch are all set to OFF .
4	<i>If it has not already been done</i> , set the facility circuit breaker supplying AC power to the frame to ON .
5	Set the ACLC MAIN circuit breaker ON . - For the North American cabinet: Observe that all eight (8) green LEDs on the front of the ACLC are illuminated (NO TAG). - For the International cabinet: Observe that all four (4) green LEDs on the front of the ACLC are illuminated (NO TAG).
6	On the ACLC, set RECT. 1/3 and then RECT. 2/4 branch circuit breakers ON . All the installed rectifier modules (NO TAG) will start up, and the green DC and PWR LEDs should light on each.
7	Set the MAP power switch to ON . The MAP VOLT display should read 27.4 ± 0.2 VDC with the TCP switch OFF . ! CAUTION Once power is applied to the MAP, be careful not to short either of the VOLT TEST POINTS to ground. Failure to comply will result in severe damage to the MAP.
8	On the MAP, set the TCP switch (Figure 2-5) to ON . Verify no alarm LEDs are lighted on the MAP. NOTE Depending on battery compartment temperature, the rectifier voltage displayed on the MAP VOLT indicator may change by as much as ± 1.5 V when the TCP is set to on.
9	Check the rectifier current bar graph displays (green LED display on the rectifier module). None should be lighted at this time.
10	If batteries are fitted, set the ACLC HEATER circuit breaker to ON . NOTE The GFCI AC circuit breaker should remain OFF <i>unless</i> the GFCI outlet is in use.

Figure 2-5: Meter Alarm Panel (MAP)



DC Power Application and Testing

Table 2-6 lists the step-by-step instructions for applying DC power and ensuring the DC power system components are correctly functioning.

Table 2-6: DC Power Application and Tests	
Step	Action
1	Be sure <i>all</i> DC PDA and battery shelf circuit breakers are OFF (pulled out).
2	Be sure the procedures in Table 2-3 (if applicable) and Table 2-5 have been performed.
3	! CAUTION When measuring voltage at the VOLT TEST POINTS, be careful not to short either of the test points to ground. Failure to comply will result in severe damage to the MAP. Measure voltage at the MAP VOLT TEST POINTS while pressing the 25° C SET button (Figure 2-5). The voltage should read 27.4 ± 0.2 Vdc. Adjust with the MASTER VOLTAGE ADJ. on the MAP, if necessary, to obtain an indicated 27.4 ± 0.2 Vdc. Release the 25° C SET button.
4	Depending on the ambient temperature, the voltage reading may now change by up to ± 1.5 V compared to the reading just measured. If it is cooler than 25°C, the voltage will be higher, and if it is warmer than 25°C, the voltage will be lower.
5	Inside the battery compartment, measure the voltage between the cable connection point at the bottom of the + (red) battery bus bar and chassis ground, observing that the polarity is correct. The voltage should be the same as the measurement in step 4.
6	Measure the voltage between the + (red) and – (black) battery bus bars in the battery compartment. Place the probe at the bottom of the bus bars where the cables are connected. The DC voltage should measure the same as in step 4.
7	Close (push in) DC PDA MAIN BREAKER.
8	On the DC PDA (Figure 2-4), set the PS1 and PS2 circuit breakers to the ON position by pushing them in one at a time while observing the rectifier output current indicated on the MAP AMP display. The display should indicate between 20 and 60 amps.

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Table 2-6: DC Power Application and Tests

Step	Action
9	<i>On the DC PDA</i>), set the <i>remaining</i> circuit breakers to the ON position by pushing them in one at a time <i>in the following sequence</i>: 1. PA (four circuit breakers, labeled 1A–1B through 3C–3D). 2. HEAT EXCHANGER (two circuit breakers) 3. ETIB 4. PILOT BEACON 5. OPTIONS
10	Confirm that the MAP AMP display continues to indicate between 20 and 60 amps during the initial power application. NOTE No battery charging or heavy RF loading is present at this point.
11	<i>If the frame is not equipped with the pilot beacon option</i>, set the PILOT BEACON circuit breaker to OFF.

Battery Charge Test (Connected Batteries)

Table 2-7 lists the step-by-step instructions for testing the battery charging performance.

Table 2-7: Battery Charge Test (Connected Batteries)

Step	Action
1	Close the battery shelf circuit breakers (NO TAG) for connected batteries <i>only</i>. This process should be completed quickly to avoid individual battery strings drawing excess charge current NOTE If the batteries are sufficiently discharged, the battery circuit breakers may not engage individually due to the surge current. If this condition occurs, disconnect the batteries from the 27Vdc bus by setting the MAP power switch to OFF, and then engage all the connected battery circuit breakers. The MAP power switch should then be turned ON.
2	Using the clamp-on DC current probe and DMM, measure the current in each of the battery string connections to the battery bus bars. The charge current may initially be high but should quickly reduce in a few minutes if the batteries have a typical new-battery charge level.

. . . continued on next page

Table 2-7: Battery Charge Test (Connected Batteries)

Step	Action
	NOTE The MAP AMP display will indicate the total current output of the rectifiers during this procedure. As an alternative, the bar graph meters on the AC rectifier modules can be used as a rough estimate of the total battery charge current. Each rectifier module bar graph has eight (8) LED elements to represent the output current. Each illuminated LED element indicates that approximately 12.5% (1/8 or 8.75 Amps) of an individual rectifier's maximum current output (70 Amps) is flowing. RECTIFIER BAR GRAPH EXAMPLE: Question: A system fitted with three (3) rectifier modules each have three bar graph LED elements illuminated. What is the total output current into the batteries? Answer: Each bar graph is indicating approximately 12.5% of 70 amps, therefore, 3 x 8.75 equals 26.25 amps per rectifier. As there are three rectifiers, the total charge current is equal to (3 x 26.25 A) 78.75 amps. This charge current calculation is only valid when the RF and PA compartment electronics are not powered on, and the RF compartment heat exchanger is turned off. This can only be accomplished if the DC PDA MAIN BREAKER is set to OFF.
3	The current in each string should be approximately equal (within ± 5 amps).
4	Allow a few minutes to ensure that the battery charge current stabilizes before taking any further action. Recheck the battery current in each string. If the batteries had a reasonable charge, the current in each string should reduce to less than 5 amps.
5	Recheck the DC output voltage. It should remain the same as measured in step 4 of the frame DC Power Application and Test (Table 2-6). NOTE If discharged batteries are installed, the MAP AMP display may indicate approximately 288 amps for a two-carrier frame (four rectifiers) or 216 amps for a single-carrier frame (three rectifiers). Alternately, all bar graph elements may be lighted on the rectifiers during the charge test. Either indication shows that the rectifiers are at full capacity and are rapidly charging the batteries. It is recommended in this case that the batteries are allowed to charge and stabilize as in the above step before commissioning the site. This could take several hours.

Battery Discharge Test

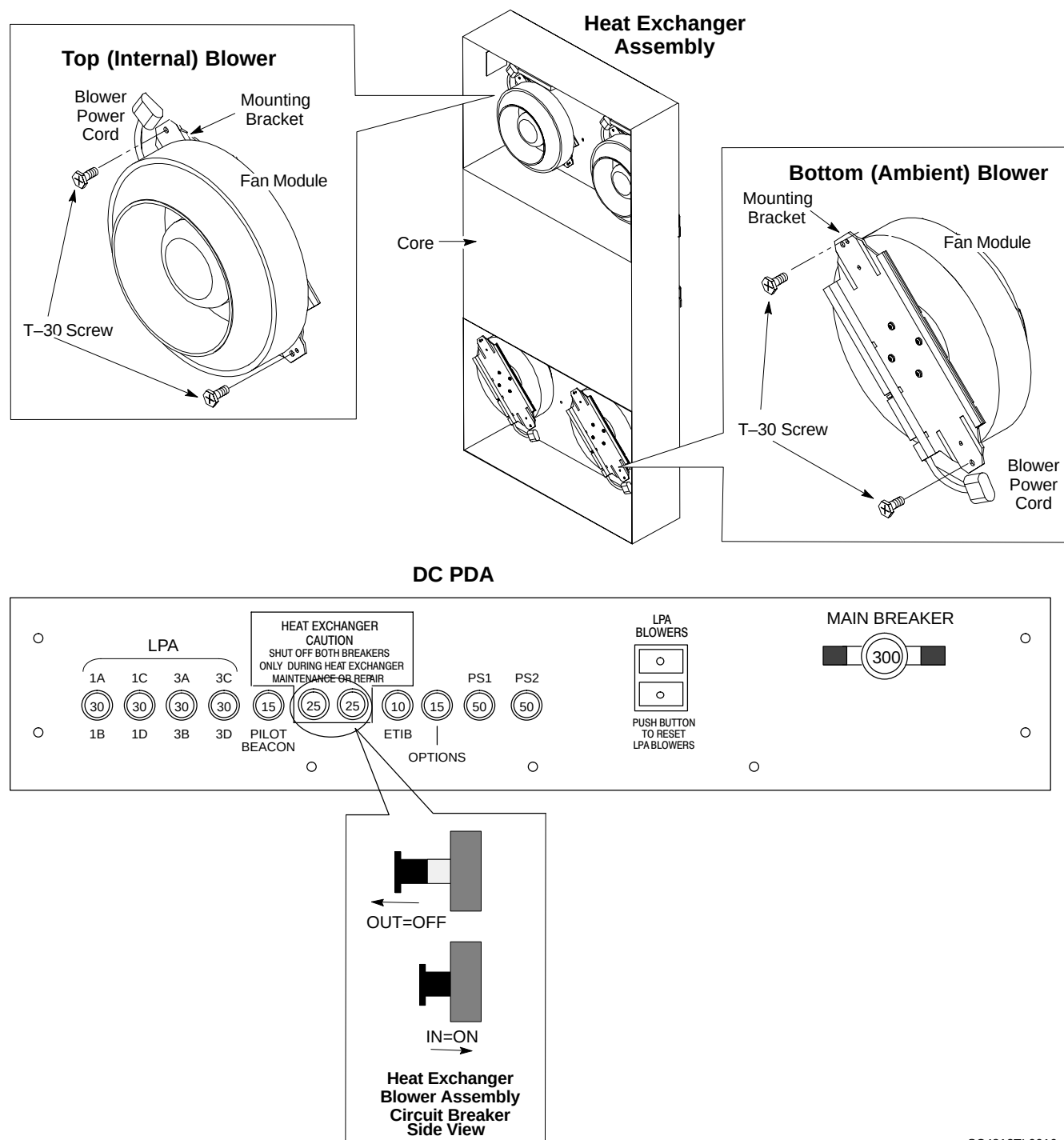
Perform the test procedure in Table 2-8 only when the battery current is less than 5 Amps per string. Refer to Table 2-7 on the procedures for checking current levels.

Table 2-8: Battery Discharge Test

Step	Action
1	Turn the BATT TEST switch on the MAP ON (Figure 2-5). The rectifier output voltage and current should decrease by approximately 10% as the batteries assume the load. Alarms for the MAP may occur.
2	Measure the individual battery string current using the clamp-on DC current probe and DMM. The battery discharge current in each string should be approximately the same (within ± 5 amps).
3	Turn BATT TEST switch OFF .

CAUTION Failure to *turn off* the MAP BATT TEST switch before leaving the site will result in low battery capacity and reduce battery life.

Figure 2-6: Heat Exchanger Blower Assembly and Circuit Breakers



SC4812TL0016-3

Power Removal

Introduction

Power removal from an SC4812T Lite BTS frame is accomplished in the following two-stage sequence:

1. DC power removal
2. AC power removal

Some maintenance, upgrade, or other activities may only require removing DC power. In those situations where *all* power must be removed from a frame, shutting down AC power will also be required.

Remove DC Power

If it becomes necessary to remove DC power from the frame, refer to Figure 2-4 and follow the procedure in Table 2-9.

Table 2-9: DC Power Removal	
Step	Action
1	Set all DC PDA circuit breakers to OFF (pulled out) in the following sequence: 1. PA (four circuit breakers, labeled 1A–1B through 3C–3D) 2. PILOT BEACON 3. HEAT EXCHANGER (two circuit breakers) 4. ETIB 5. OPTIONS 6. PS1 and PS2 7. MAIN BREAKER
2	Δ WARNING The surge capacitors in the DC PDA will store a large electrical charge for long periods of time. Failure to discharge these capacitors as specified in this step could result in serious personal injury or damage to equipment. On the DC PDA, set the PS1 and PS2 circuit breakers to ON (pushed in), and <i>wait at least 30 seconds</i>.
3	Set the DC PDA PS1 and PS2 circuit breakers to OFF .
4	Set the MAP power switch to OFF .

AC Power Removal

If it is necessary to remove *all* power from a frame, refer to NO TAG or NO TAG, and follow the procedure in Table 2-10.

Table 2-10: AC Power Removal	
Step	Action
1	Remove DC power from the frame by following the procedure in Table 2-9.
2	Set all ACLC circuit breakers to OFF (down) in the following sequence: 1. GFI 2. HEATER 3. RECT. 2/4 4. RECT. 1/3 5. MAIN
3	Set the facility circuit breaker controlling external power to the frame to OFF .

Power Application – Normal Power-up

Power Application Procedures

After the first power application, applying power to a BTS frame does not require performing the voltage and resistance measurements called out in the initial power-up procedure. The only exception to this is after maintenance when any major power system components were replaced. Major power system components include:

- ACLC
- DC PDA
- MAP
- Internal DC power cables

Normal power application to a BTS frame is accomplished in the following two-stage sequence:

1. AC power application
2. DC power application

Applying Internal AC Power

To apply AC power to a BTS frame, refer to NO TAG or NO TAG, and follow the procedure in Table 2-11.

Table 2-11: Apply AC Power to BTS Frame

Step	Action
1	If the external AC power leads for the BTS frame were disconnected and reconnected, perform the procedure in Table 2-4 before proceeding further.
2	Be sure <i>all</i> DC PDA circuit breakers are set to OFF (pulled out), <i>all</i> ACLC front-panel circuit breakers are OFF (down), and <i>all</i> battery shelf circuit breakers are OFF (pulled out).
3	Be sure the MAP power switch, TCP switch, and BATT TEST switch are all set to OFF (Figure 2-5).
4	<i>If it has not already been done</i> , set the facility circuit breaker supplying AC power to the frame to ON .
5	Set the ACLC MAIN circuit breaker ON . – For the North American cabinet: Verify that all eight (8) green LEDs on the front of the ACLC are illuminated (NO TAG). – For the International cabinet: Verify that all four (4) green LEDs on the front of the ACLC are illuminated (NO TAG).
6	On the ACLC, set RECT. 1/3 and then RECT. 2/4 branch circuit breakers ON . – All the installed rectifier modules (NO TAG) will start up, and the green DC and PWR LEDs should light on each. NOTE In a BTS configured for single-carrier operation (rectifier #4 not installed), a minor alarm may be generated if the RECT. 2/4 circuit breaker is engaged before the RECT. 1/3 circuit breaker.

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Table 2-11: Apply AC Power to BTS Frame

Step	Action
7	Set the MAP power switch to ON. – The MAP VOLT display should read 27.4 ± 0.2 VDC with the TCP switch set to OFF. ! CAUTION Once power is applied to the MAP, be careful not to short either of the VOLT TEST POINTS to ground. Failure to comply will result in severe damage to the MAP.
8	On the MAP, set the TCP switch (Figure 2-5) to ON. – Verify no alarm LEDs are lighted on the MAP. NOTE Depending on battery compartment temperature, the rectifier voltage displayed on the MAP VOLT indicator may change by as much as ± 1.5 V when the TCP is set to on.
9	Check the rectifier current bar graph displays (green LED display on the rectifier module). – None should be lighted at this time.
10	If batteries are fitted, set the ACLC HEATER circuit breaker to ON. NOTE The GFCI AC circuit breaker should remain OFF unless the GFCI outlet is in use.

Apply DC Power

Refer to Figure 2-4 and follow the procedure in Table 2-12 to apply DC power to a BTS frame.

Table 2-12: Apply DC Power to BTS Frame

Step	Action
1	Be sure <i>all</i> DC PDA and battery shelf circuit breakers are OFF (pulled out).
2	<i>If it has not already been done</i> , apply AC power to the frame by following the procedure in Table 2-11.
3	Close (push in) DC PDA MAIN BREAKER.
4	<i>On the DC PDA (Figure 2-4)</i>, set the PS1 and PS2 circuit breakers to the ON position by pushing them in one at a time while observing the rectifier output current indicated on the MAP AMP display. – The display should indicate between 20 and 60 amps.
5	<i>On the DC PDA</i>, set the <i>remaining</i> circuit breakers to the ON position by pushing them in one at a time <i>in the following sequence</i>: 1. PA (four circuit breakers, labeled 1A–1B through 3C–3D) 2. HEAT EXCHANGER (two circuit breakers) 3. ETIB 4. (If Pilot Beacon option is installed) PILOT BEACON 5. OPTIONS

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Table 2-12: Apply DC Power to BTS Frame

Step	Action
6	Confirm that the MAP AMP display continues to indicate between 20 and 60 amps during power application. NOTE No battery charging or heavy RF loading is present at this point.
7	If the frame is equipped with back–up batteries, close (push in) the battery shelf circuit breakers (NO TAG) for connected batteries <i>only</i>. This process should be completed quickly to avoid excess charge current draw by individual battery strings. NOTE If the batteries are sufficiently discharged, the battery circuit breakers may not engage individually because of surge current. If this condition occurs, disconnect the batteries from the 27Vdc bus by setting the MAP power switch to OFF, and then engage all the connected battery circuit breakers. The MAP power switch should then be turned ON.

Chapter 3

Optimization/Calibration

Introduction to Optimization and Calibration

Overview

This section describes procedures for isolating the BTS from the span lines, preparing and using the LMF, downloading system operating software, CSM reference verification/optimization, set up and calibration of the supported test equipment, transmit/receive path verification, using the RFDS, and verifying the customer defined alarms and relay contacts are functioning properly.

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.
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Optimization Process Summary

After a BTS is physically installed and the preliminary operations, such as power up, have been completed, the LMF is used to optimize the BTS. Companion frames must be optimized individually as separate BTSs. The basic optimization process consists of the following:

1. Download MGLI (GLI-*bts#*-1) with application code and data and then enable MGLI.

NOTE	GLIs may be GLI2s or GLI3s.
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2. Use the LMF status function and verify that all of the installed devices of the following types respond with status information: CSM, BBX, GLI, MCC8, and, if RFDS is installed, TSU or RFDS-1X RPROC. If a device is installed and powered up but is not responding and is colored gray in the BTS display, the device is not listed in the CDF file. The CDF/NECF file must be corrected before the device can be accessed by the LMF.
3. Download device application code and data to all devices of the following types:
 - CSM
 - BBX
 - Remaining GLI (GLI-*bts#*-2)
 - MCC
4. Download the RFDS TSIC or RFDS-1X RPROC (if installed).
5. Verify the operation of the GPS and HSO signals.
6. Enable the following devices (in the order listed):
 - Secondary CSM (slot CSM 2)
 - Primary CSM (slot CSM 1)
 - All MCCs
7. Using the LMF test equipment selection function, select the test equipment to be used for the calibration.
8. Calibrate the TX and RX test cables if they have not previously been calibrated with the LMF computer and software build which will be used for the optimization/calibration. Cable calibration values can be entered manually, if required.

9. Connect the required test equipment for a full optimization.
10. Select all of the BBXs and all of the MCCs and use the full optimization function. The full optimization function performs TX calibration, BLO download, TX audit, all TX tests, and all RX tests for all selected devices.
11. If the TX calibration fails, repeat the full optimization for any failed paths.
12. If the TX calibration fails again, troubleshoot and correct the problem causing the failure, and repeat the full optimization for the failed path.
13. If the TX calibration and audit portion of the full optimization passes for a path but some of the TX or RX tests fail, troubleshoot and correct the problem causing the failure, and run the individual tests as required until all TX and RX tests have passed for all paths.

Cell-site Types

Sites are configured as Omni/Omni or Sector/Sector (TX/RX). Sector/Sector sites are the three-sector configuration. The SC4812ET Lite does not support six-sector operation. Each cell site type has unique characteristics and must be optimized accordingly.

NOTE	For more information on the different in site types, please refer to the applicable <i>Hardware Installation</i> manual.
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CDF/NECF

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

The CDF/NECF includes the following information:

- Download instructions and protocol
- Site specific equipage information
- SCCP shelf allocation plan
 - BBX equipage (based on cell-site type) including IS-95A/B or CDMA2000 1X capability and redundancy
 - CSM equipage including redundancy
 - Multi Channel Card 24E, 8E, or -1X (MCC24E, MCC8E, or MCC-1X) channel element allocation plan. This plan indicates how the SCCP shelf is configured, and how the paging, synchronization, traffic, and access channel elements (and associated gain values) are assigned among the (up to 4) MCC24Es, MCC8Es, and/or MCC-1Xs in the shelf.
- Effective Rated Power (ERP) table for all TX channels to antennas respectively. Motorola System Engineering specifies the ERP of a

transmit antenna based on site geography, antenna placement, and government regulations. Working from this ERP requirement, antenna gain and antenna feed line loss can be combined to calculate the required transmit power at the frame antenna connections. The corresponding BBX output power required to achieve that power level on any channel/sector can then be determined based on Bay Level Offset (BLO) data established during the optimization process.

NOTE Refer to Figure 3-1 and the *LMF Help function on-line documentation* for additional information on the layout of the LMF directory structure (including CDF/NECF file locations and formats).

3

BTS System Software Download

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

BTSs configured for Circuit Backhaul use bts.cdf files. BTSs configured for Packet Backhaul use bts.necf files (bts-xxx.xml) located on the OMC/R.

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

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

Site Equipage Verification

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

CAUTION

- Use extreme care not to make any changes to the CDF/NECF content while viewing the file. Changes to the CDF/NECF can cause the site to operate unreliably or render it incapable of operation.
- Always wear a conductive, high impedance wrist strap while handling any circuit card/module to prevent damage by ESD. Extreme care should be taken during the removal and installation of any card/module. After removal, the card/module should be placed on a conductive surface or back into the anti-static bag in which it was shipped.

Preparing the LMF

Overview of Packet BTS files

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

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

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

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

LMF Features and Installation Requirements

Before optimization can be performed, the LMF application software must be installed and configured on a computer platform meeting Motorola-specified requirements (see Recommended Test Equipment and Software in Chapter 1).

NOTE	For the LMF graphics to display properly, the computer platform must be configured to display more than 256 colors. See the operating system software instructions for verifying and configuring the display settings.
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Software and files for installing and updating the LMF are provided on CD ROM disks. The following items must be available:

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

FTP Server

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

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

Firewalls

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

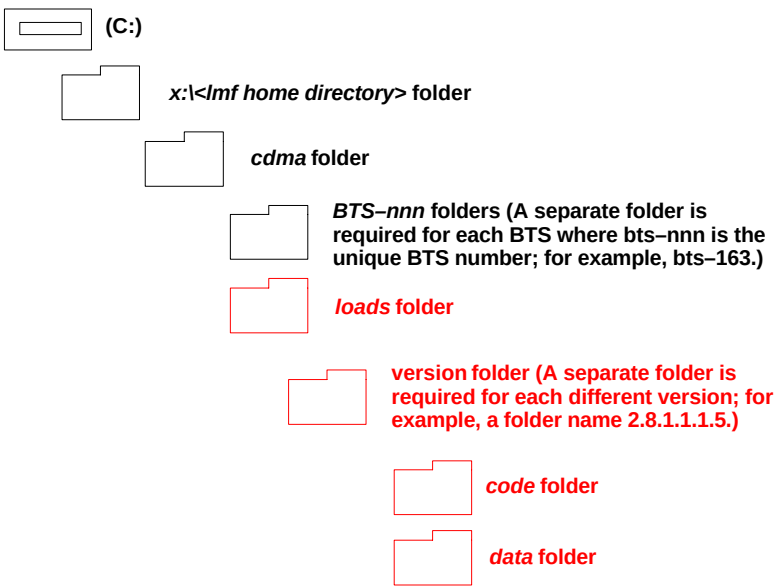
FTP Server Port in use

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

LMF File Structure Overview

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

Figure 3-1: LMF Folder Structure



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

LMF Home Directory

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

<x>:\<lmf home directory>

Where:

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

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

NECF Filename Conventions and Directory Location

NECF

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

NECB*bts#.xml

NECJ*bts#.xml

Where:

* = any characters can be substituted there

= the actual integer BTS number

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

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

Load Information File (LIF)

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

The naming convention for the LIF is:

NE_LIF.xml

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

Cal File

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

LMF Installation and Update Procedures

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

NOTE
First Time Installation Sequence:

1. Install Java Runtime Environment (JRE)
2. Install U/WIN K-shell emulator
3. Install LMF application programs
4. Install/create BTS folders

NOTE

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

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

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

Follow the procedure in Table 3-1 to install the LMF application program using the LMF CD ROM.

Table 3-1: Install LMF using CD ROM

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

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

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

NOTE

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

NOTE

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

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

The procedure in Table 3-2 lists the steps required to transfer the CDF files from the CBSC to the LMF computer. For further information, refer to the *LMF Help function on-line documentation*.

Table 3-2: Copying CDF or NECF Files to the LMF Computer

✓	Step	Action
AT THE CBSC:		
	1	Login to the CBSC workstation.
	2	Insert a DOS-formatted floppy diskette in the workstation drive.
	3	Type eject -q and press the Enter key.
	4	Type mount and press the Enter key. NOTE • Look for the “<i>floppy/no_name</i>” message on the last line displayed. • If the eject command was previously entered, <i>floppy/no_name</i> will be appended with a number. Use the explicit <i>floppy/no_name</i> reference displayed when performing step 7.
	5	Change to the directory, where the files to be copied reside, by typing cd <directoryname> (e.g., cd bts-248) and pressing the Enter key.

... continued on next page

Table 3-2: Copying CDF or NECF Files to the LMF Computer

✓	Step	Action
	6	Type ls and press the Enter key to display the list of files in the directory.
	7	With <i>Solaris versions of Unix</i> , create <i>DOS-formatted versions</i> of the bts-#.cdf and cbsc-#.cdf (or bts-#.necf and cbsc-#.necf) files on the diskette by entering the following command: unix2dos <source filename> /floppy/no_name/<target filename> (e.g., unix2dos bts-248.cdf /floppy/no_name/bts-248.cdf).
		NOTE - Other versions of Unix do not support the unix2dos and dos2unix commands. In these cases, use the Unix cp (copy) command. The <i>copied</i> files will be difficult to read with a DOS or Windows text editor because Unix files do not contain line feed characters. Editing <i>copied</i> CDF files on the LMF computer is, therefore, not recommended. - Using cp, multiple files can be <i>copied</i> in one operation by separating each filename to be copied with a space and ensuring the destination directory (<i>floppy/no_name</i>) is listed at the end of the command string following a space (e.g., cp bts-248.cdf cbsc-6.cdf /floppy/no_name).
	8	Repeat Steps 5 through 7 for each bts-# that must be supported by the LMF computer.
	9	When all required files have been copied to the diskette type eject and press the Enter key.
	10	Remove the diskette from the CBSC drive.
AT THE LMF:		
	11	If it is not running, start the <i>Windows</i> operating system on the LMF computer.
	12	Insert the diskette containing the bts-#.cdf and cbsc-#.cdf (or bts-#.necf and cbsc-#.necf) files into the LMF computer.
	13	Using <i>MS Windows Explorer</i> , create a corresponding bts-# folder in the <x>:\<lmf home directory>\cdma directory for each bts-#.cdf/cbsc-#.cdf (or bts-#.necf/cbsc-#.cdf) file pair copied from the CBSC.
	14	Use <i>MS Windows Explorer</i> to transfer the bts-#.cdf and cbsc-#.cdf (or bts-#.necf and cbsc-#.necf) files from the diskette to the corresponding <x>:\<lmf home directory>\cdma\bts-# folders created in Step 13.

Creating a Named HyperTerminal Connection for MMI Communication

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

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

Follow the procedures in Table 3-3 to establish a named HyperTerminal connection and create a *Windows* desktop shortcut for it.

Table 3-3: Create HyperTerminal Connection

Step	Action
1	From the <i>Windows</i> Start menu, select: Programs>Accessories>
2	Perform one of the following: - For <i>Win NT</i>, select Hyperterminal and then click on HyperTerminal or - For <i>Win 98</i>, select Communications, double click the Hyperterminal folder, and then double click on the Hyperterm.exe icon in the window that opens. NOTE - If a Location Information Window appears, enter the required information, then click on the Close button. (This is required the first time, even if a modem is not to be used.) - If a You need to install a modem..... message appears, click on NO.
3	When the Connection Description box opens: - Type a name for the connection being defined (e.g., MMI Session) in the Name: window, - Highlight any icon preferred for the named connection in the Icon: chooser window, and - Click OK.
4	From the Connect using: pick list in the Connect To box displayed, select COM1 or COM2 (<i>Win NT</i>) – or Direct to Com 1 or Direct to Com 2 (<i>Win 98</i>) for the RS-232 port connection and click OK .
	NOTE For LMF computer configurations where COM1 is used by another interface such as test equipment and a physical port is available for COM2, select COM2 in the following step to prevent conflicts.
5	In the Port Settings tab of the COM# Properties window displayed, configure the RS-232 port settings as follows: - Bits per second: 9600 - Data bits: 8 - Parity: None - Stop bits: 1 - Flow control: None

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Table 3-3: Create HyperTerminal Connection

Step	Action
6	Click OK .
7	Save the defined connection by selecting: File > Save
8	Close the HyperTerminal window by selecting: File > Exit
9	Click the Yes button to disconnect when prompted.
10	Perform one of the following: • If the Hyperterminal folder window is still open (<i>Win 98</i>) proceed to step 12 • From the Windows Start menu, select Programs > Accessories.
11	Perform one of the following: • For <i>Win NT</i>, select Hyperterminal and release any pressed mouse buttons. • For <i>Win 98</i>, select Communications and double click the Hyperterminal folder.
12	Highlight the newly-created connection icon by clicking on it.
13	<i>Right click and drag</i> the highlighted connection icon to the Windows desktop and release the right mouse button.
14	From the popup menu which appears, select Create Shortcut(s) Here .
15	If desired, reposition the shortcut icon for the new connection by dragging it to another location on the Windows desktop.
16	Close the Hyperterminal <i>folder</i> window by selecting: File > Close

Span Lines – Interface and Isolation

T1/E1 Span Interface

NOTE

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

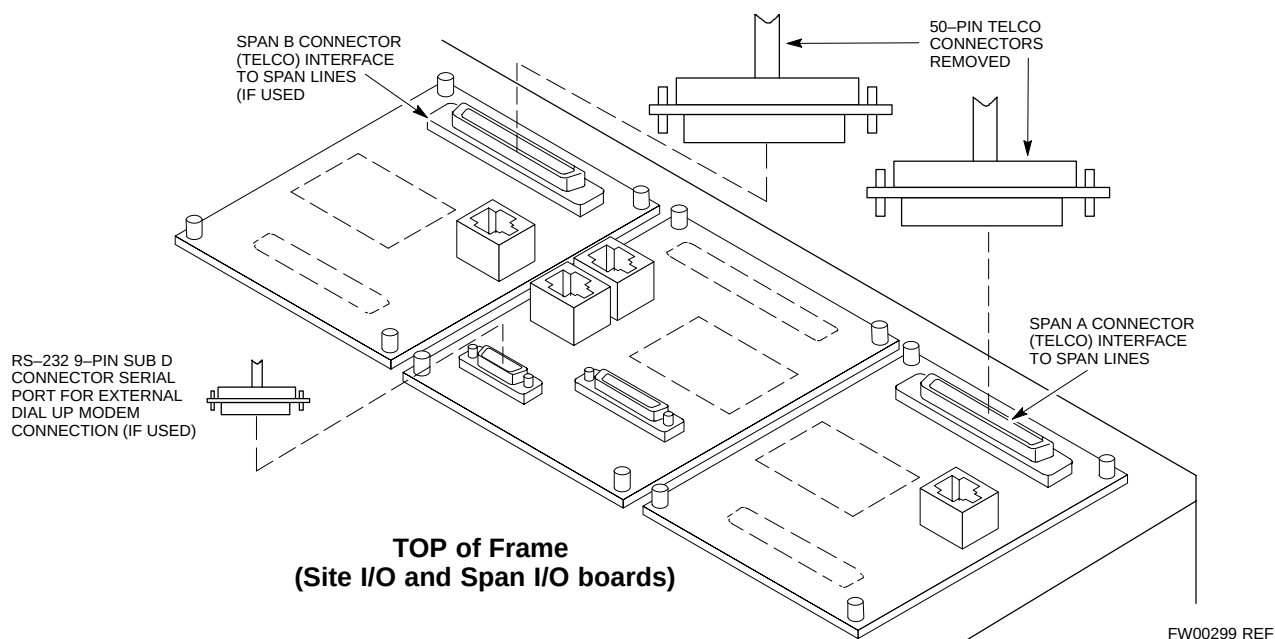
Each frame is equipped with one 50-pair punchblock for spans, customer alarms, remote GPS, and BTS frame alarms. See NO TAG and refer to NO TAG for the physical location and punchdown location information.

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

Isolate BTS from T1/E1 Span(s)

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

Figure 3-2: Span I/O Board T1 Span Isolation



T1/E1 Span Isolation

Table 3-4 describes the action required for span isolation.

Table 3-4: T1/E1 Span Isolation	
Step	Action
1	Have the OMCR/CBSC place the BTS OOS.
2	To disable the span lines, locate the connector for the span or spans which must be disabled and remove the respective connector from the applicable SCCP cage Span I/O board (Figure 3-2).

LMF to BTS Connection

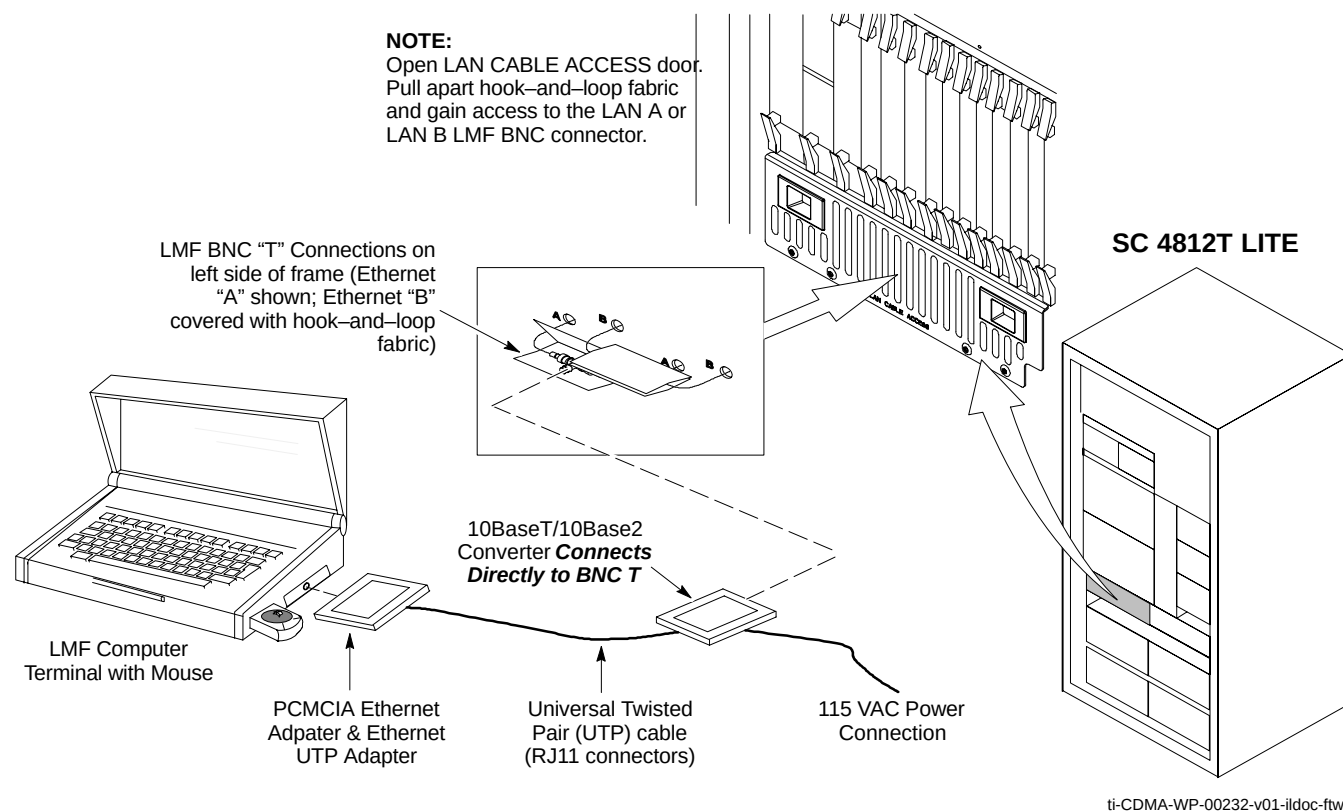
Connect the LMF to the BTS

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

Table 3-5: Connecting the LMF to the BTS

Step	Action
1	To gain access to the LAN connectors, open the LAN cable access door, then pull apart the fabric covering the BNC "T" connector and slide out the service tray, if desired (see Figure 3-3).
2	Connect the LMF computer to the LAN A (left-hand) BNC connector via PCMCIA Ethernet Adapter. NOTE Xircom Model PE3-10B2 or equivalent can also be used to interface the LMF Ethernet connection to the BTS frame connected to the PC parallel port, powered by an external AC/DC transformer. In this case, <i>the BNC cable must not exceed 91 cm (3 ft) in length.</i>
	* IMPORTANT The LAN shield is isolated from chassis ground. The LAN shield (exposed portion of BNC connector) must not touch the chassis during optimization.

Figure 3-3: LMF Connection Detail



Using the LMF

Basic LMF Operation

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

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

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

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

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

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

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

- Sorting a status report window

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

NOTE	<i>Unless otherwise noted, LMF procedures in this manual are performed using the GUI environment.</i>
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The LMF Display and the BTS

BTS Display – When the LMF is logged into a BTS, a frame tab is displayed for each BTS frames. The frame tab will be labeled with “CDMA” and the BTS number, a dash, and the frame number (for example, **BTS-812-1** for BTS 812, RFMF 1). If there is only one frame for the BTS, there will only be one tab.

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

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

Graphical User Interface Overview

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

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

Understanding GUI Operation

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

- Figure 3-4 depicts the differences between packet and circuit CDMA “cdf” file identification. Note that if there is a packet version “bts” file, the “(P)” is added as a suffix. There is a corresponding “(C)” for the circuit mode version.
- Figure 3-5 depicts the Self-Managed Network Elements (NEs) state of a packet mode SC4812T. Note that an “X” is on the front of each card that is under Self-Managed Network Elements (NEs) control by the GLI3 card.
- Figure 3-6 depicts three of the available packet mode commands. Normally the GLI3 has Self-Managed Network Elements (NEs) control of all cards as shown in Figure 3-5 by an “(X)”. In that state the LMF may only status a card. In order to download code or test a card, the LMF must request Self-Managed Network Elements (NEs) control of the card by using the shown dropdown menu. It also uses this menu to release control of the card back to the GLI3. The GLI3 will also assume control of the cards after the LMF logs out of the BTS. The packet mode GLI3 normally is loaded with a tape release and NECB and NECJ files which point to a tape release stored on the GLI3. When the GLI3 has control of a card it will maintain that card with the code on that tape release.
- Figure 3-7 depicts a packet mode site that has the MCC-1 and the BBX-1 cards under LMF control. Notice that the “X” is missing from the front of these two cards.

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

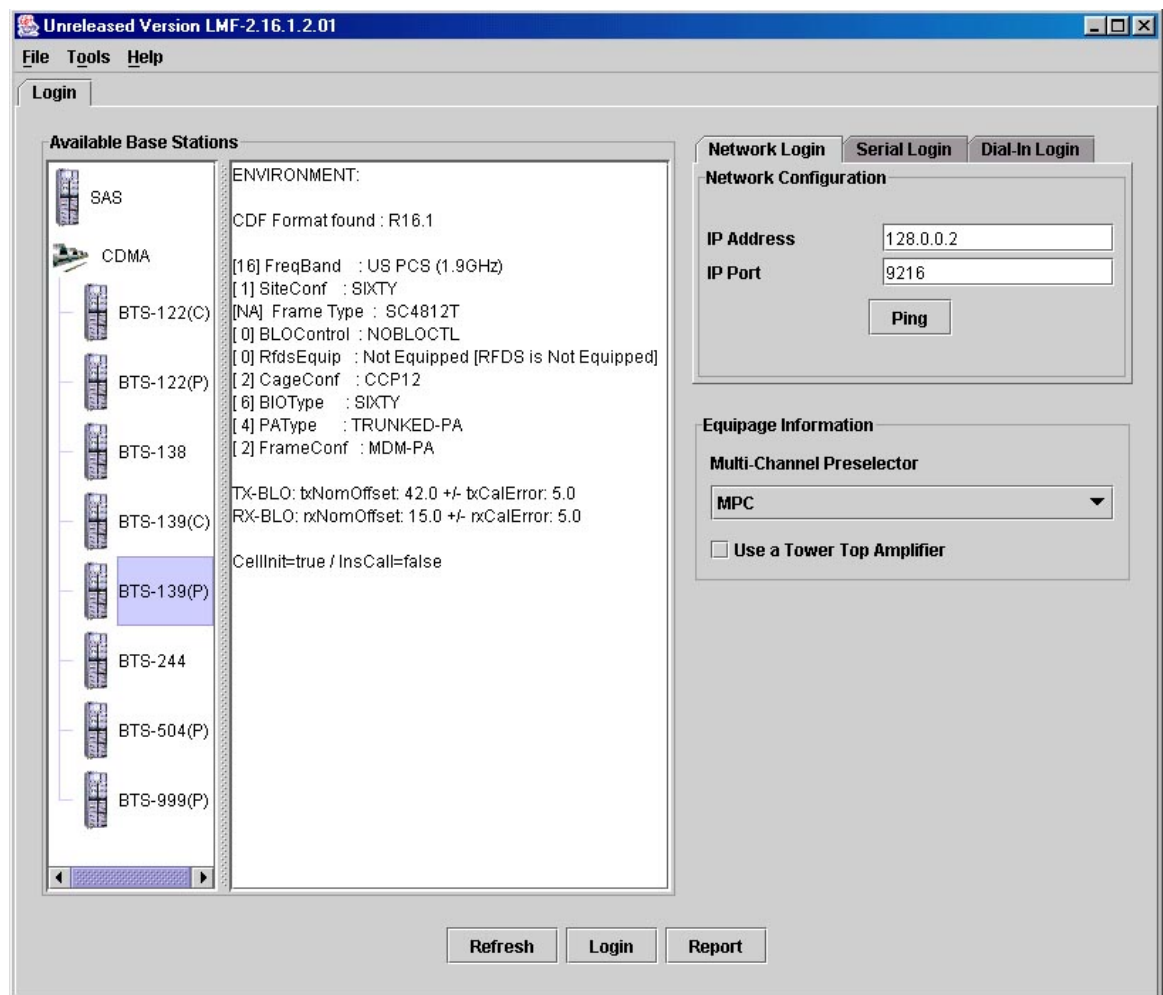
Figure 3-4: BTS Login screen – identifying circuit and packet BTS files

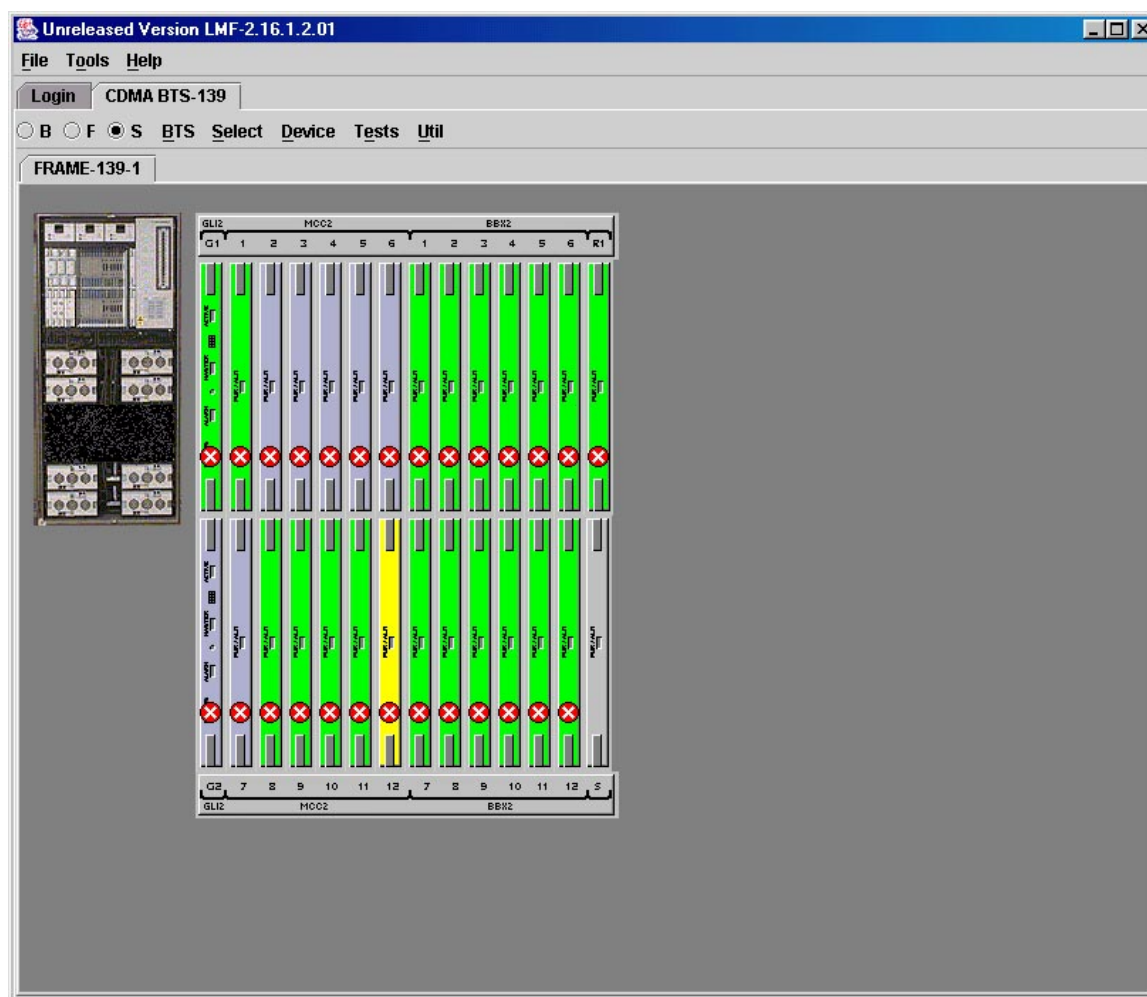
Figure 3-5: Self-Managed Network Elements (NEs) state of a packet mode SC4812T

Figure 3-6: Available packet mode commands

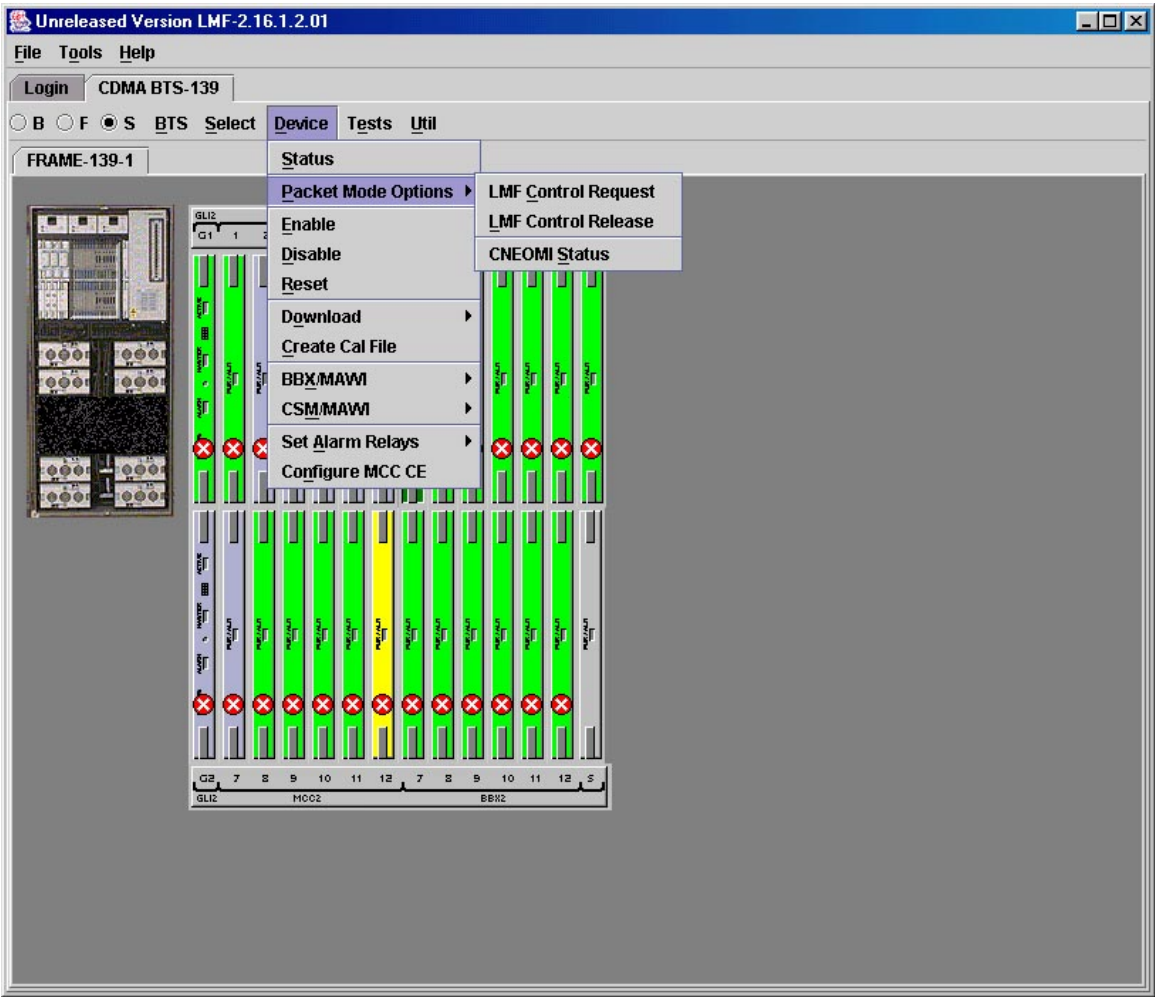
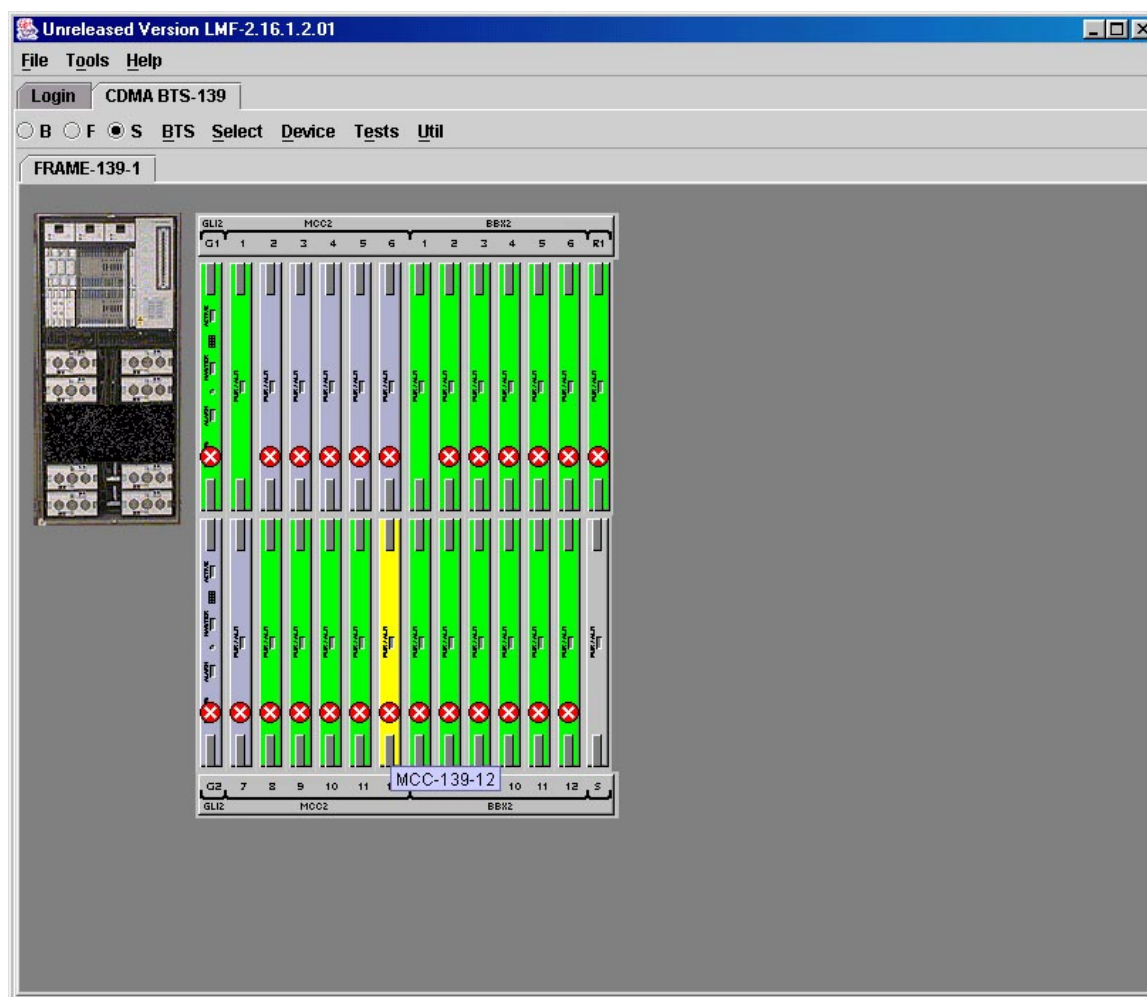


Figure 3-7: Packet mode site with MCC-1 and BBX-1 under LMF control

Command Line Interface Overview

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

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

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

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

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

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

CLI Format Conventions

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

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

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

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

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

Logging Into a BTS

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

Prerequisites

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

- The LMF is correctly installed on the LMF computer.
- A **bts-*nnn*** folder with the correct CDF/NECF and CBSC files exists.
- The LMF computer was connected to the BTS before starting the Windows operating system and the LMF software. If necessary, restart the computer after connecting it to the BTS in accordance with Table 3-5 and Figure 3-3.

CAUTION

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

BTS Login from the GUI Environment

Follow the procedures in Table 3-6 to log into a BTS when using the GUI environment.

Table 3-6: BTS GUI Login Procedure

✓	Step	Action
	1	Start the LMF GUI environment by double-clicking on the WinLMF desktop icon (if the LMF is not running). – An LMF window will open and display the LMF build number in the title bar.
		NOTE If a warning similar to the following is displayed, select No , shut down other LMF sessions which may be running, and start the LMF GUI environment again: <pre>The CLI handler is already running. This may cause conflicts with the LMF. Are you sure you want to start the application? Yes No</pre>
	2	Click on Login tab (if not displayed).
	3	Double click on CDMA (in the Available Base Stations pick list).
	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.

... continued on next page

Table 3-6: BTS GUI Login Procedure

✓	Step	Action
	7	Type in the correct IP Port number (normally 9216) if not correctly displayed in the IP Port box.
	8	Click on Ping. – If the connection is successful, the Ping Display window shows text similar to the following: Reply from 128 128.0.0.2: bytes=32 time=3ms TTL=255 – If there is no response the following is displayed: 128.0.0.2:9216:Timed out If the MGLI fails to respond, reset and perform the ping process again. If the MGLI still fails to respond, typical problems are shorted BNC to inter-frame cabling, open cables, crossed A and B link cables, missing 50-Ohm terminators, or the MGLI itself.
	9	Select the Multi-channel Preselector type from the Multi-channel Preselector drop-down list (default is MPC) to a device corresponding to your BTS configuration, if required.
		NOTE “Use a Tower Top Amplifier” is not applicable to the SC4812T Lite.
	10	Click on Login . (A BTS tab with the BTS and frame numbers is displayed.)
		NOTE • If an attempt is made to log into a BTS that is already logged on, all devices will be gray. • There may be instances where the BTS initiates a log out due to a system error (i.e., a device failure). • If the MGLI is OOS-ROM (blue), it must be downloaded with RAM code before other devices can be seen. • If the MGLI is OOS-RAM (yellow), it must be enabled before other installed devices can be seen.

BTS Login from the CLI Environment

Follow the procedures in Table 3-7 to log into a BTS when using the CLI environment.

NOTE	If the CLI and GUI environments are to be used at the same time, the <i>GUI must be started first and BTS login must be performed from the GUI</i> . Refer to Table 3-6 to start the GUI environment and log into a BTS.
-------------	--

Table 3-7: 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 before 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-<i><bts#></i> host=<i><host></i> port=<i><port></i> where: host = MGLI card IP address (defaults to address last logged into for this BTS or 128.0.0.2 if this is first login to this BTS) port = IP port of the BTS (defaults to port last logged into for this BTS or 9216 if this is first login to this BTS) A response similar to the following will be displayed: <pre> LMF> 13:08:18.882 Command Received and Accepted COMMAND=login bts-33 13:08:18.882 Command In Progress 13:08:21.275 Command Successfully Completed REASON_CODE="No Reason" </pre>

Logging Out

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

NOTE

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

Logging Out of a BTS from the GUI Environment

Follow the procedure in Table 3-8 to logout of a BTS when using the GUI environment.

Table 3-8: BTS GUI Logout Procedure		
✓	Step	Action
	1	Click on BTS in the BTS menu bar.
	2	Click the Logout item in the pull-down menu (a Confirm Logout pop-up message will appear).
	3	Click on Yes (or press the Enter key) to confirm logout. The Login tab will appear. NOTE If a logout was previously performed on the BTS from a CLI window running at the same time as the GUI, a Logout Error pop-up message will appear stating the system could not log out of the BTS. When this occurs, the GUI must be exited and restarted before it can be used for further operations.
	4	If a Logout Error pop-up message appears stating that the system could not log out of the Base Station because the given BTS is not logged in, click OK and proceed to Step 5.
	5	Select File > Exit in the window menu bar, click Yes in the Confirm Logout pop-up, and click OK in the Logout Error pop-up which appears again.
	6	If further work is to be done in the GUI, restart it.
		NOTE - The Logout item on the BTS menu bar will only log you out of the displayed BTS. - You can also log out of all BTS sessions and exit LMF by clicking on the File selection in the menu bar and selecting Exit from the File menu list. A Confirm Logout pop-up message will appear.

Logging Out of a BTS from the CLI Environment

Follow the procedure in Table 3-9 to logout of a BTS when using the CLI environment.

Table 3-9: BTS CLI Logout Procedure		
✓	Step	Action
		NOTE If the BTS is also logged into from a GUI running at the same time and further work must be done with it in the GUI, proceed to Step 2.
	1	Log out of a BTS by entering the following command: logout bts-<bts#> A response similar to the following will be displayed: <pre> LMF> 13:24:51.028 Command Received and Accepted COMMAND=logout bts-33 13:24:51.028 Command In Progress 13:24:52.04 Command Successfully Completed REASON_CODE="No Reason" </pre>
	2	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: <pre> Killing background processes.... </pre>

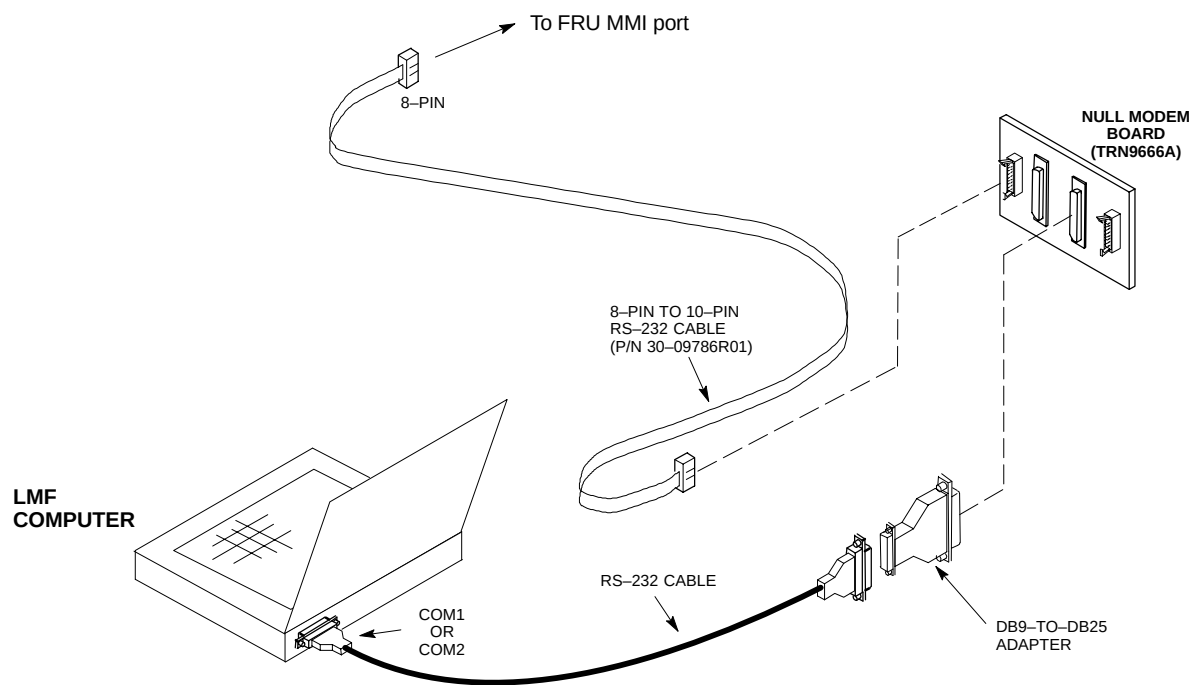
Establishing an MMI Communication Session

Equipment Connection – Figure 3-8 illustrates common equipment connections for the LMF computer. For specific connection locations on FRUs, refer to the illustration accompanying the procedures which require the MMI communication session.

Initiate MMI Communication – For those procedures which require MMI communication between the LMF and BTS FRUs, follow the procedures in Table 3-10 to initiate the communication session.

Table 3-10: Establishing MMI Communication

Step	Action
1	Connect the LMF computer to the equipment as detailed in the applicable procedure which requires the MMI communication session.
2	If the LMF computer has only one serial port (COM1) and the LMF is running, disconnect the LMF from COM1 by performing the following:
2a	– Click on Tools in the LMF window menu bar, and select Options from the pull-down menu list. — An LMF Options dialog box will appear.
2b	– In the LMF Options dialog box, click the Disconnect Port button on the Serial Connection tab.
3	Start the named HyperTerminal connection for MMI sessions by double clicking on its <i>Windows</i> desktop shortcut. NOTE If a <i>Windows</i> desktop shortcut was not created for the MMI connection, access the connection from the <i>Windows</i> Start menu by selecting: Programs > Accessories > Hyperterminal > HyperTerminal > <Named HyperTerminal Connection (e.g., MMI Session)>
4	Once the connection window opens, establish MMI communication with the BTS FRU by pressing the LMF computer <Enter> key until the prompt identified in the applicable procedure is obtained.

Figure 3-8: LMF Computer Common MMI Connections

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Online Help

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

Pinging the Processors

Pinging the BTS

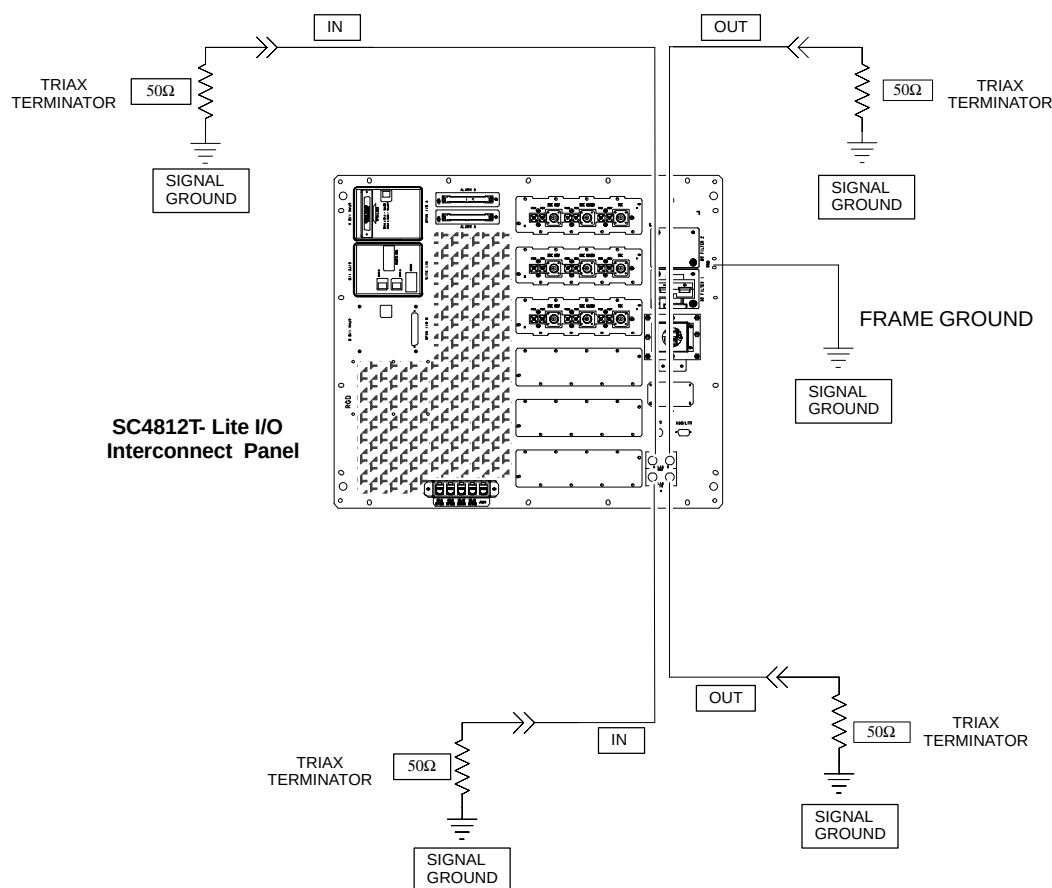
For proper operation, the integrity of the Ethernet LAN A and B links must be verified. Figure 3-9 represents a typical BTS Ethernet configuration for an SC4812T Lite stand-alone or companion frame. The drawing depicts cabling and termination for both the A and B LANs.

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

Follow the steps in Table 3-11 to ping each processor (on both LAN A and LAN B) and verify LAN redundancy is working properly.

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

Figure 3-9: BTS Ethernet LAN Termination Diagram



SC4812TL0013-5

NOTE	The Ethernet LAN A and B cables and/or terminations must be installed on each frame/enclosure external LAN connector before performing this test. All other processor board LAN connections are made through the backplanes.
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Table 3-11: Pinging the Processors

Step	Action
1	If this is a <i>first-time communication</i> with a newly-installed frame or a GLI card which has been replaced, <i>perform the procedure in Table 6-3</i> and then return to step 2.
2	Be sure any uncabled LAN A and B IN and OUT connectors in the power entry compartment (rear of frame – NO TAG and Figure 3-9) are terminated with 50 Ω loads.
3	<i>If it has not already been done</i> , connect the LMF computer to the BTS (refer to Table 3-5 and Figure 3-3.)
4	<i>If it has not already been done</i> , start a <i>GUI</i> LMF session and log into the BTS (refer to Table 3-6).
5	In the power entry compartment, remove the 50 Ω termination on the frame LAN B IN connector. – The LMF session should remain active.
6	Replace the 50 Ω terminator on the BTS frame LAN B IN connector.
7	From the <i>Windows</i> desktop, click the Start button and select Run .
8	In the Open box, type ping and the MGLI IP address (for example, ping 128.0.0.2). NOTE 128.0.0.2 is the default IP address for the GLI card in slot GLI–1 in field BTS units.
9	Click on OK .
10	If the targeted module responds, a DOS window will appear with a display similar to the following: Reply from 128.0.0.2: bytes=32 time=3ms TTL=255 – If the device responds, <i>proceed to step 18</i>. If there is no response, the following is displayed: Request timed out – If the GLI fails to respond, it should be reset and re-pinged. If it still fails to respond, typical problems would be: failure of the LMF to login, shorted BNC-to-inter-frame cabling, open cables, crossed A and B link cables, or the GLI itself.
11	Logout of the BTS as described in Table 3-8, exit from the LMF program, and restart the <i>Windows</i> operating system on the LMF computer.
12	Restart the LMF <i>GUI</i> program as described in <i>LMF Help function on-line documentation</i> , and log into the BTS as described in Table 3-6.
13	Perform steps 7 through 10 again. – If the device responds, <i>proceed to step 18</i>. If there is still no response, <i>proceed to step 14</i> .
14	If ping was unsuccessful after restarting the LMF computer, press the MGLI front panel reset pushbutton and perform steps 7 through 10 again. NOTE <i>Refer to Table 6-1 if ping was unsuccessful after resetting the MGLI.</i>

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Table 3-11: Pinging the Processors

Step	Action
15	After the BTS has been successfully pinged, be sure the 50Ω termination was replaced on the BTS frame LAN B IN connector in the power entry compartment (Figure 3-9). Disconnect the LMF cable from the LAN shelf LAN A connector, and connect it to LAN B (right-hand connector) (refer to Figure 3-3).
16	In the power entry compartment, remove the 50Ω termination on the BTS frame LAN A IN connector.
17	Repeat steps 5 through 9 using LAN B.
18	After the BTS has been successfully pinged on the secondary LAN, replace the 50Ω termination on the frame LAN A IN connector in the power entry compartment.
19	Disconnect the LMF cable from the LAN shelf LAN B and connect it to LAN A.
20	Remove and replace the 50Ω termination on the LAN B IN connector to force the MGLI to switch to primary LAN A.
21	Repeat steps 5 through 9 to ensure proper primary LAN operation.

Download the BTS

Overview

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

ROM Code

Downloading ROM code to BTS devices from the LMF is *NOT routine maintenance or a normal part of the optimization process*. It is only done in unusual situations where the resident ROM code release level in the device is not compatible with the required release level of the site operating software *and* the CBSC can not communicate with the BTS to perform the download.

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

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

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

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 (MGLI2 or MGLI3)
- Redundant GLI (GLI2 or GLI3)
- Clock Synchronization Module (CSM) (*Only if new revision code must be loaded*)
- Multi Channel CDMA (MCC24E, MCC8E, or MCC-1X) cards
- Broadband Transceiver (BBX2 or BBX-1X) cards
- RFDS Test Subscriber Interface Card (TSIC) or RFDS-1X RFDS PROCessor (RPROC) card, if RFDS is installed

NOTE

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

Verify GLI ROM Code Loads

Devices should not be loaded with a RAM code version which is not compatible with the ROM code with which they are loaded. Before downloading RAM code and data to the processor cards, follow the procedure in Table 3-12 to verify the GLI devices are loaded with the correct ROM code for the software release used by the BSS.

Prerequisite

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

Table 3-12: Verify GLI ROM Code Loads	
Step	Action
1	<i>If it has not already been done</i> , start a <i>GUI</i> LMF session and log into the BTS (refer to Table 3-6).
2	Select all GLI devices by clicking on them, and select Device > Status from the BTS menu bar.
3	In the status report window which opens, note the number in the ROM Ver column for each GLI2.
4	If the ROM code loaded in the GLIs is <i>not</i> the correct one for the software release being used on the BSS, perform the following:
4a	– Log out of the BTS as described in Table 3-8 or Table 3-9, as applicable.
4b	– Disconnect the LMF computer.
4c	– Reconnect the span lines as described in Table 5-7.
4d	– Have the CBSC download the correct ROM code version to the BTS devices.
5	When the GLIs have the correct ROM load for the software release being used, be sure the span lines are disabled as outlined in Table 3-4 and proceed to downloading RAM code and data.

Download RAM Code and Data to MGLI and GLI

Follow the steps outlined in Table 3-13 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.
- The LMF computer is connected to the BTS (refer to Table 3-5), and is logged in using the *GUI* environment (refer to Table 3-6).

Table 3-13: Download and Enable MGLI and GLI Devices

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

Download RAM Code and Data to Non-GLI Devices

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

NOTE

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

Follow the steps in Table 3-14 to download RAM code and data to non-GLI devices.

Table 3-14: Download RAM Code and Data to Non-GLI Devices		
✓	Step	Action
	1	Select the target CSM, MCC, and/or BBX device(s) by clicking on them.
	2	Click Device in the BTS menu bar, and select Download > Code/Data in the pull-down menus. – A status report is displayed that shows the results of the download for each selected device.
	3	Click OK to close the status report window when downloading is completed.
		NOTE After a BBX, CSM, or MCC device is successfully loaded with RAM code and data have changed to the OOS_RAM state (yellow), the status LED should be rapidly flashing GREEN.
		NOTE The command in Step 2 loads both code and data. Data can be downloaded without doing a code download anytime a device is OOS-RAM using the command in Step 4.
	4	To download just the firmware application data to each device, select the target device and select: Device>Download>Data

BBX Cards Remain OOS_ROM

If BBX cards remain OOS_ROM (blue) after power-up or following code load, refer to Table 6-7, Steps 9 and 10.

Selecting CSM Clock Source and Enabling CSMs

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

Select CSM Clock Source

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

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

Prerequisites

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

Follow the procedure in Table 3-15 to select a CSM Clock Source.

Table 3-15: Select CSM Clock Source		
✓	Step	Action
	1	Select the applicable CSM(s) for which the clock source is to be selected.
	2	Click on Device in the BTS menu bar, and select CSM/MAWI > Select Clock Source... in the pull-down menu list. – A CSM clock reference source selection window will appear.
	3	Select the applicable clock source in the Clock Reference Source pick lists. Uncheck the related check boxes for Clock Reference Sources 2 and 3 if you do not want the displayed pick list item to be used.
	4	Click on the OK button. – A status report is displayed showing the results of the operation.
	5	Click on the OK button to close the status report window.

NOTE

For RF-GPS, verify the CSM configured with the GPS receiver “daughter board” is installed in the frame’s CSM 1 slot before continuing.

Enable CSMs

Follow the steps outlined in Table 3-16 to enable the CSMs installed in the SCCP shelves.

Table 3-16: Enable CSMs		
✓	Step	Action
	1	NOTE If equipped with two CSMs, enable card in slot CSM 2 first. Click on the target CSM.
	2	Click on Device in the BTS menu bar, and select Enable in the pull-down menu list. – A status report is displayed showing the results of the enable operation. – Click OK to close the status report window.
		NOTE – The board in slot CSM 1 interfaces with the GPS receiver. The enable sequence for this board can take up to one hour (see below). – FAIL may be shown in the status report table for a slot CSM 1 enable action. If Waiting For Phase Lock is shown in the Description field, do not cancel the enable process. The CSM will change to the Enabled state after phase lock is achieved.
		* IMPORTANT – The GPS satellite system satellites are not in a geosynchronous orbit and are maintained and operated by the United States Department of Defense (DOD). The DOD periodically alters satellite orbits; therefore, satellite trajectories are subject to change. A GPS receiver that is INS contains an “almanac” that is updated periodically to take these changes into account. – If a GPS receiver has not been updated for a number of weeks, it may take up to an hour for the GPS receiver “almanac” to be updated. – Once updated, the GPS receiver must track at least four satellites and obtain (hold) a 3-D position fix for a minimum of 45 seconds before the CSM will come in service. (In some cases, the GPS receiver needs to track only one satellite, depending on accuracy mode set during the data load).
		NOTE – If two CSMs are installed and the board in slot CSM 1 has enabled, the LMF CSM cage view should show slot CSM 1 as bright green (INS–ACT) and slot CSM 2 as dark green (INS–SBY) – After CSMs have been successfully enabled, be sure the PWR/ALM LEDs are steady green (alternating green/red indicates the card is in an alarm state).
	3	If more than an hour has passed without the board in slot CSM 1 enabling, refer to the CSM System Time – GPS & LFR/HSO Verification section of this chapter (see Table 3-18, Figure 3-10, and Table 3-19) to determine the cause.

Enable MCCs

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

Follow the steps outlined in Table 3-17 to enable the MCCs installed in the SCCP shelves.

NOTE	The MGLI and primary CSM must be downloaded and enabled (IN-SERVICE ACTIVE), prior to downloading and enabling an MCC.
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Table 3-17: Enable MCCs		
	Step	Action
	1	If the GLI/MCC/BBX view is not displayed in the LMF window, click on the GLI/MCC/BBX area of the SCCP shelf.
	2	Click on the target MCC(s), or click on Select in the BTS menu bar, and select MCCs in the pull-down menu list.
	3	Click on Device in the BTS menu bar, and select Enable in the pull-down menu list. – A status report is displayed showing the results of the enable operation.
	4	Click OK to close the status report window.

CSM System Time – GPS & LFR/HSO Verification

Clock Synchronization Manager (CSM) Sub–system Description

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

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

CSM–II Card Type Description – Each CSM–II card features a temperature–stabilized crystal oscillator that provides 19.6608 MHz clock, even second pulse, and 3 MHz reference signals to the synchronization source selected from the following (refer to Table 3-19 for source selection/verification procedures):

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

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

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

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

Timing Source Fault Management – Fault management has the capability of switching between the GPS synchronization source and the LFR/HSO backup source in the event of a GPS receiver failure. During normal operation, the card in slot CSM 1 selects GPS as the primary timing source (Table 3-19). The source selection can also be overridden via the LMF or by the system software.

Front Panel LEDs

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

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

Low Frequency Receiver/High Stability Oscillator (LFR/HSO)

General

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

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

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

Upgrades and Expansions: LFR2/HSO2/HSOX

The LFR2 and HSO2 (second generation cards) both can export a timing signal to other BTS frames located at a site. These *secondary* frames require an HSO–expansion (HSOX) module whether the *primary* frame has an LFR2 or an HSO2. The HSOX accepts input from the primary frame and interfaces with the CSM cards in the secondary frames. LFR and LFR2 use the same source code in source selection (Table 3-19). HSO, HSO2, and HSOX use the same source code in source selection (Table 3-19).

NOTE

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

CSM Frequency Verification

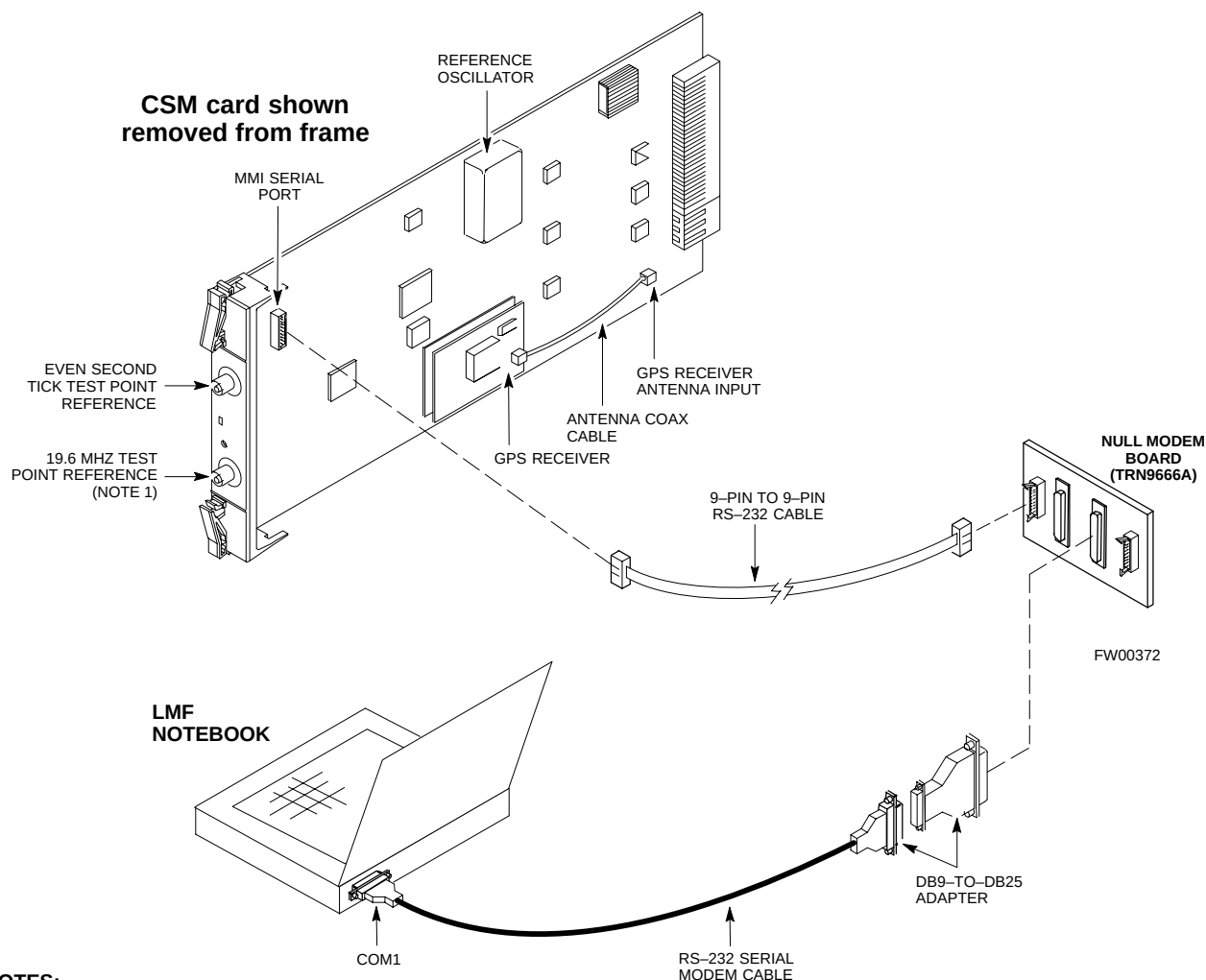
The objective of this procedure is the initial verification of the Clock Synchronization Module (CSM) cards before performing the RF path verification tests.

Test Equipment Setup (GPS & LFR/HSO Verification)

Follow the steps outlined in Table 3-18 to set up test equipment.

Table 3-18: Test Equipment Setup (GPS & LFR/HSO Verification)	
Step	Action
1	Perform one of the following as required by installed equipment:
1a	For local GPS (RF-GPS): Verify a CSM card with a GPS receiver is installed in the primary CSM slot, CSM 1, and that the card is INS_ACT (bright green). NOTE Verify by checking the card ejectors for kit number SGLN1145 on the card in slot CSM 1.
1b	For Remote GPS (RGPS): Verify a CSM-II card is installed in primary slot CSM 1 and that the card is INS_ACT (bright green). NOTE Verify by checking the card ejectors for kit number SGLN4132ED or subsequent.
2	Remove the card from slot CSM 2 (if installed) and connect a serial cable from the LMF COM 1 port (via null modem card) to the MMI port on the card in slot CSM 1 (see Figure 3-10).
3	Reinstall the card removed from slot CSM 2.
4	Start an MMI communication session with the card in slot CSM 1 by using the <i>Windows</i> desktop shortcut icon (see Table 3-10) .
5	When the terminal screen appears press the Enter key until the CSM> prompt appears.

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

Figure 3-10: CSM MMI Terminal Connection**NOTES:**

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

GPS Initialization/Verification

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- The primary CSM and HSO (if equipped) has been warmed up for at least 15 minutes.
- The LMF computer is connected to the MMI port of the primary CSM as shown in Figure 3-10.
- An MMI communication session has been started (Table 3-10), and the CSM> prompt is present in the HyperTerminal window (Table 3-18).

Follow the steps outlined in Table 3-19 to initialize and verify proper GPS receiver functioning.

Table 3-19: GPS Initialization/Verification

Step	Action																																																																																										
1	To verify that Clock alarms (0000), Dpll is locked and has a reference source, and GPS self test passed messages are displayed within the report, issue the following MMI command bstatus – The system will display a response similar to the following: <u>Clock Alarms (0000):</u> DPLL <u>is locked and has a reference source.</u> GPS receiver self test result: <u>passed</u> Time since reset 0:33:11, time since power on: 0:33:11																																																																																										
2	Enter the following command at the CSM> prompt to display the current status of the Loran and GPS receivers: sources – When equipped with LFR, the system will generate a response similar to the following: <table><tr><th>N</th><th>Source Name</th><th>Type</th><th>TO</th><th>Good</th><th>Status</th><th>Last Phase</th><th>Target Phase</th><th>Valid</th></tr><tr><td>0</td><td>LocalGPS</td><td>Primary</td><td>4</td><td>YES</td><td>Good</td><td>0</td><td>0</td><td>Yes</td></tr><tr><td>1</td><td>LFR CHA</td><td>Secondary</td><td>4</td><td>YES</td><td>Good</td><td>-2013177</td><td>-2013177</td><td>Yes</td></tr><tr><td>2</td><td>Not Used</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> <u>Current reference source number: 0</u> – When equipped with HSO, the system will generate a response similar to the following: <table><tr><th>Num</th><th>Source Name</th><th>Type</th><th>TO</th><th>Good</th><th>Status</th><th>Last Phase</th><th>Target Phase</th><th>Valid</th></tr><tr><td>0</td><td>Local GPS</td><td>Primary</td><td>4</td><td>Yes</td><td>Good</td><td>3</td><td>0</td><td>Yes</td></tr><tr><td>1</td><td>HSO</td><td>Backup</td><td>4</td><td>No</td><td>N/A</td><td>timed-out*</td><td>Timed-out*</td><td>No</td></tr></table> *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. <table><tr><th>Num</th><th>Source Name</th><th>Type</th><th>TO</th><th>Good</th><th>Status</th><th>Last Phase</th><th>Target Phase</th><th>Valid</th></tr><tr><td>0</td><td>Local GPS</td><td>Primary</td><td>4</td><td>Yes</td><td>Good</td><td>3</td><td>0</td><td>Yes</td></tr><tr><td>1</td><td>HSO</td><td>Backup</td><td>4</td><td>Yes</td><td>N/A</td><td>xxxxxxxxxx</td><td>xxxxxxxxxx</td><td>Yes</td></tr></table>	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								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	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
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																																																																																										
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																																																																																			
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																																																																																			

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Table 3-19: 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 <i>OMCR</i> determine the correct BTS timing source has been identified in the database by entering the display bts csmgen command and correct as required using the edit csm csmgen refsrc command. NOTE If any of the above areas fail, verify: – If LED is RED, verify that HSO had been powered up for at least 5 minutes. After oscillator temperature is stable, LED should go GREEN <i>Wait for this to occur before continuing !</i> – If “timed out” is displayed in the Last Phase column, suspect the HSO output buffer or oscillator is defective – Verify the HSO is FULLY SEATED and LOCKED to prevent any possible card warpage
4	Verify the following GPS information (underlined text above): – GPS information is usually the 0 reference source. – At least one Primary source must indicate “Status = good” and “Valid = yes” to bring site up.

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Table 3-19: 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: <pre> 24:06:08 <u>GPS Receiver Control Task State: tracking satellites.</u> 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 <u>8 satellites tracked, receiving 8 satellites, 8 satellites visible.</u> 24:06:08 <u>Current Dilution of Precision (PDOP or HDOP): 0.</u> 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. </pre>
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”. <i>Do not continue until this occurs!</i> – 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).

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Table 3-19: GPS Initialization/Verification

Step	Action
7	If steps 1 through 6 pass, the GPS is good. NOTE If any of the above mentioned areas fail, verify that: – If <i>Initial position accuracy</i> is “estimated” (typical), at least 4 satellites must be tracked and visible (1 satellite must be tracked and visible if actual lat, log, and height data for this site has been entered into CDF file). – If <i>Initial position accuracy</i> is “surveyed,” position data 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) (<i>If warmed-up proceed to step 9</i>) <pre>CSM>DPLL Task Wait. 884 seconds left. DPLL Task Wait. 882 seconds left. DPLL Task Wait. 880 seconds left.etc.</pre> 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. <pre>c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175</pre>
10	Verify the following GPS information (underlined text above, from left to right): – Lower limit offset from tracked source variable is not less than –60 (equates to 3μs limit). – Upper limit offset from tracked source variable is not more than +60 (equates to 3μs limit). – TK SRC: 0 is selected, where SRC 0 = GPS.
11	Enter the following commands at the CSM> prompt to exit the debug mode display. debug dpllp

LORAN-C Initialization/Verification

Table 3-20: LORAN-C Initialization/Verification

Step	Action	Note
1	At the CSM> prompt, enter lstatus <cr> to verify that the LFR is in tracking mode. A typical response is: <pre> 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> </pre>	<i>This must be greater than 100 before LFR becomes a valid source.</i> <i>This shows the LFR is locked to the selected PLL station.</i> <i>This search list and PLL data must match the configuration for the geographical location of the cell site.</i>

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Table 3-20: 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. <pre> 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 <u>Yes</u> <u>Good</u> -2013177 -2013177 <u>Yes</u> 2 Not used Current reference source number: 1 </pre> *NOTE “Timed–out” should only be displayed while the LFR is warming up. “Not–Present” or “Faulty” should not be displayed. If the LFR does not appear as one of the sources, then configure the LFR as a back–up source by entering the following command at the CSM> prompt: ss 1 2	
4	LORAN LFR information (highlighted above in boldface type) is usually the #1 reference source (verified from left to right). * IMPORTANT If any of the above mentioned areas fail, verify: – The LFR antenna is not obstructed or misaligned. – The antenna pre–amplifier power and calibration twisted pair connections are intact and < 91.4 m (300 ft) in length. – A dependable connection to suitable Earth Ground is in place. – The search list and PLL station for cellsite location are correctly configured . NOTE LFR functionality should be verified using the “source” command (as shown in Step 3). Use the <u>underlined</u> responses on the LFR row to validate correct LFR operation.	
5	Close the HyperTerminal window.	

Test Equipment Set-up

Connecting Test Equipment to the BTS

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

- LMF
- Communications system analyzer model supported by the LMF
- Power meter model supported by the LMF (required when using the HP 8921A/600 and Advantest R3465 analyzers)
- Non-radiating transmit line termination load
- Directional coupler and in-line attenuator
- RF cables and adapters

Refer to Table 3-21 for an overview of connections for test equipment currently supported by the LMF. In addition, see the following figures:

- Figure 3-14, Figure 3-15, and Figure 3-16 show the test set connections for TX calibration
- Figure 3-17 through Figure 3-22 show the test set connections for optimization/ATP tests

Test Equipment GPIB Address Settings

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

- Signal generator address: **1**
- Power meter address: **13**
- Communications system analyzer: **18**

Using the procedures included in the Verifying and Setting GPIB Addresses section of Appendix F, verify and, if necessary, change the GPIB address of each piece of employed test equipment to match the applicable addresses above

Supported Test Equipment

CAUTION	To prevent damage to the test equipment, all transmit (TX) test connections must be through a 30 dB directional coupler <i>plus</i> a 20 dB in-line attenuator for both the 800 MHz and 1.9 GHz BTSs.
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IS-95A/B Operation

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

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

CDMA2000 1X Operation

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

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

Test Equipment Preparation

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

Test Equipment Connection Charts

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

IS-95A/B-only Test Equipment Connections

Table 3-21 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 3-21: IS-95A/B-only Test Equipment Interconnection									
SIGNAL	COMMUNICATIONS SYSTEM ANALYZER				ADDITIONAL TEST EQUIPMENT				BTS
	Cyber-Test	Advantest R3465	HP 8921A	HP 8921 W/PCS	Power Meter	GPIO Interface	LMF	Attenuator & Directional Coupler	
EVEN SECOND SYNCHRONIZATION	EVEN SEC REF	EVEN SEC SYNC IN	EVEN SECOND SYNC IN	EVEN SECOND SYNC IN					SYNC MON-ITOR
	•	•	•	•					•
									•
									•
									•
19.6608 MHZ CLOCK	TIME BASE IN	CDMA TIME BASE IN	CDMA TIME BASE IN	CDMA TIME BASE IN					FREQ MON-ITOR
	•	•	•	•					•
									•
									•
									•
CONTROL IEEE 488 BUS	IEEE 488	GPIO	HP-I B	HP-IB	HP-IB	GPIO	SERIAL PORT		
	•	•	•	•	•	•	•		
TX TEST CABLES	RF IN/OUT	INPUT 50Ω	RF IN/OUT	RF IN/OUT				20 DB ATTN. 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 3-22 depicts the interconnection requirements for currently available test equipment supporting *both* CDMA 2000 1X and IS-95A/B which meets Motorola standards and is supported by the LMF.

Table 3-22: CDMA2000 1X/IS-95A/B Test Equipment Interconnection										
SIGNAL	COMMUNICATIONS SYSTEM ANALYZER			ADDITIONAL TEST EQUIPMENT						BTS
	Agilent 8935 (Option 200 or R2K)	Advantest R3267	Agilent E4406A	Agilent E4432 Signal Gen.	Advantest R3562 Signal Generator	Power Meter	GPIB Interface	LMF	Attenuator & Directional Coupler	
EVEN SECOND SYNCHRONIZATION	EVEN SECOND SYNC IN	EXT TRIG	TRIGGER IN	PATTERN TRIG IN	EXT TRIG IN					SYNC MON-ITOR
	●	●	●	●	●					●
	●	●	●	●	●					●
	●	●	●	●	●					●
19.6608 MHZ CLOCK	EXT REF IN		EXT REF IN		MOD TIME BASE IN					FREQ MON-ITOR
	●		●		●					●
	●		●		●					●
	●		●		●					●
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	SYNTH REF IN					
	●	●	●	●	●					
	●	●	●	●	●					
	●	●	●	●	●					
SIGNAL SOURCE CONTROLLED SERIAL I/O		SERIAL I/O			SERIAL I/O					
		●			●					
		●			●					
TX TEST CABLES	RF IN/OUT	INPUT 50 Ω	RF INPUT 50 Ω						20 DB ATTEN. BTS PORT	TX1-6
	●	●	●						●	●
	●	●	●						●	●
	●	●	●						●	●
RX TEST CABLES	RF IN/OUT *			RF OUTPUT 50 Ω	RF OUT 50 Ω					RX1-6
	●			●	●					●
	●			●	●					●
	●			●	●					●

Equipment Warm-up

NOTE

Warm-up *BTS equipment for a minimum of 60 minutes* prior to performing the BTS optimization procedure. This assures BTS stability and contributes to optimization accuracy.

- Time spent running initial or normal power-up, hardware/firmware audit, and BTS download counts as warm-up time.

WARNING

Before installing any test equipment directly to any **BTS TX OUT** connector, verify there are *no* CDMA channels keyed.

- At active sites, have the OMC-R/CBSC place the antenna (sector) assigned to the BBX under test OOS. Failure to do so can result in serious personal injury and/or equipment damage.

Automatic Cable Calibration Set-up

Figure 3-11 and Figure 3-12 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 3-26 provides a procedure for performing automatic cable calibration.

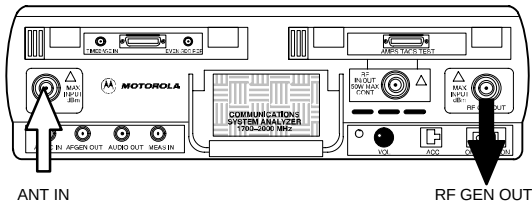
Manual Cable Calibration

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

Figure 3-11: IS-95A/B Cable Calibration Test Setup –
CyberTest, Agilent 8935, Advantest R3465, and HP 8921A

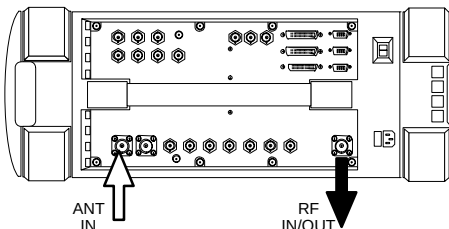
SUPPORTED TEST SETS

Motorola CyberTest

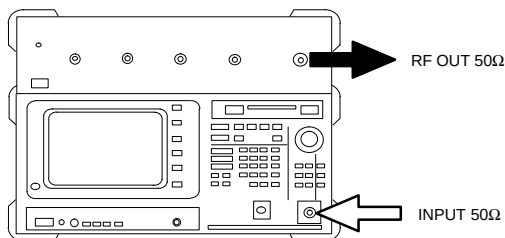


Note: The 30 dB directional coupler is not used with the CyberTest test set. The TX cable is connected directly to the CyberTest test set.

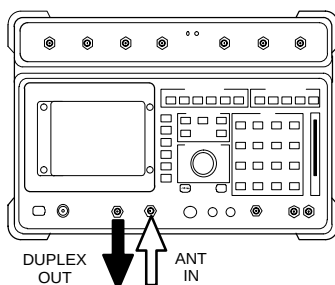
A 10dB attenuator must be used with the short test cable for cable calibration with the CyberTest test set. The 10dB attenuator is used only for the cable calibration procedure, not with the test cables for TX calibration and ATP tests.

Agilent 8935 Series E6380A
(formerly HP 8935)

Advantest Model R3465



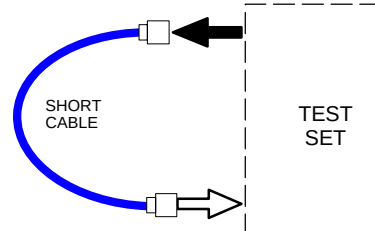
Hewlett Packard Model HP 8921A



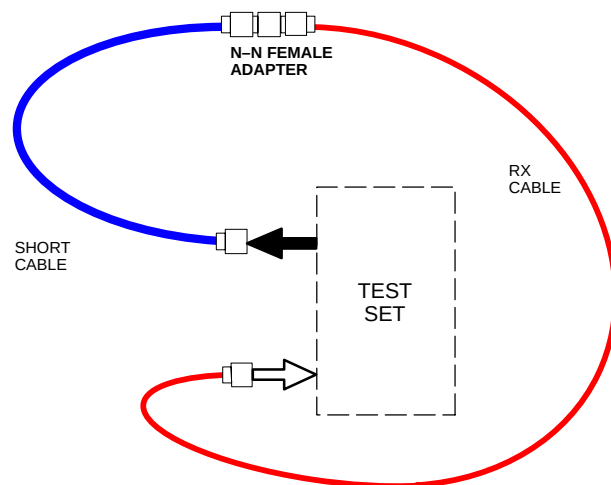
Note: For 800 MHz only. The HP8921A cannot be used to calibrate cables for PCS frequencies.

CALIBRATION SET UP

A. SHORT CABLE CAL



B. RX TEST CAL SETUP FOR TRDC



C. TX TEST AND DRDC RX TEST CAL SETUP

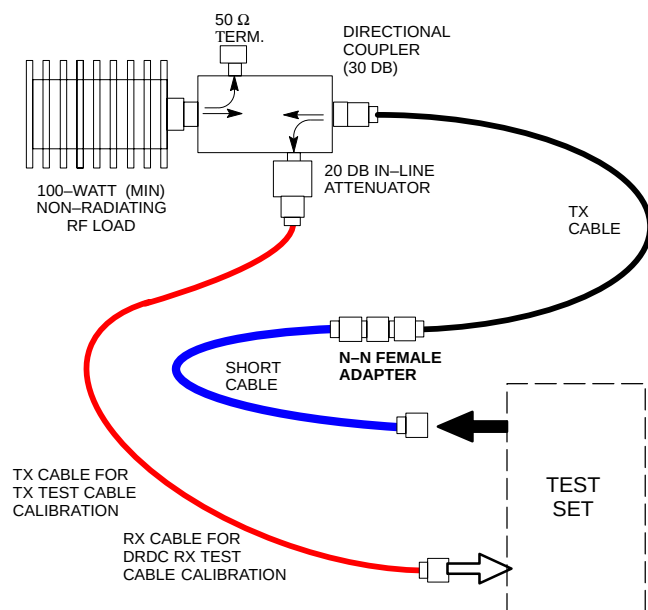
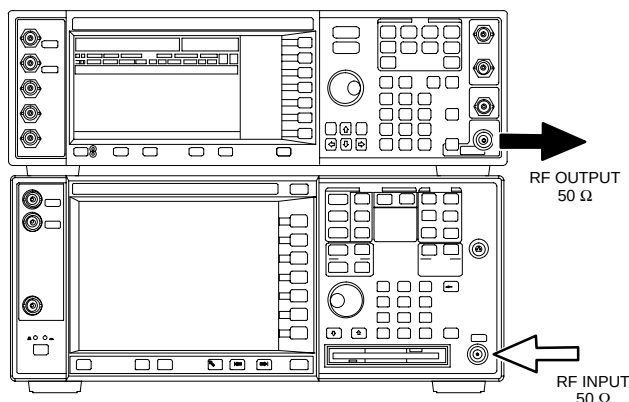


Figure 3-12: IS-95A/B and CDMA 2000 1X Cable Calibration Test Setup –
Agilent E4406A/E4432B and Advantest R3267/R3562

SUPPORTED TEST SETS

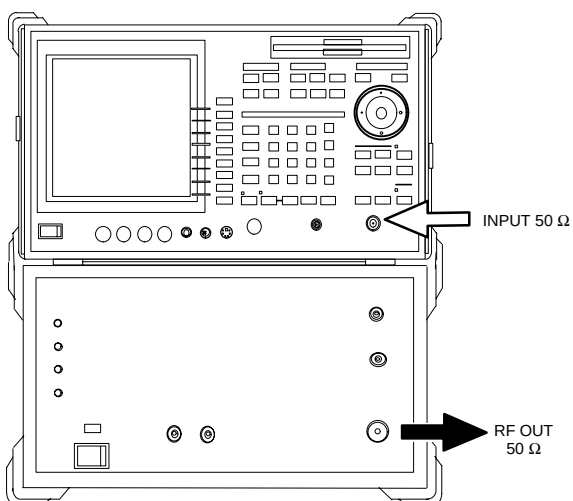
Agilent E4432B (Top) and E4406A (Bottom)



NOTE:

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

Advantest R3267 (Top) and R3562 (Bottom)

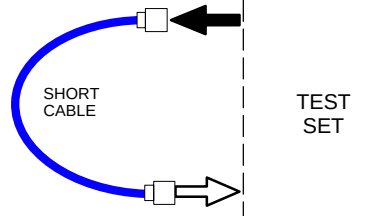


NOTE:

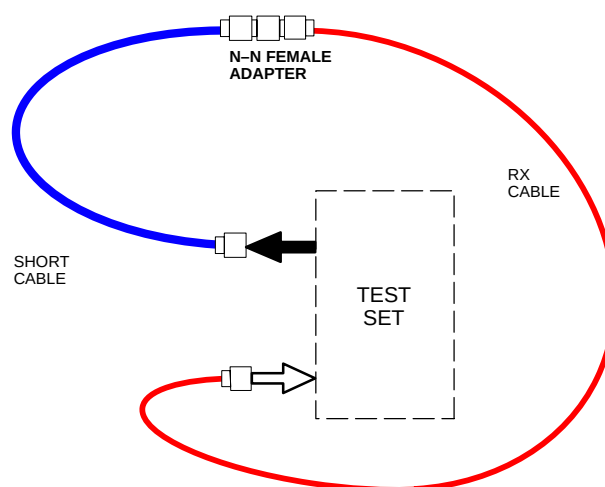
SYNTH REF IN ON REAR OF SIGNAL GENERATOR IS CONNECTED TO 10 MHZ OUT ON REAR OF SPECTRUM ANALYZER

CALIBRATION SET UP

A. SHORT CABLE CAL



B. RX TEST SETUP FOR TRDC



D. TX TEST SETUP AND DRDC RX TEST SETUP

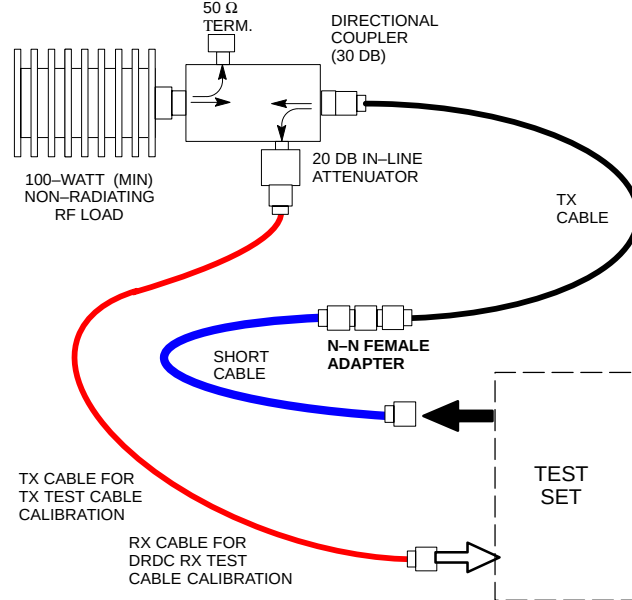
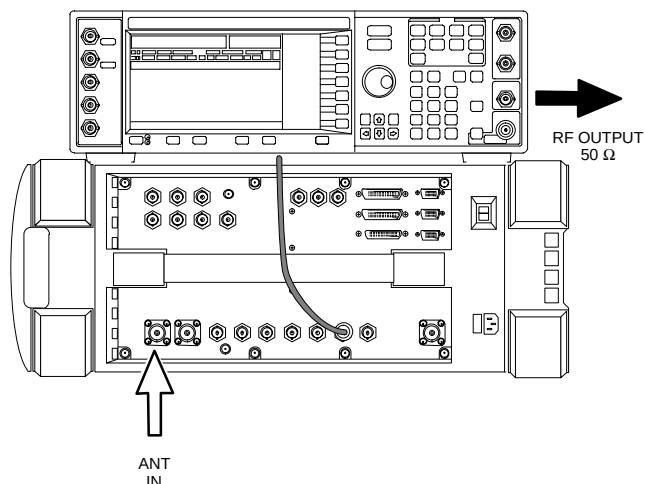


Figure 3-13: CDMA2000 1X Cable Calibration Test Setup –
Agilent 8935/E4432B and Agilent E7495A

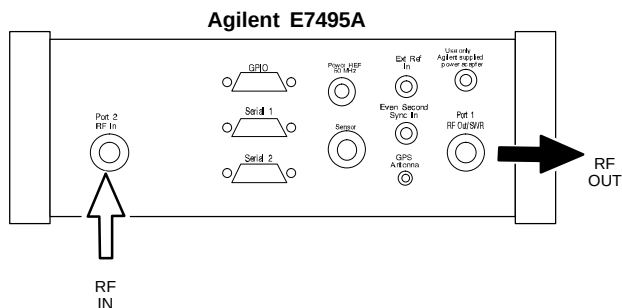
SUPPORTED TEST SETS

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



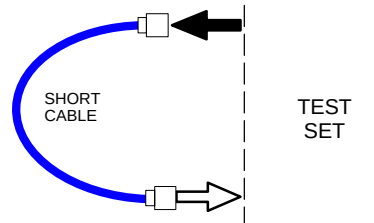
NOTE:

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

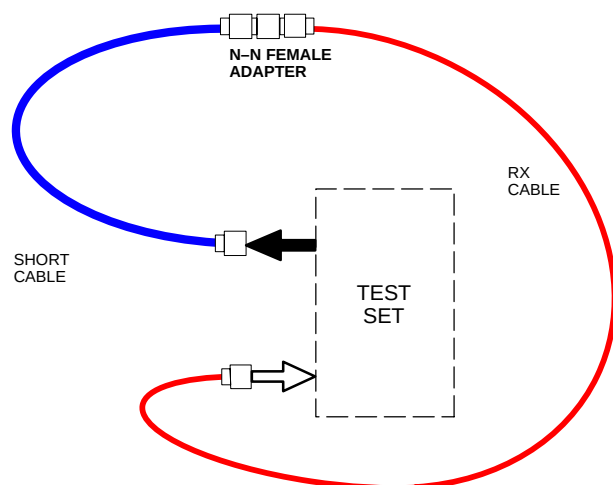


CALIBRATION SET UP

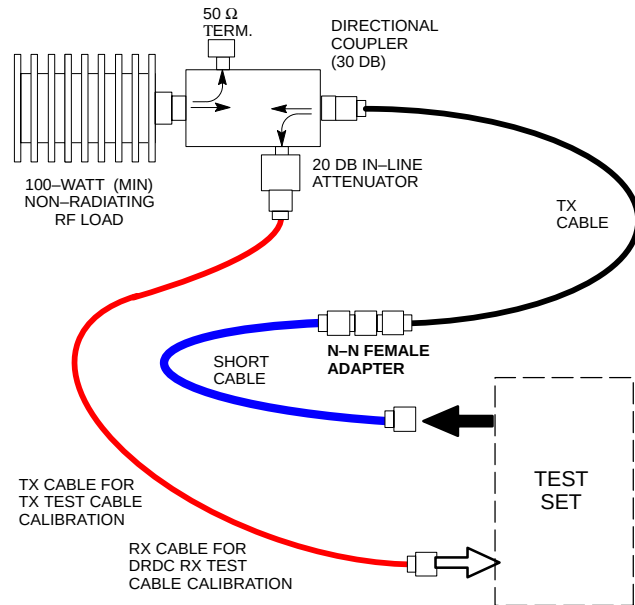
A. SHORT CABLE CAL



B. RX TEST SETUP FOR TRDC



D. TX TEST SETUP AND DRDC RX TEST SETUP



Set-up for TX Calibration

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

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

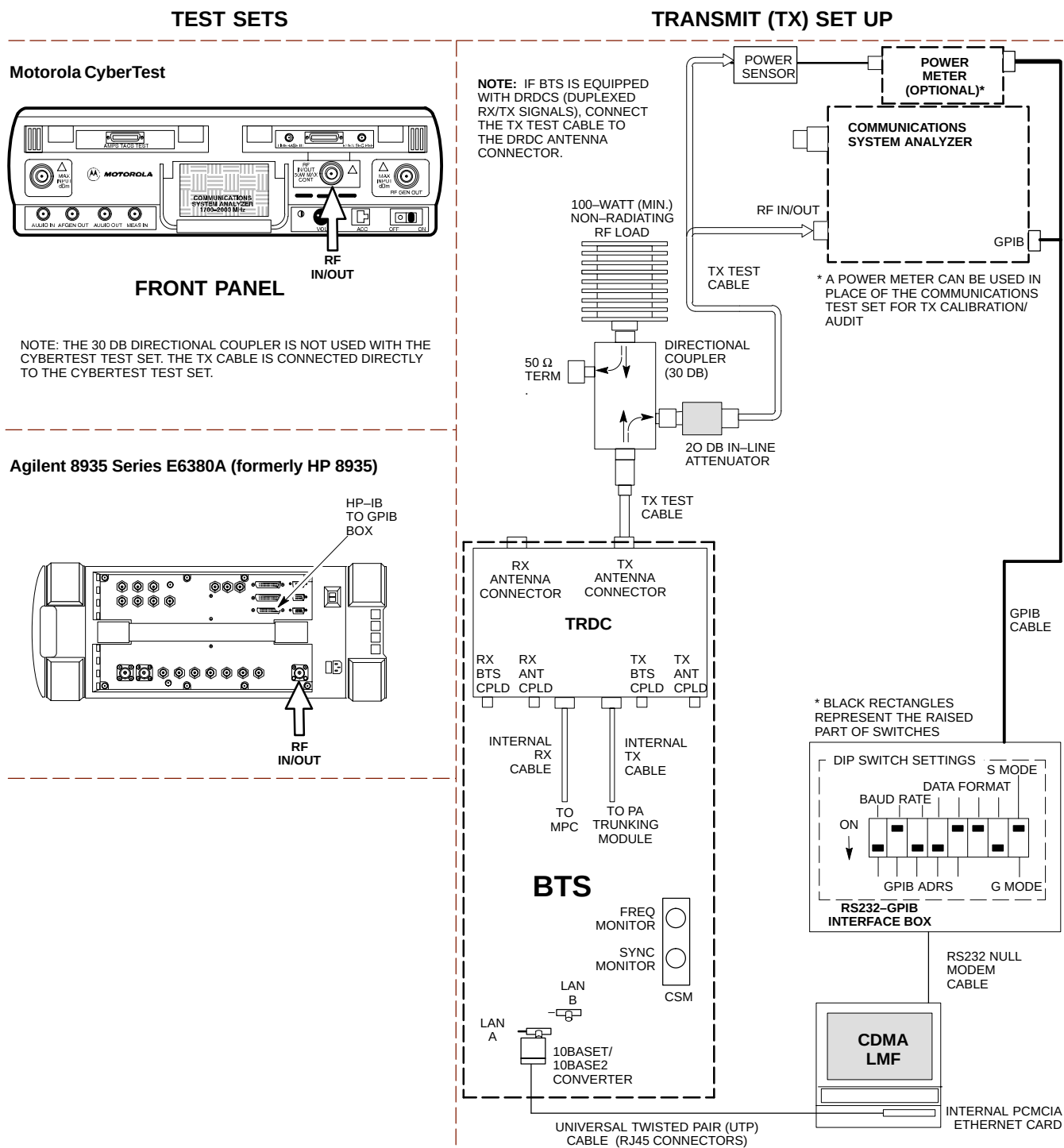


Figure 3-15: TX Calibration Test Setup – Using Power Meter

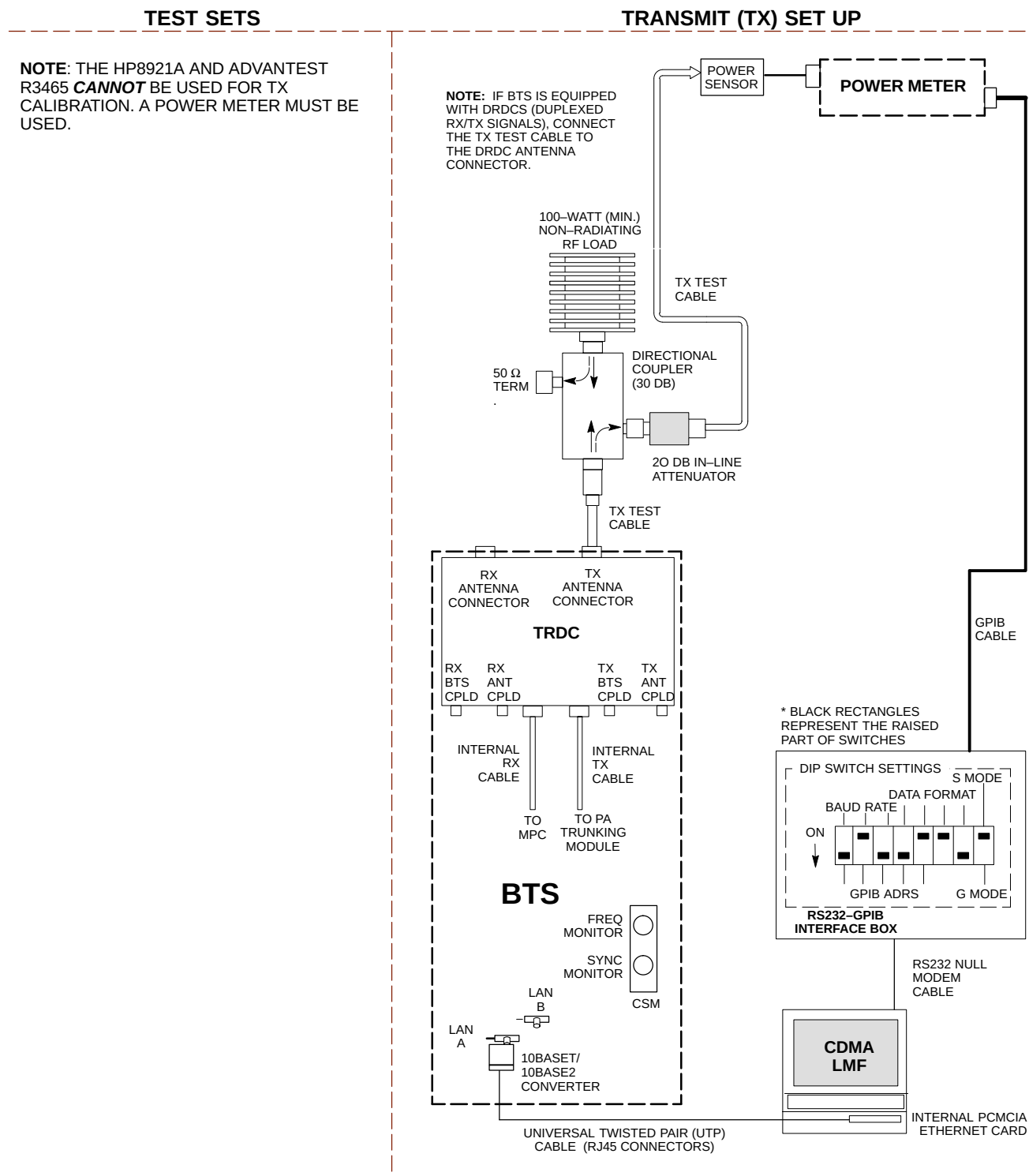
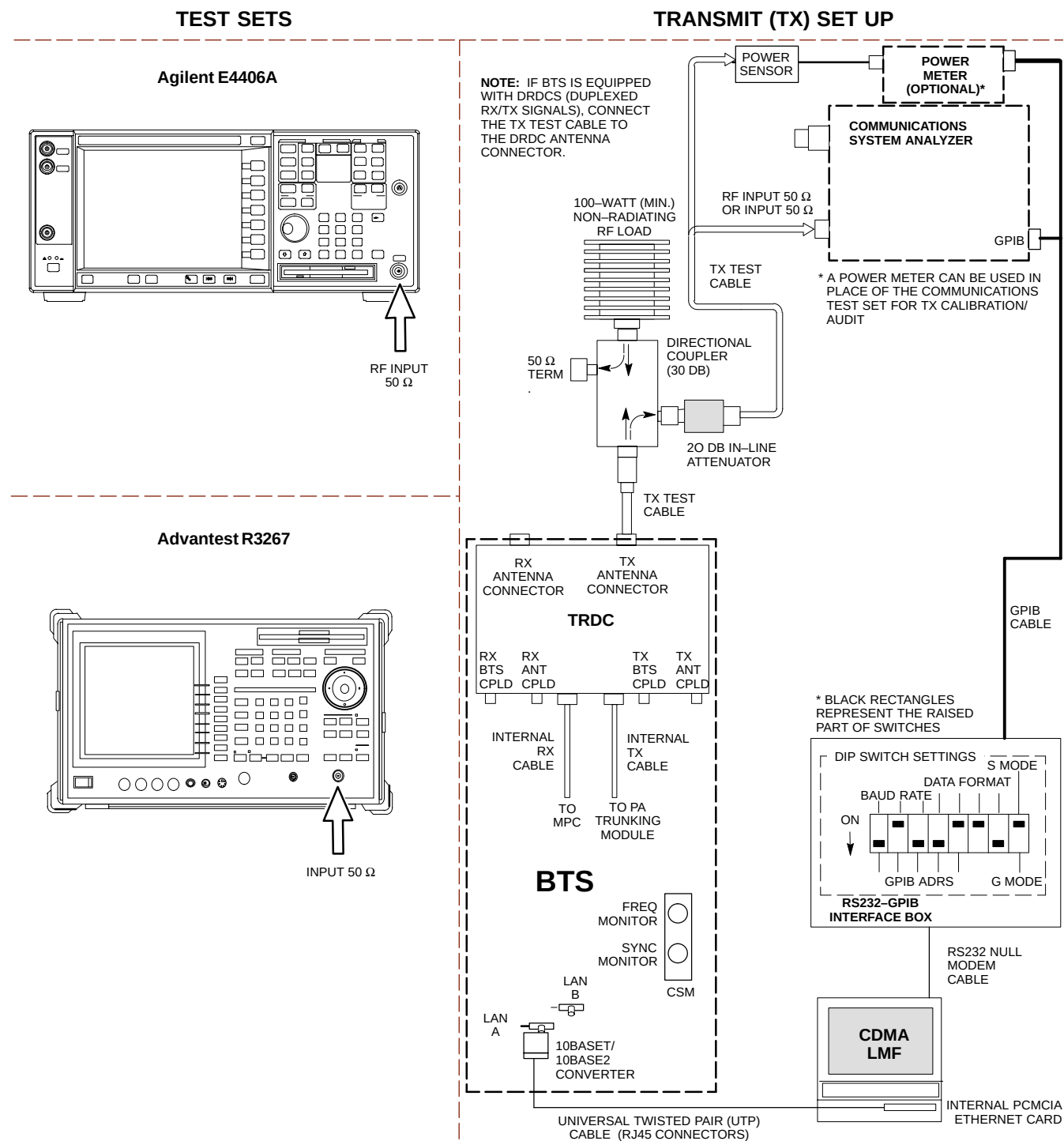


Figure 3-16: TX Calibration Test Setup –
Agilent E4406A and Advantest R3567 (IS-95A/B and CDMA2000 1X)



Set-up for ATP

Figure 3-17 and Figure 3-18 show the test set connections for ATP tests.

Figure 3-17: IS-95A/B ATP Test Set-up, TRDC Shown –
CyberTest, Advantest R3465, and Agilent 8935

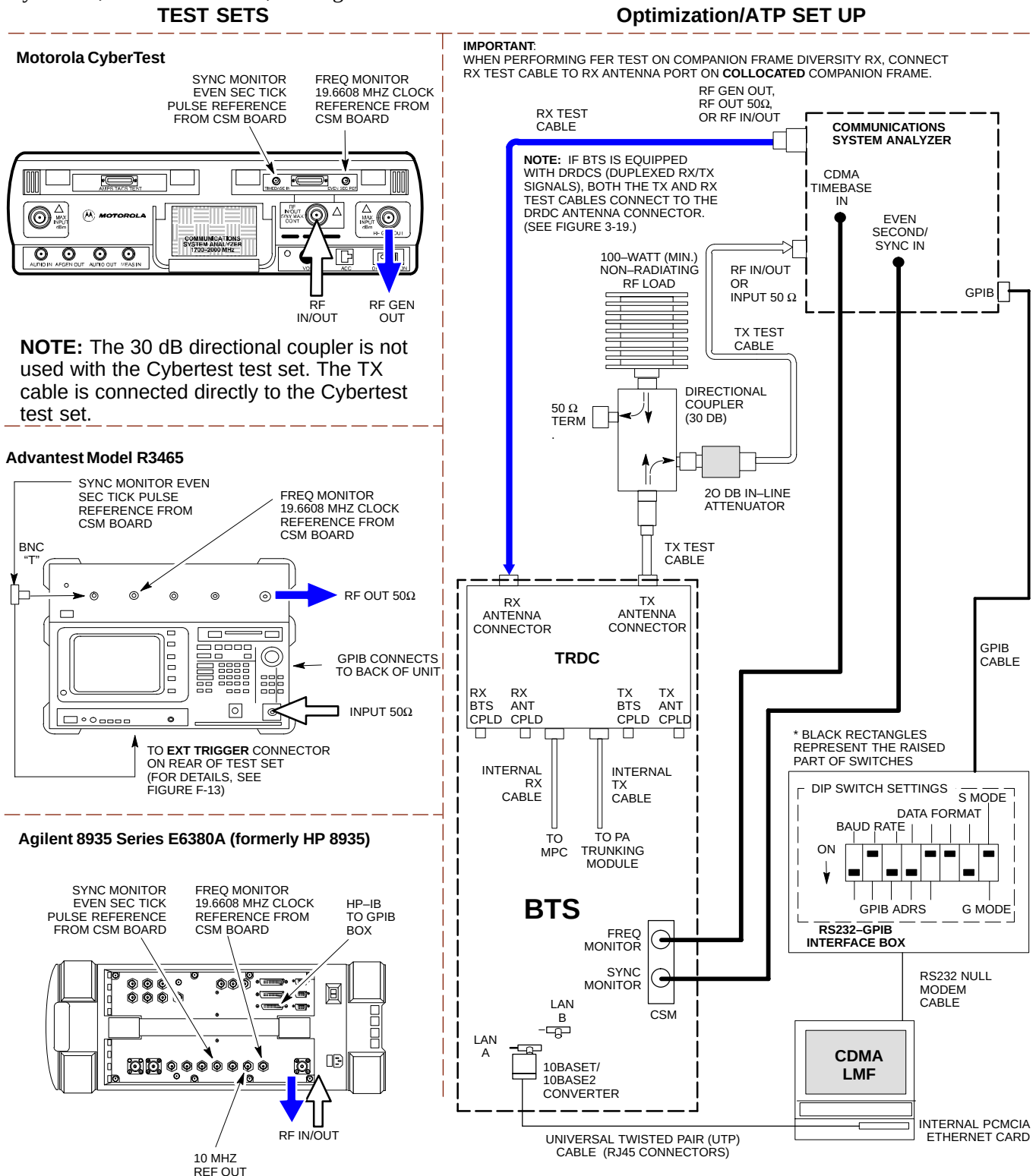
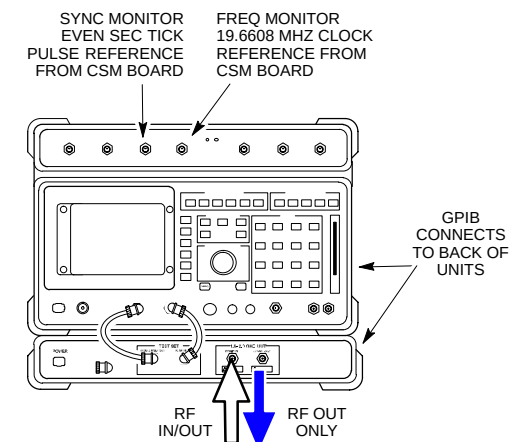


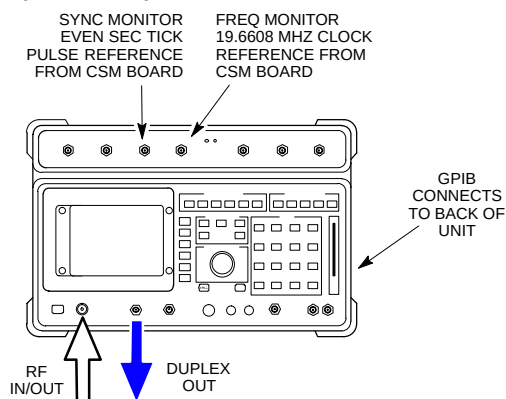
Figure 3-18: IS-95A/B ATP Test Setup – HP 8921A

TEST SETS

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



**Hewlett Packard Model HP 8921A
(for 800 MHz)**



NOTE:

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

RX TEST CABLE TO DUPLEX OUT

TX TEST CABLE TO RF IN/OUT

Optimization/ATP SET UP

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

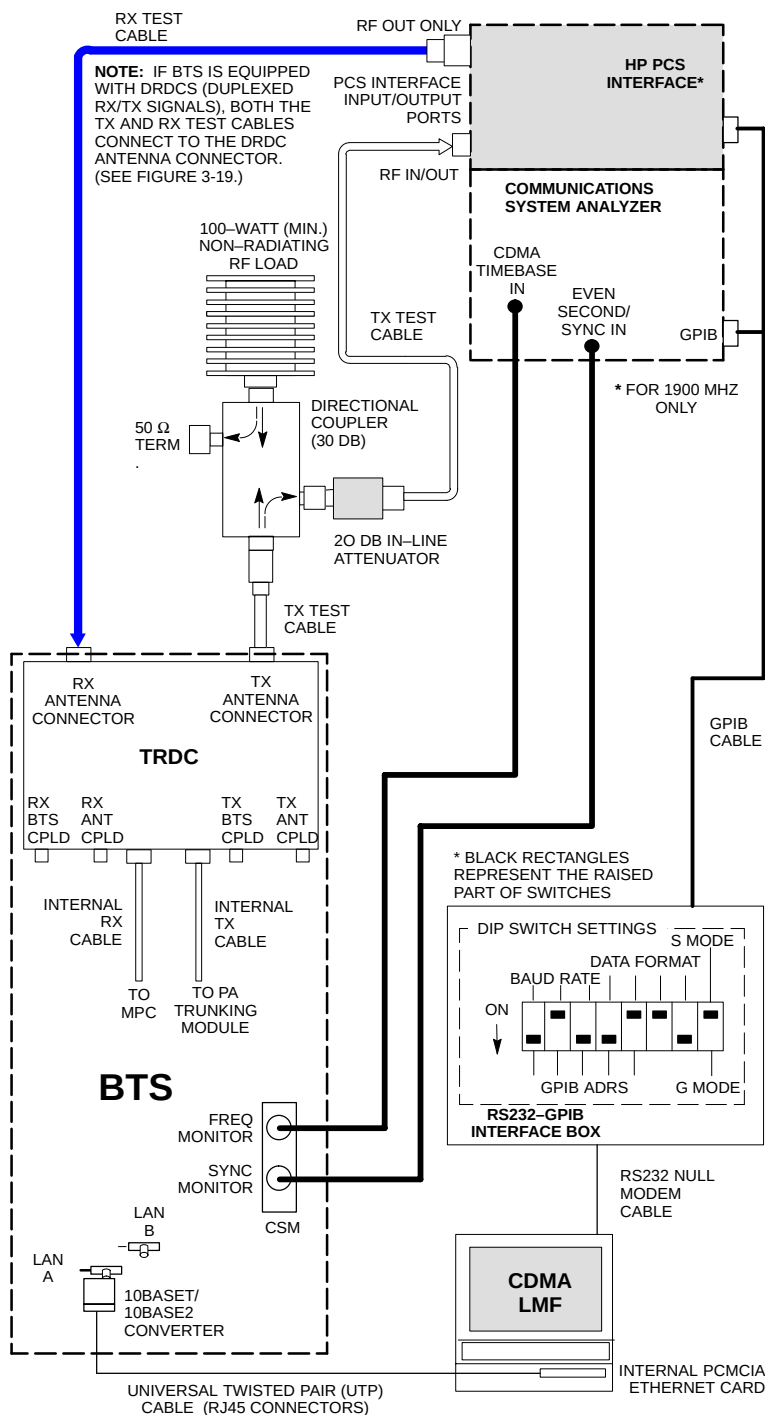


Figure 3-19: IS-95A/B and CDMA2000 1X ATP Test Setup With DRDCs – Agilent Test Equipment

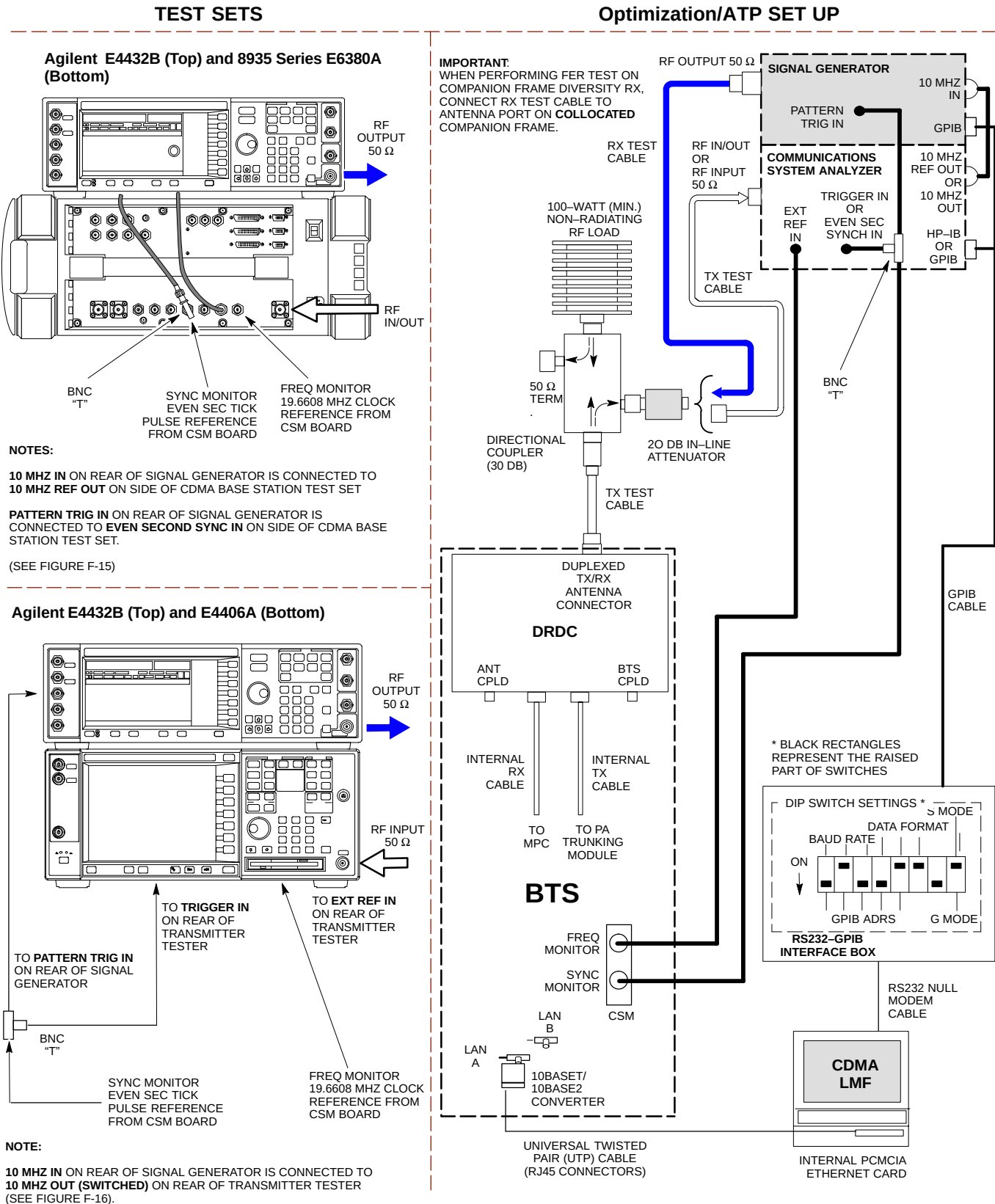


Figure 3-20: IS-95A/B and CDMA2000 1X ATP Test Setup With DRDCs –
Advantest R3267/3562 Test Equipment

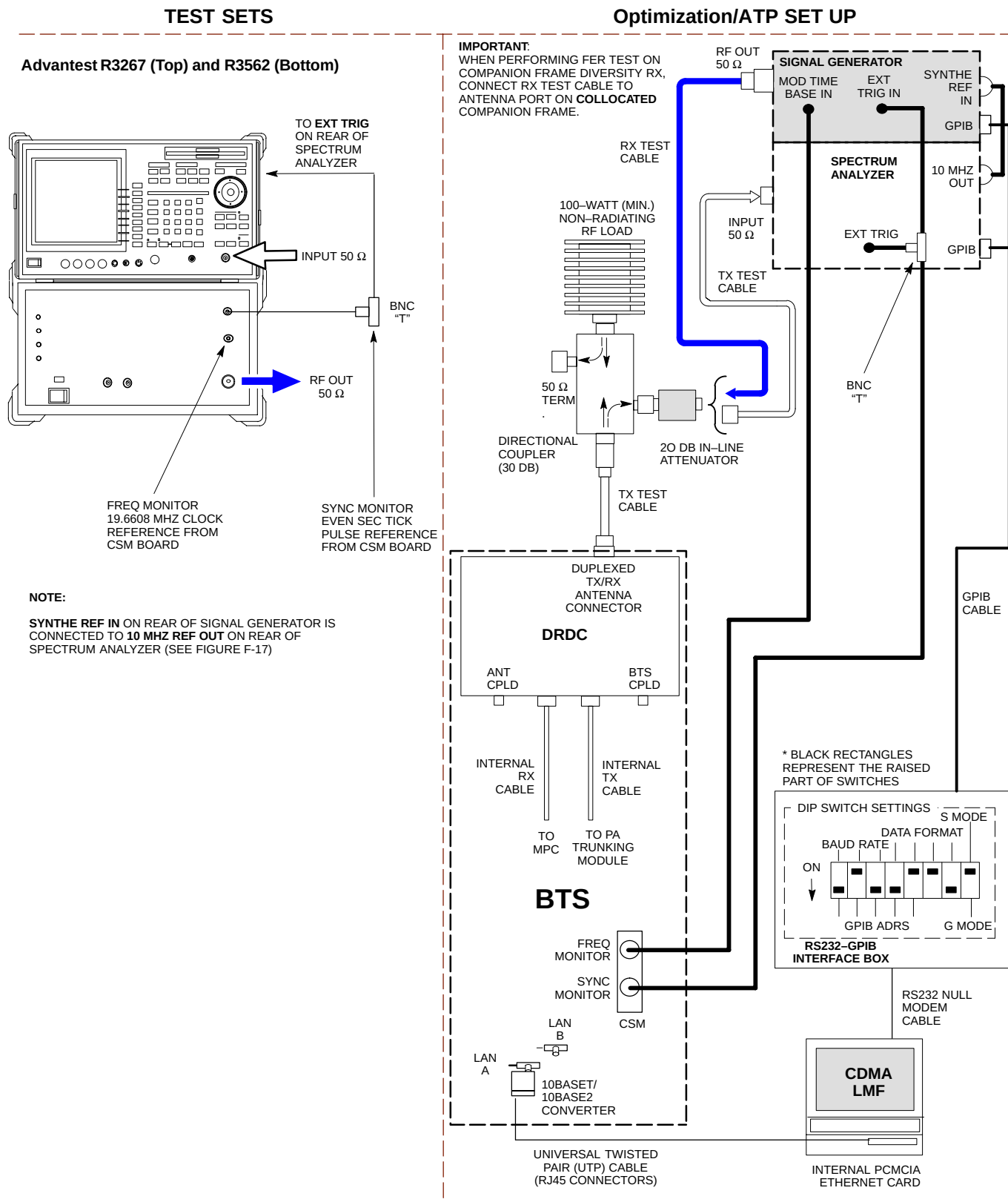


Figure 3-21: IS-95A/B and CDMA2000 1X ATP Test Setup With TRDCs – Agilent Test Equipment

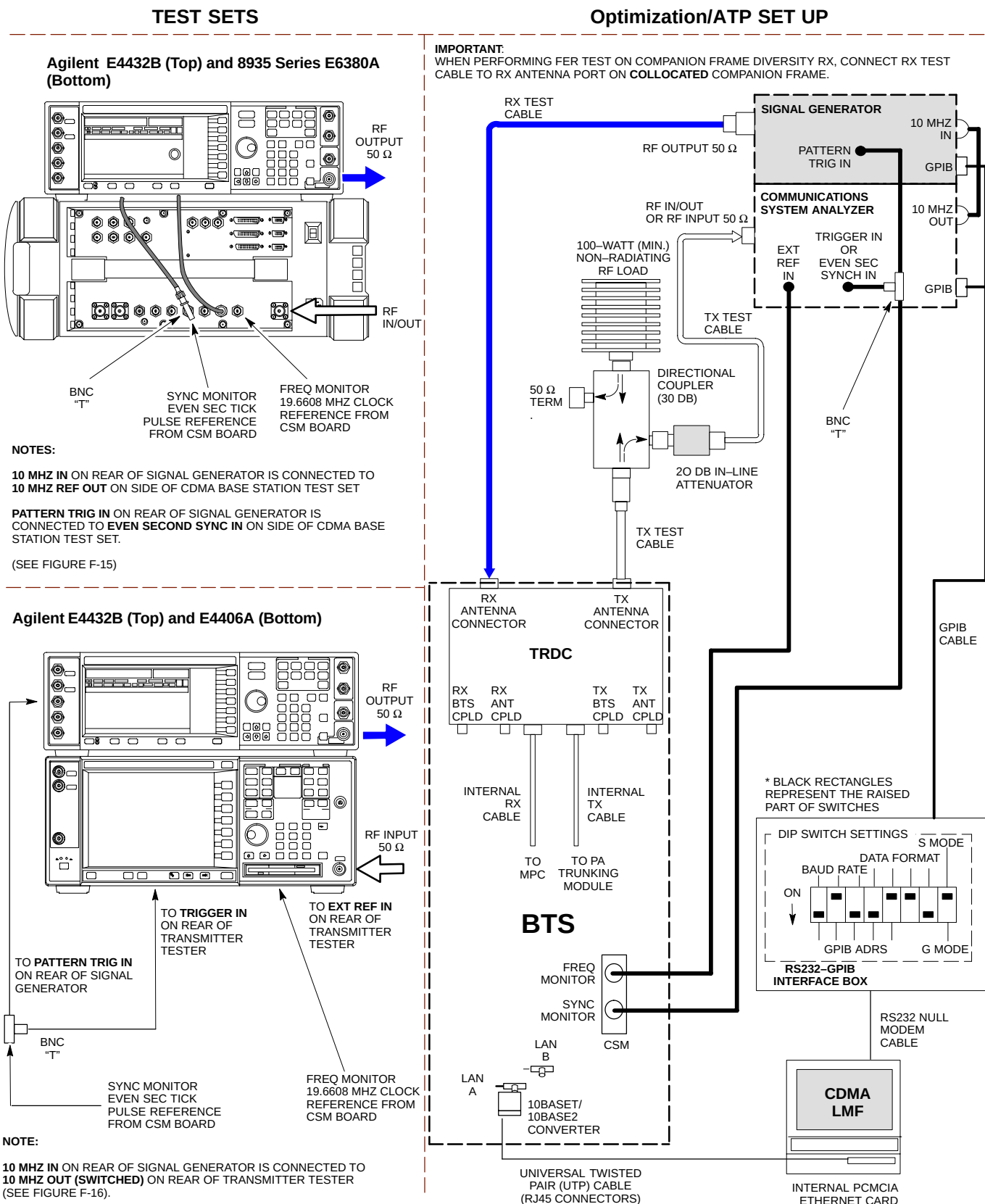
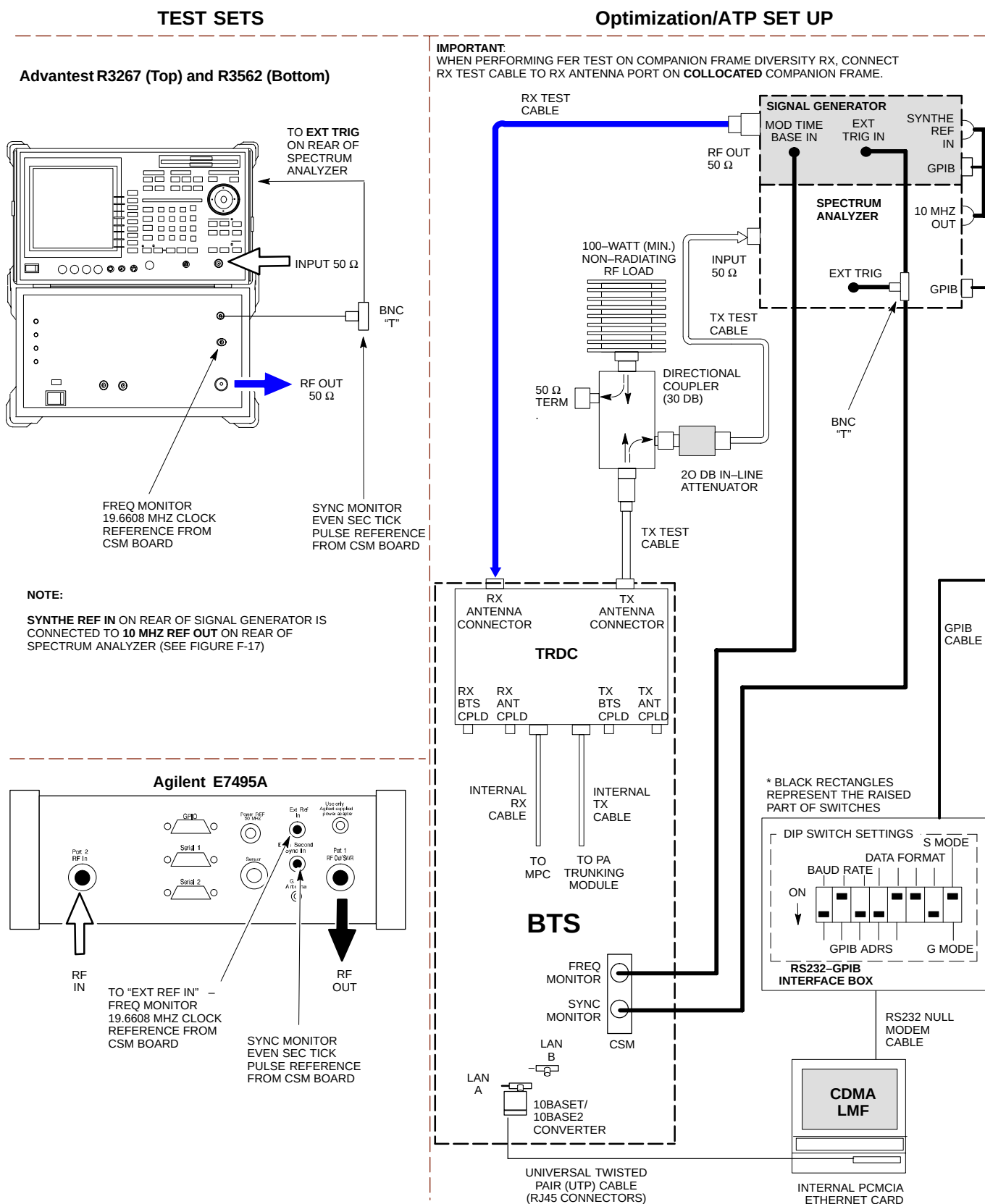


Figure 3-22: IS-95A/B and CDMA2000 1X ATP Test Setup With TRDCs –
 Advantest R3267/3562 Test Equipment, Agilent E7495A



Test Set Calibration

Background

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

NOTE	If the <i>test equipment set</i> being used to optimize or test the BTS has been calibrated and maintained as a set, this procedure does not need to be performed.
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This procedure must be performed *prior to* beginning the optimization. Verify all test equipment (including all associated cables and adapters actually used to interconnect test equipment items and the BTS) has been calibrated and maintained as a set.

CAUTION	If any piece of test equipment, test cable, or RF adapter that makes up the calibrated <i>test equipment set</i> has been replaced, the set must be re-calibrated. Failure to do so can introduce measurement errors, resulting in incorrect measurements and degradation to system performance. Motorola recommends repeating cable calibration before testing at each BTS site.
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NOTE	Calibration of the communications system analyzer (or equivalent test equipment) must be performed at the site before calibrating the overall <i>test equipment set</i> . Calibrate the test equipment <i>after</i> it has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i> .
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Calibration Procedures Included

Automatic

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

Manual

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

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

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

GPIO Addresses

GPIO 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 GPIO address boxes (Table 3-23 and Table 3-24) must match the addresses set in the test equipment. Motorola recommends using **1** for a CDMA signal generator, **13** for a power meter, and **18** for a communications system analyzer. To verify and, if necessary, change the GPIO addresses of the test equipment, refer to the Setting GPIO Addresses section of Appendix F.

Selecting Test Equipment

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

Prerequisites

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

- Test equipment is turned on.
- GPIO addresses set in the test equipment have been verified as correct using the applicable procedures in Appendix NO TAG.
- LMF computer serial port and test equipment are connected to the GPIO box.

Selecting Test Equipment

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

Manually Selecting Test Equipment in a Serial Connection Tab

Test equipment can be manually specified before or after the test equipment is connected. The LMF does not attempt to verify the test equipment is actually detected when manual selection is specified. Follow the procedure in Table 3-23 to manually select test equipment.

Table 3-23: Selecting Test Equipment Manually in the Serial Connection Tab	
Step	Action
1	In the LMF window menu bar, click Tools and select Options... from the pull-down menu. – The LMF Options window appears.
2	If it is not in the forefront, click on the Serial Connection tab.
3	Select the correct serial port in the COMM Port: pick list (normally COM1).
4	<i>If it is not selected (black dot showing)</i> , click on the Manual Specification button.
5	Click on the check box(es) corresponding to the test equipment item(s) to be used.
6	Type the GPIB address in the corresponding GPIB address box (refer to the Setting GPIB Addresses section of Appendix 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 NOTE When test equipment items are manually selected by the operator, the LMF defaults to using a power meter for RF power measurements. The LMF will use a communications system analyzer for RF power measurements only if a power meter is not selected (power meter checkbox <i>not</i> checked).
7	Click on Apply . – The button will darken until the selection has been recorded. NOTE With manual selection, the LMF does not attempt to detect the test equipment to verify it is connected and communicating with the LMF.
8	Click on Dismiss to close the LMF Options window.

Automatically Selecting Test Equipment in the Serial Connection Tab

When using the auto-detection feature to select test equipment, the LMF determines which test equipment items are actually communicating with LMF. Follow the procedure in Table 3-24 to use the auto-detection feature.

Table 3-24: Selecting Test Equipment Using Auto-Detect

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

Calibrating Test Equipment

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

NOTE

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

Prerequisites

- LMF computer serial port and test equipment are connected to the GPIB box.
- Test equipment is turned on and has warmed up for at least 60 minutes.
- Test equipment has been selected in the LMF (Table 3-23 or Table 3-24)

Follow the procedure in Table 3-25 to calibrate the test equipment.

Table 3-25: Test Equipment Calibration		
✓	Step	Action
	1	From the Util menu, select Calibrate Test Equipment from the pull-down menu. A Directions window is displayed.
	2	Follow the directions provided.
	3	Click on Continue to close the Directions window and start the calibration process. A status report window is displayed.
	4	Click on OK to close the status report window.

Calibrating Cables Overview

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

1. Measure the loss of a short cable. This is done to compensate for any measurement error of the communications system analyzer. The short cable, which is used only for the calibration process, is connected in series with both the TX and RX test cable configurations when they are measured. The measured loss of the short cable is deducted from the measured loss of the TX and RX test cable configurations to determine the actual loss of the configurations. This deduction is done so any error in the analyzer measurement will be adjusted out of both the TX and RX measurements.
2. Measure the loss of the short cable plus the RX test cable configuration. The RX test cable configuration normally consists only of a coax cable with type-N connectors that is long enough to reach from the BTS RX connector to the test equipment. When the BTS antenna connectors carry *duplexed TX and RX* signals, a directional coupler and, if required by BTS type, an additional attenuator are also required for the RX test cable configuration. These additional items must be included in the path loss measurement.
3. Measure the loss of the short cable plus the TX test cable configuration. The TX test cable configuration normally consists of two coax cables with type-N connectors, a directional coupler, a termination load with sufficient rating to dissipate the BTS output power, and an additional attenuator, if required by the BTS type. The total path loss of the TX test configuration must be as required for the BTS (normally 30 or 50 dB). The Motorola Cybertest analyzer is different from other communications system analyzers because the required attenuation/load is built into the test set. Because of this, the Cybertest TX test configuration consists only of the required length coax cable.

Calibrating Test Cabling using Communications System Analyzer

NOTE

LMF cable calibration cannot be accomplished with an HP8921A analyzer for 1.9 GHz. A different analyzer type or the signal generator and spectrum analyzer method (Table 3-27 and Table 3-28) must be used. Cable calibration values must be manually entered into the LMF cable loss file if the signal generator and spectrum analyzer method is used. To use the HP8921A for *manual* test cable configuration calibration for 800 MHz BTSs, refer to the Manual Cable Calibration section of Appendix F.

Prerequisites

- Test equipment is turned on and has warmed up for at least 60 minutes.
- Test equipment has been selected in the LMF (Table 3-23 or Table 3-24).
- Test equipment has been calibrated and correctly connected for the type of test cable configuration to be calibrated.

Procedure

Refer to Figure 3-11, Figure 3-12, or Figure 3-13 and follow the procedure in Table 3-26 to calibrate the test cable configurations.

Table 3-26: Test Cabling Calibration using Comm. System Analyzer

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

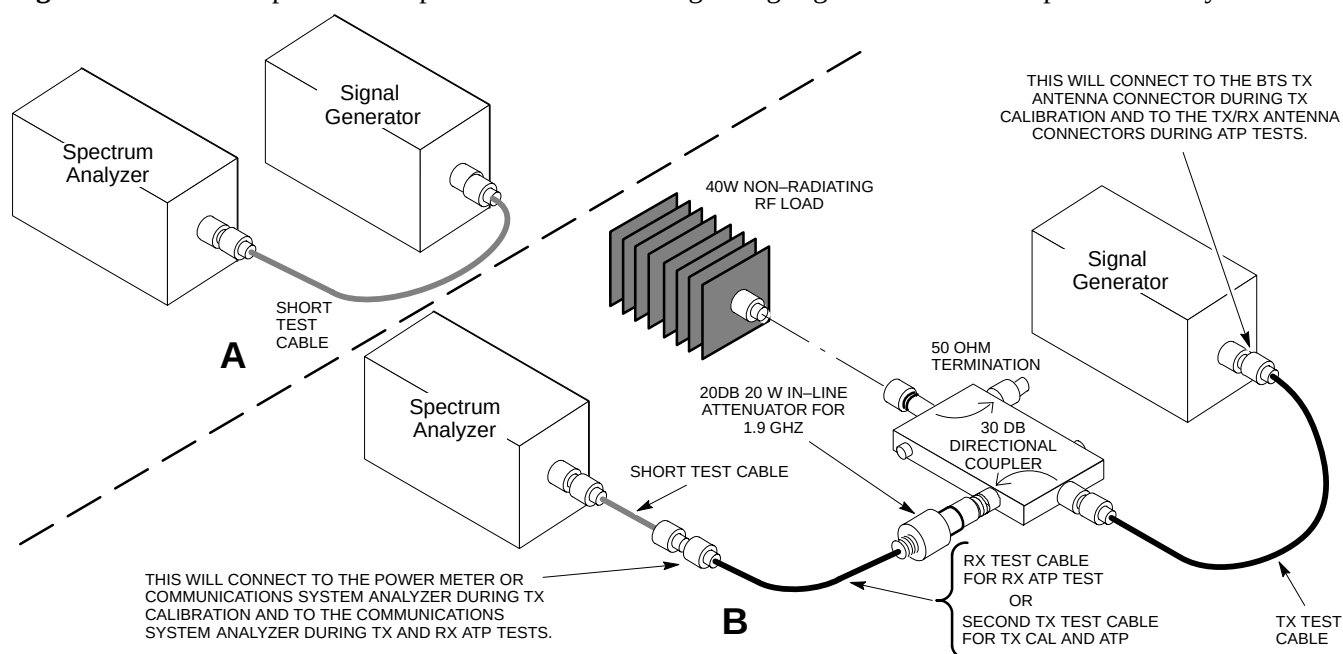
Calibrate Test Cabling Using Signal Generator & Spectrum Analyzer

Refer to Figure 3-23 and follow the procedure in Table 3-27 to calibrate the TX test cable configuration for all BTSs or the RX ATP test cable configuration for BTSs with *duplexed TX/RX* using the signal generator and spectrum analyzer. Refer to Figure 3-24 and follow the procedure in Table 3-28 to calibrate the test cable configuration for *non*-duplexed RX using the signal generator and spectrum analyzer.

TX and Duplexed RX Cable Calibration

Table 3-27: Calibrate TX/Duplexed RX Test Cabling using Signal Generator & Spectrum Analyzer	
Step	Action
1	Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 3-23, detail “A” (top portion of figure).
2	Set signal generator to 0 dBm at the customer frequency of the 869.7–893.31 MHz band for North American cellular and 1930–1990 MHz band for North American PCS.
3	Use spectrum analyzer to measure signal generator output and record the value for the detail “A” setup.
4	Change the test setup to the one shown in detail “B” (lower portion of Figure 3-23), to measure cable output at customer frequency (869.7–893.31 MHz band for North American cellular and 1930–1990 MHz for North American PCS) and record the value measured using the detail “B” test setup.
5	Calibration factor = (value measured with detail “A” setup) – (value measured with detail “B” setup) Example: Cal factor = –1 dBm – (–53.5 dBm) = 52.5 dB
NOTE The short cable is used for <i>calibration only</i>. It is <i>not</i> part of the final test setup. After calibration is completed, <i>do not</i> re-arrange any cables. Use the test cable configuration as-is to ensure test procedures use the correct calibration factor.	

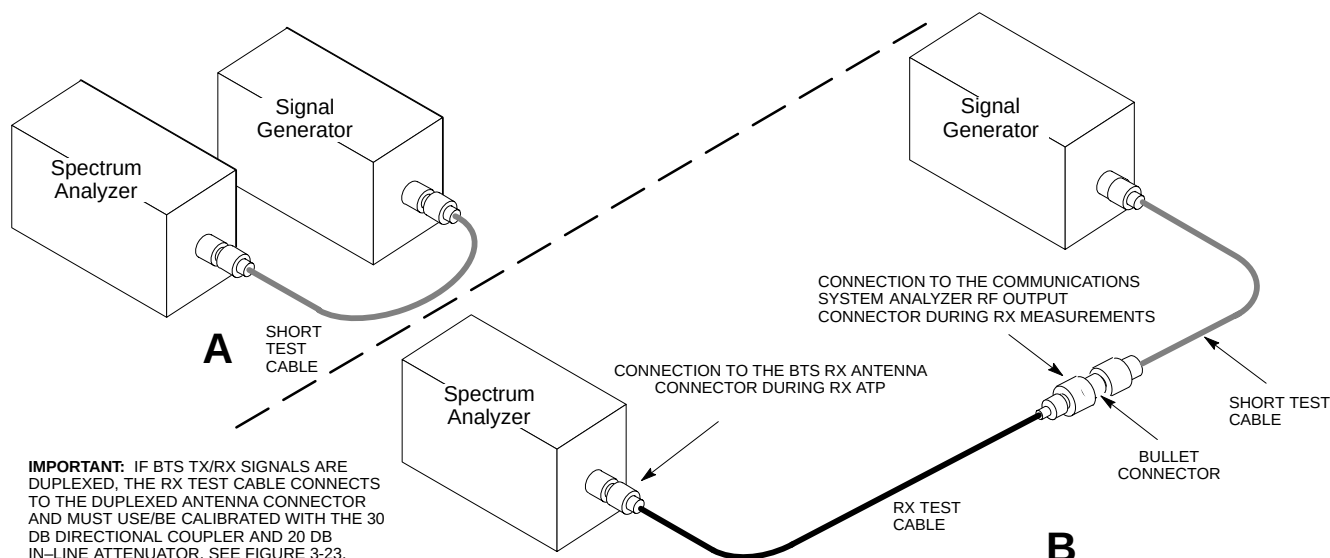
Figure 3-23: Cal Setup for TX/Duplexed RX Test Cabling Using Signal Generator & Spectrum Analyzer



Non-Duplexed RX Cable Calibration

Table 3-28: Calibrating *Non-Duplexed* RX Test Cabling Using Signal Generator & Spectrum Analyzer

Step	Action
1	NOTE When preparing to calibrate a BTS with <i>duplexed TX and RX</i> the RX cable calibration must be done using calibration setup in Figure 3-23 and the procedure in Table 3-27. Connect a short test cable between the spectrum analyzer and the signal generator as shown in Figure 3-24, detail “A” (top portion of figure).
2	Set signal generator to –10 dBm at the customer’s RX frequency of 824.7–848.31 MHz for North American cellular or 1850–1910 MHz band for North American PCS.
3	Use the spectrum analyzer to measure signal generator output and record the value for the detail “A” setup.
4	Change the test setup to the one shown in detail “B” (lower portion of Figure 3-24) to measure the output at the customer’s RX frequency (824.7–848.31 MHz for North American cellular or 1850–1910 MHz band for North American PCS). Record the value measured with the detail “B” test setup.
5	Calibration factor = (value measured with detail “A” setup) – (value measured with detail “B” setup) Example: Cal factor = –12 dBm – (–14 dBm) = 2 dB NOTE The short test cable is used for test equipment setup calibration <i>only</i>. It is not part of the final test setup. After calibration is completed, <i>do not</i> re-arrange any cables. Use the test cable configuration as-is to ensure test procedures use the correct calibration factor.

Figure 3-24: Cal Setup for Non-Duplexed RX Test Cabling Using Signal Generator & Spectrum Analyzer

Setting Cable Loss Values

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

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

- LMF is logged into the BTS

Table 3-29: Setting Cable Loss Values

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

Setting TX Coupler Loss Value

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

Prerequisites

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

Table 3-30: Setting TX Coupler Loss Values

Step	Action
1	Click Util in the BTS menu bar, and select Edit > Coupler Loss... in the pull-down menus. – A <i>tabbed</i> data entry pop-up window will appear.
2	Click on the TX Coupler Loss tab or the RX Coupler Loss tab, as required
3	Click in the Loss (dBm) column for each carrier that has a coupler and enter the appropriate value.
4	To edit existing values, click in the data box to be changed and change the value.
5	<i>For each tab with changes</i> , click on the Save button to save displayed values.
6	Click on the Dismiss button to close the window. NOTE • Values entered or changed after the Save button is used will be lost when the window is dismissed. • The In-Service Calibration check box in the Tools > Options > BTS Options tab must be checked before entered TX coupler loss values will be used by the TX calibration and audit functions. • New or changed values will be used by the LMF as soon as they are saved. Logging out and logging in again <i>are not required</i> to cause saved changes to take effect.

Bay Level Offset Calibration

Purpose of Bay Level Offset Calibration

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

What is BLO Calibration?

Description

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

BTS RF Path Descriptions

Transmit (TX) path – A TX path starts at an SCCP shelf BBX backplane slot, travels through the CIO card, is routed to the Power Amplifier (PA) trunking module for sector phase shifting, through the PAs, back through the PA trunking module for sector phase selection, through the TX bandpass filter (starter frames) or 2:1 TX combiner (companion frames), through the Transmit & Receive Filter (TRF) or Duplexer TX/RF Filter (DRF), and ends at the TRF or DRF antenna connector.

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

Diversity RX path – Diversity RX paths differ for SC4812T Lite starter (stand-alone) and companion frames. The following describe each type of path:

- **Starter frame diversity RX path** – A starter frame diversity RX path is the same as a main RX path except that it starts at ANTENNAS connectors 1B, 2B, or 3B, travels through the associated TRF or DRF, and the MPC card in SCCP cage slot MPC-2 (refer to Table 1-6).
- **Companion frame diversity RX path** – The companion frame main RX signal is used for the collocated companion frame diversity RX signal. A companion frame’s diversity RX path starts at ANTENNAS connectors 1A, 2A, or 3A *in the collocated companion frame*. It travels through the associated TRF or DRF, the MPC in SCCP cage slot MPC-1, and the CIO card where it is then routed out of the frame through the RX expansion *out* connectors (RX EXPANSION 1A, 2A,

or 3A). The signal travels through the inter-frame diversity RX cables, into the RX expansion *in* ports (RX EXPANSION 1B, 2B, or 3B in NO TAG or NO TAG) of the companion frame, through the Expansion MPC (EMPC) in SCCP cage slot MPC–2, the CIO, and terminates at a backplane BBX slot in the SCCP shelf.

- **RFDS sampling paths** – Directional couplers for RFDS signal sampling are integral to the SC4812T Lite transmit and receive paths in the DRDCs and TRDCs. Cables connect from these directional couplers to the RFDS input connectors.

Component Verification During Calibration

TX Path Calibration

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

RX Path Calibration

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

When to Calibrate BLOs

Calibration to determine BLO:

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

BLO Calibration Data File

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

NOTE

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

CAL File Organization

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

1. **Slot[1] Block** which contains the calibration data for the six primary BBX slots.
2. **Slot[20] Block** which contains the calibration data for the redundant BBX (see Table 3-32).
3. **Slot[385] Block** which contains the calibration data for the RFDS.

BBX Slot Block Parts

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

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

- A creation Date and Time – broken down into separate parameters of createMonth, createDay, createYear, createHour, and createMin.
- The number of *calibration entries* in the file – the numBayLevelPts parameter. The parameter is fixed at 720 entries for SC4812–series frames. These 720 entries are combined to define the 360 *calibration points* of the CAL file.
- The slot Block format parameter.

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

- The first view of the array is shown in Table 3-31. This view shows the three *branches* of the array, transmit, main receive, and diversity receive offsets, and the *calibration entry* ranges which apply to each.

Table 3-31: BLO bts-#.cal File Array Branch Assignments	
Range	Branch Assignment
C[1]–C[120]	Transmit
C[121]–C[240]	No SC4812T Lite BLO cal point entries (default only)
C[241]–C[360]	Receive
C[361]–C[480]	No SC4812T Lite BLO cal point entries (default only)
C[481]–C[600]	Diversity Receive
C[601]–C[720]	No SC4812T Lite BLO cal point entries (default only)

- The second view of the array is shown in Table 3-32. This view shows the assignment of *calibration entries* in each branch to each BBX slot, carrier, and sectorization. Three sectors are allowed for an SC4812T Lite frame.

Table 3-32: SC4812T Lite bts-#.cal File Array (By BBX/Sector)				
BBX	Sectorization	TX Branch	RX Branch	RX Diversity Branch
Slot[1] (Primary BBXs 1 through 6)				
1 (Omni)	3–Sector, 1st Carrier	C[1]–C[20]	C[241]–C[260]	C[481]–C[500]
2		C[21]–C[40]	C[261]–C[280]	C[501]–C[520]
3		C[41]–C[60]	C[281]–C[300]	C[521]–C[540]
4	3–Sector, 2nd Carrier	C[61]–C[80]	C[301]–C[320]	C[541]–C[560]
5		C[81]–C[100]	C[321]–C[340]	C[561]–C[580]
6		C[101]–C[120]	C[341]–C[360]	C[581]–C[600]
Not Used in SC4812T Lite (CAL file entries are Channel 0 with default power set level.)		C[121]–C[140]	C[361]–C[380]	C[601]–C[620]
		C[141]–C[160]	C[381]–C[400]	C[621]–C[640]
		C[161]–C[180]	C[401]–C[420]	C[641]–C[660]
		C[181]–C[200]	C[421]–C[440]	C[661]–C[680]
		C[201]–C[220]	C[441]–C[460]	C[681]–C[700]
		C[221]–C[240]	C[461]–C[480]	C[701]–C[720]
Slot[20] (Redundant BBX–R1)				
1 (Omni)	3–Sector, 1st Carrier	C[1]–C[20]	C[241]–C[260]	C[481]–C[500]
2		C[21]–C[40]	C[261]–C[280]	C[501]–C[520]
3		C[41]–C[60]	C[281]–C[300]	C[521]–C[540]
4	3–Sector, 2nd Carrier	C[61]–C[80]	C[301]–C[320]	C[541]–C[560]
5		C[81]–C[100]	C[321]–C[340]	C[561]–C[580]
6		C[101]–C[120]	C[341]–C[360]	C[581]–C[600]
Not Used in SC4812T Lite (CAL file entries are Channel 0 with default power set level.)		C[121]–C[140]	C[361]–C[380]	C[601]–C[620]
		C[141]–C[160]	C[381]–C[400]	C[621]–C[640]
		C[161]–C[180]	C[401]–C[420]	C[641]–C[660]
		C[181]–C[200]	C[421]–C[440]	C[661]–C[680]
		C[201]–C[220]	C[441]–C[460]	C[681]–C[700]
		C[221]–C[240]	C[461]–C[480]	C[701]–C[720]

- When referring to the CAL file print–out and Table 3-32, it can be seen that there is one BBX slot per sector with 20 “calibration *entries*” per BBX (sector) for each branch. *Two* calibration *entries* define a single “calibration *point*,” therefore there are *ten* calibration *points* in each branch for each BBX.
 - The first entry for a calibration point (all odd entries) identifies the CDMA channel (frequency) where the BLO is measured. The second calibration entry (all even entries) is the power set level (PwrLvlAdj) for that frequency. The valid range for PwrLvlAdj is

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

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

Example:

$$\left. \begin{array}{ll} C[1]=384 & \text{(odd cal entry)} \\ C[2]=19102 & \text{(even cal entry)} \end{array} \right\} = 1 \text{ “calibration point”}$$

$$\left. \begin{array}{ll} C[3]=777 & \text{(odd cal entry)} \\ C[4]=19086 & \text{(even cal entry)} \end{array} \right\} = 1 \text{ “calibration point”}$$

$$\vdots$$

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

In the example above, BLO was measured at only two frequencies (channels 384 and 777) for SCCP slot BBX–1 transmit (Table 3-32). The BLO data for the highest frequency measured (channel 777) will be written to the remaining eight transmit calibration points (defined by entries C[5] through C[20]) for BBX–1.

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

CAL File and BLO Data Download

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

Test Equipment Setup for RF Path Calibration

Follow the steps outlined in Table 3-33 and refer as needed to Figure 3-14 or Figure 3-15 to set up test equipment.

Table 3-33: Set Up Test Equipment for RF Path Calibration	
Step	Action
1	<i>If it has not already been done</i> , refer to the procedure in Table 3-5 (on page 3-17) to interface the LMF computer terminal to the frame LAN A connector.
2	<i>If it has not already been done</i> , refer to Table 3-6 (on page 3-26) to start a <i>GUI</i> LMF session.
3	If required, calibrate the test equipment per the procedure in Table 3-25 (on page 3-76).
4	! CAUTION To prevent damage to the test equipment, all transmit (TX) test connections must be via the 30 dB directional coupler for 800 MHz or via a 30 dB coupler with a 20 dB in-line attenuator for 1900 MHz. <i>For TX path calibration</i>, connect the test equipment as shown in Figure 3-14, Figure 3-15, or Figure 3-16, depending on the communications analyzer being used.

Transmit (TX) Path Calibration Description

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

NOTE	Be sure the bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files loaded on the LMF computer are current. The LMF will obtain carrier and channel information from these files and insert it into the appropriate CDMA Test Parameter screen. Failure to have the most current files from the CBSC can result in incorrect channel information being used to calibrate the BTS and unfavorable affects on BTS performance. Carrier and channel numbers should only be entered manually for special test cases or as a last resort.
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The calibration process attempts to adjust the measured power to within ± 0.5 dB of the desired power. The calibration will pass if the error is less than ± 1.5 dB.

The TX BLO for the SC 4812T Lite is approximately 42.0 dB ± 5.0 dB. BLO is the gain in dB between the known power output of the BBX and the measured power at the TX port. BLO is derived by deducting the known BBX power output from the power measured at the TX port or (Measured Power) – (BBX TX Power Output).

Example:

Measured Power (at TX port) = 36.0 dBm

Known BBX TX Power Output = –6.0 dBm

BLO = (36.0) – (–6.0) = 42.0 dB gain

TX Calibration and the LMF

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

Rate Set Drop-down Pick List

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

Verify BLO Checkbox

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

Single-Sided BLO Checkbox

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

Test Pattern Drop-down Pick List

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

- **Standard** – performs calibration or audit using pilot, paging, synch, and six traffic channels with IS-97-specified gain. This pattern setting should be used for all *non*-in-service calibrations and audits. Using this pattern setting requires the selection of both a BBX *and* at least one MCC.
- **Pilot** (default) – performs calibration using only the pilot channel. This pattern setting should be used for in-service calibrations, and requires selection of only a BBX.
- **CDFPilot** – This pattern setting is for advanced users. It performs calibration or audit using the CDF value for pilot gain and IS-97 gain values for all the other channels included in the **Standard** pattern setting (paging, synch, and six traffic). Using this pattern setting requires the selection of both a BBX *and* at least one MCC.
- **CDF** – This pattern setting is for advanced users who need to use CDF gain settings for *all* channels included in the **Standard** pattern setting (pilot, paging, synch, and six traffic). Using this pattern setting requires the selection of both a BBX *and* at least one MCC.

Test Pattern Channels and Gain Settings – The CDMA channels and their respective digital gain settings used for each test pattern are listed in Table 3-34.

Table 3-34: Test Patterns with Channels and Gain Settings Used		
Test Pattern	Channel(s)	Gain Setting
Pilot	Pilot channel only	541
Standard	Pilot	117
	Synch channel (SCH)	57
	Paging (PCH)	114
	Traffic (TCH)	80 for each of 6 Walsh codes used (6*80)
CDF Pilot	Pilot	Uses CDF-specified pilot gain
	SCH	57
	PCH	114
	TCH	6*80
CDF	Pilot	All channels use CDF-specified gains
	SCH	
	PCH	
	TCH (6)	

TX Calibration

WARNING	<i>Before</i> installing any test equipment directly to any BTS TX OUT connector, <i>first verify no CDMA channels are keyed.</i> Failure to do so can result in serious personal injury and/or equipment damage.
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CAUTION	Always wear an approved anti-static wrist strap while handling any circuit card or module. If this is not done, there is a high probability that the card or module could be damaged by ESD.
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NOTE	<i>At new site installations,</i> to facilitate the complete test of each SCCP shelf (if the shelf is not already fully populated with BBX boards), move BBX boards from shelves currently not under test and install them into the empty BBX slots of the shelf currently being tested to insure that all BBX TX paths are tested. – This procedure can be bypassed on operational sites that are due for periodic optimization. – Prior to testing, view the CDF (or NECF) file to verify the correct BBX slots are equipped. Edit the file as required to include BBX slots not currently equipped (per Systems Engineering documentation).
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All Cal/Audit and TX Calibration Procedure

The LMF All Cal/Audit and TX calibration procedures are essentially identical, except for the step that selects the type of procedure desired (Refer to Step 4 in Table 3-35).

Prerequisites

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

- The card in slot CSM 1, GLIs, MCCs, and BBXs have correct code and data loads.
- Primary CSM and MGLI are INS_ACT (bright green).
- All BBXs are OOS_RAM (yellow).
- If running calibration or audit using a test pattern *other than Pilot*, MCCs are INS_ACT (bright green).
- Test equipment and test cables are calibrated and connected for TX calibration.
- LMF is logged into the BTS in the GUI environment.

NOTE	Verify all BBX boards removed and repositioned have been returned to their assigned shelves/slots. Any BBX boards moved since they were downloaded will have to be downloaded again.
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Follow the procedure in Table 3-35 to perform BLO calibration on the TX paths, download BLO values to the BBXs, and perform TX path audit in one operation.

Table 3-35: All Cal/Audit and TX Calibration Procedure

Step	Action
1	<i>If it has not already been done</i> , configure test equipment for TX calibration by following the procedure in Table 3-33.
2	Click on the BBX(s) to be calibrated.
3	If the Test Pattern to be used is Standard , CDFPilot , or CDF , select at least one MCC (refer to “Test Pattern Drop–down Pick List” under “TX Calibration and the LMF” in this section).
4	For All Cal Audit... – Click Tests in the BTS menu bar, and select TX > All Cal/Audit... from the pull–down menus. A CDMA Test Parameters window will appear. For TX Calibration – Click Tests in the BTS menu bar, and select TX > TX Calibration from the pull–down menus. A CDMA Test Parameters window will appear.
5	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the Shift or Ctrl key while clicking on pick list items to select multiple carrier(s)–sector(s).

... continued on next page

Table 3-35: All Cal/Audit and TX Calibration Procedure

Step	Action
6	Verify that the correct channel number for the selected carrier is shown in the Carrier # Channels box. If it is not, obtain the latest bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files from the CBSC. NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.
7	If at least one MCC was selected in Step 3, select the appropriate transfer rate (1 = 9600, 3 = 9600 1X) from the drop-down list in the Rate Set box. NOTE The rate selection of 3 is only available if 1X cards are selected for the test.
8	If Verify BLO is to be used during the calibration, leave the checkbox checked (default).
9	If Single-Sided BLO is to be used during the calibration, click on the checkbox. * IMPORTANT Single-Sided BLO should only be used for primary BBXs. Do not check the box when calibrating the <i>redundant</i> BBX.
10	In the Test Pattern box, select the test pattern to use for the calibration from the drop-down list (refer to “Test Pattern Drop-down Pick List” under “TX Calibration and the LMF” in this section).
11	Click OK to display the status report window followed by a Directions pop-up window.
12	Follow cable connection directions as they are displayed. – When the calibration process is completed, results will be displayed in the status report window.
13	Click OK to close the status report window.

Exception Handling

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

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

Download BLO Procedure

After a successful TX path calibration, 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 .
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Prerequisites

Ensure the following prerequisites have been met before proceeding.

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

Follow the steps in Table 3-36 to download the BLO data to the BBXs.

Table 3-36: Download BLO		
✓	Step	Action
	1	Select the BBX(s) to be downloaded.
	2	Click Device in the BTS menu bar, and select Download > BLO from the pull-down menus. A status report window displays the result of the download. NOTE Selected device(s) do not change color when BLO is downloaded.
	3	Click OK to close the status report window.

Calibration Audit Introduction

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

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

Perform the calibration audit of the TX paths of all equipped BBX slots, per the steps in Table 3-37.

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

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

Prerequisites

Before running this test, the following should be done:

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

TX Path Audit procedure

After a TX calibration has been performed, or if verification of BLO data in the CAL file is required, follow the procedure in Table 3-37 to perform a BTS TX path audit.

Table 3-37: BTS TX Path Audit

✓	Step	Action
	1	<i>If it has not already been done</i> , configure test equipment for TX path audit by following the procedure in Table 3-33 (TX audit uses the same configuration as TX calibration).
	2	Select the BBX(s) to be audited.
	3	If the Test Pattern to be used is Standard , CDFPilot , or CDF , select at least one MCC (refer to “Test Pattern Drop–down Pick List” under “TX Calibration and the LMF” in this section).
	4	Click Tests in the BTS menu bar, and select TX > TX Audit... from the pull–down menus. A CDMA Test Parameters window will appear.
	5	Select the appropriate carrier(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the Shift or Ctrl key while clicking on pick list items to select multiple carrier(s)–sector(s).
	6	Verify that the correct channel number for the selected carrier is shown in the Carrier # Channels box. If it is not, obtain the latest bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files from the CBSC. NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.
	7	If at least one MCC was selected in Step 3, select the appropriate transfer rate (1 = 9600, 3 = 9600 1X) from the drop–down list in the Rate Set box. NOTE The rate selection of 3 is only available if 1X cards are selected for the test.
	8	From the Test Pattern pick list, select a test pattern. – Selecting Pilot (default) performs tests using a pilot signal only. – Selecting Standard performs tests using pilot, synch, paging and six traffic channels. This requires an MCC to be selected. – Selecting CDFPilot performs tests using the CDF value for pilot gain and IS–97 gain values for all the other channels included in the Standard pattern setting (paging, synch, and six traffic). Using this pattern setting requires the selection of both a BBX and at least one MCC. – Selecting CDF performs tests using pilot, synch, paging and six traffic channels, however, the gain for the channel elements is specified in the CDF file.
	9	Click OK to display the status report window followed by a Directions pop-up window.
	10	Follow the cable connection directions as they are displayed. When the calibration process is completed, results will be displayed in the status report window.
	11	Click on the Save Results or Dismiss button, as desired, to close the status report window.

Exception Handling

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

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

Create CAL File

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

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

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

Prerequisites

Before running this procedure, the following should be done:

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

Table 3-38: Create CAL File	
Step	Action
1	Select the applicable BBXs. – The CAL file will be updated for the selected BBXs <i>only</i> .
2	Click on Device in the BTS menu bar, and select Create Cal File from the pull-down menu. – A status report window will appear and display the results of the action.
3	Click the OK button to close the status report window.

RFDS Set-up and Calibration

RFDS Description

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

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

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

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 3-39 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 3-39 to review and/or edit RFDS parameters.

Table 3-39: RFDS Parameter Settings	
Step	Action
1	NOTE Log out of the BTS prior to perform this procedure. Using a text editor, verify the following fields are set correctly in the bts-#.cdf file: EXAMPLE: <pre>Asu1Equip = 1 Asu2Equip = 0 (1 if system is non-duplexed) Mc1Equip = 0 Mc2Equip = 0 Mc3Equip = 0 Mc4Equip = 0 RfdsEquip = 2 TestOrigDN = '123456789' TsuEquip = 1</pre> 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 <i>GUI</i> session(refer to Table 3-6).
4	If <i>no</i> changes were made to the bts-#.cdf file fields listed in step 1, proceed to Step 7. If changes <i>were</i> made, continue with Step 5.
5	NOTE To make certain the complete data download is accepted, the MGLI should be OOS_RAM (yellow) when RFDS parameter settings are downloaded. When changes are made to RFDS parameters in the bts-#.cdf file, data must be downloaded to the MGLI by performing the following:
5a	– To be sure it does not take control when the MGLI is disabled, <i>manually</i> 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 shows the 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 (<i>selected devices do not change color when data is downloaded</i>). — A status report window shows the status of the download.

... continued on next page

Table 3-39: RFDS Parameter Settings

Step	Action
5g	– Click OK to close the status report window.
5h	– Click on the MGLI.
5i	– Click on Device in the BTS menu bar, and select Enable from the pull-down menu. — A status report window shows the status of the operation.
5j	– When the operation is complete, click OK to close the status report window.
	! CAUTION When the MGLI changes to INS_ACT, data will automatically be downloaded to the RFDS. During this process, the RFDS LED will slowly begin flashing red and green for approximately 2–3 minutes. DO NOT attempt to perform any functions with the RFDS until the LED remains steady green.
5k	– Re-seat the redundant GLI card into the backplane connectors and lock it in place with the ejector tabs.
5l	– Once the redundant GLI initializes, download data to it by selecting the card and, in the BTS menu bar, clicking Device and selecting Download > Data from the pull-down menus.
6	Any MCCs that were INS_ACT when the MGLI was disabled must be disabled, downloaded with data, and re-enabled as follows:
6a	– Select the devices to be reset by clicking on them or using Select from the BTS menu bar and clicking on MCCs in the pull-down menu.
6b	– In the BTS menu bar, click on Device and select Disable from the pull-down menu. — A status report window shows the status of the operation.
6c	– Click OK to close the status report window.
6d	– Repeat Step 6a to select the MCCs.
6e	– Click on Device in the BTS menu bar and select Download > Data from the pull-down menu. (Selected devices do not change color when data is downloaded.) – A status report window shows the status of the download.
6f	– Click on OK to close the status report window.
6g	– When data download is complete, enable the MCCs by following the procedure in Table 3-17.
7	Click on the RFDS tab.
8	Status the RFDS TSU by performing the following:
8a	– Click on the SUA to select it.
8b	– Click on TSU in the BTS menu bar, and select Status TSU from the pull-down menu. — A status report shows the software version number for the TSIC and SUA.

. . . continued on next page

Table 3-39: RFDS Parameter Settings

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

RFDS TSU NAM Programming

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

NOTE	The user will only need to program the NAM for the initial installation of the RFDS.
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Explanation of Parameters Used When Programming the TSU NAM

Table 3-40 defines the parameters used when editing the tsu.nam file.

Table 3-40: Definition of Parameters	
Access Overload Code Slot Index System ID Network ID	These parameters are obtained from the switch.
Primary Channel A Primary Channel B Secondary Channel A Secondary Channel B	These parameters are the channels which are to be used in operation of the system.
Lock Code Security Code Service Level Station Class Mark	Do NOT change.
IMSI MCC IMSI 11 12	These fields are obtained at the OMC using the following command: OMC000>disp bts-# imsi If the fields are blank, replace the IMSI fields in the NAM file to 0, otherwise use the values displayed by the OMC.
MIN Phone Number	These fields are the phone number assigned to the mobile. The ESN and MIN must be entered into the switch as well. NOTE This field is different from the TODN field in the bts-#.cdf file. The MIN is the phone number of the RFDS subscriber, and the TODN is the number the subscriber calls.

Valid NAM Ranges

Table 3-41 provides the valid NAM field ranges. If any of the fields are missing or out-of-range, the RFDS will error out.

Table 3-41: 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 3-42 to set antenna map data for the RFDS.

Table 3-42: 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 <i>tabbed</i> 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 <i>LMF Help function on-line documentation</i> for antenna map examples.
5	<i>For each tab with changes</i> , 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 3-43 to set RFDS configuration data.

Table 3-43: 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 <i>tabbed</i> data entry pop-up window will appear.
2	In the data entry pop-up window, click on the TX RFDS Configuration or RX RFDS Configuration tab, as required.
3	To add a new antenna number, perform the following:
3a	– Click on the Add Row button.
3b	– Click in the Antenna # , Cal Antenna , Scap Antenna , or Populate [Y/N] columns, as required.
3c	– Enter the desired data.
4	To edit existing values click in the data box to be changed and change the value. NOTE Refer to the CDMA Help > Utility Menu > Edit-RFDS Configuration... section of <i>LMF Help function on-line documentation</i> for RFDS configuration data examples.
5	To delete a row, click on the row and then click on the Delete Row button.
6	<i>For each tab with changes</i> , click on the Save button to save displayed values.
7	Click on the Dismiss button to close the window. NOTE • 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 3-44.

Table 3-44: 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.

Prerequisites

- Test equipment has been selected.
- Test equipment and test cables have been calibrated.
- TX calibration has been performed and BLO data has been downloaded to the BBXs.
- Test equipment and test cables are connected for TX calibration.
- Antenna map data has been entered for the site.
- BBXs are OOS-RAM.

RFDS Calibration Procedure

Follow the procedure in Table 3-45 to perform RFDS calibration.

Table 3-45: RFDS Calibration	
Step	Action
1	In the LMF, select the CDMA BTS-xxx tab.
2	<i>If the BTS Control button is not selected (no black dot showing), click on the B button in the BTS menu bar to select it.</i>
3	Select the BBX(s) assigned to the carrier(s) and sector(s) which will be used in RFDS calibration (refer to Table 1-6 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 3-44) in the Channel Field box. - To enter more than one channel number, use the following methods: - Separate <i>non</i>-sequential channel numbers with a comma and <i>no spaces</i>; 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 <i>no spaces</i>; 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 Diversity) in the drop-down list if performing RX calibration.
10	Click on the OK button. A status report window is displayed, followed by a Directions pop-up window.
11	Follow the cable connection directions as they are displayed.
12	When the test is completed, test results are displayed in the status report window.
13	Click on the OK button to close the status report window.
14	Click on the Frame tab.
15	Select the MGLI by clicking on it.
16	Download updated RFDS offset data to the MGLI (see Step 5 in Table 3-39).

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 3-46 to program the TSU NAM.

Table 3-46: 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 3-40 and Table 3-41) .
5	Click on the OK button to display the status report.
6	Click on the OK button to close the status report window.

Alarms Testing

Alarm Verification

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

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

Alarm Reporting Display

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

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

- The **Options** button allows for a severity level (**Warning**, **Minor**, **Major**, **Critical**, and **Unknown**) selection. The default is all levels. To change the level of alarms reported click on the **Options** button and highlight the desired alarm level(s). To select multiple levels press the Ctrl key (for individual selections) or Shift key (for a range of selections) while clicking on the desired levels.
- The **Pause** button can be used to pause/stop the display of alarms. When the **Pause** button is clicked the name of the button changes to **Continue**. When the **Continue** button is click the display of alarms will continue. Alarms that occur between the time the **Pause** button is clicked and the **Continue** button is clicked will not be displayed.
- The **Clear** button can be used to clear the Alarm Monitor display. New alarms that occur after the **Clear** button is clicked will be displayed.
- The **Dismiss** button is used to dismiss/close the Alarm Monitor display.

Alarm Testing Set-up

Prepare for any alarm testing by following the procedures in Table 3-47.

Table 3-47: Alarm Testing Preparation	
Step	Action
1	<i>If it has not already been done</i> , refer to the procedure in Table 3-5 to connect the LMF computer terminal to the frame LAN A connector.
2	<i>If it has not already been done</i> , refer to Table 3-6 to start a <i>GUI</i> LMF session.
3	Click on Util in the BTS menu bar, and select Alarm Monitor... from the pull-down menu. – An Alarm Monitor window will open.

AC Fail Alarm

Table 3-48 gives instructions on testing the AC Fail Alarm.

Table 3-48: AC Fail Alarm	
Step	Action
1	NOTE – Back-up batteries <i>must be installed</i> when performing this test. – To prevent inadvertently shutting down the RF compartment electronics, the batteries should be charged before performing this test. Set the ACLC MAIN circuit breaker to OFF. – The LMF should report an alarm for an AC Fail condition as BTS Relay #21, BTS Relay #23, BTS Relay #24, and BTS Relay #29 contacts, respectively. – On the MAP, the MAJOR ALARM (red), MINOR ALARM (amber), and RECTIFIER FAIL (red) LEDs should light. – On the rectifiers, the DC and PWR LEDs should light red.
2	Set the ACLC MAIN circuit breaker to ON. – On the LMF, the AC Fail alarm should clear. – On the MAP, the MAJOR ALARM, MINOR ALARM, and RECTIFIER FAIL LEDs should extinguish. – On the rectifiers, the DC and PWR LEDs should change to green.

Minor Alarm

Table 3-49 gives instructions on performing a test to display a minor alarm.

Table 3-49: Minor Alarm	
Step	Action
1	Set the TCP switch on the MAP to OFF. This will generate a minor alarm. – The LMF should report the minor alarm as BTS Relay #24 contacts. – The TC DISABLE (red) and MINOR ALARM (amber) LEDs on the MAP should light.
2	Set the TCP switch to ON. – The alarm condition indications should clear.

Before Leaving the Site

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

Chapter 4

Automated Acceptance Test Procedures

Automated Acceptance Test Procedure

Introduction

The Acceptance Test Procedures (ATP) allow Cellular Field Engineers (CFEs) to run automated acceptance tests on all BTS subsystem devices equipped in the CDF using the LMF and the test equipment it supports.

The CFE can choose to save the results of ATP tests to a report file from which *ATP reports* are generated for later printing. See the Generating an ATP Report section in this chapter.

Because test equipment functions during acceptance testing are controlled by the LMF through the GPIB, only the test equipment models supported by the LMF can be used.

NOTE

- Before using the LMF, read the Release Notes “Caveats” section in the *LMF Help function on-line documentation* 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.

Refer to Chapter 3 for detailed interconnection information needed for calibrating equipment, cables, and other test equipment set components.

Reduced ATP

NOTE

Equipment has been factory-tested for FCC compliance. If license-governing bodies require documentation supporting *BTS 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 CFE must perform these procedures (minimum 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 (Table C-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.

ATP Test Options

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

- **All TX:** TX tests verify the performance of the BTS transmit elements. These include the GLI, MCC, BBX, trunking modules, the LPAs, and passive components including splitters, combiners, bandpass filter(s), and RF cables.
- **All RX:** The RX test verifies the performance of the BTS receive elements. These include the MPC, EMPC (for companion frames), BBX, MCC, GLI modules, and the passive components including RX filters and RF cables.
- **All TX/RX:** Executes all TX and RX tests.
- **Full Optimization:** Executes the TX calibration, downloads BLO, and executes the TX audit before running all TX and RX tests.

ATP Prerequisites

Before attempting to run *any* ATP tests, be sure the following have been completed:

- BTS has been optimized (BBXs calibrated and BLOs downloaded) (Chapter 3)
- The carrier(s) and/or sector(s) to be tested have been taken out of service at the CBSC.
- LMF is logged into the BTS.
- CSMs, GLIs, BBXs, MCCs and TSU (if the RFDS is installed) have correct code and data loads.
- Primary CSM and GLI are INS_ACT (bright green).
- MCCs are INS_ACT (bright green).
- No BBXs are keyed (transmitting).
- BBXs are OOS_RAM (yellow).
- Test cables are calibrated.
- Test equipment has been selected, warmed up 60 minutes, and calibrated.
- GPIB is on.
- BTS transmit connectors are properly terminated for the test(s) to be performed.

WARNING

1. All transmit connectors must be properly terminated for all ATP tests.
2. Before the FER is run, be sure that one of the following is done:
 - All transmitter connectors are properly terminated
 - OR
 - All LPAs are turned OFF (circuit breakers pulled)
 Failure to observe these warnings may result in bodily injury or equipment damage.

TX/RX Antenna Connections

Starter (Stand-alone) Frames

Refer to NO TAG or NO TAG for identification of starter frame transmit and receive antenna connections where measurements are to be taken. All ATP test equipment connections for starter frames are made at the ANTENNAS connectors on the RF interface panel.

Companion Frames

TX ATP Antenna Connections – Each companion frame at a site connects independently to transmit antennas. Test equipment connections for TX ATPs on each companion frame are made at the ANTENNAS connectors as on starter frames. Companion frame ANTENNAS connectors are shown in NO TAG and NO TAG.

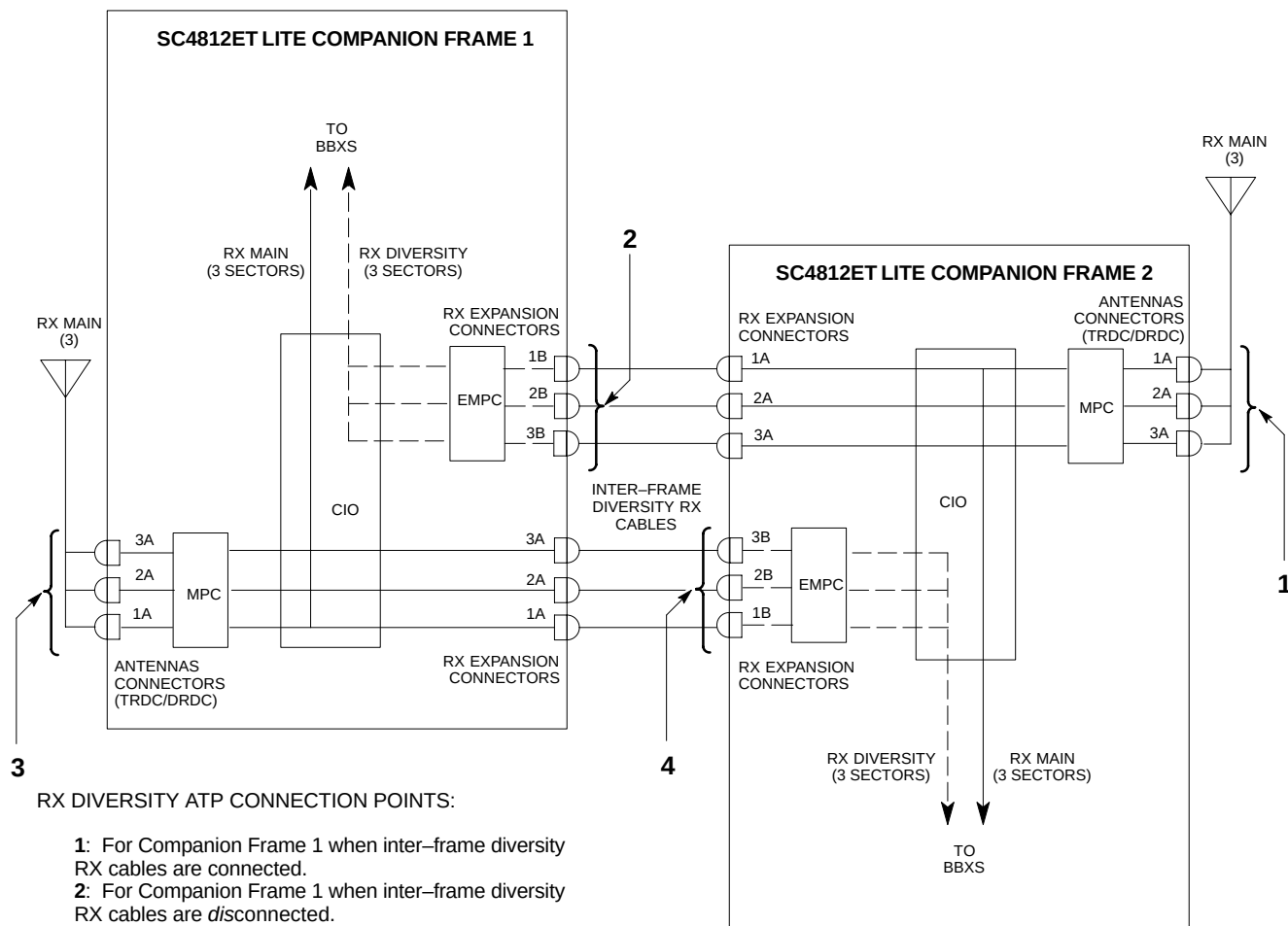
Antenna Connections for RX main ATP – Each companion frame at a site uses independent receive antennas for *main* RX signals. The main RX signals are either routed through TRDC RX ANTENNAS connectors (NO TAG) or duplexed with TX signals through the single DRDC ANTENNAS connectors (NO TAG).

Antenna Connections for RX diversity ATP – Companion frame *diversity* RX signals are obtained from the RX *main* antenna of the *collocated* companion frame. The main RX signals are sent from the collocated companion frame through inter-frame diversity RX cables to the RX EXPANSION 1B, 2B, or 3B connectors of the frame where they are used for diversity RX (refer to Figure 4-1). Diversity RX ATP test equipment connections are made at one of two different locations depending on whether or not the companion frame under test is connected to a collocated companion frame. Connection points for each situation are as follows:

- **Connected companion frames:** When inter-frame diversity RX cables are connected, connect test equipment for diversity RX ATP at the ANTENNAS connectors of the *collocated* companion frame as shown in Figure 4-1 and listed in Table 4-1. Be sure *MPC* is selected before logging the LMF into the frame or FER will fail.

- **Disconnected companion frames:** When inter-frame diversity RX cables are *disconnected*, connect test equipment for diversity RX ATP at the RX EXPANSION connectors 1B, 2B, or 3B *on the frame under test*. Refer to Figure 4-1 and Table 4-2. Be sure *EMPC* is selected before logging the LMF into the frame or FER will fail.

Figure 4-1: SC4812ET Lite Companion Frame Diversity RX Simplified Interconnection Diagram



RX DIVERSITY ATP CONNECTION POINTS:

- 1: For Companion Frame 1 when inter-frame diversity RX cables are connected.
- 2: For Companion Frame 1 when inter-frame diversity RX cables are *disconnected*.
- 3: For Companion Frame 2 when inter-frame diversity RX cables are connected.
- 4: For Companion Frame 2 when inter-frame diversity RX cables are *disconnected*.

SIGNALS:

———— RX MAIN
 - - - - - RX DIVERSITY

NOTE: ANTENNAS connectors represent TRDC/DRDC portion of receive path.

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Table 4-1: To Perform Companion Frame Diversity RX FER, Inter-frame RX Cables <i>Connected</i> (Set Multi-Channel Preselector to <i>MPC</i>)		
On		Connect RX Test Cable to <i>Collocated Companion Frame</i> RX or Duplexed TX/RX ANTENNAS Connector
Carrier	Sector	
1	1	1A
	2	2A
	3	3A
2	1	1A
	2	2A
	3	3A

Table 4-2: To Perform Companion Frame Diversity RX FER, Inter-frame RX Cables <i>Disconnected</i> (Set Multi-Channel Preselector to <i>EMPC</i>)		
On		Connect RX Test Cable to <i>Frame Under Test</i> RX EXPANSION Connector
Carrier	Sector	
1	1	1B
	2	2B
	3	3B
2	1	1B
	2	2B
	3	3B

Acceptance Tests – Test Set-up

Required Test Equipment

The following test equipment is required:

- LMF
- Power meter (used with HP8921A/600 and Advantest R3465)
- Communications system analyzer
- Signal generator for FER testing (required for *all* communications system analyzers for 1X FER)

WARNING	– Before installing any test equipment directly to any BTS TX OUT connector, verify that there are no CDMA channels keyed. – At active sites, have the OMCR/CBSC place the carrier assigned to the LPAs under test OOS. Failure to do so can result in serious personal injury and/or equipment damage.
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NOTE	The test equipment must be re-calibrated before using it to perform the TX Acceptance Tests.
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Acceptance Test Equipment Set Up

All ATP testing – Follow the steps in Table 4-3 to set up test equipment for all tests.

Table 4-3: Set Up Test Equipment – TX Output Verify/Control Tests	
Step	Action
1	<i>If it has not already been done</i> , interface the LMF computer to the BTS (refer to Table 3-5 and Figure 3-3).
2	<i>If it has not already been done</i> , refer to Table 3-6 to start a <i>GUI</i> LMF session and log into the BTS.
3	<i>If it has not already been done</i> , refer to Figure 3-17, Figure 3-18, Figure 3-19, Figure 3-20, Figure 3-21, or Figure 3-22, as applicable, for the test equipment and antenna duplexing being used, to connect test equipment for acceptance testing. NOTE LMF-based measurements factor in TX test cable loss between the RFMF and test equipment. If additional attenuation, such as external TX combiners, is inserted in the path, it must be identified to the LMF by including it in the TX test cable calibration. If this is not possible, include the attenuation in the TX path by editing cable loss values (refer to Table 3-29). Failure to do this will result in test inaccuracies and potential for erroneous ATP failures <i>because the additional losses would not be compensated for in the test measurements.</i>

Companion frame All TX/RX, All RX, and FER for Diversity RX –
 When performing All TX/RX, All RX, or FER ATP for *companion frame* diversity RX, perform the additional test equipment set-up procedures in Table 4-4.

Table 4-4: Additional Diversity RX Test Set-up for Companion Frames

Step	Action
1	If the LMF is logged into the BTS, log out of the BTS.
2	If the inter-frame diversity RX cabling to a collocated companion frame is: • <i>Connected</i> to the companion frame under test, proceed to step 3. • <i>Disconnected</i> from the companion frame under test, proceed to step 7.
3	For companion frames with inter-frame diversity RX cables <i>connected</i> , click on the LMF Login tab.
4	In the Equipage Information box, select MPC from the Multi-Channel Preselector picklist.
5	Make RX test cable connections for diversity RX FER according to Figure 4-1 and Table 4-1.
6	Proceed to step 10.
7	For companion frames with inter-frame diversity RX cables <i>disconnected</i> , click on the LMF Login tab.
8	In the Equipage Information box, select EMPC from the Multi-Channel Preselector picklist.
9	Make RX test cable connections for diversity RX FER according to Figure 4-1 and Table 4-2.
10	Click on the LMF BTS# tab, and return to the procedure for the ATP being performed.

Abbreviated (All-inclusive) Acceptance Tests

All-inclusive Tests

General – The all-inclusive acceptance tests are performed from the LMF *GUI* environment. These all-inclusive tests are called *abbreviated ATPs* because they execute various combinations of individual acceptance tests *with a single command*. This allows verification of multiple aspects of BTS performance while minimizing time needed for individual test set up and initiation.

Abbreviated ATP Options – There are three abbreviated acceptance tests which evaluate different performance aspects of the BTS. This allows the CFE to select testing to meet the specific requirements for individual maintenance and performance verification situations. The following summarizes the coverage of each abbreviated test:

- **All TX/RX**. Performs all transmit and receive ATPs on the selected MCCs and BBXs.
- **All TX**. Performs complete set of transmit ATPs on the selected MCCs and BBXs. Testing is the equivalent of performing all of the following individual tests:
 - **TX Mask** Test
 - **Rho** Test
 - **Pilot Time Offset** Test
 - **Code Domain Power** Test
- **All RX**. Performs complete receive ATP on the selected MCCs and BBXs. Testing is the equivalent of performing the following:
 - **FER** Test

Abbreviated ATP Procedures – Procedures to accomplish each type of abbreviated ATP are included in the following subsections.

All TX/RX ATP Test

Follow the procedures in Table 4-5 to perform the abbreviated, all-inclusive **transmit and receive** test.

Table 4-5: All TX/RX ATP Test Procedure

Step	Action
1	Set up the test equipment initially for abbreviated tests as described in Table 4-3.
2	If a <i>companion</i> frame is being tested and either BOTH or DIV is to be selected in step 7, perform the additional test equipment set-up in Table 4-4 for the <i>diversity</i> RX portion of the ATP. NOTE If the LMF has been logged into the BTS with a different Multi-Channel Preselector setting than the one to be used for this test, the LMF <i>must be logged out of the BTS and logged in again</i> with the new Multi-Channel Preselector setting. Using the wrong MPC setting can cause a false test failure.
3	Select the BBXs and MCCs to be tested.
4	Click on Tests in the BTS menu bar, and select All TX/RX ATP... from the pull-down menu.
5	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the Shift or Ctrl key while clicking on pick list items to select multiple carrier(s)-sector(s).
6	Verify that the correct channel number for the selected carrier is shown in the Carrier # Channels box. If it is not, obtain the latest bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files from the CBSC. NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.
7	NOTE If a companion frame with the inter-frame diversity RX cabling <i>disconnected</i> is being tested <i>do not select BOTH</i> in this step. The RX main and diversity paths must be tested separately for this configuration because each requires a different Multi-Coupler Preselector type to provide the proper test signal gain. Select the appropriate RX branch (BOTH, MAIN, or DIVersity) in the drop-down list.
8	In the Rate Set box, select the appropriate data rate (1=9600 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.
9	Enter the channel elements to be tested for the RX ATP in the Channel Element(s) box. By default, all channel elements are specified. Use one of the following methods to enter more than one channel element: – Enter non-sequential channel elements separated by a comma and no spaces (for example; 0,5,15). – Enter a range of sequential channel elements by typing the first and last channel elements separated by two periods (for example; 0..15). NOTE The channel element numbers are 0.based; that is the first channel element is 0.

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Table 4-5: All TX/RX ATP Test Procedure

Step	Action
10	In the Test Pattern box, select the test pattern to use for the acceptance tests from the drop-down list (refer to “Test Pattern Drop-down Pick List” under “TX Calibration and the LMF” in the Bay Level Offset Calibration section of Chapter 3).
11	Click OK to display a status bar followed by a Directions pop-up window.
12	NOTE When testing diversity RX paths on companion frames, be sure to follow the RX test cable connection information in Table 4-1 or Table 4-2, as applicable, during this step. Follow cable connection directions as they are displayed, and click the Continue button to begin testing. – As the ATP process is completed, results will be displayed in the status report window.
13	Click the Save Results or Dismiss button. NOTE If Dismiss is used, the test results <i>will not</i> be saved in the test report file.

All TX ATP Test

Follow the procedures in Table 4-6 to perform the abbreviated, all-inclusive **transmit** test.

Table 4-6: All TX ATP Test Procedure

Step	Action
1	Set up the test equipment for abbreviated tests per Table 4-3.
2	Select the BBXs and MCCs to be tested.
3	Click on Tests in the BTS menu bar, and select All TX ATP... from the pull-down menu.
4	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the Shift or Ctrl key while clicking on pick list items to select multiple carrier(s)–sector(s).
5	Verify that the correct channel number for the selected carrier is shown in the Carrier # Channels box. If it is not, obtain the latest bts-#.cdf (or bts-#.necf) and cbsc-#.cdf files from the CBSC. NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.
6	In the Rate Set box, select the appropriate transfer rate (1 = 9600, 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.
7	In the Test Pattern box, select the test pattern to use for the acceptance test from the drop-down list (refer to “Test Pattern Drop-down Pick List” under “TX Calibration and the LMF” in the Bay Level Offset Calibration section of Chapter 3).
8	Click OK to display a status bar followed by a Directions pop-up window.
9	Follow cable connection directions as they are displayed, and click the Continue button to begin testing. – As the ATP process is completed, results will be displayed in the status report window.
10	Click the Save Results or Dismiss button. NOTE If Dismiss is used, the test results <i>will not</i> be saved in the test report file.

All RX ATP Test

Follow the procedure in Table 4-7 to perform the abbreviated, all-inclusive **receive** test.

Table 4-7: All RX ATP Test Procedure

Step	Action
1	Set up the test equipment for abbreviated tests per Table 4-3.

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Table 4-7: All RX ATP Test Procedure

Step	Action
2	If a <i>companion</i> frame is being tested and either BOTH or DIV is to be selected in step 7, perform the additional test equipment set-up in Table 4-4 for the <i>diversity</i> RX portion of the ATP. NOTE If the LMF has been logged into the BTS with a different Multi-Channel Preselector setting than the one to be used for this test, the LMF <i>must be logged out of the BTS and logged in again</i> with the new Multi-Channel Preselector setting. Using the wrong MPC setting can cause a false test failure.
3	Select the BBXs and MCCs to be tested.
4	Click on Tests in the BTS menu bar, and select All RX ATP... from the pull-down menu.
5	Select the appropriate carrier(s) and sector(s) (carrier-bts#-sector#-carrier#) from those displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the Shift or Ctrl key while clicking on pick list items to select multiple carrier(s)-sector(s).
6	Verify that the correct channel number for the selected carrier is shown in the Carrier # Channels box. If it is not, obtain the latest bts-#.cdf (or bts-#.necf) and cbse-#.cdf files from the CBSC. NOTE If necessary, the correct channel number may be manually entered into the Carrier # Channels box.
7	NOTE If a companion frame with the inter-frame diversity RX cabling <i>disconnected</i> is being tested <i>do not select BOTH</i> in this step. The RX main and diversity paths must be tested separately for this configuration because each requires a different Multi-Coupler Preselector type to provide the proper test signal gain. Select the appropriate RX branch (BOTH, MAIN, or DIVERsity) in the drop-down list.
8	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 1 is only available if non-1X cards are selected for the test. The Rate Set selection of 3 is only available if 1X cards are selected for the test.
9	Enter the channel elements to be tested for the RX ATP in the Channel Element(s) box. By default, all channel elements are specified. Use one of the following methods to enter more than one channel element: – Enter non-sequential channel elements separated by a comma and no spaces (for example; 0,5,15). – Enter a range of sequential channel elements by typing the first and last channel elements separated by two periods (for example; 0..15). NOTE The channel element numbers are 0.based; that is the first channel element is 0.
10	Click OK to display a status bar followed by a Directions pop-up window.

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