The manual included is presently being edited and is a preliminary version representative of the

SC4812T-MC 1X/1X-EVDO @ 1.9 GHz CDMA BTS Optimization Manual

Technical Information

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1X SC4812T–MC BTS OPTIMIZATION/ATP

SOFTWARE RELEASE 2.16.4.X

800 MHZ & 1.9 GHZ

CDMA2000 1X

DRAFT

ENGLISH

5/21/04

68P09260A64–B

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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.

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

Obtaining manuals

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

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

Text conventions

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

NOTE

Presents additional, helpful, non-critical information that you can use.

IMPORTANT

Presents 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 damage to software, stored data, or equipment could occur, thus avoiding the damage.

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: for example, SERIF versus SANS SERIF) are used to name a command.
- In text, `typewriter` style characters represent prompts and the system output as displayed on an operator terminal or printer.
- In command definitions, sans serif **boldface** characters represent those parts of the command string that must be entered exactly as shown and `typewriter` style characters represent command output responses as displayed on an operator terminal or printer.
- In the command format of the command definition, `typewriter` style characters represent the command parameters.

Reporting manual errors

To report a documentation error, call the CNRC (Customer Network Resolution Center) and provide the following information to enable CNRC to open an SR (Service Request):
– the document type
– the manual title, part number, and revision character
– the page number(s) with the error
– a detailed description of the error and if possible the proposed solution
Motorola appreciates feedback from the users of our manuals.

Contact us

Send questions and comments regarding user documentation to the email address below:
cdma.documentation@motorola.com

Motorola appreciates feedback from the users of our information.

Manual banner definitions

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

24-hour support service

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

North America	+1–800–433–5202
Europe, Middle East, Africa	+44– (0) 1793–565444
Asia Pacific	+86–10–88417733
Japan & Korea	+81–3–5463–3550

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

General Safety

Remember! . . . Safety depends on you!!

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

Ground the instrument

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

NOTE

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

Do not operate in an explosive atmosphere

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

Keep away from live circuits

Operating personnel must:

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

Do not service or adjust alone

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

Use caution when exposing or handling the CRT

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

Do not substitute parts or modify equipment

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

Dangerous procedure warnings

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

WARNING

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

Revision History

Manual Number

68P09260A64–B

Manual Title

1X SC4812T–MC BTS Optimization/ATP
Software Release 2.16.4.x

Version Information

The following table lists the manual version, date of version, and remarks on the version.

Version Level	Date of Issue	Remarks
A	MAY 2004	Upissue to include 1.9 GHz information

Chapter 1: Introduction

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Notes

Physical Differences

This *Read-me-first* document describes a summary of changes between the existing SC4812T 800MHz BTS and the SC4812T-MC (Multicarrier) BTS. The SC4812T-MC is based on the existing SC 4812T platform and employs similar hardware and architecture. The differences between these products are briefly described and illustrated below. This section is not intended to replace the SC4812T-MC manual set. This information applies generally to both 800 MHz +27V and –48V frames, although only +27V illustrations are shown.

Multicarrier provides the capability for all PAs in all quadrants to provide trunked power across all sector/carriers. This differs from the previous architecture in which PA modules within a quadrant provided trunked power to only one carrier. Furthermore, in SC4812T-MC, adjacent channels can be combined onto one antenna versus being transmitted on separate antennas in SC4812T.

An overview of the BTS differences is illustrated in the following table and in illustrations on the following pages (Figure 1-1 thru Figure 1-4).

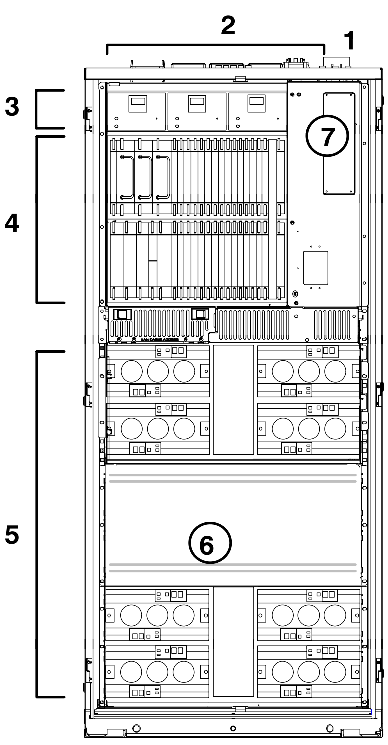
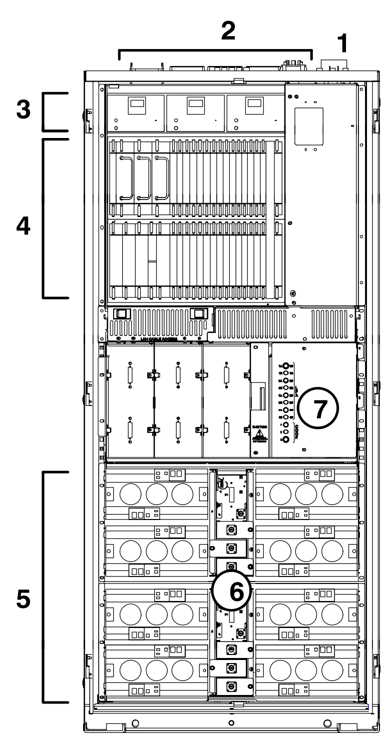
SC4812T	Description	#	Description	SC4812T-MC
	3x3 DC Power Input (see Figure 1-1)	1	2x2 DC Power Input (see Figure 1-1)	
	I/O Plate supporting 3x3 DC Power Input (see Figure 1-2)	2	I/O Plate supporting 2x2 DC Power Input (see Figure 1-2)	
	C–CCP Fan Tray	3	C–CCP Speed–Controlled Fan Tray	
	C-CCP Cage: • CIO (3- or 6-Sector) • BBX-1X • Switch	4	**C-CCP Cage:** • MCIO (3- or 6-Sector) • High Power BBX-1X • High Power Switch	
	PA Shelves: • SC 4812T LPA • 4x4 TX Backplane • PA Location and Mapping (see Figure 1-3) • Shelf Qty: 1 for up to 2 carriers; 2 for 3 or more carriers.	5	**PA Shelves:** • SC 4812T CLPA • Multicarrier module • (Switched) Parallel Linear amplifier Combiner • Enhanced Trunking Module • LPA/PLC Filler Panel • PA Location and Mapping (see Figure 1-3) • Shelf Qty: 2 for all configurations	
	2:1 or 4:1 Combiners or Dual Bandpass TX Filters	6	TX Filters and/or TX Output Terminator	
ti-CDMA-WP-00098-v01-ildoc-ftw	PA Breaker Mapping (see Figure 1-4)	7	PA Breaker Mapping (see Figure 1-4)	ti-CDMA-WP-00196-v01-ildoc-ftw

Figure 1-1: DC Power Input Connector Comparison

SC 4812T **SC 4812T–MC**

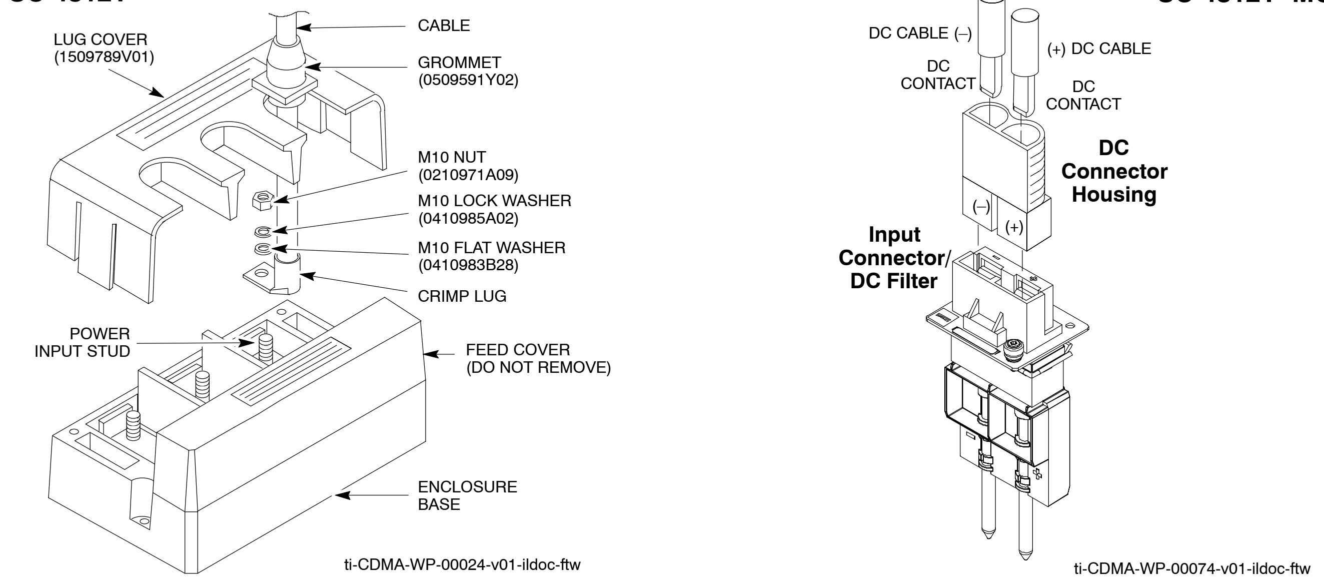


Figure 1-2: I/O Plate Comparison

SC 4812T **SC 4812T–MC**

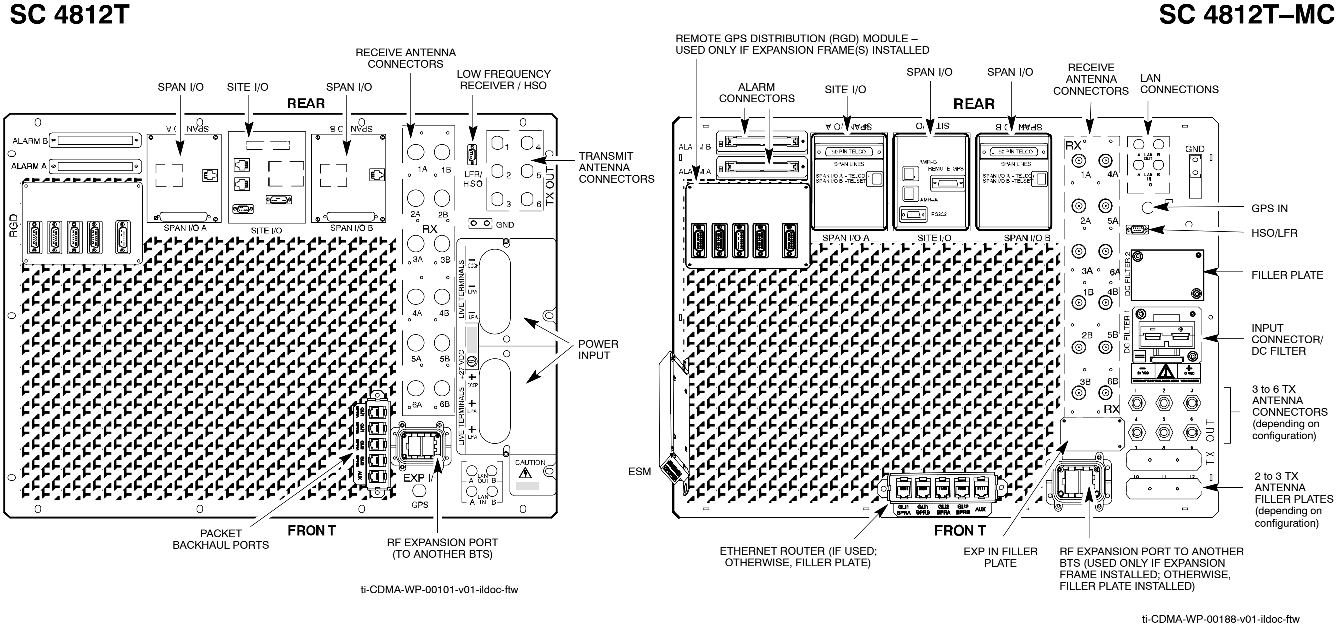


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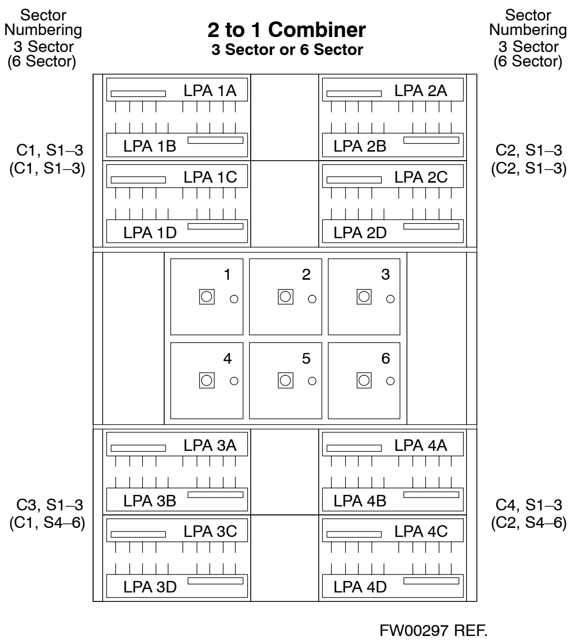
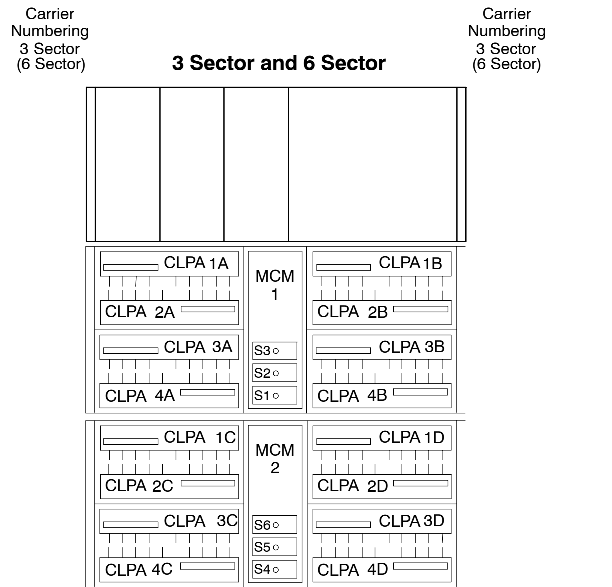
Figure 1-3: PA Location Comparison

SC 4812T



SC 4812T–MC

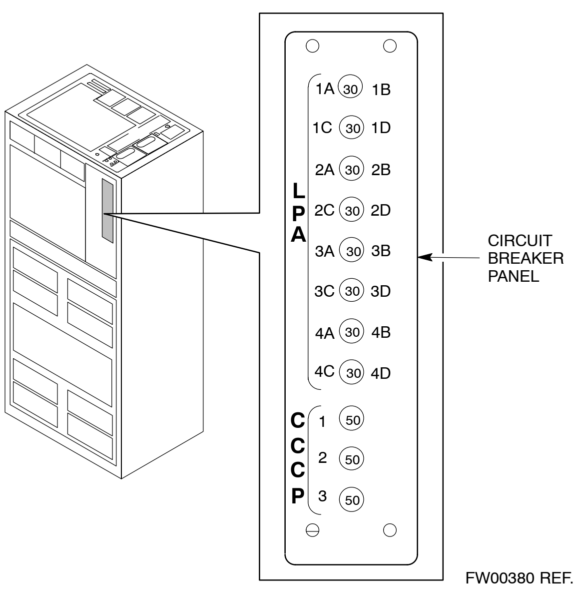


NOTES:

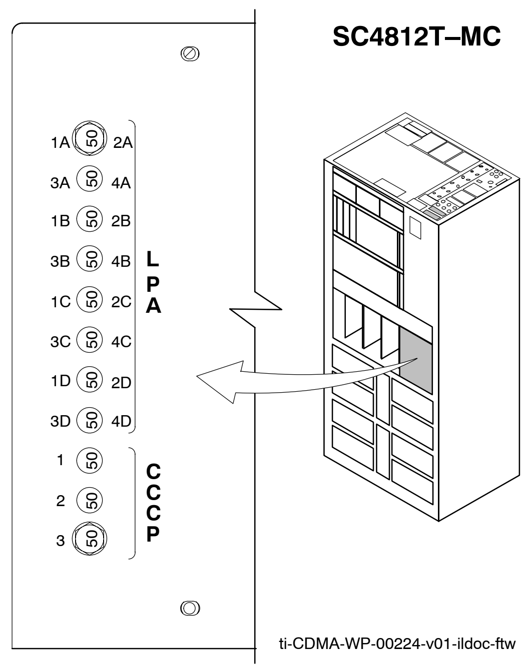
- **MCM CAN BE EITHER 3.3 OR 4X4**
- **MCM2 IS REQUIRED ONLY IN A 6–SECTOR CONFIGURATION**
- **LOWER RIGHT QUADRANT WILL ONLY HAVE CLPAS IN IT IN A 4.4 CONFIGURATION**

Figure 1-4: PA Breaker Mapping Comparison

SC 4812T



SC4812T–MC



CAUTION

Each breaker controls a pair of PAs. In an SC4812T–MC, opening (pulling) a PA breaker while the BTS is operating will degrade the TX Output power of **ALL** sector–carriers, not just a specific carrier as in an SC4812T.

General Test Procedural Changes for SC 4812T-MC

NOTE

The GENERAL information herein summarizes procedural changes introduced with the SC 4812T–MC BTS. Detailed procedures are provided in the Optimization and ATP sections.

NOTE

1. During the execution of *any* TX tests or calibration procedures, *ALL* Power Amplifiers (PA) must be in service (INS).
2. When logging into a BTS with a system release earlier than 2.16.4.x, be sure to set BTS type to MultiCarrier in the dialog box which will appear when logging into the BTS.

Transmit (TX) Bay Level Offset (BLO) Specifications – SC4812T–MC TX BLO specifications for different BTS sector configurations are as follows:

- 800 MHz Three–sector BTS:
  - Single–sided BLO: >35dB
  - Double–sided BLO: 40dB +/– 5dB
- 800 MHz Six–sector BTS
  - Single–sided BLO: >38dB
  - Double–sided BLO: 43dB +/– 5dB
- 1.9 GHz Three–sector BTS:
  - Single–sided BLO: >30dB
  - Double–sided BLO: 35dB +/– 5dB
- 1.9 GHz Six–sector BTS
  - Single–sided BLO: >33dB
  - Double–sided BLO: 38dB +/– 5dB

Verifying Pilot Power Setting with a Wide Band RF Power Meter

The SC4812T–MC requires all equipped PAs be enabled during TX test. With a “tuned” RF power meter, such as the Agilent VSA E4406A, all sectors–carriers can be enabled simultaneously and each sector–carrier power level setting can be measured. The following work–around procedures are suggested when using a wide band RF power meter and the BTS is under OMC–R control.

NOTE

This workaround is only required before system release 2.16.4.x. After release 2.16.4.x, any one BBX keyed will enable all the CLPA modules.

1–carrier configuration (requires 3 measurements) – The 1-carrier procedure is identical to the current *SC*4812T, which is to enable all three sector BBXs, then measure with each sector with the RF power meter.

2–carrier configuration (requires 6 measurements) – The procedure below allows taking measurements with both carriers enabled and more than one carrier on same sector.

Sector	Carrier 1	Carrier 2	Sector	Carrier 1	Carrier 2
1	BBX-1		1		BBX-7
2	BBX-2		2		BBX-8
3		BBX-9	3	BBX-3	
Procedure:					
1. Enable BBX-1 (C1–S1), BBX-2 (C1–S2), and BBX-9 (C2–S3). 2. Measure TX power from each of all 3 sectors. 3. Disable BBX-1, BBX-2, and BBX-9.			4. Enable BBX-3 (C1–S3), BBX-7 (C2–S1), and BBX-8 (C2–S2). 5. Measure TX power from each of all 3 sectors. 6. Disable BBX-3, BBX-7, and BBX-8.		

3–carrier configuration (requires 9 measurements) – The procedure below allows taking measurements with all 3 carriers enabled and more than one carrier on same sector.

Sector	Carrier 1	Carrier 2	Carrier 3	Sector	Carrier 1	Carrier 2	Carrier 3	Sector	Carrier 1	Carrier 2	Carrier 3
1	BBX-1			1			BBX-4	1		BBX-7	
2		BBX-8		2	BBX-2			2			BBX-5
3			BBX-6	3		BBX-9		3	BBX-3		
Procedure:											
1. Enable BBX-1 (C1–S1), BBX8 (C2–S2), and BBX6 (C3–S3) 2. Measure TX power from each of all 3 sectors 3. Disable BBX1, BBX8, and BBX6				4. Enable BBX-2 (C1–S2), BBX-9 (C2–S3), and BBX-4 (C3–S1) 5. Measure TX power from each of all 3 sectors 6. Disable BBX-2, BBX-9, and BBX-4				7. Enable BBX-3 (C1–S3), BBX-7 (C2–S1), and BBX-5 (C3–S2) 8. Measure TX power from each of all 3 sectors 9. Disable BBX-3, BBX-7, and BBX-5			

4–carrier configuration (requires 12 measurements) – Use this procedure to take measurements with all 4 carriers enabled. The sector with 2 carriers active will not be measured.

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1	BBX-1			
2		BBX-8		
3			BBX-6	BBX-12

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1			BBX-4	BBX-10
2	BBX-2			
3		BBX-9		

Procedure:

1. Enable BBX-1, BBX-8, BBX-6, and BBX-12.
2. Measure TX power from at sector 1 carrier 1 (C1-S1) and sector 2 carrier 2 (C2-S2).
3. Disable BBX-1, BBX-8, BBX-6, and BBX-12.
4. Enable BBX-2, BBX-9, BBX-4, and BBX-10.
5. Measure TX power of C1-S2 and C2-S3.
6. Disable BBX-2, BBX-9, BBX-4, and BBX-10.

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1		BBX-7		
2			BBX-5	BBX-11
3	BBX-3			

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1	BBX-1	BBX-7		
2			BBX-5	
3				BBX-12

Procedure:

7. Enable BBX-3, BBX-7, BBX-5, and BBX-11.
8. Measure TX power of C1-S3 and C2-S1.
9. Disable BBX-3, BBX-7, BBX-5, and BBX-11.
10. Enable BBX-1, BBX-7, BBX-5, and BBX-12.
11. Measure TX power of C3-S2 and C4-S3.
12. Disable BBX-1, BBX-7, BBX-5, and BBX-12.

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1				BBX-10
2	BBX-2	BBX-8		
3			BBX-6	

Sector	Carrier 1	Carrier 2	Carrier 3	Carrier 4
1			BBX-4	
2				BBX-11
3	BBX-3	BBX-9		

Procedure:

13. Enable BBX-2, BBX-8, BBX-6, and BBX-10.
14. Measure TX power of C3-S3 and C4-S1.
15. Disable BBX-2, BBX-8, BBX-6, and BBX-10.
16. Enable BBX-3, BBX-9, BBX-4, and BBX-11.
17. Measure TX power C3-S1 and C4-S2.
18. Disable BBX-3, BBX-9, BBX-4, and BBX-11.

2–carrier, 6–sector configuration (requires 12 measurements) – Use this procedure to take measurements with both carriers enabled.

Sector	Carrier 1	Carrier 2	Sector	Carrier 1	Carrier 2
1	BBX-1		1		BBX-7
2	BBX-2		2		BBX-8
3		BBX-9	3	BBX-3	
4	BBX-4		4		BBX-10
5		BBX1–11	5	BBX-5	
6		BBX1–12	6	BBX-6	
Procedure:					
1. Enable the following BBXs: – BBX-1 (C1–S1) – BBX-2 (C1–S2) – BBX-4 (C1-S4) – BBX-9 (C2–S3) – BBX-11 (C2-S5) – BBX-12 (C2-S6) 2. Measure TX power from each of all 6 sectors. 3. Disable BBXs.			4. Enable the following BBXs: – BBX-3 (C1–S3) – BBX-5 (C1-S5) – BBX-6 (C1-S6) – BBX-7 (C2–S1) – BBX-8 (C2–S2) – BBX-10 (C2-S4) 5. Measure TX power from each of all 6 sectors. 6. Disable BBXs.		

Scope, Assumptions, and Audience

CAUTION

1. Procedures in this manual apply to an *SC*4812T–MC BTS operating with Dynamic Multi–Carrier PA Control under Motorola Software Release 2.16.4.1 and later. These procedures *will not work* for an *SC*4812T–MC BTS operating with Motorola Software Release *2.16.4.0 and earlier.*
2. Procedures in this manual require the use of Local Maintenance Facility (LMF) application software version 2.16.4.0.09 or later.

Scope

This publication provides information pertaining to the optimization and acceptance tests of the SC™ 4812T–Multi–Carrier Base Transceiver Subsystem (1X *SC*4812T–MC BTS). The following models equipped with trunked Power Amplifiers (PA) and their associated internal and external interfaces are covered:

- 800 MHz models ST1407/ST1408
- 1.9 GHz models ST1426/ST1428

Circuit and Packet BTS Support

Information in this publication supports optimization and calibration of the following types of BTS sites operating with Motorola Software Release 2.16.4.1 and later:

- 1X circuit BTS
- 1X packet BTS

The cdma2000 1X (1X) packet BTS has a packet backhaul network interface provided through BTS routers operating with a Third–generation Group Line Interface (GLI3) card that can support voice (IS-95A/B, 1X) and data (IS-95B, 1X).

This BTS equipment may be configured with all 1X cards (BBX–1X and MCC–1X) or a mix of 1X cards and non–1X cards (BBX2 and MCC8E/24E). This configuration is compliant with all applicable 1X specifications. It provides the forward link and reverse link RF functions to support Second Generation (2G) features and Third Generation (3G) 1X features; that is, high capacity voice and high bit–rate data.

The 1X circuit BTS is capable of using a split or mixed backhaul (circuit/packet pipe) network interface that can handle circuit–based voice (IS-95A/B, 1X) and data (IS-95B) as well as “packetized” data (1X).

Assumptions

This document assumes that the BTS frames and cabling have been installed according to the following manuals:

- *SC Product Family Frame Mounting Guide*, which covers the physical "bolt down" of all SC series equipment frames
- *1X SC 4812T-MC BTS Hardware Installation* , which covers BTS specific cabling configurations for Packet Backhaul and the addition of carriers to the BTS

Audience

Motorola Technical Information Products and Services (TIPS) has attempted to incorporate into this document the many customer suggestions and inputs received since the inception of the *SC* product line. At the same time, TIPS has tried to ensure 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 subject in too much or not enough detail, please keep this in mind.

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 MS® Windows® 98 or *Windows* 2000™.

Content Summary

Publication Composition

This publication covers the following areas.

- Introduction: 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: jumper configuration of BTS sub–assemblies, pre–power up tests, initial power application and power–up tests for the BTS equipment frame after installation, and download of all BTS processor boards and PAs.
- Optimization/Calibration: downloading all BTS processor boards, test equipment set–up and calibration, PA verification, radio frequency (RF) path verification, Bay Level Offset (BLO) calibration, Cellular Radio Monitoring System (CRMS), and Radio Frequency Diagnostic System (RFDS) functions and calibration.
- Acceptance Test Procedures (ATP): automated ATP scripts executed by the LMF and used to verify all major transmit (TX) and receive (RX) performance characteristics on all BTS equipment. Includes generating an ATP report.
- Prepare to Leave the Site: site turnover process after ATP is completed.
- Basic Troubleshooting: procedures to perform when an ATP fails, as well as when incorrect results are obtained during logon, test equipment operation, calibration, and Global Positioning System (GPS) operation. These tests are typically used to isolate faults down to the module level. Also provided is additional information necessary to better understand equipment operation.
- 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, and procedures for downloading ROM and RAM code.

Purpose of Optimization

Why Optimize?

Proper optimization and calibration ensures that:

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

What Is Optimization?

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

What Happens During Optimization?

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

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

> **NOTE**
>
> In this publication, all models of the Broad Band Transceiver (BBX) board usable in this BTS, are generically identified as BBX, unless otherwise specified. Also, all models of the Multi–Channel CDMA (MCC) cards usable in this BTS, are generically identified as MCC, unless otherwise specified.

RF paths and transceiver optimization – Twelve of the BBX boards in each Combined–CDMA Channel Processor (C–CCP) shelf are optimized to specific RX and TX antenna connectors. The last BBX board provides redundancy for BBX boards 1 through 12, and is optimized to *all* antenna connectors. A single optimization value is generated for each complete path. This eliminates the accumulation of error that would occur from individually measuring and summing the gain and loss of each element in the path.

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

When to Optimize

New Installations

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

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

Site Expansion

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

Periodic Optimization

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

Repaired Sites

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

Test Equipment Selection, Calibration, and General Operation Requirememnts

Policy

General Requirements – To ensure consistent, reliable, and repeatable optimization test results, test equipment and software meeting the following technical criteria should be used to optimize the BTS equipment.

Test equipment substitution – Test equipment can, of course, be substituted with other test equipment models ***but those models must meet the same technical specifications***. All test equipment models selected for use in BTS calibration and acceptance testing ***must be supported by the LMF***..

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

Test Equipment Calibration

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

Test Cable Calibration

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

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

Equipment Warm–up

After arriving at 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 procedures.

- Communications Test Set
- Power Meter

Required Test Equipment and Software

Overview

Test equipment and software described in this section is required for the optimization and acceptance testing procedures. Common tools such as screwdrivers and frame keys are also needed. Read the operators manual for all test equipment items to understand their individual operation before using them for optimization or acceptance testing.

LMF Computer and Software

LMF Hardware Requirements

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

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

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

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

LMF Software

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

- Installation
- Maintenance
- Calibration
- Optimization

Ethernet LAN Transceiver

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

10BaseT/10Base2 Converter

- 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.

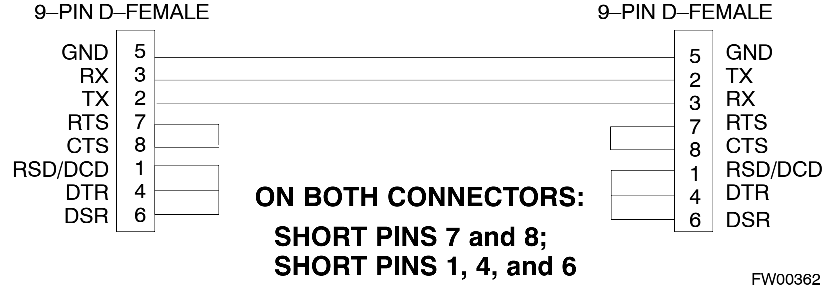
3C–PC–COMBO CBL

- 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 1-5):
  - 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 1-5: Null Modem Cable Detail



MMI Interface

Motorola cable part number CGDSMMICABLE219112 or a cable locally fabricated as described in Appendix J is used to connect the LMF to the BTS.

Communications System Analyzer CDMA/analog

Table 1-1: CDMA LMF Test Equipment Support Table

Item	Description	Test Capability
Test Sets		
Hewlett Packard, model HP 8921A (with 83203B)	Communications analyzer (includes 83203B CDMA interface option)	IS–95A/B only
Hewlett Packard, model HP 83236A	PCS interface for PCS band	IS–95A/B only
Motorola CyberTest	Communications analyzer	IS–95A/B only
Advantest R3465 (with 3561L)	Communications analyzer (with 3561 CDMA option)	IS–95A/B only
Agilent E4406A (with E4432B)	Communications analyzer (with Generator)	IS–95A/B and CDMA 2000 testing
Advantest R3267 Analyzer (with R3562)	Communications Analyzer with Advantest R3562 Generator	IS–95A/B and CDMA 2000 testing
Agilent 8935 series E6380A (formerly HP 8935) with option 200 or R2K	Communications test set	IS–95A/B and CDMA 2000 testing
Agilent E7495A	Communications test set	IS–95A/B and CDMA 2000 testing
Power Meters		
Gigatronix 8541C	Power meter	
HP437B (with HP8481A sensor)	Power meter with sensor – capable of measuring –30 dBm to 20 dBm	

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

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

- C–Message filter
- Spectrum analyzer
- CDMA code domain analyzer

GPIB Cables

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

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 30445 30 dB (Motorola Part No. 58D09643T01) 800 MHz coupler terminated with two Narda Model 375BN–M loads, or equivalent.

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 Documents and Related Publications

Required Documents

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

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

Related Publications

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

- *LMF Help function on–line documentation*
- *1X SC 4812T-MC BTS Hardware Installation* – 68P09260A38
- *1X SC 4812T-MC BTS FRU Guide* – 68P09260A87
- *1X SC 4812T/ET/ET Lite/MC/T Lite BTS Troubleshooting Manual* ; 68P09258A73 (packet) and 68P09258A74 (circuit)
- *LMF On-Line Help, Software Release 2.16.4.x* – 68P09260A45
- *LMF CDMA CLI Reference, Software Release 2.16.4.x* – 68P09260A67
- *MWR1900 Wireless Mobile Edge Router Hardware Installation Guide; part number 78–13982–01*
- *MWR1900 Wireless Mobile Edge Router Software Configuration Guide; part number 78–13983–01*
- *MWR1941–DC Mobile Wireless Edge Router Hardware Installation Guide; part number 78–15827–01*

Terms and Abbreviations

Standard and Non–standard Terms and Abbreviations

Standard terms and abbreviations used in this manual are defined in *Glossary of Cellular Terms; 68P09213A95* and *Cellular Acronyms; 68P09301A61*. Any non–standard terms or abbreviations included in this manual are listed in Table 1-2.

Table 1-2: Non–Standard Terms and Abbreviations

Term or Abbreviation	Definition
1X	One of two bandwidths currently defined in the IS–2000 CDMA specification, which extends the capability of the IS–95A and B specifications. 1X bandwidth provides wireless packet voice and data transmission capability at up to 144 Mbps.
BPR	BTS Packet Router. Markings on GLI3 Fast Ethernet connectors and SC4812T Fast Ethernet interface housing.
AR	As Required
BSS	Base Station Subsystem (BSS). The BSS consists of a Radio Access Network (RAN), at least one Access Node (AN), and a pair of core routers. It may also include a Digital Access Crossconnect System (DACS) to support split backhaul and, under Software Release 2.16.1.x and higher, a Selector Distribution Unit (SDU).
BTSRTR	BTS RouTeR (see *BTS router*)
BTSRTRGRP	BTS RouTeR GRouP (see *BTS router group*)
BTS router	One of the routers in a BTS router group.
BTS router group	The single non–redundant router or redundant router pair required for network interface when a BTS is operating on packet backhaul.
cage	Used interchangeably with "shelf" in SC4812T/ET/ET Lite BTSs, as in Combined CDMA Channel Processor shelf.
canned configuration	See *minimum standard configuration*.
C–CCP	Combined–CDMA Channel Processor. CDMA cage type used by SC4812T and SC4812ET BTSs where assemblies previously mounted in a BTS distribution shelf are *combined* into the CCP cage.
CEPT	Conference of European Postal and Telecommunications Administrators
CF	Compact Flash. Type of flash memory card used in the BTS router to store the Internetwork Operating System and configuration files.
CNEOMI	Common Network Element Operation & Maintenance Interface

table continued on next page

Table 1-2: Non–Standard Terms and Abbreviations	
Term or Abbreviation	**Definition**
CRMS	Cellular Radio Monitoring System
circuit backhaul	Conventional, non–Internet Protocol (IP) backhaul between the BTS and the Central Base Station Controller (CBSC) transcoder (XC) which carries IS–95A/B traffic.
duplex router	See *redundant router*
ESM	Ethernet Surge Module
external BTS router	MWR 1900 or MWR 1941 BTS routers mounted outside the C–CCP or SCCP cage of a packet BTS.
FE	Fast Ethernet. 100base–T mode of 10/100base–T Ethernet used for transmitting packetized control and bearer traffic between the BTS router group and GLI3 cards in the BTS.
GLI3	Third generation Group Line Interface card. Replaces GLI2 cards in a BTS when upgrading to packet backhaul capability under Software Release 2.16.1.x. Provides all the functionality of GLI2 cards plus additional capabilities needed for packet backhaul. GLI3 cards may only be installed in BSSs operating with Software Release 2.16.1.x software.
high availability BTS router	See *redundant router.*
IBR	Integrated BTS Router; see integrated BTS router
Integrated BTS Router	A GLI3 card loaded with bootROM code which allows the card's controller for Concentration Interface Highway (CHI) bus 2 to function as a router for packet traffic for the BTS. Employing IBRs permits converting a BTS to packet backhaul operation without using an external BTS router group. IBRs can operate as *non–redundant* or *redundant* BTS routers, but their employment limits BTS span capacity to one span as opposed to four spans for external BTS routers.
IOS	Internetwork Operating System. Operating system software used by the external BTS routers.
minimum standard configuration	The initial minimum configuration data which must be loaded into a BTS router to enable it to communicate on the network. This standard "canned configuration" is generated by a script included in the R16.1 software load for the OMC–R/CBSC. Separate configuration files for the primary BTS router on each FE LAN at a site is created by the script and can be copied to the Compact Flash (CF) memory card containing the IOS for BTS routers. Once the CF card with the IOS and minimum standard configuration is installed, the BTS router can communicate with the OMC–IP and the full, site–specific router configuration file can be downloaded from the Mobile Wireless Center to the router. Different configuration files are required for circuit and packet backhaul operation.
mixed backhaul	See *split backhaul*.

table continued on next page

Table 1-2: Non–Standard Terms and Abbreviations	
Term or Abbreviation	**Definition**
MWC	Mobile Wireless Center. One element of the OMC–IP which provides management and control for the MWR 1900 or MWR 1941 BTS routers installed in BTSs operating on packet backhaul.
non–redundant router	A BTS router group consisting of a single router without redundancy used as a cost–reduced network interface for a BTS operating on packet backhaul.
original design frame	+27 Vdc and –48 Vdc BTS frames in produced during early production of the product including starter and expansion frames. The FE Housing present on these frames is not located in the front middle of the top I/O panel, but located in different locations towards the rear of the unit, or on the right front side of the unit. +27 Vdc frames are 1800mm, –48 Vdc frames are 2100mm. Refer to the +27 Vdc or –48 Vdc Differences sections for a visual explanation of original production frames.
packet backhaul	IP–based backhaul between the BTS and the the network. Packet backhaul capability is implemented in Software Release 2.16.1.x and requires equipping a BTS with BTS routers and GLI3 cards. With the packet backhaul upgrade, a BTS can be configured for circuit operation with the capability to switch to packet backhaul or for packet–only operation.
packet BTS	A BTS operating on packet backhaul
pBTS	Packet BTS
R15.x	Motorola Software Release 2.15.0.39.10 or later. The version of the software which must be installed on BSS equipment to allow upgrading to Software Release 2.16.0.x.
R16.0	Motorola Software Release 2.16.0.x. The version of the software which must be loaded on BSS equipment to upgrade it to software release 2.16.1.x.
R16.1	Motorola Software Release 2.16.1.x. The earliest software release supporting packet backhaul.
redundant router	A BTS router group consisting of two MWR 1900 or MWR 1941 routers with Hot Standby Router Protocol (HSRP) to provide redundancy.
SC4812TX	An expansion frame version of the SC4812T–series BTS equipped with trunked RF power amplifiers and no receiver antenna ports.
C–CCP	Combined – CDMA Channel Processor
ROMmon	Low–level operating system used in MWR 1900 or MWR 1941 routers along with the IOS
simplex router	See non–redundant router.

table continued on next page

Table 1-2: Non–Standard Terms and Abbreviations	
Term or Abbreviation	**Definition**
split backhaul	Backhaul serving a network in which IS–95A/B traffic and 1X data traffic are mixed on circuit backhaul from CDMA2000 1X BTSs. 1X data traffic is "split" from IS–95A/B on a single span by being transported on DS0 time slots dedicated to a "packet pipe." IS–95A/B traffic is transported on the remaining DS0 time slots. Split backhaul on a single span must be connected to a Digital Access and Cross–connect System (DACS) which directs IS–95A/B traffic to the CBSC XC and 1X data traffic to the Access Node (AN), as required. If a DACS is not used, a CDMA2000 1X BTS must be equipped with separate spans for 1X data packet and IS–95A/B voice/data traffic, respectively. The 1X data packet–dedicated span would connect directly to the AN. The IS–95A/B–only span would connect directly to the CBSC XC.
tftp	trivial file transfer protocol
updated design frame	+27 Vdc and –48 Vdc BTS frames that contain enhancements of the BTS product and include starter and expansion frames. The FE Housing present on these frames is located in the front middle of the top I/O panel. Both the +27 Vdc and the –48Vdc frames are 1800mm (original –48 Vdc frames are 2100mm).Another visual reference that helps determine the frame at the site is the location of the circuit breakers. The updated design frame provides the cage circuit breakers in the middle right section of the frame. Refer to the +27 Vdc or –48 Vdc Differences sections for a visual explanation of original production frames.
Var.	Variable
WIC	WAN Interface Card (also *VWIC*)

BTS Equipment Identification

Equipment Overview

The BTS can consist of the following equipment frames:

- At least one BTS starter frame –
  –48 V configuration shown in Figure 1-6
  +27 V configuration shown in Figure 1-7
- Ancillary equipment frame (or wall mounted equipment)
- One or more Expansion frames (see Figure 1-8 and Figure 1-9). Expansion frames are essentially the same as starter frames but incorporate unique components on the I/O (Interconnect) panel.

NOTE

I/O panel detail is provided for Starter Frame in Figure 1-12 and Expansion Frame in Figure 1-13
C–CCP cage details are provided in Figure 1-14

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 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 fames.

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).

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 1-3 and Table 1-4 for specific C–CCP Shelf Device ID numbers.

Table 1-3: 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	GLI– 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 1-4: 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	GLI–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	202	207	208	209	210	211	212	207	208	209	210	211	212	–	–
301	–	301	302	–	–	–	302	302	307	308	309	310	311	312	307	308	309	310	311	312	–	–

Figure 1-6: BTS Starter Frame (–48V)

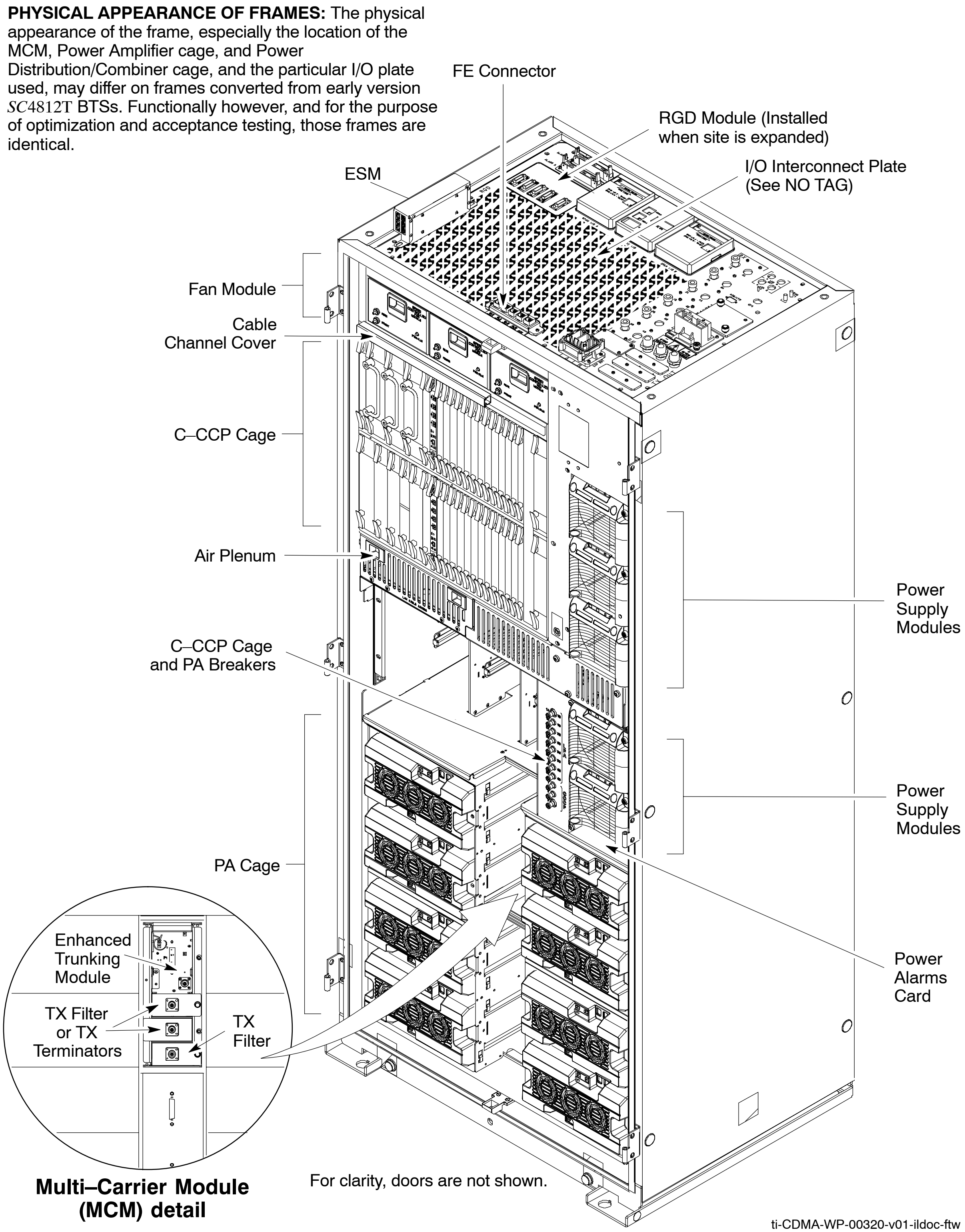


Figure 1-7: BTS Starter Frame (+27V)

PHYSICAL APPEARANCE OF FRAMES: The physical appearance of the frame, especially the location of the MCM, Power Amplifier cage, and Power Distribution/Combiner cage, and the particular I/O plate used, may differ on frames converted from early version *SC*4812T BTSs. Functionally however, and for the purpose of optimization and acceptance testing, those frames are identical.

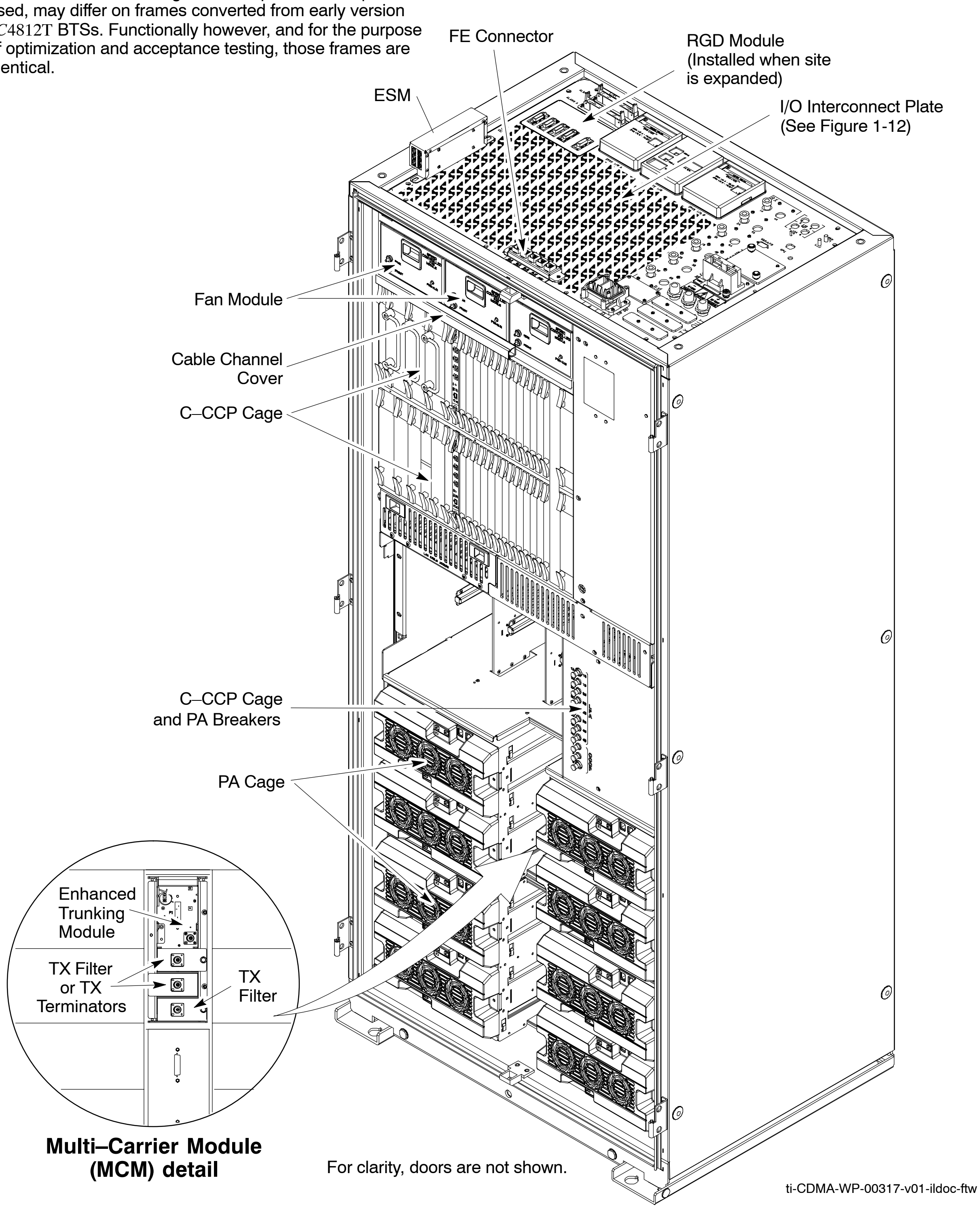


Figure 1-8: BTS Expansion Frame (–48V)

PHYSICAL APPEARANCE OF FRAMES: The physical appearance of the frame, especially the location of the MCM, Power Amplifier cage, and Power Distribution/Combiner cage, and the particular I/O plate used, may differ on frames converted from early version *SC*4812T BTSs. Functionally however, and for the purpose of optimization and acceptance testing, those frames are identical.

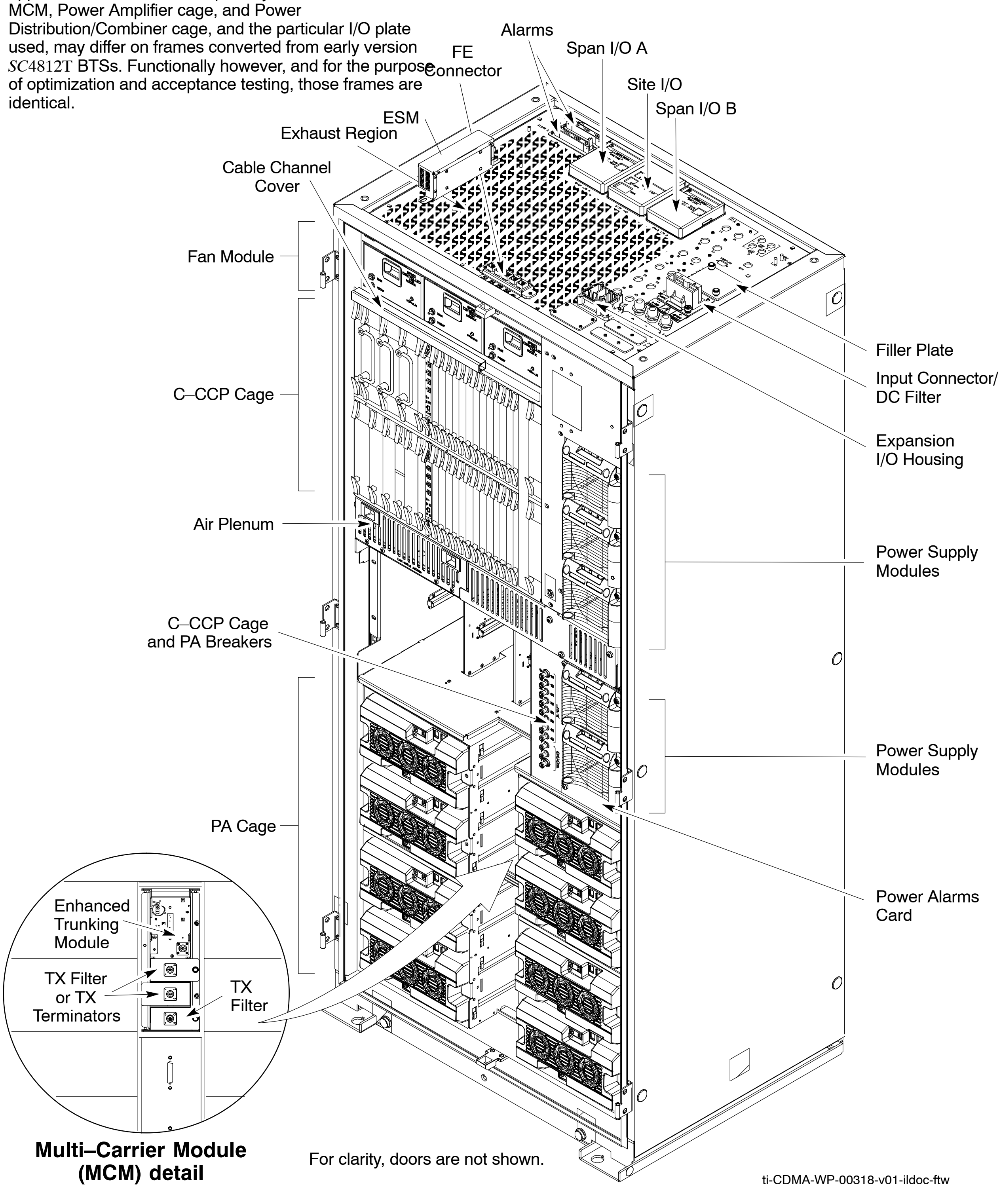


Figure 1-9: BTS Expansion Frame (+27V)

PHYSICAL APPEARANCE OF FRAMES: The physical appearance of the frame, especially the location of the MCM, Power Amplifier cage, and Power Distribution/Combiner cage, and the particular I/O plate used, may differ on frames converted from early version *SC*4812T BTSs. Functionally however, and for the purpose of optimization and acceptance testing, those frames are identical.

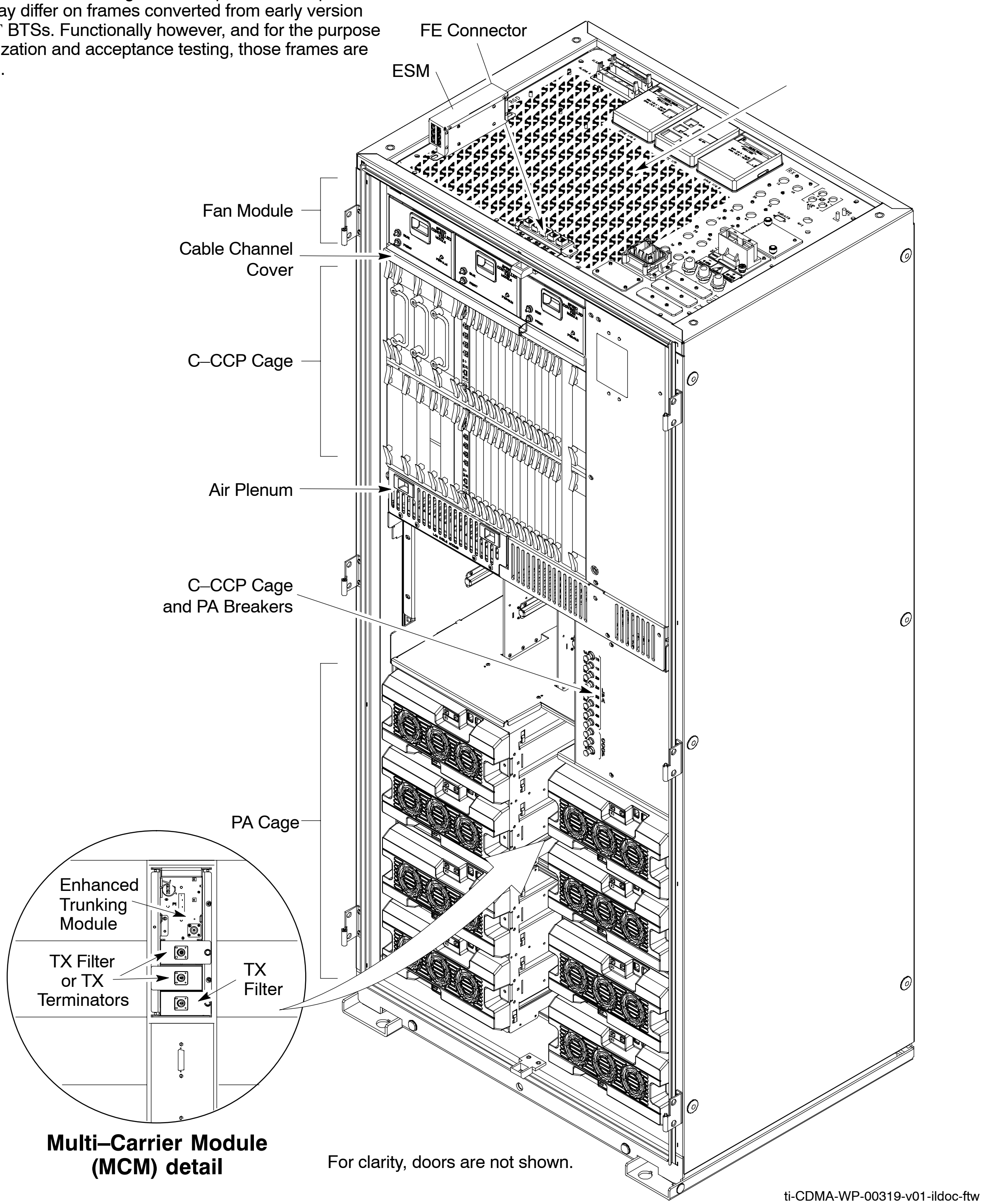


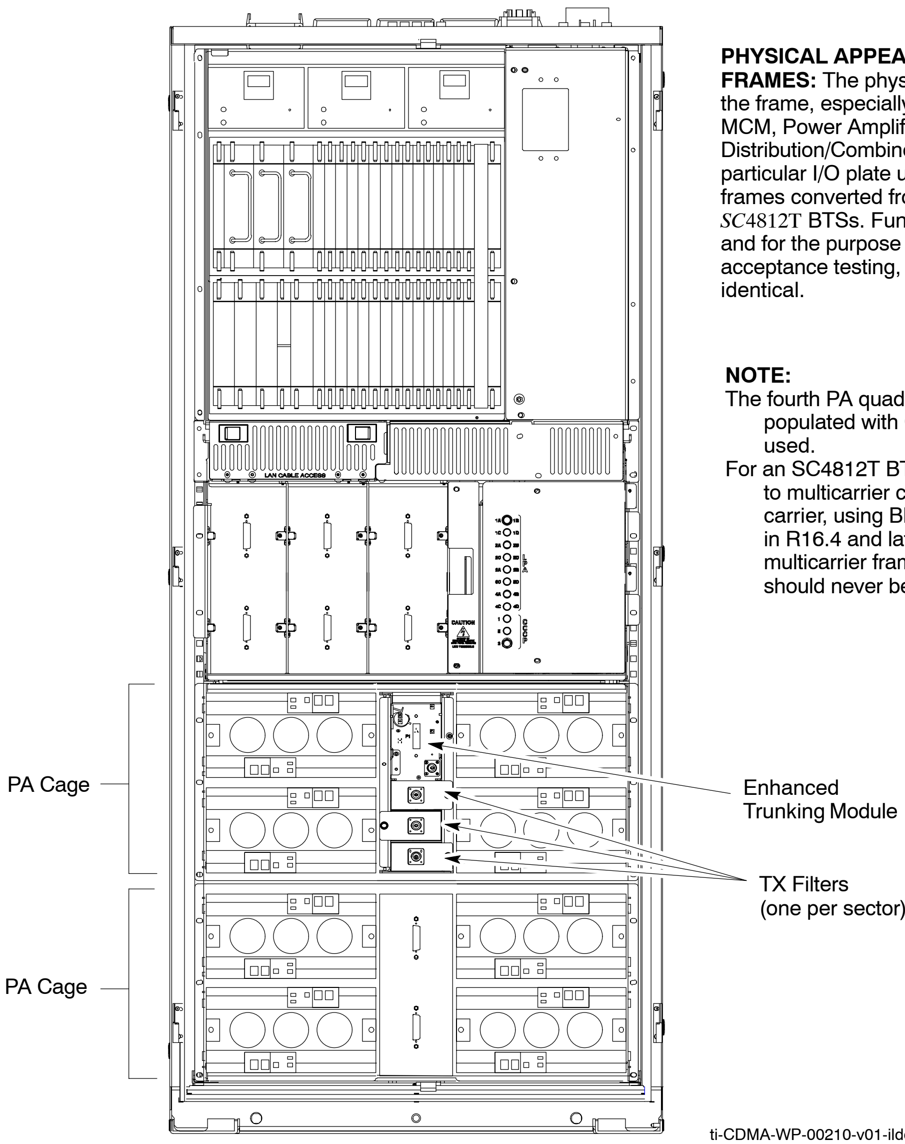
Figure 1-10: BTS Multi–Carrier Frame 3 Sector PA Cage Configuration (+27V)

PHYSICAL APPEARANCE OF FRAMES: The physical appearance of the frame, especially the location of the MCM, Power Amplifier cage, and Power Distribution/Combiner cage, and the particular I/O plate used, may differ on frames converted from early version *SC*4812T BTSs. Functionally however, and for the purpose of optimization and acceptance testing, those frames are identical.

NOTE:

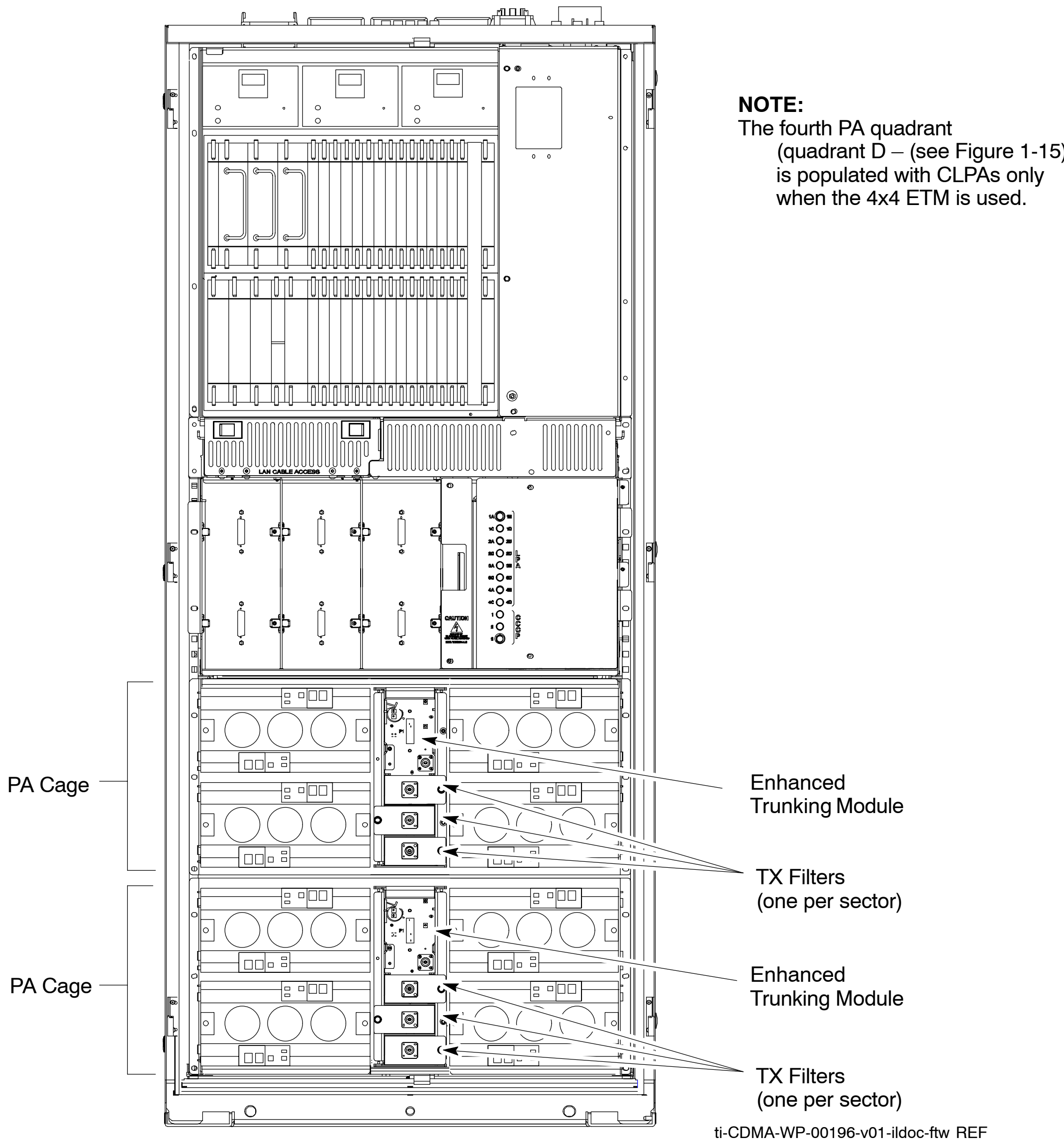
The fourth PA quadrant (quadrant D– see Figure 1-15) is populated with CLPAs only whe the 4x4 ETM is used.

For an SC4812T BTS frame which has been converted to multicarrier capability, a fourth three–sector carrier, using BBX–10 through BBX–12, is supported in R16.4 and later software releases. In a converted multicarrier frame, PA slot 4 in all PA quadrants should never be populated.



ti-CDMA-WP-00210-v01-ildoc-ftw REF

Figure 1-11: BTS Multi–Carrier Frame 6–Sector PA Cage Configuration (+27V)



BTS Frame Description

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

- The top interconnect panel where all connections are made.
- The upper portion of the frame which contains circuit breakers, cooling fans, and the C–CCP shelf.
- The lower portion of the frame which contains the PAs and PA fans, Parallel Linear amplifier Combiners (PLC), Enhanced Trunking Module(s) (ETM), and TX filters.

Top Interconnect (I/O) Panel

All cabling to and from the BTS equipment frames is accomplished at the I/O panel (seeFigure 1-12and Figure 1-13) on top of each frame. The I/O panel layout is identical for +27V and –48V frames starter and expansion frames with the exception that the power input label is voltage–specific and the RX Expansion port location changes as shown inFigure 1-12and Figure 1-13. Connections at the I/O panel include:

- Span lines
- RX antennas
- TX antenna
- Alarm connections
- Power input
- LAN connections
- RF GPS input or Remote Global Positioning System (RGPS) on the Site I/O Board
- RGPS Distribution (RGD) card
- Expansion frame connection
- Ground connections
- ESM

Figure 1-12: Starter Frame I/O Panel

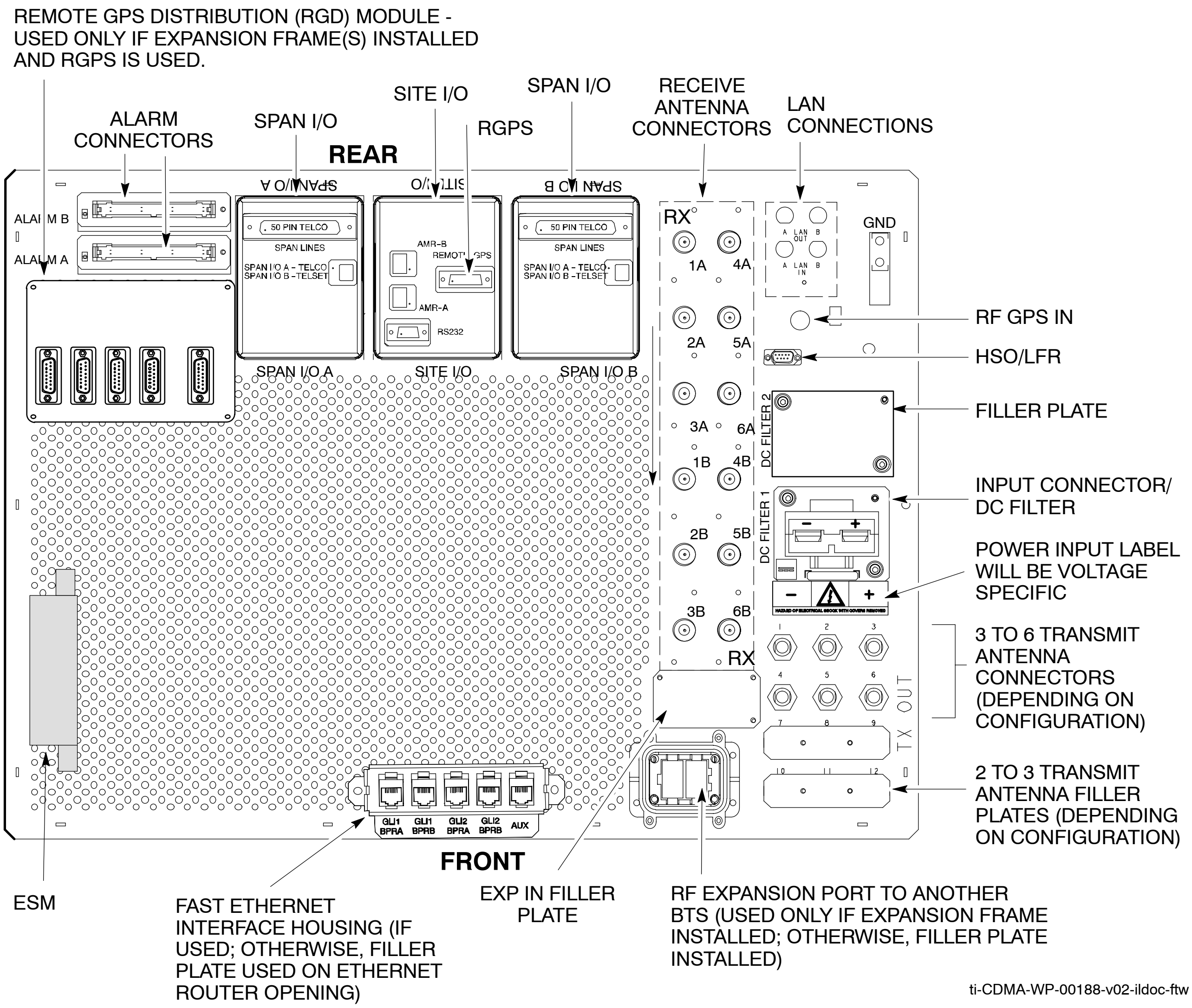
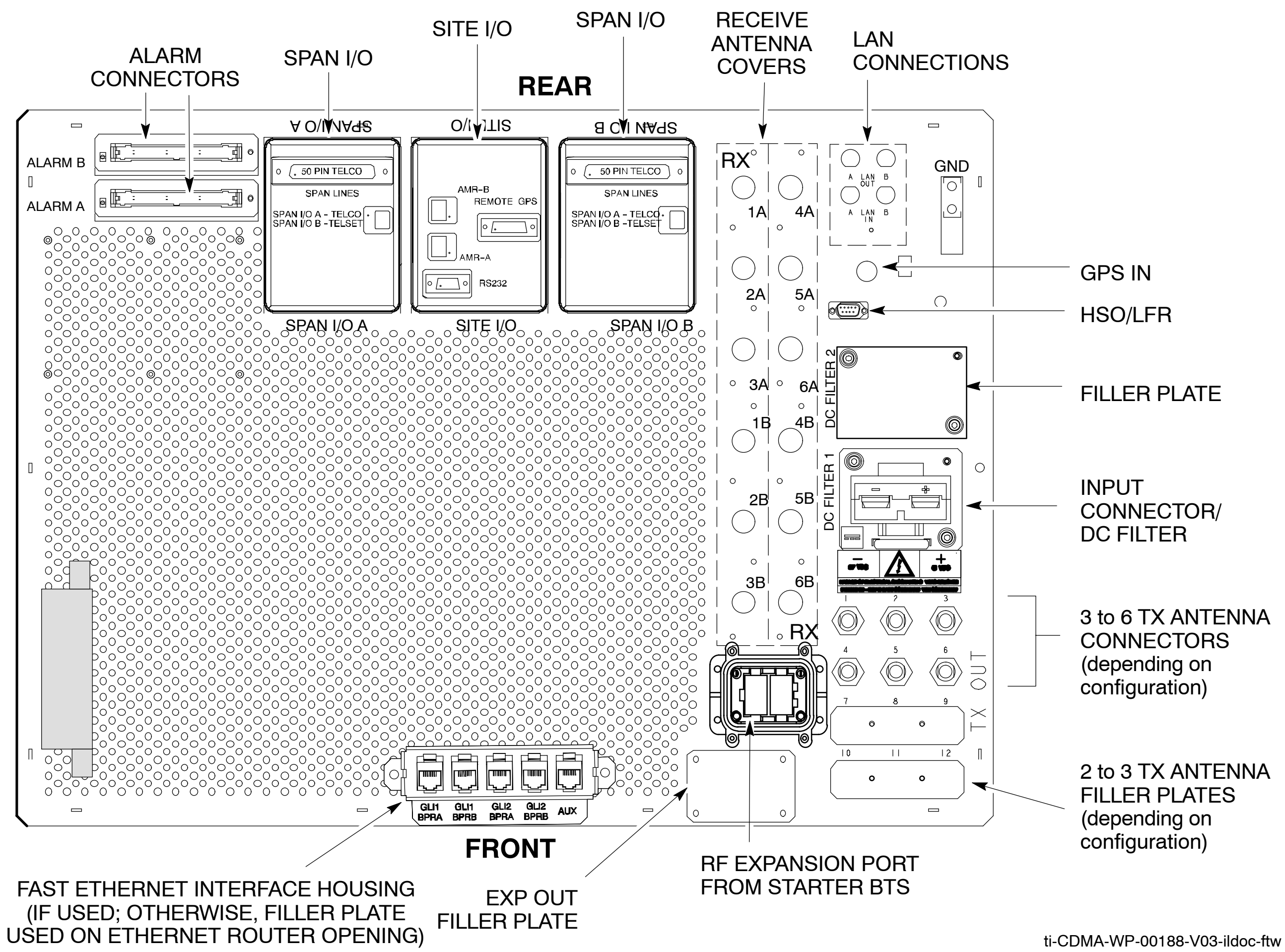


Figure 1-13: Expansion Frame I/O Panel

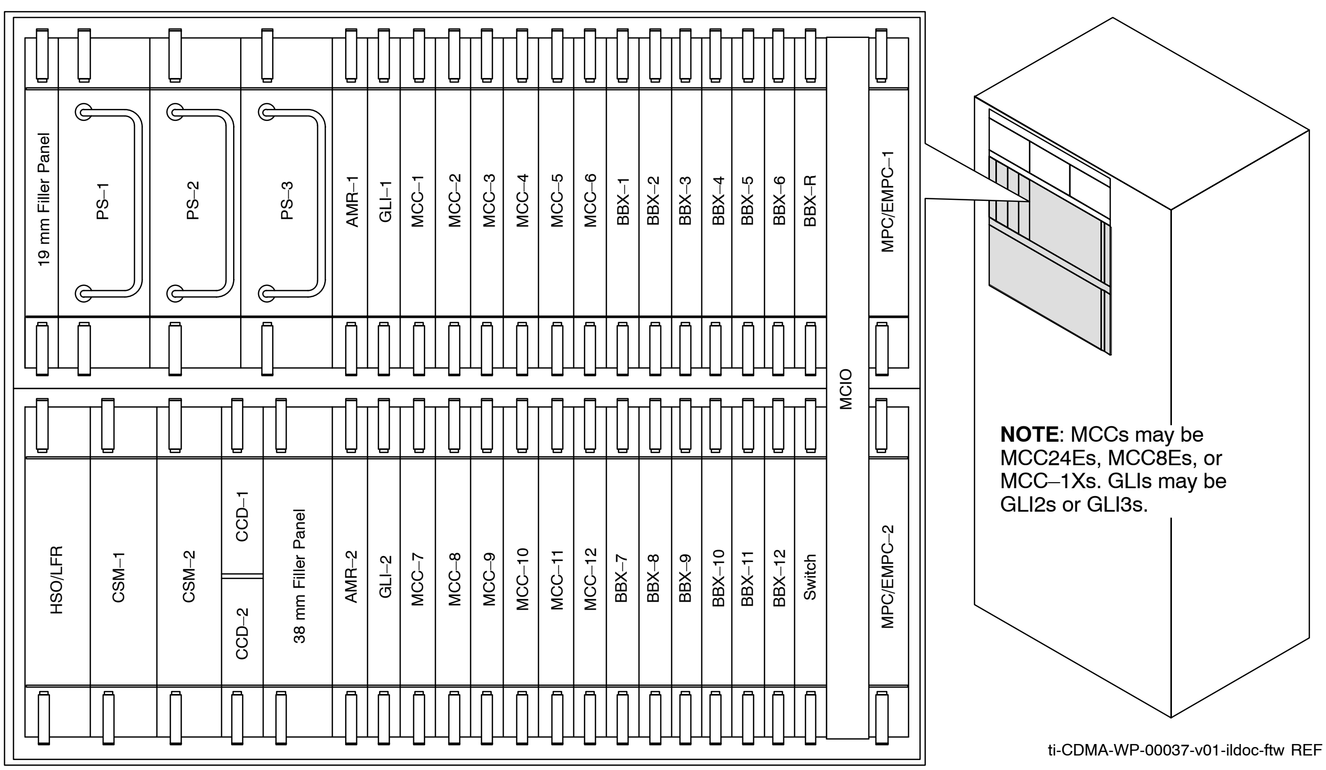


C–CCP Shelf

The upper portion of the frame houses circuit breakers, cooling fans, and the Combined–CDMA Channel Processor (C–CCP) shelf (see Figure 1-14). The C–CCP shelf includes:

- C–CCP backplane and cage
- C–CCP power supplies
- CDMA Clock Distribution (CCD) cards
- CSM and HSO/LFR cards
- Alarm Monitoring and Reporting (AMR) cards
- GLI cards
- Multcoupler Preselector Card (MPC) (starter frame)/Expansion MPC (EMPC) (expansion frame) cards
- Switch card
- MCC cards
- BBX cards
- MCIO cards

Figure 1-14: C–CCP Shelf



NOTE

For an *SC*4812T BTS frame which has been converted to multicarrier capability, a *fourth* three–sector carrier, using BBX–10 through BBX–12, is supported in R16.4 and later software releases. In a converted multicarrier frame, PA slot 4 in *all* PA quadrants should *never* be populated.

PA Shelves

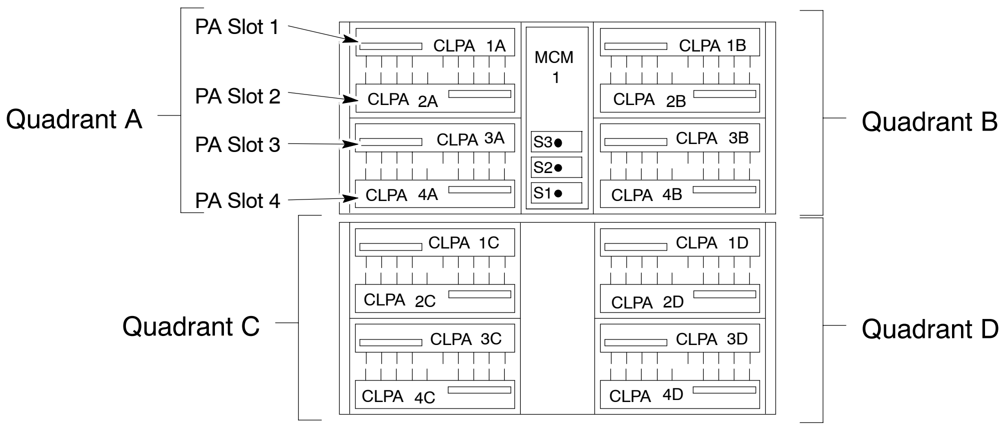
The lower shelves house the PA cages which include:

- PA modules, PA fans, and Parallel Linear amplifier Combiners (PLCs)
- Multi–Carrier Module (MCM) which includes the Enhanced Trunking Modules (ETMs), and TX filters

Location Nomenclature

Figure 1-15 presents standardized nomenclature for locations within the PA cages.

Figure 1-15: PA Cage Location Nomenclature (Original Equipment Manufacture (OEM) *SC*4812T–MC 3–Sector Shown)



PAs and Carriers

With changes in the network software for R16.4.1, PA allocation to carriers in the *SC*4812T–MC changes significantly. The quantity of PAs required is no longer dependant on the number of carriers equipped in the frame. Implementation of the change differs between six sector BTSs and BTSs equipped for omni, two–sector, and three–sector operation. Additional details for each BTS sector configuration are provided in the following paragraphs and Figure 1-20, Figure 1-21, and Figure 1-22.

Omni, two–sector, and three–sector multicarrier BTS – Up to four carriers can be supported on an omni, two–, or three–sector BTS with *one* PA set. If additional power output is required, additional PA sets can be added up to the maximum of four sets. PAs must be added as complete sets; that is, three PA modules for a 3x3 system and four PA modules for a 4x4 system. (Refer to Figure 1-20 and Figure 1-21)

Six–sector BTS – Six–sector operation is only supported in OEM multicarrier frames. For a six–sector BTS, up to two carriers can be supported with a minmum of two PA sets: six PA modules for a 3x3 system and eight PA modules for a 4x4 system. If additional power is required, two additional PA sets can be added for the maximum available capacity. (Refer to Figure 1-22).

Equipment Configurations

The various components of the PA cages may be configured differently depending upon customer requirements. Table 1-5 provides BTS carrier/sector/BBX mapping, TX Filter requirements, and PA quantities and configurations needed to provide the required BTS output power for all carriers. Figure 1-16 illustrates which BBXs are used for omni and two–sector operation. Figure 1-20, Figure 1-21, and Figure 1-22 illustrate the minimum and maximum power PA configurations for omni, two–, and three–sector OEM and converted multicarrier frames and for six–sector OEM multicarrier frames, respectively.

<table>
<tr><th colspan="9">Table 1-5: BTS Carrier/Sector/BBX Mapping and ETM/PA Quantities and Power Configurations</th></tr>
<tr><th rowspan="2">Sec – tors</th><th rowspan="2">Car– riers</th><th rowspan="2">BBXs Assigned to Carrier</th><th rowspan="2">ETM (MCM) Qty</th><th rowspan="2">TX Filter Qty</th><th colspan="2">3x3 ETM
(Standard Power)</th><th colspan="2">4x4 ETM
(High Power)</th></tr>
<tr><th>PA Qty Required</th><th>PLC Qty</th><th>PA Qty Required</th><th>PLC Qty</th></tr>
<tr><td rowspan="4">3</td><td>1</td><td>1,2,3</td><td rowspan="4">1</td><td rowspan="4">3</td><td rowspan="4">Minimum power configuration: 1 PA set in slot 1 of quadrants A through C (total of 3 CLPAs).

Additionally required power: achieved by adding additional PA sets to a maximum of:
– OEM multicarrier frames: 4 sets in quadrants A through C (total of 12 CLPAs)
– Converted multicarrier frames: 3 sets in quadrants A through C (total of 9 CLPAs)</td><td rowspan="4">3</td><td rowspan="4">Minimum power configuration: 1 PA set in slot 1 of quadrants A through D (total of 4 CLPAs).

Additionally required power: achieved by adding additional PA sets to a maximum of:
– OEM multicarrier frames: 4 sets in quadrants A through D (total of 16 CLPAs)
– Converted multicarrier frames: 3 sets in quadrants A through D (total of 12 CLPAs)</td><td rowspan="4">4</td></tr>
<tr><td>2</td><td>7,8,9</td></tr>
<tr><td>3</td><td>4,5,6</td></tr>
<tr><td>4</td><td>10,11,12</td></tr>
<tr><td colspan="9">NOTE
Six–sector operation is not available in converted multicarrier frames.</td></tr>
<tr><td rowspan="2">6</td><td>1</td><td>1,2,3,
4,5,6</td><td rowspan="2">2</td><td rowspan="2">6</td><td rowspan="2">Minimum power configuration: two PA sets, one in slot 1 and one in slot 3 of quadrants A through C (total of 6 CLPAs) (OEM multicarrier frames only).

Additionally required power: achieved by adding two additional PA sets, one in slot 2 and one in slot 4 of quadrants A through C (total of 12 CLPAs) (OEM multicarrier frames only).</td><td rowspan="2">3</td><td rowspan="2">Minimum power configuration: two PA sets, one in slot 1 and one in slot 3 of quadrants A through D (total of 8 CLPAs) (OEM multicarrier frames only).

Additionally required power: achieved by adding two additional PA sets, one in slot 2 and one in slot 4 of quadrants A through D (total of 16 CLPAs) (OEM multicarrier frames only).</td><td rowspan="2">4</td></tr>
<tr><td>2</td><td>7,8,9,
10,11,12</td></tr>
</table>