

1X SC™ 4812T BTS Optimization/ATP

Software Release 2.16.1.x

800, 1700, and 1900 MHz

CDMA

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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. It is assumed that the user of this information has a general understanding of telephony, as used in the operation of the Public Switched Telephone Network (PSTN), and is familiar with these concepts as they are applied in the cellular mobile/portable radiotelephone environment. The user, however, is not expected to have any detailed technical knowledge of the internal operation of the equipment.

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.

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.
----------------	---

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.

Changes to manual

Changes that occur after the printing date are incorporated into your manual by Cellular Manual Revisions (CMRs). The information in this manual is updated, as required, by a CMR when new options and procedures become available for general use or when engineering changes occur. The cover sheet(s) that accompany each CMR should be retained for future reference. Refer to the Revision History page for a list of all applicable CMRs contained in this manual.

Receiving updates

Technical Information Products and Services (TIPS) maintains a customer database that reflects the type and number of manuals ordered or shipped since the original delivery of your *Motorola* equipment. Also identified in this database is a “key” individual (such as Documentation Coordinator or Facility Librarian) designated to receive manual updates from TIPS as they are released.

To ensure that your facility receives updates to your manuals, it is important that the information in our database is correct and up-to-date. Therefore, if you have corrections or wish to make changes to the information in our database (i.e., to assign a new “key” individual), please contact Technical Information Products and Services.

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Reporting manual errors

In the event that you locate an error or identify a deficiency in your manual, please take time to write to us at the address above. Be sure to include your name and address, the complete manual title and part number (located on the manual spine, cover, or title page), the page number (found at the bottom of each page) where the error is located, and any comments you may have regarding what you have found. We appreciate any comments from the users of our manuals.

24-hour support service

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

Arlington Heights, IL 800-433-5202
Arlington Heights, International . . +1-847-632-5390
Cork, Ireland 44-1793-565444
Swindon, England 44-1793-565444

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.
----------------	---

15.105(b) - INFORMATION TO USER

NOTE	<p>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:</p> <ul style="list-style-type: none">- 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 in the format < US: IHEXDNANGLI3-1X>. 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) *	US: IHEXDNANGLI3-1X
Cisco Model 1900-27	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.

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.

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.

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

68P09255A61- 4

Manual Title

1X SC™ 4812T BTS Optimization/ATP Software Release 2.16.1.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 2002	DRAFT Manual submitted for engineering markup
2	Apr 2002	PRELIMINARY
3	Jul 2002	DV&V REVIEW
4	Aug 2002	PRELIMINARY: Incorporate comments from DV&V and engineering.

Patent Notification

Patent numbers

This product is manufactured and/or operated under one or more of the following patents and other patents pending:

4128740	4661790	4860281	5036515	5119508	5204876	5247544	5301353
4193036	4667172	4866710	5036531	5121414	5204977	5251233	5301365
4237534	4672657	4870686	5038399	5123014	5207491	5255292	5303240
4268722	4694484	4872204	5040127	5127040	5210771	5257398	5303289
4282493	4696027	4873683	5041699	5127100	5212815	5259021	5303407
4301531	4704734	4876740	5047762	5128959	5212826	5261119	5305468
4302845	4709344	4881082	5048116	5130663	5214675	5263047	5307022
4312074	4710724	4885553	5055800	5133010	5214774	5263052	5307512
4350958	4726050	4887050	5055802	5140286	5216692	5263055	5309443
4354248	4729531	4887265	5058136	5142551	5218630	5265122	5309503
4367443	4737978	4893327	5060227	5142696	5220936	5268933	5311143
4369516	4742514	4896361	5060265	5144644	5222078	5271042	5311176
4369520	4751725	4910470	5065408	5146609	5222123	5274844	5311571
4369522	4754450	4914696	5067139	5146610	5222141	5274845	5313489
4375622	4764737	4918732	5068625	5152007	5222251	5276685	5319712
4485486	4764849	4941203	5070310	5155448	5224121	5276707	5321705
4491972	4775998	4945570	5073909	5157693	5224122	5276906	5321737
4517561	4775999	4956854	5073971	5159283	5226058	5276907	5323391
4519096	4797947	4970475	5075651	5159593	5228029	5276911	5325394
4549311	4799253	4972355	5077532	5159608	5230007	5276913	5327575
4550426	4802236	4972432	5077741	5170392	5233633	5276915	5329547
4564821	4803726	4979207	5077757	5170485	5235612	5278871	5329635
4573017	4811377	4984219	5081641	5170492	5235614	5280630	5339337
4581602	4811380	4984290	5083304	5182749	5239294	5285447	D337328
4590473	4811404	4992753	5090051	5184349	5239675	5287544	D342249
4591851	4817157	4998289	5093632	5185739	5241545	5287556	D342250
4616314	4827507	5020076	5095500	5187809	5241548	5289505	D347004
4636791	4829543	5021801	5105435	5187811	5241650	5291475	D349689
4644351	4833701	5022054	5111454	5193102	5241688	5295136	RE31814
4646038	4837800	5023900	5111478	5195108	5243653	5297161	
4649543	4843633	5028885	5113400	5200655	5245611	5299228	
4654655	4847869	5030793	5117441	5203010	5245629	5301056	
4654867	4852090	5031193	5119040	5204874	5245634	5301188	



Chapter 1

Introduction

Optimization Manual: Scope and Layout

Scope of This Document

This document provides information pertaining to the optimization and audit tests of Motorola SC 4812T Base Transceiver Subsystem (BTS) equipment frames equipped with trunked high-power Linear Power Amplifiers (LPAs) and their associated internal and external interfaces.

This document assumes the following prerequisites:

- The BTS frames and cabling have been installed per the *BTS Frame Installation* manual, which covers the physical “bolt down” of all SC series equipment frames, and the *SC 4812T CDMA BTS Installation* manual, which covers BTS specific cabling configurations.

In most applications the same test procedure is used for all equipment variations. However, decision break points are provided throughout the procedure when equipment specific tests are required.

NOTE

As the Code Division Multiple Access (CDMA) Local Maintenance Facility (LMF) capability comes on-line, applicable LMF based procedures will be incorporated. Eventually, only the CDMA LMF platform will be supported as the recommended customer method of interfacing with and servicing the SC series BTS equipment.

We at Motorola Technical Education & Documentation have strived to incorporate into this document the many suggestions and inputs received from you, the customer, since the inception of the SC product line. At the same time, we have tried to insure that **the scope of the document targets both the novice and expert site technician and engineer with the information required to successfully perform the task at hand.** If in some areas, the manual seems to cover the test in too much detail (or not enough detail) we hope you will keep this in mind.

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 optimization or tests are performed.
- Preliminary Operations, consisting of pre-power up tests, jumper configuration of BTS sub-assemblies, and initial application of power to the BTS equipment frames. Download of all BTS processor boards, and LPAs.
- Optimization/Calibration, consisting of downloading all BTS processor boards, LPA verification, radio frequency (RF) path verification, Bay Level Offset (BLO) calibration, and Radio Frequency Diagnostic System (RFDS) functions and calibration
- Acceptance Test Procedures (ATP), consisting of automated ATP scripts executed by the LMF and used to verify all major transmit (TX) and receive (RX) performance characteristics on all BTS equipment. Also generates an ATP report.
- Optional manual performance tests used to verify specific areas of site operation or to verify regulation compliance. These tests are typically used to isolate faults down to the module level and information necessary to better understand equipment operation.
- Site turnover after ATP is completed.
- Appendices that contain pertinent data sheets that are filled out manually by the CFE at the site, Pseudorandom Noise (PN) Offset information, an optimization/ATP matrix , output power data tables, CDMA operating frequency programming information, manual test setup information, procedures for verifying that the Voltage Standing Wave Ratio (VSWR) of all antennas and associated feed lines fall within acceptable limits, procedures for downloading ROM and RAM code, and procedures for performing in-service ATP.

CDMA LMF Product Description

The CDMA LMF is a graphical user interface (GUI) based LMF. This product is specifically designed to provide cellular communications field personnel the vehicle to support the following CDMA BTS operations:

- Installation
- Maintenance
- Calibration
- Optimization

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 action is complete and displays other pertinent information.
- Clicking the **OK** button closes the status report window.

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 cannot be launched from the GUI, only from the desktop icon.

Refer to the *LMF CLI Commands, R15.x* manual for a complete explanation of the CLI commands and their use.

Online Help

Task oriented online help is available in the CDMA LMF by clicking on **Help** from the menu bar.

Purpose of the Optimization

Why Optimize?

Proper optimization and calibration assures:

- 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. Cables that interconnect the BTS and Duplexer assemblies (if used), for example, are cut and installed at the time of the BTS frame installation at the site. 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, causing improper site operation.

Optimization identifies the accumulated loss (or gain) for all receive and transmit paths at the BTS site, and stores that value in a database.

- The RX path for the starter frame starts at the ancillary equipment frame RFDS RX directional coupler antenna feedline port, through the ancillary equipment frame RFDS RX directional coupler antenna feedline port, through the RX input port on the top of the frame, through the bandpass filter, Combiner Input/Output (CIO) card, Multicoupler Preselector Card (MPC), and additional splitter circuitry, ending at a CDMA Channel Processor (C-CCP) backplane Broad Band Transceiver (BBX) slot in the C-CCP shelf.

NOTE	In this manual, all version of the BBX, MCC, and GLI usable in this BTS are generically identified as BBX, MCC, or GLI unless otherwise specified.
-------------	--

- The RX path for the expansion frame starts at the ancillary equipment frame RFDS RX directional coupler antenna feedline port, through the ancillary equipment frame RFDS RX directional coupler antenna feedline port, through the RX input port on the top of the starter frame, through the bandpass filter and CIO card, out the expansion port at the top of the starter frame, through the expansion cable to the expansion port on the expansion frame, through the Expansion Multicoupler Preselector Card (EMPC) and CIO, ending at a BBX slot in the C-CCP shelf.
- The TX path starts at the BBX, through the C-CCP backplane slot, travels through the LPA/Combiner TX Filter and ends at the top of the RFDS TX directional coupler antenna feedline port (CDMA), installed on the ancillary equipment frame. If the RFDS option is added, then the TX path continues and ends at the top of the RFDS TX directional coupler antenna feedline port installed in the ancillary equipment frame. The TX paths are identical for the starter and expansion frames.

These values are factored in by the BTS equipment internally, leaving only site specific antenna feed line loss and antenna gain characteristics to be factored in by the CFE when determining site Effective Radiated Power (ERP) output power requirements.

Each C-CCP shelf BBX board is optimized to a specific RX and TX antenna port. (One BBX board acts in a redundant capacity for BBXs 1-12, and is optimized to all antenna ports.) A single value is generated for each path, thereby eliminating the accumulation of error that would occur from individually measuring and summing the gain and loss of each element in the path.

When to Optimize

New Installations

After the initial site installation, it must be prepared for operation. This preparation includes verifying hardware installation, initial power-up, download of operating code, and Clock Synchronization Module (CSM) verification.

Next, the optimization is performed. Optimization includes performance verification and calibration of all transmit and receive RF paths, and download of accumulated calibration data.

After optimization, a series of manual pre-ATP verification tests are covered that address alarm/redundancy tests.

After manual pre-Acceptance Test Procedure (pre-ATP) verification tests, a series of manual ATP CDMA verification tests are covered using the actual equipment set up. An ATP is also required before the site can be placed in service.

Site Expansion

Optimization is required after expansion of a site.

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 detailed basic guideline tables and detailed Optimization/ATP Test Matrix outlining the minimum tests that must be performed *anytime* a BTS subassembly or RF cable associated with it is replaced.

Abbreviations and Acronyms

Table 1-1 identifies the equipment related abbreviations and acronyms used in this manual.

Table 1-1: Abbreviations and Acronyms	
Acronym	Definition
AMR	Alarm Monitor Reporting
ATP	Acceptance Test Procedure
BBX	Broadband Transceiver
BBX2	Broadband Transceiver, 2nd Generation supports IS-95A/B
BBX-1X	Broadband Transceiver, 3rd Generation supports IS-95A/B and cdma2000 1X
BLO	Bay Level Offset
BTS	Base Transceiver Subsystem
CBSC	Centralized Base Station Controller
CCD	CDMA Clock Distribution
CDMA	Code Division Multiple Access
CE	Channel Element
CHI	Concentration Highway Interface
CIO	Combiner Input/Output
CLI	Command Line Interface
CM	Channel Module
CNEOMI	Common Network Element Operation and Maintenance Interface
CSM	Clock Synchronization Manager
CSM-I	Clock Synchronization Manager, 1st Generation CSM card hardware version
CSM-II	Clock Synchronization Manager, 2nd Generation CSM card hardware version
DRDC	Duplexer/RX Filter/Directional Coupler
EMI	Electromagnetic Interference
EMPC	Expansion Multicoupler Preselector Card
FRU	Field Replaceable Unit
GLI	Group Line Interface,
GLI2	Group Line Interface, 2nd Generation card hardware version
GLI3	Group Line Interface, 3rd Generation card hardware version for packet backhaul
GPS	Global Positioning System
HSO	High Stability Oscillator
HSOX	High Stability Oscillator Expansion
I&Q	In-phase and Quadrature

. . . continued on next page

Table 1-1: Abbreviations and Acronyms	
Acronym	Definition
ISB	Inter Shelf Bus
LFR	Low Frequency Receiver
LMF	Local Maintenance Facility
LORAN	LOng RANge Navigational
LPA	Linear Power Amplifier
MCC	Multi-Channel CDMA
MCC8E/24E	Multi-Channel CDMA, 8/24 Channels; 2nd Generation supports IS-95A/B
MCC1X-16/48	Multi-Channel CDMA, 16/48 Channels; 3rd Generation supports IS-95A/B and cdma2000 1X
MGLI	Master Group Line Interface
MM	Mobility Manager
MMI	Man Machine Interface
MPC	Multicoupler Preselector Card
MSC	Mobile Switching Center
OMCR	Operations Maintenance Center - Radio
PDA	Power Distribution Assembly
PN	Pseudo-random Noise
RF	Radio Frequency
RGD	Remote GPS Distribution
RGPS	Remote GPS
RSSI	Received Signal Strength Indicator
SBPF	Single Bandpass Filter
SCAP	SC (Super Cell) Application Protocol
SNMP	Simple Network Management Protocol
STRAU	SC (Super Cell) Transcoder/Rate Adaption Unit
SU	Subscriber Unit
TCH	Traffic Channel
TRDC	Transmit Receive filter/Directional Coupler
TSI	Time Slot Interchanger
UTC	Universal Time Coordinates

Required Test Equipment

Policy

The LMF is used in conjunction with Motorola recommended test equipment and is part of a “calibrated test set”. To ensure consistent, reliable, and repeatable optimization test results, only recommended test equipment supported by the LMF must be used to optimize the BTS equipment.

NOTE	During manual testing, you can, of course, substitute test equipment with other test equipment models not supported by the LMF, <i>but those models must meet the same technical specifications.</i>
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The customer has the responsibility of accounting for any measurement variances and/or additional losses/inaccuracies that can be introduced as a result of test equipment 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, calibration, and characterization prior to BTS optimization. Follow the original equipment manufacturer (OEM) recommended maintenance and calibration schedules closely.

Test Cable Calibration

Equipment test cables are very important in optimization. Motorola recommends that the cable calibration be run at every BTS with the test cables attached. 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 is to account for the loss by entering it into the LMF during the optimization procedure. This method requires accurate test cable characterization in a shop. The cable should be tagged with the characterization information prior to field optimization.

Equipment Warm-up

After arriving at the a site, the test equipment should be plugged in and turned on to allow warm up and stabilization to occur for as long as possible. The following pieces of test equipment must be warmed-up for *a minimum of 60 minutes* prior to using for BTS optimization or RFDS calibration procedures.

- Communications Test Set
- Rubidium Time Base
- Power Meter

Test Equipment Specifications

Test equipment specification requirements for the test equipment (or configuration of test equipment) used to make up the general test equipment (DVM, etc) are given in the following paragraphs.

LMF Hardware Requirements

Motorola recommends an LMF computer platform that meets the following requirements:

- Notebook computer
- 266 MHz (32-bit CPU) Pentium processor
- Windows 98SE or Windows 2000 operating system
- 128 MB RAM for Windows 98SE; 256 MB RAM for Windows 2000
- 4 GB internal hard disk drive
- CD ROM drive
- 3 1/2 inch floppy drive
- Color display with 1024 x 768 pixel resolution and capability to display more than 256 colors
- Serial port (COM 1)
- Parallel port (LPT 1)
- PCMCIA Ethernet interface card (for example, 3COM Etherlink III) with a 10Base-T-to-coax adapter

Test Equipment List

The following pieces of test equipment are required during the optimization procedure. Common assorted tools like screwdrivers and frame keys are not listed but are still required. Read the owner's manual on all of the following major pieces of test equipment to understand their individual operation prior to use in optimization.

NOTE	Always refer to specific OEM test equipment documentation for detailed operating instructions.
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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 -
- Transition Engineering Model E-CX-TBT-03 10BaseT/10Base2 Converter

NOTE	Xircom Model PE3-10B2 or equivalent can also be used to interface the LMF Ethernet connection to the frame.
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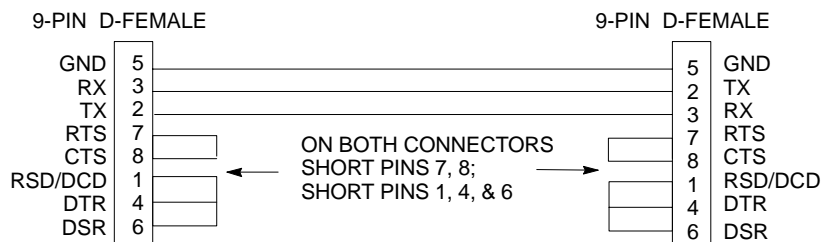
3C-PC-COMBO CBL

- Connects to the 3COM PCMCIA card and eliminates the need for a 10BaseT/10base2 Converter.

RS-232 to GPIB Interface

- National Instruments GPIB-232-CT with Motorola CGDSEDN04X RS232 serial null modem cable or equivalent; used to interface the LMF to the test equipment.
- Standard RS-232 cable can be used with the following modifications (see Figure 1-1):
 - This solution passes only the 3 minimum electrical connections between the LMF and the General Purpose Information Bus (GPIB) interface. The control signals are jumpered as enabled on both ends of the RS-232 cable (9-pin D). TX and RX signals are crossed as Null Modem effect. Pin 5 is the ground reference.
 - Short pins 7 and 8 together, and short pins 1, 4, and 6 together on each connector.

Figure 1-1: Null Modem Cable Detail



FW00362

Man Machine Interface (MMI) Interface Kit (Motorola part number CGDSMMICABLE219112)

This cable is used to connect the LMF to the BTS.

Communications System Analyzer

The communication system analyzer is used during optimization and testing of the RF communications portion of BTS equipment and provides the following functions:

- (1) Frequency counter
- (2) RF power meter (average and code domain)
- (3) RF Signal Generator (capable of CDMA modulation)
- (4) Spectrum Analyzer
- (5) CDMA Code Domain analyzer

The following communication system analyzers are currently supported by the LMF:

- **HP8921A/600 Analyzer** - including 83203B CDMA Interface, manual control system card, and 83236A/B Personal communication Interface (PCS) Interface for 1700/1900 MHz BTS.
- **Advantest R3465 Analyzer** - including R3561L Test Source Unit
- **CyberTest Communication Analyzer**
- **Hewlett-Packard HP 8935** - with option 200 or R2K for 1X TX and with Agilent E4432B Signal Generator for 1X FER
- **Advantest R3267 Analyzer** - including R3562 Test Source Unit
- **Agilent E4406A Analyzer** - including E4432B Test Source Unit

GPIB Cables

- Hewlett Packard 10833A or equivalent; 1 to 2 meters (3 to 6 feet) long used to interconnect test equipment and LMF terminal.

Power Meter

One of the following power meters is required with the HP8921 and Advantest analyzers:

- Hewlett Packard Model HP HP437B with HP8481A power sensor
- Gigatronics 8541C with model 80601A power sensor

Timing Reference Cables

- *Two* BNC-male to BNC-male RG316 cables; 3.05 m (10 ft.) long. Used to connect the communications analyzer to the front timing reference of the CSM cards in the BTS frame.

Digital Multimeter

- Fluke Model 8062A with Y8134 test lead kit or equivalent; used for precision dc and ac measurements, requiring 4-1/2 digits.

Directional Coupler

- Narda Model 30661 30 dB (Motorola part no. 58D09732W01) 1900 MHz coupler terminated with two Narda Model 375BN-M loads, or equivalent.
- Narda Model 30445 30 dB (Motorola Part No. 58D09643T01) 800 MHz coupler terminated with two Narda Model 375BN-M loads, or equivalent.

RF Attenuator

- 20 dB fixed attenuator, 20 W (Narda 768-20); used with 1.7/1.9 GHz test cable calibrations or during general troubleshooting procedures.

RF Terminations/Loads

- At least three 100-Watt (or larger) non-radiating RF terminations/loads.

Miscellaneous RF Adapters, Loads, etc

- As required to interface test cables and BTS equipment and for various test set ups. Should include at least two 50 Ohm loads (type N) for calibration and one RF short, two N-Type Female-to-Female Adapters.

LAN Cable

- BNC-to BNC 50 ohm coaxial cable [.91 m (3 ft) maximum] with an F-to-F adapter, used to connect the 10BaseT-to-coaxial adapter to the BTS LAN connector.

High-impedance Conductive Wrist Strap

- Motorola Model 42-80385A59; used to prevent damage from Electrostatic Discharge (ESD) when handling or working with modules.

Optional Equipment

NOTE

Not all optional equipment specified here will be supported by the LMF in automated tests or when executing various measure type command line interface (CLI) commands. It is meant to serve as a list of additional equipment that might be required during maintenance and troubleshooting operations.

Frequency Counter

- Stanford Research Systems SR620 or equivalent. 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.

Local Area Network (LAN) Tester

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

Span Line (T1/E1) Verification Equipment

- As required for local application

Oscilloscope

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

2-way Splitter

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

High Stability 10 MHz Rubidium Standard

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

Itasca Alarms Test Box

- Itasca CGDSCMIS00014 - This test box may be used as a tool to assist in the testing of customer alarms.

Required Documentation

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 files (bts-#.cdf and cbsc-#.cdf)
- *BTS Frame Installation Manual*; 68P09226A18
- *1X SC 4812T BTS Hardware Installation*; 68P09255A60
- Demarcation Document (Scope of Work Agreement)
- *CDMA LMF Operator's Guide*; 68P64114A78
- *CDMA RFDS Hardware Installation manual*; 68P64113A93
- *CDMA RFDS User's Guide*, 68P64113A37
- *LMF CLI Commands, R16*, 68P09253A56
- Equipment Manuals for non-Motorola test equipment

Intended Reader Profile

The information in this manual set is intended for use by the cellular communications craftsperson(s) in the initial installation and configuration, as well as the day-to-day operation and maintenance of a BTS.

The user of this information has a general understanding of telephony, as used in the operation of the Public Switched Telephone Network (PSTN), and is familiar with these concepts as they are applied in the cellular and maintenance mobile/portable radiotelephone environment.

The user also needs a working knowledge of the computer platform operating system being used (Windows 98™ or Windows 2000™).

BTS Equipment Identification

Equipment Overview

The Motorola SC 4812T BTS can consist of the following equipment frames:

- At least one BTS starter frame
 - +27 V BTS (see Figure 1-2)
 - -48 V BTS (see Figure 1-3)
- Ancillary equipment frame (or wall mounted equipment)
- Expansion frames
 - +27 V BTS (see Figure 1-4)
 - -48 V BTS (see Figure 1-5)

Ancillary Equipment Frame Identification

NOTE	Equipment listed below can be wall mounted or mounted in a standard 19 inch frame. The description assumes that all equipment is mounted in a frame for clarity.
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If equipped with the RFDS option, the RFDS and directional couplers are the interface between the site antennas and the BTS or Modem frame. The RFDS equipment includes:

- Directional couplers
- Site receive bandpass/bandreject filters
- RFDS

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 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 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.

C-CCP 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 1-2 and Table 1-3 for specific C-CCP Shelf Device ID numbers.

Table 1-2: C-CCP Shelf/Cage Card/Module Device ID Numbers (Top Shelf)

Frame #	Card/Module ID Number (Left to Right)																		
	Power (PS-1)	Power (PS-2)	Power (PS-3)	AMR -1	GLI2 -1	MCC						BBX						BBX-R	MPC/EMPC -1
1	-	-	-	1	1	1	2	3	4	5	6	1	2	3	4	5	6	R1	-
101	-	-	-	101	101	101	102	103	104	105	106	101	102	103	104	105	106	R101	-
201	-	-	-	201	201	201	202	203	204	205	206	201	202	203	204	205	206	R201	-
301	-	-	-	301	301	301	302	303	304	305	306	301	302	303	304	305	306	R301	-

Table 1-3: C-CCP 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	7	8	9	10	11	12	7	8	9	10	11	12	-	-
101	-	101	102	-	-	-	102	102	107	108	109	110	111	112	107	108	109	110	111	112	-	-
201	-	201	202	-	-	-	202	102	207	208	209	210	211	212	207	208	209	210	211	212	-	-
301	-	301	302	-	-	-	302	102	307	308	309	310	311	312	307	308	309	310	311	312	-	-

Figure 1-2: +27 V SC 4812T BTS Starter Frame

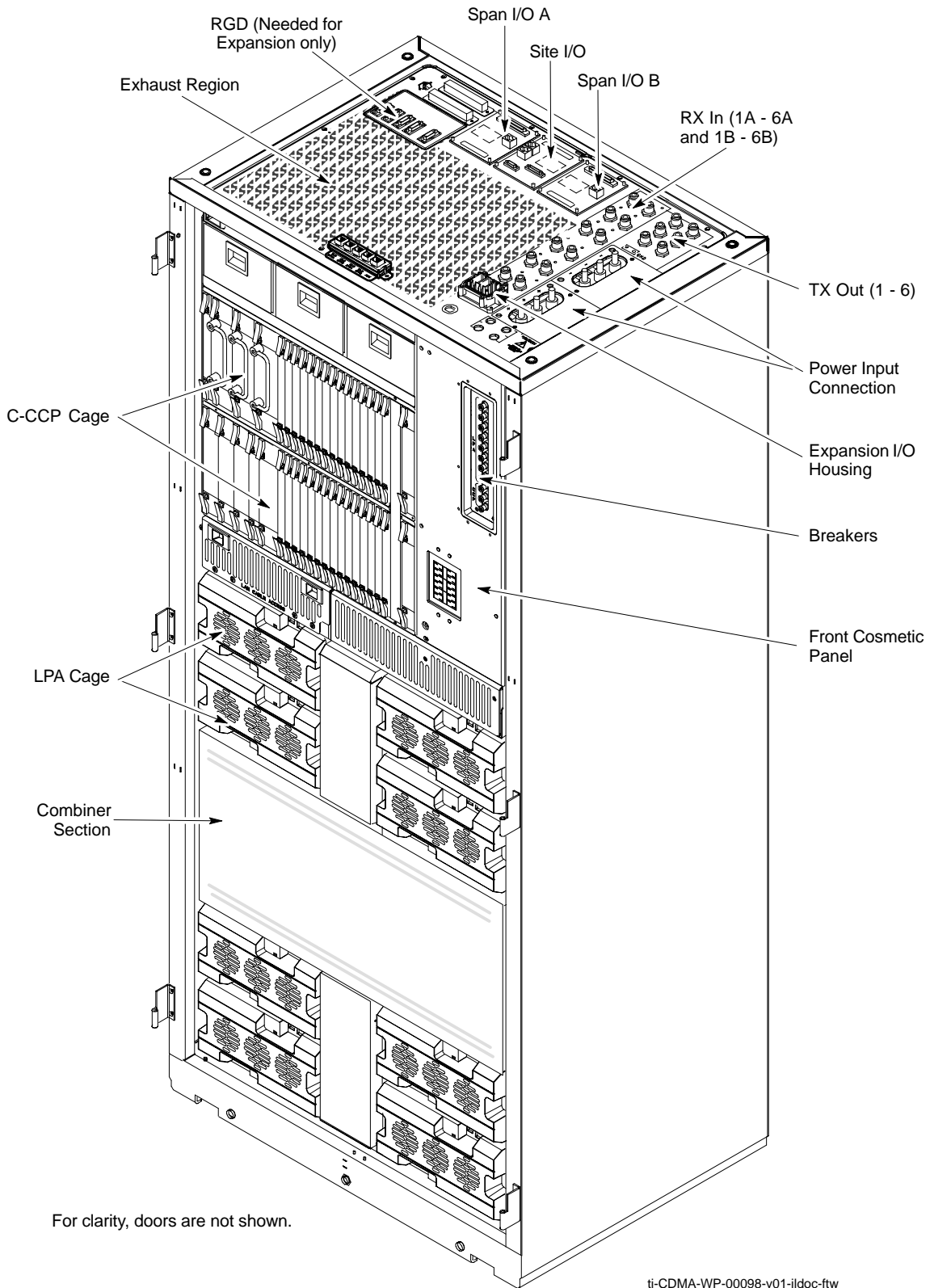


Figure 1-3: -48 V SC 4812T BTS Starter Frame

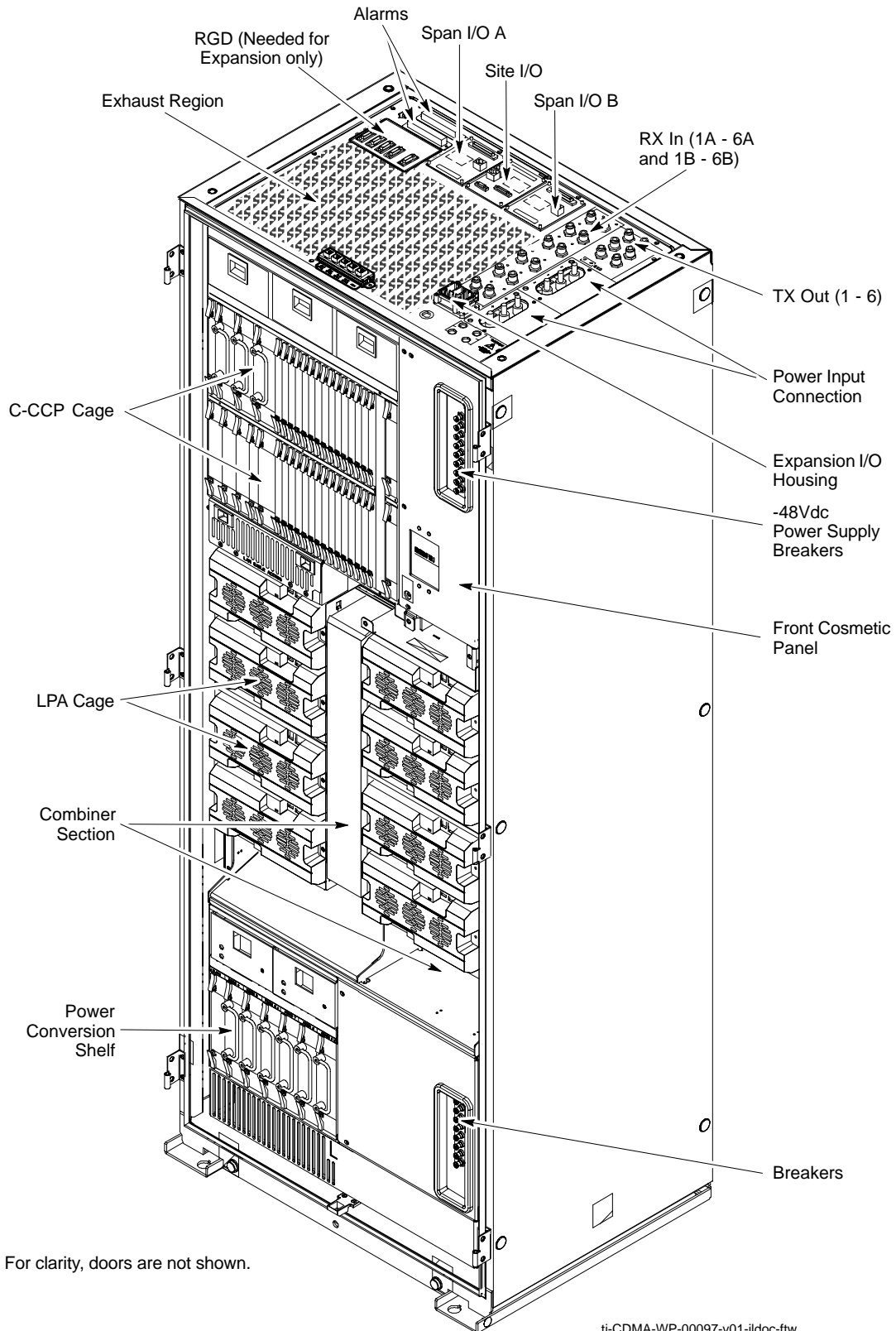
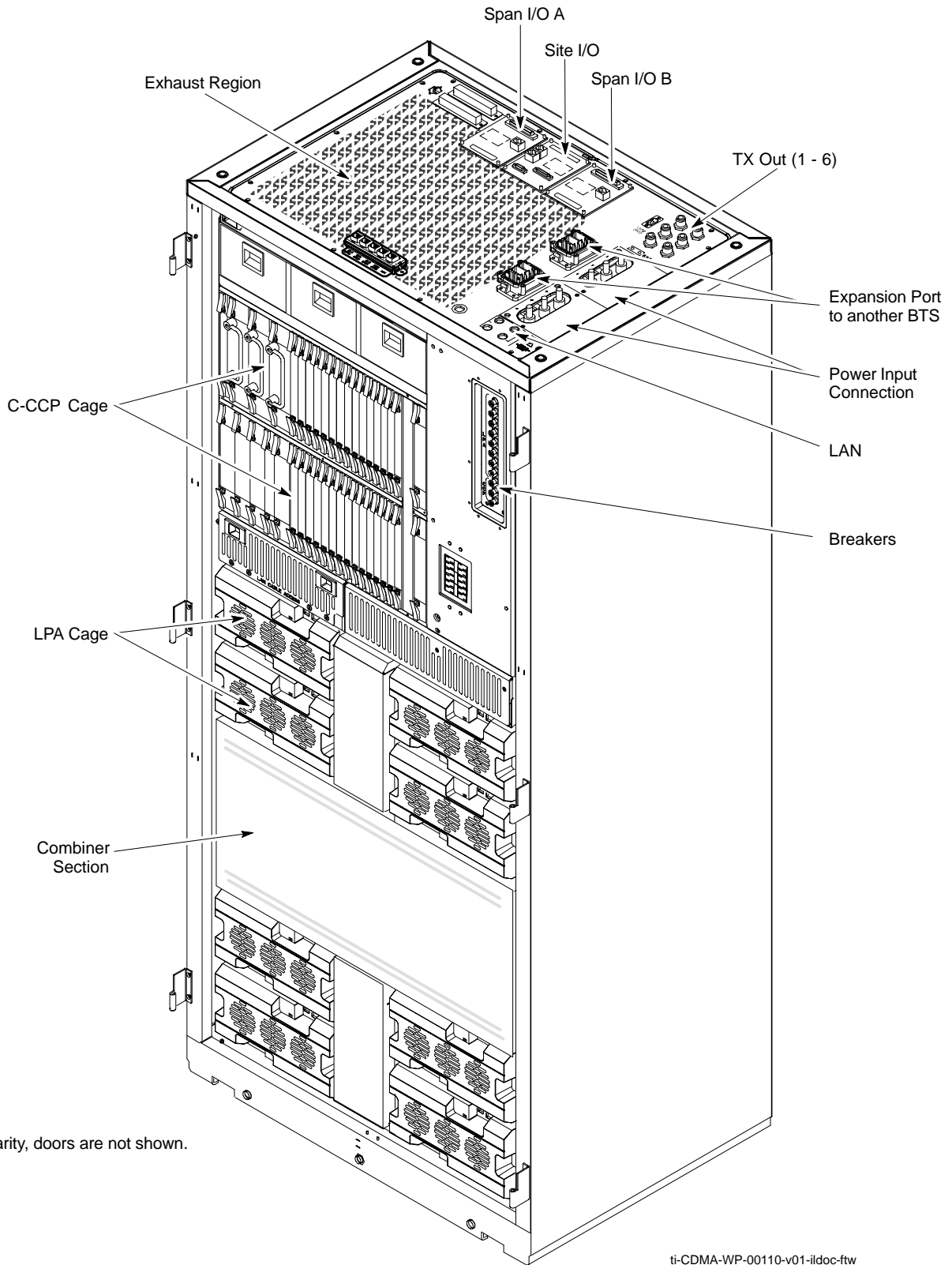


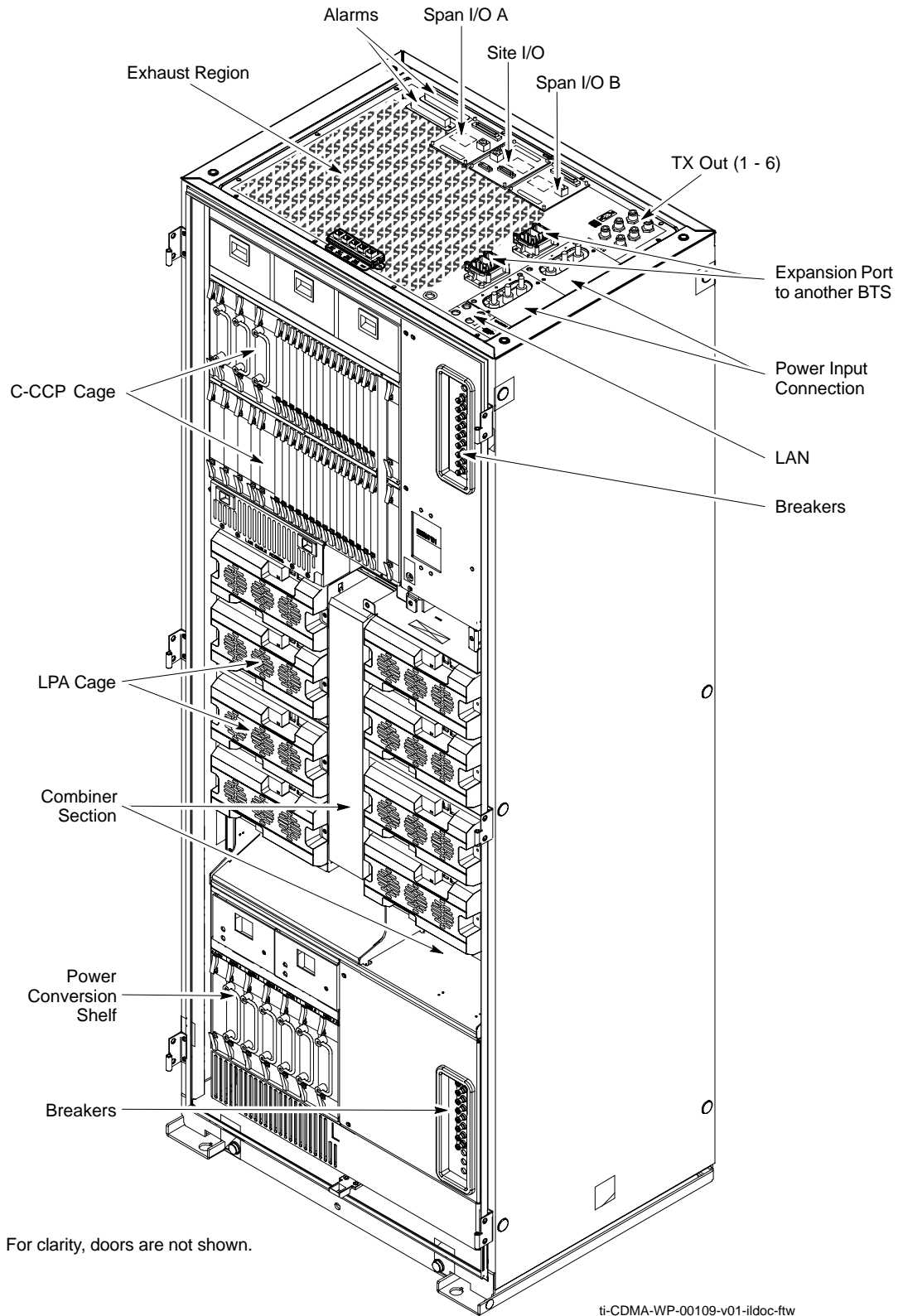
Figure 1-4: +27 V SC 4812T BTS Expansion Frame



For clarity, doors are not shown.

ti-CDMA-WP-00110-v01-ildoc-ftw

Figure 1-5: -48 V SC 4812T BTS Expansion Frame



1

BTS Frame Description

The BTS is the interface between the span lines to/from the Cellsite Base Station Controller (CBSC) and the site antennas. This frame is described in three sections:

- The top interconnect plate where all connections are made.
- The upper portion of the frame which houses circuit breakers, cooling fans, and the C-CCP shelf.
- The lower portion of the frame which houses the LPA fans, LPAs, and TX filter/combiners.
- The -48 V version of the BTS also has a section below the LPAs containing a power conversion shelf that supplies power to the LPAs.

Use the illustrations that follow to visually identify the major components, that make up the Motorola SC 4812T BTS frame.

Top Interconnect Plate (see Figure 1-6 or Figure 1-7)

All cabling to and from the BTS equipment frames is via the interconnect panel on the top of each frame. Connections made here include:

- Span lines
- RX antennas
- TX antenna
- Alarm connections
- Power input
- LAN connections
- GPS input or Remote Global Positioning System (RGPS) on the Site I/O Board
- Remote Global Positioning System Distribution (RGD)
- LORAN-C Low Frequency Receiver (LFR) input
- Expansion frame connection
- Ground connections
- RJ-45 Pass-through Connectors

C-CCP Shelf (see Figure 1-10)

- C-CCP backplane and cage
- Power supply modules
- CDMA clock distribution (CCD) boards
- CSM and HSO/LFR boards
- Alarm Monitoring and Reporting (AMR) boards
- GLI cards (may be GLI2 or GLI3)
- MPC/EMPC boards
 - MPC - starter frame only
 - EMPC - expansion frames
- Switch card
- MCC boards (may be MCC8E, MCC24, or MCC-1X)
- BBX boards (may be BBX2 or BBX-1X)
- CIO boards

PA Shelves (see Figure 1-11 or Figure 1-12)

- LPA cages
- LPA trunking backplanes
- Single Tone Linear Power Amplifier (STLPA, or more commonly referred to as “LPA”) modules
- LPA fan modules
- LPA Combiner Cage (+27 V BTS)
- TX filter combiners or bandpass filters

-48 V Power Conversion Shelf (see Figure 1-15)

- Power conversion backplane and shelf
- Power conversion boards
- Power conversion alarm card
- Fan modules
- Power distribution assembly
- Air plenum

Frame Module Location & Identification

Figure 1-6: +27 V SC 4812T Starter Frame I/O Plate

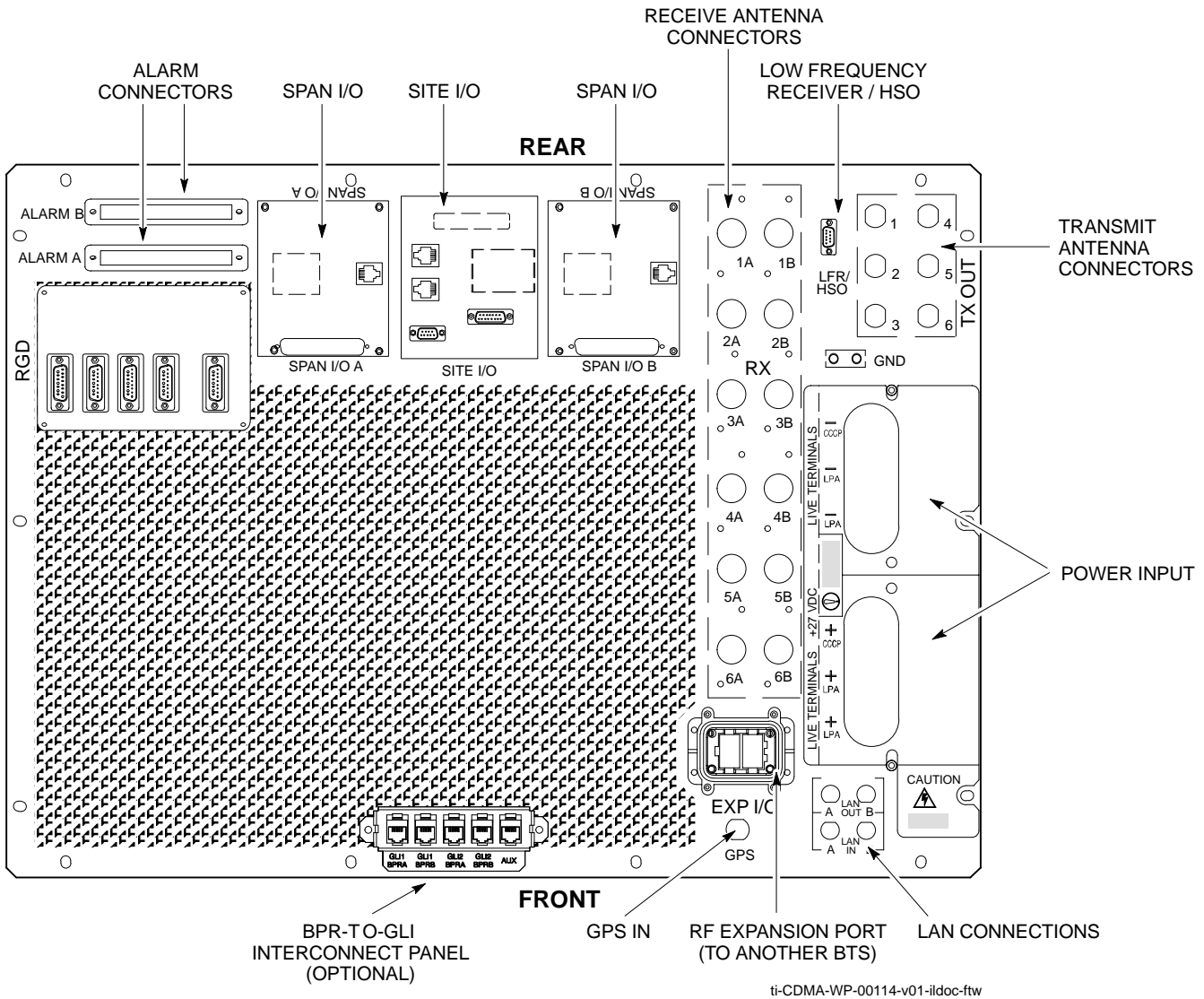
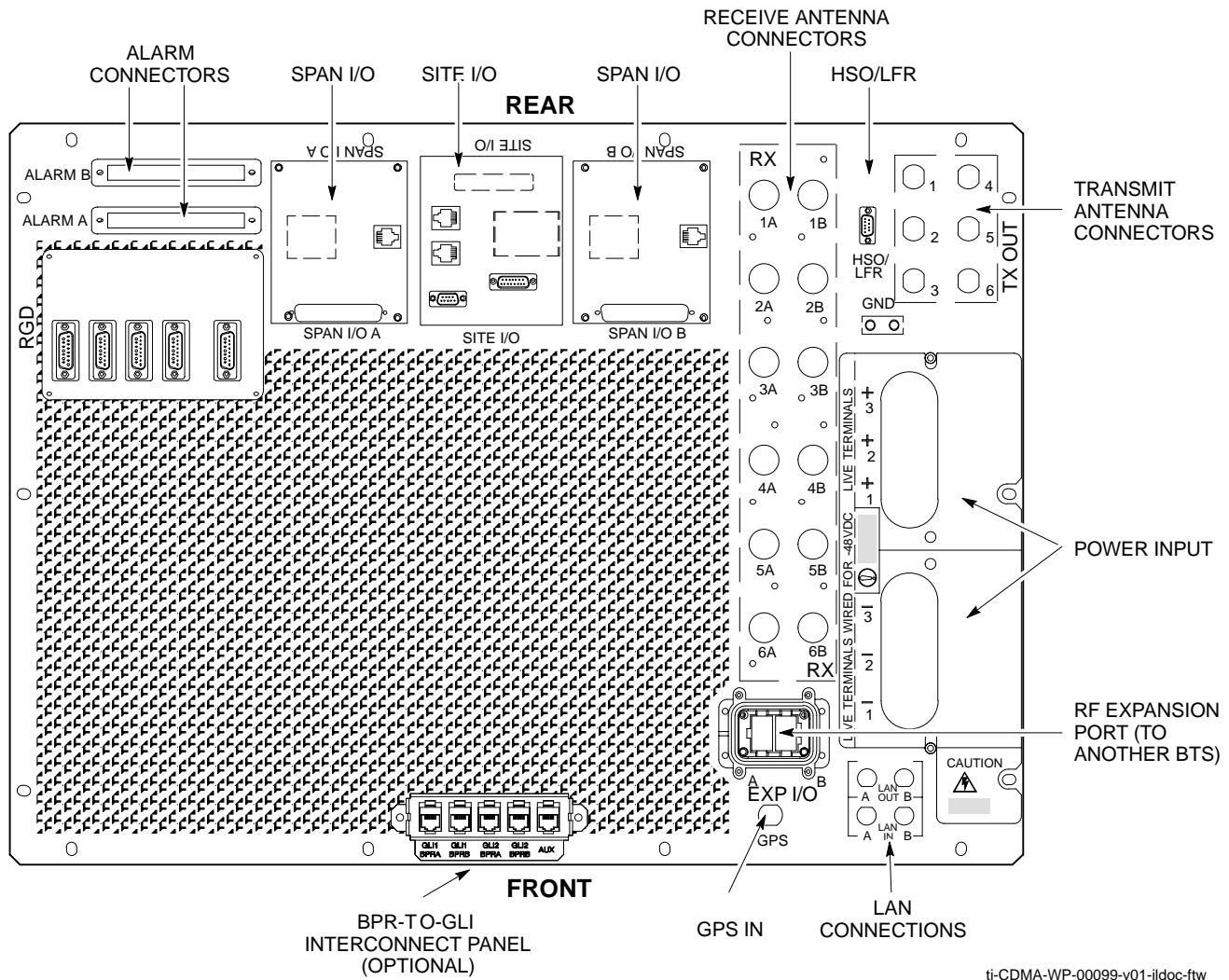
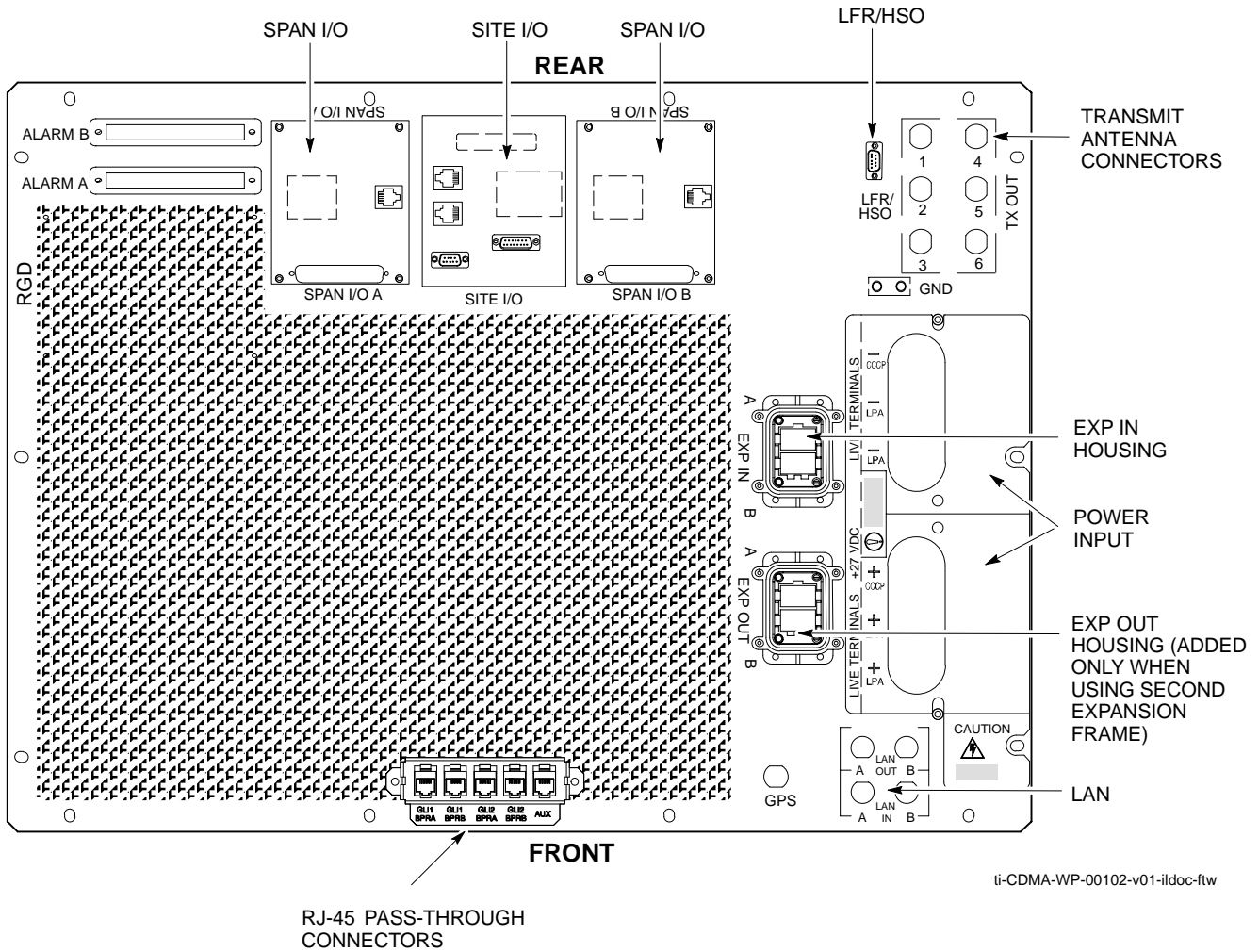


Figure 1-7: -48 V SC 4812T Starter Frame I/O Plate



ti-CDMA-WP-00099-v01-ildoc-ftw

Figure 1-8: +27 V SC 4812T Expansion Frame I/O Plate



ti-CDMA-WP-00102-v01-ildoc-ftw

Figure 1-9: -48 V SC 4812T Expansion Frame I/O Plate

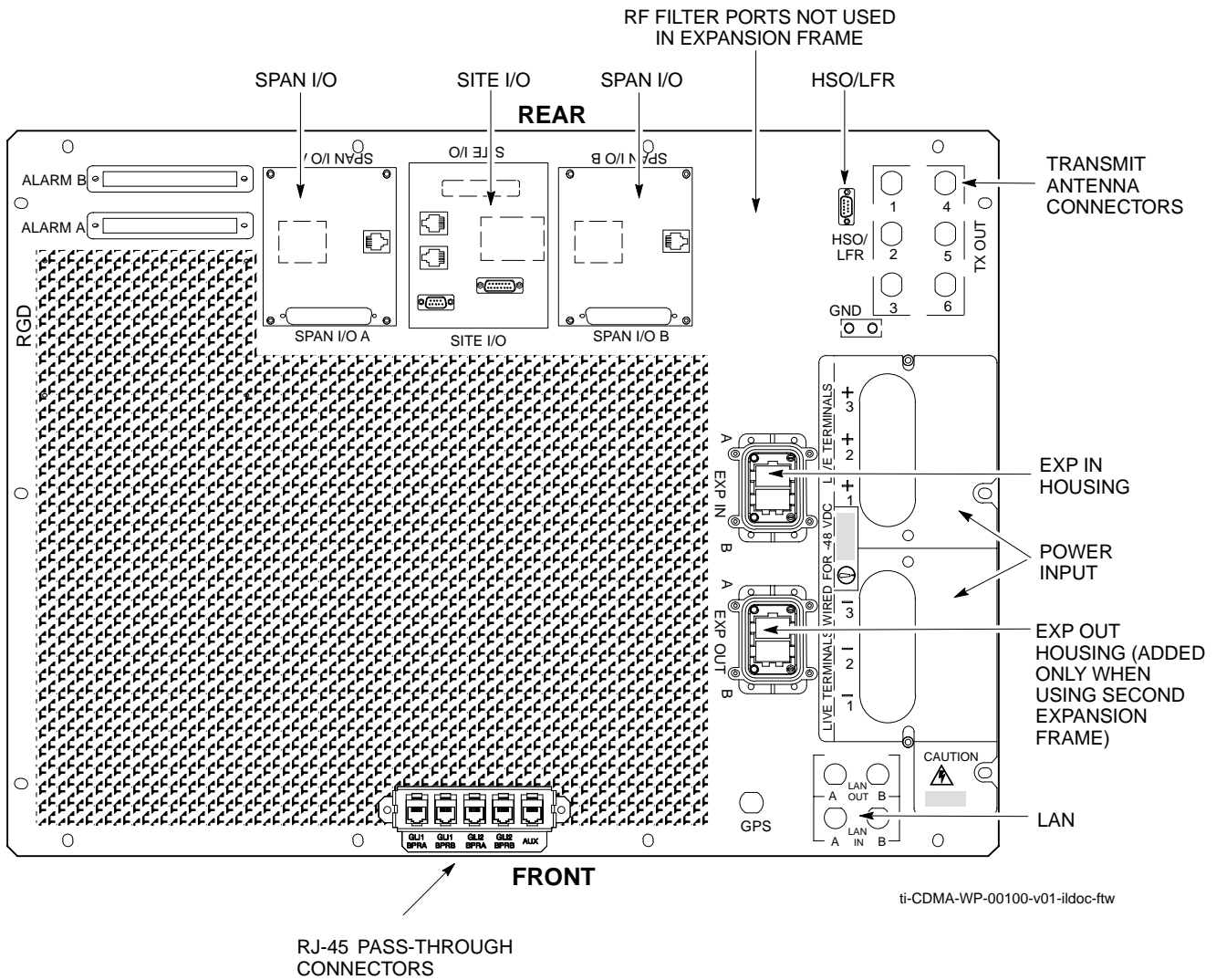
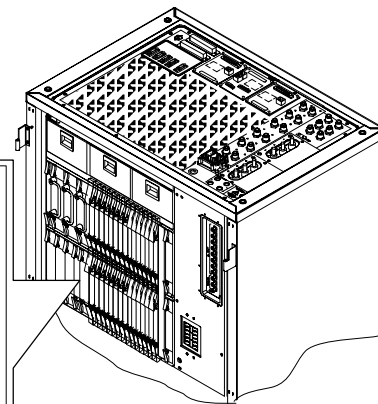
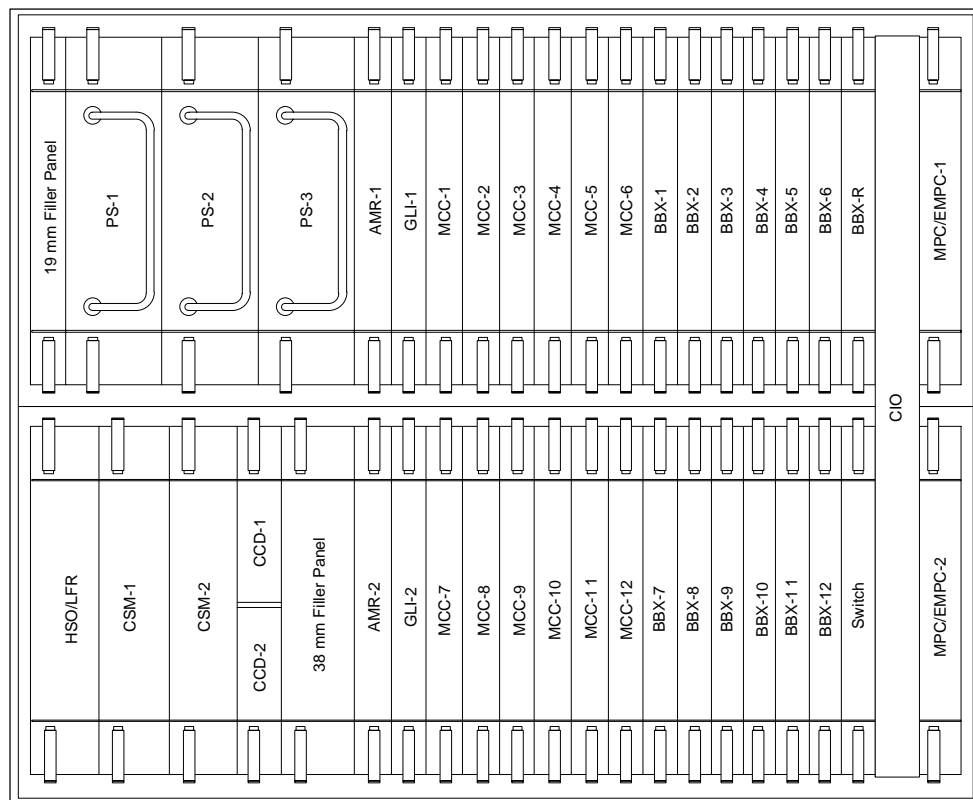


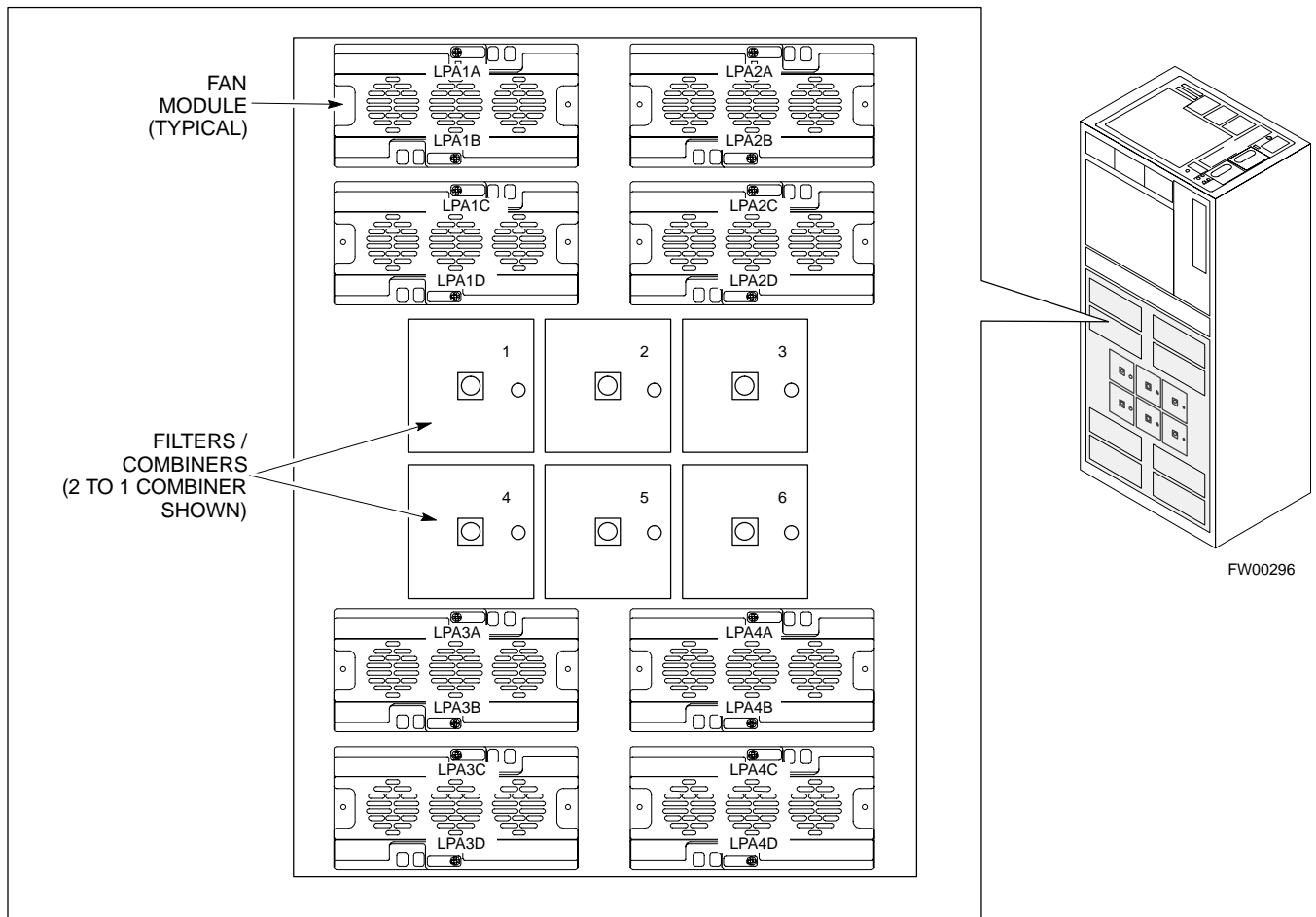
Figure 1-10: SC 4812T C-CCP Shelf



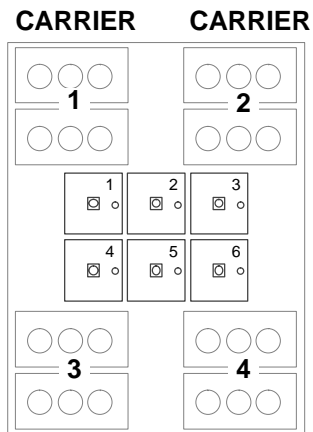
NOTE: MCCs may be MCC8Es, MCC24s, or MCC-1Xs. BBXs may be BBX2s or BBX-1Xs. GLIs may be GLI2s or GLI3s.

REF FW00295

Figure 1-11: +27 V SC 4812T LPA Configuration - 4 Carrier with 2:1 Combiners

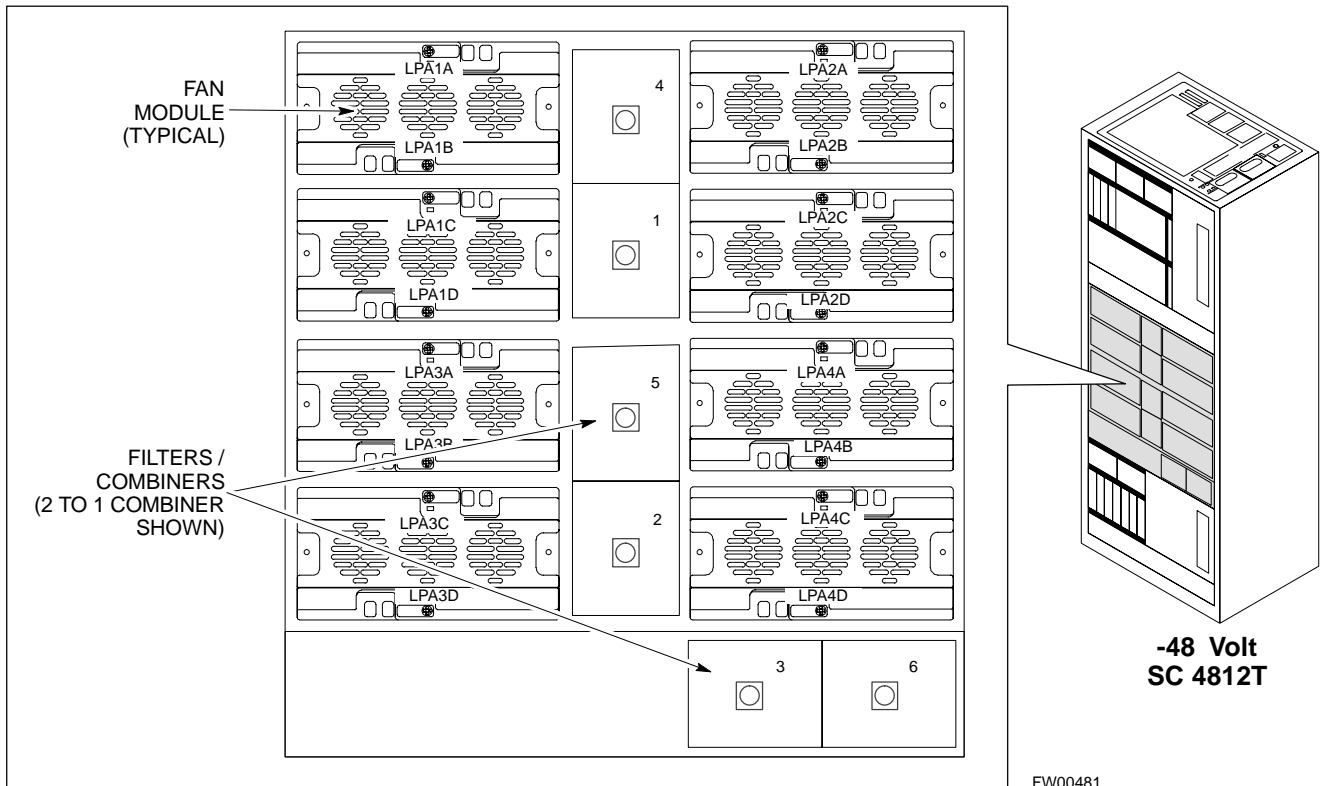


4-CARRIER CONFIGURATION

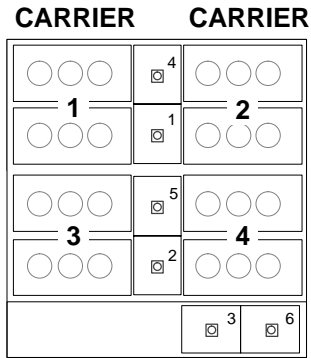


Note
 No adjacent carriers may exist within the same TX filter combiner. "Adjacent" is defined as f_{c1} and f_{c2} being 1.25 MHz apart (center-to-center). "Non-adjacent" is defined as f_{c1} and f_{c2} being ≥ 2.50 MHz apart (center-to-center).

Figure 1-12: -48 V SC 4812T LPA Configuration - 4 Carrier, 3-Sector with 2:1 Combiners



4-CARRIER CONFIGURATION



Note
 No adjacent carriers may exist within the same TX filter combiner. "Adjacent" is defined as f_{c1} and f_{c2} being 1.25 MHz apart (center-to-center). "Non-adjacent" is defined as f_{c1} and f_{c2} being ≥ 2.50 MHz apart (center-to-center).

Sector Configuration

There are a number of ways to configure the BTS frame. Table 1-4 outlines the basic requirements. When carrier capacity is greater than two, a 2:1 or 4:1 cavity combiner must be used. For one or two carriers, bandpass filters or cavity combiners may be used, depending on sectorization and channel sequencing.

Number of carriers	Number of sectors	Channel spacing	Filter requirements
1	3 or 6	N/A	Bandpass Filter, Cavity Combiner (2:1 or 4:1)
2	6	Non-adjacent	Cavity Combiner (2:1 Only)
2	6	Adjacent	Not supported in single frame
2	3	Non-adjacent	Cavity Combiner (2:1 or 4:1)
2	3	Adjacent	Bandpass Filter
3,4	3	Non-adjacent	Cavity Combiner (2:1 or 4:1)
3,4	3	Adjacent	Cavity Combiner (2:1 Only)

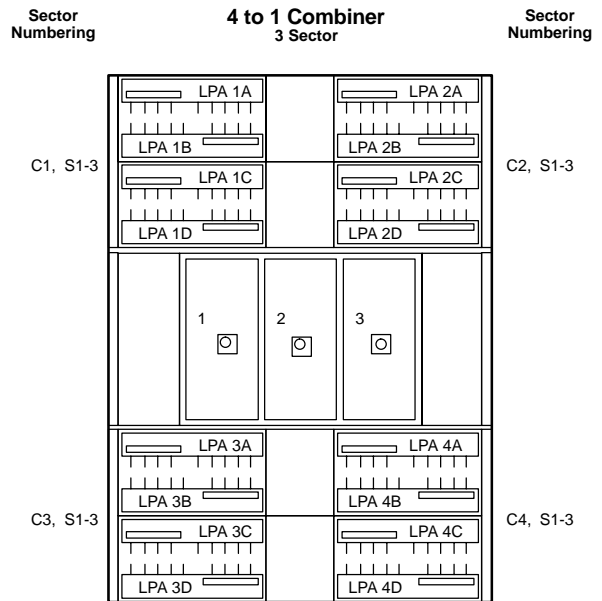
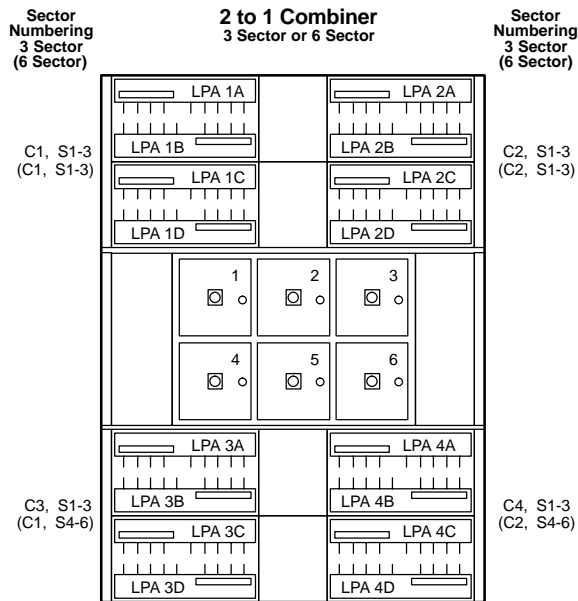
NOTE In Table 1-5, BBXs may be BBX2s or BBX-1Xs.

Table 1-5: Sector Configurations							
Config Ref. No.	Description						
1	3-Sector/2-ADJACENT Carriers - The configuration below maps TX with optional 2:1 cavity combiners for 3 sectors/2 carriers for <i>adjacent</i> channels. Note that 2:1 cavity combiners are used (6 total).						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1 N/A	BBX-2 N/A	BBX-3 N/A	N/A BBX-4	N/A BBX-5	N/A BBX-6	1 2
2	6-Sector/2-NON-ADJACENT Carriers - The configuration below maps TX with 2:1 cavity combiners for 6 sectors/2 carriers for <i>non-adjacent</i> channels.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1 BBX-7	BBX-2 BBX-8	BBX-3 BBX-9	BBX-4 BBX-10	BBX-5 BBX-11	BBX-6 BBX-12	1 2
3	3-Sector/2-NON-ADJACENT Carriers - The configuration below maps TX with 2:1 cavity combiners for 3 sectors/2 carriers for <i>non-adjacent</i> channels.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1 BBX-7	BBX-2 BBX-8	BBX-3 BBX-9	N/A N/A	N/A N/A	N/A N/A	1 2
4	3-Sector/4-ADJACENT Carriers - The configuration below maps TX with 2:1 cavity combiners for 3 sector/4 carriers for <i>adjacent</i> channels.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1	BBX-2	BBX-3	N/A	N/A	N/A	1
	BBX-7	BBX-8	BBX-9	N/A	N/A	N/A	2
	N/A	N/A	N/A	BBX-4	BBX-5	BBX-6	3
N/A	N/A	N/A	BBX-10	BBX-11	BBX-12	4	
5	3-Sector / 2-ADJACENT Carriers - The configuration below maps TX with bandpass filters for 3 sectors/2 carriers for <i>adjacent</i> channels.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1 N/A	BBX-2 N/A	BBX-3 N/A	N/A BBX-7	N/A BBX-8	N/A BBX-9	1 2
6	3-Sector/3 or 4-NON-ADJACENT Carriers - The configuration below maps TX with 4:1 cavity combiners for 3 sectors/3 or 4 carriers for <i>non-adjacent</i> channels.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1	BBX-2	BBX-3	N/A	N/A	N/A	1
	BBX-7	BBX-8	BBX-9	N/A	N/A	N/A	2
	BBX-4	BBX-5	BBX-6	N/A	N/A	N/A	3
BBX-10	BBX-11	BBX-12	N/A	N/A	N/A	4	
7	6-Sector/1-Carrier - The configuration below maps TX with either bandpass filters or 2:1 cavity combiners for 6 sector/1 carrier.						
	TX1	TX2	TX3	TX4	TX5	TX6	Carrier#
	BBX-1	BBX-2	BBX-3	BBX-4	BBX-5	BBX-6	1

Figure 1-13: +27 V SC4812T LPA Configuration with Combiners/Filters

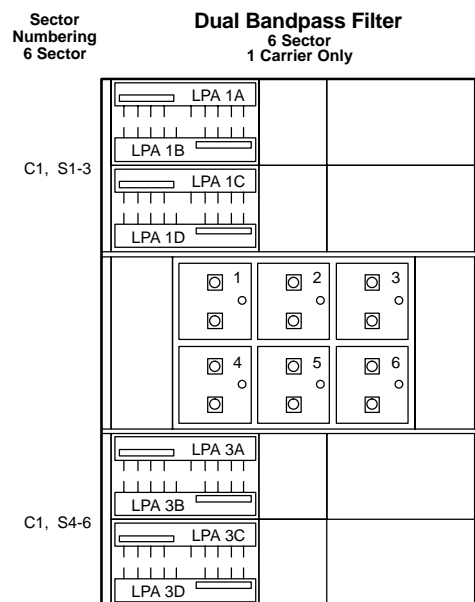
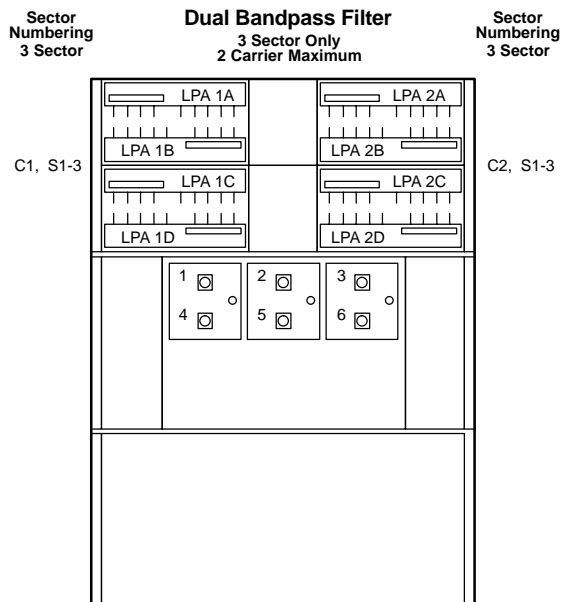
Note: See Table 1-5 Configuration Reference Numbers 1, 2, 3, 4.

Note: See Table 1-5 Configuration Reference Number 6.



Note: See Table 1-5 Configuration Reference Number 5.

Note: See Table 1-5 Configuration Reference Number 7.

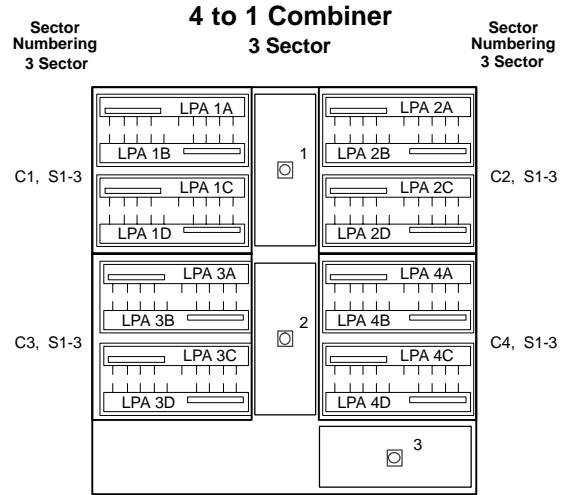
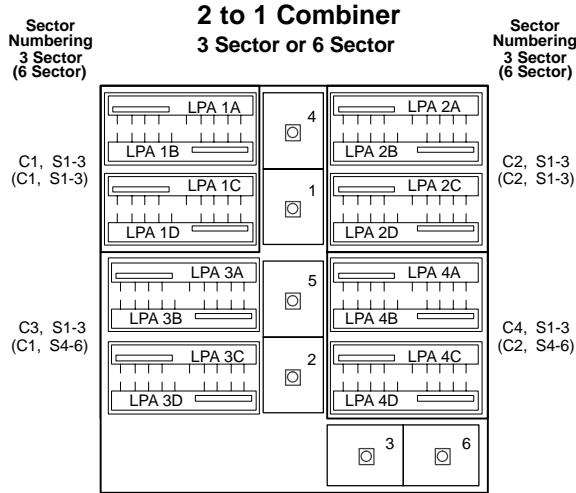


FW00297

Figure 1-14: -48 V SC4812T LPA Configuration with Combiners/Filters

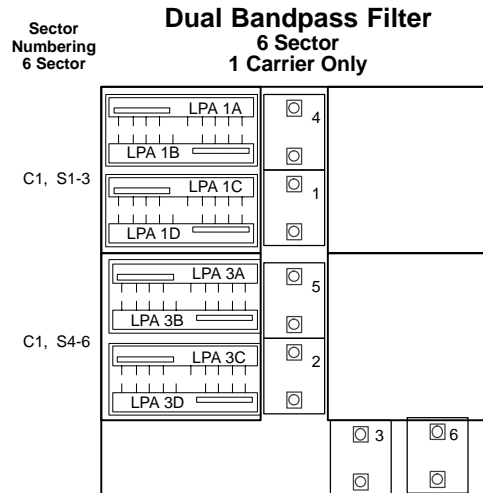
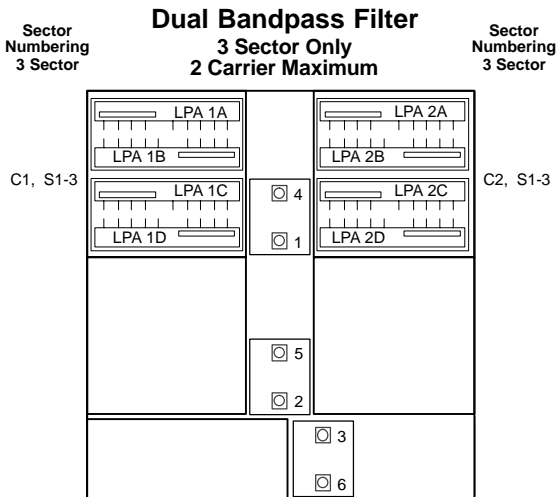
Note: See Table 1-5 Configuration Reference Numbers 1, 2, 3, 4.

Note: See Table 1-5 Configuration Reference Number 6.



Note: See Table 1-5 Configuration Reference Number 5.

Note: See Table 1-5 Configuration Reference Number 7.



REF FW00482

Figure 1-15: -48 V BTS Power Conversion Shelf

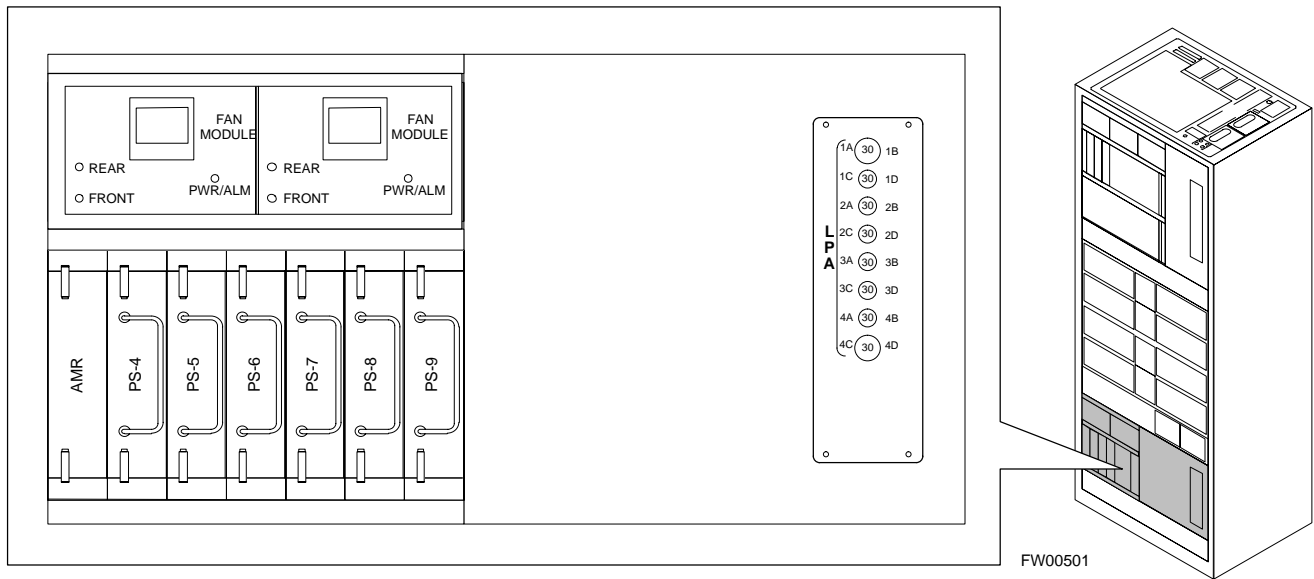
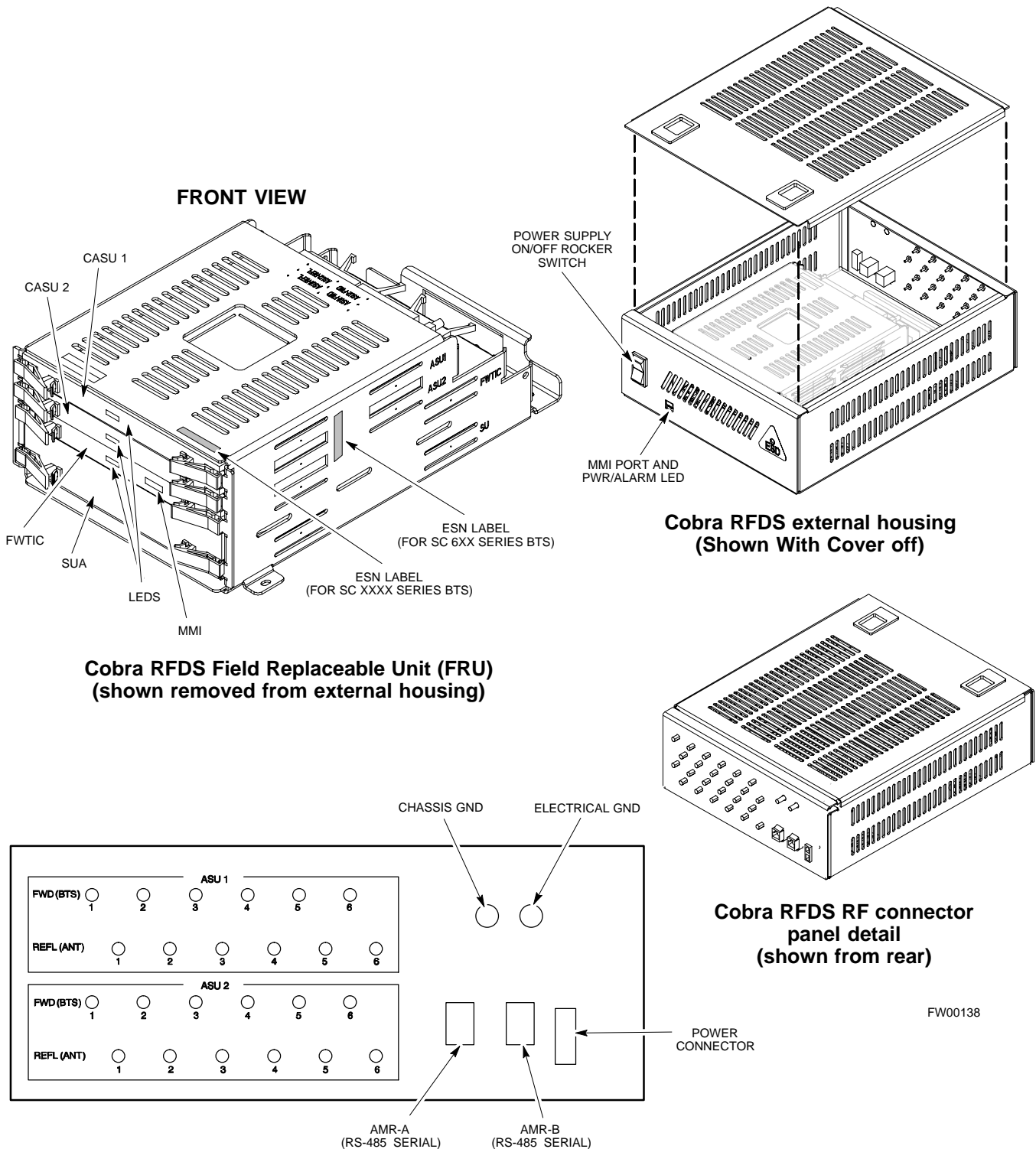


Figure 1-16: CDMA (COBRA) RFDS Layout



Chapter 2

Preliminary Operations

Preliminary Operations: Overview

Introduction

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

Cell Site Types

Sites are configured as Omni with a maximum of 4 carriers, 3-sectored with a maximum of 4 carriers, and 6-sectored with a maximum of 2 carriers. Each type has unique characteristics and must be optimized accordingly. For more information on the differences in site types, please refer to the *BTS/Modem Frame Hardware Installation* manual.

CDF

The Cell-site Data File (CDF) contains site type and equipage data information and passes it directly to the LMF during optimization. The number of modem frames, C-CCP shelves, BBX boards, MCC boards (per cage), and linear power amplifier assignments are some of the equipage data included in the CDF.

NOTE

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

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 BTS or Modem frame and ancillary equipment frame.

CAUTION

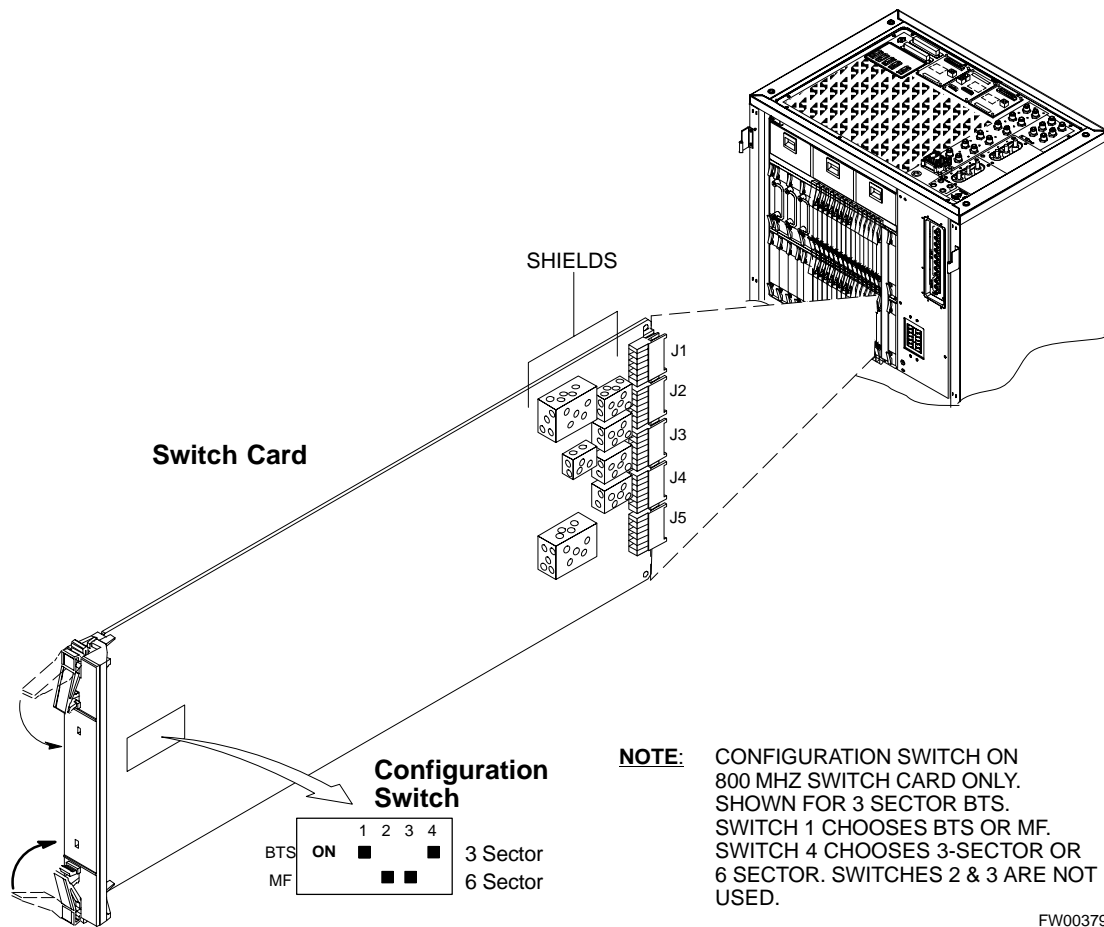
Always wear a conductive, high impedance wrist strap while handling any circuit card/module to prevent damage by ESD. After removal, the card/module should be placed on a conductive surface or back into the anti-static shipping bag.

Initial Installation of Boards/Modules

Follow the procedure in Table 2-1 to verify the initial installation of boards/modules.

Table 2-1: Initial Installation of Boards/Modules	
Step	Action
1	Refer to the site documentation and install all boards and modules into the appropriate shelves as required. Verify they are NOT SEATED 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: Switch Card

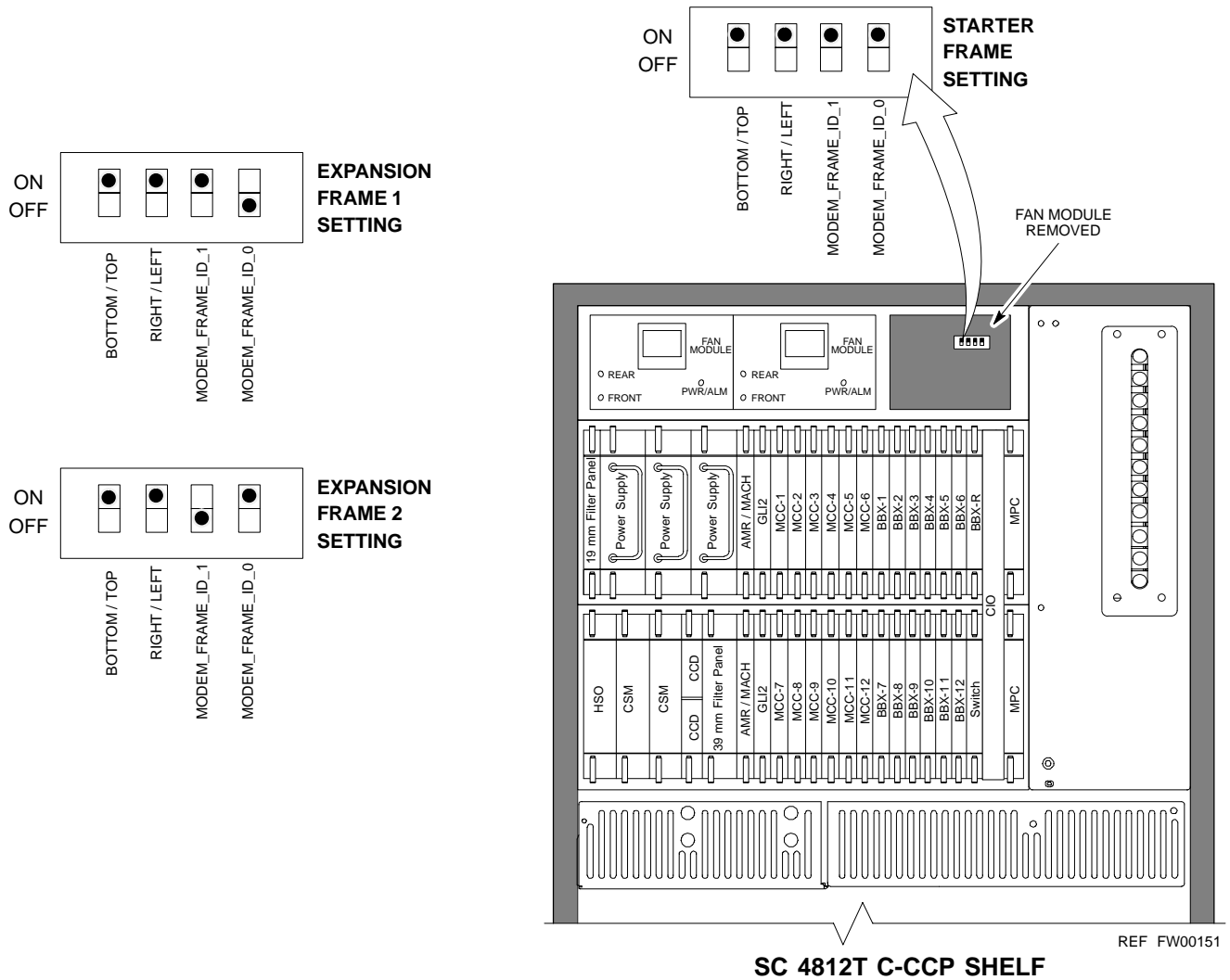


Setting Frame C-CCP Shelf Configuration Switch

The backplane switch settings behind the fan module nearest the breaker panel should be set 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 - SC 4812T



Pre-Power-up Tests

Objective

This procedure checks for any electrical short circuits and verifies the operation and tolerances of the cellsite and BTS power supply units prior to applying power for the first time.

2

Test Equipment

The following test equipment is required to complete the pre-power-up tests:

- Digital Multimeter (DMM)

CAUTION	Always wear a conductive, high impedance wrist strap while handling the any circuit card/module to prevent damage by ESD.
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Cabling Inspection

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

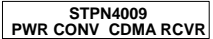
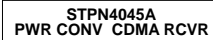
- Receive RF cabling - up to 12 RX cables
- Transmit RF cabling - up to six TX cables
- GPS
- LFR

NOTE	<p>For positive power applications (+27 V):</p> <ul style="list-style-type: none">• The positive power cable is red.• The negative power cable (ground) is black. <p>For negative power applications (-48 V):</p> <ul style="list-style-type: none">• The negative power cable is red or blue.• The positive power cable (ground) is black. <p>In all cases, the black power cable is at ground potential.</p>
-------------	--

DC Power Pre-test (BTS Frame)

Before applying any power to the BTS frame, follow the procedure in Table 2-2 while referring to Figure 2-3 and Figure 2-4 for +27 V systems or to Figure 2-5 and Figure 2-6 for -48 V systems to verify there are no shorts in the BTS frame DC distribution system.

Table 2-2: DC Power Pre-test (BTS Frame)

Step	Action
1	Physically verify that all DC power sources supplying power to the frame are OFF or disabled.
2	<p><i>On each frame:</i></p> <ul style="list-style-type: none"> Unseat all circuit boards (except CCD and CIO cards) in the C-CCP shelf and LPA shelves, but leave them in their associated slots. Set C-CCP shelf breakers to the OFF position by <i>pulling out</i> power distribution breakers (labeled C-CCP 1, 2, 3 on the +27 V BTS C-CCP power distribution panel and labeled POWER 1,4,5,2,6,7,3,8,9 on the -48 V C-CCP power distribution panel). Set LPA breakers to the OFF position by <i>pulling out</i> the LPA breakers (8 breakers, labeled 1A-1B through 4C-4D - located on the C-CCP power distribution panel in the +27 V BTS or on the power conversion shelf power distribution panel in the -48 V BTS).
3	<p>Verify that the resistance from the power (+ or -) feed terminals with respect to the ground terminal on the top of the frame measures $\geq 500 \Omega$ (see Figure 2-3).</p> <ul style="list-style-type: none"> If reading is $< 500 \Omega$, a short may exist somewhere in the DC distribution path supplied by the breaker. Isolate the problem before proceeding. A reading $> 3 M\Omega$ could indicate an open (or missing) bleeder resistor (installed across the filter capacitors behind the breaker panel).
4	<p>Set the C-CCP (POWER) breakers to the ON position by pushing them IN <i>one at a time</i>. Repeat Step 3 after turning on each breaker.</p> <p>NOTE If the ohmmeter stays at 0Ω after inserting any board/module, a short probably exists in that board/module. Replace the suspect board/module and repeat the test. If test still fails, isolate the problem before proceeding.</p>
5	<p>Insert and lock the DC/DC converter modules for the C-CCP shelf and into their associated slots <i>one at a time</i>. Repeat Step 3 after inserting each module.</p> <ul style="list-style-type: none"> A typical response is that the ohmmeter steadily climbs in resistance as capacitors charge, finally indicating approximately 500Ω. <p>! CAUTION Verify the correct power/converter modules by observing the locking/retracting tabs appear as follows:</p> <ul style="list-style-type: none"> -  (in +27 V BTS C-CCP shelf) -  (in -48 V BTS C-CCP shelf)
6	<p>Insert and lock all remaining circuit boards and modules into their associated slots in the C-CCP shelf. Repeat Step 3 after inserting and locking each board or module.</p> <ul style="list-style-type: none"> A typical response is that the ohmmeter steadily climbs in resistance as capacitors charge, stopping at approximately 500Ω.
7	<p>Set the LPA breakers ON by pushing them IN <i>one at a time</i>. Repeat Step 3 after turning on each breaker.</p> <ul style="list-style-type: none"> A typical response is that the ohmmeter will steadily climb in resistance as capacitors charge, stopping at approximately 500Ω.

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Table 2-2: DC Power Pre-test (BTS Frame)


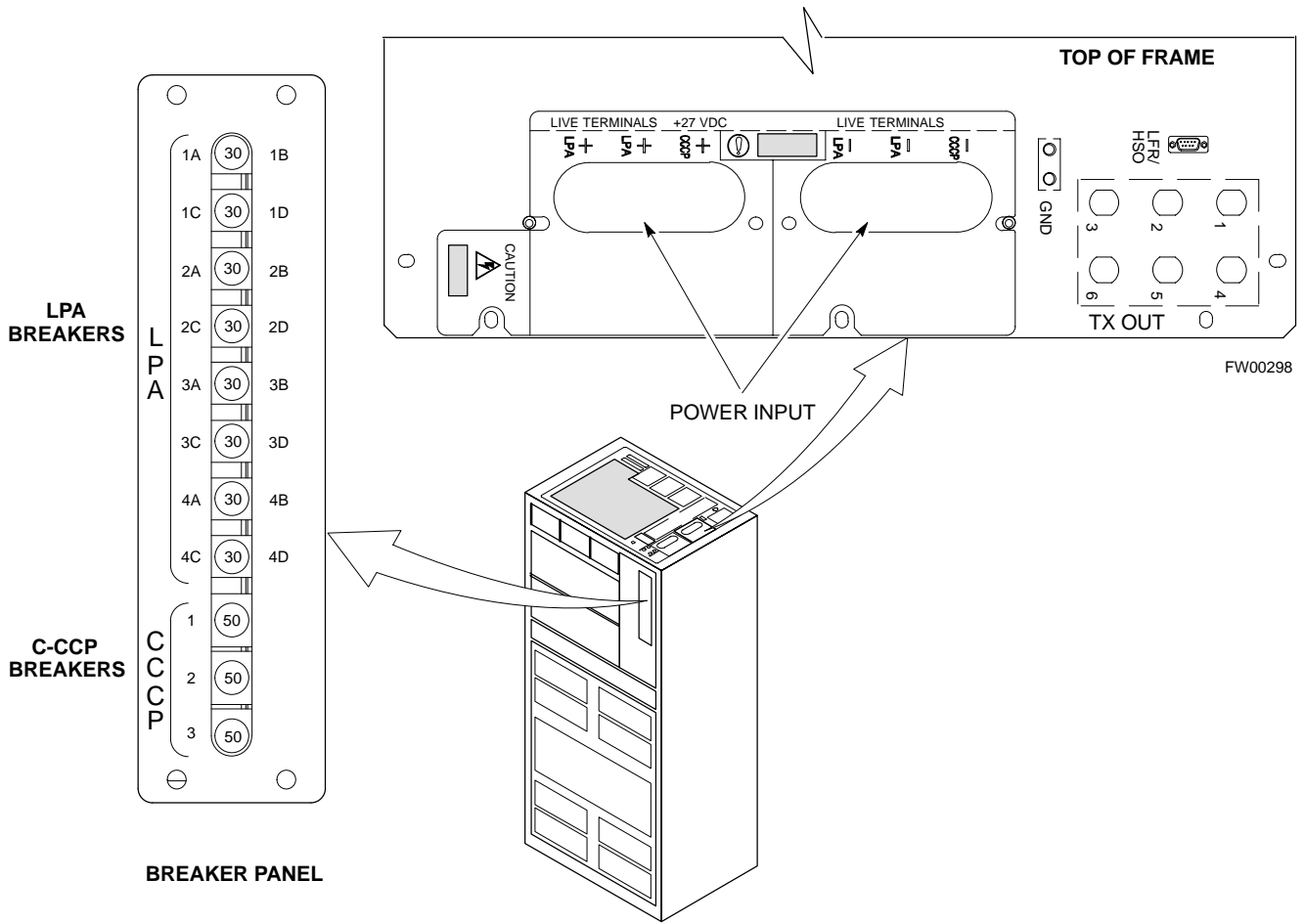
Step	Action
8	<p>In the -48 V BTS, insert and lock the DC/DC LPA converter modules into their associated slots <i>one at a time</i>. Repeat Step 3 after inserting each module.</p> <ul style="list-style-type: none"> A typical response is that the ohmmeter steadily climbs in resistance as capacitors charge, finally indicating approximately 500 Ω <p>! CAUTION Verify the correct power/converter modules by observing the locking/retracting tabs appear as follows:</p> <p>-  (in -48 V BTS power conversion shelf)</p>
9	<p>Seat all LPA and associated LPA fan modules into their associated slots in the shelves <i>one at a time</i>. Repeat Step 3 after seating each LPA and associated LPA fan module.</p> <ul style="list-style-type: none"> A typical response is that the ohmmeter will steadily climb in resistance as capacitors charge, stopping at approximately 500 Ω.

Figure 2-3: +27 V BTS DC Distribution Pre-test



Breaking:

- Two LPAs on each trunking backplane breakered together
- Designed for peak LPA current of 15 amps (30 amp breakers)
- Unused TX paths do not need to be terminated
- Single feed for C-CCP
- Dual feed for LPA

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Figure 2-4: +27 V SC 4812T BTS Starter Frame

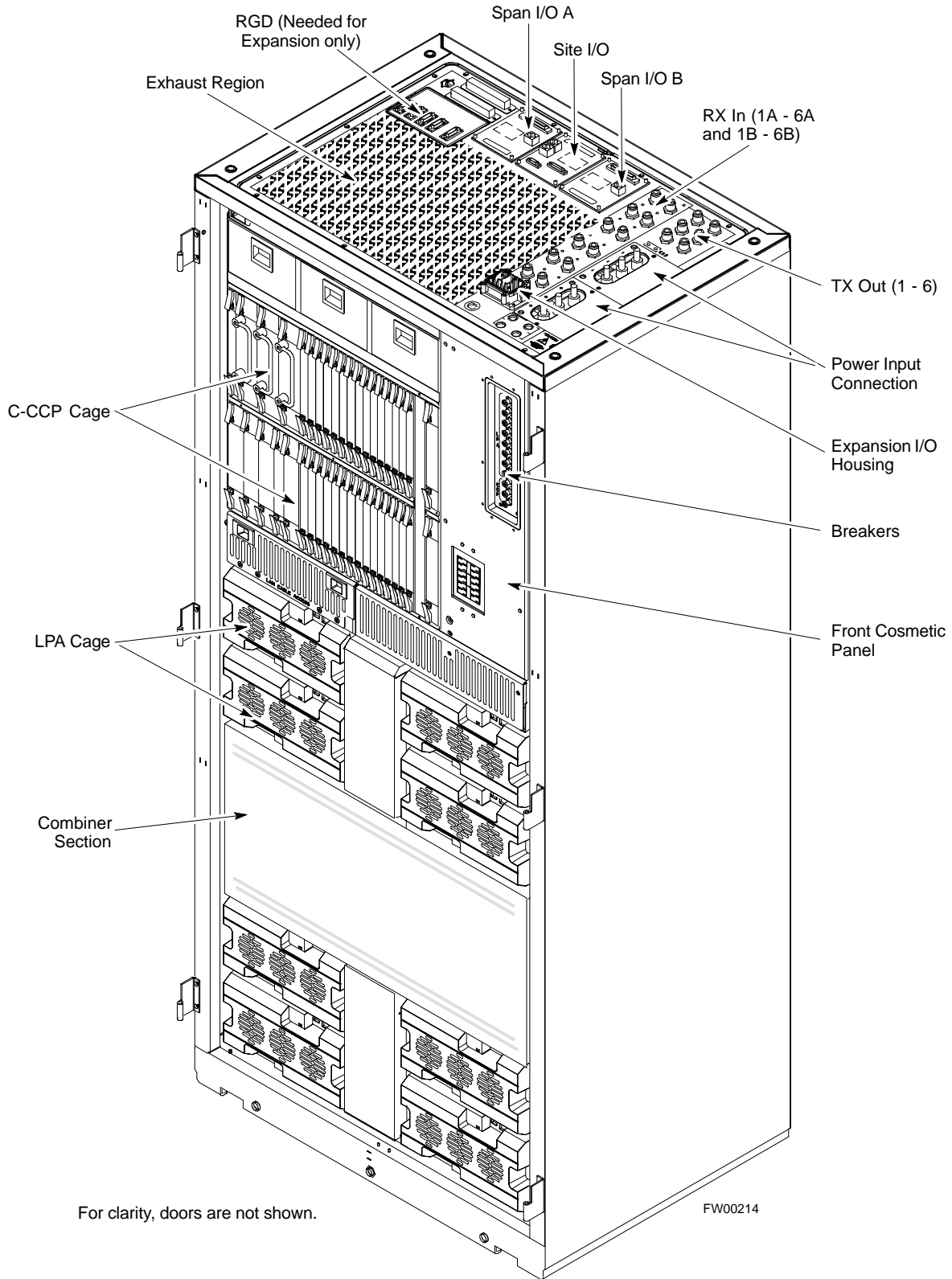
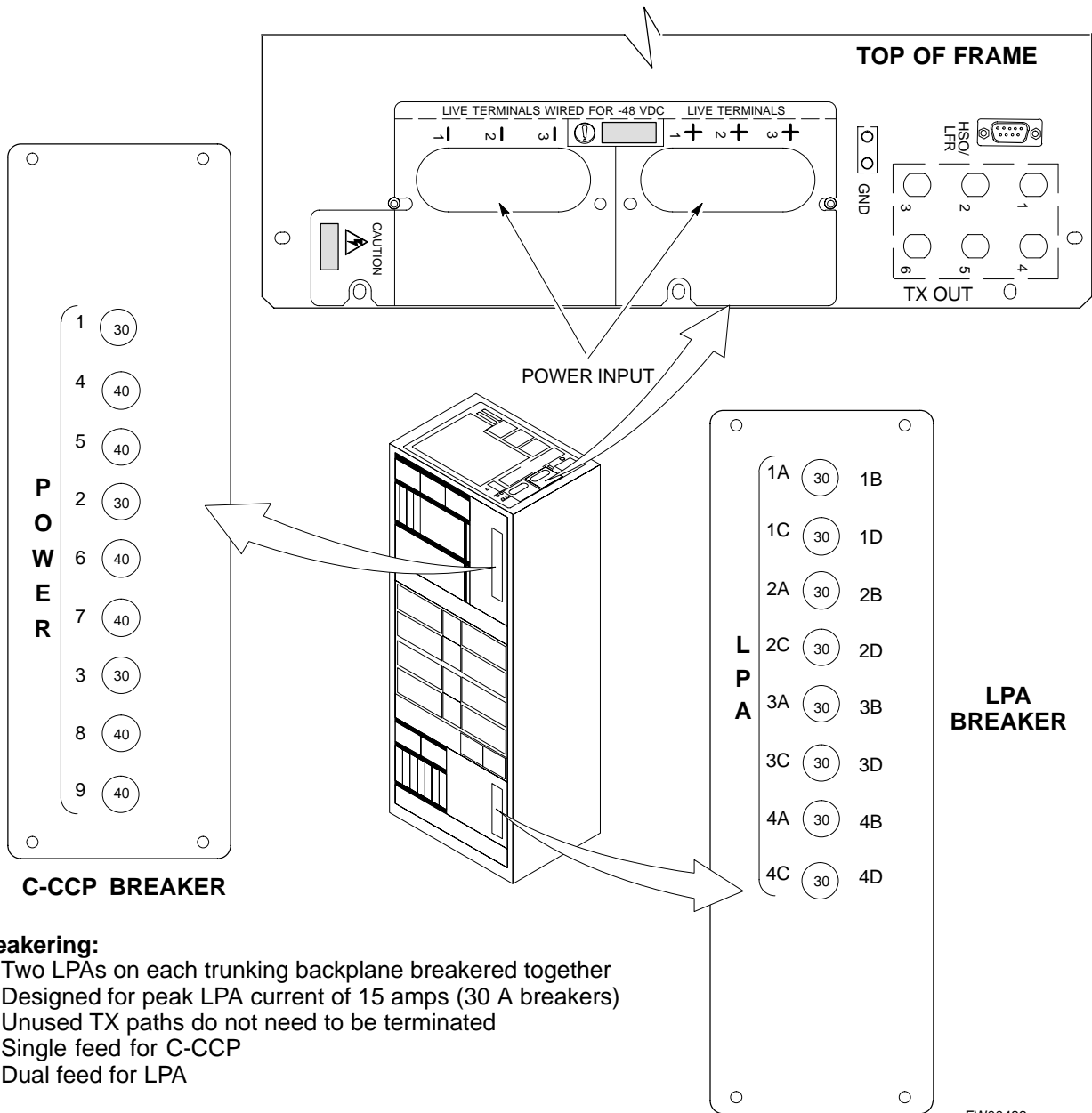


Figure 2-5: -48 V BTS DC Distribution Pre-test



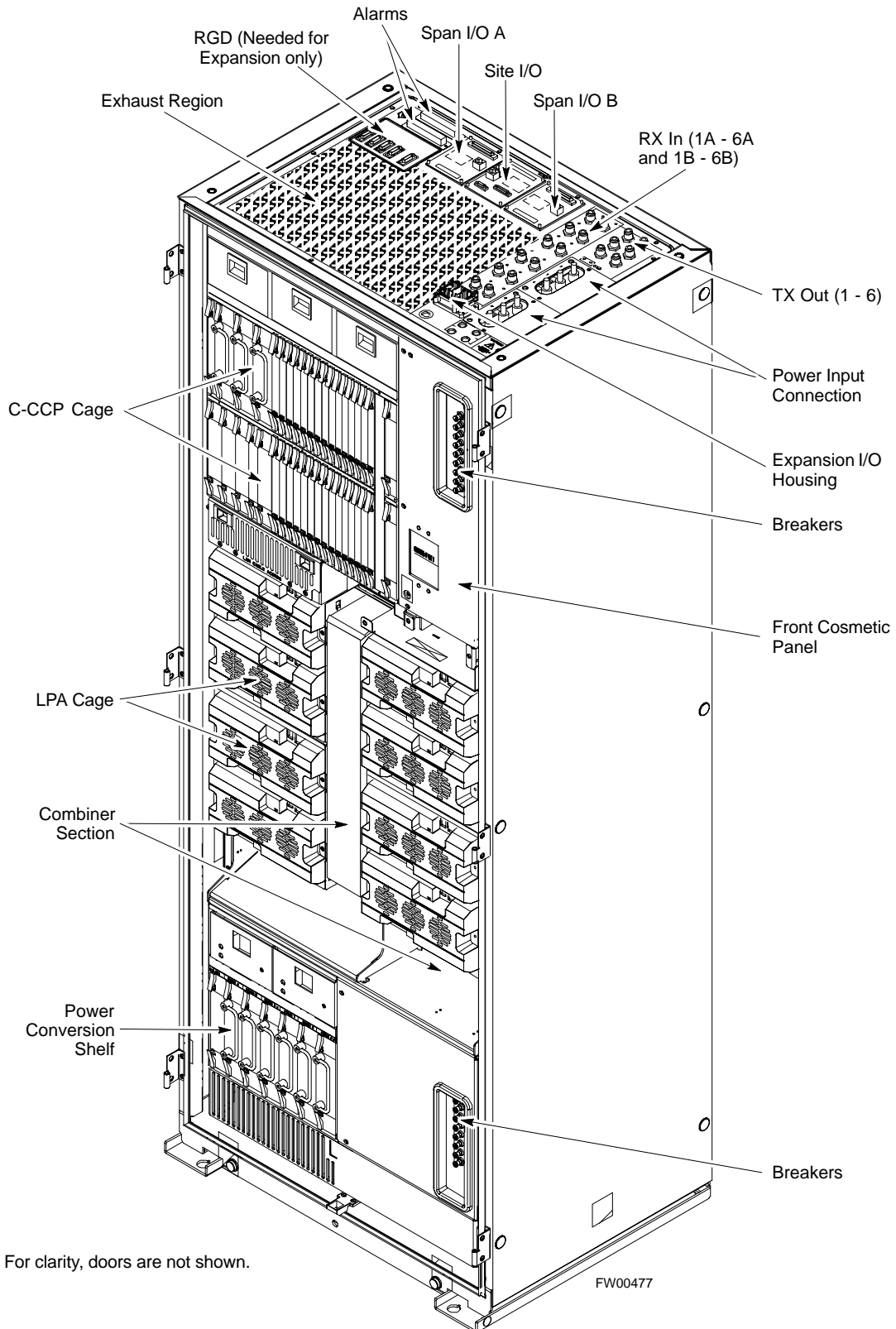
Breaking:

- Two LPAs on each trunking backplane breakered together
- Designed for peak LPA current of 15 amps (30 A breakers)
- Unused TX paths do not need to be terminated
- Single feed for C-CCP
- Dual feed for LPA

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Figure 2-6: -48 V SC 4812T BTS Starter Frame



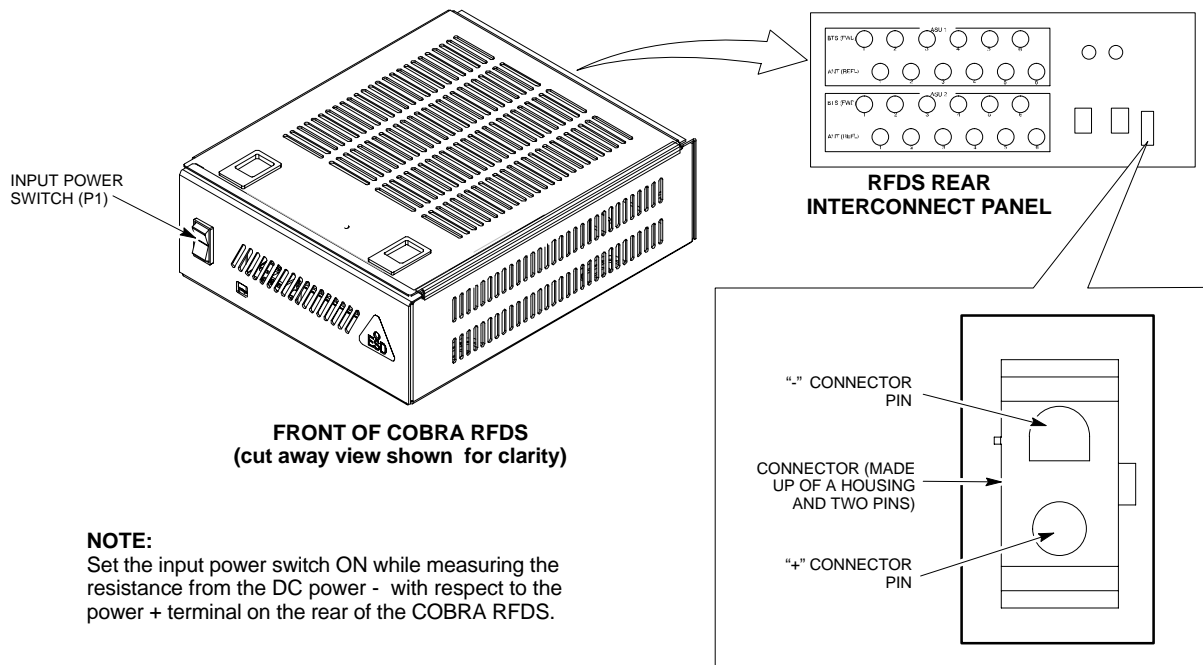
DC Power Pre-test (RFDS)

Before applying power to the RFDS, follow the steps in Table 2-3, while referring to Figure 2-7, to verify there are no shorts in the RFDS DC distribution system, backplanes, or modules/boards. As of the date of this publication, the RFDS is not used with the -48 V BTS.

NOTE Visual inspection of card placement and equipage for each frame vs. site documentation must be completed, as covered in Table 2-1 on page 2-3, before proceeding with this test.

Step	Action
1	Physically verify that all DC/DC converters supplying the RFDS are OFF or disabled.
2	Set the input power rocker switch P1 to the OFF position (see Figure 2-7).
3	Verify the initial resistance from the power (+ or -) feed terminal with respect to ground terminal measures $\geq 5 \text{ k}\Omega$, then slowly begins to increase. <ul style="list-style-type: none"> If the initial reading is $\leq 5 \text{ k}\Omega$ and remains constant, a short exists somewhere in the DC distribution path supplied by the breaker. Isolate the problem before proceeding.
4	Set the input power rocker switch P1 to the ON position. Repeat Step 3.

Figure 2-7: DC Distribution Pre-test (COBRA RFDS Detail)



NOTE:
Set the input power switch ON while measuring the resistance from the DC power - with respect to the power + terminal on the rear of the COBRA RFDS.

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Initial Power-up Tests

Power-up Procedures

WARNING Potentially lethal voltage and current levels are routed to the BTS equipment. This test must be performed with a second person present, acting in a safety role. Remove all rings, jewelry, and wrist watches prior to beginning this test.

DC Input Power

In the tests to follow, power will first be verified at the input to each BTS frame. After power is verified, cards and modules within the frame itself will be powered up and verified one at a time.

Before applying any power, verify the correct power feed and return cables are connected between the power supply breakers and the power connectors at the top of each BTS frame. Verify correct cable position referring to Figure 2-3 on page 2-8 for +27 V systems and Figure 2-5 on page 2-10 for -48 V systems.

CAUTION 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.

NOTE For positive power applications (+27 V):

- The positive power cable is red.
- The negative power cable (ground) is black.

For negative power applications (-48 V):

- The negative power cable is red or blue.
- The positive power cable (ground) is black.

In all cases, the black power cable is at ground potential.

Motorola recommends that the DC input power cable used to connect the frame to the main DC power source conforms to the guidelines outlined in Table 2-4.

Table 2-4: DC Input Power Cable Guidelines	
Maximum Cable Length	Wire Size
30.38 m (100 ft)	107 mm ² (AWG #4/0)
54.864 m (180 ft)	185 mm ² (350 kcmil)
Greater than 54.864 m (180 ft)	Not recommended

NOTE If Anderson SB350 style power connectors are used, make sure the connector adapters are securely attached to each of the BTS power feeds and returns. Also, make sure the cables have been properly installed into each connector.

Common Power Supply Verification

The procedure in Table 2-5 must be performed on any BTS frame connected to a common power supply at the site *after the common power supply has been installed and verified per the power supply OEM suggested procedures.*

Perform the following steps to verify the power input is within specification *before* powering up the individual cards/modules with the frames themselves.

Table 2-5: Common Power Supply Verification

Step	Action
1	Physically verify that all DC power sources supplying the frame are OFF or disabled.
2	On the RFDS (for +27 V systems only), set the input power switch P1 to the OFF position (see Figure 2-7).
3	<p><i>On each frame:</i></p> <ul style="list-style-type: none"> • <i>Unseat</i> all circuit boards (except CCD and CIO cards) in the C-CCP shelf and LPA shelves, but leave them in their associated slots. • Set breakers to the OFF position by <i>pulling out</i> C-CCP and LPA breakers (see Figure 2-3 on page 2-8 or Figure 2-5 on page 2-10 for breaker panel layout if required). <ul style="list-style-type: none"> - C-CCP shelf breakers are labeled CCCP-1, 2, 3 in the +27 V BTS and labeled POWER 1,4,5,2,6,7,3,8,9 in the -48 V BTS. - LPA breakers are labeled 1A-1B through 4C-4D.
4	Inspect input cables, verify correct input power polarity via decal on top of frame (+27 Vdc or -48 Vdc).
5	Apply power to BTS frames, <i>one at a time</i> , by setting the appropriate breaker in the power supply that supplies the frame to the ON position.
6	After power is applied to each frame, use a digital voltmeter to verify power supply output voltages at the top of each BTS frame are within specifications: +27.0 Vdc or -48 Vdc nominal.

Initial Power-up (RFDS)

The procedure in Table 2-6 must be performed on the RFDS after input power from the common power supply has been verified. Perform the following steps to apply initial power to the cards/modules within the frame itself, verifying that each is operating within specification.

NOTE	Visual inspection of card placement and equipage for each frame vs. site documentation must be completed , as covered in Table 2-1, on page 2-3, before proceeding with this test.
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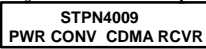

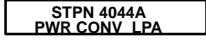
Table 2-6: Initial Power-up (RFDS)

Step	Action
1	On the RFDS, set the input power rocker switch (P1) to the ON position (see Figure 2-7).
2	Verify power supply output voltages (at the top of BTS frame), using a digital voltmeter, are within specifications: +27.0 V nominal.

Initial Power-up (BTS)

The procedure must be performed on each frame after input power from the common power supply has been verified. Follow the steps in Table 2-7 to apply initial power to the cards/modules within the frame itself, verifying that each is operating within specification.

Table 2-7: Initial Power-up (BTS)

Step	Action
1	At the BTS, set the C-CCP (POWER) power distribution breakers (see Figure 2-3 on page 2-8 or Figure 2-5 on page 2-10) to the ON position by <i>pushing in</i> the breakers.
2	Insert the C-CCP fan modules. Observe that the fan modules come on line.
3	<p>! CAUTION</p> <p>Verify the correct power/converter modules by observing the locking/retracting tabs appear as follows:</p> <ul style="list-style-type: none"> -  (in +27 V BTS C-CCP shelf) -  (in -48 V BTS C-CCP shelf) -  (in -48 V BTS power conversion shelf) <p>Insert and lock the converter/power supplies into their associated slots <i>one at a time</i>.</p> <ul style="list-style-type: none"> • If no boards have been inserted, all three PWR/ALM LEDs would indicate RED to notify the user that there is no load on the power supplies. <ul style="list-style-type: none"> - If the LED is RED, do not be alarmed. After Step 4 is performed, the LEDs should turn GREEN; if not, then a faulty converter/power supply module is indicated and should be replaced <i>before proceeding</i>.
4	Seat and lock all remaining circuit cards and modules in the C-CCP shelf into their associated slots.
5	Seat the first equipped LPA module pair into the assigned slot in the upper LPA shelf including LPA fan. <ul style="list-style-type: none"> • In +27 V systems, observe that the LPA internal fan comes on line.
6	Repeat step 5 for all remaining LPAs.

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Table 2-7: Initial Power-up (BTS)

Step	Action
7	<p>Set the LPA breakers to the ON position (<i>per configuration</i>) by pushing them IN <i>one at a time</i>. See Figure 1-13 on page 1-33 or Figure 1-14 on page 1-34 for configurations and Figure 2-3 on page 2-8 or Figure 2-5 on page 2-10 for LPA breaker panel layout.</p> <p>On +27 V frames, engage (push) LPA circuit breakers.</p> <ul style="list-style-type: none"> • Confirm LEDs on LPAs light. <p>On -48 V frames, engage (push) LPA PS circuit breakers.</p> <ul style="list-style-type: none"> • Confirm LPA PS fans start. • Confirm LEDs on -48 V power converter boards light. • Confirm LPA fans start. • Confirm LEDs on LPAs light.
8	<p>After all cards/modules have been seated and verified, use a digital voltmeter to verify power supply output voltages at the top of the frame remain within specifications: +27.0 Vdc or -48 Vdc nominal.</p>
9	<p>Repeat Steps 1 through 8 for additional co-located frames (if equipped).</p>

Chapter 3

Optimization/Calibration

Optimization/Calibration - Introduction

Introduction

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

After a BTS is physically installed and the preliminary operations (power up) have been completed, use the LMF to calibrate and optimize the BTS. Motorola recommends that the optimization be accomplished as follows:

1. Download MGLI-1 with code and data and then enable MGLI-1.

NOTE	GLIs may be GLI2s or GLI3s.
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2. Use the status function and verify that all of the installed devices of the following types respond with status information: CSM, BBX, GLI, MCC, and TSU (if RFDS is installed). 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 file must be corrected before the device can be accessed by the LMF.
3. Download code and data to all devices of the following types:
 - CSM
 - BBX (may be BBX2 or BBX-1X)
 - GLI (other than MGLI-1)
 - MCC (may be MCC-8E, MCC24, or MCC-1X)
4. Download the RFDS TSIC (if installed).
5. Verify the operation of the GPS and HSO or LFR signals.
6. Enable the following devices (in the order listed):
 - Secondary CSM
 - Primary CSM
 - All MCCs
7. Connect the required test equipment for a full optimization.
8. Select the test equipment.
9. Calibrate the TX and RX test cables if they have not previously been calibrated using the CDMA LMF that will be used for the optimization/calibration. The cable calibration values can also be entered manually.

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, correct the problem that caused 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, correct the problem that caused the failure and run the individual tests as required until all TX and RX tests have passed for all paths.

Site Types

Sites are configured as Omni/Omni or Sector/Sector (TX/RX). Each type has unique characteristics and must be optimized accordingly.

NOTE	For more information on the differences in site types, please refer to the applicable <i>BTS/Modem Frame Hardware Installation and Functional Hardware Description</i> manuals.
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Cell-Site Data File

The Cell-Site Data File (CDF) contains information that defines the BTS and data used to download files to the devices. A CDF file must be placed in the applicable BTS folder before the LMF can be used to log into that BTS. CDF files are normally obtained from the CBSC using a floppy disk. A file transfer protocol (ftp) method can be used if the LMF computer has that capability.

The CDF includes the following information:

- Download instructions and protocol
- Site specific equipage information
- C-CCP shelf allocation plan
 - BBX equipage (based on cell-site type) including redundancy
 - CSM equipage including redundancy
 - MCC (MCC24E, MCC8E, or MCC-1X) channel element allocation plan. This plan indicates how the C-CCP shelf is configured, and how the paging, synchronization, traffic, and access channel elements (and associated gain values) are assigned among the (up to 12) MCCs in the shelf.
- CSM equipage including redundancy
- 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, the antenna gain, (dependent on the units of measurement specified) and antenna feed line loss can be combined to determine the required power at the top of the BTS frame. The corresponding BBX output level required to achieve that power level on any channel/sector can also be determined.

NOTE Refer to the *CDMA LMF Operator's Guide* for additional information on the layout of the LMF directory structure (including CDF file locations and formats).

BTS System Software Download

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

NOTE Before using the LMF for optimization/ATP, the correct **bts-#.cdf** and **cbsc-#.cdf** 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 files can cause wrong results. **Failure to use the correct CDF files to log into a live (traffic carrying) site can shut down the site.**

The CDF 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 *CDMA LMF Operator's Guide*, or the LMF Help screen, for the procedure.

Site Equipage Verification

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

CAUTION 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.

Isolate Span Lines/Connect LMF

Isolate BTS from T1/E1 Spans

NOTE At active sites, the OMC/CBSC must disable the BTS and place it out of service (OOS). **DO NOT** remove the 50-pin TELCO cable connected to the BTS frame site I/O board **J1** connector until the OMC/CBSC has disabled the BTS!

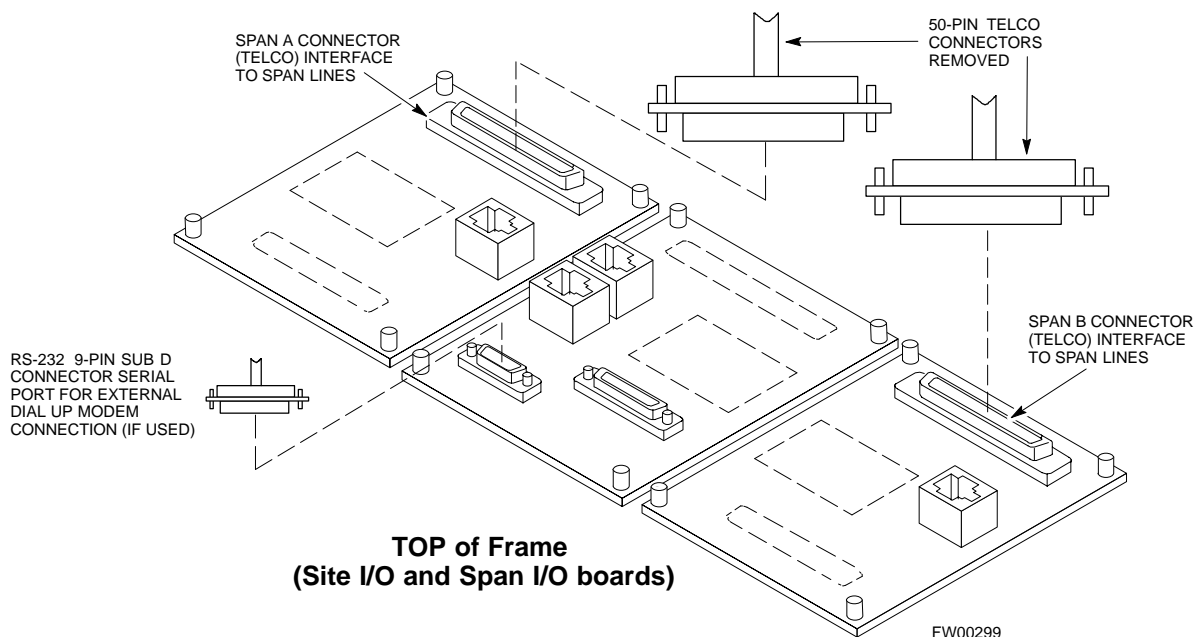
Each frame is equipped with one Site I/O and two Span I/O boards. The Span I/O J1 connector provides connection of 25 pairs of wire. A GLI card can support up to six spans. In the SC 4812T configuration, the odd spans (1, 3, and 5) terminate on the Span “A” I/O; and the even spans (2, 4, and 6) terminate on the Span “B” I/O.

Before connecting the LMF to the frame LAN, the OMC/CBSC must disable the BTS and place it OOS to allow the LMF to control the CDMA BTS. This prevents the CBSC from inadvertently sending control information to the CDMA BTS during LMF based tests. Refer to Figure 3-1 and Figure 3-2 as required.



Table 3-1: T1/E1 Span Isolation	
Step	Action
1	<p>From the OMC/CBSC, disable the BTS and place it OOS. Refer to <i>SC OMC-R/CBSC System Operator Procedures</i>.</p> <ul style="list-style-type: none"> - The T1/E1 span 50-pin TELCO cable connected to the BTS frame SPAN I/O board J1 connector can be removed from both Span I/O boards, if equipped, to isolate the spans. <p>NOTE If a third party is used for span connectivity, the third party must be informed before disconnecting the span line. Verify that you remove the SPAN cable, <i>not</i> the “MODEM/TELCO” connector.</p>

Figure 3-1: Span I/O Board T1 Span Isolation



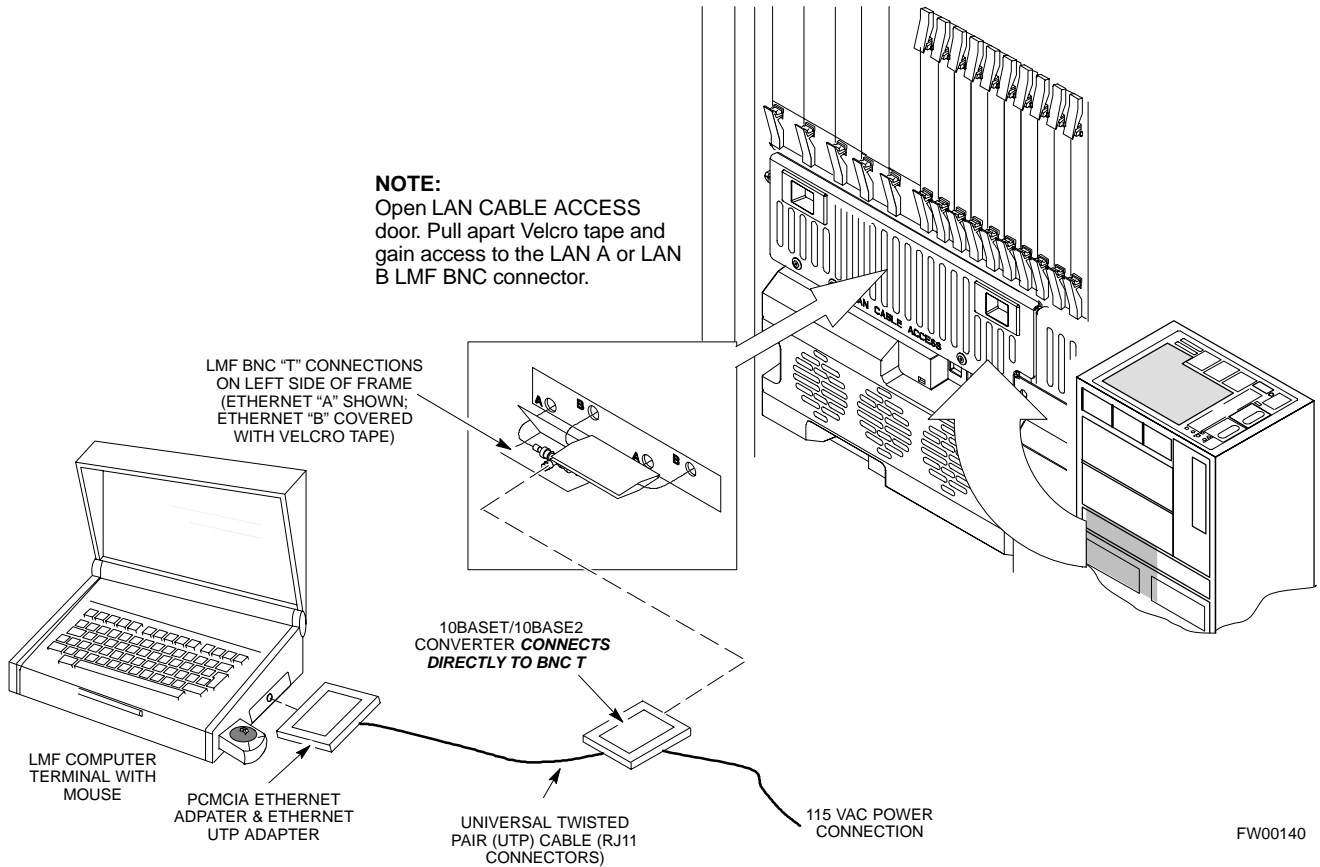
LMF to BTS Connection

The LMF is connected to the LAN A or B connector located on the left side of the frame's lower air intake grill, behind the LAN Cable Access door (see Figure 3-2).

3

Table 3-2: LMF to BTS Connection	
Step	Action
1	To gain access to the connectors on the BTS, open the LAN Cable Access door, then pull apart the Velcro® tape covering the BNC "T" connector (see Figure 3-2).
2	<p>Connect the LMF to the LAN A BNC connector via PCMCIA Ethernet Adapter with an unshielded twisted-pair (UTP) Adapter and 10BaseT/10Base2 converter (powered by an external AC/DC transformer).</p> <ul style="list-style-type: none"> - If there is no login response, connect the LMF to the LAN B connector. - If there is still no login response, see Table 6-1, Login Failure Troubleshooting Procedures. <p>NOTE</p> <ul style="list-style-type: none"> - Xircom Model PE3-10B2 or equivalent can also be used to interface the LMF Ethernet connection to the 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> <p>! CAUTION</p> <ul style="list-style-type: none"> - The LAN shield is isolated from chassis ground. The LAN shield (exposed portion of BNC connector) must not touch the chassis during optimization.

Figure 3-2: LMF Connection Detail



Preparing the LMF

Overview

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

- LMF Program on CD ROM
- CDF for each supported BTS (on diskette or available from the CBSC)
- CBSC File for each supported BTS (on diskette or available from the CBSC)

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

NOTE

For the CDMA 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.

CDMA LMF Home Directory

The CDMA 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.”

LMF Operating System Installation

Follow the procedure in Table 3-3 to install the LMF operating system.

Table 3-3: LMF Operating System Installation		
Step	Action	
1	Insert the LMF Program CD ROM into the LMF CD ROM drive. <ul style="list-style-type: none"> - If the Setup screen is displayed, go to step 5. - If the Setup screen is not displayed, proceed to step 2. 	
2	Click on the Start button.	
3	Select Run .	
4	In the Open box, enter d:\autorun and click on the OK button. <p>NOTE If applicable, replace the letter d with the correct CD ROM drive letter.</p>	
5	Follow the instructions displayed on the Setup screen. <p>NOTE First Time Installations:</p> <ul style="list-style-type: none"> - Install U/WIN (First) - Install Java Runtime Environment (Second) - Install LMF Software (Third) - Install/Create BTS Folders (Fourth) <p>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.</p> <p>NOTE 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.</p> <p>If applicable, a separate CD ROM of BTS Binaries may be available for binary updates.</p>	

Copy CDF Files from CBSC

Before the LMF can execute the optimization/ATP procedures for the BTS, the correct **bts-#.cdf** and **cbsc-#.cdf** files must be obtained from the CBSC and put in a **bts-#** folder in the LMF notebook. This requires copying the CBSC CDF files to a DOS formatted diskette, and using the diskette to install the CDF file in the LMF.

Follow the procedure in Table 3-4 to obtain the CDF files from the CBSC and copy the files to a diskette. For any further information, refer to the *CDMA LMF Operator's Guide* or the LMF Help screen.

NOTE

If the LMF has ftp capability, the ftp method can be used to copy the CDF files from the CBSC.

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

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

- The numbers used in the **bts-#.cdf** and **cbsc-#.cdf** filenames must correspond to the locally assigned numbers for each BTS and its controlling CBSC.
- The generic **cbsc-1.cdf** file supplied with the LMF works with locally numbered BTS CDF files. Using this file *does 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.

Table 3-4: Copying CBSC CDF Files to the LMF

✓	Step	Action
AT THE CBSC:		
	1	Login to the CBSC workstation.
	2	Insert a DOS formatted diskette in the workstation drive.
	3	Type eject -q and press the <Enter> key.
	4	Type mount and press the <Enter> key. NOTE <ul style="list-style-type: none"> • Look for the “<i>floppy/no_name</i>” message on the last line displayed. • If the eject command was previously entered, <i>floppy/no_name</i> will be appended with a number. Use the explicit <i>floppy/no_name</i> reference displayed when performing step 7.
	5	Change to the directory containing the file by typing cd <directory name> (ex. cd bts-248) and pressing <Enter> .
	6	Type ls <Enter> to display the list of files in the directory.

... continued on next page

Table 3-4: Copying CBSC CDF Files to the LMF

✔	Step	Action
	7	With <i>Solaris versions of Unix</i> , create <i>DOS-formatted versions</i> of the bts-#.cdf and cbsc-#.cdf files on the diskette by entering the following command: unix2dos <source filename> /floppy/no_name/<target filename> (e.g., unix2dos bts-248.cdf /floppy/no_name/bts-248.cdf). NOTE <ul style="list-style-type: none"> • Other versions of Unix do not support the unix2dos and dos2unix commands. In these cases, use the Unix cp (copy) command. The <i>copied</i> files will be difficult to read with a DOS or Windows text editor because Unix files do not contain line feed characters. Editing copied 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/na_name).
	8	Repeat steps 5 through 7 for each bts-# that must be supported by the LMF.
	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.
AT THE LMF:		
	11	Start the Windows operating system.
	12	Insert the diskette into the LMF.
	13	Using Windows Explorer (or equivalent program), create a corresponding bts-# folder in the <lmf home directory>\cdma directory for each bts-#.cdf/cbsc-#.cdf file pair copied from the CBSC.
	14	Use Windows Explorer (or equivalent program) to transfer the cbsc-#.cdf and bts-#.cdf files from the diskette to the corresponding <lmf home directory>\cdma\bts-# folders created in step 13.

3

Creating a Named HyperTerminal Connection for MMI Connection

Confirming or changing the configuration data of certain BTS Field Replaceable Units (FRUs) 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 procedure in Table 3-5 to establish a named HyperTerminal connection and create a Windows desktop shortcut for it.

Table 3-5: Creating a Named Hyperlink Connection for MMI Connection

Step	Action
1	From the Windows Start menu, select: Programs>Accessories
2	Select Communications , double click the Hyperterminal folder, and then double click on the Hyperterm.exe icon in the window that opens. NOTE <ul style="list-style-type: none"> • If a Location Information Window appears, enter the required information, then click Close. (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 NO.
3	When the Connection Description box opens: <ul style="list-style-type: none"> - Type a name for the connection being defined (e.g., MMI Session) in the Name: window. - Highlight any icon preferred for the named connection in the Icon: chooser window. - Click OK.
4	NOTE For LMF configurations where COM1 is used by another interface such as test equipment and a physical port is available for COM2, select COM2 to prevent conflicts. From the Connect using: pick list in the Connect To box displayed, select the RS-232 port to be used for the connection (e.g., COM1 or COM2 (Win NT) - or Direct to Com 1 or Direct to Com 2 (Win 98)), and click OK .
5	In the Port Settings tab of the COM# Properties window displayed, configure the RS-232 port settings as follows: <ul style="list-style-type: none"> • Bits per second: 9600 • Data bits: 8 • Parity: None • Stop bits: 1 • Flow control: None
6	Click OK .
7	Save the defined connection by selecting: File>Save
8	Close the HyperTerminal window by selecting: File>Exit
9	Click Yes to disconnect when prompted.
10	Perform one of the following: <ul style="list-style-type: none"> • If the Hyperterminal folder window is still open (<i>Win 98</i>) proceed to step 12 • From the Windows Start menu, select Programs > Accessories.

. . . continued on next page

Table 3-5: Creating a Named Hyperlink Connection for MMI Connection

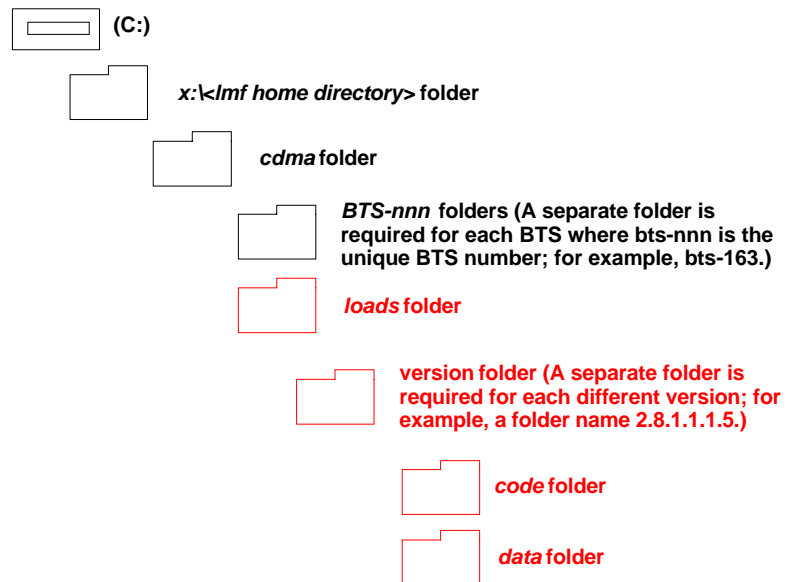
Step	Action
11	Perform one of the following: <ul style="list-style-type: none"> • For <i>Win NT</i>, select Hyperterminal and release any pressed mouse buttons. • For <i>Win 98</i>, select Communications and double click the Hyperterminal folder.
12	Highlight the newly created connection icon by moving the cursor over it (<i>Win NT</i>) or clicking on it (<i>Win 98</i>).
13	<i>Right click and drag</i> the highlighted connection icon to the Windows desktop and release the right mouse button.
14	From the pop-up menu displayed, 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.

3

Folder Structure Overview

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

Figure 3-3: LMF Folder Structure



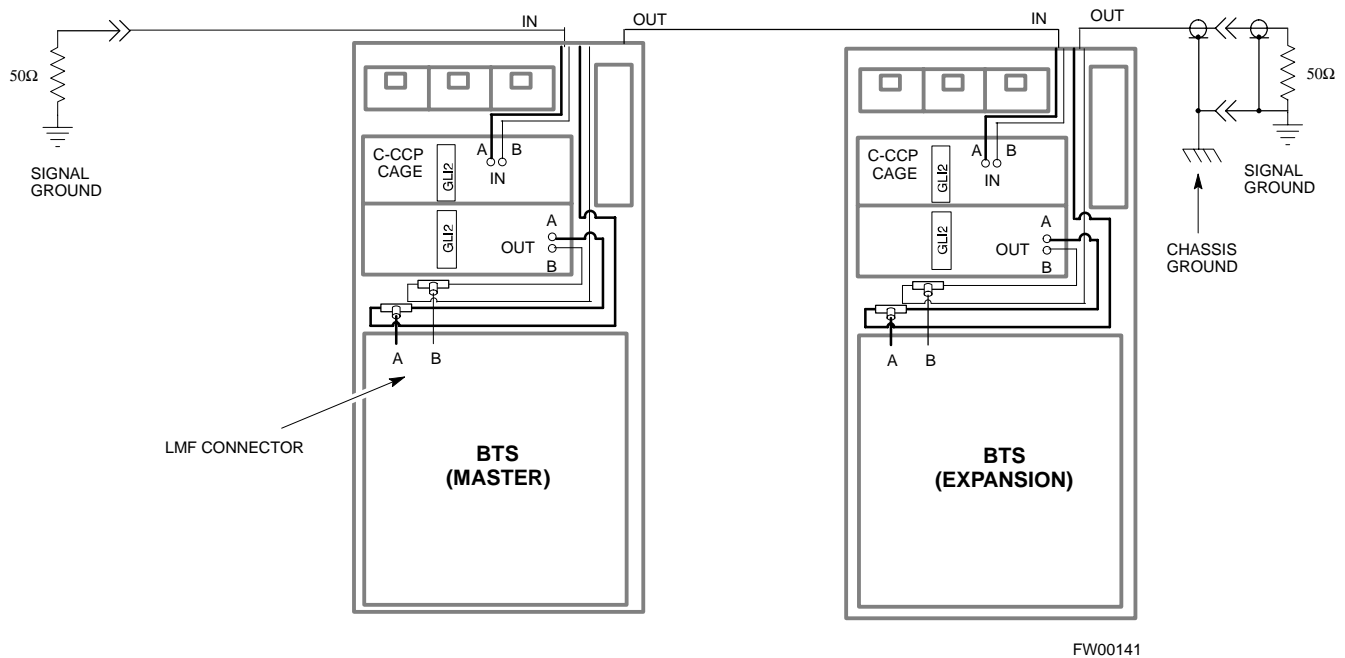
NOTE The “loads” folder and all the folders below it are not available from the LMF for Software Release 2.16.1.x. These folders may be present as a legacy from previous software versions or downloaded from the CBSC/OMC-R.

Pinging the Processors

For proper operation, the integrity of the Ethernet LAN A and B links must be verified. Figure 3-4 represents a typical BTS Ethernet configuration. The drawing depicts one (of two identical) links, A and B.

Ping is a program that routes request packets to the LAN network modules to obtain a response from the specified “targeted” BTS.

Figure 3-4: BTS LAN Interconnect Diagram



Follow the procedure in Table 3-6 and refer to Figure 3-5 or Figure 3-6, as required, to ping each processor (on both LAN A and LAN B) and verify LAN redundancy is operating correctly.

CAUTION Always wear a conductive, high impedance wrist strap while handling any circuit card/module to prevent damage by ESD.

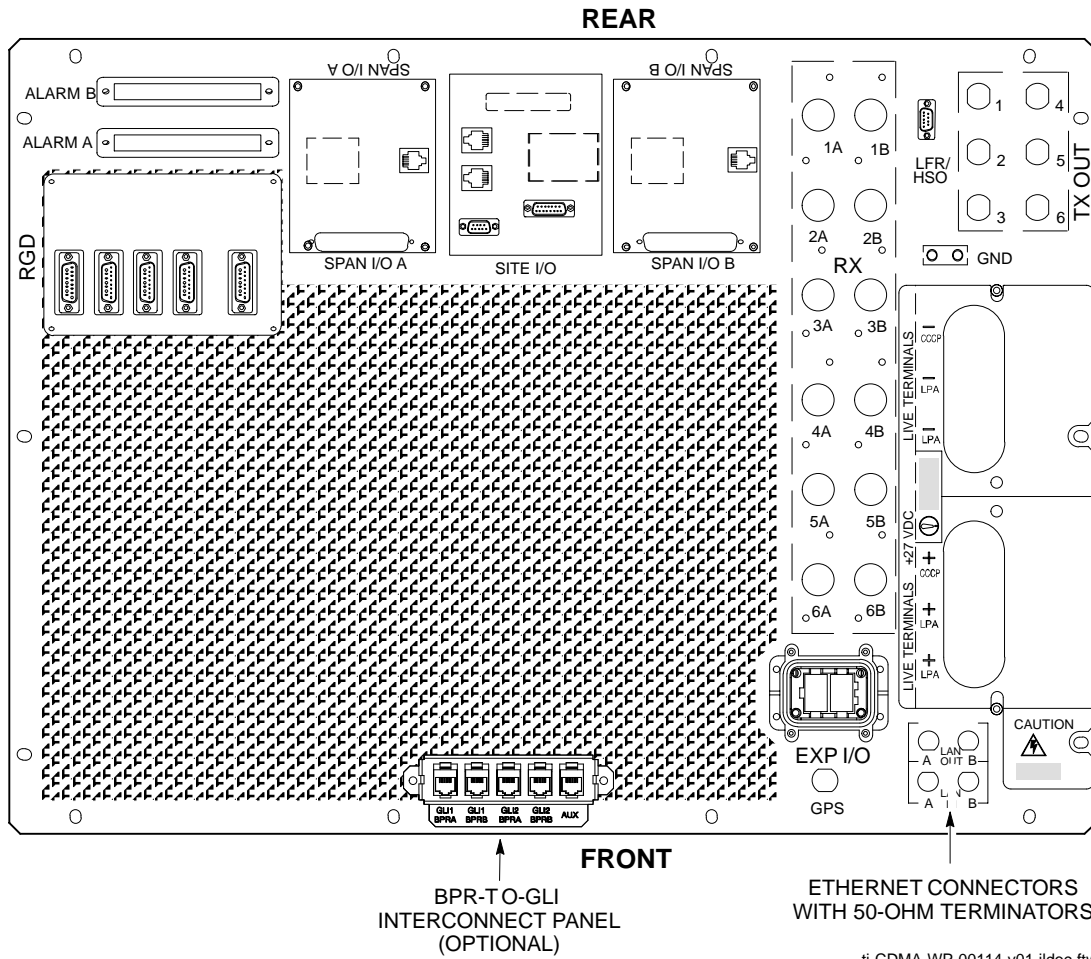
NOTE The Ethernet LAN A and B cables must be installed on each frame/enclosure before performing this test. All other processor board LAN connections are made via the backplanes.

Table 3-6: Pinging the Processors

✓	Step	Action
	1	If you have not already done so, connect the LMF to the BTS (see Table 3-2 on page 3-6).
	2	From the Windows desktop, click the Start button and select Run .
	3	In the Open box, type ping and the <i><MGLI IP address></i> (for example, ping 128.0.0.2). NOTE 128.0.0.2 is the default IP address for MGLI-1 in field BTS units. 128.0.0.1 is the default IP address for MGLI-2.
	4	Click on the OK button.
	5	If the connection is successful, text similar to the following is displayed: Reply from 128 128.0.0.2: bytes=32 time=3ms TTL=255 If there is no response the following is displayed: Request 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.

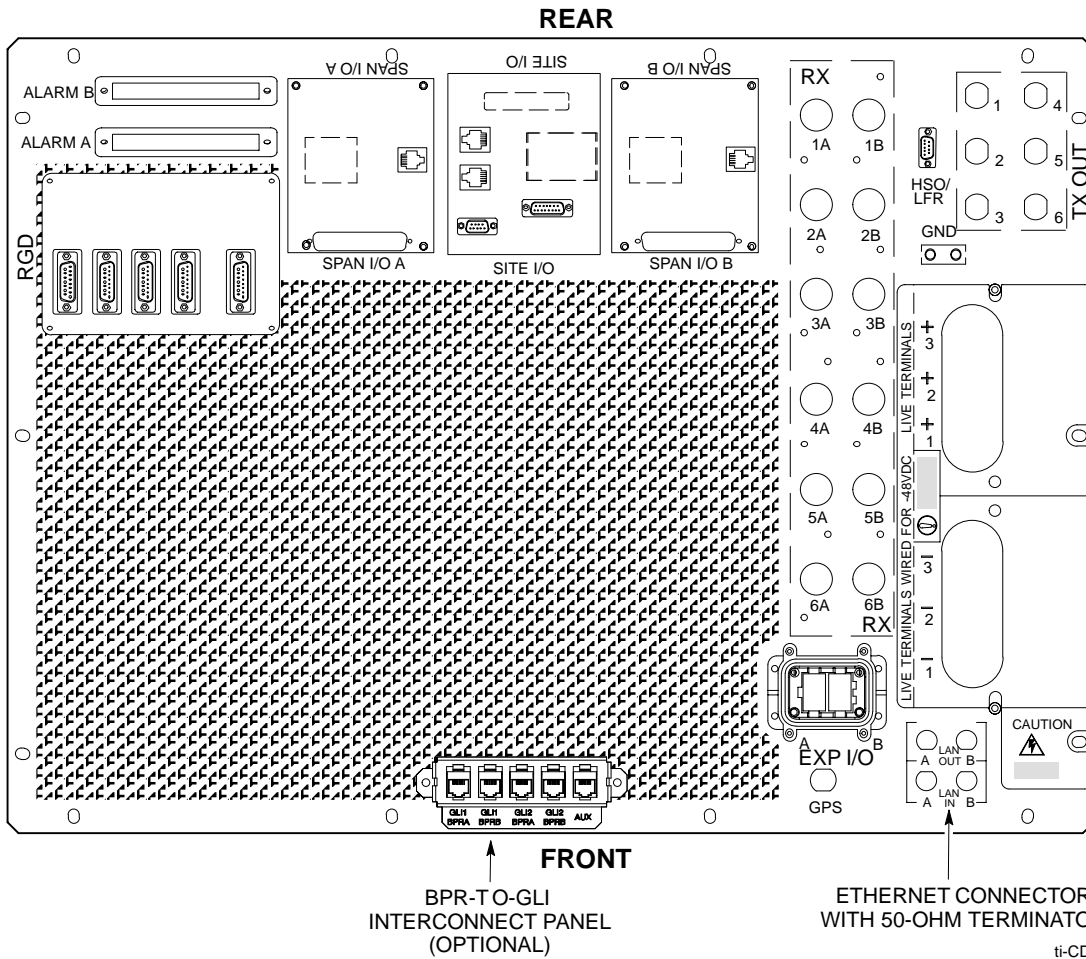
3

Figure 3-5: +27 V SC 4812T Starter Frame I/O Plate



3

Figure 3-6: -48 V SC 4812T Starter Frame I/O Plate



ti-CDMA-WP-00099-v01-ildoc-ftw

3

Using CDMA LMF

Basic LMF Operation

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

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

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

Basic operation of the LMF GUI includes the following:

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

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

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.

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. Due to architectural limitations, 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 signs (=) between the keywords and the parameter values
 - parameter values

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

measure bbx-<bts_id>-<bbx_id> rssi channel=6 sector=5

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

Logging into a BTS

NOTE

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

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

Before attempting to log into the BTS, confirm the CDMA LMF is properly connected to the BTS (see Figure 3-2).

Prerequisites

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

- The LMF operating system is correctly installed and prepared.
- A *bts-**nnn*** folder with the correct CDF and CBSC file exists.
- The LMF is correctly installed and prepared, and the LMF computer is connected to the BTS before starting the Windows operating system and LMF software. If necessary, restart the computer after connecting it to the BTS (see Table 3-2 and Figure 3-2).

BTS Login from the GUI Environment

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

Table 3-7: BTS GUI Login Procedure

Step	Action
1	<p>Start the CDMA LMF GUI environment by double clicking on the WinLMF desktop icon (if the LMF is not running).</p> <p>NOTE If a warning similar to the following is displayed, select No, shut down other LMF sessions which may be running, and start the CDMA LMF GUI environment again:</p> <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 the Login tab (if not displayed).
3	If no base stations are displayed in the Available Base Stations pick list, double click on the CDMA icon.

... continued on next page

Table 3-7: BTS GUI Login Procedure

Step	Action
4	Click on the desired BTS number.
5	Click on the Network Login tab (if not already in the forefront).
6	<p>Enter the correct IP address (normally 128.0.0.2 for a field BTS) if not correctly displayed in the IP Address box.</p> <p>NOTE 128.0.0.2 is the default IP address for MGLI-1 in field BTS units. 128.0.0.1 is the default IP address for MGLI-2.</p>
7	Type in the correct IP Port number (normally 9216) if not correctly displayed in the IP Port box.
8	<p>Click on Ping.</p> <ul style="list-style-type: none"> - If the connection is successful, the Ping Display window shows text similar to the following: 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 <p>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.</p>
9	<p>Change the Multi-Channel Preselector (from the Multi-Channel Preselector pick list), normally MPC, corresponding to your BTS configuration, if required.</p> <p>NOTE When performing RX tests on expansion frames, do not choose EMPC if the test equipment is connected to the starter frame.</p>
10	Click on the Use a Tower Top Amplifier , if applicable.
11	<p>Click on Login.</p> <p>A BTS tab with the BTS is displayed.</p> <p>NOTE</p> <ul style="list-style-type: none"> • If you attempt to login to a BTS that is already logged on, all devices will be gray. • There may be instances where the BTS initiates a log out due to a system error (i.e., a device failure). • If the MGLI is OOS_ROM (blue), it will have to be downloaded with code before other devices can be seen. • If the MGLI is OOS-RAM (yellow), it must be enabled before other installed devices can be seen.

BTS Login from the CLI Environment

Follow the procedure in Table 3-8 to log into a BTS when using the CLI environment.

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 logout has occurred.

Table 3-8: BTS CLI Login Procedure

Step	Action
1	<p>Double click the WinLMF CLI desktop icon (if the LMF CLI environment is not already running).</p> <p>NOTE If a BTS was logged into under a GUI session when the CLI environment was started, the CLI session will be logged into the same BTS, and step 2 is not required.</p>
2	<p>At the /wlmf prompt, enter the following command: login bts-<bts#> host=<host> port=<port></p> <p>where:</p> <p>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).</p> <p>port = IP port of the BTS (defaults to port last logged into for this BTS or 9216 if this is first login to this BTS).</p> <p>A response similar to the following will be displayed:</p> <pre>LMF> 13:08:18.882 Command Received and Accepted COMMAND=login bts-33 13:08:18.882 Command In Progress 13:08:21.275 Command Successfully Completed REASON_CODE="No Reason"</pre>

Logging Out

Logging out of a BTS is accomplished differently for the GUI and the 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 logout has occurred.

Logging Out of a BTS from the GUI Environment

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

Table 3-9: BTS GUI Logout Procedure	
Step	Action
1	Click on BTS on the BTS tab menu bar.
2	Click the Logout item in the pull-down menu. A Confirm Logout pop-up message appears.
3	Click on Yes or press the <Enter> key to confirm logout. You are returned to the Login tab. NOTE If a logout was previously performed on the BTS from a CLI window running at the same time as the GUI, a Logout Error pop-up message appears stating the system should not log out of the BTS. When this occurs, the GUI must be exited and restarted before it can be used for further operations.
4	If a Logout Error pop-up message appears stating that the system could not log out of the Base Station because the given BTS is not logged in, perform the following actions: <ul style="list-style-type: none"> - Click OK. - Select File>Exit in the window menu bar. - Click Yes in the Confirm Logout pop-up. - Click Yes in the Logout Error pop-up which appears again.
5	If further work is to be done in the GUI, restart it. NOTE <ul style="list-style-type: none"> • The Logout item on the BTS menu bar will only log you out of the displayed BTS. • You can also log out of all BTS sessions and exit LMF by clicking on the File selection in the menu bar and selecting Exit from the File menu list. A Confirm Logout pop-up message will appear.

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 3-10: BTS CLI Logout Procedure

Step	Action
1	<p>NOTE If the BTS is also logged into from a GUI running at the same time and further work must be done with it in the GUI, proceed to step 2.</p> <p>Logout of a BTS by entering the following command: logout bts-<i><bts#></i></p> <p>A response similar to the following is displayed:</p> <pre>LMF> 12:22:58.028 Command Received and Accepted Command=logout bts-33 12:22:58.028 Command Received and Accepted 12:22:58.028 Command Successfully Completed REASON_CODE="No Reason"</pre>
2	<p>If desired, close the CLI interface by entering the following command: exit</p> <p>A response similar to the following is displayed before the window closes: Killing background processes....</p>

Establishing an MMI Communication Session

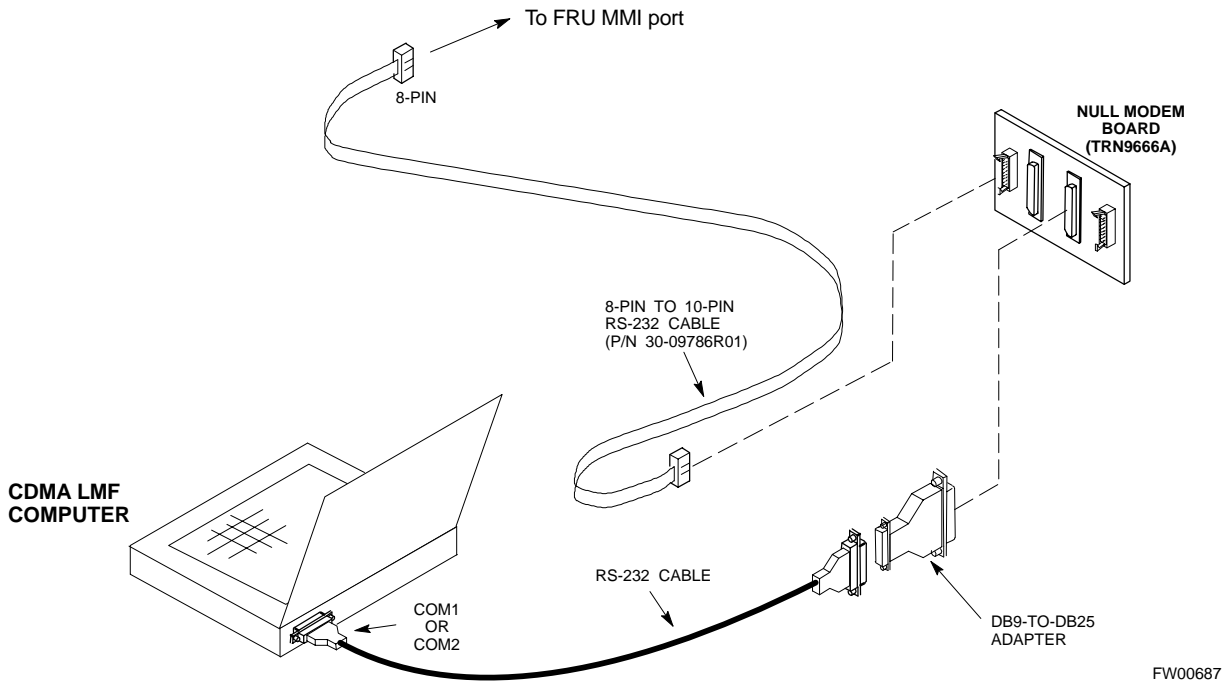
For those procedures that require MMI communications between the LMF and BTS FRUs, follow the procedure in Table 3-11 to initiate the communication session.

NOTE If the LMF GUI is running and the LMF is logged into a BTS, the LMF cannot initiate a hyperterminal session on the COM port normally used to communicate with the test equipment. Also, if the LMF has only one COM port, you cannot operate test equipment and have a hyperterminal session running at the same time.

3

Table 3-11: Establishing MMI Communications	
Step	Action
1	Connect the LMF computer to the equipment as detailed in the applicable procedure that requires the MMI communication session.
2	Start the named HyperTerminal connection for MMI sessions by double clicking on its desktop shortcut. NOTE If a desktop shortcut was not created for the MMI connection, access the connection from the Start menu by selecting: Programs>Accessories>Hyperterminal>HyperTerminal><Named HyperTerminal Connection (e.g., MMI Session)>
3	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 3-7: CDMA LMF Computer Common MMI Connections



FW00687

Download the BTS

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 or factory repair. 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 nor a normal part of the optimization process*. It is only done in unusual situations where the resident ROM code in the device does not match the release level of the site operating software *AND* the CBSC cannot communicate with the BTS to perform the download. If you must download ROM code, refer to Appendix H.

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.

NOTE

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

RAM Code

Before RAM code can be downloaded from the CDMA 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 CDMA LMF file structure. The RAM code file is selected automatically if the file is in the `\lmf\cdma\loads\n.n.n.n\code` folder (where *n.n.n.n* is the version number of the download code). The RAM code file in the code folder must have the correct hardware bin number.

RAM code can be downloaded to a device that is in any state. After the download is started, the device being downloaded changes to OOS-ROM (blue). When the download is completed successfully, the device changes to OOS-RAM (yellow). When code is downloaded to an MGLI, the LMF automatically also downloads data, and then enables the MGLI. When enabled, the MGLI changes to INS (green).

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

Download Code to Devices

Code can be downloaded to a device that is in any state. After the download starts, the device being downloaded changes to OOS_ROM (blue). If the download is completed successfully, the device changes to OOS_RAM with code loaded (yellow). Prior to downloading a device, a code file must exist. The code file is selected automatically if the code file is in the */lmf/cdma/n.n.n.n/code* folder (where *n.n.n.n* is the version number of the download code that matches the “NextLoad” parameter in the CDF file). The code file in the code folder must have the correct hardware bin number. Code can be automatically or manually selected.

The following are the devices to be downloaded:

- Span Configuration
 - Master Group Line Interface (MGLI2 or MGLI3)
 - Group Line Interface (GLI2 or GLI3)
- Clock Synchronization Module (CSM)
- Multi Channel Card (MCC24E, MCC8E or MCC-1X)
- Broadband Transceiver (BBX2 or BBX-1X)
- Test Subscriber Interface Card (TSIC) - if RFDS is installed

NOTE The MGLI *must* be successfully downloaded with code and data, and put INS *before* downloading any other device. The download code process for an MGLI automatically downloads data and enables the MGLI before downloading other devices. The other devices can be downloaded in any order.

Follow the procedure in Table 3-12 to download the firmware application code for the MGLI. The download code action downloads data and also enables the MGLI.

Prerequisite

Prior to performing this procedure, ensure a code file exists for each of the devices to be downloaded.

Table 3-12: Download and Enable MGLI

✔	Step	Action
	1	Select Tools>Update Next Load>CDMA function to ensure the Next Load parameter is set to the correct code version level.
	2	Download code to the primary MGLI by clicking on the MGLI. <ul style="list-style-type: none"> - From the Device pull down menu, select Download>Code/Data. A status report confirms change in the device(s) status. - Click OK to close the status window. (<i>The MGLI should automatically be downloaded with data and enabled.</i>)
	3	Download code and data to the redundant MGLI but do not enable at this time.

Download Code and Data to Non-GLI Devices

Non-GLI devices can be downloaded individually or all equipped devices can be downloaded with one action. Follow the procedure in Table 3-13 to download code and data to the non-GLI devices.

NOTE

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

Table 3-13: Download Code and Data to Non-GLI Devices

✓	Step	Action
	1	Select all devices to be downloaded.
	2	<p>From the Device pull down menu, select Download>Code/Data. A status report displays the result of the download for each selected device. Click OK to close the status window.</p> <p>NOTE After the download has started, the device being downloaded changes to blue. If the download is completed successfully, the device changes to yellow (OOS-RAM with code loaded). After a BBX, CSM or MCC is successfully downloaded with code and has changed to OOS-RAM, the status LED should be rapidly flashing GREEN.</p>
	3	<p>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 3.</p> <p>To download the firmware application data to each device, select the target device and select: Device>Download>Data</p>

Select CSM Clock Source

A CSM can have three different clock sources. The **Clock 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 sources 2 & 3)
- HSO Extender
- HSOX (only for sources 2 & 3)
- LFR (only for sources 2 & 3)
- 10 MHz (only for sources 2 & 3)
- NONE (only for sources 2 & 3)

Prerequisites

MGLI=INS_ACT

CSM= OOS_RAM or INS_ACT

Follow the procedure in Table 3-14 to select a CSM Clock Source.

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

Enable CSMs

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

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

NOTE

- CSMs are code loaded at the factory. This data is retained in EEPROM. The download code procedure is required in the event it becomes necessary to code load CSMs with updated software versions. Use the status function to determine the current code load versions.
- For non-RGPS sites only, verify the CSM configured with the GPS receiver “daughter board” is installed in the CSM-1 slot before continuing.
- The CSM(s) to be enabled must have been downloaded with code (Yellow, OOS-RAM) and data.



Follow the procedure in Table 3-15 to enable the CSMs.

Table 3-15: Enable CSMs	
✔ Step	Action
1	Verify the CSM(s) have been downloaded with code (Yellow, OOS-RAM) and data.
2	<p>Click on the target CSM. From the Device pull down, select Enable.</p> <p>NOTE If equipped with two CSMs, enable CSM-2 first and then CSM-1. A status report confirms change in the device(s) status. Click OK to close the status window.</p> <p>NOTE FAIL may be shown in the status table for enable action. If Waiting For Phase Lock is shown in the Description field, the CSM changes to the enabled state after phase lock is achieved. CSM-1 houses the GPS receiver. The enable sequence can take up to <i>one hour</i> to complete.</p> <p>NOTE The GPS satellite system satellites are not in a geosynchronous orbit and are maintained and operated by the United States Department of Defense (D.O.D.). The D.O.D. periodically alters satellite orbits; therefore, satellite trajectories are subject to change. A GPS receiver that is INS contains an “almanac” that is updated periodically to take these changes into account. If an installed GPS receiver has not been updated for a number of weeks, it may take up to one 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.)</p>
3	<p>NOTE If equipped with two CSMs, the LMF should display CSM-1 as bright GREEN (INS-ACT) and CSM-2 as dark green (INS-STB). After the CSMs have been successfully enabled, the PWR/ALM LEDs are steady green (alternating green/red indicates the card is in an alarm state).</p> <p>If more than an hour has passed, refer to Table 3-19 and Table 3-20 to determine the cause.</p>

Enable MCCs

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

Follow the procedure in Table 3-16 to enable the MCCs.

NOTE The MGLI and primary CSM must be downloaded and enabled (IN-SERVICE ACTIVE) before downloading and enabling the MCC.

Table 3-16: Enable MCCs		
✔	Step	Action
	1	Verify the MCC(s) have been downloaded with code (Yellow, OOS-RAM) and data.
	2	Select the MCCs to be enabled or from the Select pull-down menu choose MCCs .
	3	From the Device menu, select Enable A status report confirms change in the device(s) status.
	4	Click on OK to close the status report window.

Enable Redundant GLIs

Follow the procedure in Table 3-17 to enable the redundant GLI(s).

Table 3-17: Enable Redundant GLIs		
✔	Step	Action
	1	Select the target redundant GLI(s).
	2	From the Device menu, select Enable . A status report window confirms the change in the device(s) status and the enabled GLI(s) is green.
	3	Click on OK to close the status report window.

3

CSM System Time/GPS and LFR/HSO Verification

CSM & LFR Background

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

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

In a typical operation, the primary CSM locks its Digital Phase Locked Loop (DPLL) circuits to GPS signals. These signals are generated by either an on-board GPS module (RF-GPS) or a remote GPS receiver (R-GPS). The CSM2 card is required when using the R-GPS. DPLL circuits employed by the CSM provide switching between the primary and redundant unit upon request. Synchronization between the primary and redundant CSM cards, as well as the LFR or HSO back-up source, provides excellent reliability and performance.

Each CSM board features an ovenized, crystal oscillator that provides 19.6608 MHz clock, even second tick reference, and 3 MHz sinewave reference, referenced to the selected synchronization source (GPS, LORAN-C Frequency Receiver (LFR), or High Stability Oscillator (HSO), T1 Span, or external reference oscillator sources). The 3 MHz signals are also routed to the RDM EXP 1A & 1B connectors on the top interconnect panel for distribution to co-located frames at the site.

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

All boards are mounted in the C-CCP shelf at the top of the BTS frame. Figure 1-10 on page 1-28 illustrates the location of the boards in the BTS frame.

Low Frequency Receiver/ High Stability Oscillator

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

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

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

Upgrades and Expansions: LFR2/HSO2/HSOX

LFR2/HSO2 (second generation cards) both export a timing signal to the expansion or logical BTS frames. The associated expansion or logical frames require an HSO-expansion (HSOX) whether the starter frame has an LFR2 or an HSO2. The HSOX accepts input from the starter frame and interfaces with the CSM cards in the expansion frame. LFR and LFR2 use the same source code in source selection (see Table 3-18). HSO, HSO2, and HSOX use the same source code in source selection (see Table 3-18).

NOTE

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

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.

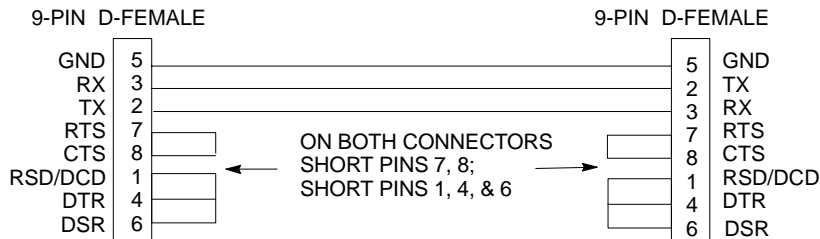
CSM Frequency Verification

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

Null Modem Cable

A null modem cable is required. It is connected between the MMI port of the primary CSM and the null modem board. Figure 3-8 shows the wiring detail for the null modem cable.

Figure 3-8: Null Modem Cable Detail



FW00362

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- The LMF is **NOT** logged into the BTS.
- The COM1 port is connected to the MMI port of the primary CSM via a null modem board.

Test Equipment Setup: GPS & LFR/HSO Verification

Follow the procedure in Table 3-18 to set up test equipment while referring to Figure 3-9 as required.

Step	Action
1	Perform one of the following operations: <ul style="list-style-type: none"> • For local GPS (RF-GPS), verify a CSM board with a GPS receiver is installed in primary CSM slot 1 and that CSM-1 is INS. This is verified by checking the board ejectors for kit number SGLN1145 on the board in slot 1. • For Remote GPS (RGPS), verify a CSM2 board is installed in primary slot 1 and that CSM-1 is INS. This is verified by checking the board ejectors for kit number SGLN4132ED (or later).
2	Remove CSM-2 (if installed) and connect a serial cable from the LMF COM 1 port (via null modem board) to the MMI port on CSM-1.
3	Reinstall CSM-2.

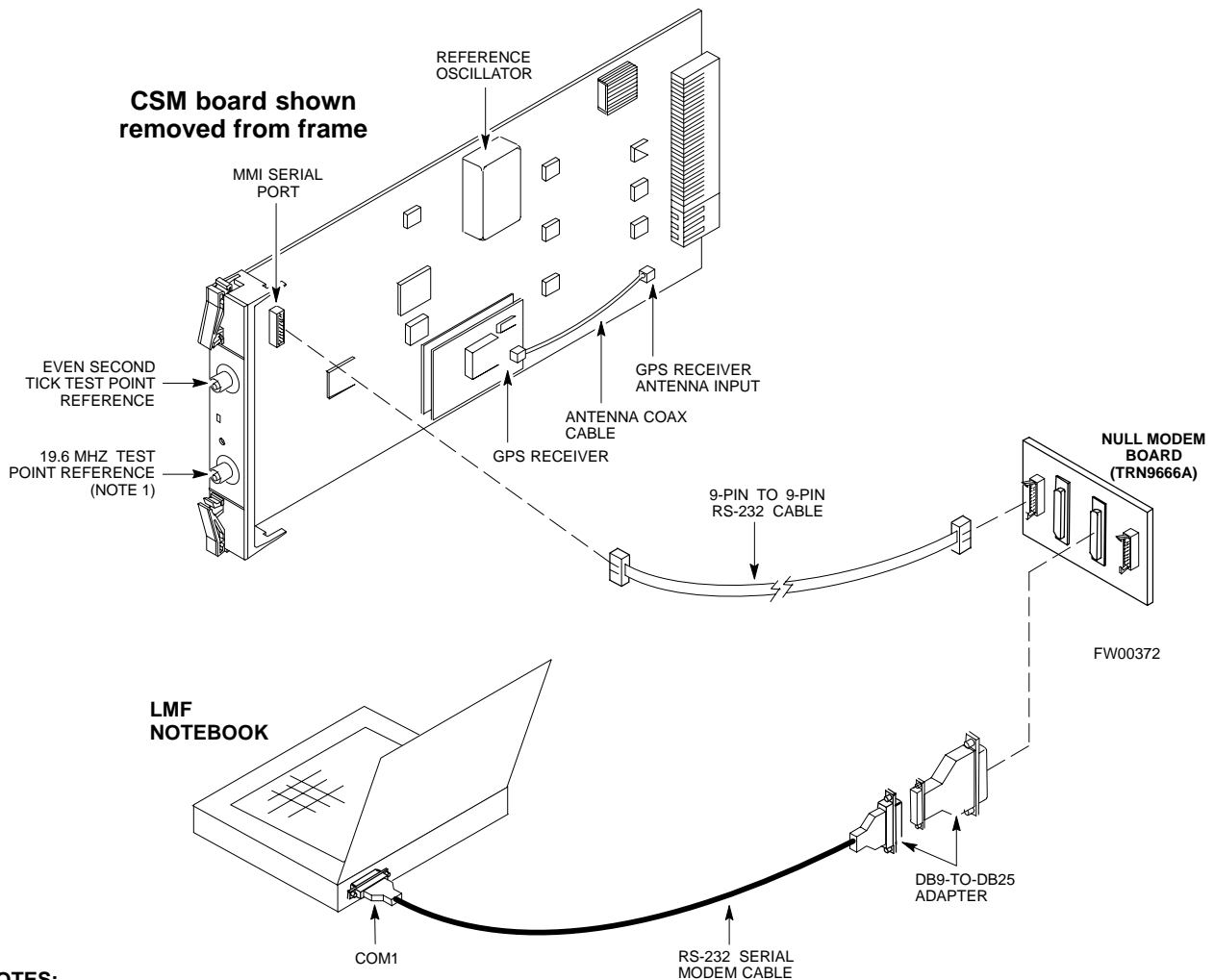
... continued on next page

Table 3-18: Test Equipment Setup (GPS & LFR/HSO Verification)

Step	Action
4	Start an MMI communication session with CSM-1 by using the Windows desktop shortcut icon (see Table 3-5) NOTE The LMF program must not be running when a Hyperterminal session is started if COM1 is being used for the MMI session.
5	When the terminal screen appears, press the <Enter> key until the CSM> prompt appears.

3

Figure 3-9: 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

Follow the procedure in Table 3-19 to initialize and verify proper GPS receiver operation.

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- The LMF is not logged into the BTS.
- The COM1 port is connected to the MMI port of the primary CSM via a null modem board (see Figure 3-9).
- The primary CSM and HSO (if equipped) have been warmed up for at least 15 minutes.

CAUTION	Connect the GPS antenna to the GPS RF 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.
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Table 3-19: GPS Initialization/Verification

Step	Action
1	<p>To verify that Clock alarms (0000), Dpll is locked and has a reference source, and GPS self test passed messages are displayed within the report, issue the following MMI command</p> <p>bstatus</p> <ul style="list-style-type: none"> Observe the following typical response: <pre> Clock Alarms (0000): DPLL is locked and has a reference source. GPS receiver self test result: <u>passed</u> Time since reset 0:33:11, time since power on: 0:33:11 </pre>
2	<p>Enter the following command at the CSM> prompt to display the current status of the Loran and the GPS receivers.</p> <p>sources</p> <ul style="list-style-type: none"> Observe the following typical response for systems equipped with LFR: <pre> 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 <u>Current reference source number: 0</u> </pre> <ul style="list-style-type: none"> Observe the following typical response for systems equipped with HSO: <pre> 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 </pre> <p>*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:</p> <p>ss 1 12</p> <p>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.</p> <p>The HSO should be valid within one (1) minute, assuming the DPLL is locked and the HSO rubidium oscillator is fully warmed.</p> <pre> 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 xxxxxxxxxxx xxxxxxxxxxx Yes </pre>
3	<p>HSO information (underlined text above, verified from left to right) is usually the #1 reference source. If this is not the case, have the OMCR determine the correct BTS timing source has been identified in the database by entering the display bts csmgen command and correct as required using the edit csm csmgen refsrc command.</p>

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Table 3-19: GPS Initialization/Verification

Step	Action
4	If any of the above mentioned areas fail, verify: <ul style="list-style-type: none"> - 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 board warpage
5	Verify the following GPS information (underlined text above): <ul style="list-style-type: none"> - GPS information is usually the 0 reference source. - At least one Primary source must indicate “Status = good” and “Valid = yes” to bring site up.
6	Enter the following command at the CSM> prompt to verify that the GPS receiver is in tracking mode. <p>gstatus</p> <ul style="list-style-type: none"> - 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>

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Table 3-19: GPS Initialization/Verification

Step	Action
7	<p>Verify the following GPS information (shown above in <u>underlined</u> text):</p> <ul style="list-style-type: none"> - At least 4 satellites are tracked, and 4 satellites are visible. - GPS Receiver Control Task State is “tracking satellites”. <i>Do not continue until this occurs!</i> - Dilution of Precision indication is not more that 30. <p>Record the current position base site latitude, longitude, height and height reference (height reference to Mean Sea Level (MSL) or GPS height (GPS). (GPS = 0 MSL = 1).</p>
8	<p>If steps 1 through 7 pass, the GPS is good.</p> <p>NOTE If any of the above mentioned areas fail, verify that:</p> <ul style="list-style-type: none"> - If <i>Initial position accuracy</i> is “estimated” (typical), at least 4 satellites must be tracked and visible (1 satellite must be tracked and visible if actual lat, log, and height data for this site has been entered into CDF file). - If <i>Initial position accuracy</i> is “surveyed”, position data 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.
9	<p>Enter the following commands at the CSM> prompt to verify that the CSM is warmed up and that GPS acquisition has taken place.</p> <p>debug dpll</p> <p>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 10</i>)</p> <pre>CSM>DPLL Task Wait. 884 seconds left. DPLL Task Wait. 882 seconds left. DPLL Task Wait. 880 seconds left.etc.</pre> <p>NOTE The warm command can be issued at the MMI port used to force the CSM into warm-up, but the reference oscillator will be unstable.</p>

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3

Table 3-19: GPS Initialization/Verification	
Step	Action
10	<p>Observe the following typical response if the CSM is warmed up.</p> <pre>c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17486 off: <u>-11</u>, 3, <u>6</u> <u>TK SRC:0</u> S0: 3 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175 c:17470 off: <u>-11</u>, 1, <u>6</u> <u>TK SRC:0</u> S0: 1 S1:-2013175,-2013175</pre>
11	<p>Verify the following GPS information (underlined text above, from left to right):</p> <ul style="list-style-type: none"> - Lower limit offset from tracked source variable is not less than -60 (equates to 3μs limit). - Upper limit offset from tracked source variable is not more than +60 (equates to 3μs limit). - TK SRC: 0 is selected, where SRC 0 = GPS.
12	<p>Enter the following commands at the CSM> prompt to exit the debug mode display.</p> <pre>debug dpllp</pre>

LFR Initialization/Verification

The LORAN-C LFR is a full size card that resides in the C-CCP Shelf. The LFR is a completely self-contained unit that interfaces with the CSM via a serial communications link. The CSM handles the overall configuration and status monitoring functions of the LFR.

The LFR receives a 100 kHz, 35 kHz BW signal from up to 40 stations (8 chains) simultaneously and provides the following major functions:

- Automatic antenna pre-amplifier calibration (using a second differential pair between LFR and LFR antenna)
- A 1 second ± 200 ns strobe to the CSM

If the BTS is equipped with an LFR, follow the procedure in Table 3-20 to initialize the LFR and verify proper operation as a backup source for the GPS.

NOTE	If CSMRefSrc2 = 2 in the CDF file, the BTS is equipped with an LFR. If CSMRefSrc2 = 18, the BTS is equipped with an HSO.
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Table 3-20: LFR Initialization/Verification

Step	Action	Note
1	<p>At the CSM> prompt, enter lstatus <cr> to verify that the LFR is in tracking mode. A typical response is:</p> <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>	<p><i>This must be greater than 100 before LFR becomes a valid source.</i></p> <p><i>This shows the LFR is locked to the selected PLL station.</i></p> <p><i>This search list and PLL data must match the geographical location of the cell site.</i></p>
2	<p>Verify the following LFR information (highlighted above in boldface type):</p> <ul style="list-style-type: none"> - 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 signal to noise (S/N) ratio of the phase locked station is greater than 8. 	
3	<p>At the CSM> prompt, enter sources <cr> to display the current status of the the LORAN receiver.</p> <ul style="list-style-type: none"> - 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 Yes Good -2013177 -2013177 Yes 2 Not used Current reference source number: 1 </pre>	

... continued on next page



Table 3-20: LFR Initialization/Verification

Step	Action	Note
4	<p>LORAN-C LFR information (highlighted above in boldface type) is usually the #1 reference source (verified from left to right).</p> <p>NOTE If any of the above mentioned areas fail, verify:</p> <ul style="list-style-type: none"> - 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 . 	
	<p>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.</p>	
5	Close the Hyperterminal window.	

HSO Initialization/Verification

The HSO module is a full-size card that resides in the C-CCP Shelf. This completely self contained high stability 10 MHz oscillator interfaces with the CSM via a serial communications link. The CSM handles the overall configuration and status monitoring functions of the HSO. In the event of GPS failure, the HSO is capable of maintaining synchronization initially established by the GPS reference signal for a limited time.

The HSO is typically installed in those geographical areas not covered by the LORAN-C system and provides the following major functions:

- Reference oscillator temperature and phase lock monitor circuitry
- Generates a highly stable 10 MHz sine wave.
- Reference divider circuitry converts 10 MHz sine wave to 10 MHz TTL signal, which is divided to provide a 1 PPS strobe to the CSM.

Prerequisites

- The LMF is not logged into the BTS.
- The COM1 port is connected to the MMI port of the primary CSM via a null modem board.
- The primary CSM and the HSO (if equipped) have warmed up for 15 minutes.

If the BTS is equipped with an HSO, follow the procedure in Table 3-21 to configure the HSO.

3

Table 3-21: HSO Initialization/Verification

Step	Action
1	<p>At the BTS, slide the HSO card into the cage.</p> <p>NOTE The LED on the HSO should light <i>red</i> for no longer than 15-minutes, then switch to <i>green</i>. The CSM must be locked to GPS.</p>
2	<p>On the LMF at the CSM> prompt, enter sources <cr>.</p> <p>- Observe the following typical response for systems equipped with HSO:</p> <pre> Num Source Name Type TO Good Status Last Phase Target Phase Valid ----- 0 Local GPS Primary 4 Yes Good 0 0 Yes 1 HSO Backup 4 Yes N/A xxxxxxxx -69532 Yes 2 Not used Current reference source number: 0 </pre> <p>When the CSM is locked to GPS, verify that the HSO “Good” field is <i>Yes</i> and the “Valid” field is <i>Yes</i>.</p>
3	<p>If source “1” is not configured as HSO, enter at the CSM> prompt: ss 1 12 <cr></p> <p>Check for <i>Good</i> in the Status field.</p>
4	<p>At the CSM> prompt, enter sources <cr>.</p> <p>Verify the HSO valid field is <i>Yes</i>. If not, repeat this step until the “Valid” status of <i>Yes</i> is returned. The HSO should be valid within one (1) minute, assuming the DPLL is locked and the HSO Rubidium oscillator is fully warmed.</p>

Test Equipment Set-up

Connecting Test Equipment to the BTS

All test equipment is controlled by the LMF via an IEEE-488/GPIB bus. If there is a communications problem between the LMF and any piece of test equipment, verify that the GPIB addresses have been set correctly (normally 1 for a signal generator, 13 for a power meter, and 18 for a CDMA analyzer). See Appendix J for procedures to verify and change the GPIB addresses.

The following equipment is required to perform optimization:

- LMF
- Test set
- Directional coupler and attenuator
- RF cables and connectors
- Null modem cable (see Figure 3-8)
- GPIB interface box

Refer to Table 3-22 and Table 3-23 for an overview of connections for test equipment currently supported by the LMF. In addition, see the following figures:

- Figure 3-12 and Figure 3-13 show the test set connections for TX calibration.
- Figure 3-14 and Figure 3-15 show test set connections for IS-95 A/B optimization/ATP tests.
- Figure 3-16 shows test set connections for IS-95 A/B and CDMA 2000 optimization/ATP tests.
- Figure 3-17 and Figure 3-18 show typical TX and RX ATP setup with a directional coupler (shown with and without RFDS).

Supported Test Sets

CAUTION	To prevent damage to the test equipment, all TX test connections must be through the directional coupler and in-line attenuator as shown in the test setup illustrations.
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IS-95 A/B Testing

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

- CyberTest
- Advantest R3465 and HP 437B or Gigatronics Power Meter
- Hewlett-Packard HP 8935
- Hewlett-Packard HP 8921 (W/CDMA and PCS Interface for 1.7/1.9 GHz) and HP 437B or Gigatronics Power Meter

The equipment listed above cannot be used for CDMA 2000 testing.

CDMA 2000 Testing

NOTE	IS-95 C is the same as CDMA 2000.
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Optimization and ATP testing may be performed using one of the following test sets:

- Advantest R3267 Analyzer with Advantest R3562 Signal Generator
- Agilent E4406A with E4432B Signal Generator
- Hewlett-Packard HP 8935 with option 200 or R2K for 1X TX and with Agilent E4432B Signal Generator for 1X FER

The E4406A/E4432B pair, or the R3267/R3562 pair, should be connected together using a GPIB cable. In addition, the R3562 and R3267 should be connected with a serial cable from the Serial I/O to the Serial I/O. This test equipment is capable of performing tests in both IS-95 A/B mode and CDMA 2000 mode if the required options are installed.

Optional test equipment

- Spectrum Analyzer (HP8594E) - can be used to perform cable calibration.

Test Equipment Reference Chart

Table 3-22 and Table 3-23 depicts the current test equipment available meeting Motorola standards.

To identify the connection ports, locate the test equipment presently being used in the **TEST SETS** columns, and read down the column. Where a ball appears in the column, connect one end of the test cable to that port. Follow the horizontal line to locate the end connection(s), reading up the column to identify the appropriate equipment/BTS port.

Table 3-22: IS-95 A/B Test Equipment Setup

SIGNAL	COMMUNICATIONS SYSTEM ANALYZER					ADDITIONAL TEST EQUIPMENT				BTS
	Cyber-Test	Advant-est R3465	HP 8935	HP 8921A	HP 8921 W/PCS	Power Meter	GPIB Interface	LMF	30 dB Directional Coupler & 20 dB Pad*	
EVEN SECOND SYNCHRONIZATION	EVEN SEC REF	EVEN SEC SYNC IN	EVEN SECOND SYNC IN	EVEN SECOND SYNC IN	EVEN SECOND SYNC IN					SYNC MONITOR
19.6608 MHZ CLOCK	TIME BASE IN	CDMA TIME BASE IN	EXT REF IN	CDMA TIME BASE IN	CDMA TIME BASE IN					FREQ MONITOR
CONTROL IEEE 488 BUS	IEEE 488	GPIB	HP-IB	HP-IB	HP-IB	HP-IB	GPIB	SERIAL PORT		
TX TEST CABLES	RF IN/OUT	INPUT 50-OHM	RF IN/OUT	RF IN/OUT	RF IN/OUT				30 DB COUPLER AND 20 DB PAD	TX1-6
RX TEST CABLES	RF GEN OUT	RF OUT 50-OHM	RF IN/OUT	DUPLEX OUT	RF OUT ONLY					RX1-6



Table 3-23: IS-95 A/B/C Test Equipment Setup

SIGNAL	TEST SETS					ADDITIONAL TEST EQUIPMENT				BTS
	Advantest R3562 Signal Generator	Advantest R3267 Analyzer	Agilent E4406A Analyzer	Agilent E4432B Signal Generator	HP 8935	Power Meter	GPIB Interface	LMF	30 dB Directional Coupler & 20 dB Pad*	
EVEN SECOND SYNCHRONIZATION	EXT TRIG IN	EXT TRIG	TRIGGER IN	PATTERN TRIG IN	EVEN SECOND SYNC IN					SYNC MONITOR
19.6608 MHZ CLOCK	MOD TIME BASE IN		EXT REF IN		EXT REF IN					FREQ MONITOR
SIGNAL SOURCE CONTROLLED SERIAL I/O	SERIAL I/O	SERIAL I/O								
10 MHZ	10 MHZ IN	10 MHZ OUT	10 MHZ OUT	10 MHZ IN						
CONTROL IEEE 488 BUS	IEEE 488	GPIB	HP-IB	GPIB	HP-IB	HP-IB	GPIB	SERIAL PORT		
TX TEST CABLES	RF OUT	RF IN	RF INPUT 50 OHM	RF OUTPUT 50 OHM	RF IN/OUT				30 DB COUPLER AND 20 DB PAD	TX1-6
RX TEST CABLES	RF GEN OUT	RF OUT 50-OHM	RF OUT ONLY	RF OUTPUT 50-OHM	DUPLEX					RX1-6

3

Equipment Warm-up

NOTE	Warm-up <i>BTS equipment for a minimum of 60 minutes</i> prior to performing the BTS optimization procedure. This assures BTS site stability and contributes to optimization accuracy. (Time spent running initial power-up, hardware/firmware audit, and BTS download counts as warm-up time.)
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Calibrating Cables

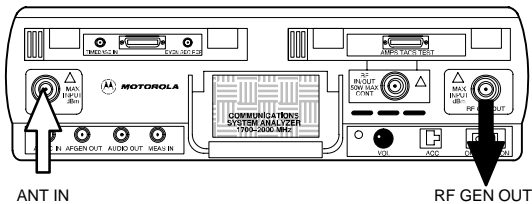
Figure 3-10 and Figure 3-11 show the cable calibration setup for various supported test sets. The left side of the diagram depicts the location of the input and output ports of each test set, and the right side details the set up for each test.

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

Figure 3-10: Cable Calibration Test Setup

SUPPORTED TEST SETS

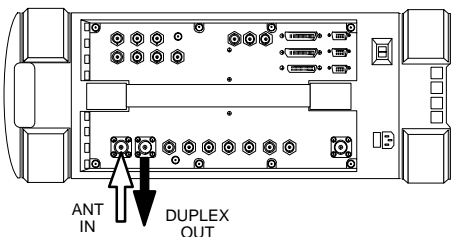
Motorola CyberTest



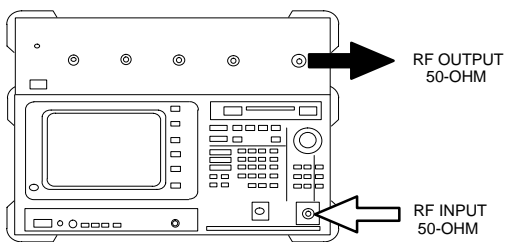
Note: The Directional Coupler is not used with the CyberTest Test Set. The TX cable is connected directly to the CyberTest Test Set.

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.

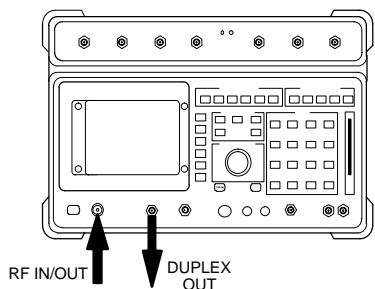
Hewlett-Packard Model HP 8935



Advantest Model R3465



Hewlett-Packard Model HP 8921A

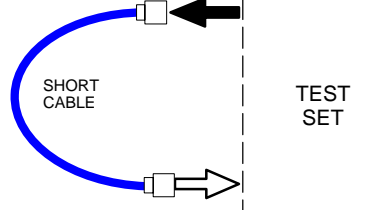


Note: For 800 MHz only. The HP8921A cannot be used to calibrate cables for PCS frequencies.

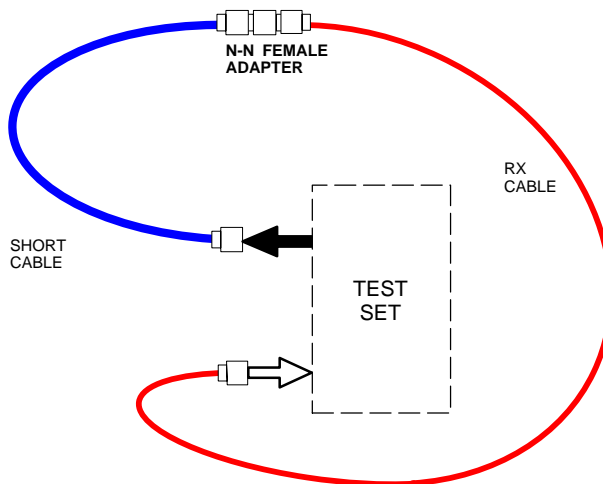
FW00089

CALIBRATION SET UP

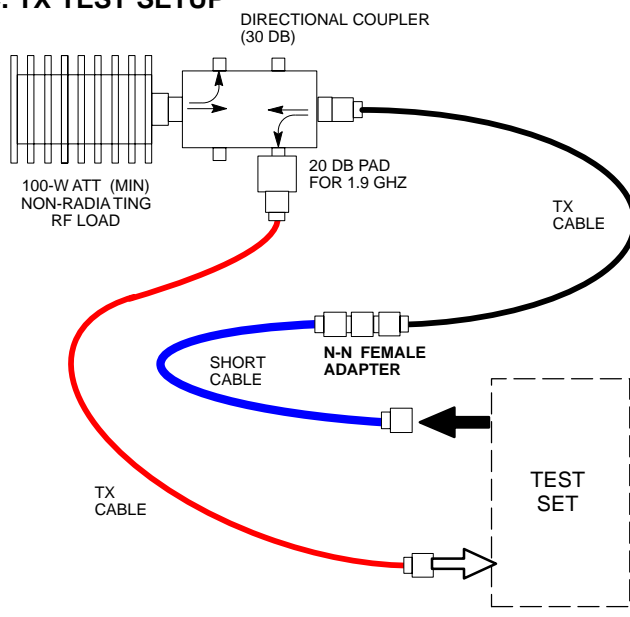
A. SHORT CABLE CAL



B. RX TEST SETUP

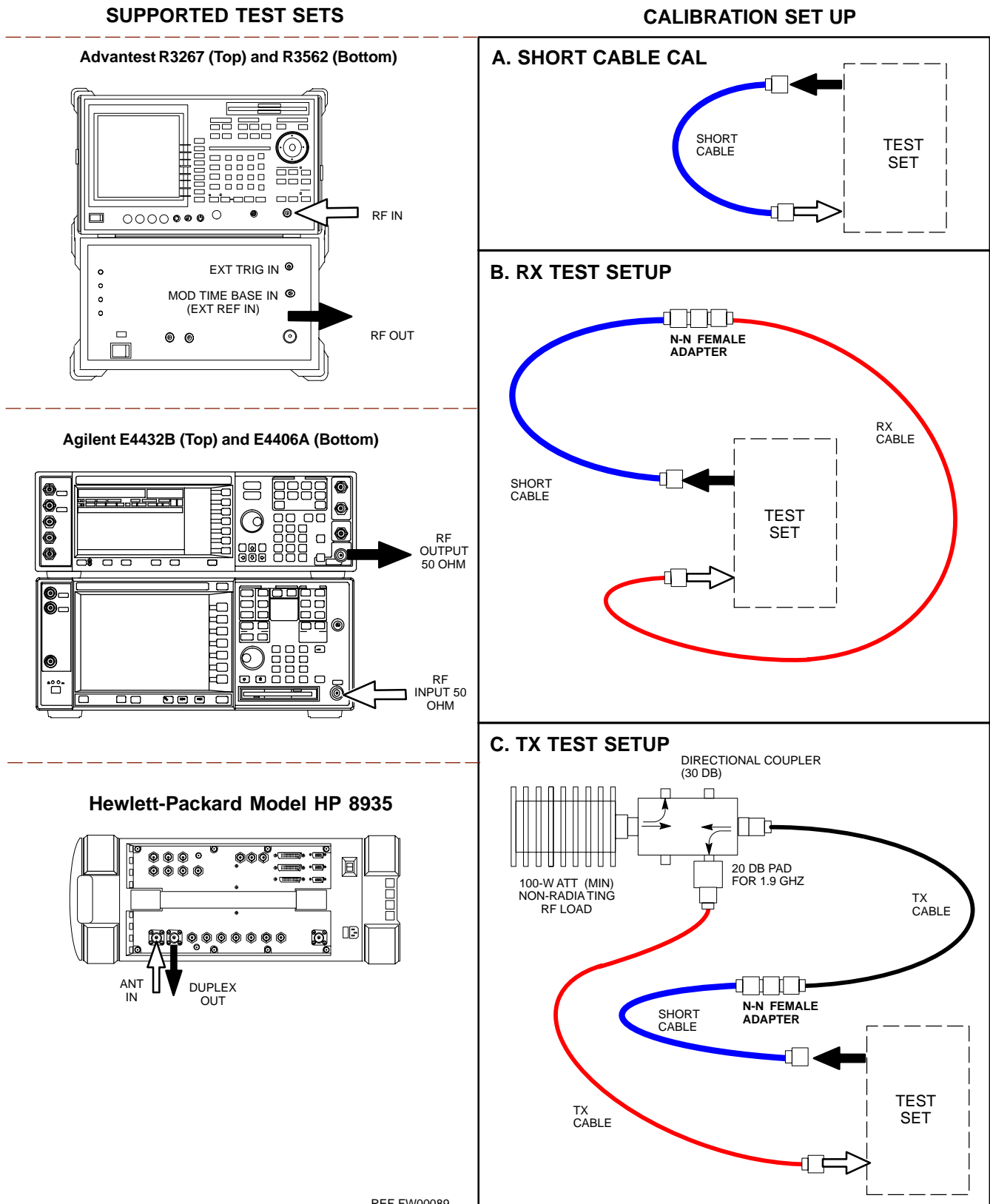


C. TX TEST SETUP



3

Figure 3-11: Cable Calibration Test Setup (Advantest R3267, Agilent E4406A)



Setup for TX Calibration

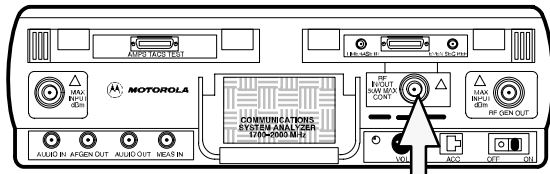
Figure 3-12 and Figure 3-13 show the test set connections for TX calibration.

Figure 3-12: TX Calibration Test Setup (CyberTest, HP 8935, and Advantest)

3

TEST SETS

Motorola CyberTest

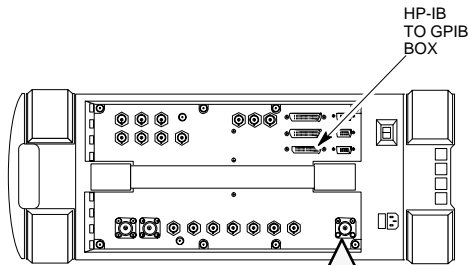


FRONT PANEL

RF IN/OUT

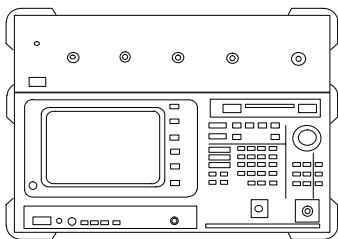
NOTE: THE DIRECTIONAL COUPLER IS NOT USED WITH THE CYBERTEST TEST SET. THE TX CABLE IS CONNECTED DIRECTLY TO THE CYBERTEST TEST SET.

Hewlett-Packard Model HP 8935



RF IN/OUT

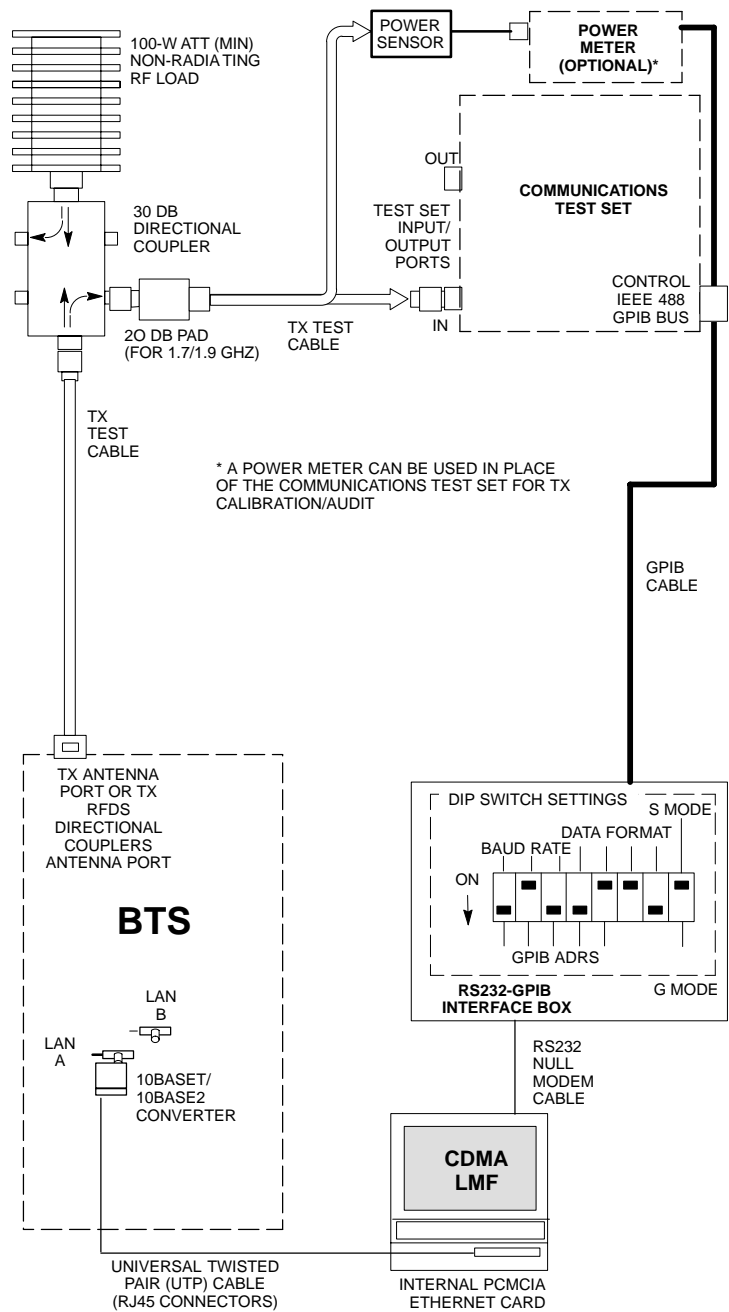
Advantest Model R3465



GPIB CONNECTS TO BACK OF UNIT

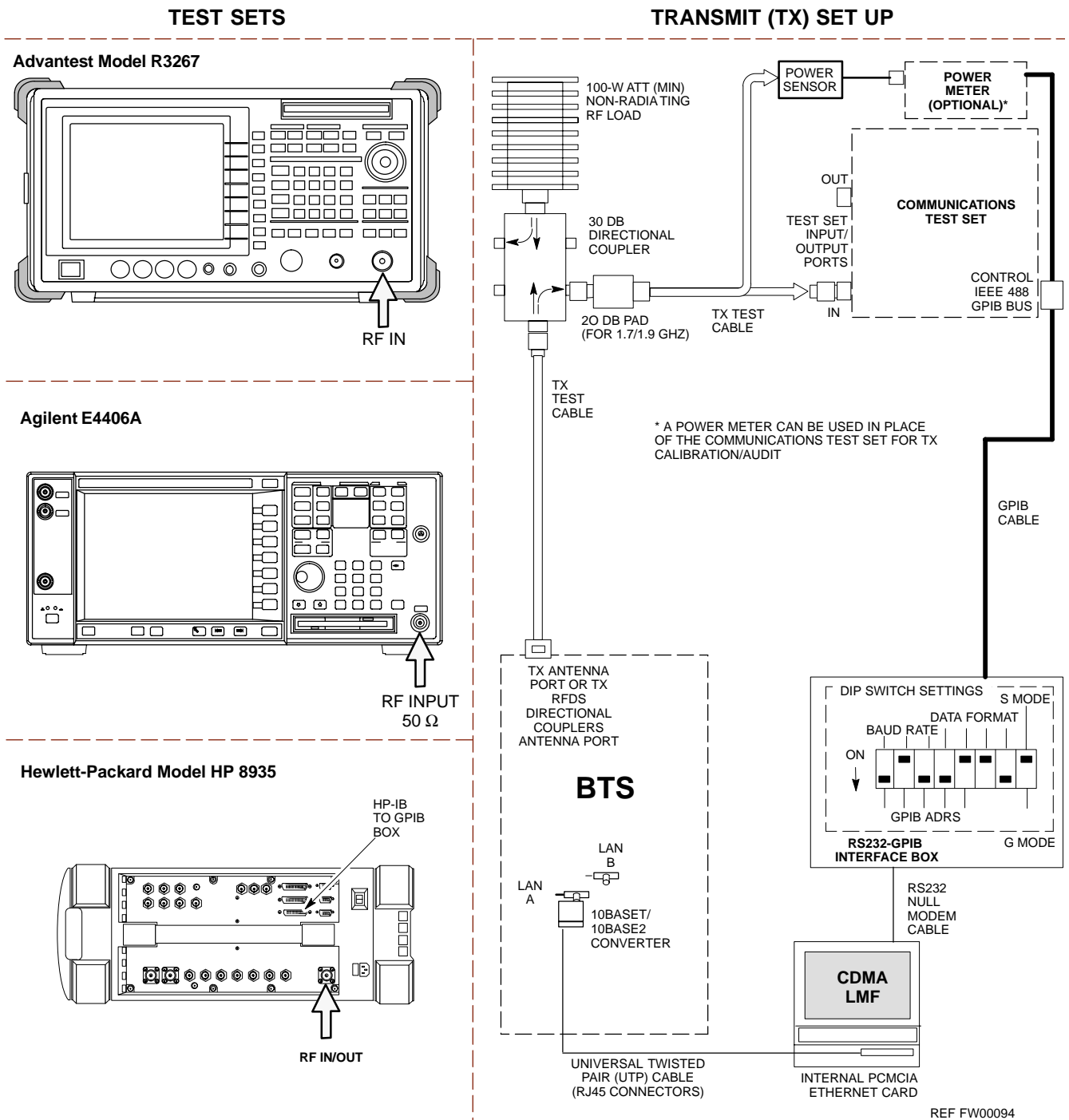
INPUT 50-OHM

TRANSMIT (TX) SET UP



REF FW00094

Figure 3-13: TX Calibration Test Setup (Advantest R3267, Agilent E4406A, and HP8935)



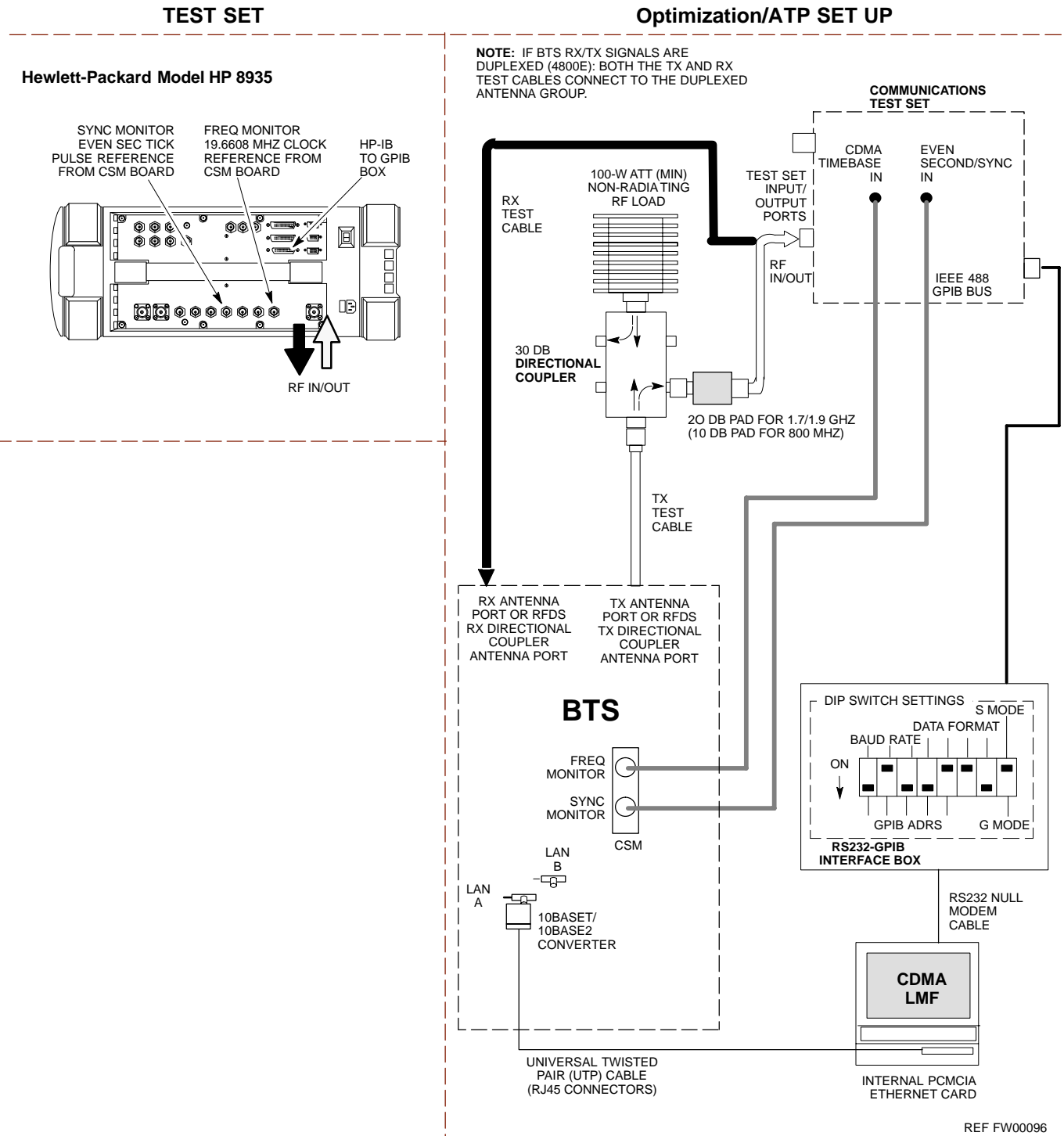
* A POWER METER CAN BE USED IN PLACE OF THE COMMUNICATIONS TEST SET FOR TX CALIBRATION/AUDIT

REF FW00094

Setup for Optimization/ATP

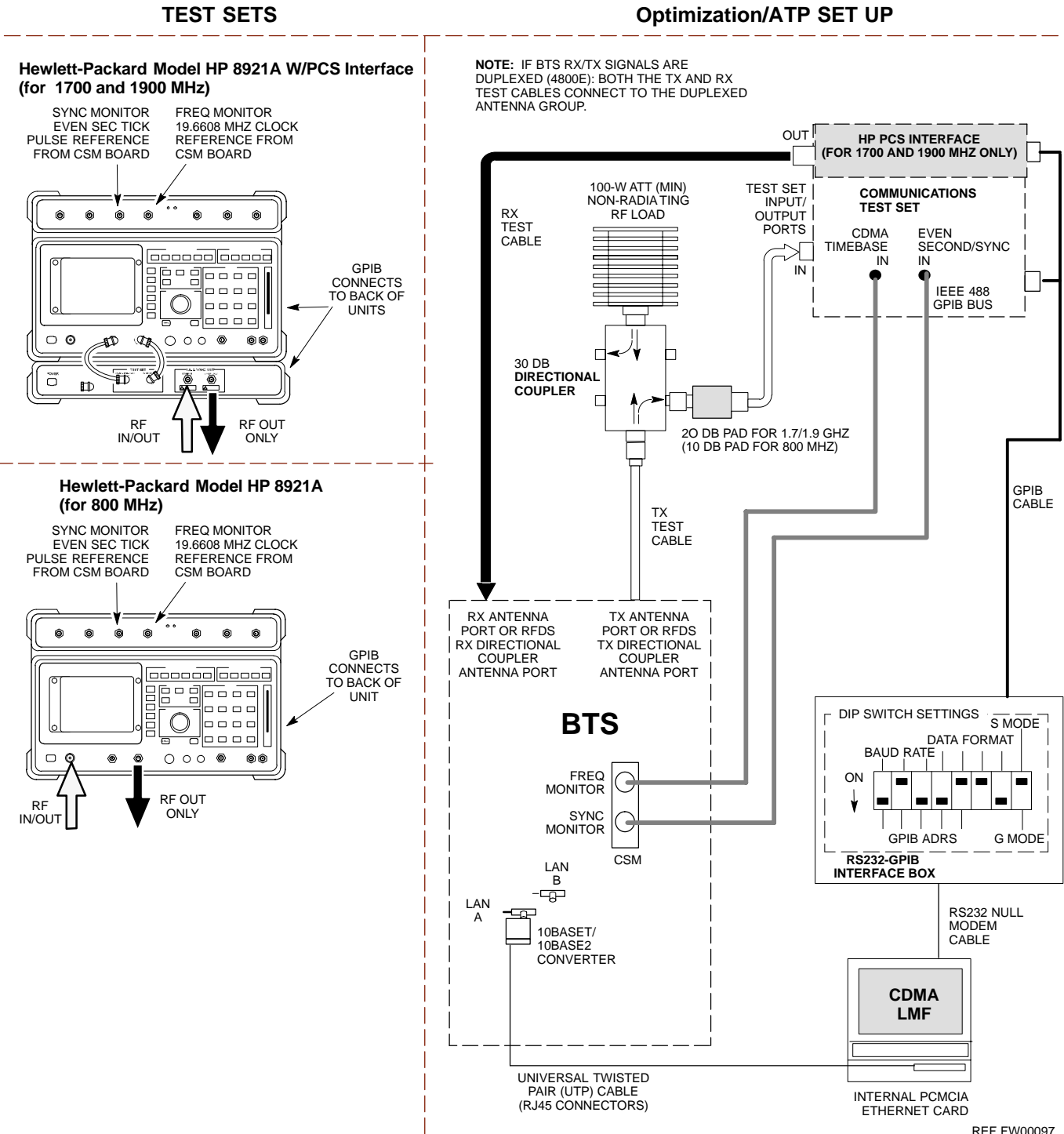
Figure 3-14 and Figure 3-15 show test set connections for IS-95 A/B optimization/ATP tests. Figure 3-16 shows test set connections for IS-95 A/B/C optimization/ATP tests.

Figure 3-14: Opt/ATP Test Setup Calibration (HP 8935)



3

Figure 3-15: Opt/ATP Test Setup (HP 8921A)



REF FW00097

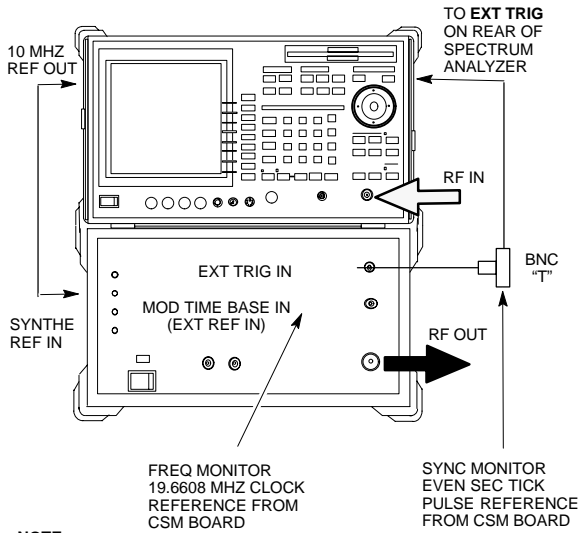
Figure 3-16: Opt/ATP Test Setup (Advantest R3267 and Agilent E4406A)

3

TEST SETS

Optimization/ATP SET UP

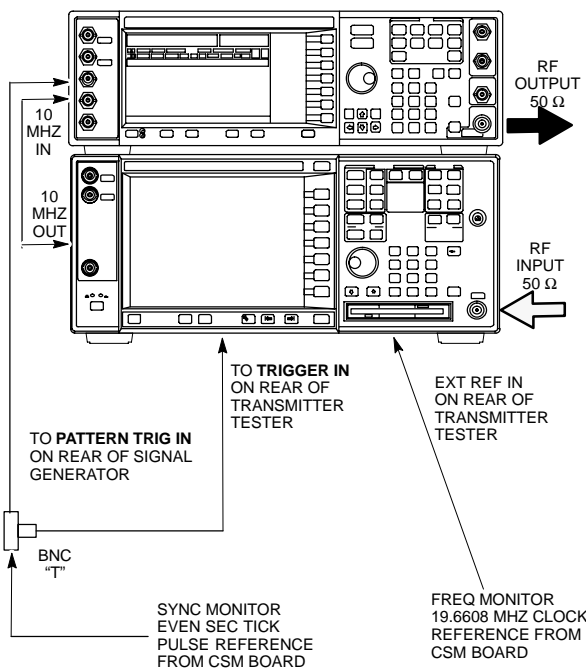
Advantest R3267 (Top) and R3562 (Bottom)



NOTE:

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

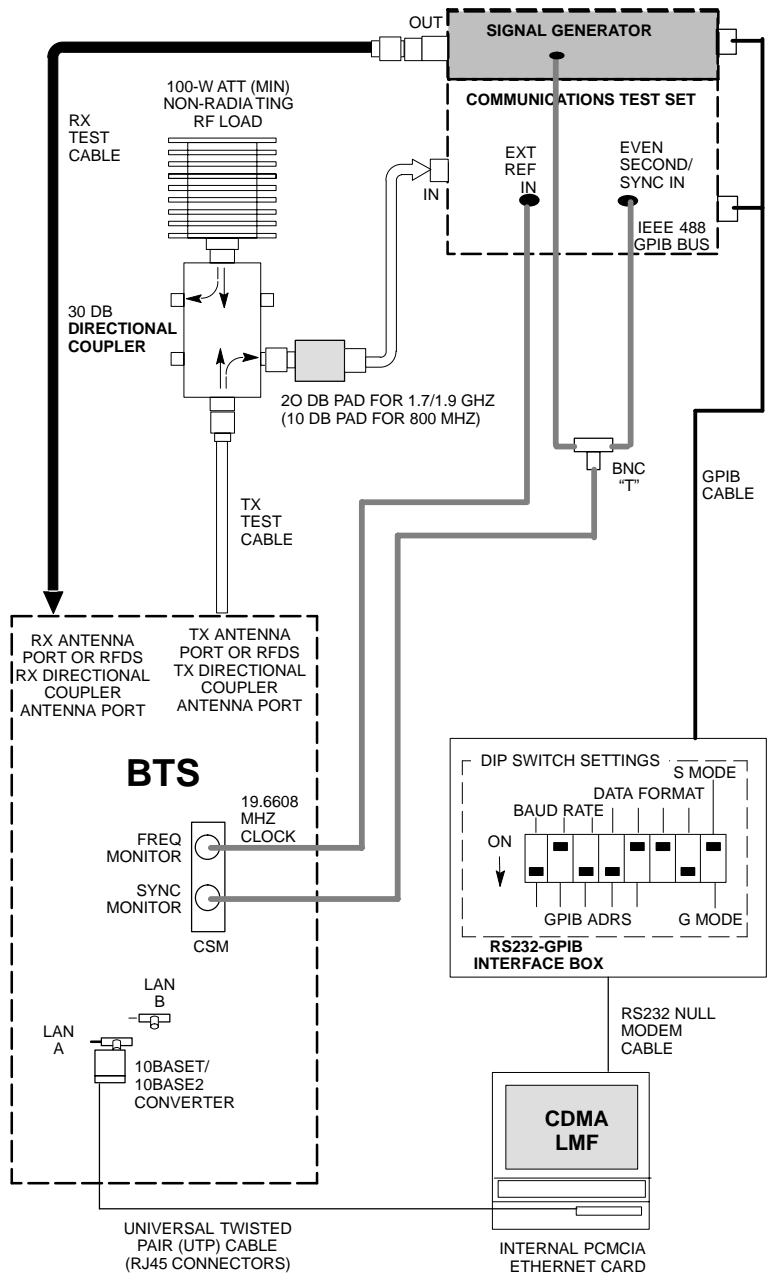
Agilent E4432B (Top) and E4406A (Bottom)



NOTE:

FOR MANUAL TESTING, GPIB MUST BE CONNECTED BETWEEN THE ANALYZER AND THE SIGNAL GENERATOR

NOTE: IF BTS RX/TX SIGNALS ARE DUPLEXED: BOTH THE TX AND RX TEST CABLES CONNECT TO THE DUPLEXED ANTENNA GROUP.



REF FW00758

TX ATP Setup

Figure 3-17 shows a typical TX ATP setup.

Figure 3-17: Typical TX ATP Setup with Directional Coupler

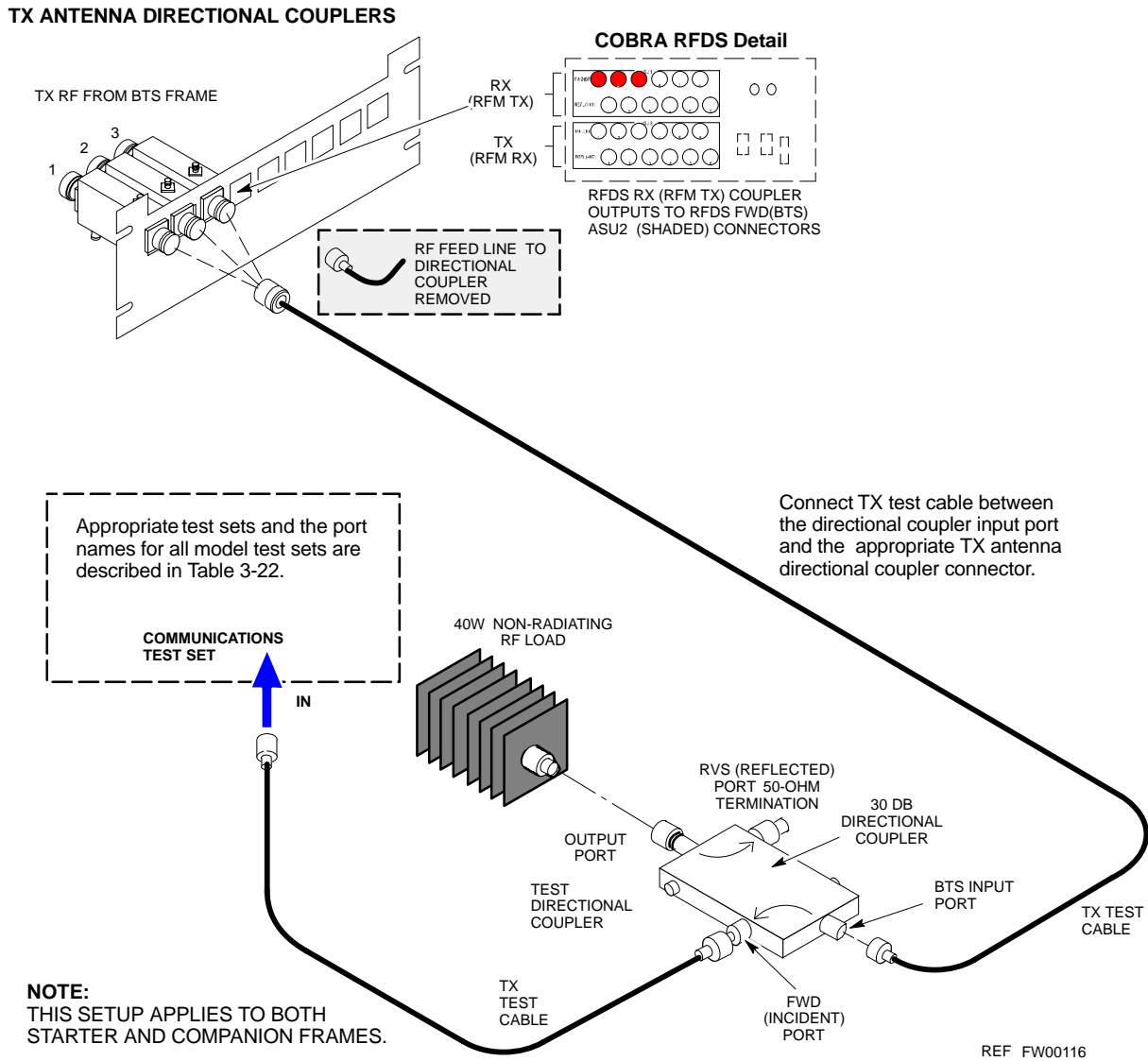
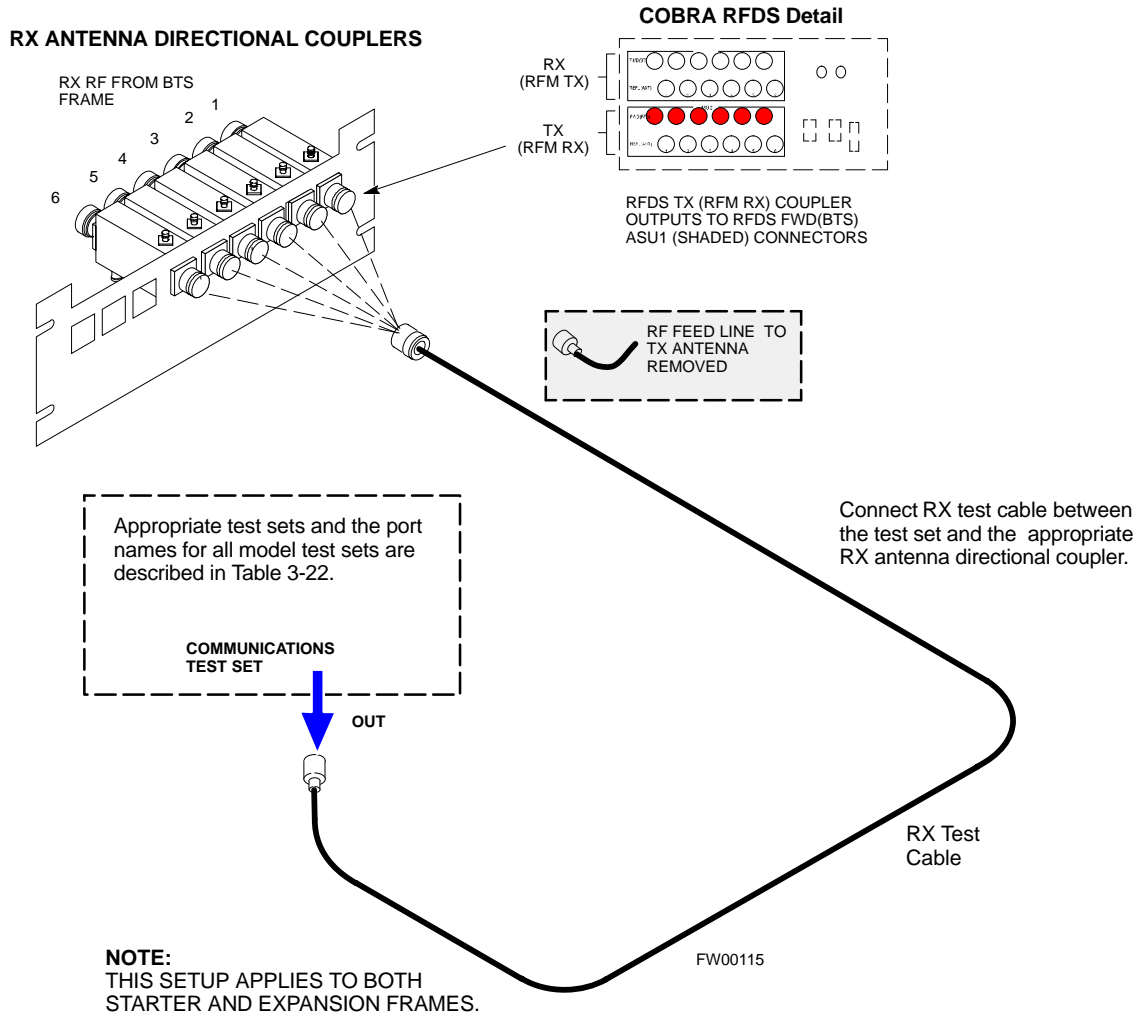


Figure 3-18: Typical RX ATP Setup with Directional Coupler



Test Set Calibration

Test Set Calibration Background

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

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

CAUTION	If any piece of test equipment, test cable, or RF adapter, that makes up the calibrated test equipment set, has been replaced, re-calibration must be performed. Failure to do so can introduce measurement errors, resulting in incorrect measurements and degradation to system performance.
----------------	--

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

Purpose of Test Set Calibration

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

Selecting Test Equipment

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

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

Prerequisites

Ensure the following prerequisites have been met before proceeding:

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

Manually Selecting Test Equipment in a Serial Connection Tab

Test equipment can be manually specified before, or after, the test equipment is connected. The LMF does not check to see if the test equipment is actually detected for manual specification. Follow the procedure in Table 3-24 to select test equipment manually.

Table 3-24: Selecting Test Equipment Manually in a Serial Connection Tab

✓	Step	Action
	1	From the Tools menu, select Options . The LMF Options window appears.
	2	Click on the Serial Connection tab (if not in the forefront).
	3	Select the correct serial port in the COMM Port pick list (normally COM1).
	4	Click on the Manual Specification button (if not enabled).
	5	Click on the check box corresponding to the test item(s) to be used.
	6	<p>NOTE GPIB addresses can range from 1 through 30. The LMF will accept any address in that range, but the numbers in the GPIB address boxes must match the addresses of the test equipment. Motorola recommends that you use 1 for a CDMA signal generator, 13 for a power meter, and 18 for a CDMA analyzer. To verify and, if necessary, change the GPIB addresses of the test equipment, refer to Appendix J.</p> <p>Type the GPIB address in the corresponding GPIB address box.</p> <p><i>Recommended Addresses</i> 1 = CDMA Signal generator 13 = Power Meter 18 = CDMA Analyzer</p>
	7	Click on Apply . (The button darkens until the selection has been committed.) <p>NOTE With manual selection, the LMF does not detect the test equipment to see if it is connected and communicating with the LMF. To verify and, if necessary, change the GPIB address of the test equipment, refer to Appendix J.</p>
	8	Click on Dismiss to close the test equipment window.

Automatically Selecting Test Equipment in a Serial Connection Tab

When using the auto-detection feature to select test equipment, the LMF examines which test equipment items are actually communicating with the LMF. Follow the procedure in Table 3-25 to use the auto-detect feature.

Table 3-25: Selecting Test Equipment Using Auto-Detect

✓	Step	Action
	1	From the Tools menu, select Options . The LMF Options window appears.
	2	Click on the Serial Connection tab (if not in the forefront).
	3	Select the correct serial port in the COMM Port pick list (normally COM1).
	4	Click on Auto-Detection (if not enabled).
	5	<p>NOTE GPIB addresses can range from 1 through 30. The LMF will accept any address in that range, but the numbers in the GPIB address to search box must match the addresses of the test equipment. Motorola recommends that you use 1 for a CDMA signal generator, 13 for a power meter, and 18 for a CDMA analyzer. To verify and, if necessary, change the GPIB addresses of the test equipment, refer to Appendix J.</p> <p>Type the GPIB addresses in the box labeled GPIB address to search (if not already displayed).</p> <p>NOTE When both a power meter and an analyzer are selected, the LMF uses the first item that is capable of performing the test and is listed in the GPIB addresses to search box for RF power measurements (i.e., TX calibration). The address for a CDMA signal generator is normally 1, the address for a power meter is normally 13, and the address for a CDMA analyzer is normally 18. If 1,13,18 is included in the GPIB addresses to search box, the power meter (13) is used for RF power measurements. When the test equipment items are manually selected, the CDMA analyzer is used only if a power meter is not selected.</p>
	6	Click on Apply . NOTE The button darkens until the selection has been committed. A check mark appears in the Manual Configuration section for detected test equipment items.
	7	Click Dismiss to close the LMF Options window.

Calibrating Test Equipment

The calibrate test equipment function zeros the power measurement level of the test equipment item that is to be used for TX calibration and audit. If both a power meter and an analyzer are connected, only the power meter is zeroed.

Use the **Calibrate Test Equipment** menu item from the **Util** menu to calibrate test equipment. The test equipment must be selected before calibration can begin. Follow the procedure in Table 3-26 to calibrate the test equipment.

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- Test equipment to be calibrated has been connected correctly for tests that are to be run.
- Test equipment has been selected.

Table 3-26: Test Equipment Calibration

✓	Step	Action
	1	From the Util menu, select Calibrate Test Equipment . A Directions window is displayed.
	2	Follow the directions provided.
	3	Click on Continue to close the Directions window. A status report window is displayed.
	4	Click on OK to close the status report window.



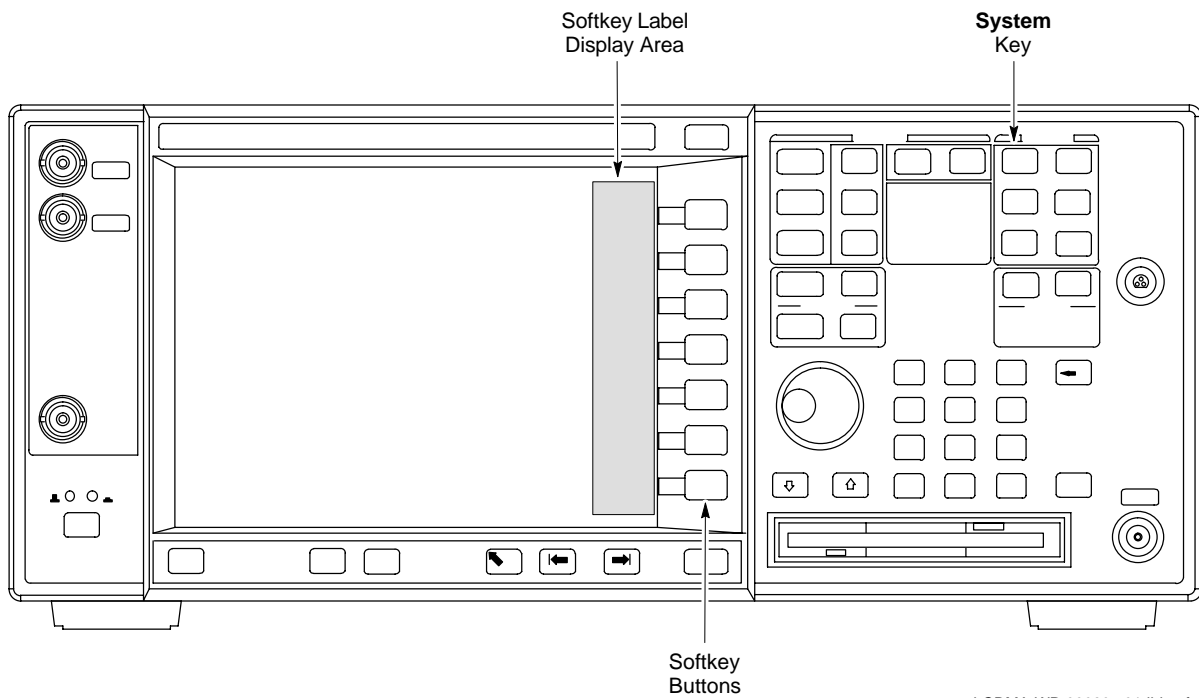
Agilent E4406A Transmitter Tester Self-alignment (Calibration)

The Agilent E4406A requires pre-calibration actions or calibration verification that are not supported by the LMF. Follow the procedure in Table 3-27 and refer to Figure 3-19 to perform the Agilent E4406A self-alignment (calibration).

Table 3-27: Agilent E4406A Self-alignment (Calibration)	
Step	Action
1	In the SYSTEM section of the instrument front panel, press the System key. - The softkey labels displayed on the right side of the instrument screen will change.
2	Press the Alignments softkey button to the right of the instrument screen. - The softkey labels will change.
3	Press the Align All Now softkey button. - All other instrument functions will be suspended during the alignment. - The display will change to show progress and results of the alignments performed. - The alignment will take less than one minute.

3

Figure 3-19: Agilent E4406A Self-alignment



ti-CDMA-WP-00080-v01-ildoc-ftw

Calibrating Cables

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

- **Measuring the loss of a short cable** - This is required to compensate for any measurement error of the analyzer. The short cable (used only for the calibration process) is used in series with both the TX and RX cable configuration when measuring. The measured loss of the short cable is deducted from the measured loss of the TX and RX cable configuration to determine the actual loss of the TX and RX cable configurations. The result is then adjusted out of both the TX and RX measurements to compensate for the measured loss.
- **Measuring the short cable plus the RX cable configuration loss** - The RX cable configuration normally consists only of a coax cable with type-N connectors that is long enough to reach from the BTS RX port of the test equipment.
- **Measuring the short cable plus the TX cable configuration loss** - The TX cable configuration normally consists of two coax cables with type-N connectors and a directional coupler, a load, and an additional attenuator (if required by the specified BTS). The total loss of the path loss of the TX cable configuration must be as required for the BTS (normally 30 or 50 dB).

Calibrating Cables with a CDMA Analyzer

Cable Calibration is used to calibrate both TX and RX test cables. Follow the procedure in Table 3-28 to calibrate the cables. Figure 3-10 illustrates the cable calibration test equipment setup. Appendix F covers the procedures for manual cable calibration.

NOTE

LMF cable calibration for PCS systems (1.7/1.9 GHz) cannot be accomplished using an HP8921 analyzer with PCS interface or an Advantest analyzer. A different analyzer type or the signal generator and spectrum analyzer method must be used (refer to Table 3-29 and Figure 3-20). Cable calibration values are then manually entered.

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- Test equipment to be calibrated has been connected correctly for cable calibration.
- Test equipment has been selected and calibrated.

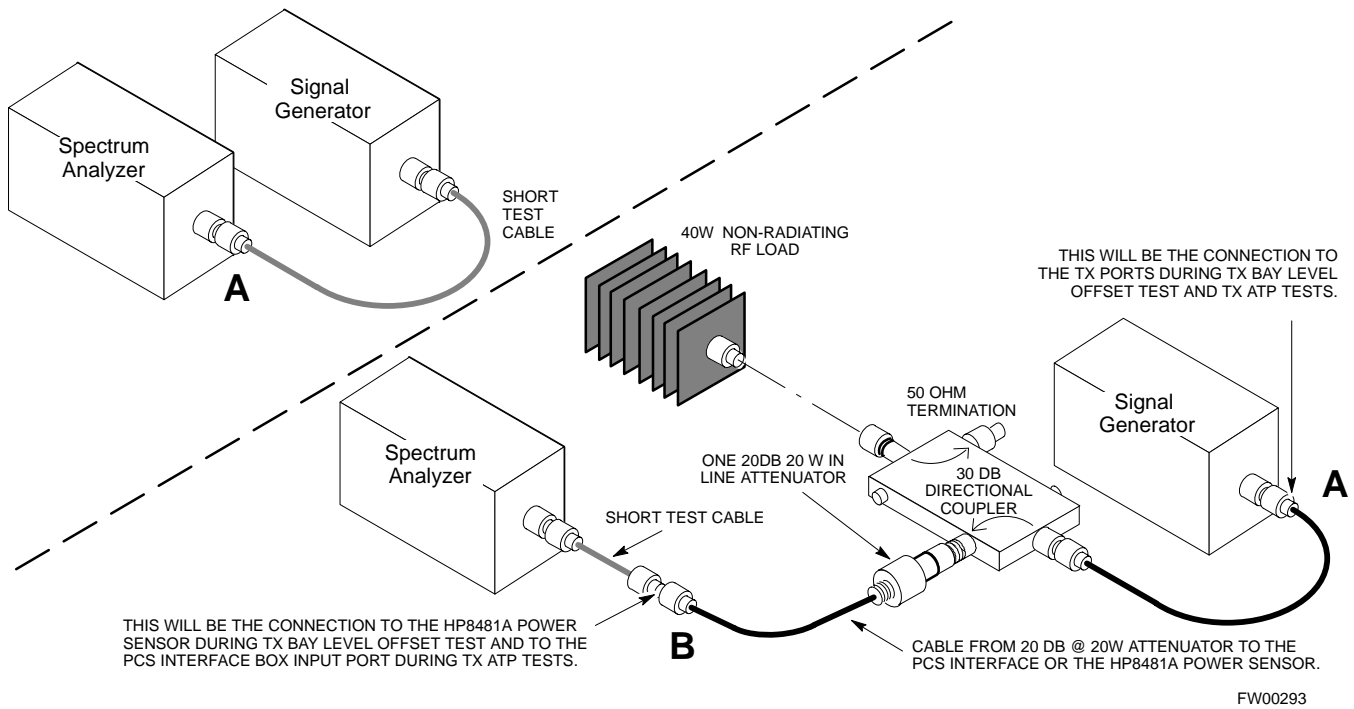
Table 3-28: Cable Calibration		
✓	Step	Action
	1	From the Util menu, select Cable Calibration . A Cable Calibration window is displayed.
	2	Enter a channel number(s) in the Channels box. NOTE Multiple channels numbers must be separated with a comma, no space (i.e., 200,800). When two or more channels numbers are entered, the cables are calibrated for each channel. Interpolation is 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 pick list.
	4	Click OK . Follow the direction displayed for each step. A status report window displays the results of the cable calibration.

Calibrating TX Cables Using a Signal Generator and Spectrum Analyzer

Follow the procedure in Table 3-29 to calibrate the TX cables using a signal generator and spectrum analyzer. Refer to Figure 3-20 for a diagram of the signal generator and spectrum analyzer.

Table 3-29: Calibrating TX Cables Using Signal Generator and Spectrum Analyzer		
✓	Step	Action
	1	Connect a short test cable between the spectrum analyzer and the signal generator.
	2	Set signal generator to 0 dBm at the customer frequency of: <ul style="list-style-type: none"> - 869-894 MHz for 800 MHz CDMA - 1930-1990 MHz for North American PCS. - 1840-1870 MHz for Korean PCS
	3	Use a spectrum analyzer to measure signal generator output (see Figure 3-20, A) and record the value.
	4	Connect the spectrum analyzer's short cable to point B , (as shown in the lower right portion of the diagram) to measure cable output at customer frequency of: <ul style="list-style-type: none"> - 869-894 MHz for 800 MHz CDMA - 1930-1990 MHz for North American PCS. - 1840-1870 MHz for Korean PCS Record the value at point B .
	5	Calibration factor = A - B Example: Cal = -1 dBm - (-53.5 dBm) = 52.5 dB NOTE The short cable is used for <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 equipment setup, as is, to ensure test procedures use the correct calibration factor.

Figure 3-20: Calibrating Test Equipment Setup for TX BLO and TX ATP Tests



Calibrating RX Cables Using a Signal Generator and Spectrum Analyzer

Follow the procedure in Table 3-30 to calibrate the RX cables using the signal generator and spectrum analyzer. Refer to Figure 3-21, if required.

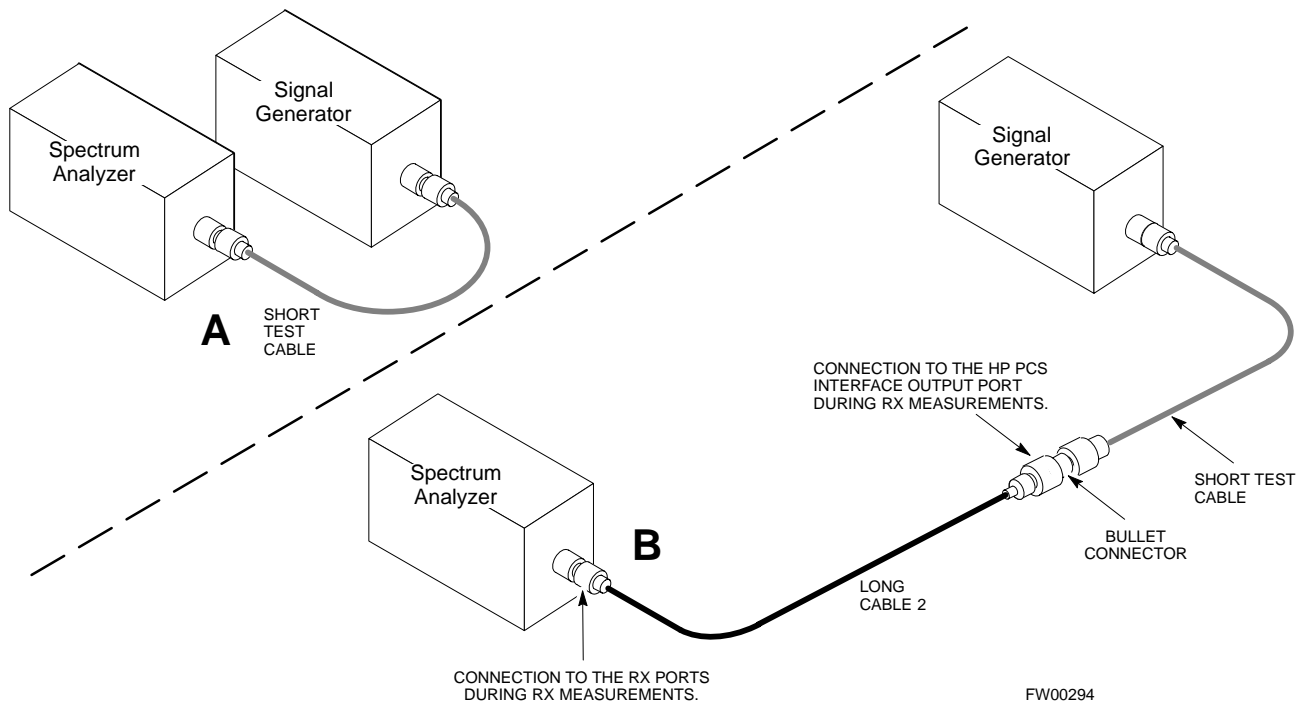
Step	Action
1	Connect a short test cable to the spectrum analyzer and connect the other end to the Signal Generator.
2	Set signal generator to -10 dBm at the customer's RX frequency of: <ul style="list-style-type: none"> - 824-849 for 800 MHz CDMA - 1850-1910 MHz band for North American PCS - 1750-1780 MHz for Korean PCS
3	Use spectrum analyzer to measure signal generator output (see Figure 3-21, A) and record the value for A .
4	Connect the test setup, as shown in the lower portion of the diagram to measure the output at the customer's RX frequency of: <ul style="list-style-type: none"> - 824-849 for 800 MHz CDMA - 1850-1910 MHz band for North American PCS - 1750-1780 MHz for Korean PCS Record the value at point B .

... continued on next page

Table 3-30: Calibrating RX Cables Using a Signal Generator and Spectrum Analyzer		
Step	Action	
5	Calibration factor = A - B Example: Cal = -12 dBm - (-14 dBm) = 2 dBm NOTE The short test cable is used for test equipment setup calibration <i>only</i> . It is not be part of the final test setup. After calibration is completed, <i>do not</i> re-arrange any cables. Use the equipment setup, as is, to ensure test procedures use the correct calibration factor.	

Figure 3-21: Calibrating Test Equipment Setup for RX ATP Test

3



Setting Cable Loss Values

Cable loss values for the TX and RX test cable configurations are normally set by accomplishing cable calibration using the applicable test equipment. The resulting values are stored in the cable loss files. The cable loss values can also be set/changed manually. Follow the procedure in Table 3-31 to set cable loss values.

Prerequisites

- Logged into the BTS

Table 3-31: Setting Cable Loss Values

Step	Action
1	Click on the Util menu.
2	Select Edit>Cable Loss>TX or RX . A data entry pop-up window appears.
3	To add a new channel number, click on the Add Row button, then click in the Channel # and Loss (dBm) columns and enter the desired values.
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	To save displayed values, click on the Save button.
7	To exit the window, click on the Dismiss button. Values entered/changed after the Save button was used are not saved. NOTE <ul style="list-style-type: none"> • If cable loss values exist for two different channels, the LMF will interpolate for all other channels. • Entered values are used by the LMF as soon as they are saved. You do not have to logout and login.

Setting Coupler Loss Values

If an in-service coupler is installed, the coupler loss (e.g., 30 dB) must be manually entered so it will be included in the LMF TX calibration and audit calculations and RX FER Test. Follow the procedure in Table 3-32 to set coupler loss values.

Prerequisites

- Logged into the BTS.

Table 3-32: Setting Coupler Loss Value

Step	Action
1	Click on the Util menu.
2	Select Edit>Coupler Loss>TX or RX . A data entry pop-up window appears.
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	Click on the Save button to save displayed values.
6	Click on the Dismiss button to exit the window. Values entered/changed after the Save button was used are not saved. NOTE <ul style="list-style-type: none"> • The In-Service Calibration check box in the Tools>Options>BTS Options tab must be checked before entered coupler loss values are used by the TX calibration and audit functions or RX FER test. • Entered values are used by the LMF as soon as they are saved. You do not have to logout and login.

Bay Level Offset Calibration

Introduction to Bay Level Offset Calibration

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

RF Path Bay Level Offset Calibration

Calibration identifies the accumulated gain in every transmit path (BBX slot) at the BTS site and stores that value in a BLO database calibration table in the LMF. The BLOs are subsequently downloaded to each BBX.

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

For expansion frames each receive path starts at the BTS RX port of the cell site starter frame, travels through the frame-to-frame expansion cable, and terminates at a backplane BBX slot of the expansion frame. The transmit path starts at a BBX backplane slot of the expansion frame, travels through the LPA, and terminates at a BTS TX antenna port of the same expansion frame.

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

At omni sites, BBX slots 1 and 13 (redundant) are tested. At sector sites, BBX slots 1 through 12, and 13 (redundant) are tested. Only those slots (sectors) *actually equipped* in the current CDF are tested, regardless of physical BBX board installation in the slot.

When to Calibrate BLOs

Calibration of BLOs is required:

- After initial BTS installation
- Once each year
- After replacing any of the following components or associated interconnecting RF cabling:
 - BBX board
 - C-CCP shelf
 - CIO card
 - CIO to LPA backplane RF cable
 - LPA backplane
 - LPA
 - TX filter / TX filter combiner
 - TX thru-port cable to the top of frame

TX Path Calibration

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

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

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

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

- This procedure can be bypassed on operational sites that are due for periodic optimization.
- Prior to testing, view the CDF file to verify the correct BBX slots are equipped. Edit the file as required to include BBX slots not currently equipped (per Systems Engineering documentation).

BLO Calibration Data File

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

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

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

Slot 1 contains the calibration data for the 12 BBX slots. Slot 20 contains the calibration data for the redundant BBX. Each BBX slot header block contains:

- A creation Date and Time - broken down into separate parameters of createMonth, createDay, createYear, createHour, and createMin.
- The number of calibration entries - fixed at 720 entries corresponding to 360 calibration points of the CAL file including the slot header and actual calibration data.

- The calibration data for a BBX is organized as a large flat array. The array is organized by branch, sector, and calibration point.
 - The first breakdown of the array indicates which branch the contained calibration points are for. The array covers transmit, main receive and diversity receive offsets as follows:

Range	Assignment
C[1]-C[240]	Transmit
C[241]-C[480]	Main Receive
C[481]-C[720]	Diversity Receive

NOTE Slot 385 is the BLO for the RFDS.

- The second breakdown of the array is per sector. Configurations supported are Omni, 3-sector or 6-sector.

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

BBX	Sectorization	TX	RX	RX Diversity	
7	6 Sector, 2nd Carrier	3-Sector, 2nd Carrier	C[121]-C[140]	C[361]-C[380]	C[601]-C[620]
8			C[141]-C[160]	C[381]-C[400]	C[621]-C[640]
9			C[161]-C[180]	C[401]-C[420]	C[641]-C[660]
10		3-Sector, 4th Carrier	C[181]-C[200]	C[421]-C[440]	C[661]-C[680]
11			C[201]-C[220]	C[441]-C[460]	C[681]-C[700]
12			C[221]-C[240]	C[461]-C[480]	C[701]-C[720]

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

Example:

$C[1]=384,$ *odd cal entry* = 1 “calibration point”

$C[2]=19102,$ *even cal entry*

$C[3]=777,$

$C[4]=19086,$

.

.

$C[19]=777,$

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

- When the BBX is loaded with image = data, the cal file data for the BBX is downloaded to the device in the order it is stored in the cal file. TxCal data is sent first, C[1] - C[240]. Sector 1’s ten calibration points are sent (C[1] - C[20]) followed by sector 2’s ten calibration points (C[21] - C[40]), etc. The RxCal data is sent next (C[241] - C[480]), followed by the RxDCal data (C[481] - C[720]).
- Temperature compensation data is also stored in the cal file for each set.

Test Equipment Setup: RF Path Calibration

Follow the procedure in Table 3-35 to set up test equipment.

Table 3-35: Test Equipment Setup (RF Path Calibration)

Step	Action
	<p>NOTE Verify the GPIB controller is properly connected and turned on.</p>
	<p>! CAUTION To prevent damage to the test equipment, all transmit (TX) test connections must be via the 30 dB directional coupler for 800 MHz with an additional 20 dB in-line attenuator for 1.7/1.9 GHz.</p>
1	<p>Connect the LMF computer terminal to the BTS LAN A connector on the BTS (if you have not already done so). Refer to the procedure in Table 3-2 on page 3-6.</p> <ul style="list-style-type: none"> • If required, calibrate the test equipment per the procedure in Table 3-26 on page 3-60. • Connect the test equipment as shown in Figure 3-12 on page 3-50.

3

TX Path Calibration

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

NOTE If both the `BTS-x.cdf` and `CBSC-x.cdf` files are current, all information will be correct on the LMF. If not, the carrier and channel will have to be set for each test.

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

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

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

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

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

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

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

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

Single-sided BLO

Another option that appears in the pull-down menu is **Single-sided BLO**. Normally valid BLO values are some value plus-or-minus some offset. The ranges that we currently use for calibration are wider than necessary to accommodate the redundant BBX. The lower half of that range is where non-redundant BBXs should be. When **Single-sided BLO** is selected, the result is only considered a success if it is in the lower half of the range. If it was normally a success from 37-47 (which is 42 ± 5), **Single-sided BLO** would make it a success only if the result was from 37-42. To get the more stringent conditions, the operator checks **Single-sided BLO** when calibrating non-redundant transceivers. **Single-sided BLO** carries the likelihood of more failures. This option should only be used by experienced CFEs.

Test Pattern

The **TESTS_TX CAL** menu has a **Test Pattern** pull-down menu. This menu has the following choices:

- **Pilot** (default) - performs tests using a pilot signal only. This pattern should be used when running in-service tests. It only requires a BBX to do the test.
- **Standard** - performs the tests using pilot, synch, paging and six traffic channels. This pattern should be used on all non-in-service tests. **Standard** requires a BBX and an MCC. **Standard** uses gain values specified by the IS97 standard.
- **CDFPilot** - performs the tests using the pilot signal, however, the gain is specified in the CDF file. Advanced users may use **CDFPilot** to generate a Pilot pattern using the value specified by the PilotGain parameter in the CDF file instead of a pre-determined value.

- **CDF** - performs the tests using pilot, synch, paging and six traffic channels, however, the gain for the channel elements is specified in the CDF file. Advanced users may use **CDF** to generate a standard pattern. Instead of using the values specified by IS97, the settings for the following CDF parameters are used:
 - PilotGain
 - PchGain
 - SchGain
 - NomGain1Way

Prerequisites

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

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

Connect the test equipment as shown in Figure 3-12 and follow the procedure in Table 3-36 to perform the TX calibration test.

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

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

Follow the procedure in Table 3-36 to perform the TX calibration test.

Table 3-36: BTS TX Path Calibration		
✔	Step	Action
	1	Select the BBX(s) to be calibrated. NOTE If STANDARD or CDF is selected for TEST PATTERN , then at least one MCC must be also selected.
	2	From the Tests menu, select TX>TX Calibration or All Cal/Audit .
	3	Select the appropriate carrier(s) displayed in the Channels/Carrier pick list. (Press and hold the <Shift> or <Ctrl> key to select multiple items.)
	4	Type the appropriate channel number in the Carrier n Channels box.
	5	Select Verify BLO (default) or Single-sided BLO . NOTE Single-sided BLO is only used when checking non-redundant transceivers.

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Table 3-36: BTS TX Path Calibration

✔	Step	Action
	6	From the Test Pattern pick list, select a test pattern. NOTE <ul style="list-style-type: none"> • Selecting Pilot (default) performs tests using a pilot signal only. • Selecting Standard performs tests using pilot, synch, paging and six traffic channels. This requires an MCC to be selected. • Selecting CDFPilot performs tests using a pilot signal, however, the gain for the channel elements is specified in the CDF file. • Selecting CDF performs tests using pilot, synch, paging and six traffic channels, however, the gain for the channel elements is specified in the CDF file.
	7	Click on OK .
	8	Follow the cable connection directions as they are displayed. A status report window displays the test results.
	9	Click on Save Results or Dismiss to close the status report window.

Exception Handling

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

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

Download BLO Procedure

After a successful TX path calibration, download the bay level offset (BLO) calibration file data to the BBXs. BLO data is extracted from the CAL file for the Base Transceiver Subsystem (BTS) and downloaded to the selected BBX devices.

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

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- BBXs being downloaded are OOS-RAM (yellow).
- TX calibration is successfully completed.

Follow the procedure in Table 3-37 to download the BLO data to the BBXs.

Table 3-37: Download BLO		
✔	Step	Action
	1	Select the BBX(s) to be downloaded.
	2	From the Device menu, select Download>BLO . A status report window displays the result of the download. NOTE Selected device(s) do not change color when BLO is downloaded.
	3	Click on 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 offsets. The calibration audit procedure measures the path gain or loss of every BBX transmit path at the site. In this test, actual system tolerances are used to determine the success or failure of a test. The same external test equipment set up is used.

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

TX Path Audit

Perform the calibration audit of the TX paths of all equipped BBX slots per the procedure in Table 3-38

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

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

3

TX Audit Test

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

Prerequisites

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

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

Connect the test equipment as shown in Figure 3-12 or Figure 3-13. Follow the procedure in Table 3-38 to perform the BTS TX Path Audit test.

Table 3-38: BTS TX Path Audit

✔	Step	Action
	1	Select the BBX(s) to be audited. NOTE If STANDARD or CDF is selected for Test Pattern , then at least one MCC must be also selected.
	2	From the Tests menu, select TX>TX Audit .
	3	Select the appropriate carrier(s) displayed in the Channels/Carrier pick list. Press and hold the <Shift> or <Ctrl> key to select multiple items.
	4	Type the appropriate channel number in the Carrier n Channels box.
	5	If at least one MCC was selected in Step 1, 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.
	6	Select Verify BLO (default) or Single-sided BLO .

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Table 3-38: BTS TX Path Audit

✔	Step	Action
		<p>NOTE Single-sided BLO is only used when checking non-redundant transceivers.</p>
	7	<p>From the Test Pattern pick list, select a test pattern.</p> <p>NOTE</p> <ul style="list-style-type: none"> • Selecting Pilot (default) performs tests using a pilot signal only. • Selecting Standard performs tests using pilot, synch, paging and six traffic channels. This requires an MCC to be selected. • Selecting CDFPilot performs tests using a pilot signal, however, the gain for the channel elements is specified in the CDF file. • 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.
	8	Click on OK .
	9	<p>Follow the cable connection directions as they are displayed.</p> <p>A status report window displays the test results.</p>
	10	Click on Save Results or Dismiss to close the status report window.

Exception Handling

In the event of a failure, the calibration procedure displays a **FAIL** message in the Status Report window and provides information in the **Description** field. Recheck the test setup and connection and re-run the test. If the tests fail again, note specifics about the failure, and refer to Chapter 6, *Troubleshooting*.

3

All Cal/Audit Test

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

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

Prerequisites

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

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

Follow the procedure in Table 3-39 to perform the All Cal/Audit test.

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

Table 3-39: All Cal/Audit Test

✔	Step	Action
	1	Select the BBX(s) to be tested. NOTE If STANDARD , CDFPilot , or CDF is selected for the TEST PATTERN , then at least one MCC must be also selected.
	2	From the Tests menu, select All Cal/Audit .
	3	Select the appropriate carrier(s) displayed in the Channels/Carrier pick list. Press and hold the <Shift> or <Ctrl> key to select multiple items.
	4	Type the appropriate channel number in the Carrier n Channels box.
	5	If at least one MCC was selected in Step1 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.
	6	Select Verify BLO or Single-sided BLO . NOTE Single-sided BLO is only used when checking non-redundant transceivers.

Table 3-39: All Cal/Audit Test

✔	Step	Action
	7	From the Test Pattern pick list, select a test pattern. NOTE <ul style="list-style-type: none"> • Selecting Pilot (default) performs tests using a pilot signal only. • Selecting Standard performs tests using pilot, synch, paging and 6 traffic channels. This requires an MCC to be selected. • Selecting CDFPilot performs tests using a pilot signal, however, the gain for the channel elements is specified in the CDF file. • Selecting CDF performs tests using pilot, synch, paging and 6 traffic channels, however, the gain for the channel elements is specified in the CDF file.
	8	Click on OK .
	9	Follow the cable connection directions as they are displayed. A status report window displays the test results.
	10	Click on Save Results or Dismiss to close the status report window.

3

Create CAL File

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

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

WARNING The user is not encouraged to edit the CAL file 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 is lost.

Prerequisites

Before running this test, the following should be done:

- LMF is logged into the BTS.
- BBXs are OOS_RAM with BLO downloaded.

Table 3-40: Create CAL File

✓	Step	Action
	1	Select the applicable BBXs. NOTE The CAL file is only updated for the selected BBXs.
	2	Click on the Device menu.
	3	Click on the Create Cal File menu item. A status report window displays the results of the action.
	4	Click OK to close the status report window.

RFDS Set-up and Calibration

RFDS Description

NOTE	The RFDS is not available for the -48 V BTS at the time of this publication.
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The optional RFDS performs RF tests of the site from the CBSC or from an LMF. The RFDS consists of the following elements:

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

For complete information regarding the RFDS, refer to the *CDMA RFDS Hardware Installation* manual and *CDMA RFDS User's Guide*.

The LMF provides the following functions for RFDS equipment:

- TX and RX Calibration
- Dekey Test Subscriber Unit (TSU)
- Download Test Subscriber Interface Card (TSIC)
- Forward Test
- Key TSU
- Measure TSU Receive Signal Strength Indication (RSSI)
- Ping TSU
- Program TSU Number Assignment Module (NAM)
- Reverse Test
- RGLI actions (for GLI based RFDS units)
- Set ASU
- Status TSU

RFDS Parameter Settings

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 3-41 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
(9600 system 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 supporting the LMF may be used to open any text files to verify, view, or modify data.

Table 3-41: RFDS Parameter Settings

Step	Action
	<p>NOTE Log out of the BTS prior to performing this procedure.</p>
1	<p>Using a text editor, verify the following fields are set correctly in the <code>bts-#.cdf</code> file (1 = GLI based RFDS; 2 = Cobra RFDS).</p> <p>EXAMPLE:</p> <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> <p>NOTE The above is an example of the <code>bts-#.cdf</code> file that should have been generated by the OMC and copied to the LMF. These fields will have been set by the OMC if the RFDSPARM database is modified for the RFDS.</p>
2	<p>Save and/or quit the editor. If any changes were made to these fields, data will need to be downloaded to the GLI (see Step 3, otherwise proceed to Step 4).</p>
3	<p>To download to the GLI, click on the Device menu and select the Download>Code/Data menu item (<i>selected devices do not change color when data is downloaded</i>).</p> <p>A status report window displays the status of the download. Click OK to close the status report window.</p> <p>! CAUTION After downloading data to the GLI, the RFDS LED slowly begins flashing red and green for approximately 2-3 minutes. DO NOT attempt to perform any functions with the RFDS until the LED remains green.</p>
4	<p>Status the RFDS TSU.</p> <p>A status report window displays the software version number for the TSIC and SUA.</p> <p>NOTE If the LMF yields an error message, check the following:</p> <ul style="list-style-type: none"> • Ensure the AMR cable is correctly connected from the BTS to the RFDS. • Verify the RFDS has power. • Verify the RFDS status LED is green. • Verify fields in the <code>bts-#.cdf</code> file are correct (see Step 1). • Status the MGLI and ensure the device is communicating (via Ethernet) with the LMF, and the device is in the proper state (INS).

3

RFDS TSU NAM Programming

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. The TSU NAM should be configured the same way that any local mobile subscriber would use.

NOTE	The user will only need to program the NAM for the initial install of the RFDS.
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The NAM must be programmed into the SUA before it can receive and process test calls, or be used for any type of RFDS test.

Explanation of Parameters used when Programming the TSU NAM

Table 3-42 defines the parameters used when editing the tsu.nam file.

Table 3-42: 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 used in operation of the system.
Lock_Code Security_Code Service_Level Station_Class_Mark	Do <i>not</i> change.
IMSI_11_12 IMSI_MCC	These fields can be 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_1 Phone Number	This field is the phone number assigned to the mobile. The ESN and MIN should be entered into the switch as well. NOTE: This field is different from the TestOrigDN field in the bts.cdf file. The MIN is the phone number of the RFDS subscriber, and the TestOrigDN is the number the subscriber calls.

Valid NAM Ranges

Table 3-43 provides the valid NAM field ranges. If any of the fields are missing or out of range, the RFDS errors out.

Table 3-43: 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	0	7
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 is only used for RFDS tests and is required if an RFDS is installed. Antenna map data does not have to be entered if an RFDS is not installed. The antenna map data must be entered manually. Perform the procedure in Table 3-44 to set the Antenna Map Data.

Prerequisite

- Logged into the BTS

Table 3-44: Set Antenna Map Data	
Step	Action
1	Click on the Util menu.
2	Select Edit>Antenna Map . A data entry pop-up window appears with a tab for TX and a tab for RX .
3	Enter/edit values as required for each carrier. NOTE Refer to the Util >Edit-antenna map LMF help screen for antenna map examples.
4	Click on the Save button to save displayed values.

... continued on next page

Table 3-44: Set Antenna Map Data

Step	Action
	NOTE Entered values are used by the LMF as soon as they are saved. You do not have to logout and login.
5	Click on the Dismiss button to exit the window. NOTE Values entered/changed after using the Save button are not saved.

Set RFDS Configuration Data

If an RFDS is installed, the RFDS configuration data must be manually entered. Perform the procedure in Table 3-45 to set the RFDS Configuration Data.

Prerequisite

- Logged into the BTS.

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

Table 3-45: Set RFDS Configuration Data

Step	Action
1	Click on the Util menu.
2	Select Edit>RFDS Configuration . A data entry pop-up window appears with a tab for TX and a tab for RX .
3	To add a new antenna number, click on the Add Row button, then click in the other columns and 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 Util >Edit-RFDS Configuration LMF help screen for RFDS configuration data examples.
5	To delete a row, click on the row and click on the Delete Row button.
6	To save displayed values, click on the Save button. NOTE • Entered values are used by the LMF as soon as they are saved. You do not have to logout and login.
7	To exit the window, click on the Dismiss button . NOTE Values entered/changed after using the Save button are not saved.

RFDS Calibration

The RFDS TX and RX antenna paths must be calibrated to ensure peak performance. The RFDS calibration option calibrates the RFDS TX and RX paths.

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.

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 XCVR. A CDMA signal at the same power level measured by the BTS XCVR is then injected at the RX antenna directional coupler by the RFDS keyed power level and the power level measured at the BTS XCVR is the RFDS RX calibration offset value.

The TX and RX RFDS calibration offset values are written to the CAL file.

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- BBXs are OOS_RAM.
- Cable calibration has been performed
- TX calibration has been performed and BLO has been downloaded for the BTS.
- Test equipment has been connected correctly for a TX calibration.
- Test equipment has been selected and calibrated.

Follow the procedure in Table 3-46 to calibrate the TX and RX antenna paths.

Table 3-46: RFDS Calibration Procedure

✓	Step	Action
	1	Select the BTS tab.
	2	Select the B (for BTS) radio button.
	3	Select the BBX to use during the test.
	4	Select the RFDS menu.
	5	Select the RFDS Calibration menu item.
	6	Select the appropriate direction (TX or RX) in the Direction pick list.
	7	Type the appropriate channel number(s) in the Channel box. NOTE Separate channel numbers with a comma or dash (no spaces) if using more than one channel number (e.g., 247,585,742 or 385-395 for numbers through and including).

. . . continued on next page

Table 3-46: RFDS Calibration Procedure

✓ Step	Action
8	Select the appropriate carrier(s) in the Carriers pick list. NOTE Use the <Shift> or <Ctrl> key to select multiple carriers.
9	Select the appropriate Rx branch (Main , Diversity or Both) in the RX Branch pick list.
10	Click OK . A status report window is displayed, followed by a Directions pop-up window.
11	Follow the cable connection directions as they are displayed. A status report window displays the results of the actions.
12	Click on the OK button to close the status report window.
13	Click on the MGLI .
14	Download updated RFDS offset data to the selected GLI device by clicking on Device>Download>Data from the tab menu bar and pull-down menu.

Program TSU NAM

Follow the procedure in Table 3-47 to program the 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

Ensure the following prerequisites have been met before proceeding:

- MGLI is INS.
- TSU is powered up and has a code load.

Table 3-47: Program the TSU NAM

Step	Action
1	Select the RFDS tab.
2	Select the SUA (Cobra RFDS) or TSU (GLI based RFDS).
3	Click on the TSU menu.
4	Click on the Program TSU NAM menu item.
5	Enter the appropriate information in the boxes (see Table 3-42 and Table 3-43).
6	Click on the OK button to display the status report.
7	Click on the OK button to close the status report window.

BTS Redundancy/Alarm Testing

Objective

This section tests the redundancy options that could be included in the cell site. These tests verify, under a fault condition, that all modules equipped with redundancy switch operations to their redundant partner and resume operation. An example would be to pull the currently active CSM and verify the standby CSM takes over distribution of the CDMA reference signal.

Redundancy covers many BTS modules. Confirm the redundant options included in the BTS, and proceed as required. If the BTS has *only* basic power supply redundancy, the tests and procedures detailed in the following tables should be bypassed.

- Table 3-50. Miscellaneous Alarm Tests (BTS Frame)
- Table 3-51. BBX Redundancy Tests (BTS Frame)
- Table 3-52. CSM, GPS, & LFR/HSO Redundancy Alarm Tests
- Table 3-53. LPA Redundancy Test
- Table 3-54. MGLI/GLI Redundancy Test

During redundancy verification of the test, alarms reported by the master GLI (displayed via the alarm monitor) will also be verified/noted.

Test Equipment

The following pieces of test equipment are required to perform this test:

- LMF
- Communications Test Set

Redundancy/Alarm Test

Perform each of the following tests to verify BTS redundancy and to confirm all alarms are received and reported by the BTS equipment. The procedures should be performed on the following modules/boards:

- Power supply/converter modules in all frames
- Distribution shelf modules in the BTS frame
- C-CCP shelf modules in the BTS frame (except MCCs)
- LPA modules in the BTS frame
- AMR Customer defined input/output tests

Test Equipment Setup

Follow the procedure in Table 3-48 to set up test equipment:

NOTE	All alarm tests are performed using TX antenna 1
-------------	--

Table 3-48: Test Equipment Setup for Redundancy/Alarm Tests	
Step	Action
1	Interface the LMF computer to the BTS LAN A connector on the BTS frame (refer to Table 3-2, page 3-6).
2	Login to the BTS.
3	Set up test equipment for TX Calibration at TXOUT1 (see Figure 3-12). NOTE <i>If site is not equipped for redundancy</i> , remove all GLI and BBX boards installed in any redundant slot positions at this time.
4	Display the alarm monitor by selecting Util>Alarm Monitor .
5	Unequip all customer defined AMR alarms reported via the AMR Alarm connector (A & B) by clicking on MGLI , then selecting Device>Set Alarm Relays>Unequipped . NOTE During configuration of MGLI alarm reporting, spurious alarms may report. Allow the BTS to stabilize for 10 seconds. If any alarms are actively being reported after the BTS has stabilized, determine the cause before proceeding further.

3

Power Supply Redundancy

Follow the steps in Table 3-49 to verify redundancy of the power supply modules. Alarms reported by the master GLI (displayed via the alarm monitor) are also verified.

Table 3-49: Power Supply/Converter Redundancy (BTS Frame)	
Step	Action
1	Select the MGLI (highlight) and from the pulldown menu select: Device>BBX/MAWI>Set Redundant Sector>Carrier-#-1-1 Device>BBX/MAWI>Set Pilot Only>Carrier-#-1-1 Device>BBX/MAWI>Set Pilot Gain>Carrier-#-1-1 and Pilot Gain = 262
2	Select (highlight) BBX-1 and from the pulldown menu select Device>BBX/MAWI>Key .
3	Set XCVR gain to 40 and enter the correct XCVR channel number.
4	Remove PS-1 from the power distribution shelf (see Figure 3-22). - Observe that an alarm message is reported via the MGLI as displayed on the alarm monitor. - Verify no other modules went OOS.
5	Re-install PS-1. Observe the alarm clears on the alarm monitor.
6	Repeat steps 4 and 5 for PS-2 and PS-3.

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Table 3-49: Power Supply/Converter Redundancy (BTS Frame)

Step	Action
	NOTE For +27 V systems, skip to step 7 through step 10.
7	On -48 V systems, remove PS-4 (see Figure 3-23). - Observe that an alarm message is reported via the MGLI as displayed on the alarm monitor. - Verify no other modules went OOS.
8	Re-install PS-4. Observe the alarm clears on the alarm monitor.
9	Repeat steps 7 and 8 for PS-5 through PS-9.
10	Verify that all PWR/ALM LEDs are GREEN.
11	Select BBX-1 and Device>BBX/MAWI>Dekey

3

Figure 3-22: SC 4812T C-CCP Shelf

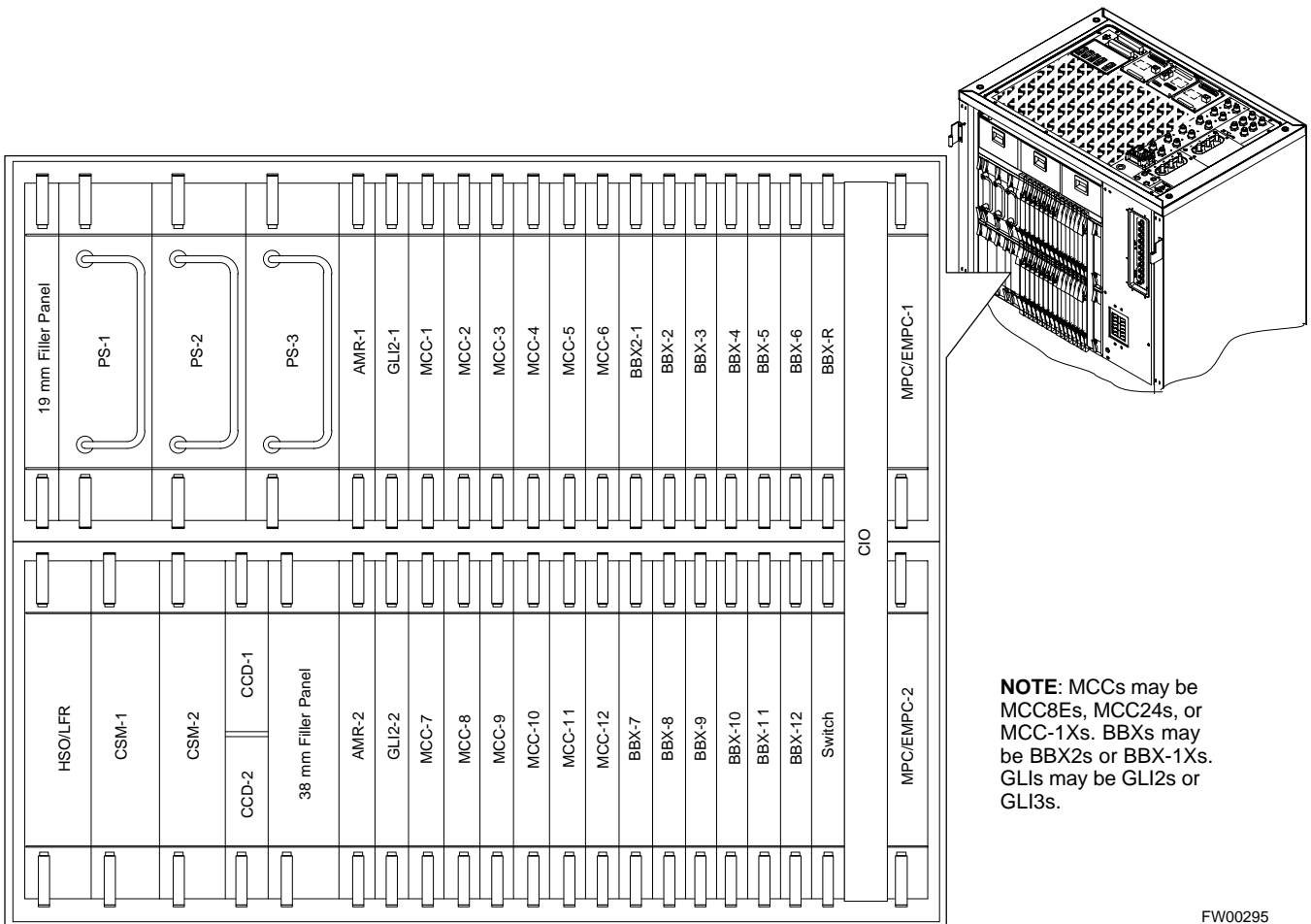
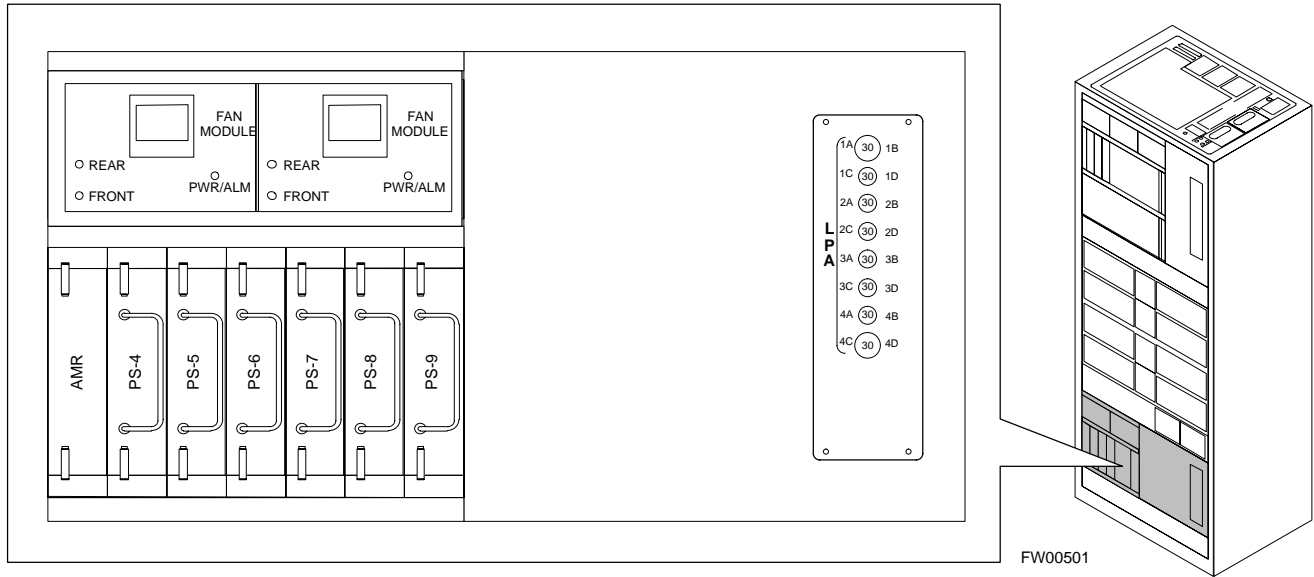


Figure 3-23: -48 V BTS Power Conversion Shelf



Miscellaneous Alarm/Redundancy Tests

Follow the steps in Table 3-50 to verify alarms reported by the master GLI are displayed via the alarm monitor if a BTS frame module failure occurs.

Table 3-50: Miscellaneous Alarm Tests	
Step	Action
1	Select Util>Alarm Monitor to display the alarm monitor window.
2	Perform the following to verify fan module alarms: <ul style="list-style-type: none"> • Unseat a fan module (see Figure 3-24 or Figure 3-25). • Observe an alarm message was reported via the MGLI (as displayed on the alarm monitor). • Replace fan module and verify the alarm monitor reports that the alarm clears. • Repeat for all other fan modules in the BTS frame.
	NOTE Follow Step 3 for Starter Frames and Step 4 for Expansion Frames.
3	<i>Starter Frames Only:</i> Perform the following to verify MPC module alarms. <ul style="list-style-type: none"> • Unseat MPC modules (see Figure 3-22) one at a time. • Observe that an alarm message was reported via the MGLI as displayed on the alarm monitor. • Replace the MPC modules and verify the alarm monitor reports the alarm clears.
4	<i>Expansion Frames Only:</i> Perform the following to verify EMPC module alarms. <ul style="list-style-type: none"> • Unseat EMPC modules (see Figure 3-22) one at a time • Observe that an alarm message was reported via the MGLI as displayed on the alarm monitor. • Replace the EMPC modules and verify the alarm monitor reports that the alarm clears.

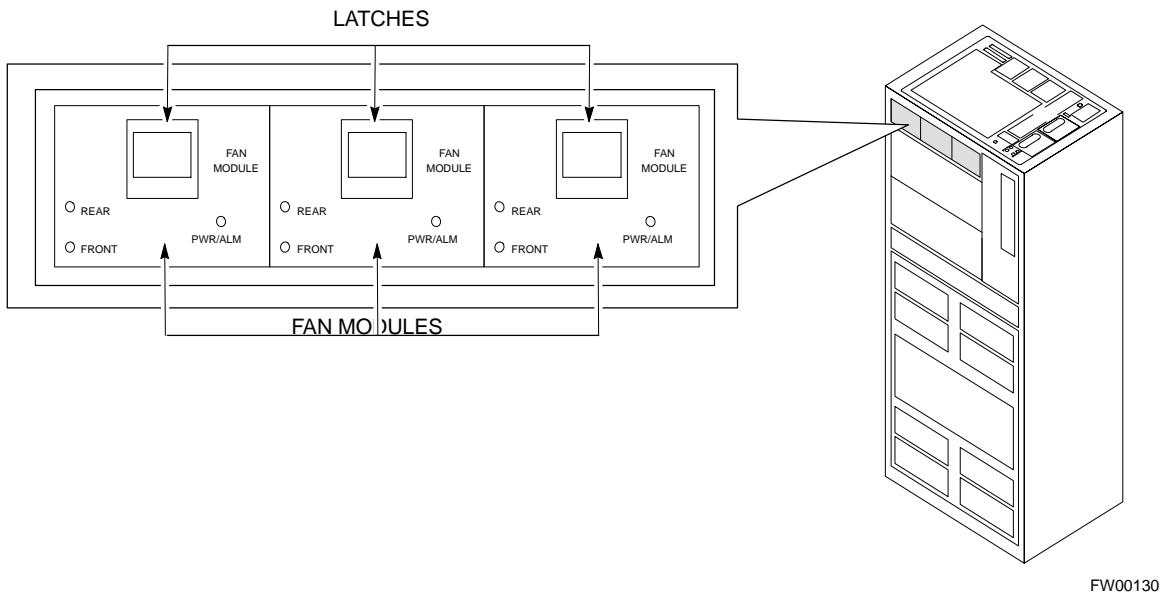
. . . continued on next page

Table 3-50: Miscellaneous Alarm Tests

Step	Action
5	If equipped with AMR redundancy, perform the following to verify AMR module redundancy/alarms. <ul style="list-style-type: none"> • Unseat AMR 2 (see Figure 3-22). • Observe that an alarm message is reported via the MGLI (as displayed on the alarm monitor). • Repeat Steps 1 through 3 and/or 4. • Replace the AMR module and verify the alarm monitor reports that the alarm clears. • Unseat AMR 1 and observe an alarm message was reported via the MGLI (as displayed on the alarm monitor). • Replace the AMR module and verify the LMF reports the alarm has cleared.
	<p>NOTE All PWR/ALM LEDs should be GREEN at the completion of this test.</p>

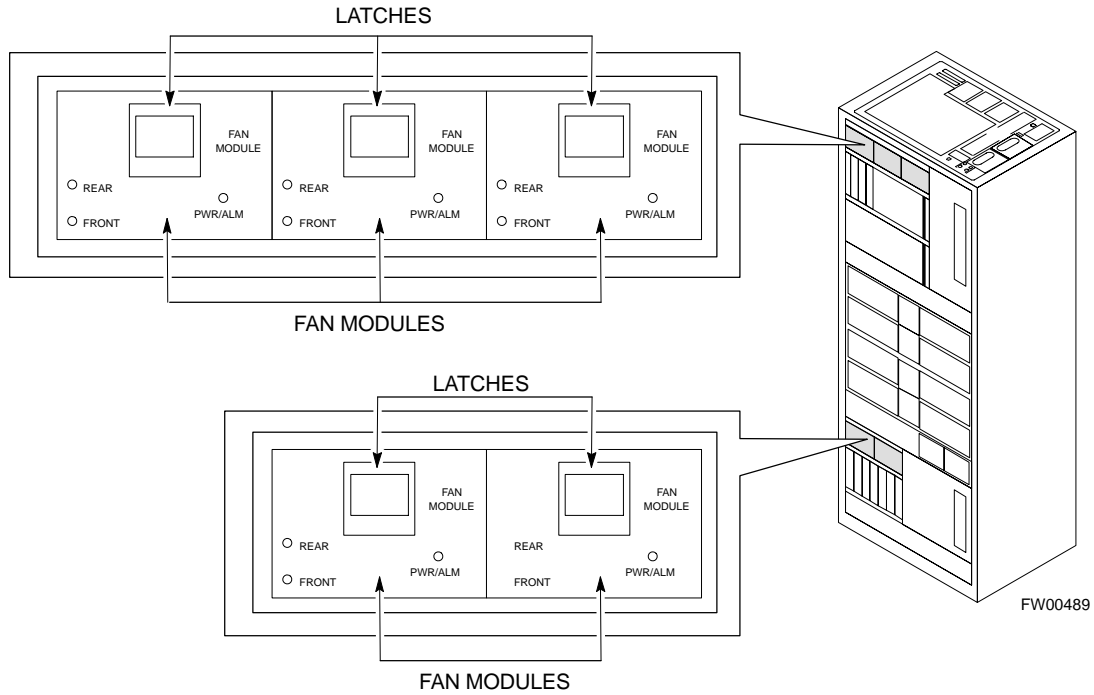
3

Figure 3-24: +27 V BTS C-CCP Fan Modules



FW00130

Figure 3-25: -48 V BTS C-CCP and Power Conversion Shelf Fan Modules



BBX Redundancy

Follow the steps in Table 3-51 to verify redundancy of the BBXs in the C-CCP shelf. Alarms reported by the master GLI (displayed via the alarm monitor) are also verified. *This test can be repeated for additional sectors at the customer's discretion.*

Table 3-51: BBX Redundancy Alarms

Step	Action
	<p>Δ WARNING</p> <p>Any BBXs enabled will immediately key-up. Before enabling any BBX, <i>always verify</i> that the TX output assigned to the BBX is terminated into a 50 W non-radiating RF load! Failure to do so could result in serious personal injury and/or damage to the equipment.</p>
1	Enable the primary , then the redundant BBX assigned to ANT 1 by selecting the BBX and Device>BBX/MAWI>Key .
2	Observe that primary BBXs key up, and a carrier is present at each respective frequency.
3	Remove the primary BBX.
4	Observe a carrier is still present. The Redundant BBX is now the active BBX for Antenna 1.
5	Replace the primary BBX and reload the BBX with code and data.
6	Re-enable the primary BBX assigned to ANT 1 and observe that a carrier is present at each respective frequency.
7	Remove the redundant BBX and observe a carrier is still present.

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3

Table 3-51: BBX Redundancy Alarms

Step	Action
8	The Primary BBX is now the active BBX for ANT 1.
9	Replace the redundant BBX and reload the BBX with code and data.
10	Re-enable the redundant BBX assigned to ANT 1 and observe that a carrier is present at each respective frequency:
11	De-key the Xcvr by selecting Device>BBX/MAWI>Dekey .
12	Repeat Steps 1 through 11 for additional BBXs/antennas, if equipped.

CSM, GPS, & LFR/HSO Redundancy/Alarm Tests

Follow the procedure in Table 3-52 to verify the *manual* redundancy of the CSM, GPS, and LFR/HSO boards. Verification of alarms reported is also covered.

NOTE DO NOT perform the procedure in Table 3-52, unless the site is configured with a LORAN-C or HSO timebase as a backup for the GPS.

Table 3-52: CSM, GPS, & LFR/HSO, Redundancy/Alarm Tests

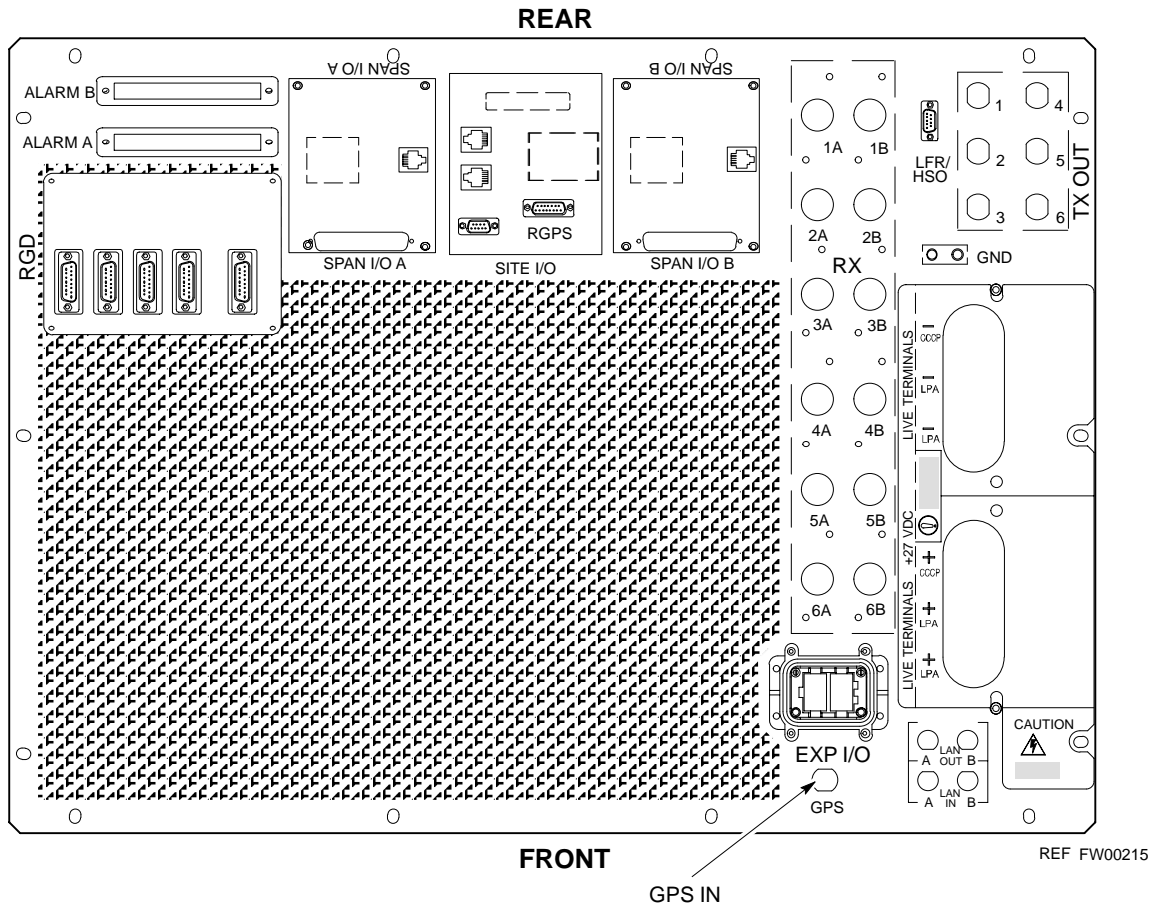
Step	Action
	<p>Δ WARNING</p> <p>Any BBXs enabled will immediately key-up. Before enabling any BBX, <i>always verify</i> that the TX output assigned to the BBX is terminated into a 50 W non-radiating RF load! Failure to do so could result in serious personal injury and/or damage to the equipment.</p>
1	Enable the primary , then the redundant BBXs assigned to ANT 1 by selecting the BBX and Device>BBX/MAWI>Key .
2	Disconnect the GPS antenna cable, located on top of the BTS frame (see Figure 3-26). This forces the LORAN-C LFR or HSO board timebase to become the CDMA timing source.
3	Observe a CDMA timing reference alarm and source change is reported by the alarm monitor.
4	<p>Allow the LFR/HSO to become the active timing source.</p> <ul style="list-style-type: none"> • Verify the BBXs remain keyed and INS. • Verify no other modules went OOS due to the transfer to LFR/HSO reference. • Observe the PWR/ALM LEDs on the CSM 1 front panel are steady GREEN.
5	Reconnect the GPS antenna cable.
6	<p>Allow the GPS to become the active timing source.</p> <ul style="list-style-type: none"> • Verify the BBXs remain keyed and INS. • Verify no other modules went OOS due to the transfer back to the GPS reference. • Observe the PWR/ALM LEDs on CSM 1 are steady GREEN.

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Table 3-52: CSM, GPS, & LFR/HZO, Redundancy/Alarm Tests

Step	Action
7	Disable CSM 1 and enable CSM 2 . <ul style="list-style-type: none"> • Various CSM source and clock alarms are now reported and the site comes down. • Alarms clear when the site comes back up.
8	Allow the CSM 2 board to go INS_ACT . <ul style="list-style-type: none"> • Verify the BBXs are dekeyed and OOS, and the MCCs are OOS_RAM. • Verify no other modules went OOS due to the transfer to CSM 2 reference. • Observe the PWR/ALM LEDs on CSM 2 front panels are steady GREEN. <p>NOTE It can take up to 20 minutes for the CSM to re-establish the GPS link and go INS. MCCs go OOS_RAM.</p>
9	Key BBXs 1 and R and observe a carrier is present.
10	Repeat Steps 2 through 6 to verify CSM source redundancy with CSM 2.
11	<p>* IMPORTANT DO NOT ENABLE the redundant CSM.</p> Disable CSM 2 and enable CSM 1 . <ul style="list-style-type: none"> • Various CSM Source and Clock alarms are reported and the site comes down. • Alarms clear when the site comes back up.
12	De-key the Xcvt by selecting Device>BBX/MAWI>Dekey .
13	Allow the CSM 1 board to go INS_ACT . <ul style="list-style-type: none"> • Verify the BBXs are de-keyed and OOS. • Verify no other modules went OOS due to the transfer to CSM 1 reference. • Observe PWR/ALM LEDs on the CSM 1 front panels are steady GREEN.
14	Disable the primary and redundant BBXs.

Figure 3-26: +27 V SC 4812T Starter Frame I/O Plate



3

LPA Redundancy Test

Follow the procedure in Table 3-53 to verify redundancy of the LPAs.

WARNING *First verify there are no BBX channels keyed BEFORE moving the antenna connection. Failure to do so can result in serious personal injury and/or equipment damage.*

Table 3-53: LPA Redundancy Test

Step	Action
1	From the pulldown menu select: Device>BBX/MAWI>Set Redundant Sector>Carrier-#-1-1 Device>BBX/MAWI>Set Pilot Only>Carrier-#-1-1 Device>BBX/MAWI>Set Pilot Gain> Carrier-#-1-1 and Pilot Gain = 262
2	Key-up the BBX assigned to the LPAs associated with the sector under test (gain = 40).
3	Adjust the communications test set spectrum analyzer, as required, to observe the overall carrier amplitude and IM Shelf and note for reference . These figures will be required later. NOTE See Figure 3-14 for test equipment setup, if required.
4	Push-in and release the breaker supplying the 1st LPA of the pair. NOTE After power is removed, IM suppression takes a few seconds to settle out while compensating for the removal of the 1st LPA. The overall gain decreases by approximately 6 dB. The process must be complete before proceeding.
5	Verify: <ul style="list-style-type: none"> • The other LPA module did not go OOS due to the loss of the LPA. • The overall carrier amplitude is reduced by approximately 6 dB and IM suppression on the analyzer display remains basically unchanged. • LPA fault message is reported via the MGLI and displayed on the alarm monitor.
6	Re-apply power to the LPA module and observe the alarm has cleared on the alarm monitor. NOTE All PWR/ALM LEDs should be GREEN at completion of test.
7	Repeat Steps 4 through 6 to verify the 2nd LPA of the pair.
8	De-key the BBX.
	△ WARNING <i>First verify there are no BBX channels keyed when moving the antenna connection. Failure to do so can result in serious personal injury and/or equipment damage.</i>
9	Repeat Steps 1 through 8 to verify LPAs assigned to sectors 2 and 3 (if equipped). Move the test cable on top of the BTS to TX OUT 2 and TX OUT 3 antenna connectors as required.

MGLI/GLI Redundancy Test

CAUTION This test can *only* be performed when the MM path is established by the MM (not just with LAPD link connected). Attempting to force the GLIs to “hot swap” under alarm monitor control, when isolated from the MM, causes MGLIs to hang up.

Table 3-54: MGLI/GLI Redundancy Test (with MM Connection Established)

Step	Action
	<p>NOTE</p> <ul style="list-style-type: none"> • This test assumes the alarm monitor is NOT connected to the BTS and the T1/E1 span is connected and communication is established with the MM. • BOTH GLIs must be INS before continuing.
1	Verify the BBXs are enabled and a CDMA carrier is present.
2	Identify the primary and redundant MGLI pairs.
3	Pull the MGLI that is <i>currently</i> INS-ACT and has cage control.
4	Observe the BBX remains GREEN, and the redundant MGLI is now active .
5	Verify no other modules go OOS due to the transfer of control to the redundant module.
6	Verify that the BBXs are enabled and a CDMA carrier is present.
7	Reinstall the MGLI and have the OMCR/CBSC place it back in-service.
8	Repeat Steps 1 through 7 to verify the other MGLI/GLI board.

BTS Alarms Testing

Alarm Test Overview

ALARM connectors provide Customer Defined Alarm Inputs and Outputs. The customer can connect BTS site alarm input sensors and output devices to the BTS, thus providing alarm reporting of active sensors as well controlling output devices.

The SC 4812T is capable of concurrently monitoring 36 input signals coming into the BTS. These inputs are divided between 2 Alarm connectors marked '**ALARM A**' and '**ALARM B**' located at the top of the frame (see Figure 3-27). The **ALARM A** connector is always functional; **ALARM B** is functional when an AMR module is equipped in the AMR 2 slot in the distribution shelf. **ALARM A** port monitors input numbers 1 through 18, while **ALARM B** port monitors input numbers 19 through 36 (see Figure 3-28). State transitions on these input lines are reported to the LMF and OMCR as MGLI Input Relay alarms.

ALARM A and **ALARM B** connectors each provide 18 inputs and 8 outputs. If both **A** and **B** are functional, 36 inputs and 16 outputs are available. They may be configured as redundant. The configuration is set by the CBSC.

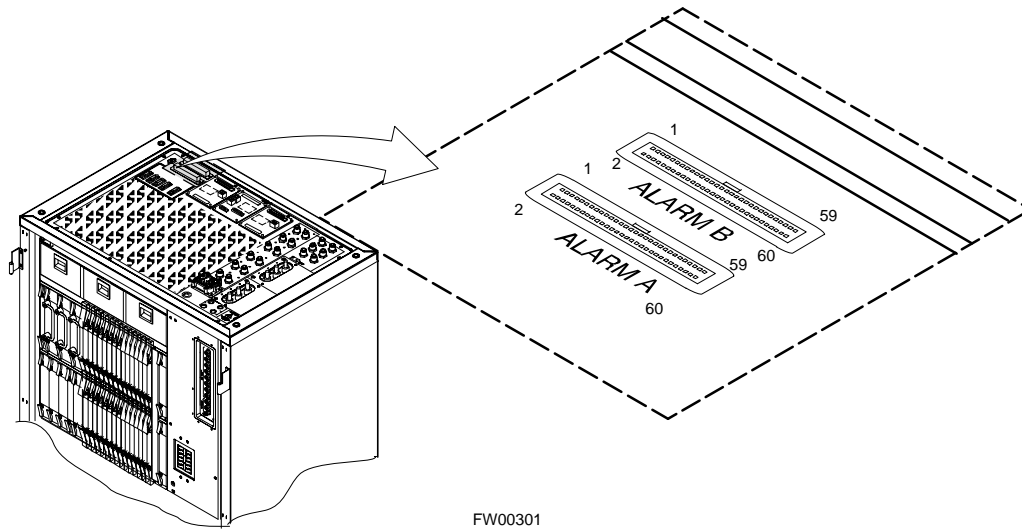
Alarm Reporting Display

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

The following buttons are included:

- The **Options** button allows for a severity level (**Warning**, **Minor**, and **Major**) 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 pauses/stops the display of alarms. When the **Pause** button is clicked the name of the button changes to **Continue**. When the **Continue** button is clicked, the display of alarms continues. Alarms that occur between the time the **Pause** button is clicked and the **Continue** button is clicked are not displayed.
- The **Clear** button clears the Alarm Monitor display. New alarms that occur after the **Clear** button is clicked are displayed.
- The **Dismiss** button dismisses/closes the Alarm Monitor display.

Figure 3-27: Alarm Connector Location and Connector Pin Numbering



3

Purpose

The following procedures verify the customer defined alarms and relay contacts are functioning properly. These tests are performed on all AMR alarms/relays in a sequential manner until all have been verified. Perform these procedures periodically to ensure the external alarms are reported properly. Following these procedures ensures continued peak system performance.

Study the site engineering documents and perform the following tests only after **first** verifying that the AMR cabling configuration required to interconnect the BTS frame with external alarm sensors and/or relays meet requirements called out in the *SC 4812T Series BTS Installation Manual*.

NOTE Motorola **highly** recommends that you read and understand this procedure in its entirety before starting this procedure.

Test Equipment

The following test equipment is required to perform these tests:

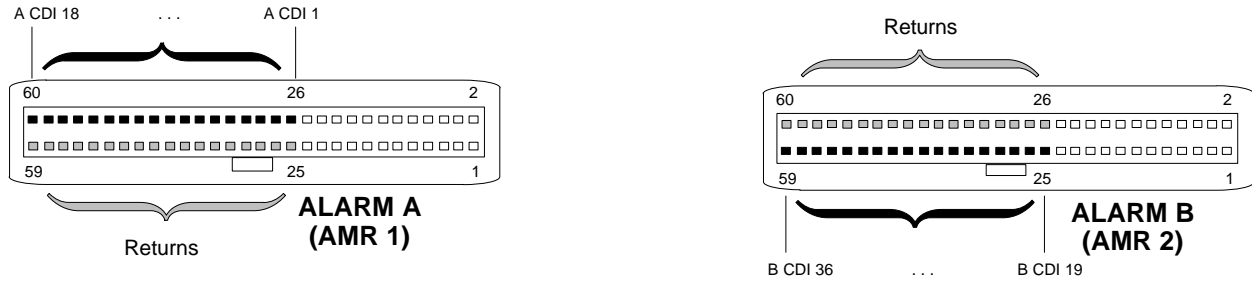
- LMF
- Alarms Test Box (CGDSCMIS00014) -optional

NOTE

Abbreviations used in the following figures and tables are defined as:

- NC = normally closed
- NO = normally open
- COM or C = common
- CDO = Customer Defined (Relay) Output
- CDI = Customer Defined (Alarm) Input

Figure 3-28: AMR Connector Pin Numbering



FW00302

NOTE The preferred method to verify alarms is to follow the Alarms Test Box Procedure, Table 3-55. If not using an Alarm Test Box, follow the procedure listed in Table 3-56.

CDI Alarm Input Verification with Alarms Test Box

Table 3-55 describes how to test the CDI alarm input verification using the Alarm Test Box. Follow the steps as instructed and compare results with the LMF display.

NOTE It may take a few seconds for alarms to be reported. The default delay is 5 seconds. Leave the alarms test box switches in the new position until the alarms have been reported.

Table 3-55: CDI Alarm Input Verification Using the Alarms Test Box

Step	Action
1	Connect the LMF to the BTS and log into the BTS.
2	Select the MGLI.
3	Click on the Device menu.
4	Click on the Set Alarm Relays menu item.
5	Click on Normally Open . A status report window displays the results of the action.
6	Click on the OK button to close the status report window.
7	Set all switches on the alarms test box to the Open position.
8	Connect the alarms test box to the ALARM A connector (see Figure 3-27).
9	Set all of the switches on the alarms test box to the Closed position. An alarm should be reported for each switch setting.
10	Set all of the switches on the alarms test box to the Open position. A clear alarm should be reported for each switch setting.
11	Disconnect the alarms test box from the ALARM A connector.
12	Connect the alarms test box to the ALARM B connector.
13	Set all switches on the alarms test box to the Closed position. An alarm should be reported for each switch setting

... continued on next page

Table 3-55: CDI Alarm Input Verification Using the Alarms Test Box

Step	Action
14	Set all switches on the alarms test box to the Open position. A clear alarm should be reported for each switch setting.
15	Disconnect the alarms test box from the ALARM B connector.
16	Select the MGLI.
17	Click on the Device menu.
18	Click on the Set Alarm Relays menu item.
19	Click on Normally Closed . A status report window displays the results of the action.
20	Click OK to close the status report window. Alarms should be reported for alarm inputs 1 through 36.
21	Set all switches on the alarms test box to the Closed position.
22	Connect the alarms test box to the ALARM A connector. Alarms should be reported for alarm inputs 1 through 18.
23	Set all switches on the alarms test box to the Open position. An alarm should be reported for each switch setting.
24	Set all switches on the alarms test box to the Closed position. A clear alarm should be reported for each switch setting.
25	Disconnect the alarms test box from the ALARM A connector.
26	Connect the alarms test box to the ALARM B connector. A clear alarm should be reported for alarm inputs 19 through 36.
27	Set all switches on the alarms test box to the Open position. An alarm should be reported for each switch setting.
28	Set all switches on the alarms test box to the Closed position. A clear alarm should be reported for each switch setting.
29	Disconnect the alarms test box from the ALARM B connector.
30	Select the MGLI.
31	Click on the Device menu.
32	Click on the Set Alarm Relays menu item.
33	Click on Unequipped . A status report window displays the results of the action.
34	Click on the OK button to close the status report window.
35	Connect the alarms test box to the ALARM A connector.
36	Set all switches on the alarms test box to both the Open and the Closed position. No alarm should be reported for any switch settings.

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Table 3-55: CDI Alarm Input Verification Using the Alarms Test Box

Step	Action
37	Disconnect the alarms test box from the ALARM A connector.
38	Connect the alarms test box to the ALARM B connector.
39	Set all switches on the alarms test box to both the Open and the Closed position. No alarm should be reported for any switch settings.
40	Disconnect the alarms test box from the ALARM B connector.
41	Load data to the MGLI to reset the alarm relay conditions according to the CDF file.

CDI Alarm Input Verification without Alarms Test Box

Table 3-56 describes how to test the CDI alarm input verification without the use of the Alarms Test Box. Follow the steps as instructed and compare results with the LMF display.

NOTE	It may take a few seconds for alarms to be reported. The default delay is 5 seconds. When shorting alarm pins wait for the alarm report before removing the short.
-------------	--

Table 3-56: CDI Alarm Input Verification Without the Alarms Test Box

Step	Action
1	Connect the LMF to the BTS and log into the BTS.
2	Select the MGLI.
3	Click on the Device menu.
4	Click on the Set Alarm Relays menu item.
5	Click on Normally Open . A status report window displays the results of the action.
6	Click on OK to close the status report window.
7	Refer to Figure 3-28 and sequentially short the ALARM A connector CDI 1 through CDI 18 pins (25-26 through 59-60) together. An alarm should be reported for each pair of pins that are shorted. A clear alarm should be reported for each pair of pins when the short is removed.
8	Refer to Figure 3-28 and sequentially short the ALARM B connector CDI 19 through CDI 36 pins (25-26 through 59-60) together. An alarm should be reported for each pair of pins that are shorted. A clear alarm should be reported for each pair of pins when the short is removed.
9	Select the MGLI.
10	Click on the Device menu.
11	Click on the Set Alarm Relays menu item.

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Table 3-56: CDI Alarm Input Verification Without the Alarms Test Box

Step	Action
12	Click on Normally Closed . A status report window displays the results of the action.
13	Click on OK to close the status report window. Alarms should be reported for alarm inputs 1 through 36.
14	Refer to Figure 3-28 and sequentially short the ALARM A connector CDI 1 through CDI 18 pins (25-26 through 59-60) together. A clear alarm should be reported for each pair of pins that are shorted. An alarm should be reported for each pair of pins when the short is removed.
15	Refer to Figure 3-28 and sequentially short the ALARM B connector CDI 19 through CDI 36 pins (25-26 through 59-60) together. A clear alarm should be reported for each pair of pins that are shorted. An alarm should be reported for each pair of pins when the short is removed.
16	Select the MGLI.
17	Click on the Device menu.
18	Click on the Set Alarm Relays menu item.
19	Click on Unequipped . A status report window displays the results of the action.
20	Click on OK to close the status report window.
21	Refer to Figure 3-28 and sequentially short the ALARM A connector CDI 1 through CDI 18 pins (25-26 through 59-60) together. No alarms should be displayed.
22	Refer to Figure 3-28 and sequentially short the ALARM B connector CDI 19 through CDI 36 pins (25-26 through 59-60) together. No alarms should be displayed.
23	Load data to the MGLI to reset the alarm relay conditions according to the CDF file.

3

Pin and Signal Information for Alarm Connectors

Table 3-57 lists the pins and signal names for Alarms A and B.

Table 3-57: Pin and Signal Information for Alarm Connectors

ALARM A				ALARM B			
Pin	Signal Name	Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
1	A CDO1 NC	31	Cust Retn 4	1	B CDO9 NC	31	B CDI 22
2	A CDO1 Com	32	A CDI 4	2	B CDO9 Com	32	Cust Retn 22
3	A CDO1 NO	33	Cust Retn 5	3	B CDO9 NO	33	B CDI 23
4	A CDO2 NC	34	A CDI 5	4	B CDO10 NC	34	Cust Retn 23

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Table 3-57: Pin and Signal Information for Alarm Connectors

ALARM A				ALARM B			
Pin	Signal Name	Pin	Signal Name	Pin	Signal Name	Pin	Signal Name
5	A CDO2 Com	35	Cust Retn 6	5	B CDO10 Com	35	B CDI 24
6	A CDO2 NO	36	A CDI 6	6	B CDO10 NO	36	Cust Retn 24
7	A CDO3 NC	37	Cust Retn 7	7	B CDO11 NC	37	B CDI 25
8	A CDO3 Com	38	A CDI 7	8	B CDO11 Com	38	Cust Retn 25
9	A CDO3 NO	39	Cust Retn 8	9	B CDO11 NO	39	B CDI 26
10	A CDO4 NC	40	A CDI 8	10	B CDO12 NC	40	Cust Retn 26
11	A CDO4 Com	41	Cust Retn 9	11	B CDO12 Com	41	B CDI 27
12	A CDO4 NO	42	A CDI 9	12	B CDO12 NO	42	Cust Retn 27
13	A CDO5 NC	43	Cust Retn 10	13	B CDO13 NC	43	B CDI 28
14	A CDO5 Com	44	A CDI 10	14	B CDO13 Com	44	Cust Retn 28
15	A CDO5 NO	45	Cust Retn 11	15	B CDO13 NO	45	B CDI 29
16	A CDO6 NC	46	A CDI 11	16	B CDO14 NC	46	Cust Retn 29
17	A CDO6 Com	47	Cust Retn 12	17	B CDO14 Com	47	B CDI 30
18	A CDO6 NO	48	A CDI 12	18	B CDO14 NO	48	Cust Retn 30
19	A CDO7 NC	49	Cust Retn 13	19	B CDO15 NC	49	B CDI 31
20	A CDO7 Com	50	A CDI 13	20	B CDO15 Com	50	Cust Retn 31
21	A CDO7 NO	51	Cust Retn 14	21	B CDO15 NO	51	B CDI 32
22	A CDO8 NC	52	A CDI 14	22	B CDO16 NC	52	Cust Retn 32
23	A CDO8 Com	53	Cust Retn 15	23	B CDO16 Com	53	B CDI 33
24	A CDO8 NO	54	A CDI 15	24	B CDO16 NO	54	Cust Retn 33
25	Cust Retn 1	55	Cust Retn 16	25	B CDI 19	55	B CDI 34
26	A CDI 1	56	A CDI 16	26	Cust Retn 19	56	Cust Retn 34
27	Cust Retn 2	57	Cust Retn 17	27	B CDI 20	57	B CDI 35
28	A CDI 2	58	A CDI 17	28	Cust Retn 20	58	Cust Retn 35
29	Cust Retn 3	59	Cust Retn 18	29	B CDI 21 (+27 V) Converter Alarm (-48 V)	59	B CDI 36
30	A CDI 3	60	A CDI 18	30	Cust Retn 21 (+27 V) Converter Retn (-48V)	60	Cust Retn 36

NOTE

CDO = Customer Defined Output

CDI = Customer Defined Input

Notes

Chapter 4

Automated Acceptance Test

Procedure

Automated Acceptance Test Procedures - All-inclusive TX & RX

Introduction

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

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

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

CAUTION

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

The ATP test is to be performed on out-of-service (OOS) sectors *only*.

DO NOT substitute test equipment not supported by the LMF.

NOTE

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

Reduced ATP

NOTE

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

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

1. Verify the TX/RX paths by performing TX Calibration, TX Audit and FER tests.
2. Retrieve Calibration Data required for normal site operation.

Should failures occur while performing the specified tests, refer to the Basic Troubleshooting section of this manual for help in determining the failure point. Once the point of failure has been identified and corrected, refer to the BTS Optimization and ATP Test Matrix section (Appendix C) 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.

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.

NOTE

The test equipment must be re-calibrated before using it to perform the TX Acceptance Tests.

ATP Test Prerequisites

Before attempting to run any ATP tests, ensure the following have been completed:

- BTS has been optimized and calibrated (see Chapter 3).
- LMF is logged into the BTS.
- CSMs, GLIs, BBXs, MCCs, and TSU (if the RFDS is installed) have correct code load and data load.
- Primary CSM, GLI, and MCCs are INS_ACT (bright green).
- BBXs are calibrated and BLOs are downloaded.
- No BBXs are keyed (transmitting).
- BBXs are OOS_RAM (yellow).
- Test cables are calibrated.
- Test equipment is connected for ATP tests (see Figure 3-14 through Figure 3-18 starting on page 3-52).
- Test equipment has been warmed up 60 minutes and calibrated.
- GPIB is on.
- BTS transmit connectors are properly terminated for the test(s) to be performed.

WARNING Before performing the FER, be sure that all LPAs are turned OFF (circuit breakers pulled) or that all transmitter ports are properly terminated.

All transmit ports must be properly terminated for all ATP tests.

Failure to observe these warnings may result in bodily injury or equipment damage.

TX OUT Connection

NOTE Many of the acceptance test procedures require taking measurements at the **TX OUT** (BTS/RFDS) connector. At sites without RFDS installed, all measurements will be via the BTS **TX OUT** connector. At sites with RFDS installed, all measurements will be via the RFDS directional coupler **TX OUT** connector.

ATP Tests

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

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

- **All RX:** RX tests verify the performance of the BTS receiver line up. These include the MPC (for starter frames), EMPC (for expansion frames), CIO, BBX, MCC, and GLI cards and the passive components including RX filters (starter frame only), and RF cables.
- **Full Optimization:** Executes the TX calibration, downloads the BLO, and executes the TX audit before running all of the TX and RX tests.

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

If manual testing has been performed with the HP analyzer, remove the manual control/system memory card from the card slot and set the **I/O Config** to the **Talk & Lstn** mode before starting the automated testing.

Follow the procedure in Table 4-1 to perform any ATP test.

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



Table 4-1: ATP Test Procedure

✔	Step	Action
	1	Ensure that all pre-requisites have been met.
	2	<p>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 <i>new Multi-Channel Preselector</i> setting. Using the wrong MPC setting can cause a false test failure.</p> <p style="color: red; text-align: center;">AUTHOR NOTE: Is this step necessary for the T and ET? As it stands now, the additional test equipment set-up table is not in the T and ET books.</p> <p>If a <i>companion</i> frame is being tested and either BOTH or DIV is to be selected in step 8, perform the additional test equipment set-up in Table ??? for the <i>diversity</i> RX portion of the ATP.</p>
	3	Select the device(s) to be tested.
	4	From the Tests menu, select the test you want to run.
	5	Select the appropriate carrier(s) (carrier-bts#-sector#-carrier#) displayed in the Channels/Carrier pick list. NOTE To select multiple items, hold down the <Shift> or <Ctrl> key while making the selections.
	6	Enter the appropriate channel number in the Carrier n Channels box. The default channel number displayed is determined by the CdmaChans[n] number in the cbsc-n.cdf file for the BTS.
	7	<p>NOTE Single-sided BLO is only used when checking non-redundant transceivers.</p> <p>If applicable, select Verify BLO (default) or Single-sided BLO.</p>

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Table 4-1: ATP Test Procedure

✓	Step	Action
	8	<p>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 step 8. 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.</p> <p>Select the appropriate RX branch (BOTH, MAIN, or DIVersity) in the drop-down list.</p>
	9	<p>NOTE The Rate Set selection of 1 is only available if non-1X cards are selected for the test. The Rate Set selection of 2 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.</p> <p>In the Rate Set box, select the appropriate data rate (1=9600, 2=14400, 3=9600 1X) from the drop-down list.</p>
	10	<p>Enter the channel elements to be tested for the RX ATP in the Channel Element(s) box. By default, all channel elements are specified.</p> <p>Use one of the following methods to enter more than one channel element:</p> <ul style="list-style-type: none"> - 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). <p>NOTE The channel element numbers are 0 based; that is the first channel element is 0.</p>
	11	<p>If applicable, select a test pattern from the Test Pattern pick list.</p> <p>NOTE</p> <ul style="list-style-type: none"> • Selecting Pilot (default) performs tests using only a pilot signal. • Selecting Standard performs tests using pilot, synch, paging and 6 traffic channels. This requires an MCC to be selected. • Selecting CDFPilot performs tests using only a pilot signal, however, the gain for the channel elements is specified in the CDF file. • Selecting CDF performs tests using pilot, synch, paging and 6 traffic channels, however, the gain for the channel elements is specified in the CDF file.
	12	<p>Click on the OK button.</p> <p>The status report window and a Directions pop-up are displayed.</p>
	13	<p>Follow the cable connection directions as they are displayed, and click the Continue button to begin testing.</p> <p>The test results are displayed in the status report window.</p>
	14	<p>Click on Save Results or Dismiss.</p> <p>NOTE If Dismiss is used, the test results will not be saved in the test report file.</p>

TX Output Acceptance Tests: Introduction

Individual Acceptance Tests

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

Spectral Purity TX Mask (Primary & Redundant BBX)

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

Waveform Quality (rho)

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

Pilot Time Offset

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

Code Domain Power (Primary & Redundant BBX)

This test verifies the code domain power levels, which have been set for all ODD numbered Walsh channels, using the OCNS command. This is done by verifying that the ratio of PILOT divided by OCNS is equal to 10.2 ± 2 dB, and, that the noise floor of all EVEN numbered “OFF” Walsh channels measures ≤ -27 dB (with respect to total CDMA channel power).

Frame Error Rate

The Frame Error Rate (FER) test verifies RX operation of the entire CDMA Reverse Link using all equipped MCCs assigned to all respective sectors/antennas. This test verifies the BTS sensitivity on all traffic channel elements currently configured on all equipped MCCs at an RF input level of -119 dBm (or -116 dBm if using TMPC).

TX Spectral Purity Transmit Mask Acceptance Test

Tx Mask Test

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

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

NOTE	TX output power is set to +40 dBm by setting BTS power level to +33.5 dBm to compensate for 6.5 dB increase from pilot gain set to 541.
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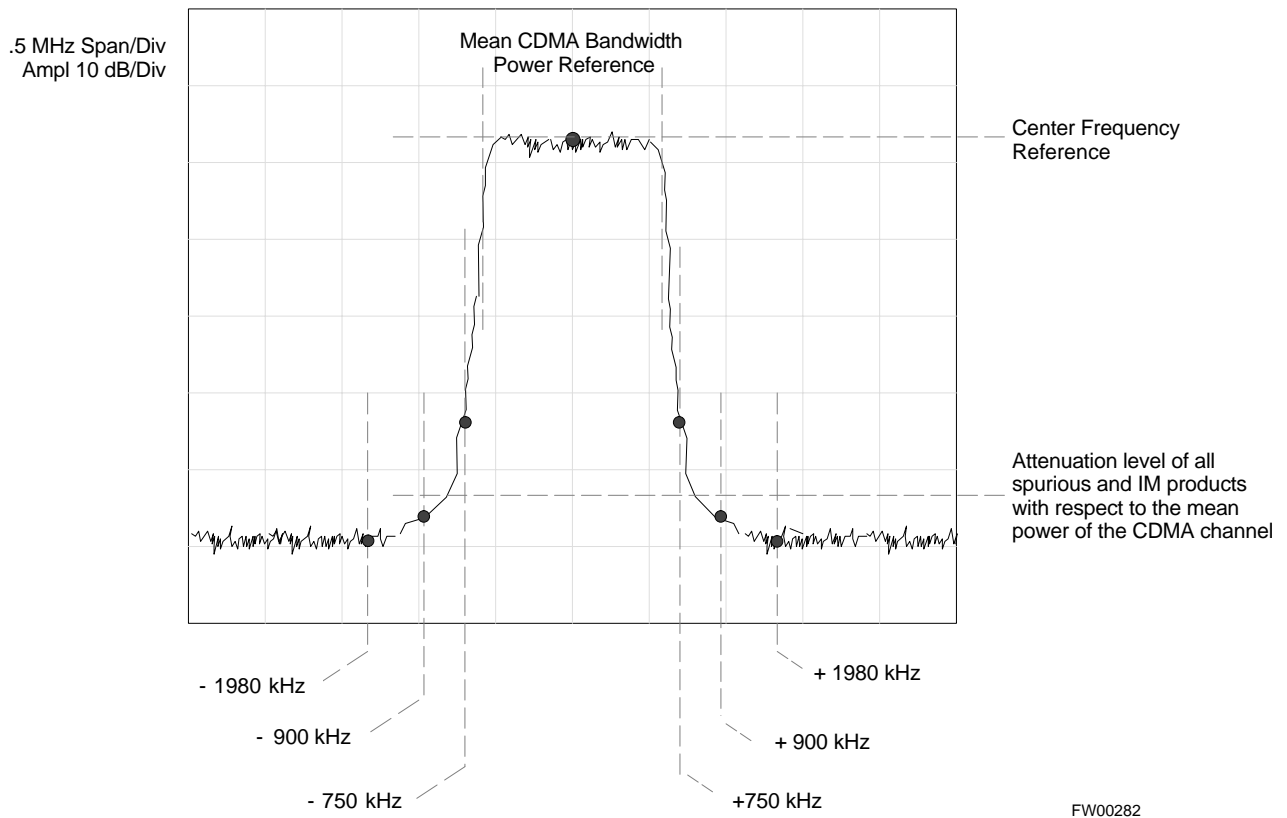
The calibrated communications test set measures and returns the attenuation level of all spurious and IM products in a 30 kHz resolution bandwidth. With respect to the mean power of the CDMA channel measured in a 1.23 MHz bandwidth in dB, verify that results meet system tolerances at the following test points:

- 1.7/1.9 GHz:
 - at least **-45 dB @ + 900 kHz** from center frequency
 - at least **-45 dB @ - 900 kHz** from center frequency
- 800 MHz:
 - at least **-45 dB @ + 750 kHz** from center frequency
 - at least **-45 dB @ - 750 kHz** from center frequency
 - at least **-60 dB @ - 1980 kHz** from center frequency
 - at least **-60 dB @ - 1980 kHz** from center frequency

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

See Table 4-1 to perform this test.

Figure 4-1: TX Mask Verification Spectrum Analyzer Display



TX Waveform Quality (rho) Acceptance Test

Rho Test

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

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

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

- Waveform quality (rho) should be ≥ 0.912 (**-0.4dB**).

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

See Table 4-1 to perform this test.

TX Pilot Time Offset Acceptance Test

Pilot Offset Acceptance Test

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

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

The calibrated communications test set measures and returns the Pilot Time Offset in μs , verifying results meet system tolerances:

- Pilot Time Offset should be within $\leq 3 \mu\text{s}$ of the target PT Offset (**0 μs**).

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

See Table 4-1 to perform this test.

TX Code Domain Power/Noise Floor Acceptance Test

Code Domain Power Test

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

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

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

Verify the code domain power levels, which have been set for all ODD numbered Walsh channels, using the OCNS command. This is done by verifying that Pilot Power (dBm) minus OCNS Power (dBm) is equal to **10.2 ± 2 dB** and that the noise floor of all “OFF” Walsh channels measures **≤ -27 dB** (with respect to total CDMA channel power).

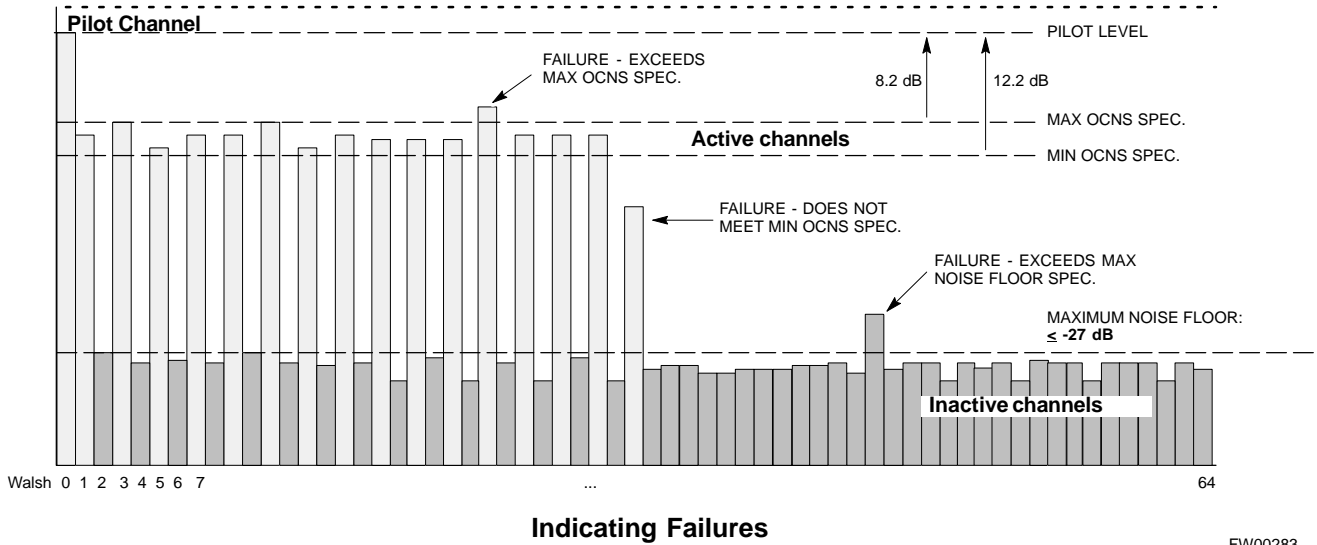
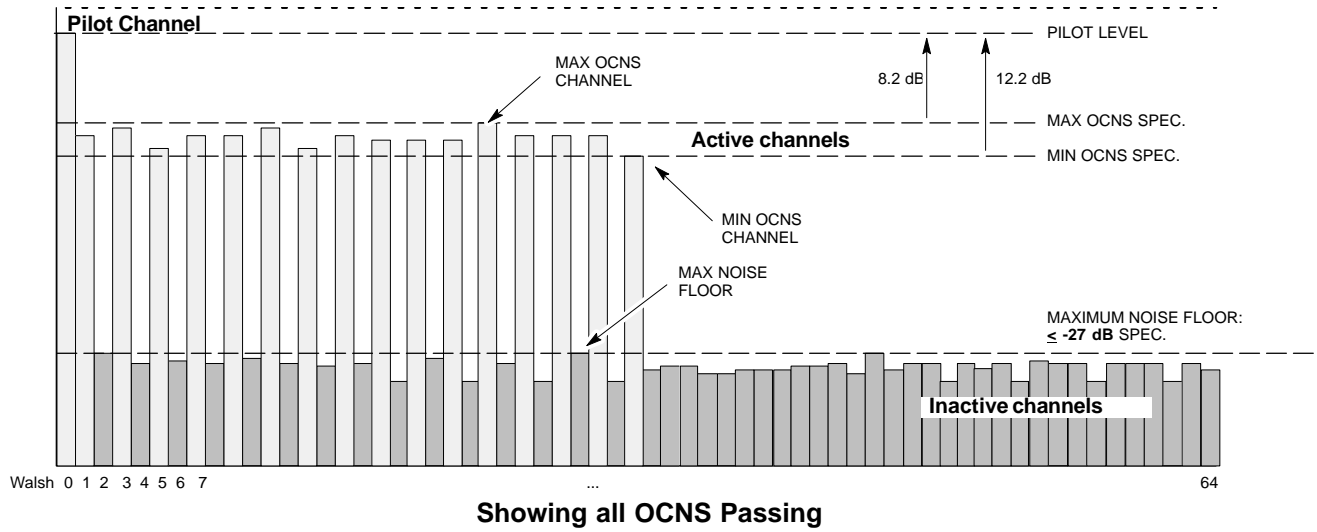
NOTE

When performing this test using the LMF and the MCC is an MCC8E or MCC24E, the redundant BBX may fail or show marginal performance. This is due to a timing mismatch that the LMF does not address. Performing this test from the CBSC will not have this timing problem.

The BBX then de-keys and, if selected, the MCC is re-configured to assign the applicable redundant BBX to the current TX antenna path under test. The test is then repeated. Upon completion of the test, the OCNS is disabled on the specified MCC/CE.

See Table 4-1 to perform this test.

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



FW00283

RX Frame Error Rate (FER) Acceptance Test

FER Test

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

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

The LMF prompts the MCC/CE under test to measure all zero longcode and provide the FER report on the selected active MCC on the reverse link for both the main and diversity RX antenna paths, verifying that results meet the following specification:

- FER returned less than **1%** and total frames measured is **1500**

All MCC/CEs selected are tested on the specified RX antenna path. The BBX then de-keys and, if selected, the MCC is re-configured to assign the applicable redundant BBX to the current RX antenna paths under test. The test is then repeated.

See Table 4-1 to perform this test.

Generate an ATP Report

Background

Each time an ATP test is run, an ATP report is updated to include the results of the most recent ATP tests if the **Save Results** button is used to close the status report window. The ATP report *is not* updated if the status reports window is closed using the **Dismiss** button.

ATP Report

Each time an ATP test is run, a separate report is created for each BTS and includes the following for each test:

- Test name
- BBX number
- Channel number
- Carrier number
- Sector number
- Upper test limit
- Lower test limit
- Test result
- PASS or FAIL
- Description information (if applicable)
- Time stamp
- Details/Warning information (if applicable)

The report can be printed if the LMF computer is connected to a printer. Follow the procedure in the Table 4-2 to view and/or print the ATP report for a BTS.

Table 4-2: Generating an ATP Report

✓	Step	Action
	1	Click on the Login tab (if not in the forefront).
	2	Select the desired BTS from the available Base Station pick list.
	3	Click on the Report button.
	4	Click on a column heading to sort the report.
	5	<ul style="list-style-type: none"> - If not desiring a printable file copy, click on the Dismiss button. - If requiring a printable file copy, select the desired file type in the picklist and click on the Save button.

Chapter 5

Prepare to Leave the Site

Prepare to Leave the Site

External Test Equipment Removal

Perform the procedure in Table 5-1 to disconnect the test equipment and configure the BTS for active service.

Table 5-1: External Test Equipment Removal

Step	Action
1	Disconnect all external test equipment from all TX and RX connectors on the top of the frame.
2	Reconnect and visually inspect all TX and RX antenna feed lines at the top of the frame.

CAUTION Verify that all sector antenna feed lines are connected to the correct ports on the frame. Crossed antenna cables will cause system degradation of call processing.

NOTE Each module or device can be in any state prior to downloading. Each module or device will be in an OOS_RAM state after downloading has completed.

- For all LMF commands, information in *italics* represents valid ranges for that command field.
- Only those fields requiring an input will be specified. Default values for other fields will be assumed.
- For more complete command examples (including system response details), refer to the *CDMA LMF User Guide*.

Reset All Devices

Reset all devices by cycling power before leaving the site. The configuration data and code loads could be different from data and code on the LMF. By resetting all devices, the CBSC can load the proper data and code when the span is active again.

Follow the procedure in Table 5-2 *as required* to bring all processor modules from the OOS to INS mode.

NOTE Have the CBSC/MM bring up the site and enable all devices at the BTS.

Table 5-2: Enabling Devices

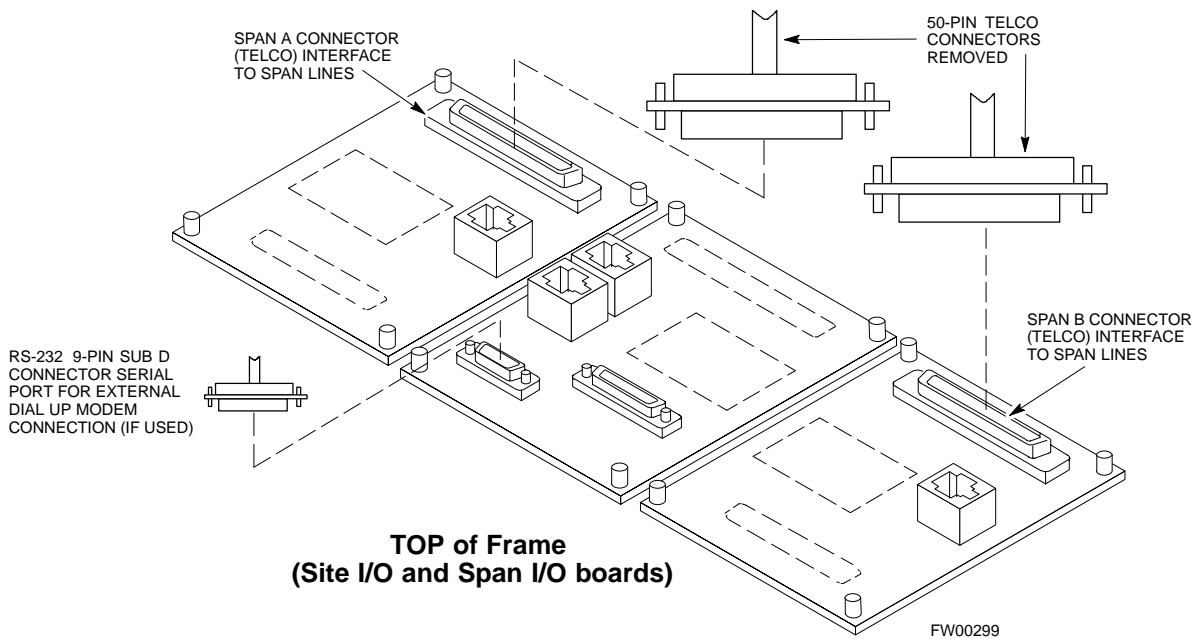
✔	Step	Action
	1	On the LMF, select the device(s) you wish to enable. NOTE The MGLI and CSM must be INS before an MCC can be put INS.
	2	Click on Device from the menu bar.
	3	Click on Enable from the Device menu. A status report window is displayed.
		NOTE If a BBX is selected, a Transceiver Parameters window is displayed to collect keying information. Do not enable the BBX.
	4	Click OK to close the Transceiver Parameters window. A status report window displays the status of the device.
	5	Click OK to close the status report window. The selected devices that successfully change to INS change color to green.

Re-connect BTS T1 Spans and Integrated Frame Modem

Before leaving the site, connect any T1 span TELCO connectors that were removed to allow the LMF to control the BTS. Refer to Table 5-3 and Figure 5-1 as required.

Table 5-3: T1/E1 Span/IFM Connections	
Step	Action
1	Connect the 50-pin TELCO cables to the BTS span I/O board 50-pin TELCO connectors.
2	If used, connect the dial-up modem RS-232 serial cable to the Site I/O board RS-232 9-pin sub D connector.
	NOTE Verify that you connect both SPAN cables (if removed previously), and the Integrated Frame Modem (IFM) "TELCO" connector.

Figure 5-1: Site and Span I/O Boards T1 Span Connections



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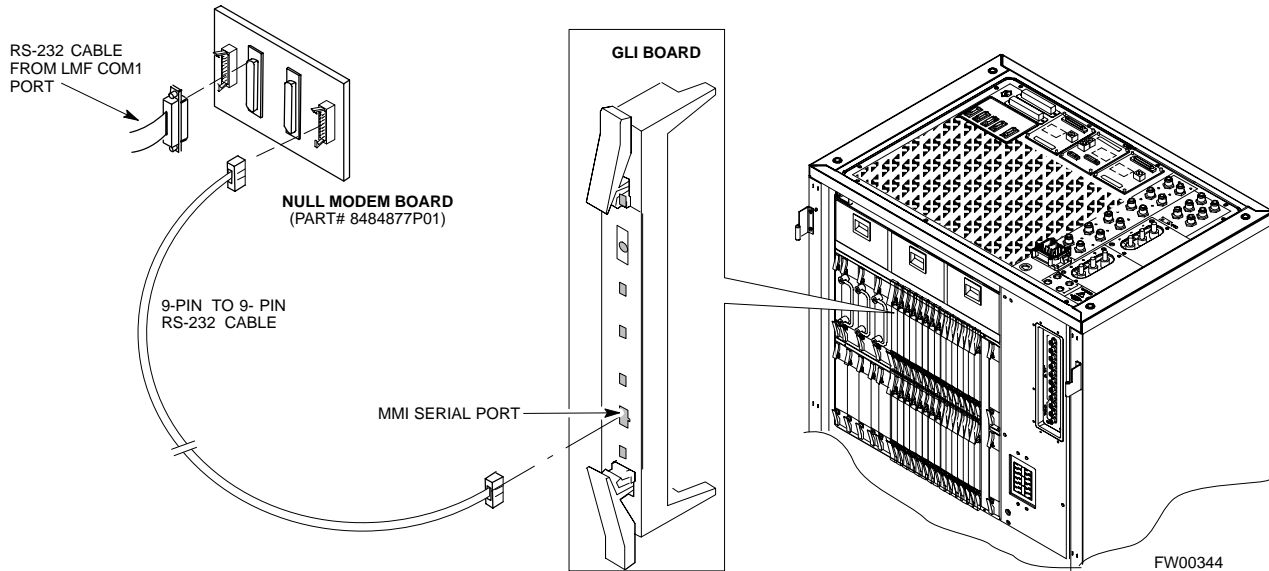
BTS Site Span Configuration Verification

Perform the procedure in Table 5-4 to verify the current Span Framing Format and Line Build Out (LBO) parameters. *ALL* MGLI2/GLI2 boards in all C-CCP shelves that terminate a T1/E1 span should be verified.

Table 5-4: BTS Span Parameter Configuration

Step	Action
1	Connect a serial cable from the LMF COM1 port (via null modem board) to the front panel of the MGLI2 MMI port (see Figure 5-2).
2	<p>Start an MMI communication session with MGLI2 by using the Windows desktop shortcut icon (see Table 3-5 on page 3-11).</p> <p>NOTE The LMF program must not be running when a Hyperterminal session is started if COM1 is being used for the MMI session.</p>
3	<p>Enter the following MMI command to display the current MGLI2/GLI2 framing format and line code configuration (in bold type):</p> <p style="padding-left: 40px;">span view <cr></p> <p>Observe a display similar to the options shown below:</p> <pre>COMMAND ACCEPTED: span view The parameter in NVM is set to T1_2. The frame format in flash is set to use T1_2. Equalization: Span A - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span B - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span C - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span D - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span E - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span F - Default (0-131 feet for T1/J1, 120 Ohm for E1) Linkspeed: Default (56K for T1 D4 AMI, 64K otherwise) Currently, the link is running at the default rate The actual rate is 0</pre> <p>NOTE Defaults for span equalization are 0-131 feet for T1/J1 spans and 120 Ohm for E1. Default linkspeed is 56K for T1 D4 AMI spans and 64K for all other types. There is no need to change from defaults unless the OMC-R/CBSC span configuration requires it. If the current MGLI2/GLI2 framing format and line code configuration does not display the correct choice, proceed to Table 5-5.</p>
4	Repeat steps 1 through 3 for all remaining GLIs.
5	Exit the GLI MMI session and HyperTerminal connection by selecting File from the connection window menu bar, and then Exit from the drop-down menu.

Figure 5-2: MGLI2/GLI2 MMI Port Connection



Set BTS Site Span Configuration

Perform the procedure in Table 5-5 to configure the Span Framing Format and Line Build Out (LBO) parameters. *ALL* MGLI2/GLI2 boards in all C-CCP shelves that terminate a T1/E1 span must be configured.

NOTE Perform the following procedure *ONLY* if span configurations loaded in the MGLI2/GLI2s do not match those in the OMCR/CBSC data base, *AND ONLY* when the exact configuration data is available. Loading incorrect span configuration data will render the site inoperable.

Table 5-5: Set BTS Span Parameter Configuration

Step	Action
1	If not already done, connect a serial cable from the LMF COM1 port (via null modem board) to the front panel of the MGLI2 MMI port (see Figure 5-2).
2	Start an MMI communication session with CSM-1 by using the Windows desktop shortcut icon (see Table 3-5 on page 3-11).
	<p>NOTE</p> <p>The LMF program must not be running when a Hyperterminal session is started if COM1 is being used for the MMI session.</p>

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Table 5-5: Set BTS Span Parameter Configuration

Step	Action
3	<p><i>If required only</i>, enter the following MMI command for each span line to set the BTS span parameters to match that of the physical spans <i>a - f</i> run to the site:</p> <p>span_config <option#1> <option#2> <option#3> <option#4> <option#5></p> <p><i>option#1</i> = the span to change (a - f)</p> <p><i>option#2</i> = the span type (0 - 8):</p> <ul style="list-style-type: none"> 0 - E1_1 (HDB3, CCS, CRC-4) 1 - E1_2 (HDB3, CCS) 2 - E1_3 (HDB3, CAS, CRC-4, TS16) 3 - E1_4 (HDB3, CAS, TS16) 4 - T1_1 (AMI, DS1 AT&T D4, without ZCS, 3 to 1 packing, Group 0 unusable) 5 - T1_2 (B8ZS, DS1 AT&T ESF, 4 to 1 packing, 64K link) 6 - J1_1 (B8ZS, J1 AT&T ESF, Japan CRC6, 4 to 1 packing) 7 - J1_2 (B8ZS, J1 AT&T ESF, US CRC6, 4 to 1 packing) 8 - T1_3 (AMI, DS1 AT&T D4, with ZCS, 3 to 1 packing, Group 0 unusable) <p><i>option#3</i> = the link speed (56 or 64) Kbps</p> <p><i>option#4</i> = the span equalization (0 - 7):</p> <ul style="list-style-type: none"> 0 - T1_6 (T1,J1:long haul) 1 - T1_4 (T1,J1:393-524 feet) 2 - T1_4 (T1,J1:131-262 feet) 3 - E1_75 (E1:75 Ohm) 4 - T1_4 (T1,J1:0-131 feet) 5 - T1_4 (T1,J1:524-655 feet) 6 - T1_4 (T1,J1:262-393 feet) 7 - E1_120 (E1:120 Ohm) <p><i>option#5</i> = the slot that has LAPD channel (0 - 31)</p> <p><i>Example for setting span configuration to E1_2, 64 Kbps, E1_120-Ohm, LAPD channel 1:</i></p> <pre>span_config a 1 64 7 1 . . span_config f 1 64 7 1</pre> <p><i>Example for setting span configuration to T1_2, 64 Kbps, T1_4 (0-131 feet), LAPD channel 0:</i></p> <pre>span_config a 5 64 4 0 . . span_config f 5 64 4 0</pre> <p>NOTE</p> <p>Make sure that spans <i>a - f</i> are set to the same span type and link speed. The equalization may be different for each individual span.</p> <p>After executing the span_config command, the affected MGLI2/GLI2 board MUST be reset and re-loaded for changes to take effect.</p> <p>Although defaults are shown, always consult site specific documentation for span type and rate used at the site.</p>
4	Press the RESET button on the GLI2 for changes to take effect.

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Table 5-5: Set BTS Span Parameter Configuration

Step	Action
5	This completes the site specific BTS Span setup for this GLI. Move the MMI cable to the next GLI2 and repeat steps 1 and 4 for ALL MGLI2/GLI2 boards.
6	Terminate the Hyperterm session and disconnect the LMF from the MGLI/SGLI.

Updating CBSC LMF Files

Updated calibration (CAL) file information must be moved from the LMF Windows environment back to the CBSC, which resides in a Unix environment. The procedures that follow detail how to move files from one environment to the other.

Backup CAL Data to a Diskette

The BLO calibration files should be backed up to a diskette (per BTS). Follow the procedure in Table 5-6 to copy CAL files from a CDMA LMF computer to a diskette.

Table 5-6: Backup CAL Data to a Diskette

✓	Step	Action
	1	Insert a diskette into the LMF A drive. NOTE If your diskette has not been formatted, format it using Windows. The diskette must be DOS formatted before copying any files. Consult your Windows/DOS documentation or on-line help on how to format diskettes.
	2	Click on the Start button and launch the Windows Explorer program from the Programs menu.
	3	Click on your C: drive.
	4	Double Click on the wlmf folder.
	5	Double Click on the CDMA folder.
	6	Click on the bts-# folder for the calibration file you want to copy.
	7	Drag the BTS-#.cal file to the 3-1/2 floppy (A:) icon on the top left of the screen and release the mouse button.
	8	Repeat steps 6 and 7 until you have copied each file desired.
	9	Close the Windows Explorer program by selecting Close from the File menu option.

5

LMF Removal

CAUTION **DO NOT** power down the LMF without performing the procedure indicated below. Corrupted/lost data files may result, and in some cases, the LMF may lock up.

Follow the procedure in Table 5-7 to terminate the LMF session and remove the terminal.

Table 5-7: LMF Termination and Removal		
✔	Step	Action
	1	From the CDMA window select File>Exit .
	2	From the Windows Task Bar click Start>Shutdown . Click Yes when the Shut Down Windows message appears.
	3	Disconnect the LMF terminal Ethernet connector from the BTS cabinet.
	4	Disconnect the LMF serial port, the RS-232 to GPIB interface box, and the GPIB cables as required for equipment transport.

Copying CAL Files from Diskette to the CBSC

Follow the procedure in Table 5-8 to copy CAL files from a diskette to the CBSC.

Table 5-8: Procedures to Copy CAL Files from Diskette to the CBSC		
✔	Step	Action
	1	Login to the CBSC on the workstation using your account name and password. NOTE Enter the information that appears in bold text .
	2	Place your diskette containing CAL file(s) in the CBSC workstation diskette drive.
	3	Type eject -q and press the <Enter> key.
	4	Type mount and press the <Enter> key. Verify that <code>floppy/no_name</code> is displayed.
		NOTE If the eject command has been previously entered, <code>floppy/no_name</code> will be appended with a <u>number</u> . Use the explicit <code>floppy/no_name</code> reference displayed.
	5	Enter cd /floppy/no_name and press the <Enter> key.
	6	Enter ls -lia and press the <Enter> key. Verify that the bts-#.cal file is on the diskette.
	7	Enter cd and press the <Enter> key.
	8	Enter pwd and press the <Enter> key. Verify that you are in your home directory (<code>/home/<name></code>).
	9	Enter dos2unix /floppy/no_name/bts-#.cal bts-#.cal and press the <Enter> key (where # is the BTS number).

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Table 5-8: Procedures to Copy CAL Files from Diskette to the CBSC

✔	Step	Action
	10	Enter ls -l *.cal and press the <Enter> key. Verify that the CAL file was successfully copied.
	11	Type eject and press the <Enter> key.
	12	Remove the diskette from the workstation.

Re-establish OMC-R Control/ Verifying T1/E1

NOTE

After all activities at the site have been completed, and after disconnecting the LMF, place a phone call to the OMC-R and request the BTS be placed under control of the OMC-R.

Chapter 6

Basic Troubleshooting

Basic Troubleshooting Overview

Overview

The information in this section addresses some of the scenarios likely to be encountered by Cellular Field Engineering (CFE) team members. This troubleshooting guide was created as an interim reference document for use in the field. It provides basic “what to do if” basic troubleshooting suggestions when the BTS equipment does not perform per the procedure documented in the manual.

Comments are consolidated from inputs provided by CFEs in the field and information gained from experience in Motorola labs and classrooms.

Troubleshooting: Installation

Cannot Log into Cell-Site

Follow the procedure in Table 6-1 to troubleshoot a login failure.

✓ Step	Action
1	If the MGLI LED is solid RED, it implies a hardware failure. Reset the MGLI by re-seating it. If this persists, install a known good MGLI card in the MGLI slot and retry. A Red LED may also indicate no Ethernet termination at top of frame.
2	Verify that T1 is disconnected (see Table 3-1 on page 3-5). If T1 is still connected, verify the CBSC has disabled the BTS.
3	Try <i>pinging</i> the MGLI (see Table 3-6 on page 3-14).
4	Verify the LMF is connected to the Primary LMF port (LAN A) in the front of the BTS (see Table 3-2 on page 3-6).
5	Verify the LMF was configured properly (see Preparing the LMF section starting on page 3-6).
6	Verify the BTS-LMF cable is RG-58 [flexible black cable of less than 76 cm (2.5 feet) length].
7	Verify the Ethernet ports are terminated properly (see Figure 3-4 on page 3-13).
8	Verify a T-adaptor is <u>not</u> used on the LMF side port if connected to the BTS front LMF primary port.
9	Try connecting to the I/O panel (top of frame). Use BNC T-adaptors at the LMF port for this connection.
10	Re-boot the LMF and retry.
11	Re-seat the MGLI and retry.
12	Verify IP addresses are configured properly.

Cannot Communicate to Power Meter

Follow the procedure in Table 6-2 to troubleshoot a power meter communication failure.

✓ Step	Action
1	Verify the Power Meter is connected to the LMF with a GPIB adapter.
2	Verify the cable setup as specified in Chapter 3.
3	Verify the GPIB address of the power meter is set to the same value displayed in the applicable GPIB address box of the LMF Options window Test Equipment tab. Refer to Table 3-24 or Table 3-25 and the GPIB Addresses section of Appendix J for details.
4	Verify the GPIB adapter DIP switch settings are correct. Refer to the CDMA 2000 Test Equipment Preparation section of Appendix F for details.

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Table 6-2: Troubleshooting a Power Meter Communication Failure

✔	Step	Action
	5	Verify the GPIB adapter is not locked up. Under normal conditions, only two green LEDs must be 'ON' (Power and Ready). If any other LED is continuously 'ON', then cycle GPIB box power and retry.
	6	Verify the LMF computer COM1 port is not used by another application; for example, if a HyperTerminal window is open for MMI, close it.
	7	Reset all test equipment by clicking Util in the BTS menu bar and selecting Test Equipment>Reset from the pull-down lists.

Cannot Communicate to Communications Analyzer

Follow the procedure in Table 6-3 to troubleshoot a communications analyzer communication failure.

Table 6-3: Troubleshooting a Communications Analyzer Communication Failure

✔	Step	Action
	1	Verify signal generator is connected to LMF with GPIB adapter.
	2	Verify cable connections as specified in Chapter 3.
	3	Verify the signal generator GPIB address is set to the same value displayed in the applicable GPIB address box of the LMF Options window Test Equipment tab. Refer to Table 3-24 or Table 3-25 and the GPIB Address section of Appendix J for details.
	4	Verify the GPIB adapter DIP switch settings are correct. Refer to the CDMA 2000 Test Equipment Preparation section of Appendix F for details.
	5	Verify the GPIB adapter is not locked up. Under normal conditions, only two green LEDs must be 'ON' (Power and Ready). If any other LED is continuously 'ON', then cycle the GPIB box power and retry.
	6	Verify the LMF computer COM1 port is not used by another application; for example, if a HyperTerminal window is open for MMI, close it.
	7	Reset <i>all</i> test equipment by clicking Util in the BTS menu bar and selecting Test Equipment>Reset from the pull-down lists.

Troubleshooting: Download

Cannot Download CODE to Any Device (card)

Follow the procedure in Table 6-4 to troubleshoot a code download failure.

Table 6-4: Troubleshooting Code Download Failure		
✓	Step	Action
	1	Verify T1 is disconnected from the BTS.
	2	Verify the LMF can communicate with the BTS device using the Status function.
	3	Communication to the MGLI must first be established before trying to talk to any other BTS device. The MGLI must be INS_ACT state (green).
	4	Verify the card is physically present in the cage and powered-up.
	5	If the card LED is solid RED, it implies hardware failure. Reset the card by re-seating it. If the LED remains solid red, replace with a card from another slot & retry. NOTE The card can only be replaced by a card of the same type.
	6	Re-seat the card and try again.
	7	If BBX reports a failure message and is OOS_RAM, the code load was OK.
	8	If the download portion completes and the reset portion fails, reset the device by selecting the device and Reset .
	9	If a BBX or an MCC remains OOS_ROM (blue) after code download, use the LMF Device > Status function to verify that the code load was accepted.
	10	If the code load was accepted, use LMF Device > Download > Flash to load RAM code into flash memory.

Cannot Download DATA to Any Device (Card)

Perform the procedure in Table 6-5 to troubleshoot a data download failure.

Table 6-5: Troubleshooting Data Download Failure		
✓	Step	Action
	1	Re-seat the card and repeat code and data load procedure.

Cannot ENABLE Device

Before a device can be enabled (placed in-service), it must be in the OOS_RAM state (yellow) with data downloaded to the device. The color of the device changes to green once it is enabled.

The three states that devices can be changed to are as follows:

- Enabled (green, INS)
- Disabled (yellow, OOS_RAM)
- Reset (blue, OOS_ROM)

Follow the procedure in Table 6-6 to troubleshoot a device enable failure.

Table 6-6: Troubleshooting Device Enable (INS) Failure		
✔	Step	Action
	1	Re-seat the card and repeat the code and data load procedure.
	2	If the CSM cannot be enabled, verify the CDF file has correct latitude and longitude data for cell site location and GPS sync.
	3	Ensure the primary CSM is in INS_ACT state. NOTE MCCs will not go INS without the CSM being INS.
	4	Verify the 19.6608 MHz CSM clock; MCCs will not go INS otherwise.
	5	The BBX should not be enabled for ATP tests.
	6	If MCCs give “invalid or no system time”, verify the CSM is operable.

6

Miscellaneous Errors

Perform the procedure in Table 6-7 to troubleshoot miscellaneous failures.

Table 6-7: Miscellaneous Failures		
✔	Step	Action
	1	If LPAs continue to give alarms, even after cycling power at the circuit breakers, then connect an MMI cable to the LPA and set up a Hyperterminal connection (see Table 3-5 on page 3-11).
	2	Enter ALARMS in the Hyperterminal window. The resulting LMF display may provide an indication of the problem. (Call Field Support for further assistance.)

Troubleshooting: Calibration

Bay Level Offset Calibration Failure

Perform the procedure in Table 6-8 to troubleshoot a BLO calibration failure.

Table 6-8: Troubleshooting BLO Calibration Failure		
✓	Step	Action
	1	Verify the Power Meter is configured correctly (see the test equipment setup section in Chapter 3) and connection is made to the proper TX port.
	2	Verify the parameters in the bts-#.cdf file are set correctly for the following bands: For 1900 MHz: Bandclass=1; Freq_Band=16; SSType=16 For 800 MHz: Bandclass=0; Freq_Band=8; SSType=8 For 1700 MHz: Bandclass=4; Freq_Band=128; SSType=16
	3	Verify that no LPA in the sector is in alarm state (flashing red LED). Reset the LPA by pulling the circuit breaker and, after 5 seconds, pushing back in.
	4	Re-calibrate the Power Meter and verify it is calibrated correctly with cal factors from the sensor head.
	5	Verify the GPIB adapter is not locked up. Under normal conditions, only two green LEDs must be 'ON' (Power and Ready). If any other LED is continuously 'ON', power-cycle (turn power off and on) the GPIB Box and retry.
	6	Verify the sensor head is functioning properly by checking it with the 1 mW (0 dBm) Power Ref signal.
	7	If communication between the LMF and Power Meter is operational, the Meter display will show "RES".

Cannot Load BLO

For Load BLO failures see Table 6-7.

Calibration Audit Failure

Follow the procedure in Table 6-9 to troubleshoot a calibration audit failure.

Table 6-9: Troubleshooting Calibration Audit Failure		
✓	Step	Action
	1	Verify the Power Meter is configured correctly (refer to the test equipment setup section of Chapter 3).
	2	Re-calibrate the Power Meter and verify it is calibrated correctly with cal factors from the sensor head.
	3	Verify that no LPA is in alarm state (rapidly flashing red LED). Reset the LPA by pulling the circuit breaker and, after 5 seconds, pushing back in.
	4	Verify that no sensor head is functioning properly by checking it with the 1 mW (0 dBm) Power Ref signal.
	5	After calibration, the BLO data must be re-loaded to the BBXs before auditing. Click on the BBX(s) and select Device>Download BLO . Re-try the audit.
	6	Verify the GPIB adapter is not locked up. Under normal conditions, only two green LEDs must be "ON" (Power and Ready). If any other LED is continuously "ON", power-cycle (turn power off and on) the GPIB Box and retry.

Troubleshooting: Transmit ATP

BTS passed Reduced ATP tests but has forward link problem during normal operation

Follow the procedure in Table 6-10 to troubleshoot a Forward Link problem during normal operation.

Table 6-10: Troubleshooting Forward Link Failure (BTS Passed Reduced ATP)		
✓	Step	Action
	1	Perform these additional TX tests to troubleshoot a forward link problem: <ul style="list-style-type: none"> - TX mask - TX rho - TX code domain

Cannot Perform TX Mask Measurement

Follow the procedure in Table 6-11 to troubleshoot a TX mask measurement failure.

Table 6-11: Troubleshooting TX Mask Measurement Failure		
✓	Step	Action
	1	Verify that TX audit passes for the BBX(s).
	2	If performing manual measurement, verify analyzer setup.
	3	Verify that no LPA in the sector is in alarm state (flashing red LED). Re-set the LPA by pulling the circuit breaker and, after 5 seconds, pushing it back in.


Cannot Perform Rho or Pilot Time Offset Measurement

Follow the procedure in Table 6-12 to troubleshoot a rho or pilot time offset measurement failure.

Table 6-12: Troubleshooting Rho and Pilot Time Offset Measurement Failure		
✓	Step	Action
	1	Verify presence of RF signal by switching to spectrum analyzer screen.
	2	Verify PN offsets displayed on the analyzer is the same as the PN offset in the CDF file.
	3	Re-load BBX data and repeat the test.
	4	If performing manual measurement, verify analyzer setup.
	5	Verify that no LPA in the sector is in alarm state (flashing red LED). Reset the LPA by pulling the circuit breaker and, after 5 seconds, pushing back in.
	6	If Rho value is unstable and varies considerably (e.g. .95,.92,.93), this may indicate that the GPS is still phasing (i.e., trying to reach and maintain 0 freq. error). Go to the freq. bar in the upper right corner of the Rho meter and select Hz . Press <Shift-avg> and enter 10 , to obtain an average Rho value. This is an indication the GPS has not stabilized before going <i>INS</i> and may need to be re-initialized.

Cannot Perform Code Domain Power and Noise Floor Measurement


Perform the procedure in Table 6-13 to troubleshoot a code domain and noise floor measurement failure.

Table 6-13: Troubleshooting Code Domain Power and Noise Floor Measurement Failure		
	Step	Action
	1	Verify presence of RF signal by switching to spectrum analyzer screen.
	2	Verify PN offset displayed on analyzer is same as PN offset being used in the CDF file.
	3	Disable and re-enable MCC (one or more MCCs based on extent of failure).

Troubleshooting: Receive ATP

Multi-FER Test Failure

Perform the procedure in Table 6-14 to troubleshoot a Multi-FER failure.

Table 6-14: Troubleshooting Multi-FER Failure		
	Step	Action
	1	Verify the test equipment set up is correct for an FER test.
	2	Verify the test equipment is locked to 19.6608 and even second clocks. On the HP8921A test set, the yellow LED (REF UNLOCK) must be OFF.
	3	Verify the MCCs have been loaded with data and are INS-ACT.
	4	Disable and re-enable the MCC (one or more based on extent of failure).
	5	Disable, re-load code and data, and re-enable the MCC (one or more MCCs based on extent of failure).
	6	Verify the antenna connections to frame are correct based on the directions messages.

Troubleshooting: CSM Check-list

Problem Description

Many of the Clock Synchronization Manager (CSM) board failures may be resolved in the field before sending the boards to the factory for repair. This section describes known CSM problems identified in field returns, some of which are field-repairable. Check these problems before returning suspect CSM boards.

Intermittent 19.6608 MHz Reference Clock/GPS Receiver Operation

If having any problems with CSM board kit numbers, SGLN1145 or SGLN4132, check the suffix with the kit number. If the kit has version “AB”, then replace with version “BC” or higher, and return model “AB” to the repair center.

No GPS Reference Source

Check the CSM boards for proper hardware configuration. CSM kit SGLN1145, in Slot 1, has an on-board GPS receiver; while kit SGLN4132, in Slot 2, does not have a GPS receiver. Any incorrectly configured board *must* be returned to the repair center. *Do not attempt to change hardware configuration in the field.* Also, verify the GPS antenna is not damaged and is installed per recommended guidelines.

Checksum Failure

The CSM could have corrupted data in its firmware resulting in a non-executable code. The problem is usually caused by either electrical disturbance or interruption of data during a download. Attempt another download with no interruptions in the data transfer. Return the CSM board back to the repair center if the attempt to reload fails.

GPS Bad RX Message Type

This problem is believed to be caused by a later version of CSM software (3.5 or higher) being downloaded, via LMF, followed by an earlier version of CSM software (3.4 or lower), being downloaded from the CBSC. Download again with CSM software code 3.5 or higher. Return the CSM board back to the repair center if the attempt to reload fails.

CSM Reference Source Configuration Error

This problem is caused by incorrect reference source configuration performed in the field by software download. CSM kits SGLN1145 and SGLN4132 must have proper reference sources configured (as shown below) to function correctly.

CSM Kit No.	Hardware Configuration	CSM Slot No.	Reference Source Configuration	CDF Value
SGLN1145	With GPS Receiver	1	Primary = Local GPS Backup = Either LFR or HSO	0 2 or 18
SGLN4132	Without GPS Receiver	2	Primary = Remote GPS Backup = Either LFR or HSO	1 2 or 18

Takes Too Long for CSM to Come INS

This problem may be caused by a delay in GPS acquisition. Check the accuracy flag status and/or current position. Refer to the GSM system time/GPS and LFR/HSO verification section in Chapter 3. At least one satellite should be visible and tracked for the “surveyed” mode and four satellites should be visible and tracked for the “estimated” mode. Also, verify correct base site position data used in “surveyed” mode.

C-CCP Backplane Troubleshooting

Introduction

The C-CCP backplane is a multi-layer board that interconnects all the C-CCP modules. The complexity of this board lends itself to possible improper diagnoses when problems occur.

Connector Functionality

The following connector overview describes the major types of backplane connectors along with the functionality of each. This information allows the CFE to:

- Determine which connector(s) is associated with a specific problem type.
- Isolate problems to a specific cable or connector.

Primary “A” and Redundant “B” Inter Shelf Bus Connectors

The 40 pin Inter Shelf Bus (ISB) connectors provide an interface bus from the master GLI to all other GLIs in the modem frame. Their basic function is to provide clock synchronization from the master GLI to all other GLIs in the frame.

The ISB also provides the following functions:

- Span line grooming when a single span is used for multiple cages.
- MMI connection to/from the master GLI to cell site modem.
- Interface between GLIs and the AMR (for reporting BTS alarms).

Span Line Connector

The span line input is an 8-pin RJ-45 connector that provides a primary and secondary (if used) span line interface to each GLI in the C-CCP shelf. The span line is used for MM/EMX switch control of the Master GLI and also all the BBX traffic.

Primary “A” and Redundant “B” Reference Distribution Module Input/Output

The Reference Distribution Module (RDM) connectors route the 3 MHz reference signals from the CSMs to the GLIs and all BBXs in the backplane. The signals are used to phase lock loop all clock circuits on the GLIs and BBX boards to produce precise clock and signal frequencies.

Power Input (Return A, B, and C connectors)

Provides a +27 volt or -48 volt input for use by the power supply modules.

Power Supply Module Interface

Each power supply module has a series of three different connectors to provide the needed inputs/outputs to the C-CCP backplane. These include a VCC/Ground input connector, a Harting style multiple pin interface, and a +15 V/Analog Ground output connector. The C-CCP Power Modules convert +27 or -48 Volts to a regulated +15, +6.5, and +5.0 Volts to be used by the C-CCP shelf cards. In the -48 V BTS, the LPA power modules convert -48 Volts to a regulated +27 Volts.

GLI Connector

This connector consists of a Harting 4SU digital connector and a 6-conductor coaxial connector for RDM distribution. The connectors provide inputs/outputs for the GLIs in the C-CCP backplane.

GLI 10Base-2 Ethernet “A” and “B” Connections

These BNC connectors are located on the C-CCP backplane and routed to the GLI board. This interface provides all the control and data communications between the master GLI and the other GLI, between gateways, and for the LMF on the LAN.

BBX Connector

Each BBX connector consists of a Harting 2SU/1SU digital connector and two 6-conductor coaxial connectors. These connectors provide DC, digital, and RF inputs/outputs for the BBXs in the C-CCP backplane.

CIO Connectors

- RX RF antenna path signal inputs are routed through RX Tri-Filters (on the I/O plate), and via coaxial cables to the two MPC modules - the six “A” (main) signals go to one MPC; the six “B” (diversity) to the other. The MPC outputs the low-noise-amplified signals via the C-CCP backplane to the CIO where the signals are split and sent to the appropriate BBX.
- A digital bus then routes the baseband signal through the BBX, to the backplane, then on to the MCC slots.
- Digital TX antenna path signals originate at the MCCs. Each output is routed from the MCC slot via the backplane appropriate BBX.
- TX RF path signal originates from the BBX, through the backplane to the CIO, through the CIO, and via multi-conductor coaxial cabling to the LPAs in the LPA shelf.

C-CCP Backplane Troubleshooting Procedure

Table 6-15 through Table 6-24 provide procedures for troubleshooting problems that appear to be related to a defective C-CCP backplane. The tables are broken down into possible problems and steps that should be taken in an attempt to find the root cause.

NOTE	Table 6-15 through Table 6-24 must be completed before replacing ANY C-CCP backplane.
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Digital Control Problems

No GLI Control via LMF (all GLIs)

Follow the procedure in Table 6-15 to troubleshoot a GLI control via LMF failure.

Table 6-15: No GLI Control via LMF (all GLIs)		
✓	Step	Action
	1	Check the 10Base-2 ethernet connector for proper connection, damage, shorts, or opens.
	2	Verify the C-CCP backplane Shelf ID DIP switch is set correctly.
	3	Visually check the master GLI connector (both board and backplane) for damage.
	4	Replace the master GLI with a known good GLI.

No GLI Control through Span Line Connection (All GLIs)

Follow the procedures in Table 6-16 and Table 6-17 to troubleshoot GLI control failures.

Table 6-16: No GLI Control through Span Line Connection (Both GLIs)	
Step	Action
1	Verify the C-CCP backplane Shelf ID DIP switch is set correctly.
2	Verify that the BTS and GLIs are correctly configured in the OMCR/CBSC data base.
3	Visually check the master GLI connector (both board and backplane) for damage.
4	Replace the master GLI with a known good GLI.
5	Check the span line inputs from the top of the frame to the master GLI for proper connection and damage.
6	Check the span line configuration on the MGLI (see Table 5-4 on page 5-5).

Table 6-17: MGLI Control Good - No Control over Co-located GLI	
Step	Action
1	Verify that the BTS and GLIs are correctly configured in the OMCR CBSC data base.
2	Check the ethernet for proper connection, damage, shorts, or opens.
3	Visually check all GLI connectors (both board and backplane) for damage.
4	Replace the remaining GLI with a known good GLI.

No AMR Control (MGLI good)

Perform the procedure in Table 6-18 to troubleshoot an AMR control failure when the MGLI control is good.

Table 6-18: MGLI Control Good - No Control over AMR	
Step	Action
1	Visually check the master GLI connector (both board and backplane) for damage.
2	Replace the master GLI with a known good GLI.
3	Replace the AMR with a known good AMR.

No BBX Control in the Shelf - (No Control over Co-located GLIs)

Perform the procedure in Table 6-19 to troubleshoot a BBX control in the shelf failure.

Table 6-19: No BBX Control in the Shelf - No Control over Co-located GLIs	
Step	Action
1	Visually check all GLI connectors (both board and backplane) for damage.
2	Replace the remaining GLI with a known good GLI.
3	Visually check BBX connectors (both board and backplane) for damage.
4	Replace the BBX with a known good BBX.

No (or Missing) Span Line Traffic

Perform the procedure in Table 6-20 to troubleshoot a span line traffic failure.

Table 6-20: MGLI Control Good - No (or Missing) Span Line Traffic	
Step	Action
1	Visually check all GLI connectors (both board and backplane) for damage.
2	Replace the remaining GLI with a known good GLI.
3	Visually check all span line distribution (both connectors and cables) for damage.
4	If the problem seems to be limited to one BBX, replace the MGLI with a known good MGLI.
5	Perform the BTS Span Parameter Configuration (see Table 5-4 on page 5-5).
6	Ensure that ISB cabling is correct.

No (or Missing) MCC Channel Elements

Perform the procedure in Table 6-21 to troubleshoot a channel elements failure.

Table 6-21: No MCC Channel Elements

Step	Action
1	Verify CEs on a co-located MCC (MCC24 TYPE=2).
2	If the problem seems to be limited to one MCC, replace the MCC with a known good MCC. - Check connectors (both board and backplane) for damage.
3	If no CEs on any MCC: - Verify clock reference to CIO.
4	Check the CDF for MCCTYPE=2 (MCC24) or MCCTYPE=0 (MCC8).

DC Power Problems

Perform the procedure in Table 6-22 to troubleshoot a DC input voltage to power supply module failure.

WARNING Potentially lethal voltage and current levels are routed to the BTS equipment. This test must be carried out with a second person present, acting in a safety role. Remove all rings, jewelry, and wrist watches prior to beginning this test.

No DC Input Voltage to Power Supply Module

Table 6-22: No DC Input Voltage to Power Supply Module

Step	Action
1	Verify DC power is applied to the BTS frame.
2	Verify there are no breakers tripped. * IMPORTANT If a breaker has tripped, remove all modules from the applicable shelf supplied by the breaker and attempt to reset it. <ul style="list-style-type: none"> - If the breaker trips again, there is probably a cable or breaker problem within the frame. - If the breaker does not trip, there is probably a defective module or sub-assembly within the shelf.
3	Verify that the C-CCP shelf breaker on the BTS frame breaker panel is functional.
4	Use a voltmeter to determine if the input voltage is being routed to the C-CCP backplane by measuring the DC voltage level on the PWR_IN cable. <ul style="list-style-type: none"> - If the voltage is not present, there is probably a cable or breaker problem within the frame. - If the voltage is present at the connector, reconnect and measure the level at the “VCC” power feed clip on the distribution backplane. - If the voltage is correct at the power clip, inspect the clip for damage.
5	If everything appears to be correct, visually inspect the power supply module connectors.
6	Replace the power supply module with a known good module.
7	If steps 1 through 5 fail to indicate a problem, a C-CCP backplane failure (possibly an open trace) has occurred.

No DC Voltage (+5, +6.5, or +15 Volts) to a Specific GLI, BBX, or Switchboard

Perform the procedure in Table 6-23 to troubleshoot a DC input voltage to GLI, BBX, or Switchboard failure.

Table 6-23: No DC Input Voltage to any C-CCP Shelf Module	
Step	Action
1	Verify the steps in Table 6-22 have been performed.
2	Inspect the defective board/module (both board and backplane) connector for damage.
3	Replace suspect board/module with known good board/module.

TX and RX Signal Routing Problems

Perform the procedure in Table 6-24 to troubleshoot TX and RX signal routing problems.

Table 6-24: TX and RX Signal Routing Problems	
Step	Action
1	Inspect all Harting Cable connectors and back-plane connectors for damage in all the affected board slots.
2	Perform steps in the RF path troubleshooting flowchart in this manual.



Module Front Panel LED Indicators and Connectors

Module Status Indicators

Each of the non-passive plug-in modules has a bi-color (green & red) LED status indicator located on the module front panel. The indicator is labeled PWR/ALM. If both colors are turned on, the indicator is yellow.

Each plug-in module, except for the fan module, has its own alarm (fault) detection circuitry that controls the state of the PWR/ALM LED.

The fan TACH signal of each fan module is monitored by the AMR. Based on the status of this signal, the AMR controls the state of the PWR/ALM LED on the fan module.

LED Status Combinations for All Modules (except GLI, CSM, BBX, MCC)

PWR/ALM LED

The following list describes the states of the module status indicator.

- Solid GREEN - module operating in a normal (fault free) condition.
- Solid RED - module is operating in a fault (alarm) condition due to electrical hardware failure.

Note that a fault (alarm) indication may or may not be due to a complete module failure and normal service may or may not be reduced or interrupted.

DC/DC Converter LED Status Combinations

The PWR CNVTR has alarm (fault) detection circuitry that controls the state of the PWR/ALM LED. This is true for both the C-CCP and LPA power converters.

PWR/ALM LED

The following list describes the states of the bi-color LED.

- Solid GREEN - module operating in a normal (fault free) condition.
- Solid RED - module is operating in a fault (alarm) condition due to electrical hardware problem.

CSM LED Status Combinations

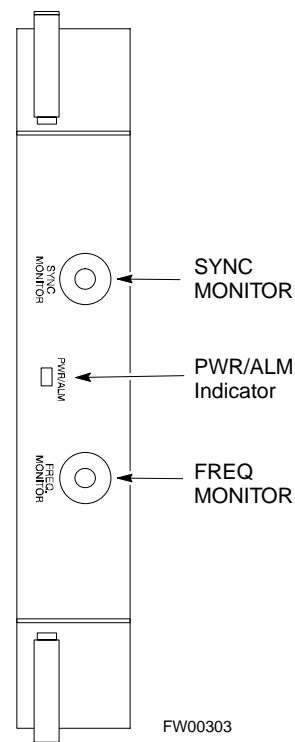
PWR/ALM LED

The CSMs include on-board alarm detection. Hardware and software/firmware alarms are indicated via the front panel indicators.

After the memory tests, the CSM loads OOS-RAM code from the Flash EPROM, if available. If not available, the OOS-ROM code is loaded from the Flash EPROM.

- Solid GREEN - module is INS_ACT or INS_STBY no alarm.
- Solid RED - Initial power up or module is operating in a fault (alarm) condition.
- Slowly Flashing GREEN - OOS_ROM no alarm.
- Long RED/Short GREEN - OOS_ROM alarm.
- Rapidly Flashing GREEN - OOS_RAM no alarm or INS_ACT in DUMB mode.
- Short RED/Short GREEN - OOS_RAM alarm.
- Long GREEN/Short RED - INS_ACT or INS_STBY alarm.
- Off - no DC power or on-board fuse is open.
- Solid YELLOW - After a reset, the CSMs begin to boot. During SRAM test and Flash EPROM code check, the LED is yellow. (If SRAM or Flash EPROM fail, the LED changes to a solid RED and the CSM attempts to reboot.)

Figure 6-1: CSM Front Panel Indicators & Monitor Ports



. . . continued on next page

FREQ Monitor Connector

A test port provided at the CSM front panel via a BNC receptacle allows monitoring of the 19.6608 MHz clock generated by the CSM. When both CSM 1 and CSM 2 are in an in-service (INS) condition, the CSM 2 clock signal frequency is the same as that output by CSM 1.

The clock is a sine wave signal with a minimum amplitude of +2 dBm (800 mVpp) into a 50 Ω load connected to this port.

SYNC Monitor Connector

A test port provided at the CSM front panel via a BNC receptacle allows monitoring of the “Even Second Tick” reference signal generated by the CSMs.

At this port, the reference signal is a TTL active high signal with a pulse width of 153 nanoseconds.

MMI Connector - Only accessible behind front panel. The RS-232 MMI port connector is intended to be used primarily in the development or factory environment, but may be used in the field for debug/maintenance purposes.

GLI2 LED Status Combinations

The GLI2 module has indicators, controls and connectors as described below and shown in Figure 6-2.

The operating states of the 5 LEDs are:

ACTIVE

Solid GREEN - GLI2 is active. This means that the GLI2 has shelf control and is providing control of the digital interfaces.

Off - GLI2 is not active (i.e., Standby). The mate GLI2 should be active.

MASTER

- Solid GREEN - GLI2 is Master (sometimes referred to as MGLI2).
- Off - GLI2 is non-master (i.e., Slave).

ALARM

- Solid RED - GLI2 is in a fault condition or in reset.
- While in reset transition, STATUS LED is OFF while GLI2 is performing ROM boot (about 12 seconds for normal boot).
- While in reset transition, STATUS LED is ON while GLI2 is performing RAM boot (about 4 seconds for normal boot).
- Off - No Alarm.

STATUS

- Flashing GREEN- GLI2 is in service (INS), in a stable operating condition.
- On - GLI2 is in OOS RAM state operating downloaded code.
- Off - GLI2 is in OOS ROM state operating boot code.

SPANS

- Solid GREEN - Span line is connected and operating.
- Solid RED - Span line is disconnected or a fault condition exists.

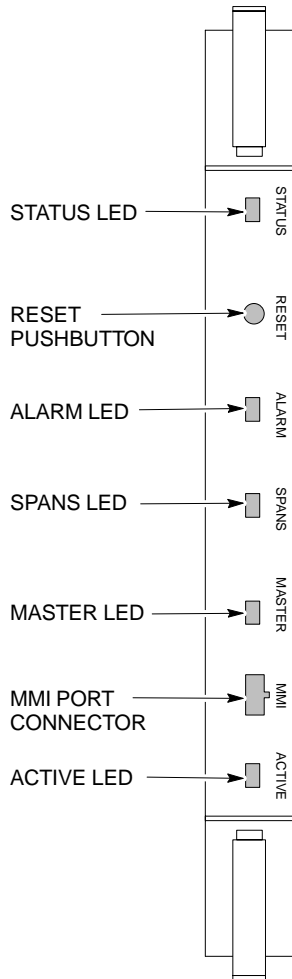
GLI2 Pushbuttons and Connectors

RESET Pushbutton - Depressing the RESET pushbutton causes a partial reset of the CPU and a reset of all board devices. The GLI2 is placed in the OOS_ROM state

MMI Connector - The RS-232MMI port connector is intended to be used primarily in the development or factory environment but may be used in the field for debug/maintenance purposes.

LAN Connectors (A & B) - The two 10BASE2 Ethernet circuit board mounted BNC connectors are located on the bottom front edge of the GLI2; one for each LAN interface, A & B. Ethernet cabling is connected to tee connectors fastened to these BNC connectors.

Figure 6-2: GLI2 Front Panel



LED	OPERATING STATUS
STATUS	OFF - operating normally ON - briefly during power-up when the Alarm LED turns OFF. SLOW GREEN - when the GLI2 is INS (in-service)
RESET	All functions on the GLI2 are reset when pressing and releasing the switch.
ALARM	OFF - operating normally ON - briefly during power-up when the Alarm LED turns OFF. SLOW GREEN - when the GLI2 is INS (in-service)
SPANS	OFF - card is powered down, in initialization, or in standby GREEN - operating normally YELLOW - one or more of the equipped initialized spans is receiving a remote alarm indication signal from the far end RED - one or more of the equipped initialized spans is in an alarm state
MASTER	The pair of GLI2 cards include a redundant status. The card in the top shelf is designated by hardware as the active card; the card in the bottom shelf is in the standby mode. ON - operating normally in active mode OFF - operating normally in standby mode
MMI PORT CONNECTOR	An RS-232, serial, asynchronous communications link for use as an MMI port. This port supports 300 baud, up to a maximum of 115,200 baud communications.
ACTIVE	Shows the operating status of the redundant cards. The redundant card toggles automatically if the active card is removed or fails ON - active card operating normally OFF - standby card operating normally

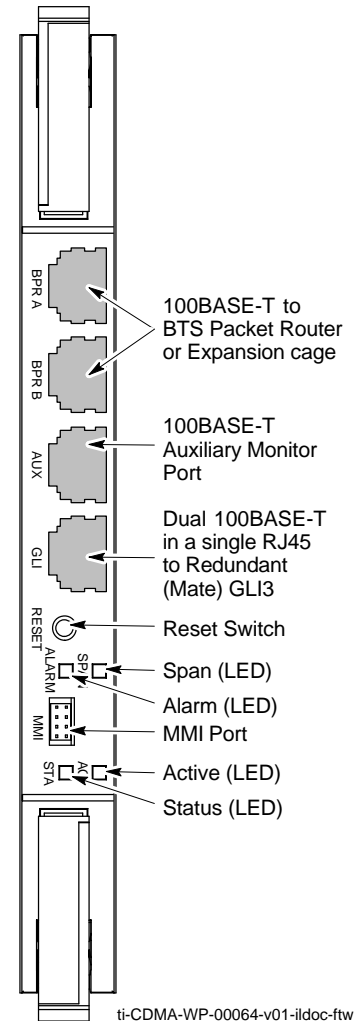
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GLI3 Front Panel

Figure 6-3 shows the GLI3 front panel.

Figure 6-3: GLI3 Front Panel

LED	OPERATING STATUS
BPR A	Connects to either a BPR or expansion cage and is wired as an ethernet client.
BPR B	Connects to either a BPR or expansion cage and is wired as an ethernet client.
AUX	Wired as an ethernet client for direct connection to a personal computer with a standard ethernet cable. It allows connection of ethernet "sniffer" when the ethernet switch is properly configured for port monitoring.
GLI	Supports the cross-coupled ethernet circuits to the mate GLI using a double crossover cable.
RESET	Pressing and releasing the switch resets all functions on the GLI3.
ALARM	OFF - operating normally ON - briefly during power-up when the Alarm LED turns OFF SLOW GREEN - when the GLI3 is INS (in-service)
Span	OFF - card is powered down, in initialization, or in standby GREEN - operating normally YELLOW - one or more of the equipped initialized spans is receiving a remote alarm indication signal from the far end RED - one or more of the equipped initialized spans is in an alarm state
MMI	An RS-232, serial, asynchronous communications link for use as an MMI port. This port supports 300 baud, up to a maximum of 115,200 baud communications.
STATUS	OFF - operating normally ON - briefly during power-up when the Alarm LED turns OFF SLOW GREEN - when the GLI3 is INS (in-service)
ACTIVE	Shows the operating status of the redundant cards. The redundant card toggles automatically if the active card is removed or fails ON - active card operating normally OFF - standby card operating normally



BBX LED Status Combinations

PWR/ALM LED

The BBX module has its own alarm (fault) detection circuitry that controls the state of the PWR/ALM LED.

The following list describes the states of the bi-color LED:

- Solid GREEN - INS_ACT no alarm
- Solid RED Red - initializing or power-up alarm
- Slowly Flashing GREEN - OOS_ROM no alarm
- Long RED/Short GREEN - OOS_ROM alarm
- Rapidly Flashing GREEN - OOS_RAM no alarm
- Short RED/Short GREEN - OOS_RAM alarm
- Long GREEN/Short RED - INS_ACT alarm

MCC LED Status Combinations

The MCC module has LED indicators and connectors as described below (see Figure 6-4). Note that the figure does not show the connectors as they are concealed by the removable lens.

The LED indicators and their states are as follows:

PWR/ALM LED

- RED - fault on module

ACTIVE LED

- Off - module is inactive, off-line, or not processing traffic.
- Slowly Flashing GREEN - OOS_ROM no alarm.
- Rapidly Flashing Green - OOS_RAM no alarm.
- Solid GREEN - module is INS_ACT, on-line, processing traffic.

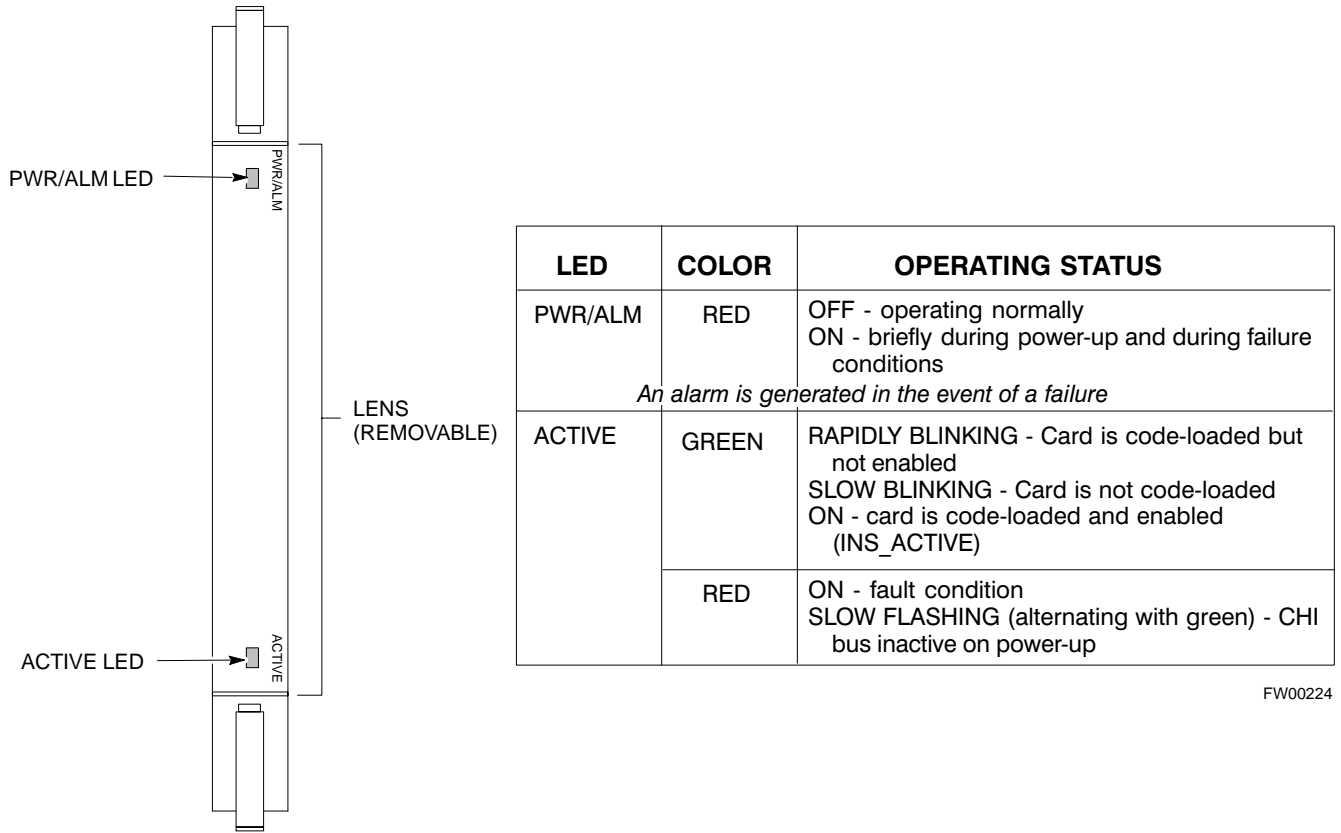
PWR/ALM and ACTIVE LEDs

- Solid RED - module is powered but is in reset or the BCP is inactive.

MMI Connectors

- The RS-232 MMI port connector (four-pin) is intended to be used primarily in the development or factory environment but may be used in the field for debugging purposes.
- The RJ-11 ethernet port connector (eight-pin) is intended to be used primarily in the development environment but may be used in the field for high data rate debugging purposes.

Figure 6-4: MCC Front Panel



LPA Shelf LED Status Combinations

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LPA Module LED

Each LPA module contains a bi-color LED just above the MMI connector on the front panel of the module. Interpret this LED as follows:

- GREEN — LPA module is active and is reporting no alarms (Normal condition).
- Flashing GREEN/RED — LPA module is active but is reporting an low input power condition. If no BBX is keyed, this is normal and does not constitute a failure.

Basic Troubleshooting - Span Control Link

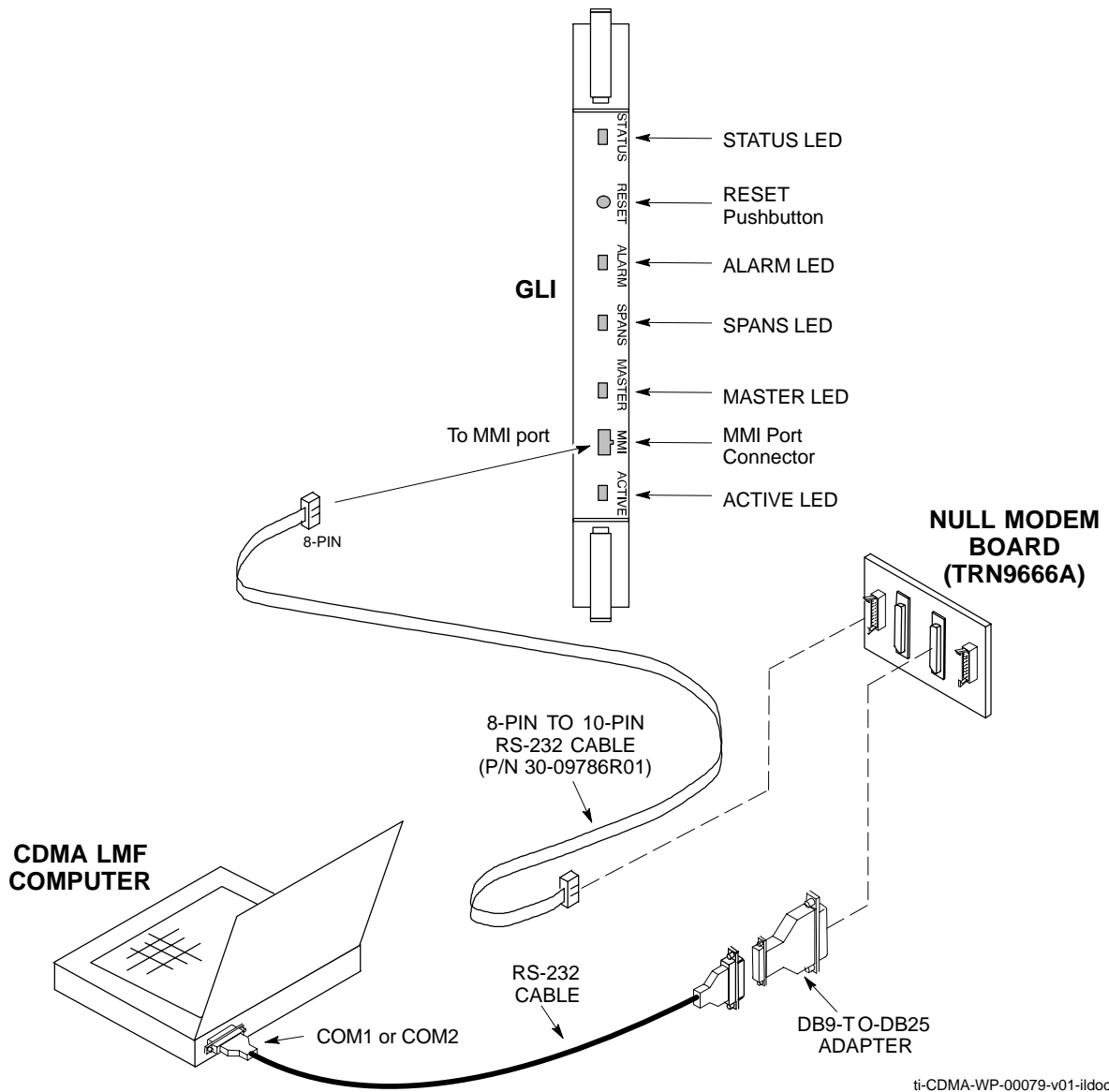
Span Problems (No Control Link)

Perform the procedure in Table 6-25 to troubleshoot a control link failure.

Table 6-25: Troubleshoot Control Link Failure

✓ Step	Action
1	Connect the CDMA LMF computer to the MMI port on the applicable MGLI/GLI as shown in Figure 6-5 or Figure 6-6.
2	Start an MMI communication session with the applicable MGLI/GLI by using the Windows desktop shortcut icon.
3	Once the connection window opens, press the CDMA LMF computer Enter key until the GLI> prompt is obtained.
4	<p>At the GLI> prompt, enter:</p> <p>config ni current <cr> (equivalent of <code>span view</code> command)</p> <p>The system will respond with a display similar to the following:</p> <pre>The frame format in flash is set to use T1_2. Equalization: Span A - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span B - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span C - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span D - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span E - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span F - Default (0-131 feet for T1/J1, 120 Ohm for E1) Linkspeed: Default (56K for T1 D4 AMI, 64K otherwise) Currently, the link is running at the default rate The actual rate is 0</pre> <p>NOTE</p> <p>Defaults for span equalization are 0-131 feet for T1/J1 spans and 120 Ohm for E1.</p> <p>Default linkspeed is 56K for T1 D4 AMI spans and 64K for all other types.</p> <p>There is no need to change from defaults unless the OMC-R/CBSC span configuration requires it.</p>
5	The span configurations loaded in the GLI must match those in the OMCR/CBSC database for the BTS. If they do not, proceed to Table 6-26.
6	Repeat steps 1 through 5 for all remaining GLIs.
7	<p>If the span settings are correct, verify the edlc parameters using the <code>show</code> command.</p> <p>Any alarm conditions indicate that the span is not operating correctly.</p> <ul style="list-style-type: none"> • Try looping back the span line from the DSX panel back to the MM, and verify that the looped signal is good. • Listen for control tone on the appropriate timeslot from the Base Site and MM.
8	Exit the GLI MMI session and HyperTerminal connection by selecting File from the connection window menu bar, and then Exit from the drop-down menu.
9	If no TCHs in groomed MCCs (or in whole C-CCP shelf) can process calls, verify that the ISB cabling is correct and that ISB A and ISB B cables are not swapped.

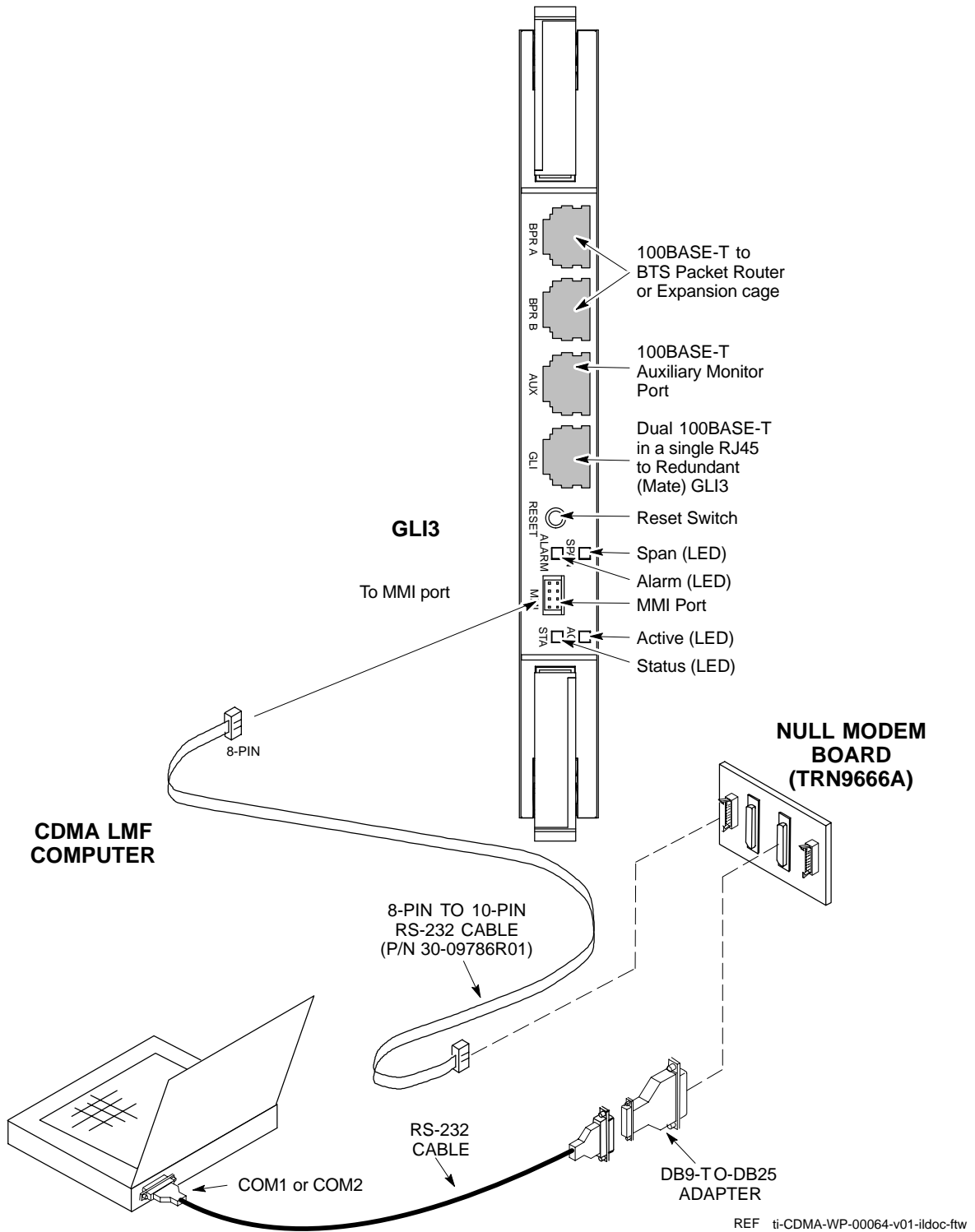
Figure 6-5: MGLI/GLI Board MMI Connection Detail



ti-CDMA-WP-00079-v01-ildoc-ftw

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Figure 6-6: GLI3 Board MMI Connection Detail



Set BTS Site Span Configuration

Perform the procedure in Table 6-26 to set the span parameter configuration.

NOTE Perform the following procedure *ONLY* if span configurations loaded in the MGLI/GLIs do not match those in the OMCR/CBSC data base, *AND ONLY* when the exact configuration data is available. Loading incorrect span configuration data will render the site inoperable.

Table 6-26: Set BTS Span Parameter Configuration

✔ Step	Action
1	If not previously done, connect the CDMA LMF computer to the MMI port on the applicable MGLI/GLI as shown in Figure 6-5.
2	If there is no MMI communication session in progress with the applicable MGLI/GLI, initiate one by using the Windows desktop shortcut icon.
3	<p>At the GLI> prompt, enter:</p> <p>config ni format <option> <cr></p> <p>The terminal will display a response similar to the following:</p> <pre> COMMAND SYNTAX: config ni format option Next available options: LIST - option : Span Option E1_1 : E1_1 - E1 HDB3 CRC4 no TS16 E1_2 : E1_2 - E1 HDB3 no CRC4 no TS16 E1_3 : E1_3 - E1 HDB3 CRC4 TS16 E1_4 : E1_4 - E1 HDB3 no CRC4 TS16 T1_1 : T1_1 - D4, AMI, No ZCS T1_2 : T1_2 - ESF, B8ZS J1_1 : J1_1 - ESF, B8ZS (Japan) - Default J1_2 : J1_2 - ESF, B8ZS T1_3 : T1_3 - D4, AMI, ZCS > </pre> <p>NOTE With this command, all active (in-use) spans will be set to the same format.</p>
4	<p>To set or change the span type, enter the correct option from the list at the entry prompt (>), as shown in the following example:</p> <p>> T1_2 <cr></p> <p>NOTE The entry is case-sensitive and must be typed <i>exactly</i> as it appears in the list. If the entry is typed incorrectly, a response similar to the following will be displayed:</p> <pre> CP: Invalid command GLI2> </pre>

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Table 6-26: Set BTS Span Parameter Configuration

✓	Step	Action
	5	<p>An acknowledgement similar to the following will be displayed:</p> <pre>The value has been programmed. It will take effect after the next reset. GLI2></pre>
	6	<p>If the current MGLI/GLI span rate must be changed, enter the following MMI command:</p> <p>config ni linkspeed <cr></p> <p>The terminal will display a response similar to the following:</p> <pre>Next available options: LIST - linkspeed : Span Linkspeed 56K : 56K (default for T1_1 and T1_3 systems) 64K : 64K (default for all other span configurations) ></pre> <p>NOTE With this command, all active (in-use) spans will be set to the same linkspeed.</p>
	7	<p>To set or change the span linkspeed, enter the required option from the list at the entry prompt (>), as shown in the following example:</p> <pre>> 64K <cr></pre> <p>NOTE The entry is case-sensitive and must be typed <i>exactly</i> as it appears in the list. If the entry is typed incorrectly, a response similar to the following will be displayed:</p> <pre>CP: Invalid command GLI2></pre>
	8	<p>An acknowledgement similar to the following will be displayed:</p> <pre>The value has been programmed. It will take effect after the next reset. GLI2></pre>
	9	<p>If the span equalization must be changed, enter the following MMI command:</p> <p>config ni equal <cr></p> <p>The terminal will display a response similar to the following:</p> <pre>COMMAND SYNTAX: config ni equal span equal Next available options: LIST - span : Span a : Span A b : Span B c : Span C d : Span D e : Span E f : Span F ></pre>

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Table 6-26: Set BTS Span Parameter Configuration

✓	Step	Action
	10	<p>At the entry prompt (>), enter the designator from the list for the span to be changed as shown in the following example:</p> <pre>> a <cr></pre> <p>The terminal will display a response similar to the following:</p> <pre>COMMAND SYNTAX: config ni equal a equal Next available options: LIST - equal : Span Equalization 0 : 0-131 feet (default for T1/J1) 1 : 132-262 feet 2 : 263-393 feet 3 : 394-524 feet 4 : 525-655 feet 5 : LONG HAUL 6 : 75 OHM 7 : 120 OHM (default for E1)</pre> <p>></p>
	11	<p>At the entry prompt (>), enter the code for the required equalization from the list as shown in the following example:</p> <pre>> 0 <cr></pre> <p>The terminal will display a response similar to the following:</p> <pre>> 0 The value has been programmed. It will take effect after the next reset. GLI2></pre>
	12	Repeat steps 9 through 11 for each in-use span.
	13	<p>NOTE</p> <p>After executing the <i>config ni format</i>, config ni linkspeed, and/or <i>config ni equal</i> commands, the affected MGLI/GLI board <i>MUST</i> be reset and reloaded for changes to take effect.</p> <p>Although defaults are shown, <i>always</i> consult site specific documentation for span type and linkspeed used at the site.</p> <p>Press the RESET button on the MGLI/GLI for changes to take effect.</p>

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Table 6-26: Set BTS Span Parameter Configuration

✔	Step	Action
	14	<p>Once the MGLI/GLI has reset, execute the following command to verify span settings are as required:</p> <p>config ni current <cr> (equivalent of <code>span view</code> command)</p> <p>The system will respond with a display similar to the following:</p> <p>The frame format in flash is set to use T1_2. Equalization: Span A - 0-131 feet Span B - 0-131 feet Span C - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span D - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span E - Default (0-131 feet for T1/J1, 120 Ohm for E1) Span F - Default (0-131 feet for T1/J1, 120 Ohm for E1)</p> <p>Linkspeed: 64K Currently, the link is running at 64K The actual rate is 0</p>
	15	If the span configuration is not correct, perform the applicable step from this table to change it and repeat steps 13 and 14 to verify required changes have been programmed.
	16	Return to step 6 of Table 6-25.

Notes

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Appendix A

Data Sheets



Optimization (Pre-ATP) Data Sheets

Verification of Test Equipment Used

Table A-1: Verification of Test Equipment Used		
Manufacturer	Model	Serial Number

Comments: _____

Site Checklist

Table A-2: Site Checklist			
OK	Parameter	Specification	Comments
<input type="checkbox"/>	Deliveries	Per established procedures	
<input type="checkbox"/>	Floor Plan	Verified	
<input type="checkbox"/>	Inter Frame Cables:		
<input type="checkbox"/>	Ethernet	Per procedure	
<input type="checkbox"/>	Frame Ground	Per procedure	
<input type="checkbox"/>	Power	Per procedure	
<input type="checkbox"/>	Factory Data:		
<input type="checkbox"/>	BBX	Per procedure	
<input type="checkbox"/>	Test Panel	Per procedure	
<input type="checkbox"/>	RFDS	Per procedure	
<input type="checkbox"/>	Site Temperature		
<input type="checkbox"/>	Dress Covers/Brackets		

Preliminary Operations

Table A-3: Preliminary Operations			
OK	Parameter	Specification	Comments
<input type="checkbox"/>	Shelf ID Dip Switches	Per site equipage	
<input type="checkbox"/>	BBX Jumpers	Verified per procedure	
<input type="checkbox"/>	Ethernet LAN verification	Verified per procedure	

Comments: _____

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Pre-Power and Initial Power Tests

Table A-4: Pre-power Checklist

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Pre-power-up tests	Verify power supply output voltage at the top of each BTS frame is within specifications	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Internal Cables: ISB (all cages) CSM (all cages) Power (all cages) Ethernet Connectors LAN A ohms LAN B ohms LAN A shield LAN B shield Ethernet Boots	verified verified verified verified verified isolated isolated installed	
<input type="checkbox"/>	Air Impedance Cage (single cage)	installed	
<input type="checkbox"/>	Initial power-up tests	Verify power supply output voltage at the top of each BTS frame is within specifications:	

Comments: _____

General Optimization Checklist

Table A-5: Pre-power Checklist			
OK	Parameter	Specification	Comments
<input type="checkbox"/>	LEDs	illuminated	
<input type="checkbox"/>	Frame fans	operational	
	LMF to BTS Connection		
<input type="checkbox"/>	Preparing the LMF	per procedure	
<input type="checkbox"/>	Log into the LMF PC	per procedure	
<input type="checkbox"/>	Create site specific BTS directory	per procedure	
<input type="checkbox"/>	Create master-bts-cdma directory	per procedure	
<input type="checkbox"/>	Download device loads	per procedure	
<input type="checkbox"/>	Moving/Linking files	per procedure	
<input type="checkbox"/>	Ping LAN A	per procedure	
<input type="checkbox"/>	Ping LAN B	per procedure	
<input type="checkbox"/>	Download/Enable MGLIs	per procedure	
<input type="checkbox"/>	Download/Enable GLIs	per procedure	
<input type="checkbox"/>	Set Site Span Configuration	per procedure	
<input type="checkbox"/>	Download CSMs	per procedure	
<input type="checkbox"/>	Download	per procedure	
<input type="checkbox"/>	Enable CSMs	per procedure	
<input type="checkbox"/>	Download/Enable MCCs	per procedure	
<input type="checkbox"/>	Download BBXs	per procedure	
<input type="checkbox"/>	Download TSU (in RFDS)	per procedure	
<input type="checkbox"/>	Program TSU NAM	per procedure	
<input type="checkbox"/>	Test Set Calibration	per procedure	

Comments: _____

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GPS Receiver Operation

Table A-6: GPS Receiver Operation

OK	Parameter	Specification	Comments
<input type="checkbox"/>	GPS Receiver Control Task State: tracking satellites	Verify parameter	
<input type="checkbox"/>	Initial Position Accuracy:	Verify Estimated or Surveyed	
<input type="checkbox"/>	Current Position: lat lon height	RECORD in ms and cm also convert to deg min sec	
<input type="checkbox"/>	Current Position: satellites tracked Estimated: (>4) satellites tracked,(>4) satellites visible Surveyed: (≥1) satellite tracked,(>4) satellites visible	Verify parameter as appropriate:	
<input type="checkbox"/>	GPS Receiver Status:Current Dilution of Precision (PDOP or HDOP): (<30)	Verify parameter	
<input type="checkbox"/>	Current reference source: Number: 0; Status: Good; Valid: Yes	Verify parameter	

Comments: _____

LFR Receiver Operation

Table A-7: LFR Receiver Operation

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Station call letters M X Y Z assignment.	as specified in site documentation	
<input type="checkbox"/>	SN ratio is > 8 dB		
<input type="checkbox"/>	LFR Task State: lfr locked to station xxxx	Verify parameter	
<input type="checkbox"/>	Current reference source: Number: 1; Status: Good; Valid: Yes	Verify parameter	

Comments: _____

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LPA IM Reduction

Table A-8: LPA IM Reduction

OK	Parameter					Specification	Comments
	LPA #	CARRIER					
		4:1 & 2:1 3-Sector	2:1 6-Sector	Dual BP 3-Sector	Dual BP 6-Sector		
<input type="checkbox"/>	1A	C1	C1	C1	C1	No Alarms	
<input type="checkbox"/>	1B	C1	C1	C1	C1	No Alarms	
<input type="checkbox"/>	1C	C1	C1	C1	C1	No Alarms	
<input type="checkbox"/>	1D	C1	C1	C1	C1	No Alarms	
<input type="checkbox"/>	2A	C2	C2	C2		No Alarms	
<input type="checkbox"/>	2B	C2	C2	C2		No Alarms	
<input type="checkbox"/>	2C	C2	C2	C2		No Alarms	
<input type="checkbox"/>	2D	C2	C2	C2		No Alarms	
<input type="checkbox"/>	3A	C3	C1		C1	No Alarms	
<input type="checkbox"/>	3B	C3	C1		C1	No Alarms	
<input type="checkbox"/>	3C	C3	C1		C1	No Alarms	
<input type="checkbox"/>	3D	C3	C1		C1	No Alarms	
<input type="checkbox"/>	4A	C4	C2			No Alarms	
<input type="checkbox"/>	4B	C4	C2			No Alarms	
<input type="checkbox"/>	4C	C4	C2			No Alarms	
<input type="checkbox"/>	4D	C4	C2			No Alarms	

Comments: _____

Cx - denotes physical carriers

For applied frequency requirements, see Appendix E.



LPA Convergence

Table A-9: LPA Convergence			
OK	Parameter	Specification	Data
	LPA # Converged		
<input type="checkbox"/>	1A	Verify per procedure & upload convergence data	
<input type="checkbox"/>	1B		
<input type="checkbox"/>	1C		
<input type="checkbox"/>	1D		
<input type="checkbox"/>	2A	Verify per procedure & upload convergence data	
<input type="checkbox"/>	2B		
<input type="checkbox"/>	2C		
<input type="checkbox"/>	2D		
<input type="checkbox"/>	3A	Verify per procedure & upload convergence data	
<input type="checkbox"/>	3B		
<input type="checkbox"/>	3C		
<input type="checkbox"/>	3D		
<input type="checkbox"/>	4A	Verify per procedure & upload convergence data	
<input type="checkbox"/>	4B		
<input type="checkbox"/>	4C		
<input type="checkbox"/>	4D		

A

TX BLO/Power Output Verification for 3-Sector Configurations

1-Carrier

2-Carrier Non-adjacent Channels

4-Carrier Non-adjacent Channels

Table A-10: TX BLO Calibration (3-S: 1-C, and 2- and 4-C Non-adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 1	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-1, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB
<input type="checkbox"/>	Calibrate carrier 2	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-7, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB
<input type="checkbox"/>	Calibrate carrier 3	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-4, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-5, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-6, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB
<input type="checkbox"/>	Calibrate carrier 4	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-10, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-11, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-12, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB
<input type="checkbox"/>	Calibration Audit carrier 1	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-1, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB

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Table A-10: TX BLO Calibration (3-S: 1-C, and 2- and 4-C Non-adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibration Audit carrier 2	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-7, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 3	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-4, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-5, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-6, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 4	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-10, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-11, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-12, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB

Comments: _____

2-Carrier Adjacent Channel

Table A-11: TX BLO Calibration (3-S: 2-C Adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 1	TX Bay Level Offset = 42 dB (typical), 38 dB (minimum) prior to calibration	BBX-1, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB

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Table A-11: TX BLO Calibration (3-S: 2-C Adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 2	TX Bay Level Offset = 42 dB (typical), 38 dB (minimum) prior to calibration	BBX-7, ANT-4 = ____ dB BBX-r, ANT-4 = ____ dB
<input type="checkbox"/>			BBX-8, ANT-5 = ____ dB BBX-r, ANT-5 = ____ dB
<input type="checkbox"/>			BBX-9, ANT-6 = ____ dB BBX-r, ANT-6 = ____ dB
<input type="checkbox"/>	Calibration Audit carrier 1	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-1, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB
<input type="checkbox"/>	Calibration Audit carrier 2	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-7, ANT-4 = ____ dB BBX-r, ANT-4 = ____ dB
<input type="checkbox"/>			BBX-8, ANT-5 = ____ dB BBX-r, ANT-5 = ____ dB
<input type="checkbox"/>			BBX-9, ANT-6 = ____ dB BBX-r, ANT-6 = ____ dB

Comments: _____

**3-Carrier Adjacent Channels
4-Carrier Adjacent Channels**

Table A-12: TX BLO Calibration (3-S: 3- or 4-C Adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 1	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-1, ANT-1 = ____ dB BBX-r, ANT-1 = ____ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ____ dB BBX-r, ANT-2 = ____ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ____ dB BBX-r, ANT-3 = ____ dB

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Table A-12: TX BLO Calibration (3-S: 3- or 4-C Adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 2	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-7, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>	Calibrate carrier 3	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-4, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-5, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-6, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB
<input type="checkbox"/>	Calibrate carrier 4	TX Bay Level Offset = 42 dB (± 4 dB) prior to calibration	BBX-10, ANT-4 = ___ dB BBX-3, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-11, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-12, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 1	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-1, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 2	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-7, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB

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Table A-12: TX BLO Calibration (3-S: 3- or 4-C Adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibration Audit carrier 3	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-4, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-5, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-6, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 4	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-10, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-11, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-12, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB

Comments: _____



TX BLO/Power Output Verification for 6-Sector Configurations
1-Carrier
2-Carrier Non-adjacent Channels

Table A-13: TX BLO Calibration (6-S: 1-C, 2-C Non-adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibrate carrier 1	TX Bay Level Offset = 42 dB (typical), 38 dB (minimum) prior to calibration	BBX-1, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>			BBX-4, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-5, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-6, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB
<input type="checkbox"/>	Calibrate carrier 2	TX Bay Level Offset = 42 dB (typical), 38 dB (minimum) prior to calibration	BBX-7, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>			BBX-10, ANT-4 = ___ dB BBX-3, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-11, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-12, ANT-6 = ___ dB BBX-r, ANT-5 = ___ dB

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Table A-13: TX BLO Calibration (6-S: 1-C, 2-C Non-adjacent Channels)

OK	Parameter	Specification	Comments
<input type="checkbox"/>	Calibration Audit carrier 1	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-1, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-2, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-3, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>			BBX-4, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-5, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-6, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB
<input type="checkbox"/>	Calibration Audit carrier 2	0 dB (± 0.5 dB) for gain set resolution post calibration	BBX-7, ANT-1 = ___ dB BBX-r, ANT-1 = ___ dB
<input type="checkbox"/>			BBX-8, ANT-2 = ___ dB BBX-r, ANT-2 = ___ dB
<input type="checkbox"/>			BBX-9, ANT-3 = ___ dB BBX-r, ANT-3 = ___ dB
<input type="checkbox"/>			BBX-10, ANT-4 = ___ dB BBX-r, ANT-4 = ___ dB
<input type="checkbox"/>			BBX-11, ANT-5 = ___ dB BBX-r, ANT-5 = ___ dB
<input type="checkbox"/>			BBX-12, ANT-6 = ___ dB BBX-r, ANT-6 = ___ dB

Comments: _____

BTS Redundancy/Alarm Tests

Table A-14: BTS Redundancy/Alarm Tests			
OK	Parameter	Specification	Data
<input type="checkbox"/>	SIF: Misc. alarm tests	Verify per procedure	
<input type="checkbox"/>	MGLI redundancy test	Verify per procedure	
<input type="checkbox"/>	GLI redundancy test	Verify per procedure	
<input type="checkbox"/>	Power supply/converter redundancy	Verify per procedure	
<input type="checkbox"/>	Misc. alarm tests	Verify per procedure	
<input type="checkbox"/>	CSM, GPS, & LFR redundancy/alarm tests	Verify per procedure	
<input type="checkbox"/>	LPA redundancy test	Verify per procedure	

Comments: _____

TX Antenna VSWR

Table A-15: TX Antenna VSWR			
OK	Parameter	Specification	Data
<input type="checkbox"/>	VSWR - Antenna 1	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 2	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 3	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 4	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 5	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 6	< (1.5 : 1)	

Comments: _____

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RX Antenna VSWR

Table A-16: RX Antenna VSWR

OK	Parameter	Specification	Data
<input type="checkbox"/>	VSWR - Antenna 1	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 2	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 3	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 4	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 5	< (1.5 : 1)	
<input type="checkbox"/>	VSWR - Antenna 6	< (1.5 : 1)	

Comments: _____

AMR Verification

Table A-17: AMR CDI Alarm Input Verification

OK	Parameter	Specification	Data
<input type="checkbox"/>	Verify CDI alarm input operation ("ALARM A" (numbers 1 -18)	BTS Relay #XX - Contact Alarm Sets/Clears	
<input type="checkbox"/>	Verify CDI alarm input operation ("ALARM B" (numbers 19 -36)	BTS Relay #XX - Contact Alarm Sets/Clears	

Comments: _____



Site Serial Number Check List

Date _____

Site _____

C-CCP Shelf

Site I/O A & B

C-CCP Shelf

CSM-1

CSM-2

HSO

CCD-1

CCD-2

AMR-1

AMR-2

MPC-1

MPC-2

Fans 1-3

GLI-1

GLI-2

BBX-1

BBX-2

BBX-3

BBX-4

BBX-5

BBX-6

BBX-7

BBX-8

BBX-9

BBX-10

BBX-11

BBX-12

BBX-r

MCC-1

MCC-2

MCC-3

MCC-4

MCC-5

MCC-6

MCC-7

MCC-8

MCC-9



- MCC-1-10 _____
- MCC-1 1 _____
- MCC-1-12 _____
- CIO _____
- SWITCH _____
- PS-1 _____
- PS-2 _____
- PS-3 _____

LPAs

- LPA 1A _____
- LPA 1B _____
- LPA 1C _____
- LPA 1D _____
- LPA 2A _____
- LPA 2B _____
- LPA 2C _____
- LPA 2D _____
- LPA 3A _____
- LPA 3B _____
- LPA 3C _____
- LPA 3D _____
- LPA 4A _____
- LPA 4B _____
- LPA 4C _____
- LPA 4D _____

Power Conversion Shelf (-48 V BTS Only)

- AMR _____
- PS 4 _____
- PS 5 _____
- PS 6 _____
- PS 7 _____
- PS 8 _____
- PS 9 _____

Appendix B

PN Offset/I & Q Offset Register

Programming Information

PN Offset Programming Information

PN Offset Background



All channel elements transmitted from a BTS in a particular 1.25 MHz CDMA channel are orthonogonally spread by 1 of 128 possible Walsh code functions; additionally, they are also spread by a quadrature pair of PN sequences unique to each sector.

Overall, the mobile uses this to differentiate multiple signals transmitted from the same BTS (and surrounding BTS) sectors, and to synchronize to the next strongest sector.

The PN offset per sector is stored on the BBXs, where the corresponding I & Q registers reside.

The PN offset values are determined on a per BTS/per sector(antenna) basis as determined by the appropriate cdf file content. A breakdown of this information is found in Table B-1.

PN Offset Usage

Only the 14-chip delay is currently in use. It is important to determine the RF chip delay to be able to test the BTS functionality. This can be done by ascertaining if the CDF file `FineTxAdj` value was set to “on” when the MCC was downloaded with “image data”. The `FineTxAdj` value is used to compensate for the processing delay (approximately 20 μ S) in the BTS using any type of mobile meeting IS-97 specifications.

If the `FineTxAdj` value in the cdf file is 213 (D5 HEX), `FineTxAdj` has been set for the *14 chip table*.

NOTE

CDF file I and Q values can be represented in DECIMAL or HEX. If using HEX, add 0x before the HEX value. If necessary, convert HEX values in Table B-1 to decimal before comparing them to cdf file I & Q value assignments.

Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I (Hex.)	Q
0	17523	23459	4473	5BA3
1	32292	32589	7E24	7F4D
2	4700	17398	125C	43F6
3	14406	26333	3846	66DD
4	14899	4011	3A33	0FAB
5	17025	2256	4281	08D0
6	14745	18651	3999	48DB
7	2783	1094	0ADF	0446
8	5832	21202	16C8	52D2
9	12407	13841	3077	3611
10	31295	31767	7A3F	7C17
11	7581	18890	1D9D	49CA
12	18523	30999	485B	7917
13	29920	22420	74E0	5794
14	25184	20168	6260	4EC8
15	26282	12354	66AA	3042
16	30623	11187	779F	2BB3
17	15540	11834	3CB4	2E3A
18	23026	10395	59F2	289B
19	20019	28035	4E33	6D83
20	4050	27399	0FD2	6B07
21	1557	22087	0615	5647
22	30262	2077	7636	081D
23	18000	13758	4650	35BE
24	20056	11778	4E58	2E02
25	12143	3543	2F6F	0DD7
26	17437	7184	441D	1C10
27	17438	2362	441E	093A
28	5102	25840	13EE	64F0
29	9302	12177	2456	2F91
30	17154	10402	4302	28A2
31	5198	1917	144E	077D
32	4606	17708	11FE	452C
33	24804	10630	60E4	2986
34	17180	6812	431C	1A9C
35	10507	14350	290B	380E
36	10157	10999	27AD	2AF7
37	23850	25003	5D2A	61AB
38	31425	2652	7AC1	0A5C
39	4075	19898	0FEB	4DBA
40	10030	2010	272E	07DA
41	16984	25936	4258	6550
42	14225	28531	3791	6F73
43	26519	11952	6797	2EB0
44	27775	31947	6C7F	7CCB
45	30100	25589	7594	63F5
46	7922	11345	1EF2	2C51
47	14199	28198	3777	6E26
48	17637	13947	44E5	367B
49	23081	8462	5A29	210E
50	5099	9595	13EB	257B

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q (Dec.)	I (Hex.)	Q (Hex.)
51	32743	4670	7FE7	123E
52	7114	14672	1BCA	3950
53	7699	29415	1E13	72E7
54	19339	20610	4B8B	5082
55	28212	6479	6E34	194F
56	29587	10957	7393	2ACD
57	19715	18426	4D03	47FA
58	14901	22726	3A35	58C6
59	20160	5247	4EC0	147F
60	22249	29953	56E9	7501
61	26582	5796	67D6	16A4
62	7153	16829	1BF1	41BD
63	15127	4528	3B17	11B0
64	15274	5415	3BAA	1527
65	23149	10294	5A6D	2836
66	16340	17046	3FD4	4296
67	27052	7846	69AC	1EA6
68	13519	10762	34CF	2A0A
69	10620	13814	297C	35F6
70	15978	16854	3E6A	41D6
71	27966	795	6D3E	031B
72	12479	9774	30BF	262E
73	1536	24291	0600	5EE3
74	3199	3172	0C7F	0C64
75	4549	2229	11C5	08B5
76	17888	21283	45E0	5323
77	13117	16905	333D	4209
78	7506	7062	1D52	1B96
79	27626	7532	6BEA	1D6C
80	31109	25575	7985	63E7
81	29755	14244	743B	37A4
82	26711	28053	6857	6D95
83	20397	30408	4FAD	76C8
84	18608	5094	48B0	13E6
85	7391	16222	1CDF	3F5E
86	23168	7159	5A80	1BF7
87	23466	174	5BAA	00AE
88	15932	25530	3E3C	63BA
89	25798	2320	64C6	0910
90	28134	23113	6DE6	5A49
91	28024	23985	6D78	5DB1
92	6335	2604	18BF	0A2C
93	21508	1826	5404	0722
94	26338	30853	66E2	7885
95	17186	15699	4322	3D53
96	22462	2589	57BE	0A1D
97	3908	25000	0F44	61A8
98	25390	18163	632E	46F3
99	27891	12555	6CF3	310B
100	9620	8670	2594	21DE

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
101	6491	1290	195B	050A
102	16876	4407	41EC	1137
103	17034	1163	428A	048B
104	32405	12215	7E95	2FB7
105	27417	7253	6B19	1C55
106	8382	8978	20BE	2312
107	5624	25547	15F8	63CB
108	1424	3130	0590	0C3A
109	13034	31406	32EA	7AAE
110	15682	6222	3D42	184E
111	27101	20340	69DD	4F74
112	8521	25094	2149	6206
113	30232	23380	7618	5B54
114	6429	10926	191D	2AAE
115	27116	22821	69EC	5925
116	4238	31634	108E	7B92
117	5128	4403	1408	1133
118	14846	689	39FE	02B1
119	13024	27045	32E0	69A5
120	10625	27557	2981	6BA5
121	31724	16307	7BEC	3FB3
122	13811	22338	35F3	5742
123	24915	27550	6153	6B9E
124	1213	22096	04BD	5650
125	2290	23136	08F2	5A60
126	31551	12199	7B3F	2FA7
127	12088	1213	2F38	04BD
128	7722	936	1E2A	03A8
129	27312	6272	6AB0	1880
130	23130	32446	5A5A	7EBE
131	594	13555	0252	34F3
132	25804	8789	64CC	2255
133	31013	24821	7925	60F5
134	32585	21068	7F49	524C
135	3077	31891	0C05	7C93
136	17231	5321	434F	14C9
137	31554	551	7B42	0227
138	8764	12115	223C	2F53
139	15375	4902	3C0F	1326
140	13428	1991	3474	07C7
141	17658	14404	44FA	3844
142	13475	17982	34A3	463E
143	22095	19566	564F	4C6E
144	24805	2970	60E5	0B9A
145	4307	23055	10D3	5A0F
146	23292	15158	5AFC	3B36
147	1377	29094	0561	71A6
148	28654	653	6FEE	028D
149	6350	19155	18CE	4AD3
150	16770	23588	4182	5C24

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
151	14726	10878	3986	2A7E
152	25685	31060	6455	7954
153	21356	30875	536C	789B
154	12149	11496	2F75	2CE8
155	28966	24545	7126	5FE1
156	22898	9586	5972	2572
157	1713	20984	06B1	51F8
158	30010	30389	753A	76B5
159	2365	7298	093D	1C82
160	27179	18934	6A2B	49F6
161	29740	23137	742C	5A61
162	5665	24597	1621	6015
163	23671	23301	5C77	5B05
164	1680	7764	0690	1E54
165	25861	14518	6505	38B6
166	25712	21634	6470	5482
167	19245	11546	4B2D	2D1A
168	26887	26454	6907	6756
169	30897	15938	78B1	3E42
170	11496	9050	2CE8	235A
171	1278	3103	04FE	0C1F
172	31555	758	7B43	02F6
173	29171	16528	71F3	4090
174	20472	20375	4FF8	4F97
175	5816	10208	16B8	27E0
176	30270	17698	763E	4522
177	22188	8405	56AC	20D5
178	6182	28634	1826	6FDA
179	32333	1951	7E4D	079F
180	14046	20344	36DE	4F78
181	15873	26696	3E01	6848
182	19843	3355	4D83	0D1B
183	29367	11975	72B7	2EC7
184	13352	31942	3428	7CC6
185	22977	9737	59C1	2609
186	31691	9638	7BCB	25A6
187	10637	30643	298D	77B3
188	25454	13230	636E	33AE
189	18610	22185	48B2	56A9
190	6368	2055	18E0	0807
191	7887	8767	1ECF	223F
192	7730	15852	1E32	3DEC
193	23476	16125	5BB4	3EFD
194	889	6074	0379	17BA
195	21141	31245	5295	7A0D
196	20520	15880	5028	3E08
197	21669	20371	54A5	4F93
198	15967	8666	3E5F	21DA
199	21639	816	5487	0330
200	31120	22309	7990	5725

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
201	3698	29563	0E72	737B
202	16322	13078	3FC2	3316
203	17429	10460	4415	28DC
204	21730	17590	54E2	44B6
205	17808	20277	4590	4F35
206	30068	19988	7574	4E14
207	12737	6781	31C1	1A7D
208	28241	32501	6E51	7EF5
209	20371	6024	4F93	1788
210	13829	20520	3605	5028
211	13366	31951	3436	7CCF
212	25732	26063	6484	65CF
213	19864	27203	4D98	6A43
214	5187	6614	1443	19D6
215	23219	10970	5AB3	2ADA
216	28242	5511	6E52	1587
217	6243	17119	1863	42DF
218	445	16064	01BD	3EC0
219	21346	31614	5362	7B7E
220	13256	4660	33C8	1234
221	18472	13881	4828	3639
222	25945	16819	6559	41B3
223	31051	6371	794B	18E3
224	1093	24673	0445	6061
225	5829	6055	16C5	17A7
226	31546	10009	7B3A	2719
227	29833	5957	7489	1745
228	18146	11597	46E2	2D4D
229	24813	22155	60ED	568B
230	47	15050	002F	3ACA
231	3202	16450	0C82	4042
232	21571	27899	5443	6CFB
233	7469	2016	1D2D	07E0
234	25297	17153	62D1	4301
235	8175	15849	1FEF	3DE9
236	28519	30581	6F67	7775
237	4991	3600	137F	0E10
238	7907	4097	1EE3	1001
239	17728	671	4540	029F
240	14415	20774	384F	5126
241	30976	24471	7900	5F97
242	26376	27341	6708	6ACD
243	19063	19388	4A77	4BBC
244	19160	25278	4AD8	62BE
245	3800	9505	0ED8	2521
246	8307	26143	2073	661F
247	12918	13359	3276	342F
248	19642	2154	4CBA	086A
249	24873	13747	6129	35B3
250	22071	27646	5637	6BFE

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Table B-1: PnMask I and PnMask Q Values for PilotPn

14-Chip Delay				
Pilot PN	I (Dec.)	Q	I (Hex.)	Q
251	13904	1056	3650	0420
252	27198	1413	6A3E	0585
253	3685	3311	0E65	0CEF
254	16820	4951	41B4	1357
255	22479	749	57CF	02ED
256	6850	6307	1AC2	18A3
257	15434	961	3C4A	03C1
258	19332	2358	4B84	0936
259	8518	28350	2146	6EBE
260	14698	31198	396A	79DE
261	21476	11467	53E4	2CCB
262	30475	8862	770B	229E
263	23984	6327	5DB0	18B7
264	1912	7443	0778	1D13
265	26735	28574	686F	6F9E
266	15705	25093	3D59	6205
267	3881	6139	0F29	17FB
268	20434	22047	4FD2	561F
269	16779	32545	418B	7F21
270	31413	7112	7AB5	1BC8
271	16860	28535	41DC	6F77
272	8322	10378	2082	288A
273	28530	15065	6F72	3AD9
274	26934	5125	6936	1405
275	18806	12528	4976	30F0
276	20216	23215	4EF8	5AAF
277	9245	20959	241D	51DF
278	8271	3568	204F	0DF0
279	18684	26453	48FC	6755
280	8220	29421	201C	72ED
281	6837	24555	1AB5	5FEB
282	9613	10779	258D	2A1B
283	31632	25260	7B90	62AC
284	27448	16084	6B38	3ED4
285	12417	26028	3081	65AC
286	30901	29852	78B5	749C
287	9366	14978	2496	3A82
288	12225	12182	2FC1	2F96
289	21458	25143	53D2	6237
290	6466	15838	1942	3DDE
291	8999	5336	2327	14D8
292	26718	21885	685E	557D
293	3230	20561	0C9E	5051
294	27961	30097	6D39	7591
295	28465	21877	6F31	5575
296	6791	23589	1A87	5C25
297	17338	26060	43BA	65CC
298	11832	9964	2E38	26EC
299	11407	25959	2C8F	6567
300	15553	3294	3CC1	0CDE

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
301	17418	30173	440A	75DD
302	14952	15515	3A68	3C9B
303	52	5371	0034	14FB
304	27254	10242	6A76	2802
305	15064	28052	3AD8	6D94
306	10942	14714	2ABE	397A
307	377	19550	0179	4C5E
308	14303	8866	37DF	22A2
309	24427	15297	5F6B	3BC1
310	26629	10898	6805	2A92
311	20011	31315	4E2B	7A53
312	16086	19475	3ED6	4C13
313	24374	1278	5F36	04FE
314	9969	11431	26F1	2CA7
315	29364	31392	72B4	7AA0
316	25560	4381	63D8	111D
317	28281	14898	6E79	3A32
318	7327	23959	1C9F	5D97
319	32449	16091	7EC1	3EDB
320	26334	9037	66DE	234D
321	14760	24162	39A8	5E62
322	15128	6383	3B18	18EF
323	29912	27183	74D8	6A2F
324	4244	16872	1094	41E8
325	8499	9072	2133	2370
326	9362	12966	2492	32A6
327	10175	28886	27BF	70D6
328	30957	25118	78ED	621E
329	12755	20424	31D3	4FC8
330	19350	6729	4B96	1A49
331	1153	20983	0481	51F7
332	29304	12372	7278	3054
333	6041	13948	1799	367C
334	21668	27547	54A4	6B9B
335	28048	8152	6D90	1FD8
336	10096	17354	2770	43CA
337	23388	17835	5B5C	45AB
338	15542	14378	3CB6	382A
339	24013	7453	5DCD	1D1D
340	2684	26317	0A7C	66CD
341	19018	5955	4A4A	1743
342	25501	10346	639D	286A
343	4489	13200	1189	3390
344	31011	30402	7923	76C2
345	29448	7311	7308	1C8F
346	25461	3082	6375	0C0A
347	11846	21398	2E46	5396
348	30331	31104	767B	7980
349	10588	24272	295C	5ED0
350	32154	27123	7D9A	69F3

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
351	29572	5578	7384	15CA
352	13173	25731	3375	6483
353	10735	10662	29EF	29A6
354	224	11084	00E0	2B4C
355	12083	31098	2F33	797A
356	22822	16408	5926	4018
357	2934	6362	0B76	18DA
358	27692	2719	6C2C	0A9F
359	10205	14732	27DD	398C
360	7011	22744	1B63	58D8
361	22098	1476	5652	05C4
362	2640	8445	0A50	20FD
363	4408	21118	1138	527E
364	102	22198	0066	56B6
365	27632	22030	6BF0	560E
366	19646	10363	4CBE	287B
367	26967	25802	6957	64CA
368	32008	2496	7D08	09C0
369	7873	31288	1EC1	7A38
370	655	24248	028F	5EB8
371	25274	14327	62BA	37F7
372	16210	23154	3F52	5A72
373	11631	13394	2D6F	3452
374	8535	1806	2157	070E
375	19293	17179	4B5D	431B
376	12110	10856	2F4E	2A68
377	21538	25755	5422	649B
378	10579	15674	2953	3D3A
379	13032	7083	32E8	1BAB
380	14717	29096	397D	71A8
381	11666	3038	2D92	0BDE
382	25809	16277	64D1	3F95
383	5008	25525	1390	63B5
384	32418	20465	7EA2	4FF1
385	22175	28855	569F	70B7
386	11742	32732	2DDE	7FDC
387	22546	20373	5812	4F95
388	21413	9469	53A5	24FD
389	133	26155	0085	662B
390	4915	6957	1333	1B2D
391	8736	12214	2220	2FB6
392	1397	21479	0575	53E7
393	18024	31914	4668	7CAA
394	15532	32311	3CAC	7E37
395	26870	11276	68F6	2C0C
396	5904	20626	1710	5092
397	24341	423	5F15	01A7
398	13041	2679	32F1	0A77
399	23478	15537	5BB6	3CB1
400	1862	10818	0746	2A42

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I (Hex.)	Q
401	5850	23074	16DA	5A22
402	5552	20250	15B0	4F1A
403	12589	14629	312D	3925
404	23008	29175	59E0	71F7
405	27636	13943	6BF4	3677
406	17600	11072	44C0	2B40
407	17000	29492	4268	7334
408	21913	5719	5599	1657
409	30320	7347	7670	1CB3
410	28240	12156	6E50	2F7C
411	7260	25623	1C5C	6417
412	17906	27725	45F2	6C4D
413	5882	28870	16FA	70C6
414	22080	31478	5640	7AF6
415	12183	28530	2F97	6F72
416	23082	24834	5A2A	6102
417	17435	9075	441B	2373
418	18527	32265	485F	7E09
419	31902	3175	7C9E	0C67
420	18783	17434	495F	441A
421	20027	12178	4E3B	2F92
422	7982	25613	1F2E	640D
423	20587	31692	506B	7BCC
424	10004	25384	2714	6328
425	13459	18908	3493	49DC
426	13383	25816	3447	64D8
427	28930	4661	7102	1235
428	4860	31115	12FC	798B
429	13108	7691	3334	1E0B
430	24161	1311	5E61	051F
431	20067	16471	4E63	4057
432	2667	15771	0A6B	3D9B
433	13372	16112	343C	3EF0
434	28743	21062	7047	5246
435	24489	29690	5FA9	73FA
436	249	10141	00F9	279D
437	19960	19014	4DF8	4A46
438	29682	22141	73F2	567D
439	31101	11852	797D	2E4C
440	27148	26404	6A0C	6724
441	26706	30663	6852	77C7
442	5148	32524	141C	7F0C
443	4216	28644	1078	6FE4
444	5762	10228	1682	27F4
445	245	23536	00F5	5BF0
446	21882	18045	557A	467D
447	3763	25441	0EB3	6361
448	206	27066	00CE	69BA
449	28798	13740	707E	35AC
450	32402	13815	7E92	35F7

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q	I	Q
			(Hex.)	
451	13463	3684	3497	0E64
452	15417	23715	3C39	5CA3
453	23101	15314	5A3D	3BD2
454	14957	32469	3A6D	7ED5
455	23429	9816	5B85	2658
456	12990	4444	32BE	115C
457	12421	5664	3085	1620
458	28875	7358	70CB	1CBE
459	4009	27264	0FA9	6A80
460	1872	28128	0750	6DE0
461	15203	30168	3B63	75D8
462	30109	29971	759D	7513
463	24001	3409	5DC1	0D51
464	4862	16910	12FE	420E
465	14091	20739	370B	5103
466	6702	10191	1A2E	27CF
467	3067	12819	0BFB	3213
468	28643	19295	6FE3	4B5F
469	21379	10072	5383	2758
470	20276	15191	4F34	3B57
471	25337	27748	62F9	6C64
472	19683	720	4CE3	02D0
473	10147	29799	27A3	7467
474	16791	27640	4197	6BF8
475	17359	263	43CF	0107
476	13248	24734	33C0	609E
477	22740	16615	58D4	40E7
478	13095	20378	3327	4F9A
479	10345	25116	2869	621C
480	30342	19669	7686	4CD5
481	27866	14656	6CDA	3940
482	9559	27151	2557	6A0F
483	8808	28728	2268	7038
484	12744	25092	31C8	6204
485	11618	22601	2D62	5849
486	27162	2471	6A1A	09A7
487	17899	25309	45EB	62DD
488	29745	15358	7431	3BFE
489	31892	17739	7C94	454B
490	23964	12643	5D9C	3163
491	23562	32730	5C0A	7FDA
492	2964	19122	0B94	4AB2
493	18208	16870	4720	41E6
494	15028	10787	3AB4	2A23
495	21901	18400	558D	47E0
496	24566	20295	5FF6	4F47
497	18994	1937	4A32	0791
498	13608	17963	3528	462B
499	27492	7438	6B64	1D0E
500	11706	12938	2DBA	328A

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Table B-1: PnMask I and PnMask Q Values for PilotPn				
14-Chip Delay				
Pilot PN	I (Dec.)	Q (Dec.)	I (Hex.)	Q (Hex.)
501	14301	19272	37DD	4B48
502	23380	29989	5B54	7525
503	11338	8526	2C4A	214E
504	2995	18139	0BB3	46DB
505	23390	3247	5B5E	0CAF
506	14473	28919	3889	70F7
507	6530	7292	1982	1C7C
508	20452	20740	4FE4	5104
509	12226	27994	2FC2	6D5A
510	1058	2224	0422	08B0
511	12026	6827	2EFA	1AAB



B



Notes



Appendix C

FRU Optimization/ATP Test Matrix

FRU Optimization/ATP Test Matrix

Usage & Background

Periodic maintenance of a site may also may mandate re-optimization of specific portions of the site. An outline of some basic guidelines is included in the following tables.

NOTE	Re-optimization steps listed for any assembly detailed in the tables below must be performed <i>anytime</i> an RF cable associated with it is replaced.
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BTS Frame

Table C-1: When RF Optimization Is required on the BTS	
Item Replaced	Optimize:
C-CCP Shelf	All sector TX and RX paths to all Combined CDMA Channel Processor (C-CCP) shelves.
Multicoupler/ Preselector Card	The three or six affected sector RX paths for the C-CCP shelf in the BTS frames.
BBX board	RX and TX paths of the affected C-CCP shelf / BBX board.
CIO Card	All RX and TX paths of the affected CDMA carrier.
Any LPA Module	The affected sector TX path.
LPA Backplane	The affected sector TX path.
LPA Filter	The affected sector TX path.

Ancillary Frame

Item Replaced	Optimize:
Directional Coupler	All affected sector RX and TX paths to all BTS frame shelves.
Site filter	All affected RX sector paths in all shelves in all BTS frames.
Any RFDS component or TSU.	The RFDS calibration RX & TX paths (MONFWD/GENFWD).

Inter-frame Cabling

Optimization must be performed after the replacement of any RF cabling between BTS frames.

Item Replaced	Optimize:
Ancillary frame to BTS frame (RX) cables	The affected sector/antenna RX paths.
BTS frame to ancillary frame (TX) cables	The affected sector/antenna TX paths.

Detailed Optimization/ATP Test Matrix

Table C-3 outlines in more detail the tests that would need to be performed if one of the BTS components were to fail and be replaced. It is also assumed that all modules are placed OOS-ROM via the LMF until full redundancy of all applicable modules is implemented.

The following guidelines should also be noted when using this table.

NOTE	Not every procedure required to bring the site back on line is indicated in Table C-3. It is meant to be used as a guideline ONLY. The table assumes that the user is familiar enough with the BTS Optimization/ATP procedure to understand which test equipment set ups, calibrations, and BTS site preparation will be required before performing the Table # procedures referenced.
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Various passive BTS components (such as the TX and RX directional couplers, Preselector IO, CIO; etc.) only call for a TX or RX calibration audit to be performed in lieu of a full path calibration. If the RX or TX path calibration audit fails, the entire RF path calibration will need to be repeated. If the RF path calibration fails, further troubleshooting is warranted.

Whenever any C-CCP BACKPLANE is replaced, it is assumed that only power to the C-CCP shelf being replaced is turned off via the breaker supplying that shelf.

Whenever any DISTRIBUTION BACKPLANE is replaced it is assumed that the power to the entire RFM frame is removed and the Preselector I/O is replaced. The modem frame should be brought up as if it were a new installation.

NOTE	If any significant change in signal level results from any component being replaced in the RX or TX signal flow paths, it would be identified by re-running the RX and TX calibration audit command.
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When the CIO is replaced, the C-CCP shelf remains powered up. The BBX boards may need to be removed, then re-installed into their original slots, and re-downloaded (code and BLO data). RX and TX calibration audits should then be performed.



Table C-3: SC 4812T BTS Optimization and ATP Test Matrix

Doc Tbl #	page	Description	Directional Coupler (RX)	Directional Coupler (TX)	RX Filter	RX Cables	TX Cables	MPC/EMPC	CIO	C-CCP Backplane	BBX	MCC	CSM	LFR/HSO	GPS	GLI	LPA Trunking Backplane	LPA	LPA Bandpass Filter	Power Supply Modules**	Switch Card	RFDS
Table 2-1	2-3	Initial Boards/Modules Install, Preliminary Operations, CDF Site Equipage; etc.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Table 2-2 Table 2-5	2-6 2-14	DC Power Pre-Test Physical Inspect			•					•												
Table 2-7	2-15	Initial Power-up								•							•	•		•		•
Table 3-6	3-14	Ping the Processors								•	•	•	•			•					•	
Table 3-12	3-26	Download/Enable MGLIs								•						•						•
Table 3-12	3-26	Download/Enable GLIs								•						•						•
Table 3-13	3-27	Download CSMs								•			•		•							•
Table 3-13	3-27	Download MCCs								•			•		•							•
Table 3-13	3-27	Download BBXs								•	•											•
Table 3-15	3-29	Enable CSMs								•			•									
Table 3-16	3-30	Enable MCCs								•		•										
Table 3-19	3-36	GPS Initialization / Verification								•			•		•							
Table 3-20	3-40	LFR Initialization / Verification								•				•								
Table 3-21	3-42	HSO Initialization/Verification								•				•								
Table 3-36	3-74	TX Path Calibration	4	4			4		1	1	4					*	3	3	4		7	
Table 3-37	3-76	Download Offsets to BBX	4	4						1	4					*						
Table 3-38	3-77	TX Path Calibration Audit	4	4			4		1	1	4					*	3	3	4		7	
Table 3-46	3-88	RFDS Calibration Procedure	6	6		5	4	5	1	1	6					*	3	3	4			6
Table 4-1	4-5	Spectral Purity TX Mask ATP	4	4						1	4					*	*	*	*		*	
Table 4-1	4-5	Waveform Quality (rho) ATP	4	4					*	1	4		*		*	*	*	*	*			
Table 4-1	4-5	Pilot Time Offset ATP	4	4					*	1	4		*		*	*	*	*	*			
Table 4-1	4-5	Code Domain Power / Noise Floor	4	4						1	4	8	8	8	8	*	*	*	*			
Table 4-1	4-5	FER Test	5	5		5	5	2	2	5	8	8	8	8	*							7

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Table C-3: SC 4812T BTS Optimization and ATP Test Matrix

Doc Tbl #	page	Description	Directional Coupler (RX)	Directional Coupler (TX)	RX Filter	RX Cables	TX Cables	MPC/EMPC	CIO	C-CCP Backplane	BBX	MCC	CSM	LFR/HSO	GPS	GLI	LPA Trunking Backplane	LPA	LPA Bandpass Filter	Power Supply Modules**	Switch Card	RFDS
OPTIMIZATION AND TEST LEGEND																						
•	Required																					
*	Perform if necessary for additional fault isolation, repair assurance, or site certification.																					
**	Replace power converters one card at a time so that power to the C-CCP or LPA shelf is not lost. If power to the C-CCP shelf is lost, all cards in the shelf must be downloaded again.																					
1	Perform on all carrier and sector TX paths to the C-CCP cage.																					
2	Perform on all carrier and sector RX paths to the C-CCP cage.																					
3	Perform on all primary and redundant TX paths of the affected carrier.																					
4	Perform on the affected carrier and sector TX paths. (BBXR replacement affects all carrier and sector TX paths.)																					
5	Perform on the affected carrier and sector RX paths. (BBXR replacement affects all carrier and sector RX paths.)																					
6	Perform on all RF paths of the affected carrier and sector (RFDS replacement affects all carriers.)																					
7	Perform with redundant BBX for all sectors on all carriers.																					
8	Verify performance by performing on one sector of one carrier only.																					



C

Appendix D

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BBX Gain Set Point vs. BTS Output

BBX Gain Set Point vs. BTS Output Considerations

Usage & Background

Table D-1 outlines the relationship between the *total* of all code domain channel element gain settings (digital root sum of the squares) and the BBX Gain Set Point between 33.0 dBm and 44.0 dBm. The resultant RF output (as measured at the top of the BTS in dBm) is shown in the table. The table assumes that the BBX Bay Level Offset (BLO) values have been calculated.

As an illustration, consider a BBX keyed up to produce a CDMA carrier with only the Pilot channel (no MCCs forward link enabled). Pilot gain is set to 262. In this case, the BBX Gain Set Point is shown to correlate exactly to the actual RF output anywhere in the 33 to 44 dBm output range. (This is the level used to calibrate the BTS).

Table D-1: BBX Gain Set Point vs. Actual BTS Output (in dBm)

dBm↗ Gain↘	44	43	42	41	40	39	38	37	36	35	34	33
541	-	-	-	-	-	-	-	43.3	42.3	41.3	40.3	39.3
533	-	-	-	-	-	-	-	43.2	42.2	41.2	40.2	39.2
525	-	-	-	-	-	-	44	43	42	41	40	39
517	-	-	-	-	-	-	43.9	42.9	41.9	40.9	39.9	38.9
509	-	-	-	-	-	-	43.8	42.8	41.8	40.8	39.8	38.8
501	-	-	-	-	-	-	43.6	42.6	41.6	40.6	39.6	38.6
493	-	-	-	-	-	-	43.5	42.5	41.5	40.5	39.5	38.5
485	-	-	-	-	-	-	43.4	42.4	41.4	40.4	39.4	38.4
477	-	-	-	-	-	-	43.2	42.2	41.2	40.2	39.2	38.2
469	-	-	-	-	-	-	43.1	42.1	41.1	40.1	39.1	38.1
461	-	-	-	-	-	43.9	42.9	41.9	40.9	39.9	38.9	37.9
453	-	-	-	-	-	43.8	42.8	41.8	40.8	39.8	38.8	37.8
445	-	-	-	-	-	43.6	42.6	41.6	40.6	39.6	38.6	37.6
437	-	-	-	-	-	43.4	42.4	41.4	40.4	39.4	38.4	37.4
429	-	-	-	-	-	43.3	42.3	41.3	40.3	39.3	38.3	37.3
421	-	-	-	-	-	43.1	42.1	41.1	40.1	39.1	38.1	37.1
413	-	-	-	-	44	43	42	41	40	39	38	37
405	-	-	-	-	43.8	42.8	41.8	40.8	39.8	38.8	37.8	36.8
397	-	-	-	-	43.6	42.6	41.6	40.6	39.6	38.6	37.6	36.6
389	-	-	-	-	43.4	42.4	41.4	40.4	39.4	38.4	37.4	36.4

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Table D-1: BBX Gain Set Point vs. Actual BTS Output (in dBm)												
dBm↗ Gain↘	44	43	42	41	40	39	38	37	36	35	34	33
381	-	-	-	-	43.3	42.3	41.3	40.3	39.3	38.3	37.3	36.3
374	-	-	-	-	43.1	42.1	41.1	40.1	39.1	38.1	37.1	36.1
366	-	-	-	43.9	42.9	41.9	40.9	39.9	38.9	37.9	36.9	35.9
358	-	-	-	43.7	42.7	41.7	40.7	39.7	38.7	37.7	36.7	35.7
350	-	-	-	43.5	42.5	41.5	40.5	39.5	38.5	37.5	36.5	35.5
342	-	-	-	43.3	42.3	41.3	40.3	39.3	38.3	37.3	36.3	35.3
334	-	-	-	43.1	42.1	41.1	40.1	39.1	38.1	37.1	36.1	35.1
326	-	-	43.9	42.9	41.9	40.9	39.9	38.9	37.9	36.9	35.9	34.9
318	-	-	43.7	42.7	41.7	40.7	39.7	38.7	37.7	36.7	35.7	34.7
310	-	-	43.5	42.5	41.5	40.5	39.5	38.5	37.5	36.5	35.5	34.5
302	-	-	43.2	42.2	41.2	40.2	39.2	38.2	37.2	36.2	35.2	34.2
294	-	44	43	42	41	40	39	38	37	36	35	34
286	-	43.8	42.8	41.8	40.8	39.8	38.8	37.8	36.8	35.8	34.8	33.8
278	-	43.5	42.5	41.5	40.5	39.5	38.5	37.5	36.5	35.5	34.5	33.5
270	-	43.3	42.3	41.3	40.3	39.3	38.3	37.3	36.3	35.3	34.3	33.3
262	44	43	42	41	40	39	38	37	36	35	34	33
254	43.7	42.7	41.7	40.7	39.7	38.7	37.7	36.7	35.7	34.7	33.7	-
246	43.4	42.4	41.4	40.4	39.4	38.4	37.4	36.4	35.4	34.4	33.4	-
238	43.2	42.2	41.2	40.2	39.2	38.2	37.2	36.2	35.2	34.2	33.2	-
230	42.9	41.9	40.9	39.9	38.9	37.9	36.9	35.9	34.9	33.9	-	-
222	42.6	41.6	40.6	39.6	38.6	37.6	36.6	35.6	34.6	33.6	-	-
214	42.2	41.2	40.2	39.2	38.2	37.2	36.2	35.2	34.2	33.2	-	-

D

Appendix E

CDMA Operating Frequency



Operating Frequency - North American PCS Bands

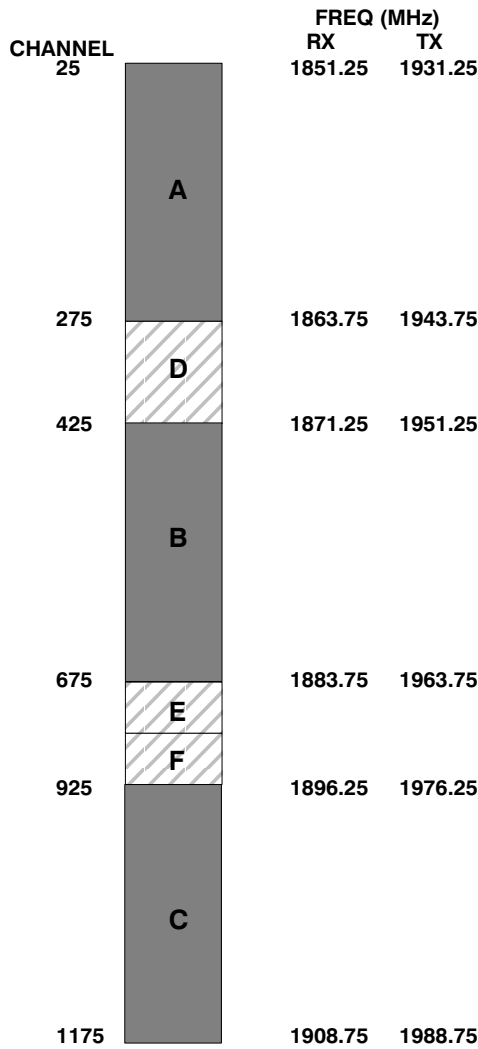
Introduction

Programming of each of the BTS BBX synthesizers is performed by the BTS GLIs via the CHI bus. This programming data determines the transmit and receive transceiver operating frequencies (channels) for each BBX.

1900 MHz PCS Channels

Figure E-1 shows the valid channels for the North American PCS 1900 MHz frequency spectrum. There are 10 CDMA wireline or non-wireline band channels used in a CDMA system (unique per customer operating system).

Figure E-1: North American PCS 1900 MHz Frequency Spectrum



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Calculating 1900 MHz Center Frequencies

Table E-1 shows selected 1900 MHz CDMA candidate operating channels, listed in both decimal and hexadecimal, and the corresponding transmit, and receive frequencies. Center frequencies (in MHz) for channels not shown in the table may be calculated as follows:

- $TX = 1930 + 0.05 * \text{Channel\#}$

Example: Channel 262

$$TX = 1930 + 0.05 * 262 = 1943.10 \text{ MHz}$$

- $RX = TX - 80$

Example: Channel 262

$$RX = 1943.10 - 80 = 1863.10 \text{ MHz}$$

Actual frequencies used depend on customer CDMA system frequency plan.

Each CDMA channel requires a 1.77 MHz frequency segment. The actual CDMA carrier is 1.23 MHz wide, with a 0.27 MHz guard band on both sides of the carrier.

Minimum frequency separation required between any CDMA carrier and the nearest NAMPS/AMPS carrier is 900 kHz (center-to-center).

Table E-1: 1900 MHz TX and RX Frequency vs. Channel

Channel Number		Transmit Frequency (MHz) Center Frequency	Receive Frequency (MHz) Center Frequency
Decimal	Hex		
25	0019	1931.25	1851.25
50	0032	1932.50	1852.50
75	004B	1933.75	1853.75
100	0064	1935.00	1855.00
125	007D	1936.25	1856.25
150	0096	1937.50	1857.50
175	00AF	1938.75	1858.75
200	00C8	1940.00	1860.00
225	00E1	1941.25	1861.25
250	00FA	1942.50	1862.50
275	0113	1943.75	1863.75
300	012C	1945.00	1865.00
325	0145	1946.25	1866.25
350	015E	1947.50	1867.50
375	0177	1948.75	1868.75
400	0190	1950.00	1870.00
425	01A9	1951.25	1871.25
450	01C2	1952.50	1872.50
475	01DB	1953.75	1873.75
500	01F4	1955.00	1875.00
525	020D	1956.25	1876.25
550	0226	1957.50	1877.50
575	023F	1958.75	1878.75

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Table E-1: 1900 MHz TX and RX Frequency vs. Channel

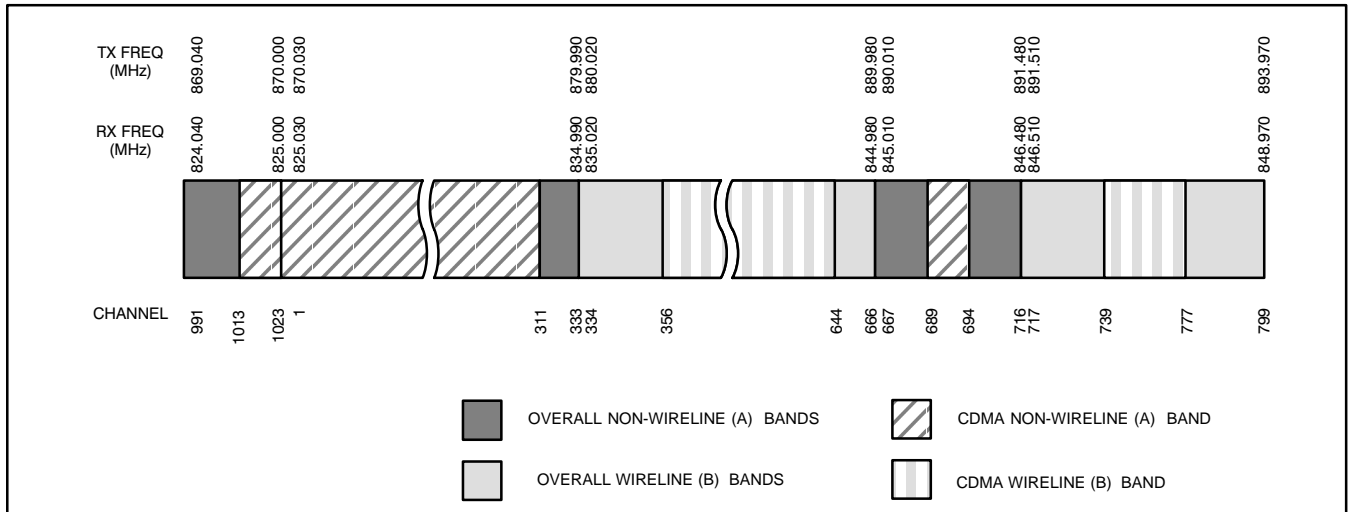
Channel Number		Transmit Frequency (MHz)	Receive Frequency (MHz)
Decimal	Hex	Center Frequency	Center Frequency
600	0258	1960.00	1880.00
625	0271	1961.25	1881.25
650	028A	1962.50	1882.50
675	02A3	1963.75	1883.75
700	02BC	1965.00	1885.00
725	02D5	1966.25	1886.25
750	02EE	1967.50	1887.50
775	0307	1968.75	1888.75
800	0320	1970.00	1890.00
825	0339	1971.25	1891.25
850	0352	1972.50	1892.50
875	036B	1973.75	1893.75
900	0384	1975.00	1895.00
925	039D	1976.25	1896.25
950	03B6	1977.50	1897.50
975	03CF	1978.75	1898.75
1000	03E8	1980.00	1900.00
1025	0401	1981.25	1901.25
1050	041A	1982.50	1902.50
1075	0433	1983.75	1903.75
1100	044C	1985.00	1905.00
1125	0465	1986.25	1906.25
1150	047E	1987.50	1807.50
1175	0497	1988.75	1908.75

E

800 MHz CDMA Channels

Figure E-2 shows the valid channels for the North American cellular telephone frequency spectrum. There are 10 CDMA wireline or non-wireline band channels used in a CDMA system (unique per customer operating system).

Figure E-2: North American Cellular Telephone System Frequency Spectrum



FW00402



Calculating 800 MHz Center Frequencies

Table E-2 shows selected 800 MHz CDMA candidate operating channels, listed in both decimal and hexadecimal, and the corresponding transmit, and receive frequencies. Center frequencies (in MHz) for channels not shown in the table may be calculated as follows:

- Channels 1-777
 $TX = 870 + 0.03 * Channel\#$
Example: Channel 262
 $TX = 870 + 0.03 * 262 = 877.86 \text{ MHz}$
- Channels 1013-1023
 $TX = 870 + 0.03 * (Channel\# - 1023)$
Example: Channel 1015
 $TX = 870 + 0.03 * (1015 - 1023) = 869.76 \text{ MHz}$
- $RX = TX - 45 \text{ MHz}$
Example: Channel 262
 $RX = 877.86 - 45 = 832.86 \text{ MHz}$

Channel Number		Transmit Frequency (MHz)	Receive Frequency (MHz)
Decimal	Hex	Center Frequency	Center Frequency
1	0001	870.0300	825.0300
25	0019	870.7500	825.7500
50	0032	871.5000	826.5000

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Table E-2: 800 MHz TX and RX Frequency vs. Channel

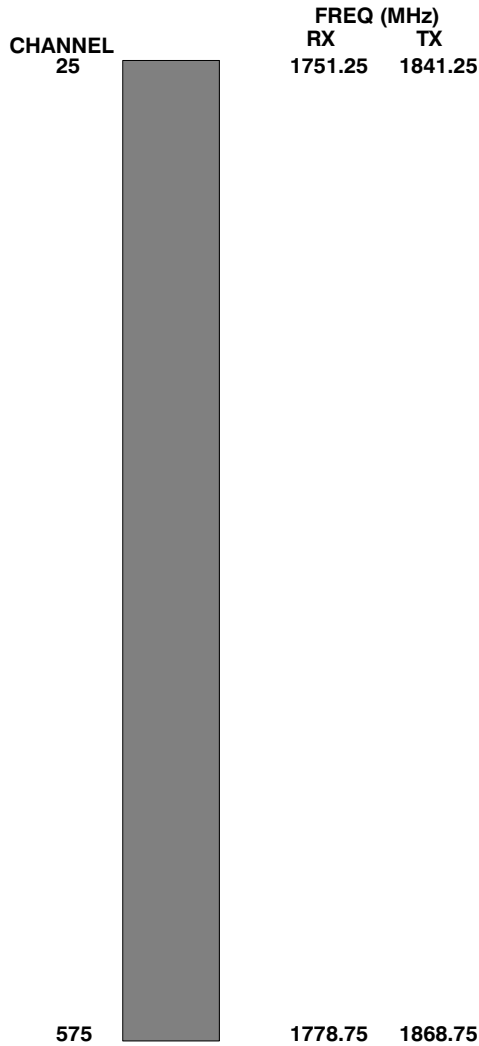
Channel Number		Transmit Frequency (MHz) Center Frequency	Receive Frequency (MHz) Center Frequency
Decimal	Hex		
75	004B	872.2500	827.2500
100	0064	873.0000	828.0000
125	007D	873.7500	828.7500
150	0096	874.5000	829.5000
175	00AF	875.2500	830.2500
200	00C8	876.0000	831.0000
225	00E1	876.7500	831.7500
250	00FA	877.5000	832.5000
275	0113	878.2500	833.2500
300	012C	879.0000	834.0000
325	0145	879.7500	834.7500
350	015E	880.5000	835.5000
375	0177	881.2500	836.2500
400	0190	882.0000	837.0000
425	01A9	882.7500	837.7500
450	01C2	883.5000	838.5000
475	01DB	884.2500	839.2500
500	01F4	885.0000	840.0000
525	020D	885.7500	840.7500
550	0226	886.5000	841.5000
575	023F	887.2500	842.2500
600	0258	888.0000	843.0000
625	0271	888.7500	843.7500
650	028A	889.5000	844.5000
675	02A3	890.2500	845.2500
700	02BC	891.0000	846.0000
725	02D5	891.7500	846.7500
750	02EE	892.5000	847.5000
775	0307	893.2500	848.2500
NOTE			
Channel numbers 778 through 1012 are not used.			
1013	03F5	869.7000	824.7000
1023	03FF	870.0000	825.0000

Operating Frequency - Korean Bands

1700 MHz PCS Channels

Figure E-3 shows the valid channels for the 1700 MHz PCS frequency spectrum. The CDMA channels are spaced in increments of 25 (25, 50, 75, . . . 575) across the CDMA band.

Figure E-3: 1700 MHz PCS Frequency Spectrum



E

Calculating 1700 MHz Center Frequencies

Center frequency for channels may be calculated as follows:

Direction	Formula	Example
TX	$1840 + (0.05 * \text{Channel\#})$	Channel: $1840 + (0.05 * 25) = 1841.25$
RX	$1750 + (0.05 * \text{Channel\#})$	Channel: $1750 + (0.05 * 25) = 1751.25$

- Actual frequencies used depend on customer CDMA system frequency plan.
- Each CDMA channel requires a 1.77 MHz frequency segment. The actual CDMA carrier is 1.23 MHz wide, with a 0.27 MHz guard band on both sides of the carrier
- Minimum frequency separation required between any CDMA carrier and the nearest NAMPS/AMPS carrier is 900 kHz (center to center).

Table E-3: 1700 MHz TX and RX Frequency vs. Channel (Korean Bands)

Channel Number		Transmit Frequency (MHz) Center Frequency	Receive Frequency (MHz) Center Frequency
Decimal	Hex		
25	0019	1841.25	1751.25
50	0032	1842.50	1752.50
75	004B	1843.75	1753.75
100	0064	1845.00	1755.00
125	007D	1846.25	1756.25
150	0096	1847.50	1757.50
175	00AF	1848.75	1758.75
200	00C8	1850.00	1760.00
225	00E1	1851.25	1761.25
250	00FA	1852.50	1762.50
275	0113	1853.75	1763.75
300	012C	1855.00	1765.00
325	0145	1856.25	1766.25
350	015E	1857.50	1767.50
375	0177	1858.75	1768.75
400	0190	1860.00	1770.00
425	01A9	1861.25	1771.25
450	01C2	1862.50	1772.50
475	01DB	1863.75	1773.75
500	01F4	1865.00	1775.00
525	020D	1866.25	1776.25
550	0226	1867.50	1777.50
575	023F	1868.75	1778.75

E

Appendix F

PCS Interface Setup for Manual

Testing



Test Equipment Set-up

Purpose

This section covers other test equipment and peripherals not covered in Chapter 3. Procedures for the manual testing are covered here, along with procedures to calibrate the TX and RX cables using the signal generator and spectrum analyzer.

Equipment Warm up

NOTE	Warm-up BTS equipment for a minimum of <i>60 minutes</i> prior to performing the BTS optimization procedure. This assures BTS site stability and contributes to optimization accuracy. (Time spent running initial power-up, hardware/firmware audit, and BTS download counts as warm-up time.)
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CAUTION	If any piece of test equipment (i.e., test cable, RF adapter) has been replaced, re-calibration must be performed. Failure to do so could introduce measurement errors, resulting in incorrect measurements and degradation to system performance.
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NOTE	Calibration of the communications test set (or equivalent test equipment) <i>must be</i> performed at the site before calibrating the overall test set. 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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Prerequisites

Prior to performing any of these procedures, all preparations for preparing the LMF, updating LMF files, and any other pre-calibration procedures, as stated in Chapter 3, must have been completed.

HP8921A System Connectivity Test

Follow the steps in Table F-1 to verify that the connections between the PCS Interface and the HP8921A are correct, and cables are intact. The software also performs basic functionality checks of each instrument.

NOTE	Disconnect other GPIB devices, especially system controllers, from the system before running the connectivity software.
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Table F-1: System Connectivity

Step	Action
	<p>NOTE</p> <ul style="list-style-type: none"> - Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i>.
1	Insert HP 83236A Manual Control/System card into memory card slot.
2	Press the [PRESET] pushbutton.
3	Press the Screen Control [TESTS] pushbutton to display the “Tests” Main Menu screen.
4	Position the cursor at Select Procedure Location and select by pressing the cursor control knob. In the Choices selection box, select Card .
5	Position the cursor at Select Procedure Filename and select by pressing the cursor control knob. In the Choices selection box, select SYS_CONN .
6	Position the cursor at RUN TEST and select it. The software will prompt you through the connectivity setup.
7	When the test is complete, position the cursor on STOP TEST and select it; <i>OR</i> press the [K5] pushbutton.
8	To return to the main menu, press the [K5] pushbutton.

Manual Cable Calibration using HP8921 with HP PCS Interface (HP83236)

Perform the procedure in Table F-2 to calibrate the test equipment using the HP8921 Cellular Communications Analyzer equipped with the HP83236 PCS Interface.

NOTE

This calibration method *must be executed with great care*. Some losses are measured close to the minimum limit of the power meter sensor (-30 dBm).

Prerequisites

Ensure the following prerequisites have been met before proceeding:

- Test equipment to be calibrated has been connected correctly for cable calibration.
- Test equipment has been selected and calibrated.

Refer to Figure F-1 for location of the components on the PCS Interface and Communications Test Set.

Table F-2: Manual Cable Calibration Test Equipment Setup (using the HP PCS Interface)

Step	Action		
	NOTE Verify that GPIB controller is turned off.		
1	Insert HP 83236A Manual Control System card into memory card slot (see Figure F-1).		
2	Press the Preset pushbutton.		
3	Under Screen Controls , press the TESTS pushbutton to display the TESTS (Main Menu) screen.		
4	Position the cursor at Select Procedure Location and select it. In the Choices selection box, select CARD .		
5	Position the cursor at Select Procedure Filename and select it. In the Choices selection box, select MANUAL .		
6	Position the cursor at RUN TEST and select it. HP must be in Control Mode Select YES .		
7	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>If using HP 83236A: Set channel number=<chan#>:</p> <ul style="list-style-type: none"> - Position cursor at Channel Number and select it. - Enter the <i>chan#</i> using the numeric keypad; press [Enter] and the screen will go blank. - When the screen reappears, the <i>chan#</i> will be displayed on the channel number line. </td> <td style="width: 50%; vertical-align: top;"> <p>If using HP 83236B: Set channel frequency:</p> <ul style="list-style-type: none"> - Position cursor at Frequency Band and press Enter. - Select User Defined Frequency. - Go Back to Previous Menu. - Position the cursor to 83236 generator frequency and enter actual RX frequency. - Position the cursor to 83236 analyzer frequency and enter actual TX frequency. </td> </tr> </table>	<p>If using HP 83236A: Set channel number=<chan#>:</p> <ul style="list-style-type: none"> - Position cursor at Channel Number and select it. - Enter the <i>chan#</i> using the numeric keypad; press [Enter] and the screen will go blank. - When the screen reappears, the <i>chan#</i> will be displayed on the channel number line. 	<p>If using HP 83236B: Set channel frequency:</p> <ul style="list-style-type: none"> - Position cursor at Frequency Band and press Enter. - Select User Defined Frequency. - Go Back to Previous Menu. - Position the cursor to 83236 generator frequency and enter actual RX frequency. - Position the cursor to 83236 analyzer frequency and enter actual TX frequency.
<p>If using HP 83236A: Set channel number=<chan#>:</p> <ul style="list-style-type: none"> - Position cursor at Channel Number and select it. - Enter the <i>chan#</i> using the numeric keypad; press [Enter] and the screen will go blank. - When the screen reappears, the <i>chan#</i> will be displayed on the channel number line. 	<p>If using HP 83236B: Set channel frequency:</p> <ul style="list-style-type: none"> - Position cursor at Frequency Band and press Enter. - Select User Defined Frequency. - Go Back to Previous Menu. - Position the cursor to 83236 generator frequency and enter actual RX frequency. - Position the cursor to 83236 analyzer frequency and enter actual TX frequency. 		
8	Set RF Generator level: <ul style="list-style-type: none"> - Position the cursor at RF Generator Level and select it. - Enter -10 using the numeric keypad; press [Enter] and the screen will go blank. - When the screen reappears, the value -10 dBm will be displayed on the RF Generator Level line. 		

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Table F-2: Manual Cable Calibration Test Equipment Setup (using the HP PCS Interface)

Step	Action
9	Set the user fixed Attenuation Setting to 0 dBm : <ul style="list-style-type: none"> - Position cursor at Analyzer Attenuation and select it - Position cursor at User Fixed Atten Settings and select it. - Enter 0 (zero) using the numeric keypad and press [Enter].
10	Select Back to Previous Menu .
11	Record the HP83236 Generator Frequency Level: Record the HP83236 B Generator Frequency Level: <ul style="list-style-type: none"> - Position cursor at Show Frequency and Level Details and select it. - Under HP83236 Frequencies and Levels, record the Generator Level. - Under HP83236B Frequencies and Levels, record the Generator Frequency Level (1850 - 1910 MHz for 1.9 GHz or 1750 - 1780 for 1.7 GHz). - Position cursor at Prev Menu and select it.
12	Click on Pause for Manual Measurement .
13	Connect the power sensor directly to the <i>RF OUT ONLY</i> port of the PCS Interface.
14	On the HP8921A, under To Screen , select CDMA GEN .
15	Move the cursor to the Amplitude field and click on the Amplitude value.
16	Increase the Amplitude value until the power meter reads 0 dBm ±0.2 dB . NOTE The Amplitude value can be increased coarsely until 0 dBm is reached; then fine tune the amplitude by adjusting the Increment Set to 0.1 dBm and targeting in on 0 dBm.
17	Disconnect the power sensor from the <i>RF OUT ONLY</i> port of the PCS Interface. NOTE The Power Meter sensor's lower limit is -30 dBm. Thus, only components having losses ≤30 dB should be measured using this method. For further accuracy, always re-zero the power meter before connecting the power sensor to the component being calibrated. After connecting the power sensor to the component, record the calibrated loss immediately.
18	Disconnect all components in the test setup and calibrate each one separately by connecting each component, one-at-a-time, between the <i>RF OUT ONLY PORT</i> and the power sensor (see Figure F-1, Setups A, B, or C). Record the calibrated loss value displayed on the power meter. <ul style="list-style-type: none"> • Example: (A) Test Cable(s) = -1.4 dB (B) 20 dB Attenuator = -20.1 dB (B) Directional Coupler = -29.8 dB
19	After all components are calibrated, reassemble all components together and calculate the total test setup loss by adding up all the individual losses: <ul style="list-style-type: none"> • Example: Total test setup loss = -1.4 -29.8 -20.1 = -51.3 dB. This calculated value will be used in the next series of tests.
20	Under Screen Controls press the TESTS button to display the TESTS (Main Menu) screen.
21	Select Continue (K2) .
22	Select RF Generator Level and set to -119 dBm.

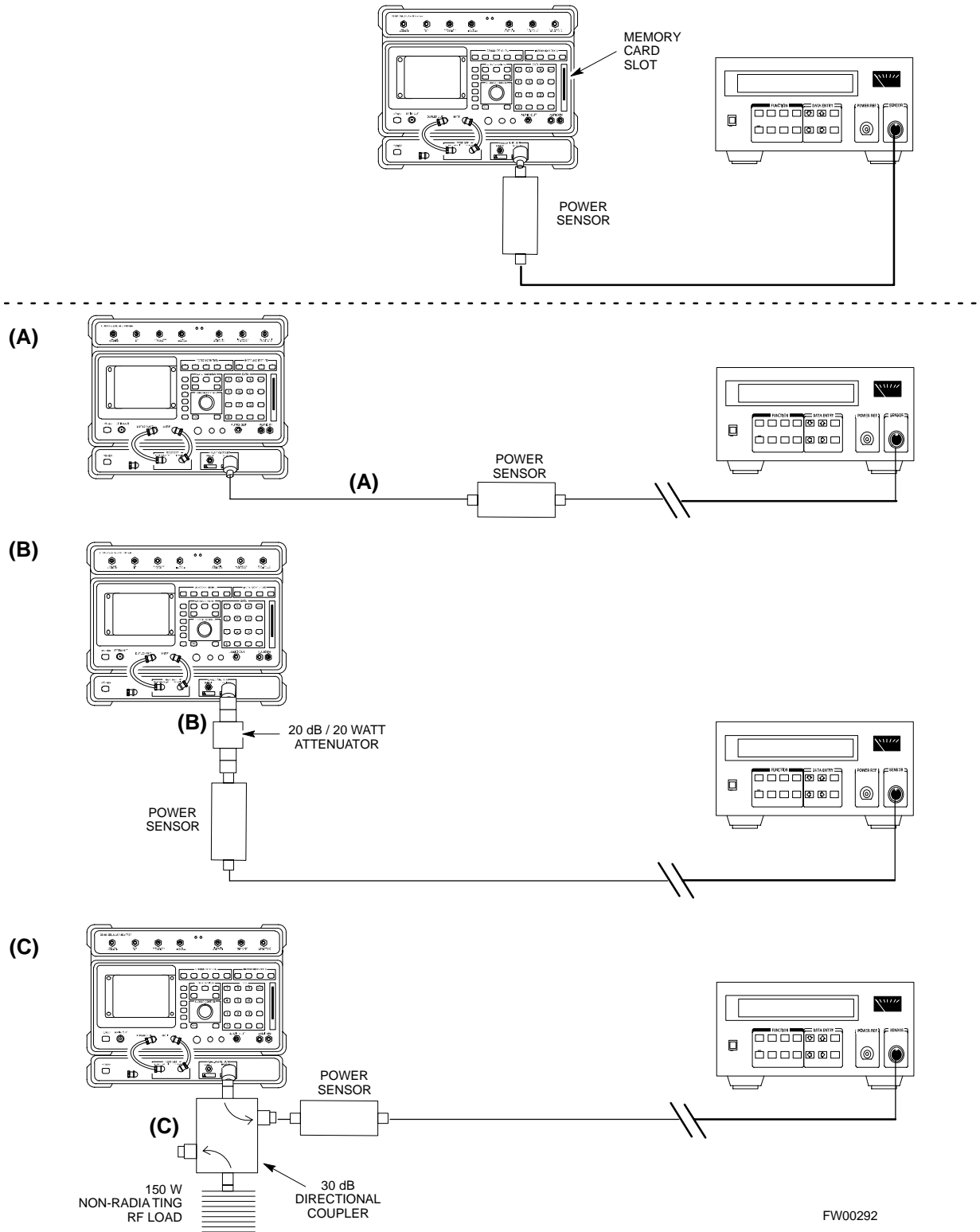
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Table F-2: Manual Cable Calibration Test Equipment Setup (using the HP PCS Interface)

Step	Action
23	Click on Pause for Manual Measurement .
24	<p>Verify the HP8921A Communication Analyzer/83203A CDMA interface setup is as follows (fields not indicated remain at default):</p> <ul style="list-style-type: none"> • Verify the GPIB (HP-IB) address: <ul style="list-style-type: none"> - under To Screen, select More - select IO CONFIG - Set HP-IB Adrs to 18 - set Mode to Talk&Lstn • Verify the HP8921A is displaying frequency (instead of RF channel) <ul style="list-style-type: none"> - Press the blue [SHIFT] button, then press the Screen Control [DUPLEX] button; this switches to the CONFIG (CONFIGURE) screen. - Use the cursor control to set RF Display to Freq
25	Refer to Table 3-31 for assistance in manually setting the cable loss values into the LMF.

Figure F-1: Calibrating Test Setup Components



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HP PCS Interface Test Equipment Setup for Manual Testing

Follow the procedure in Table F-3 to setup the HP PCS Interface Box for manual testing.

Table F-3: HP PCS Interface Test Equipment Setup for Manual Testing		
✓	Step	Action
		NOTE Verify GPIB controller is turned off.
	1	Insert HP83236B Manual Control/System card into the memory card slot.
	2	Under Screen Controls , press the [TESTS] push-button to display the TESTS (Main Menu) screen.
	3	Position the cursor at Select Procedure Location and select. In the Choices selection box, select CARD .
	4	Position the cursor at Select Procedure Filename and select. In the Choices selection box, select MANUAL .
	5	Position the cursor at RUN TEST and select OR press the K1 push-button.
	6	Set channel number=<chan#>: <ul style="list-style-type: none"> - Position cursor at Channel Number and select. - Enter the <i>chan#</i> using the numeric keypad and then press [Enter] (the screen will blank). - When the screen reappears, the <i>chan#</i> will be displayed on the channel number line.
	7	NOTE If using a TMPC with Tower Top Amplifier (TTA) skip Step 7. <ul style="list-style-type: none"> • Set RF Generator level= -119 dBm + Cal factor Example: -119 dBm + 2 dB = -117 dBm • Continue with Step 9 (skip Step 8).
	8	Set RF Generator level= -116 dBm + Cal factor. Example: -116 dBm + 2 dB = -114 dBm
	9	Set the user fixed Attenuation Setting to 0 dB : <ul style="list-style-type: none"> - Position cursor at RF Generator Level and select. - Position cursor at User Fixed Atten Settings and select. - Enter 0 (zero) using the numeric keypad and press [Enter].
	10	Select Back to Previous Menu .
	11	Select Quit , then select Yes .

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Calibrating Test Cable Setup using Advantest R3465

NOTE	Be sure the GPIB Interface is OFF for this procedure.
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Perform the procedure in Table F-4 to calibrate the test cable setup using the Advantest R3465. Advantest R3465 Manual Test setup and calibration must be performed at both the TX and RX frequencies.

Table F-4: Procedure for Calibrating Test Cable Setup Using Advantest R3465

Step	Action
	<p>NOTE</p> <ul style="list-style-type: none"> - This procedure can only be performed <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i>.
1	Press the SHIFT and the PRESET keys located below the display.
2	Press the ADVANCE key in the MEASUREMENT area of the control panel.
3	Select the CDMA Sig CRT menu key.
4	Select the Setup CRT menu key.
5	Using the vernier knob and the cursor keys set the following parameters: <p>NOTE Fields not listed remain at default.</p> <p>Generator Mode: SIGNAL Link: FORWARD Level Unit: dBm CalCorrection: ON Level Offset: OFF</p>
6	Select the return CRT menu key.
7	Press FREQ key in the ENTRY area.
8	Set the frequency to the desired value using the keypad entry keys.
9	Verify that the Mod CRT menu key is highlighting OFF; if not, press the Mod key to toggle it OFF.
10	Verify that the Output CRT menu key is highlighting OFF; if not, press the Output key to toggle it OFF.
11	Press the LEVEL key in the ENTRY area.
12	Set the LEVEL to 0 dBm using the key pad entry keys.
13	Zero power meter. Next connect the power sensor directly to the “RF OUT” port on the R3561L CDMA Test Source Unit.
14	Press the Output CRT menu key to toggle Output to ON.
15	Record the power meter reading _____
16	Disconnect the power meter sensor from the R3561L RF OUT jack.

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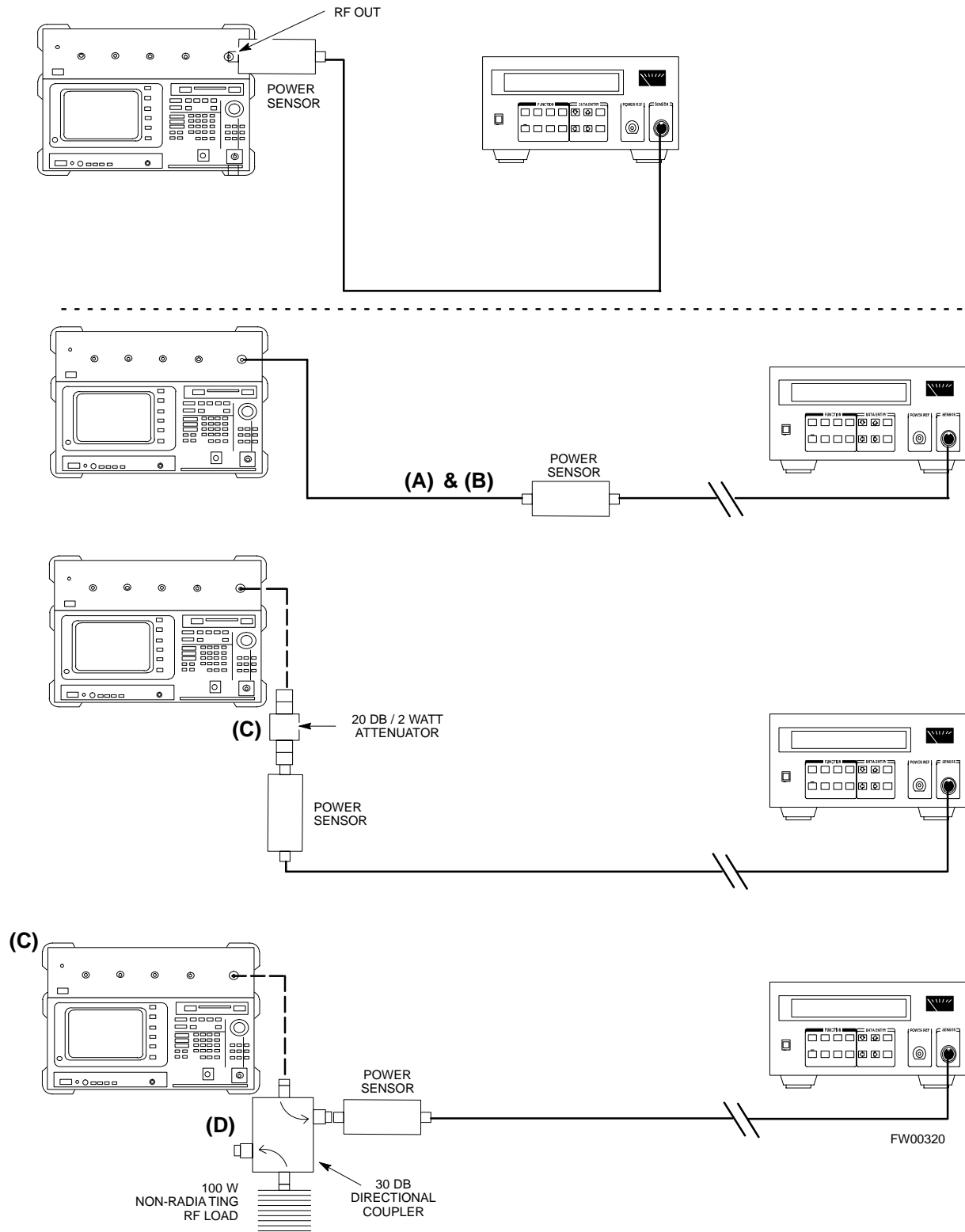
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Table F-4: Procedure for Calibrating Test Cable Setup Using Advantest R3465

Step	Action
17	<p>NOTE The Power Meter sensor lower limit is -30 dBm. Thus, only components having losses ≤ 30 dB should be measured using this method. For best accuracy, always re-zero the power meter before connecting the power sensor to the component being calibrated. Then, after connecting the power sensor to the component, record the calibrated loss immediately.</p> <p>Disconnect all components in the the test setup and calibrate each one separately. Connect each component one-at-a-time between the “RF OUT” port and the power sensor (see Figure F-2, “Setups A, B, and C”). Record the calibrated loss value displayed on the power meter for each connection.</p> <p>Example: (A) 1st Test Cable = -0.5 dB (B) 2nd Test Cable = -1.4 dB (C) 20 dB Attenuator = -20.1 dB (D) 30 dB Directional Coupler = -29.8 dB</p>
18	Press the Output CRT menu key to toggle Output OFF.
19	<p>Calculate the total test setup loss by adding up all the individual losses: Example: Total test setup loss = 0.5 + 1.4 + 20.1 + 29.8 = 51.8 dB This calculated value will be used in the next series of tests.</p>
20	Press the FREQ key in the ENTRY area.
21	Using the keypad entry keys, set the test frequency to the RX frequency.
22	Repeat steps 9 through 19 for the RX frequency.
23	Refer to Table 3-31 for assistance in manually setting the cable loss values into the LMF.

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Figure F-2: Cable Calibration using Advantest R3465



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Notes



Appendix G

VSWR

Transmit & Receive Antenna VSWR

Purpose

The following procedures will verify that the Voltage Standing Wave Ratio (VSWR) of all antennas and associated feed lines fall within acceptable limits. The tests will be performed on all antennas in a sequential manner (i.e., ANT 1, then ANT 2) until all antennas/feedlines have been verified.

These procedures should be performed periodically by measuring each respective antenna's VSWR (reflected power) to verify that the antenna system is within acceptable limits. This will ensure continued peak system performance.

The antenna VSWR will be calculated at the CDMA carrier frequency assigned to each antenna. Record and verify that they meet the test specification of less than or equal to 1.5:1.

NOTE	Motorola recommends that the installer be familiar with the following procedure in its entirety before beginning the actual procedure. Ensure that the entire site is currently not in service. This test is used to test RX antennas by substituting RX frequencies for TX frequencies.
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*Study the site engineering documents and perform the following tests only after **first** verifying that the RF cabling configuration required to interconnect the BTS frames and antennas meet requirements called out in the *BTS Installation Manual*.*

Test equipment

The following pieces of test equipment will be required to perform this test:

- LMF
- Directional coupler
- Communications test set

WARNING	Prior to performing antenna tests, insure that no CDMA BBX channels are keyed. Failure to do so could result in personal injury or serious equipment damage.
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Equipment Setup - HP Test Set

Follow the procedure in Table G-1 to set up test equipment required to measure and calculate the VSWR for each antenna.

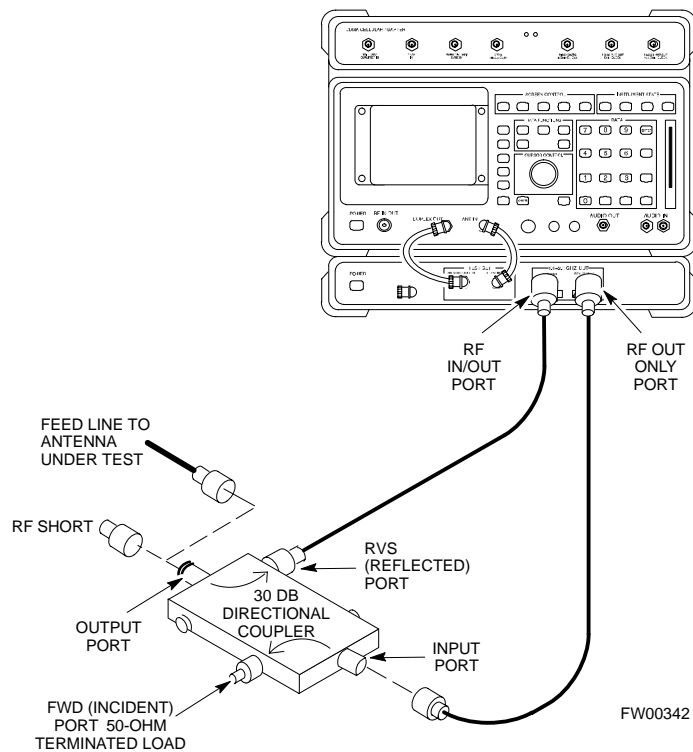
Table G-1: VSWR Measurement Procedure - HP Test Set		
Step	Action	HP TEST SET
1	<i>If you have not already done so</i> , refer to the procedure in Table 3-2 on page 3-6 to set up test equipment & interface the LMF computer to the BTS.	
2	<p><i>For manual VSWR testing</i>, using external directional coupler, refer to Figure G-1 (1700/1900 MHz) or Figure G-2 (800 MHz).</p> <ul style="list-style-type: none"> - Connect the communications test set RF OUT ONLY port to the INPUT port of the directional coupler. - Connect the RF IN/OUT port of the communication test set to the reverse (RVS) port on the directional coupler. Terminate the forward port with a 50 ohm load. - Install the antenna feed line to the output port on the directional coupler. 	
	<p>NOTE Manual Communications Analyzer test setup (fields not indicated remain at default):</p> <ul style="list-style-type: none"> • Set screen to RF GEN. - For 1900 MHz systems, set the RF Gen Freq to center frequency of actual CDMA carrier between 1930-1990 MHz for TX and 1850-1910 MHz for RX. For 800 MHz systems, set the RF Gen Freq to center frequency of actual CDMA carrier between 869-894 MHz for TX and 824-849 MHz for RX. For 1700 MHz systems, set the RF Gen Freq to center frequency of actual CDMA carrier between 1840-1870 MHz for TX and 1750-1780 MHz for RX. - Set Amplitude to -30 dBm. - Set Output Port to RF OUT. - Set AFGen1 & AFGen2 to OFF. 	
3	Remove the antenna feed line and install an “RF short” onto the directional coupler output port.	
	<p>NOTE Set-up communication test set as follows (fields not indicated remain at default):</p> <ul style="list-style-type: none"> • Set screen to SPEC ANL. - Under Controls, set input port to ANT. - Set Ref Level to -40 dBm. - Under Controls, select Main, select Auxiliary. - Under Controls, select AVG. Set Avg = 20. 	
4	<ul style="list-style-type: none"> - Record the reference level on the communications analyzer and <i>Note as P_S for reference</i>. - Replace the short with the antenna feedline. Record the reference level on the communications analyzer and <i>Note for as P_A reference</i>. - Record the difference of the two readings in dB. 	

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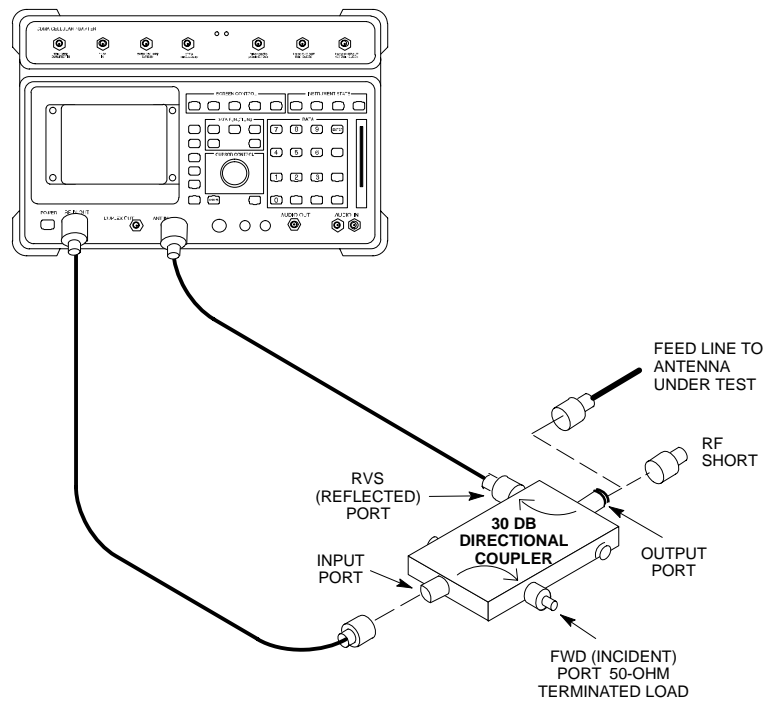
Table G-1: VSWR Measurement Procedure - HP Test Set		
Step	Action	HP TEST SET
5	<p>Calculate the VSWR per the equation shown to the right.</p> <p>Where:</p> $R_L(\text{dB}) = P_A(\text{dBm}) - P_S(\text{dBm})$ <p>P_A = Power reflected from antenna P_S = Power reflected from short</p> <p>A calculated value of -13.98 dB equates to VSWR of better than 1.5:1.</p>	$VSWR = \left[\frac{1 + 10^{\frac{R_L}{20}}}{1 - 10^{\frac{R_L}{20}}} \right]$
6	<p>If the readings indicate a potential problem, verify the physical integrity of all cables (including any in-line components, pads, etc.) and associated connections up to the antenna. If problem still persists, consult antenna OEM documentation for additional performance verification tests or replacement information.</p>	
7	<p>Repeat steps 2 through 6 for all remaining TX sectors/antennas.</p>	
8	<p>Repeat steps 2 through 6 for all remaining RX sectors/antennas.</p>	

Figure G-1: Manual VSWR Test Setup Using HP8921 Test Set (1700/1900 MHz)



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Figure G-2: Manual VSWR Test Setup Using HP8921 Test Set (800 MHz)



FW00343

Equipment Setup - Advantest Test Set

Follow the steps in Table G-2 to set up test equipment required to measure and calculate the VSWR for each antenna.

Table G-2: VSWR Measurement Procedure - Advantest Test Set		
Step	Action	ADVANTEST
1	<i>If you have not already done so</i> , refer to the procedure in Table 3-2 on page 3-6 to set up test equipment and interface the LMF computer to the BTS.	
2	<p>For manual VSWR testing using external directional coupler, refer to Figure G-3.</p> <ul style="list-style-type: none"> - Connect the communications test set RF OUT port to the input port of the directional coupler. - Connect the INPUT port of the communication test set to the forward port on the directional coupler. Terminate the forward port with a 50 Ohm load. - Connect the RF short to the directional coupler output port. 	

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Table G-2: VSWR Measurement Procedure - Advantest Test Set

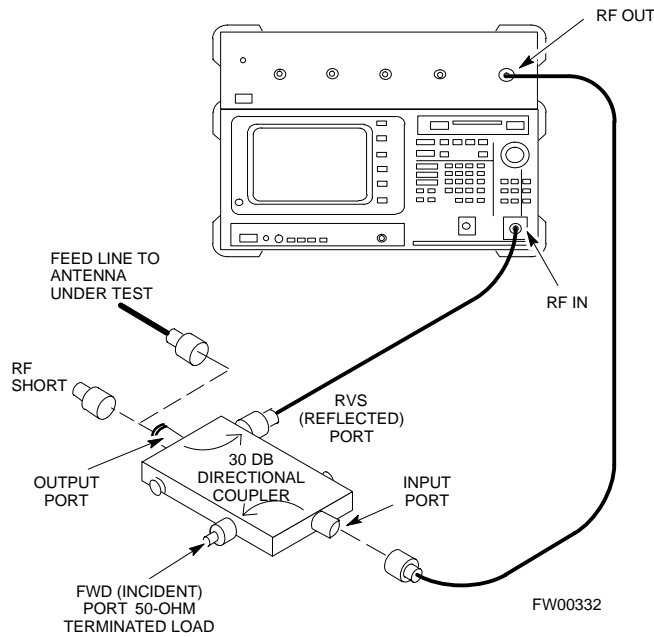
Step	Action	ADVANTEST
3	<p>Preform the following to instruct the calibrated test set to generate a CDMA RF carrier (RVL call) with all zero longcode at the assigned RX frequency at -10 dBm:</p> <ul style="list-style-type: none"> • Push the ADVANCE Measurement key. • Push the CDMA Sig CRT menu key. • Push the FREQ Entry key: <ul style="list-style-type: none"> - For 1900 MHz systems, set RF Gen Freq to center frequency of actual CDMA carrier between 1930-1990 MHz for TX and 1850-1910 MHz for RX. - For 800 MHz systems, set RF Gen Freq to center frequency of actual CDMA carrier between 869-894 MHz for TX and 824-849 MHz for RX. - For 1700 MHz systems, set RF Gen Freq to center frequency of actual CDMA carrier between 1840-1870 MHz for TX and 1750-1780 MHz for RX. • Push the LEVEL Entry key; set to 0 dBm (by entering 0 and pushing the -dBm key). • Verify that ON is active in the Output CRT menu key. • Verify that OFF is active in the Mod CRT menu key. • Push the CW Measurement key. • Push the FREQ Entry key. <ul style="list-style-type: none"> - Push the more 1/2 CRT menu key. - Set Preselect CRT menu key to 3.0G. • Push the Transient Measurement key. <ul style="list-style-type: none"> - Push the Tx Power CRT menu key. - Push the LEVEL entry key (set to 7 dBm by entering 7 and pushing the the dBm key). - Set Avg Times CRT menu key to ON. Set to 20 (by entering 20 and pushing the Hz ENTER key). • Push the REPEAT Start key to take the measurement. 	
4	Record the Burst Power display on the communications analyzer and <i>Note as P_S for reference.</i>	
5	Install the antenna feedline to the output port of the directional coupler.	
6	<ul style="list-style-type: none"> • Push the Auto Level Set CRT menu key. • Push the REPEAT Start key to take the measurement. 	
7	Record the Burst Power on the communications analyzer and <i>Note as P_A level for reference.</i> Record the difference of the two readings in dBm.	
8	<p>Calculate the VSWR per the equation shown to the right.</p> <p>Where:</p> $R_L(\text{dB}) = P_A(\text{dBm}) - P_S(\text{dBm})$ <p>P_A = Power reflected from antenna P_S = Power reflected from short</p> <p>A calculated value of -13.98 dB equates to VSWR of better than 1.5:1.</p>	$VSWR = \left[\frac{1 + 10^{\frac{R_L}{20}}}{1 - 10^{\frac{R_L}{20}}} \right]$

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Table G-2: VSWR Measurement Procedure - Advantest Test Set		
Step	Action	ADVANTEST
9	If the readings indicate a potential problem, verify the physical integrity of all cables (including any in-line components, pads, etc.) and associated connections up to the antenna. If problem still persists, consult antenna OEM documentation for additional performance verification tests or replacement information.	
10	Repeat steps 2 through 9 for all remaining TX sectors/antennas.	
11	Repeat steps 2 through 9 for all remaining RX sectors/antennas.	

Figure G-3: Manual VSWR Test Setup Using Advantest R3465



Appendix H

Download ROM Code

Download ROM Code

Download ROM Code

ROM code can be downloaded to a device that is in any state. After the download is started, the device being downloaded changes to OOS_ROM (blue) and remains OOS_ROM (blue). The same R-level RAM code must then be downloaded to the device. This procedure includes steps for both the ROM code download and the RAM code download.

ROM code files cannot be selected automatically. The ROM code file must be selected manually. Follow the procedure in Table H-1 to download ROM code.

Prerequisite

- ROM and RAM code files exist for the device to be downloaded.

CAUTION	The R-level of the ROM code to be downloaded must be the same as the R-level of the ROM code for other devices in the BTS. Code must not be mixed in a BTS. This procedure should only be used to upgrade replacement devices for a BTS and it should not be used to upgrade all devices in a BTS. If a BTS is to be upgraded from one R-level to another, the optimization and ATP procedures must first be performed with the BTS in the original configuration. The upgrade should then be done by the CBSC.
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Table H-1: Download ROM Code

Step	Action
1	Click on the device to be downloaded. NOTE More than one device of the <i>same</i> type can be selected for download by either clicking on each one to be downloaded or from the BTS menu bar Select pull-down menu, select the <i>device</i> item that applies. Where: <i>device</i> = the type of device to be loaded (BBX, CSM, GLI, MCC)
2	Click on the Device menu.
3	Click on the Status menu item. A status report window appears.
4	Make a note of the number in the HW Bin Type column. NOTE “HW Bin Type” is the Hardware Binary Type for the device. This code is used as the last four digits in the filename of a device’s binary ROM code file. Using this part of the filename, the ROM code file can be matched to the device in which it is to be loaded.
5	Click on the OK button to dismiss the status report window.
	NOTE ROM code is automatically selected for download from the <x>:\<lmf home directory>\<version folder>\<code folder> specified by the NextLoad property in the bts-#.cdf file. To check the value of the NextLoad property, click on Util > Examine > Display Nextload . A pop-up message will show the value of the NextLoad.

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Table H-1: Download ROM Code

Step	Action
6	From the BTS menu bar Device pull-down menus, select Download > ROM . <ul style="list-style-type: none"> - If the file matching the Hardware Binary Type of the device is found in the code folder, a status report shows the result of the download. Proceed to Step 12. - If a file selection window appears, select the ROM code file manually.
7	Double-click on the version folder that contains the desired ROM code file.
8	Double-click on the Code folder. A list of ROM and RAM code files is displayed.
	! CAUTION A ROM code file having the correct hardware binary type (HW Bin Type) needs to be chosen. The hardware binary type (last four digits in the file name) was determined in step 4. Unpredictable results can happen and the device may be damaged (may have to be replaced) if a ROM code file with wrong binary type is downloaded.
9	Choose a ROM code file having the correct hardware binary type (HW Bin Type). The hardware binary type (last four digits in the file name) was determined in step 4.
10	Click on the ROM code file that matches the device type and HW Bin Type (e.g., bbx_rom.bin.0604 for a BBX having a HW Bin Type of 0604). The file should be highlighted.
11	Click on the Load button. A status report window displays the result of the download.
	NOTE If the ROM load failed for some devices, load them <i>individually</i> by clicking on one device, perform steps 6 through 11 for it, and repeat the process for each remaining device.
12	Click on the Ok button to close the status report window.
13	Click on the Util menu.
14	Select the Tools menu item.
15	Click on the Update NextLoad>CDMA menu item.
16	Select the version number of the folder that was used for the ROM code download.
17	Click on the Save button. A pop-up message indicates that the CDF file has been updated.
18	Click on the OK button to dismiss the pop-up message.
19	Click on the device that was downloaded with ROM code.
20	Click on the Device menu.
21	Click on the Download Code menu item to download RAM code. A status report window displays the result of the download. NOTE Data is automatically downloaded to GLI devices when the RAM code is downloaded. Use the Download Data procedure to download data to other device types after they have been upgraded.
22	Click on the Ok button to close the status report window. The downloaded device should be OOS_RAM (yellow) unless it is a GLI in which case it should be INS (green).

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Table H-1: Download ROM Code

Step	Action
23	Click on the device that was downloaded.
24	Click on the Device menu.
25	Click on the Status menu item. Verify that the status report window displays the correct ROM and RAM version numbers.
26	Click on the Ok button to close the status report window.


H


Appendix I

In-Service Calibration



Introduction

Purpose

This procedure is a guide to expanding your system with multiple carriers while the system remains in service. This procedure also allows you to perform on site maintenance (replace defective boards and recalibrate) while the remainder of the site stays in service.

Motorola recommends that you perform this procedure during a maintenance window.

This procedure cannot be performed on BTSs with 4-to-1 combiners. The procedure can only be performed on one side of the BTS at one time. That is, LPAs 1, 2, 3, 7, 8, 9 (feed antennas 1, 2, 3) can be calibrated while LPAs 6, 7, 8, 10, 11, 12 (feed antennas 4, 5, 6) remain in service and vice versa.

Equipment Warm up

NOTE	Calibration of the communications test set (or equivalent test equipment) <i>must be</i> performed at the site before calibrating the overall test set. 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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CAUTION	If any piece of test equipment (i.e., test cable, RF adapter) has been replaced, re-calibration must be performed. Failure to do so could introduce measurement errors, causing incorrect measurements and degradation to system performance.
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Power Delta Calibration

Power Delta Calibration Introduction

The In-service calibration procedure has several differences from a normal calibration procedure. One of these is the use of a spectrum analyzer instead of a power meter to measure power. Power meters are broadband measurement devices and cannot be used to measure power during In-service Calibration since other carriers are operating. A spectrum analyzer can be used because it measures power at a given frequency. However, measuring power using a spectrum analyzer is less accurate than using a power meter. Therefore, you must compensate for the difference (delta) between the power meter and the spectrum analyzer.

HP8921A Power Delta Calibration

Use the HP8921A Spectrum Analyzer to measure power during In-Service Calibration for 800 MHz systems. After the offset value has been calculated, add it to the TX cable loss value.

Follow the procedure in Table I-1 to perform the HP8921A Power Delta Calibration procedure.

NOTE	This procedure requires two HP8921As.
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Table I-1: HP8921A Power Delta Calibration Procedure

Step	Action
	NOTE Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i> .
1	Connect a short RF cable between the HP8921A Duplex Out port and the HP437B power sensor (see Figure I-1).
2	Set the HP8921A signal source as follows: <ul style="list-style-type: none"> - Measure mode to CDMA Generator - Frequency to the CDMA Calibration target frequency - CW RF Path to IQ - Output Port to Dupl - Data Source to Random - Amplitude to 0 dBm
3	Measure and record the power value reading on the HP437B Power Meter.
4	Record the Power Meter reading as result A _____.
5	Turn off the source HP8921A signal output, and disconnect the HP437B. NOTE Leave the settings on the source HP8921A for convenience in the following steps.
6	Connect the short RF cable between the source HP8921A Duplex Out port and the measuring HP8921A RF-IN port (see Figure I-2).

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Table I-1: HP8921A Power Delta Calibration Procedure	
Step	Action
7	Ensure that the source HP8921A settings are the same as in Step 2.
8	Set the measuring HP8921A as follows: <ul style="list-style-type: none"> - Measure mode to CDMA AnI - Frequency to the CDMA calibration target frequency - Input Attenuation to 0 dB - Input port to RF-IN - Gain to Auto - Analyzer Direction to Fwd
9	Turn on the source HP8921A signal output.
10	Measure and record the channel power reading on the measuring HP8921A as result B _____.
11	Turn off the source HP8921A signal output and disconnect the equipment.
12	Compute the delta between HP437B and HP8921A using the following formula: $\text{Delta} = A - B$ Example: Delta = -0.70 dBm - (-1.25 dBm) = 0.55 dBm Example: Delta = 0.26 dBm - 0.55 dBm = -0.29 dBm These examples are included to show the mathematics and do not represent actual readings. NOTE Add this delta value to the TX Cable Loss value during In-Service Calibration (see Step 4 in Table I-5).

Figure I-1: Delta Calibration Setup - HP8921A to HP437B

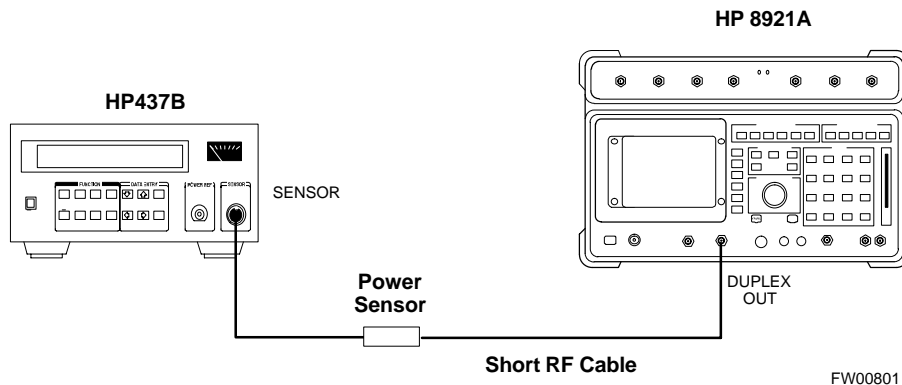
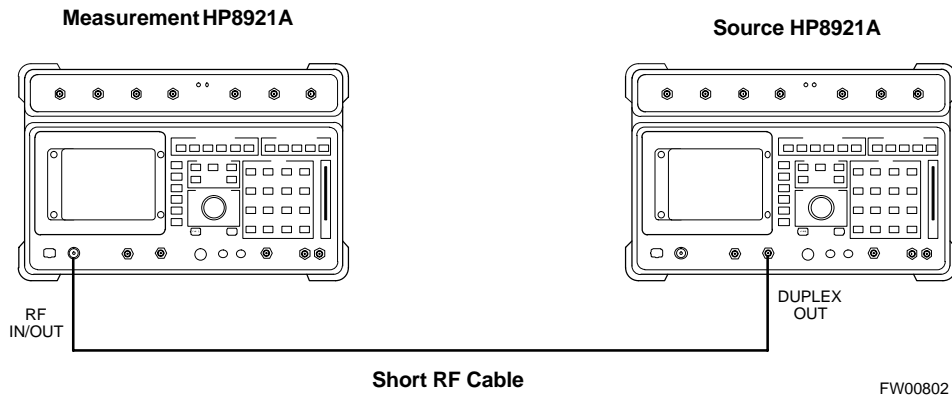


Figure I-2: Delta Calibration Setup - HP8921A to HP8921A



Advantest R3465 Power Delta Calibration

Follow the procedure in Table I-2 to perform the Advantest R3465 Power Delta Calibration procedure.

Table I-2: Advantest Power Delta Calibration Procedure

Step	Action
	NOTE Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i> .
On the Advantest R3465:	
1	Press the SHIFT and the PRESET keys located below the CRT display.
2	Press the ADVANCE key in the Measurement area of the control panel.
3	Press the CDMA Sig CRT menu key.
4	Press the FREQ key in the Entry area of the control panel.
5	Set the frequency to the desired value using the keypad entry keys.
6	Press the LEVEL key in the Entry area of the control panel.
7	Set the LEVEL to 0 dBm using the keypad entry keys.
8	Verify the Mod CRT menu key is highlighting OFF , if not press the Mod key to toggle it OFF .
9	Verify the Output CRT menu key is highlighting OFF . If not, press the Output key to toggle it OFF .
On the HP 437 Power Meter:	
10	Zero the Power Meter prior to connecting the power sensor to the RF cable from the signal generator.
	NOTE For best accuracy, always re-zero the power meter before connecting the power sensor to the component being calibrated.
11	Connect the RF cable from the R3561L CDMA Test Source Unit RF OUT port to the power sensor (see Figure I-3).
12	Press the Output CRT menu key to toggle the Output to ON .

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Table I-2: Advantest Power Delta Calibration Procedure

Step	Action
13	Record the Power Meter reading as result A _____.
14	Press the Output CRT menu key to toggle the Output to OFF .
15	Connect the RF cable from the R3561L CDMA Test Source Unit RF OUT port to the Spectrum Analyzer INPUT Port (see Figure I-4).
16	Press the Output CRT menu key to change the Output to ON .
17	Press the CW key in the Measurement area of the control panel.
18	Press the LEVEL key in the Entry area of the control panel.
19	Set the REF LEVEL to 10 dBm using the keypad entry keys.
20	Press the dB/div CRT menu key.
21	Press the 10 dB/div CRT menu key.
22	Press the FREQ key in Entry area of the control panel.
23	Set the frequency to the desired value using the keypad entry keys.
24	Press the more 1/2 CRT menu key.
25	Press the Preselector CRT menu key to highlight 3.0G .
26	Press the FORMAT key in the Display Control area of the control panel.
27	Press the TRACE CRT menu key.
28	Press the AVG A CRT menu key.
29	Set AVG to 20 using keypad entry keys.
30	Press the return CRT menu key.
31	Press the SPAN key in the Entry area of the control panel.
32	Press the Zero Span CRT menu key.
33	Press the BW key in the Entry area of the control panel.
34	Press the RBW CRT menu key to highlight MNL .
35	Set RBW to 30 kHz using keypad entry keys.
36	Press the VBW CRT menu key to highlight MNL .
37	Set VBW to 1 MHz using keypad entry keys.
38	Press the Marker ON key in the Display Control area of the control panel.
39	Record the Marker Level reading as result B _____.

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Table I-2: Advantest Power Delta Calibration Procedure	
Step	Action
40	<p>Calculate the Power Calibration Delta value. The delta value is the power meter measurement minus the Advantest measurement.</p> <p style="margin-left: 40px;">Delta = A - B</p> <p style="margin-left: 40px;">Example: Delta = -0.70 dBm - (-1.25 dBm) = 0.55 dBm</p> <p style="margin-left: 40px;">Example: Delta = 0.26 dBm - 0.55 dBm = -0.29 dBm</p> <p>These examples are included to show the mathematics and do not represent actual readings.</p> <p>NOTE</p> <p>Add this delta value to the TX Cable Loss value during In-Service Calibration (see Step 4 in Table I-5).</p>

Figure I-3: Delta Calibration Setup - R3561L to HP437B

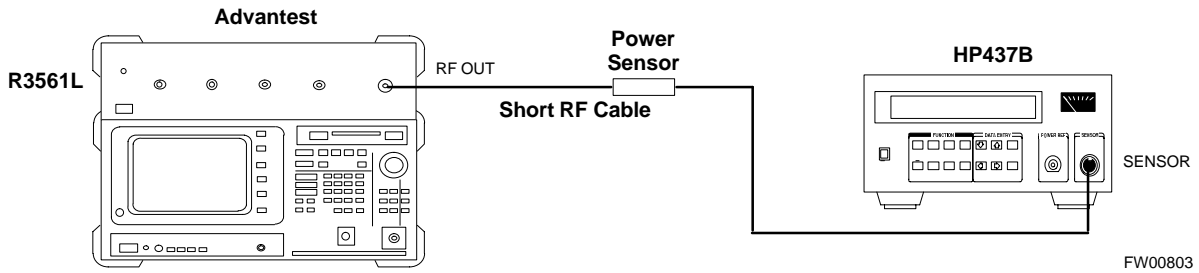
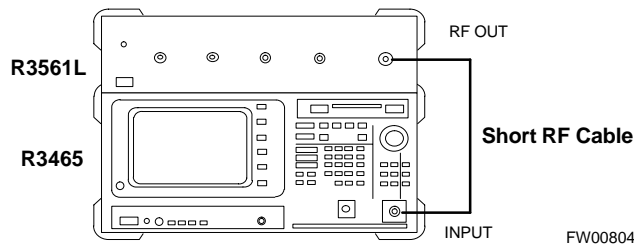


Figure I-4: Delta Calibration Setup - R3561L to R3465



HP8935 Power Delta Calibration

Follow the procedure in Table I-3 to perform the HP8935 Power Delta Calibration procedure.

Table I-3: HP8935 Power Delta Calibration Procedure	
Step	Action
	<p>NOTE Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i>.</p>
1	Connect a short RF cable between the HP8935 Duplex Out port and the HP437B power sensor (see Figure I-5).
2	Set the HP8935 signal source as follows: <ul style="list-style-type: none"> - Measure mode to CDMA Gen - Frequency to the CDMA Calibration target frequency - CW RF Path to IQ - Output Port to Dupl - Data Source to Random - Amplitude to 0 dBm
3	Measure and record the power value reading on the HP437B Power Meter.
4	Record the Power Meter reading as result A _____.
5	Turn off the source HP8935 signal output, and disconnect the HP437B. <p>NOTE Leave the settings on the source HP8935 for convenience in the following steps.</p>
6	Connect the short RF cable between the source HP8935 Duplex Out port and the RF-IN/OUT port (see Figure I-6).
7	Ensure that the source HP8935 settings are the same as in Step 2.
8	Set the measuring HP8935 as follows: <ul style="list-style-type: none"> - Measure mode to CDMA Anl - Frequency to the CDMA calibration target frequency - Input Attenuation to 0 dB - Input port to RF-IN - Gain to Auto - Anl Dir to Fwd
9	Turn on the source HP8935 signal output.
10	Set the Chn Pwr Cal to Calibrate and select to calibrate.
11	Measure and record the channel power reading on the measuring HP8935 as result B _____.
12	Turn off the source HP8935 signal output and disconnect the equipment.

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Table I-3: HP8935 Power Delta Calibration Procedure	
Step	Action
13	<p>Calculate the Power Calibration Delta value. The delta value is the power meter measurement minus the Advantest measurement.</p> <p>Delta = A - B</p> <p>Example: Delta = -0.70 dBm - (-1.25 dBm) = 0.55 dBm</p> <p>Example: Delta = 0.26 dBm - 0.55 dBm = -0.29 dBm</p> <p>These examples are included to show the mathematics and do not represent actual readings.</p> <p>NOTE</p> <p>Add this delta value to the TX Cable Loss value during In-Service Calibration (see Step 4 in Table I-5).</p>

Figure I-5: Delta Calibration Setup - HP8935 to HP437B

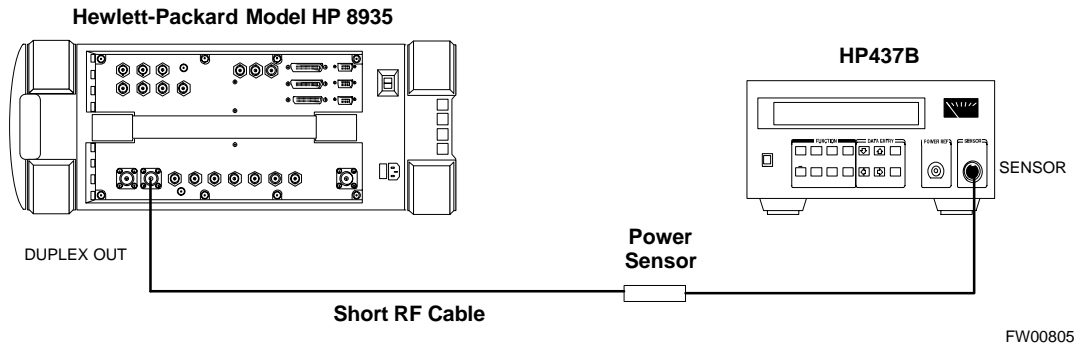
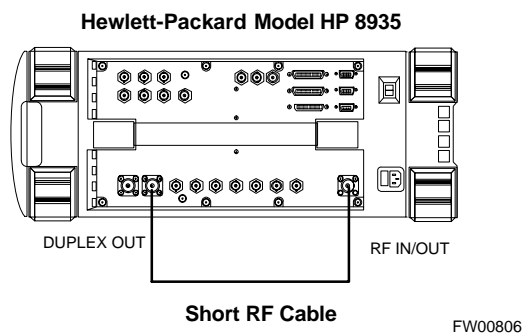


Figure I-6: Delta Calibration Setup - HP8935 to HP8935



Agilent E4406A Power Delta Calibration

The Agilent E4406A transmitter tester and E4432B signal generator test equipment combination can be used for ISC of IS-2000 CDMA 1X as well as IS-95A/B operation modes. The power delta calibration is performed on the E4406A, but the E4432B is required to generate the reference signal used to calculate the power delta offset. After the offset value has been calculated, add it to the TX cable loss value in the LMF.

Follow the procedure in Table I-4 to perform the Agilent E4406A Power Delta Calibration procedure.

Table I-4: Agilent E4406A Power Delta Calibration Procedure

Step	Action
	<p>NOTE Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i>. After it is warmed up and stabilized, calibrate the test equipment as described in the “Test Set Calibration” section of the Optimization/Calibration chapter in the <i>SC 4812T Optimization/ATP manual</i>.</p>
1	Zero the Power Meter prior to connecting the power sensor to the RF cable from the signal generator.
2	<p>NOTE For best accuracy, always re-zero the power meter before connecting the power sensor to the component being calibrated.</p> <p>Connect a short RF cable from the E4432B RF OUTPUT connector the HP437 power meter power sensor (see Figure I-7).</p>
3	<p>Set the E4432B signal generator as follows:</p> <ul style="list-style-type: none"> - Press Preset to exit any modes for which the signal generator is configured. - Press Frequency and enter the <i>frequency</i> of the channel to be calibrated using the numeric keypad. - Using the soft keys to the right of the screen, select the frequency range to be measured (for example, MHz). - Press Amplitude and, using the numeric keypad, set signal amplitude to 0 (zero). - Using the soft keys, set the measurement type to dBm.
4	<p>On the E4432B, press RF On/Off to toggle the RF output to RF ON.</p> <ul style="list-style-type: none"> - Note that the RF On/Off status in the screen display changes.
5	Measure and record the value reading on the HP437 power meter as result A _____.
6	<p>On the E4432B, press RF On/Off to toggle the RF output to RF OFF.</p> <ul style="list-style-type: none"> - Note that the RF On/Off status in the screen display changes.
7	Disconnect the short RF cable from the HP437 power meter power sensor, and connect it to the RF INPUT connector on the E4406A transmitter tester (see Figure I-8).

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Table I-4: Agilent E4406A Power Delta Calibration Procedure

Step	Action
8	<p>NOTE Do not change the frequency and amplitude settings on the E4432B when performing the following steps.</p> <p>Set the E4406A as follows:</p> <ul style="list-style-type: none"> - Press Preset to exit any modes for which the transmitter tester is configured. - Press MODE and, using the soft keys to the right of the screen, select cdmaOne. - Press MEASURE and, using the soft keys, select spectrum. - Press Frequency and, using the soft keys, select Center Frequency. - Using the numeric keypad, enter the <i>frequency</i> of the channel to be calibrated. - Using the soft keys, select the frequency range to be measured (for example, MHz). - Press Input/Output and, using the soft keys, select Input Atten. - Using the numeric keypad, set Input Atten to 0 (zero) and, using the soft keys, select dB. - Using the soft keys, select External Atten and then select Mobile. - Using the numeric keypad, set Mobile to 0 (zero) and, using the soft keys, select dB. - Using the soft keys, select Base. - Using the numeric keypad, set Base to 0 (zero) and, using the soft keys, select dB. - Press MEASURE and, using the soft keys, select Channel Power.
9	<p>On the E4432B signal generator, press RF On/Off to toggle the RF output to RF ON.</p> <ul style="list-style-type: none"> - Note that the RF On/Off status in the screen display changes.
10	<p>Read the measured Channel Power from the E4406A screen display and record it as result B _____.</p>
11	<p>On the E4432B, press RF On/Off to toggle the RF output to RF OFF.</p> <ul style="list-style-type: none"> - Note that the RF On/Off status in the screen display changes.
12	<p>Calculate the Power Calibration Delta value. The delta value is the power meter measurement minus the Agilent measurement.</p> <p style="padding-left: 40px;">Delta = A - B</p> <p style="padding-left: 40px;">Example: Delta = -0.70 dBm - (-1.25 dBm) = 0.55 dBm</p> <p style="padding-left: 40px;">Example: Delta = 0.26 dBm - 0.55 dBm = -0.29 dBm</p> <p>These examples are included to show the mathematics and do not represent actual readings.</p> <p>NOTE Add this delta value to the TX Cable Loss value during In-Service Calibration (see step 4 in Table I-5).</p>

Figure I-7: Delta Calibration Setup - Agilent E4432B to HP437

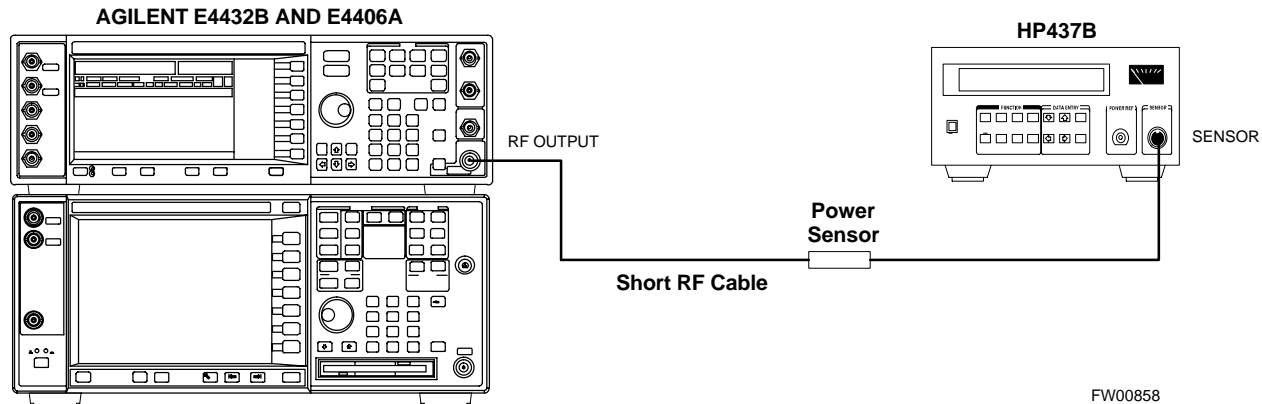
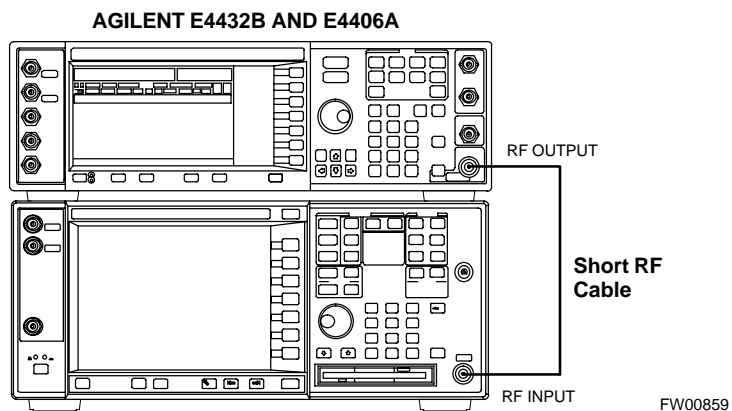


Figure I-8: Delta Calibration Setup - Agilent E4432B to Agilent E4406A



In-Service Calibration

CAUTION

This feature does NOT have fault tolerance at this time. The system has no safe-guards to stop you from doing something that will take the BTS out of service. If possible, perform this procedure during a maintenance window.

Follow the procedures in this section precisely, otherwise the entire BTS will most likely go OUT OF SERVICE.

At the CBSC, only perform operations on expansion hardware when it is in the OOS_MANUAL state.

The operator must be trained in the LMF operation prior to performing this procedure.

Prerequisites

- Expansion hardware has been added in the CBSC database, and the CDF file has been generated.
- The expansion devices have been inserted into the C-CCP cage and are in the OOS_MANUAL state at the CBSC.
- The site specific cdf (with the expansion hardware) and cal files have been loaded onto the LMF.
- The LMF has the same code and dds files as the CBSC to download.

CAUTION

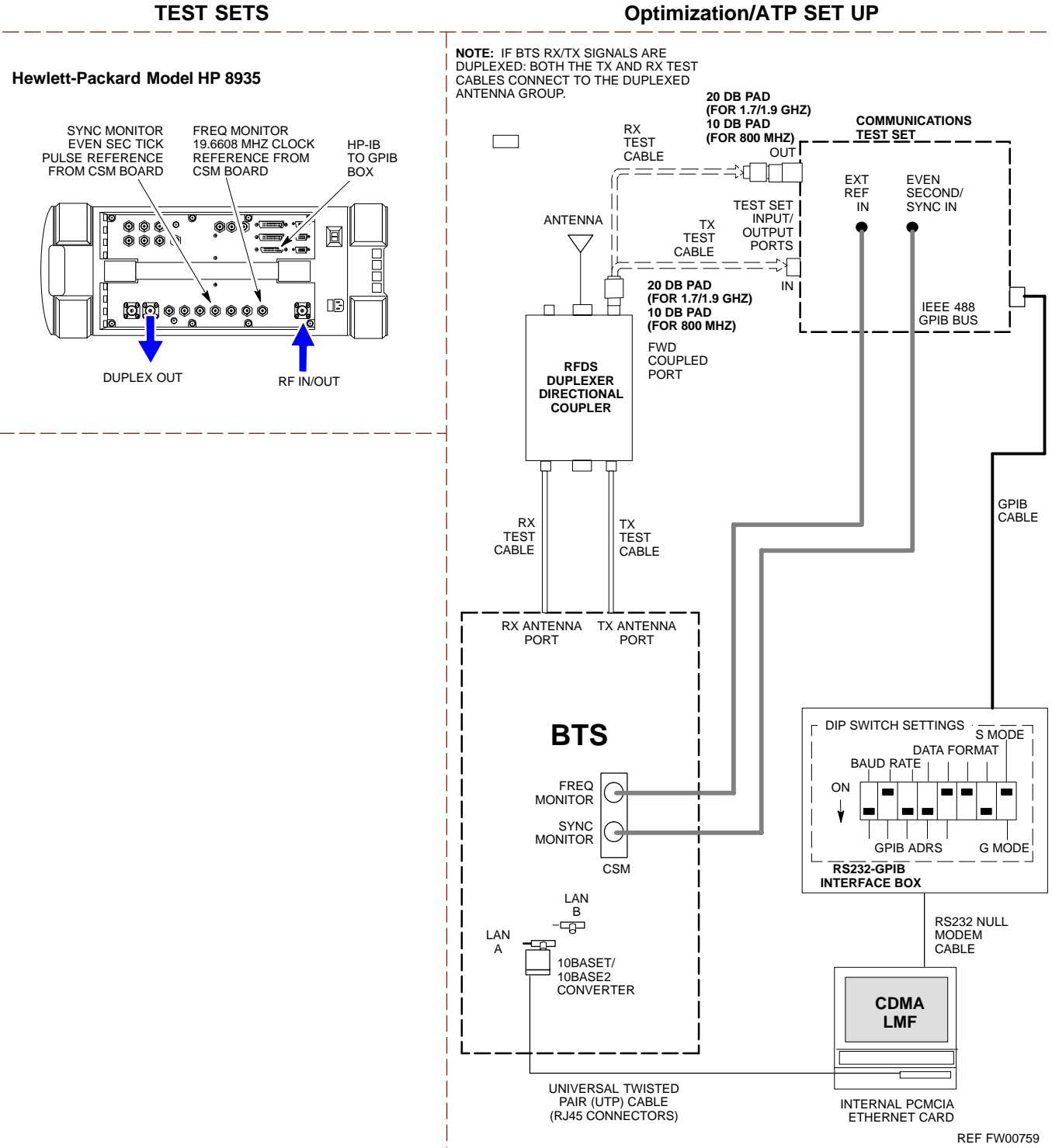
Do not download code or data to any cards other than those you are working on. Downloading code or data to other cards will take the site OUT OF SERVICE.

The code file version numbers must match the version numbers on the other cards in the frame. If the numbers do not match, the site may go OUT OF SERVICE.

The BTS-#.cdf, CBSC-#.cdf, and CAL files for this BTS must have come from the CBSC.

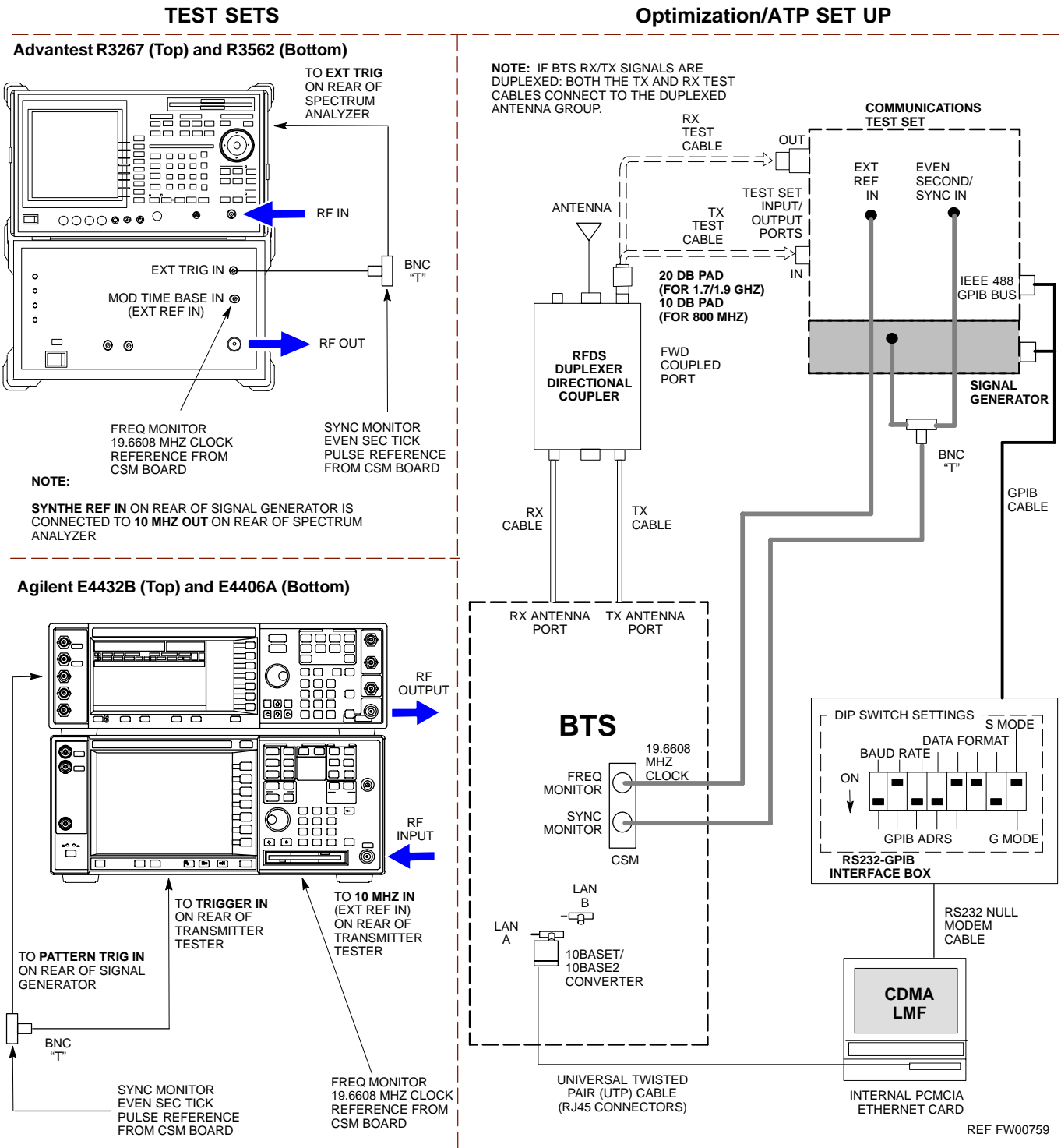
- Test equipment has been configured per Figure I-9 and Figure I-10.
- An RFDS (or at a minimum a directional coupler), whose loss is already known, must be in line to perform the in-service calibration.
- Test equipment has been calibrated after 1 hour warm up.
- A short RF cable and two BNC-N adapters are available to perform Cable Calibration.
- The Power Delta Calibration has been performed (see Table I-1, Table I-2, or Table I-3).

Figure I-9: Optimization/ATP Test Setup Using RFDS



REF FW00759

Figure I-10: IS-95 A/B/C Optimization/ATP Test Setup Using RFDS



Follow the procedure in Table I-5 to perform the In-Service Calibration.

Table I-5: In-Service Calibration	
Step	Action
	<p>NOTE Perform this procedure <i>after</i> test equipment has been allowed to warm-up and stabilize for a <i>minimum of 60 minutes</i>.</p>
1	<p>Set up the LMF for In-Service Calibration:</p> <ul style="list-style-type: none"> - Start the LMF by double-clicking the LMF icon on the Windows desktop. - Click Tools>Options from the menu bar at the login screen. - Check the applicable spectrum analyzer check box and the signal generator check box on the Test Equipment tab. Ensure that the GPIB address is 18 for the CDMA analyzer and 1 for the signal generator. - Uncheck any other other equipment that is selected. - Click the Apply button. - Select the BTS Options tab in the LMF Option window. - Check the In-Service Calibration check box. - Click the Apply button. - Click the Dismiss button to close the LMF Option window.
2	<p>Login to the target BTS:</p> <ul style="list-style-type: none"> - Select the target BTS icon. - Click the Login button at the login screen.
3	<p>Measure the Cable Loss using the Cable Calibration function:</p> <ul style="list-style-type: none"> - Click Util>Cable Calibration from the menu bar at the main window. - Set the desired channel(s) and select TX and RX CABLE CAL at the cable calibration pop up window. - Click the OK button to perform cable calibration. - Follow the on-screen instructions to complete the cable loss measurement. <p>NOTE</p> <ul style="list-style-type: none"> - The measured value is input automatically to the cable loss file. - To view the cable loss file, click Util>Examine>Cable Loss>TX or RX.
4	<p>Add the spectrum analyzer power delta to the Cable Loss.</p> <ul style="list-style-type: none"> - To view the cable loss file, click Util>Examine>Cable Loss>TX or RX. - Add the value computed in Table I-1, Table I-2, or Table I-3 to the TX Cable Loss. <p>NOTE</p> <p>Be sure to include the sign of the value. The following examples are included to show the mathematics and do not represent actual readings:</p> <ul style="list-style-type: none"> - Example: 5.65 dBm + 0.55 dBm = 6.20 dBm - Example: 5.65 dBm + (-0.29 dBm) = 5.36 dBm - Example: -5.65 dBm + 0.55 dBm = -5.10 dBm - Example: -5.65 dBm + (-0.29 dBm) = -5.94 dBm

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Table I-5: In-Service Calibration	
Step	Action
5	Input the Coupler Loss for the TX and RX tests: <ul style="list-style-type: none"> - Click Util>Edit>Coupler Loss>TX or RX from the menu bar at the main window. - Input the appropriate coupler loss for the target carrier(s) by referring to the information taken at the time of BTS installation. - Click the Save button. - Click the Dismiss button to close the window. - To view the coupler loss file, click Util>Examine>Coupler Loss>TX or RX.
6	Have the CBSC operator put the redundant BBX OOS_MANUAL.
	<p>! CAUTION</p> <p>Be sure to download OOS devices only. Loading in-service devices takes them OUT OF SERVICE and can result in dropped calls.</p> <p>The code file version numbers must match the version numbers on the other cards in the frame. If the numbers do not match, the site may go OUT OF SERVICE.</p> <p>NOTE</p> <p>Be sure to include the redundant BBX in steps 7, 8, and 9.</p>
7	Download code and data to the target devices: <ul style="list-style-type: none"> - Click Tools>Update NextLoad>CDMA to set the code version that will be downloaded. - Select the BTS(s) you need, check the appropriate code version in the pop up window, and click the Save button to close. - Select the target BBX(s) on the C-CCP cage picture. - Click Device>Download>Code/Data to start downloading code. - Select the target BBX(s) on the C-CCP cage picture. - Click Device>Download>Data to start downloading data.

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Table I-5: In-Service Calibration

Step	Action
8	<p>! CAUTION Perform the In-service Calibration procedure on OOS devices only.</p> <p>Select the desired test:</p> <ul style="list-style-type: none"> - Select the target BBX(s) on the C-CCP cage picture. - Click Tests>[desired test] from the menu bar at the main window. - Select the target carrier and confirm the channel number in the pop up window. - Leave the Verify BLO check box checked. - From the Test Pattern pick list, select a test pattern. - Click the OK button to start calibration. - Follow the on-screen instructions, except, do not connect to the BTS antenna port, connect to the directional coupler (fwd) port associated with the on screen prompt antenna port. <p>NOTE</p> <ul style="list-style-type: none"> • Selecting Pilot (default) performs tests using a pilot signal only. • Selecting Standard performs tests using pilot, synch, paging and six traffic channels. This requires an MCC to be selected. • Selecting CDFPilot performs tests using a pilot signal, however, the gain for the channel elements is specified in the CDF file. • 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	<p>Save the result and download the BLO data to the target BBX(s):</p> <ul style="list-style-type: none"> - Click the Save Result button on the result screen. The window closes automatically.
10	<p>Logout from the BTS and close the LMF session:</p> <ul style="list-style-type: none"> - Click BTS>Logout to close the BTS connection. - Close the LMF window.
11	<p>Restore the new “bts-*.cal” file to the CBSC.</p>
12	<p>Enable the target device(s) from the CBSC.</p>

Appendix J

GPIB Addresses

GPIB Addresses

Introduction

Use the procedures in this appendix to verify and/or change the GPIB addresses of the applicable test equipment.

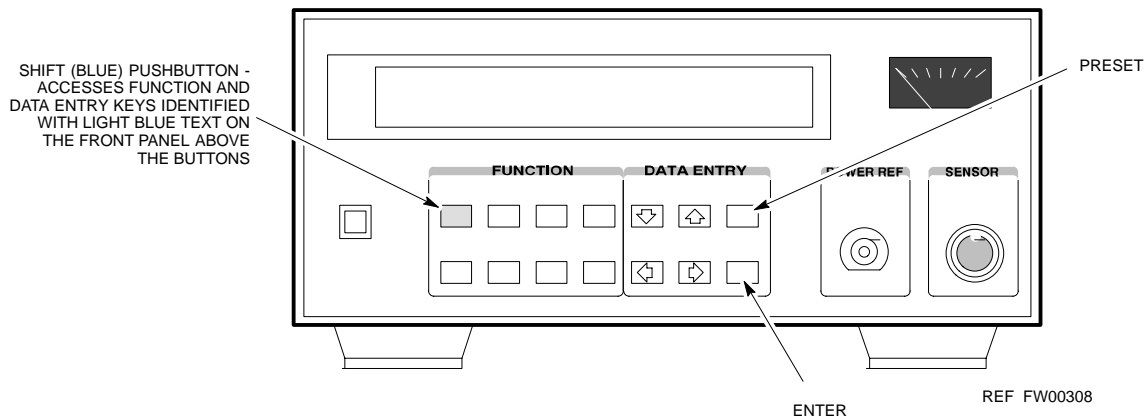
HP437 Power Meter GPIB Address

Follow the steps in Table J-1 to verify and, if necessary, change the HP437 GPIB address.

NOTE This procedure assumes that the test equipment is set up and ready for testing.

Table J-1: Verify and/or Change HP437 Power Meter GPIB Address	
Step	Action
1	Press Shift and PRESET (see Figure J-1).
2	Use the ▲ arrow key to navigate to HP-IB ADRS and press ENTER . The HP-IB address is displayed. NOTE HP-IB is the same as GPIB.
3	If the current GPIB address is not set to 13 , perform the following to change it: - Use the ▲ ▼ arrow keys to change the HP-IB ADRS to 13 . - Press ENTER to set the address.
4	Press Shift and ENTER to return to a standard configuration.

Figure J-1: HP437 Power Meter



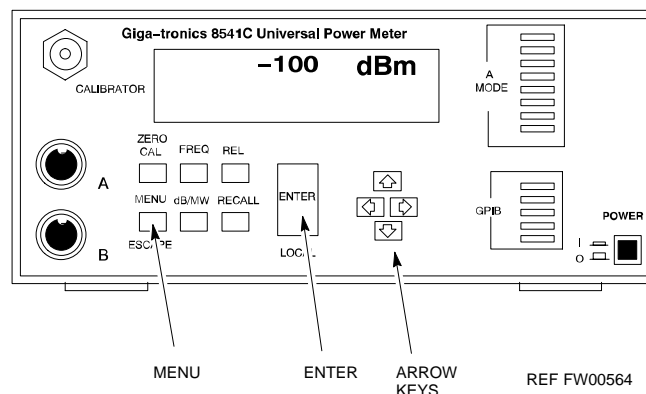
Gigatronics 8541C Power Meter GPIB Address

Follow the steps in Table J-2 to verify and, if necessary, change the Gigatronics 8541C power meter GPIB address.

NOTE This procedure assumes that the test equipment is set up and ready for testing.

Table J-2: Verify and/or Change Gigatronics 8541C Power Meter GPIB Address	
Step	Action
	<p>! CAUTION</p> <p>Do not connect/disconnect the power meter sensor cable with AC power applied to the meter. Disconnection could result in destruction of the sensing element or miscalibration.</p>
1	Press MENU (see Figure J-2).
2	Use the ▼ arrow key to select CONFIG MENU and press ENTER .
3	Use the ▼ arrow key to select GPIB and press ENTER . The current Mode and GPIB Address are displayed.
4	If the Mode is not set to 8541C , perform the following to change it: Use the ◀▶ arrow keys as required to select MODE . Use the ▼▲ arrow keys as required to set MODE to 8541C .
5	If the GPIB address is not set to 13 , perform the following to change it: Use the ▶ arrow key to select ADDRESS . Use the ▼▲ arrow keys as required to set the GPIB address to 13 .
6	Press ENTER to return to normal operation.

Figure J-2: Gigatronics 8541C Power Meter Detail



Motorola CyberTest GPIB Address

Follow the steps in Table J-3 to verify and, if necessary, change the GPIB address on the Motorola CyberTest. Changing the GPIB address requires the following items:

- Motorola CyberTest communications analyzer
- Computer running Windows 98SE or Windows 2000
- Motorola CyberTAME software program “TAME”
- Parallel printer port cable (shipped with CyberTest)

NOTE This procedure assumes that the test equipment is set up and ready for testing.

Table J-3: Verify and/or Change Motorola CyberTest GPIB Address

Step	Action
1	On the LMF desktop, locate the CyberTAME icon. Double click on the icon to run the CyberTAME application.
2	In the CyberTAME window taskbar, under Special , select IEEE.488.2 .
3	CyberTAME software will query the CyberTest Analyzer for its current GPIB address. It then will open the IEEE 488.2 dialog box. If the current GPIB address is not 18, perform the following procedure to change it: <ul style="list-style-type: none"> - Use the up or down increment arrows, or double-click in the field and type the number. - Click on the OK button. The new address will be written to the CyberTest via the parallel port and saved.
	<p>NOTE</p> <p>Verify that the address has been set by repeating steps 2 and 3. The new address should now appear in the IEEE 488.2 dialog box Address field.</p>



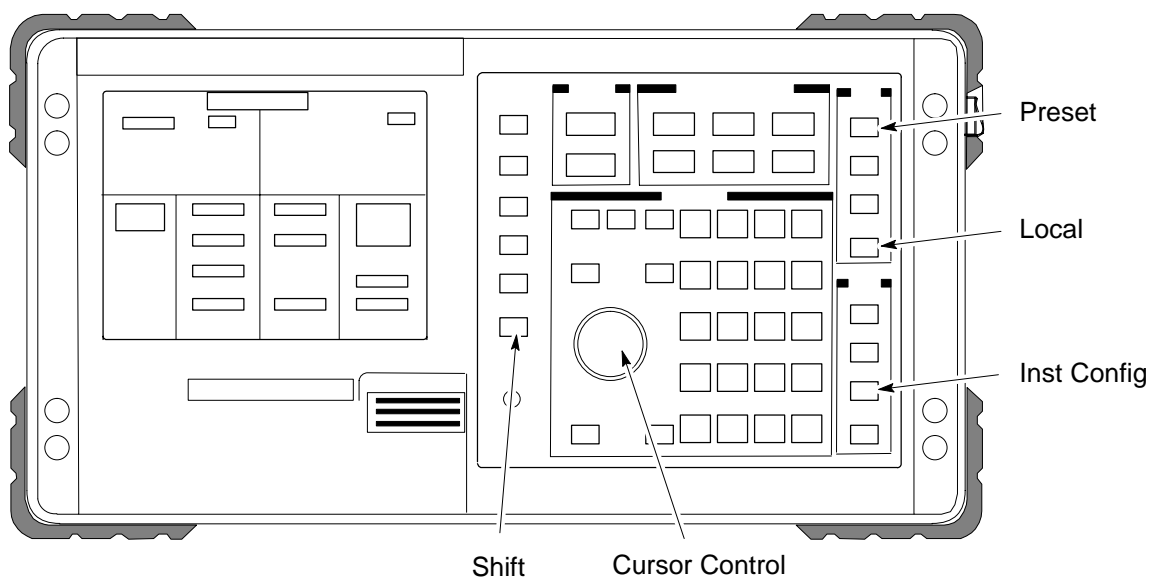
HP8935 Test Set GPIB Address

Follow the procedure in Table J-4 to verify and, if necessary, change the HP8935 GPIB address.

NOTE	This procedure assumes that the test equipment is set up and ready for testing.
-------------	---

Table J-4: Verify and/or Change HP8935 GPIB Address	
Step	Action
	<p>* IMPORTANT</p> <p>The HP I/O configuration MUST be set to Talk & Listen, or NO device on the GPIB bus will be accessible. (Consult test equipment OEM documentation for additional information as required.)</p>
1	<p>To verify that the GPIB addresses are set correctly, press Shift and LOCAL on the HP8935 (see Figure J-3). The current HP-IB address is displayed at the top of the screen.</p> <p>NOTE HP-IB is the same as GPIB.</p>
2	<p>If the current GPIB address is not set to 18, perform the following to change it:</p> <ul style="list-style-type: none"> - Press Shift and Inst Config. - Turn the Cursor Control knob to move the cursor to the HP-IB Adrs field. - Press the Cursor Control knob to select the field. - Turn the Cursor Control knob as required to change the address to 18. - Press the Cursor Control knob to set the address.
3	<ul style="list-style-type: none"> • Press Preset to return to normal operation.

Figure J-3: HP8935 Test Set



FW00885

Setting HP8921A and HP83236A/B GPIB Address

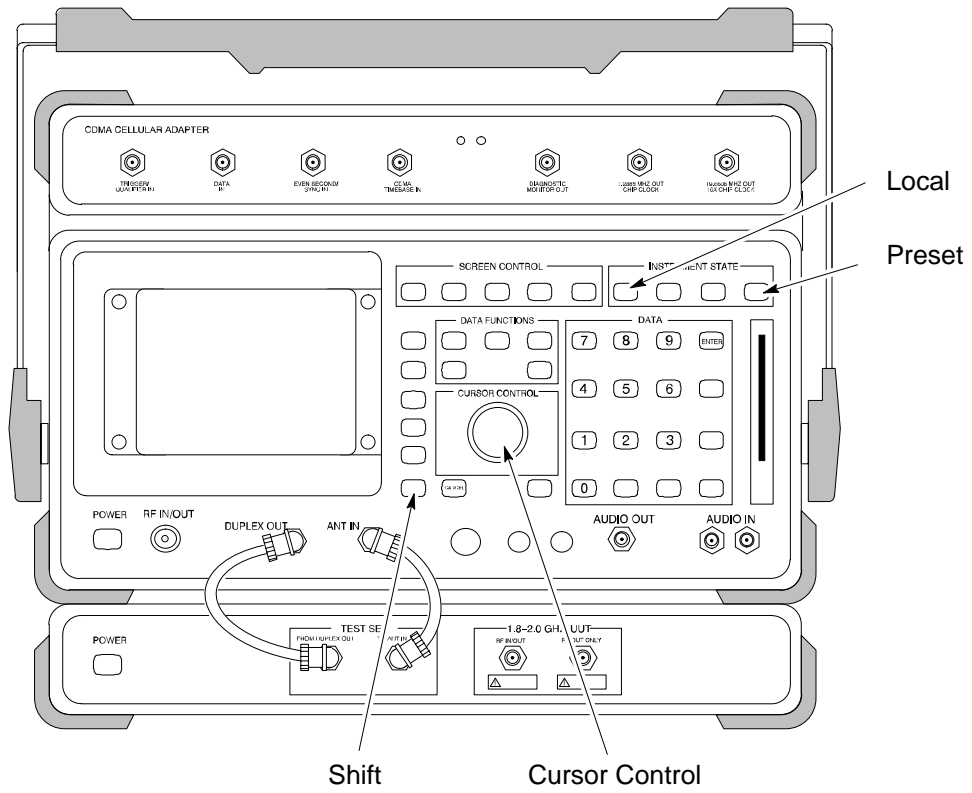
Follow the procedure in Table J-5 to verify and, if necessary, change the HP8921A HP83236A GPIB addresses.

NOTE This procedure assumes that the test equipment is set up and ready for testing.

Table J-5: Verify and/or Change HP8921A and HP83236A GPIB Addresses

Step	Action
1	<p>To verify that the GPIB addresses are set correctly, press Shift and LOCAL on the HP8921A (see Figure J-4). The current HP-IB address is displayed at the top of the screen.</p> <p>NOTE HP-IB is the same as GPIB.</p>
2	<p>If the current HP-IB address is not set to 18, perform the following to change it:</p> <ul style="list-style-type: none"> - Turn the Cursor Control knob to move the cursor to More and press the knob to select the field. - Turn the Cursor Control knob to move the cursor to I/O Config and press the knob to select the field. - Turn the Cursor Control knob to move the cursor to Adrs and press the knob to select the field. - Turn the Cursor Control knob to change the HP-IB address to 18 and press the knob to set the address. - Press Shift and Preset to return to normal operation.
3	<p>To set the HP83236A (or B) PCS Interface GPIB address=19, set the dip switches as follows:</p> <ul style="list-style-type: none"> - A1=1, A2=1, A3=0, A4=0, A5=1, HP-IB/Ser = 1

Figure J-4: HP8921A and HP83236A/B



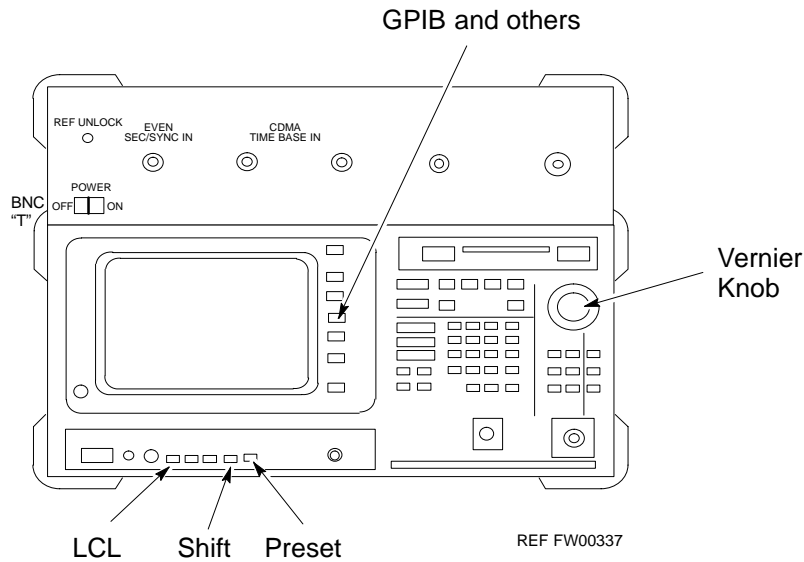
Advantest R3465 GPIB Address

Table J-6 describes the steps to verify and, if necessary, change the GPIB address for the Advantest R3465.

NOTE This procedure assumes that the test equipment is set up and ready for testing.

Table J-6: Verify and/or Change Advantest R3465 GPIB Address	
Step	Action
1	To verify that the GPIB address is set correctly, perform the following procedure: <ul style="list-style-type: none"> - Press SHIFT then PRESET (see Figure J-5). - Press LCL. - Press the GPIB and Others CRT menu key to view the current address.
2	If the current GPIB address is not set to 18 , perform the following to change it: <ul style="list-style-type: none"> - Turn the vernier knob as required to select 18. - Press the vernier knob to set the address.
3	To return to normal operation, press Shift and Preset .

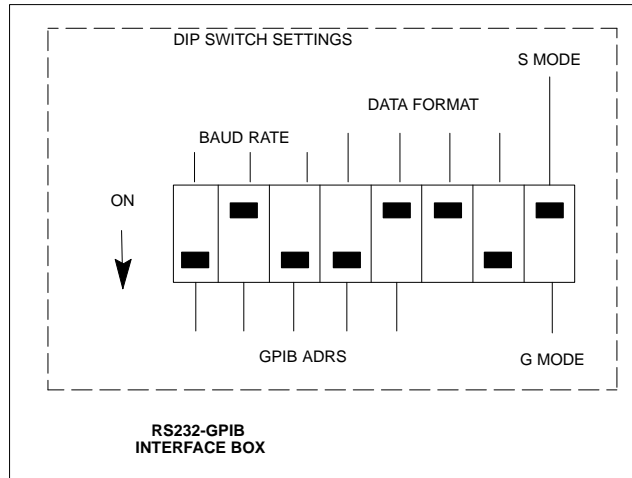
Figure J-5: R3465 Communications Test Set



RS232 GPIB Interface Box

Ensure that the RS232 GPIB interface box dip switches are set as shown in Figure J-6.

Figure J-6: RS232 GPIB Interface Box



CDMA 2000 Test Equipment Preparation

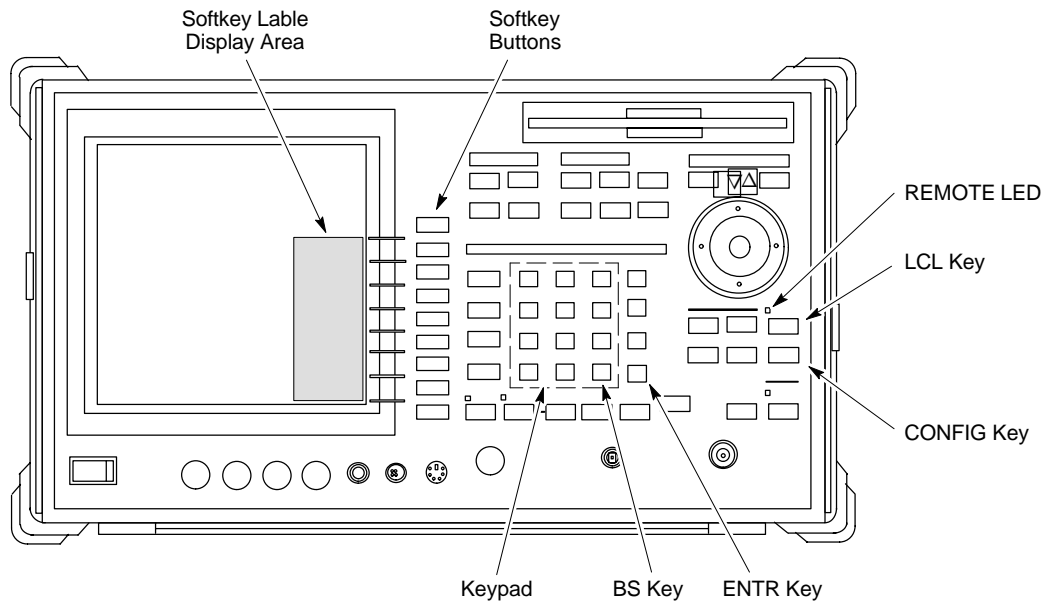
Advantest R3267 Spectrum Analyzer GPIB Address

Perform the procedure in Table J-7 and refer to Figure J-7 to verify and, if necessary, change the Advantest R3267 spectrum analyzer GPIB address.

Table J-7: Verify and Change Advantest R3267 GPIB Address

Step	Action
1	If the REMOTE LED is lighted, press the LCL key. <ul style="list-style-type: none"> - The LED extinguishes.
2	Press the CONFIG key. <ul style="list-style-type: none"> - The CONFIG softkey labels will appear in the softkey label display area of the instrument display. - The current GPIB address will be displayed below the GPIB Address softkey label.
3	If the current GPIB address is not set to 18 , perform the following to change it:
3a	<ul style="list-style-type: none"> - Press the GPIB Address softkey. <ul style="list-style-type: none"> -- A GPIB Address entry window will open in the instrument display showing the current GPIB address.
3b	<ul style="list-style-type: none"> - Enter 18 on the keypad in the ENTRY section of the instrument front panel. <ul style="list-style-type: none"> -- Characters typed on the keypad will replace the address displayed in the GPIB Address entry window. <p>NOTE To correct an entry, press the BS (backspace) key at the lower right of the keypad to delete one character at a time.</p>
3c	<ul style="list-style-type: none"> - Press the ENTER key to the lower right of the keypad to enter the address. <ul style="list-style-type: none"> -- The GPIB Address entry window closes. -- The new address is displayed in the bottom portion of the GPIB Address softkey label.

Figure J-7: Setting Advantest R3267 GPIB Address

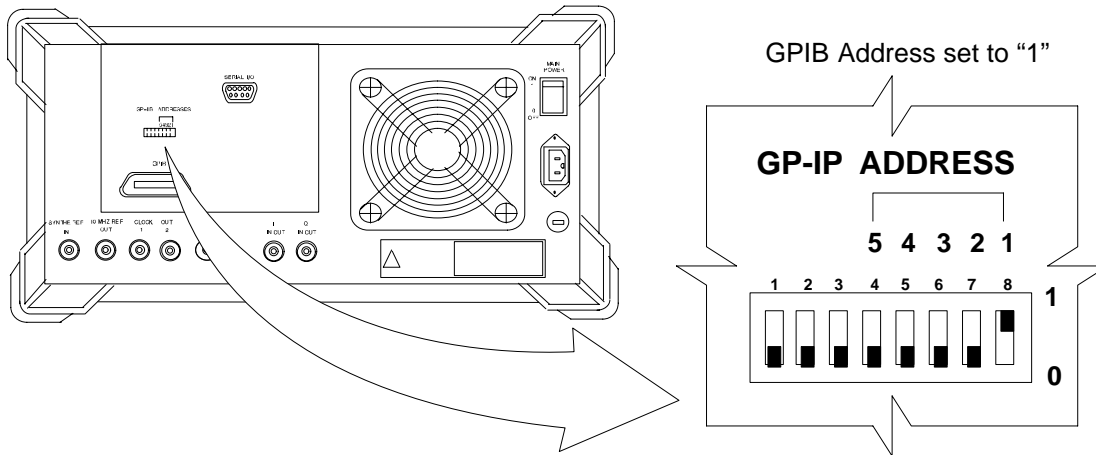


ti-CDMA-WP-00083-v01-ildoc-ftw

Advantest R3562 Signal Generator GPIB Address

Set the GP-IB ADDRESS switch on the rear of the Advantest R3562 signal generator to address 1 as shown in Figure J-8.

Figure J-8: Advantest R3562 GPIB Address Switch Setting

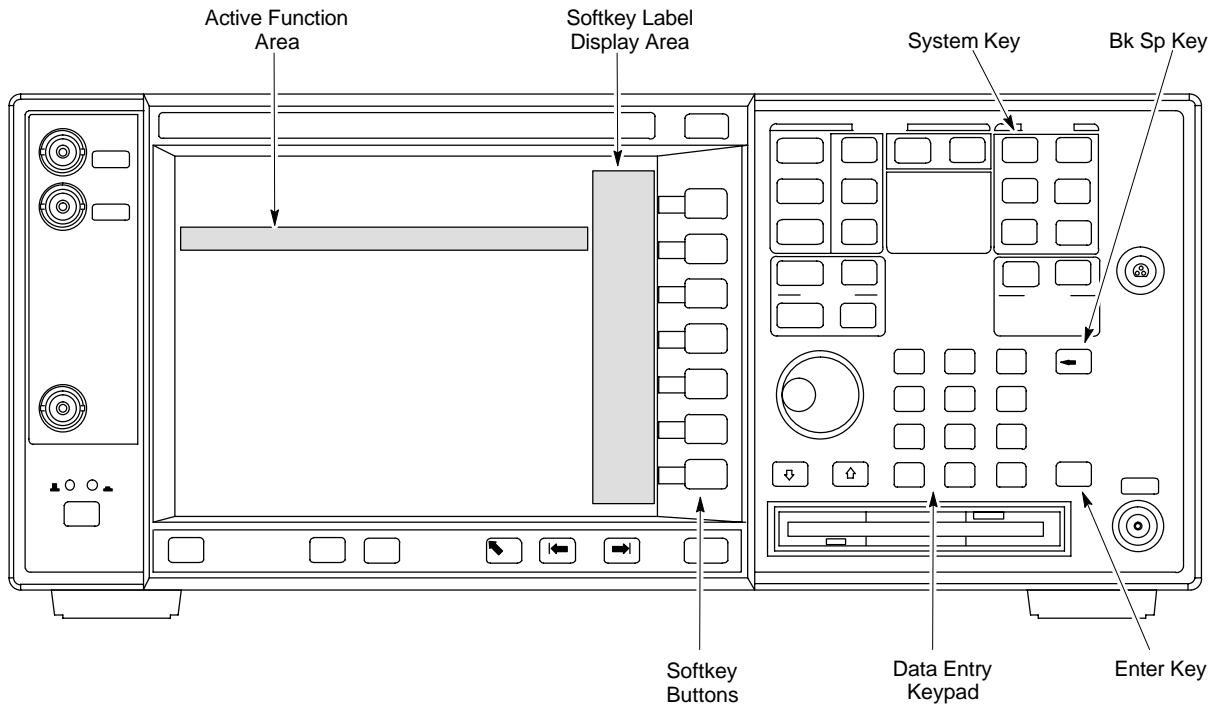


ti-CDMA-WP-00084-v01-ildoc-ftw

Agilent E4406A Transmitter Tester GPIB Address

Follow the procedure in Table J-8 and refer to Figure J-9 to verify and, if necessary, change the Agilent E4406A GPIB address.

Table J-8: Verify and Change Agilent E4406A GPIB Address	
Step	Action
1	In the SYSTEM section of the instrument front panel, press the System key. <ul style="list-style-type: none"> - The softkey labels displayed on the right side of the instrument screen will change.
2	Press the Config I/O softkey button to the right of the instrument screen. <ul style="list-style-type: none"> - The softkey labels will change. - The current instrument GPIB address will be displayed below the GPIB Address softkey label.
3	If the current GPIB address is not set to 18 , perform the following to change it:
3a	<ul style="list-style-type: none"> - Press the GPIB Address softkey button. <ul style="list-style-type: none"> -- In the on-screen Active Function Area, GPIB Address will be displayed followed by the current GPIB address.
3b	<ul style="list-style-type: none"> - On the front panel Data Entry keypad, enter the communications system analyzer GPIB address of 18. <ul style="list-style-type: none"> -- The GPIB Address label will change to Enter. -- Digits entered with the keypad will replace the current GPIB address in the display. <p>NOTE To correct an entry, press the Bk Sp key at the upper right of the keypad to delete one character at a time.</p>
3c	<ul style="list-style-type: none"> - Press the Enter softkey button or the keypad Enter key to set the new GPIB address. <ul style="list-style-type: none"> -- The Config I/O softkey labels will reappear. -- The new GPIB address will be displayed under the GPIB Address softkey label.

Figure J-9: Setting Agilent E4406A GPIB Address

ti-CDMA-WP-00085-v01-ildoc-ftw

Agilent E4432B Signal Generator GPIB Address

Follow the procedure in Table J-9 and refer to Figure J-10 to verify and, if necessary, change the Agilent E4432B GPIB address.

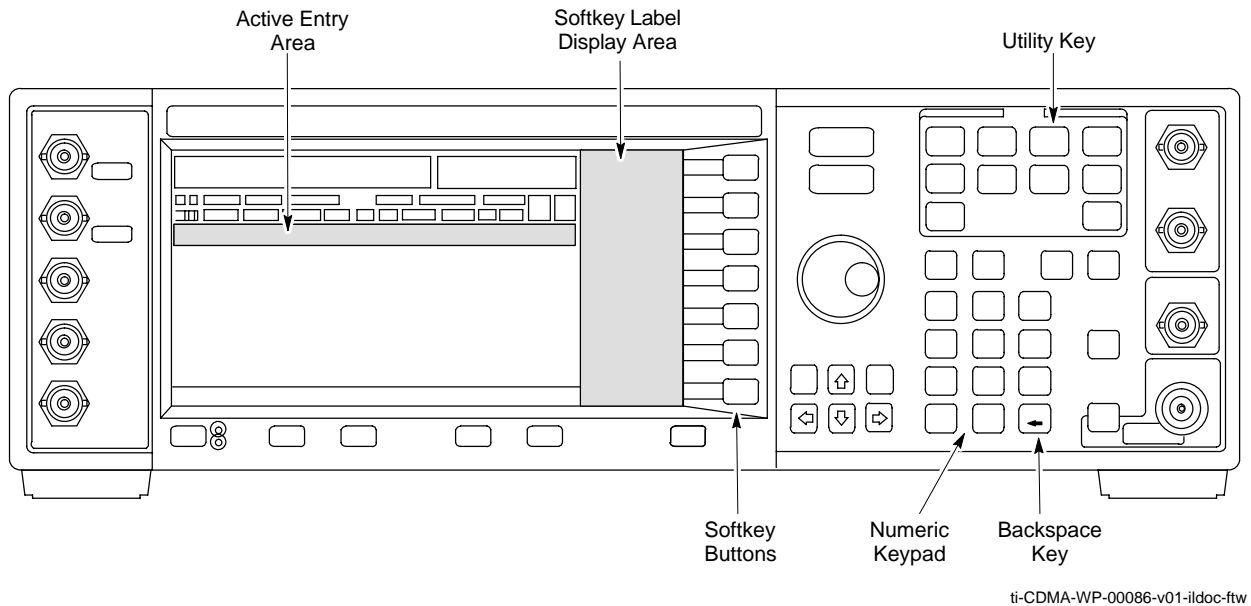
Table J-9: Verify and Change Agilent E4432B GPIB Address

Step	Action
1	In the MENUS section of the instrument front panel, press the Utility key. - The softkey labels displayed on the right side of the instrument screen will change.
2	Press the GPIB/RS232 softkey button to the right of the instrument screen. - The softkey labels will change. - The current instrument GPIB address will be displayed below the GPIB Address softkey label.
3	If the current GPIB address is not set to 1 , perform the following to change it:
3a	- Press the GPIB Address softkey button. -- The GPIB Address label and current GPIB address will change to boldface. -- In the on-screen Active Entry Area, Address: will be displayed followed by the current GPIB address.

... continued on next page

Table J-9: Verify and Change Agilent E4432B GPIB Address	
Step	Action
3b	<ul style="list-style-type: none"> - On the front panel Numeric keypad, enter the signal generator GPIB address of 1. -- The GPIB Address label will change to Enter. -- Digits entered with the keypad will replace the current GPIB address in the Active Entry display. <p>NOTE To correct an entry, press the backspace key at the lower right of the keypad to delete one character at a time.</p>
3c	<ul style="list-style-type: none"> - Press the Entr softkey button to set the new GPIB address. -- The new GPIB address will be displayed under the GPIB Address softkey label.

Figure J-10: Setting Agilent E4432B GPIB Address





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