FRU Manual Exhibit

UBS CDMA XMI Transceiver at 800MHz

1X UBS Macro BTS FRU

68P09283A64-3

SEP 2007

FOA

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1X UBS Macro BTS FRU

What is covered in this manual?

The 1X Motorola Universal Base Station (UBS) Macro BTS FRU - Software Release 2.20.0.x - manual provides information to disassemble and/or replace the various cards, modules and components of the UBS Macro CDMA Base Transceiver Subsystem (BTS) configured as a "1X Packet BTS" with packet backhaul. Low and mid capacity configurations of single band 800 MHz and 1.9 GHz frames are covered.

Revision history

The following shows the issue status of this manual since it was first released.

Version information

Table 1 Manual version history

Manual issue	Date of issue	Remarks
1	AUG 2007	DRAFT; for SME review
2	SEP 2007	PRELIMINARY; Added issue 1 review comments and Breaker Module Assembly (BMA) replacement section. For SME review and Deployment.
3	SEP 2007	FOA (First Office Application)

Resolution of Service Requests

The following Service Requests are resolved in this document:

Service Request	CMBP Number	Remarks
NA	NA	NA

Incorporation of Change Notices

The following Change Notices (CN) are incorporated in this document:

CN Date	CN Number	Title
NA	NA	NA

General information

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Cross references

References made to external publications are shown in italics. Other cross references, emphasized in blue text in electronic versions, are active links to the references.

This document is divided into numbered chapters that are divided into sections. Sections are not numbered, but are individually named at the top of each page, and are listed in the table of contents.

Text conventions

The following conventions are used in the Motorola cellular infrastructure documents to represent keyboard input text, screen output text, and special key sequences.

Input

Characters typed in at the keyboard are shown like this.
Items of interest within a command appear like this.

Output

Messages, prompts, file listings, directories, utilities, and environmental variables that appear on the screen are shown like this.
Items of interest within a screen display appear like this.

Special key sequences

Special key sequences are represented as follows:

CTRL-c or CTRL+C	Press the **Ctrl** and **C** keys at the same time.
CTRL-SHIFT-c or CTRL+SHIFT+C	Press the **Ctrl**, **Shift**, and **C** keys at the same time.
ALT-f or ALT+F	Press the **Alt** and **F** keys at the same time.
ALT+SHIFT+F11	Press the **Alt**, **Shift** and **F11** keys at the same time.
¦	Press the pipe symbol key.
RETURN or ENTER	Press the **Return** or **Enter** key.

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Motorola appreciates feedback from the users of our documents.

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If you have problems regarding the operation of your equipment, contact the Customer Network Resolution Center (CNRC) for immediate assistance. The 24–hour telephone numbers are listed at https://mynetworksupport.motorola.com. Select **Customer Network Resolution Center contact information**. Alternatively if you do not have access to CNRC or the internet, contact the Local Motorola Office.

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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 document title, part number, and revision character
- The page number with the error
- A detailed description of the error and if possible the proposed solution

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Motorola systems and equipment provide security parameters that can be configured by the operator based on their particular operating environment. Motorola recommends setting and using these parameters following industry recognized security practices. Security aspects to be considered are protecting the confidentiality, integrity, and availability of information and assets. Assets include the ability to communicate, information about the nature of the communications, and information about the parties involved.

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Contact the Customer Network Resolution Center (CNRC) for assistance. The 24–hour telephone numbers are listed at https://mynetworksupport.motorola.com. Select **Customer Network Resolution Center contact information**, from the menu located to the left of the Login box. Alternatively if you do not have access to CNRC or the internet, contact the Local Motorola Office.

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The following describes how warnings and cautions are used in this document and in all documents of this Motorola document set.

Warnings

Warnings precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:

WARNING

Warning text and consequence for not following the instructions in the warning.

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Cautions precede instructions and are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. A caution has the following format:

CAUTION

Caution text and consequence for not following the instructions in the caution.

Notes

A note means that there is a possibility of an undesirable situation or provides additional information to help the reader understand a topic or concept. A note has the following format:

NOTE

Note text.

Safety

General safety

The following general safety guidelines apply to Motorola equipment:

- 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*.

- Power down or unplug the equipment before servicing.
- Using non-Motorola parts for repair could damage the equipment or void warranty. Contact Motorola Warranty and Repair for service and repair instructions.
- Portions of Motorola equipment may be damaged from exposure to electrostatic discharge. Use precautions to prevent damage.

Electromagnetic energy

Relevant standards (USA and EC) applicable when working with RF equipment are:

- *ANSI IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.*
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations.
- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 200*4 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).

Caring for the environment

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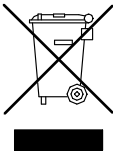

Disposal of Motorola equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of Motorola equipment in landfill sites. In the EU, Motorola in conjunction with a recycling partner ensures that equipment is collected and recycled according to the requirements of EU environmental law.

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In non-EU countries

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- Logo 2 means that the product may contain substances in excess of the maximum concentration value for materials identified in the China Management Methods regulation, and has an Environmental Friendly Use Period (EFUP) in years, fifty years in the example shown.

Logo 1 

Logo 2 

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Disclosure table

部件名称	有毒有害物质或元素					
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金属部件	×	○	×	×	○	○
电路模块	×	○	×	×	○	○
电缆及电缆组件	×	○	×	×	○	○
塑料和聚合物部件	○	○	○	○	○	×

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FCC Requirements

Content

This section presents Federal Communication Commissions (FCC) Rules Part 15 requirements and compliance information for the USB CDMA XMI Transceiver at 1.9 GHz.

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

NOTE

Changes or modifications that change the FCC type approved configuration of the equipment could void the user's authority to operate the equipment.

15.105(b) - Information to User

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, under Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Chapter
1

Overview

Information Overview

NOTE

- Before replacing components that are not covered in this manual, contact Motorola Customer Network Resolution Center for special instructions that may be involved.
- Many figures in this manual show typical equipment. The actual equipment appearance may vary slightly.

Organization of manual

This manual is divided into the following main parts:

- Chapter 1: Overview, covers:
  - Information Overview
  - UBS Macro BTS FRU Replacement Preview
  - UBS Macro BTS Product Overview
  - UBS Macro BTS Equipment Identification
  - External GPS (E-GPS) Module Equipment Identification
  - Integrated Duplexer RX Filter (IDRF) Equipment Identification
  - Site Span I/O (SSI) Module Equipment Identification
  - Transceiver Module Internal (XMI) Equipment Identification
  - Digital Module Internal (DMI) Equipment Identification
  - Power Distribution Unit (PDU) Equipment Identification
  - RX Splitter Equipment Identification
  - Power Supply Module (PSM) Shelf Equipment Identification
  - Optional RGPS Head Equipment Identification
- Chapter 2: Reference Procedures Performed at BTS Site, covers:
  - Frame Power Down & Power-Up Procedures
- Chapter 3: Reference Procedures Performed at OMCR, covers:
  - Accessing OMCR CLI Window
  - Shut Down Site Signaling Functions for a Packet BTS
  - Restore Site Signaling Operations for a Packet BTS
- Chapters 4 through 12 covers:
  - Motorola Universal Base Station (UBS) Macro BTS FRU Procedures (see next paragraph section)

BTS FRU procedures

The BTS FRU procedures are grouped by major functional areas within the Motorola Universal Base Station (UBS) Macro BTS equipment and presented in the following individual chapters:

- Chapter 4: E-GPS Replacement Procedure
- Chapter 5: IDRF Replacement Procedure

- Chapter 6: SSI Replacement Procedures
  - SSI (Site Span I/O) Module
  - Unbalanced E1 Daughter Card
  - QHSO (Quartz High Stability Oscillator)
- Chapter 7: XMI Replacement Procedures
  - XMI (Transceiver Module Internal) Module
  - XMI Fan Tray Assembly
- Chapter 8: DMI Replacement Procedures
  - DMI (Digital Module Internal) Assembly
  - Modem Boards
- Chapter 9: PDU Replacement Procedures
  - Power Distribution Unit (PDU)
  - Breaker Module Assembly (BMA)
- Chapter 10: PSM Shelf Replacement Procedures
  - –48 V DC Power Supply Module (PSM) Shelf
  - 220 V AC Power Supply Module (PSM) Shelf
  - Power Supply Modules (PSMs)
- Chapter 11: RX Splitter Replacement Procedure
- Chapter 12: RGPS Head Replacement Procedure

Each BTS FRU procedure section contains the following information:

- Description - contains general information about the FRU operation, usage and location in the frame/shelf and so on.
- System impact/considerations - describes how the replacement procedure impacts the system with respect to downtime and so on. It lists specific concerns associated with the replacement of the FRU.
- Required items - lists items that are required to perform the FRU procedure including reference documents (manuals), tools, torque requirements, and replacement unit.
- Prerequisite - highlights actions needed before and after the FRU replacement including: coordinating the replacement procedure with the OMCR operator and so on.
- Replacement procedure - provides detailed procedural steps to remove the failed FRU and install the replacement FRU including: site preparation, equipment disassembly and reassembly, equipment and site operation restoration and so on. When necessary, the procedural steps reference specific procedures to be performed by the OMCR operator.

How to use this manual

All FRU replacement procedures require interaction and two-way communications between the technician at the BTS site and the operator at the OMCR. Each of these individuals will need a copy of this manual.

First determine the FRU to be replaced.

Next, the BTS technician at the site starts performing the replacement procedure for the specific FRU. This procedure will direct the technician when to notify the operator at the OMCR as to what action(s) to take. Often the OMCR operator action is to perform a specific procedure contained in the FRU procedure chapter. When necessary, the specific FRU procedure will direct the operator to notify the BTS technician that certain events have been completed and what action(s) to take.

Depending on the specific FRU being replaced, the replacement procedure will be terminated by either the BTS technician or the OMCR operator. Usually it is terminated by the OMCR operator clearing old alarms and verifying that there are no new related alarms.

Required manuals

The following manuals are referenced in this manual and may be used for additional information regarding replacement procedures.

- *1X UBS Macro BTS Hardware Installation* (68P09283A62) manual.
- *1X UBS Macro BTS Optimization/ATP* (68P09283A63) manual.
- *System Commands Reference* (68P09282A57) manual.

FRU locations

To aid in physically identifying FRUs and locating the major functional areas of the equipment as well as a specific FRU location, refer to the illustrations in the following sections of this chapter:

- UBS Macro BTS Equipment Identification
- External GPS (E-GPS) Equipment Identification
- Integrated Duplexer RX Filter (IDRF) Equipment Identification
- Site Span I/O (SSI) Module Equipment Identification
- Transceiver Module Internal (XMI) Equipment Identification
- Digital Module Internal (DMI) Equipment Identification
- Power Distribution Unit (PDU) Equipment Identification
- RX Splitter Equipment Identification
- Power Supply Module (PSM) Shelf Equipment Identification
- Optional RGPS Head Equipment Identification

Recommended tools

Each BTS FRU procedure specifies the recommended tools that are required during the procedure. These tools along with some other useful tools are included in the following overall tool list:

- Torque driver, capable of 2.3 N-m (20 in-lbs) to 5.6 N-m (50 in-lbs) torque
- T25 TORX bit with 12-in Extension
- T20 TORX bit
- T10 TORX bit
- 19 mm open-end wrench (for N-type connectors)
- Flat blade screwdriver
- Side cutters
- Tie wraps
- Masking tape and marking pen (for making temporary cable markers)
- Removable XMI handle with two M5 screws
- SMA break over wrench - 1.02 N-M (9 in-lb)
- 3/8 inch ratchet
- 3/8 inch drive to 1/4 inch hex adapter
- 19 mm socket
- 10 mm socket
- 9/16 in socket

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
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 Kbps.
A	Ampere or Amp
AC	Alternating Current
ACC	Accessory

Continued

Table 1-1 Abbreviations and Acronyms (Continued)

Acronym	Definition
AN	Aggregation Node
ATP	Acceptance Test Plan
AWG	American Wire Gauge
BMA	Breaker Module Assembly
BSI	Baseband Switch Interface
BSS	Base Station System
BSSAN	Base Station System (BSS) Access Network. The BSSAN consists of a Radio Access Network (RAN) and an AN. It may also include a Digital Access and Cross-connect System to support split backhaul and a Selector Distribution Unit (SDU).
BTS	Base Transceiver Station or Base Transceiver Subsystem
CB	Circuit Breaker
CBSC	Centralized Base Station Controller
CCW	Counter Clockwise
CDMA	Code Division Multiple Access
CE	Channel Element
CW	Clockwise
DC	Direct Current
DIV	Diversity
DMI	Digital Module Internal
DMM	Digital Multi-Meter
E-GPS	External-GPS
ESD	Electro-Static Discharge
EV-DO	CDMA 1X Evolution - Data Only
FER	Frame Erasure Rate
FRU	Field Replaceable Unit
FWD	Forward
GND	Ground
GPS	Global Positioning System
HSO	High Stability Oscillator
IDI	Interworking DMI Interconnect
IDRF	Integrated Duplexer RX Filter
I/O	Input/Output
IP	Internet Protocol
IP/OP	Customer Alarm Input/Output

Continued

Table 1-1 Abbreviations and Acronyms (Continued)

Acronym	Definition
IS	Interim Standard
LAN	Local Area Network
LMF	Local Maintenance Facility
LMT	Local Maintenance Terminal
MGB	Master Ground Bar
MMI	Man Machine Interface
MMII	Mobility Manager II
MSC	Mobile Switching Center
MSN	Mobile Switching Network
MSO	Motorola Standard Oscillator or Medium Stability Oscillator
OMC-IP	Operations Maintenance Center - Internet Protocol
OMC-R	Operations Maintenance Center - Radio
PA	Power Amplifier
PBH	Packet Backhaul: IP-based backhaul between the BTS and the network. The UBS Macro BTS is configured for packet backhaul operation.
PC	Power Connector
PDU	Power Distribution Unit
PPS or 1PPS	1 pulse per second
PSM	Power Supply Module
PSTN	Public Switched Telephone Network
QHSO	Quartz High Stability Oscillator
RAN	Radio Access Network
RF	Radio Frequency
RFL	Reflected
RGD	Remote GPS Distribution
RGPS	Remote Global Positioning System
RSSI	Receive Signal Strength Indicator
RU	Rack Unit
RX	Receive or Receiver
SDU	Selection and Distribution Unit
SPROC	Site Processor
SSI	Site Span I/O or Site/Span Interface
TCH	Traffic Channel
TX	Transmit or Transmitter

Continued

Table 1-1 Abbreviations and Acronyms (Continued)

Acronym	Definition
UBS	Motorola Universal Base Station
UNO	Universal Network Operations
V	Volt
VPU	Vocoder Processing Unit
W	Watt
XMI	Transceiver Module Internal

UBS Macro BTS FRU Replacement Preview

Passive and DC operation

Some FRUs are passive and do not have a DC input power source. Some FRUs are **hot swappable** and can be removed/replaced with DC input power applied. Some FRUs require shutdown of DC input power before FRU removal/replacement.

FRU backup

Some FRUs have a backup with fully-automatic switchover upon removal/replacement of the primary.

Service affecting FRUs

FRUs that are service affecting require shutting down signaling to the entire BTS site before the failed FRU can be removed/replaced.

Shutdown and restore signaling

The site shutdown and restore signaling procedure is performed by the OMC operator when replacing certain FRUs.

Site shutdown signaling consists of the following sequence:

- Setup and turn ON Global Service Redirect Message to redirect all subscriber traffic away from the site
- Disable or lock BTS

Site restore signaling consists of the following sequence:

- Enable or unlock BTS
- Reset and turn OFF Global Service Redirect Message

Testing/reoptimization

Some FRUs must be tested and if needed calibrated. Calibration requires that the BTS site be shutdown/out-of-service or as an alternative In-Service Calibration procedure can be used. The In-Service Calibration procedure does not require site outage. In some cases, testing/reoptimization must be performed as part of the FRU replacement procedure. In other cases, testing/reoptimization can be performed at the next maintenance window.

FRU replacement conditions and sequence

Table 1-2 lists each FRU and the conditions and sequence of events required for replacement.

Table 1-2 FRU replacement conditions and sequence

FRU	Location	Replacement conditions and sequence
E-GPS (External-GPS)	UBS Macro frame	The UBS Macro BTS will use one of the following backup sources instead of the E-GPS: • DMI controller board MSO which can maintain system timing synchronization for up to 8 hours. • Optional Quartz High Stability Oscillator (QHSO) which can maintain system timing synchronization for up to 24 hours. FRU is **hot swappable**. • Replace FRU
IDRF (Integrated Duplexer RX Filter)	UBS Macro frame	FRU is passive; handles TX path, and RX path for both main and diversity antennas for a particular sector. **1.** **Lock** XMI **2.** Replace IDRF **3.** **Unlock** XMI **4.** At next maintenance window; TX Path Calibration Audit test affected sector TX path. RSSI test affected sector RX paths
SSI (Site Span I/O) Module	UBS Macro frame	**1.** Shut down signaling to **Site** and then DC input power to **SSI** **2.** Replace FRU **3.** Apply DC input power to **SSI** **4.** Restore signaling to **Site**
Unbalanced E1 Daughter Card	SSI front panel	FRU is passive. **1.** Shut down signaling to **Site** **2.** Replace FRU **3.** Restore signaling to **Site**
QHSO (Quartz High Stability Oscillator)	SSI rear panel	FRU is **hot swappable** and is a system timing synchronization backup for the RGPS head. **1.** Replace FRU

Continued

Table 1-2 FRU replacement conditions and sequence (Continued)

FRU	Location	Replacement conditions and sequence
XMI (Transceiver Module Internal) Module	UBS Macro frame	FRU is non-redundant. **1.** **Lock** XMI **2.** Shutdown DC input power to XMI **3.** Replace XMI **4.** Apply DC input power to XMI **5.** **Unlock** XMI **6.** Shut down signaling to **Site** (for calibration/audit) or set up optional In-Service Calibration procedure **7.** TX Path Calibration Audit test all TX paths. RSSI test all RX paths **8.** Restore signaling to **Site** if In-Service Calibration procedure was not used
XMI Fan Tray Assembly	UBS Macro frame, XMI rear panel	See XMI Module above.
DMI (Digital Module Internal) Assembly	UBS Macro frame	 **NOTE** The DMI assembly is the FRU that can be used to replace a DMI with an internal DMI component failure (including controller board, modem board, fan, or front panel failure). **1.** **Display BTS EID** information to determine model numbers of the failed DMI and its modem board(s). **2.** For a BTS with one DMI, Shut down signaling to **Site**. For a BTS with more than one DMI: c **Status** failed DMI to determine if Site Master or not c If Site Master, **Reset** DMI and then **Lock** DMI c If not Site Master, **Lock** DMI **3.** Shutdown DC input power to DMI **4.** Replace DMI **5.** Apply DC input power to DMI **Continued**

Table 1-2 FRU replacement conditions and sequence (Continued)

FRU	Location	Replacement conditions and sequence
		6. For a BTS with one DMI, Restore signaling to **Site**. For a BTS with more than one DMI, **Unlock** DMI
CDMA 1X Modem Board *- OR -* CDMA EV-DO Modem Board	Inside DMI	FRU is non-redundant. **1.** **Display BTS EID** information to determine model numbers of the failed DMI and its modem board(s). **2.** For a BTS with one DMI, Shut down signaling to **Site**. For a BTS with more than one DMI: c **Status** affected DMI to determine if Site Master or not c If Site Master, **Reset** DMI and then **Lock** DMI c If not Site Master, **Lock** DMI **3.** Shutdown DC input power to DMI **4.** Remove affected DMI assembly from UBS Macro BTS frame **5.** Replace Modem Board **6.** Install affected DMI assembly into UBS Macro BTS frame **7.** Apply DC input power to DMI **8.** For a BTS with one DMI, Restore signaling to **Site**. For a BTS with more than one DMI, **Unlock** DMI
RX Splitter	UBS Macro frame	FRU is passive; handles EXP (expansion) RX main & diversity antenna paths. • **Lock** XMIs • Replace FRU • **Unlock** XMIs • RSSI test affected RX paths at next maintenance window; reoptimize as required
PDU (Power Distribution Unit)	UBS Macro frame	**1.** Shut down signaling to **Site** and then power down the **frame** **2.** Replace FRU **3.** Power up the **frame** **4.** Restore signaling to **Site**

Continued

Table 1-2 FRU replacement conditions and sequence (Continued)

FRU	Location	Replacement conditions and sequence
Breaker Module Assembly (BMA)	UBS Macro frame inside of PDU	**1.** Shut down signaling to **Site** and then power down the **frame** **2.** Replace FRU **3.** Power up the **frame** **4.** Restore signaling to **Site**
–48 V DC PSM (Power Supply Module) Shelf	UBS Macro frame	**1.** Shut down signaling to **Site** and then power down the **frame** **2.** Replace FRU **3.** Power up the **frame** **4.** Restore signaling to **Site**
220 V AC PSM (Power Supply Module) Shelf	UBS Macro frame	**1.** Shut down signaling to **Site** and then power down the **frame** **2.** Replace FRU **3.** Power up the **frame** **4.** Restore signaling to **Site**
–48 V DC or 220 V AC PSM (Power Supply Module)	PSM shelf	FRU is **hot swappable** and **redundant**. **1.** Replace FRU
Optional RGPS (Remote GPS) Head	Pole/mast mounted outdoors	The UBS Macro frame BTS uses one of the following backup sources instead of the RGPS head: • Internal Motorola Standard Oscillator (MSO) which can maintain system timing synchronization for up to 8 hours. • Optional Quartz High Stability Oscillator (QHSO) which can maintain system timing synchronization for up to 24 hours. FRU is **hot swappable**. **1.** Replace FRU

UBS Macro BTS Product Overview

NOTE

The R20 Motorola Universal Base Station (UBS) Macro BTS supports single band 800 MHz or 1.9 GHz RF band, up to two XMIs, up to two DMIs and one SSI. UBS Macro BTS frame configurations with up to four XMIs and up to five DMIs will be available in the future.

Introduction

The Motorola Universal Base Station (UBS) Macro BTS conforms to the TIA/EIA/IS-97E and CDMA2000 for the CDMA Base Station performance specifications. It is a packet BTS that operates in the 800 MHz or 1.9 GHz RF band.

The packet BTS has a packet backhaul network interface that can handle voice and data.

A packet BTS is equipped with IP-packet routing functionality. The packet BTS connects to the Access Network (AN) using span lines. This configuration provides the packet backhaul between the packet BTS and the AN.

UBS Macro BTS Frame Overview

The Motorola Universal Base Station (UBS) Macro BTS along with other external equipment forms a 1X BTS that is part of the Motorola Radio Access Network (RAN).

The UBS Macro BTS is the interface between the Access Node (AN) in the RAN and the Subscriber Units (SUs) that are operating in the UBS Macro BTS RF coverage area.

Control and bearer traffic data, in IP-packets, is exchanged between the UBS Macro BTS and the AN. This IP-packet backhaul interconnection is through T1/E1 span lines or high-speed Ethernet.

Control and bearer traffic data is exchanged between the UBS Macro BTS and the SUs. This interconnection is by means of the CDMA2000 1X air interface.

The UBS Macro BTS air interface supports the following:

- Omni or 3–sector antenna configurations
- Single RF band operation only; 800 MHz or 1.9 GHz RF band
- Up to 120 W of total TX RF power output and up to 30 W TX RF power output per carrier in omni; 20W per sector-carrier in 3 sector
- Dual path, Main and Diversity, RX antennas

The UBS Macro BTS equipment is mounted in a 19–inch rack to form the UBS Macro BTS frame.

UBS Macro BTS frames are configured for either +27 V DC operation, –48 V DC operation, or 220 V AC operation.

UBS Macro BTS frames are also configured for low, mid, or high capacity. Capacity is determined by the quantity of sector carriers and traffic channels supported by the frame. The quantity of sector carriers is a function of the quantity of XMIs. The quantity of traffic channels is a function of the quantity of modems. Because the modems are inside the DMI, the quantity of DMIs is a capacity factor. The capacity of a UBS Macro BTS frame is essentially based on the following:

- low capacity - one XMI and up to two DMIs
- mid capacity - two XMIs and two DMIs
- high capacity - more than two XMIs (four XMIs maximum) and more than two DMIs (five DMIs maximum)

Currently, only low and mid capacity frames are available/supported.

NOTE

High capacity UBS Macro BTS frames will be available in the future.

The currently available UBS Macro BTS frames are shown in Figure 1-1 UBS Macro BTS low-tier/low-capacity frame (1000 mm rack) on page 1-27, Figure 1-2 Low capacity UBS Macro BTS starter frame (1800 mm rack) on page 1-28 and Figure 1-3 UBS Macro BTS mid-capacity frame (1800 mm rack) on page 1-30.

UBS Macro BTS Frame Standard Equipment

All UBS Macro BTS frames, regardless of capacity, are equipped with at least one of each of the following:

- IDRF (Integrated Duplexer RX Filter)
- SSI (Site Span I/O) module
- XMI (Transceiver Module Internal) module
- DMI (Digital Module Internal) module
- PDU (Power Distribution Unit)

The following sections briefly describe the UBS Macro BTS frame standard equipment.

IDRF (Integrated Duplexer RX Filter)

The IDRF is available in either the 800 MHz or 1.9 GHz RF band.

The IDRF includes:

- TX/RX bandpass filters
- Bi-directional TX and RX antenna path couplers.

The IDRF is a passive device requiring no DC input operating power.

The IDRF allows the sector TX and main RX RF carrier signals to share the same antenna. It also allows connection for a sector diversity RX RF antenna. The bi-directional antenna couplers provide forward and reflected signal port connections for antenna signal sampling and signal injection. The coupled ports are typically used for connection to test equipment.

The UBS Macro BTS frame is typically equipped with one IDRF per sector. Figure 1-1 UBS Macro BTS low-tier/low-capacity frame (1000 mm rack) on page 1-27, Figure 1-2 Low capacity UBS Macro BTS starter frame (1800 mm rack) on page 1-28 and Figure 1-3 UBS Macro BTS mid-capacity frame (1800 mm rack) on page 1-30 show the location of the IDRFs within the UBS Macro frame.

Figure 1-5 800 MHz IDRF I/O Details on page 1-32 and Figure 1-6 1.9 GHz IDRF I/O Details on page 1-33 show the locations of IDRF RF I/O port connectors.

SSI (Site Span I/O) module

The SSI provides the interfaces between the UBS Macro BTS frame and the following external interfaces:

- IP-backhaul spans

  The SSI directly supports up to 8 spans of packet backhaul through either balanced T1 or E1 span lines. SSI can also be equipped with an optional unbalanced E1 daughter card that transforms the SSI balanced E1 span line connections to 75-ohm coaxial cable connections.

- IP-backhaul via Ethernet/OTI (Open Transport Interface)

- E-GPS module or RGPS head connects to the SSI RGPS connector. This connector may also be used for the Sync Sharing Input connection from the SYNC SHARING connector of another UBS Macro BTS frame SSI.

- Sync Sharing Output is present at the SSI SYNC SHARING connector. This connector may be used for connection to the RGPS connector of another UBS Macro BTS frame SSI. Chaining the SYNC SHARING connector of one UBS Macro BTS frame to the RGPS connector of another UBS Macro BTS frame and so on provides sharing the GPS sync signal between BTSs.

- Customer inputs/outputs; up to 24 customer defined inputs and up to 8 customer defined outputs

- LMT (Local Maintenance Terminal); like the LMF (Local Maintenance Facility)

The SSI provides interfaces for the following UBS Macro BTS frame equipment:

- SSI DC power input – connects to the (PDU) Power Distribution Unit.

- SSI-to-DMI interface – connects the SSI to up to two DMIs.

- HSO interface (on rear of SSI) – connects to the optional QHSO module.

XMI (Transceiver Module Internal) module

The UBS Macro XMIs are available in either the 800 MHz or 1.9 GHz RF band. The XMI requires +27 V DC input operating power.

The XMI provides both the baseband transceiver and linear power amplifier functionality for the BTS. This functionality is integrated within a single module. The XMI supports either a three sector antenna configuration or an Omni (single sector) antenna configuration.

The XMI receiver is capable of supporting four carriers in the three-sector configuration and eight carriers in the Omni configuration. On the forward link side, XMI can support up to eight carriers in the three-sector configuration.

The XMI supports PA trunking, which enables dynamic TX RF power sharing among all sector-carriers. An advantage of PA trunking is that power can be distributed among sector-carriers with different loads. The built-in redundancy of trunking is also an advantage. If one of the XMIs internal power amplifiers fails, all sector-carriers served by that XMI can still operate at reduced power on the remaining power amplifiers. The XMI will generate a system alarm to alert the operator of the failure condition, but will stay in service.

The XMI provides main and diversity receivers for three sectors. The UBS Macro BTS frame supports soft-fail redundancy at the receiver level. If either the main and diversity receive path fails, the XMI continues to operate with one receive path, but at reduced performance instead of taking the entire XMI out-of-service.

DMI (Digital Module Internal) module

The DMI contains two main components: a controller board and at least one modem board (i.e., 1X CDMA or EV-DO). The controller board provides interfaces for up to two modem boards (i.e., 1X CDMA, EV-DO, or a combination of both). A DMI can be upgraded with a second modem board depending upon the configuration required at the BTS.

In the forward direction (BTS to Mobile), the DMI terminates the backhaul control and bearer connections from the SSI, processes the bearer and control data then routes the baseband data to the XMI for conversion/RF modulation and transmission over the air interface to the subscriber.

In the reverse direction (Mobile to BTS), the XMI receives the subscriber transmission over the air interface. The XMI demodulates the received RF signal and converts it to baseband data. The received baseband data is routed to the DMI for processing and generation to the associated control and bearer data for transmission to the network via the SSI.

External interfaces on the DMI include the following:

- +27 V DC (nominal) power input
- Two SSI interfaces
- Two XMI interfaces

The controller board provides all of the DMI external interfaces as well as interfaces for two modem boards. The controller is made up of the following functions: Site Processor (SPROC), Synchronization, Interworking (protocol termination), DMI baseband processing, XMI interfaces and SSI interface.

The DMI controller board also contains an Oven Controlled Crystal Oscillator (OCXO) that is synchronized to the BTS system timing established/sourced by the E-GPS or Remote GPS (RGPS) head. The OCXO also provides the MSO function. In the event that the GPS system timing signal (i.e., E-GPS or RGPS or sync-sharing) is lost, the DMI controller can select the MSO as a backup synchronization source for maintaining BTS system timing for up to 8 hours

PDU (Power Distribution Unit)

The PDU is the central power distribution point for the UBS Macro BTS frame. It contains input power feeds that connect to the +27 V DC power output of one of the following:

- Optional –48 V DC PSM (Power Supply Module) shelf
- Optional 220 V AC PSM shelf
- Customer supplied external +27 V DC power source

The PDU houses circuit breakers/power connectors for +27 V DC power distribution to each of the following UBS Macro BTS frame subsystems:

- XMIs
- DMIs
- SSIs
- Accessories

The PDU also contains bulk capacitance to stabilize the internal bus voltage to facilitate subsystem hot-swap and absorb surge energy.

UBS Macro BTS Frame Optional Equipment

The UBS Macro BTS frame may be equipped with following optional equipment:

- E-GPS (External GPS) module
- –48 V DC PSM (Power Supply Module) shelf with PSMs
- 220 V AC PSM (Power Supply Module) shelf with PSMs
- QHSO (Quartz High Stability Oscillator) module
- Unbalanced E1 daughter card
- Modem boards

The following sections briefly describe the UBS Macro BTS frame optional equipment.

E-GPS (External GPS) module

The optional E-GPS contains a GPS Receiver (GPSR) that requires connection to an external GPS RF antenna signal. The E-GPS output timing signal is routed to the DMI controller via the SSI.

The E-GPS is the primary source for BTS system timing.

The optional Remote GPS (RGPS) head may be used instead of the E-GPS.

The E-GPS is considered to be local with respect to the UBS Macro BTS frame, while the RGPS head is remotely located with respect to the UBS Macro BTS frame.

–48 V DC PSM (Power Supply Module) shelf with PSMs

The –48 V DC PSM shelf is optional. It is used to convert –48 V DC input power to +27V DC output operating power for distribution to the UBS Macro BTS frame electronics.

The –48 V DC PSM shelf is located at the bottom of the UBS Macro BTS frame. Figure 1-1 UBS Macro BTS low-tier/low-capacity frame (1000 mm rack) on page 1-27, Figure 1-2 Low capacity UBS Macro BTS starter frame (1800 mm rack) on page 1-28 and Figure 1-3 UBS Macro BTS mid-capacity frame (1800 mm rack) on page 1-30 show the location of the –48 V DC PSM shelf within the UBS Macro BTS frame.

The plug-in PSMs provide DC-DC conversion and +27V DC power output capabilities.

Up to three PSMs can be housed in the PSM shelf. A minimum of two PSMs are equipped for redundancy. An empty PSM 3 slot is covered with a filler panel.

220 V AC PSM (Power Supply Module) shelf with PSMs

The 220 V AC PSM shelf is optional. It is used to convert 220 V AC input power to +27V DC output operating power for distribution to the UBS Macro BTS frame electronics.

The 220 V AC PSM shelf is located at the bottom of the UBS Macro BTS frame. Figure 1-1 UBS Macro BTS low-tier/low-capacity frame (1000 mm rack) on page 1-27, Figure 1-2 Low capacity UBS Macro BTS starter frame (1800 mm rack) on page 1-28 and Figure 1-3 UBS Macro BTS mid-capacity frame (1800 mm rack) on page 1-30 show the location of the 220 V AC PSM shelf within the UBS Macro BTS frame.

The plug-in PSMs provide AC-DC conversion and +27V DC power output capabilities.

Up to three PSMs can be housed in the PSM shelf. A minimum of two PSMs are equipped for redundancy. An empty PSM 3 slot is covered with a filler panel.

QHSO (Quartz High Stability Oscillator) module

The QHSO is an upgraded backup synchronization source for maintaining BTS system timing established/sourced by the E-GPS or Remote GPS (RGPS) head. QHSO backup is used instead of the internal DMI controller MSO. The QHSO can maintain BTS system timing for up to 24 hours, as compared to 8 hours provided by the MSO.

The QHSO contains a high stability quartz crystal oscillator.

The optional QHSO is mounted on the SSI rear panel. It plugs directly into the SSI rear panel HSO connector.

Unbalanced E1 daughter card

The optional E1 daughter card is located on the front panel of the SSI.

For E1 daughter card location and connector identification, refer to Figure 1-7 SSI front panel details on page 1-35 .

The E1 daughter card has a 37-pin connector on the bottom of the card. This connector plugs into the SPAN 37-pin connector on the front panel of the SSI.

The E1 daughter card is secured to the SSI front panel via four corner screws.

The E1 daughter card is passive and does not require DC operating power. The circuitry on the E1 daughter card transforms 75–Ohm unbalanced span line I/O to 100–Ohm balanced SSI span line I/O.

The E1 daughter card supports up to eight span lines. It has 16 BNC connectors, 2 per span; RX and TX.

Modem boards

The modem board provides digital modulation/demodulation of the overhead channels and traffic channels that are carried on the TX/RX RF carriers. The UBS Macro modem boards are high density and have at least 256 channel elements that can be allocated to support the desired quantity of overhead and traffic channels.

There are two types of UBS Macro modem boards available. These are as follows:

- 1X CDMA modem board
- EV-DO modem board

The modem boards are located inside the DMI. A DMI can be equipped with up to two modem boards maximum. These modem boards can be either 1X CDMA modem, EV-DO modem, or one of each.

UBS Macro BTS Frame Optional External Equipment

The RGPS (Remote GPS) head is optional external equipment for the UBS Macro BTS frame.

The following section briefly describes the RGPS head.

RGPS (Remote GPS) head

The optional RGPS head contains a GPS antenna GPS Receiver (GPSR) and built-in GPS RF antenna. The RGPS head output timing signal is routed to the DMI controller via the SSI.

The RGPS head is the primary source for BTS system timing.

UBS Macro BTS FRU List

NOTE

Before replacing components that are not covered in this manual, contact Motorola Customer Network Resolution Center for special instructions that may be involved.

Each BTS FRU procedure specifies the required FRU(s) along with its model/part number. Table 1-3 lists all the supported UBS Macro BTS FRUs.

Table 1-3 UBS Macro BTS FRUs

FRU item	Motorola Model/Part number (unless specified otherwise)
E-GPS	STTG4052
IDRF, China Full Band 800 MHz	STFN4009
IDRF, India Full Band 800 MHz	STFN4010
IDRF, US Full Band 800 MHz	STFN4015
IDRF, US A-band 800 MHz	STFN4016
IDRF, US B-band 800 MHz	STFN4017
IDRF, 1.9 GHz	STFG4055
SSI	STLN6390
Unbalanced E1 Daughter Card	STLN6327
QHSO	SGLA4017
XMI, 800 MHz; with removable handle attached	SGTF4194
XMI, 1.9 GHz; with removable handle attached	STWG4000
XMI Fan Tray Assembly; with five 27 V DC fans	STLN6404

NOTE

All models of DMI assemblies include: DMI chassis with controller board, fans and front panel.

DMI assembly with one 1X CDMA modem board	STLN6681
DMI assembly with one EV-DO modem board	STLN6682
DMI assembly with two 1X CDMA modem boards	STLN6683
DMI assembly with one 1X CDMA modem board and one EV-DO modem board	STLN6684
DMI assembly with two EV-DO modem boards	STLN6679
DMI assembly without modem boards	STLN6325
CDMA 1X Modem Board	SGLN6336
EV-DO Modem Board	SGLN6494
RX Splitter, wide band (800 MHz through 2.1 GHz RF bands)	STRG4029
PDU	STPN4038
90A BMA for XMIs	STLN4093
20A BMA for DMIs and SSIs	STLN6472

Continued

Table 1-3 UBS Macro BTS FRUs (Continued)

FRU item	Motorola Model/Part number (unless specified otherwise)
10A BMA for ACCs	STLN6475
–48 V DC PSM Shelf; without PSMs	STHN4089
220 V AC PSM Shelf; without PSMs	STHN4092
–48 V DC PSM	STPN4037
220 V AC PSM	STPN4036
Optional RGPS Head	STLN6594

UBS Macro BTS Equipment Identification

Low and mid capacity UBS Macro BTS Frames

All Motorola Universal Base Station (UBS) Macro BTS frames are configured for either 800 MHz or 1.9 GHz RF band operation.

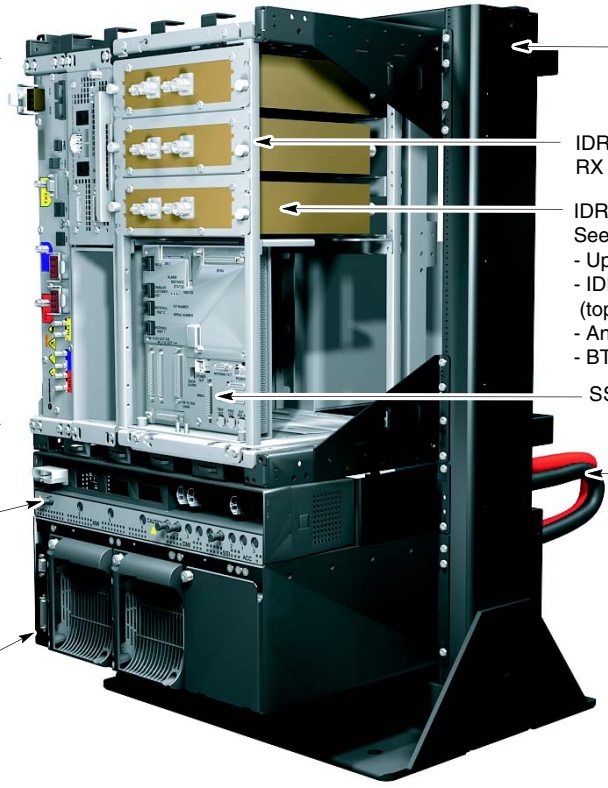
For software release 2.20.0.x, only low and mid capacity UBS Macro BTS frames are available. There are two versions low capacity UBS Macro BTS frames:

- UBS Macro BTS frame/short rack (see Figure 1-1)
- UBS Macro BTS starter frame/tall rack (see Figure 1-2)

The starter frame/tall rack can be easily expanded with equipment in the future to become a mid or high capacity frame.

The frame/short rack cannot be easily expanded. Equipment expansion of this frame/short rack would require equipment disassembly and then reassembly similar to that of the starter frame in a taller rack. Typically the frame/short rack equipment configuration is used because there is no plan for frame expansion.

Figure 1-1 UBS Macro BTS low-tier/low-capacity frame (1000 mm rack)



NOTES:
1. Interconnect cabling not shown for clarity.
2. 800 MHz equipment shown; 1.9 GHz similar.
3. 800 MHz XMI is 86 mm wide. 1.9 GHz XMI is 106.3 mm wide.
4. PSM shelf is optional and used instead of +27 V DC power Input.
5. PSM shelf is either -48 V DC or AC.
6. Only -48 V DC PSMs can be used in -48 V DC PSM shelf. Only AC PSMs can be used in AC PSM shelf.

ti-cdma-05993.eps

Figure 1-2 Low capacity UBS Macro BTS starter frame (1800 mm rack)

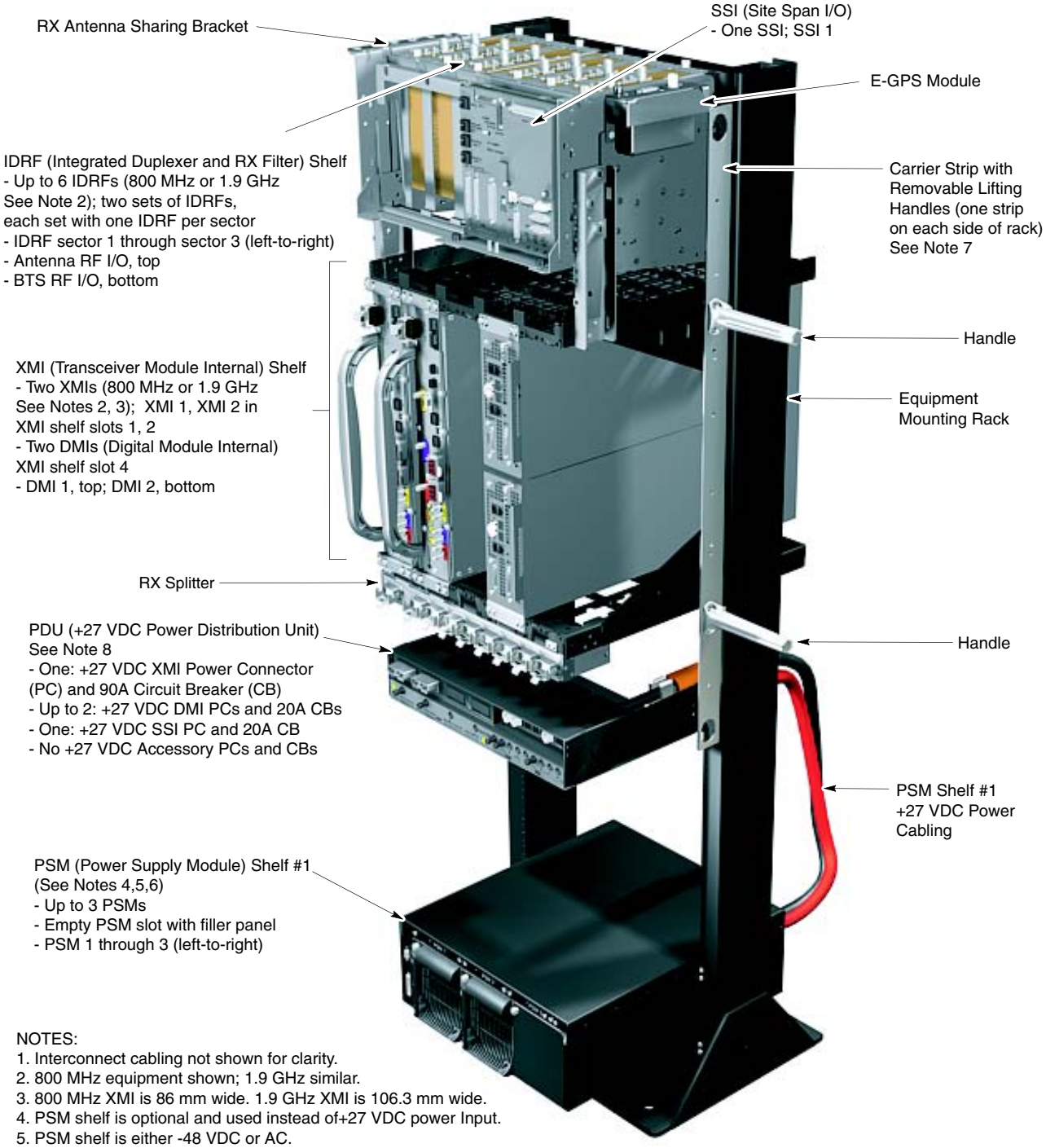
ti-cdma-05994.eps

NOTES:
1. Interconnect cabling not shown for clarity.
2. 800 MHz equipment shown; 1.9 GHz similar.
3. 800 MHz XMI is 86 mm wide. 1.9 GHz XMI is 106.3 mm wide.
4. PSM shelf is optional and used instead of+27 VDC power Input.
5. PSM shelf is either -48 VDC or AC.
6. Only -48 VDC PSMs can be used in -48 VDC PSM shelf. Only AC PSMS can be used in AC PSM shelf.
7. Carrier strips are removable.
8. PDU may be moved down 6 rack units to ease future expansion.

A typical mid capacity frame is shown in Figure 1-3.

The mid capacity frame is essentially a starter frame/tall rack that is already expanded to mid capacity. The mid capacity frame can be expanded with equipment in the future to become a high capacity frame.

Figure 1-3 UBS Macro BTS mid-capacity frame (1800 mm rack)



NOTES:
1. Interconnect cabling not shown for clarity.
2. 800 MHz equipment shown; 1.9 GHz similar.
3. 800 MHz XMI is 86 mm wide. 1.9 GHz XMI is 106.3 mm wide.
4. PSM shelf is optional and used instead of+27 VDC power Input.
5. PSM shelf is either -48 VDC or AC.
6. Only -48 VDC PSMs can be used in -48 VDC PSM shelf. Only AC PSMS can be used in AC PSM shelf.
7. Carrier strips are removable.
8. PDU may be moved down 6 rack units to ease future expansion.

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External GPS (E-GPS) Equipment Identification

E-GPS I/O Details

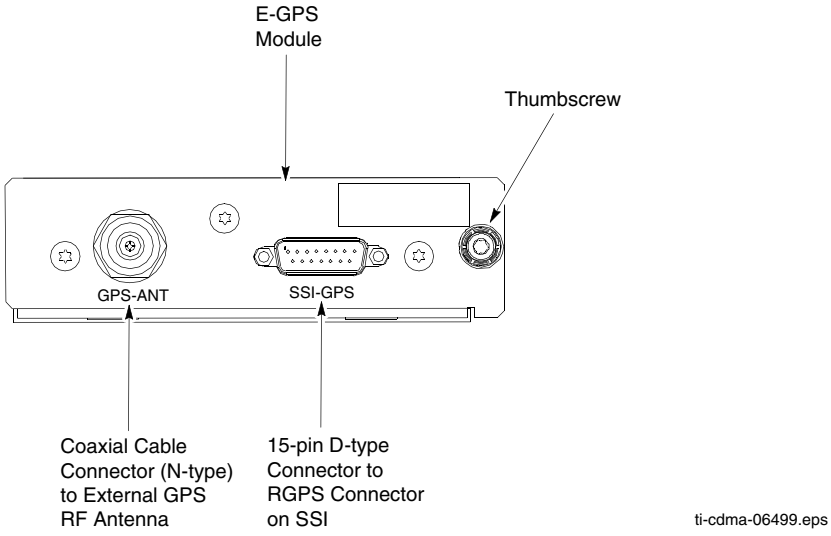
The UBS Macro BTS frame is equipped with an E-GPS module. The E-GPS module contains a GPS receiver (GPSR).

The E-GPS module connects to an external GPS RF antenna. It also connects to the SSI. The SSI and its associated DMI cabling routes the E-GPS module GPSR output signals to the controller board inside of the DMI. .

The E-GPS module operates from DC input power provided by the SSI connection.

See Figure 1-4 for E-GPS module I/O connectors location and details.

Figure 1-4 E-GPS I/O Details



Integrated Duplexer RX Filter (IDRF) Equipment Identification

IDRF I/O Details

The UBS Macro BTS antenna I/O equipment consists of the IDRF (Integrated Duplexer and RX Filter) with dual directional couplers for each antenna port.

The UBS Macro BTS frame is equipped with one IDRF per sector antenna.

The IDRFs are passive devices and therefore do not require DC input power for operation.

The BTS Antennas connect to the front of the IDRF while the BTS frame equipment connects to the rear of the IDRF.

RF test equipment can be connected to the directional couplers located on the front of the IDRF. These ports allow RF signal monitoring of the antenna paths as well as RF signal injection into the BTS equipment antenna paths.

See the applicable Figure 1-5 or Figure 1-6 for IDRF I/O connectors location and details.

Figure 1-5 800 MHz IDRF I/O Details

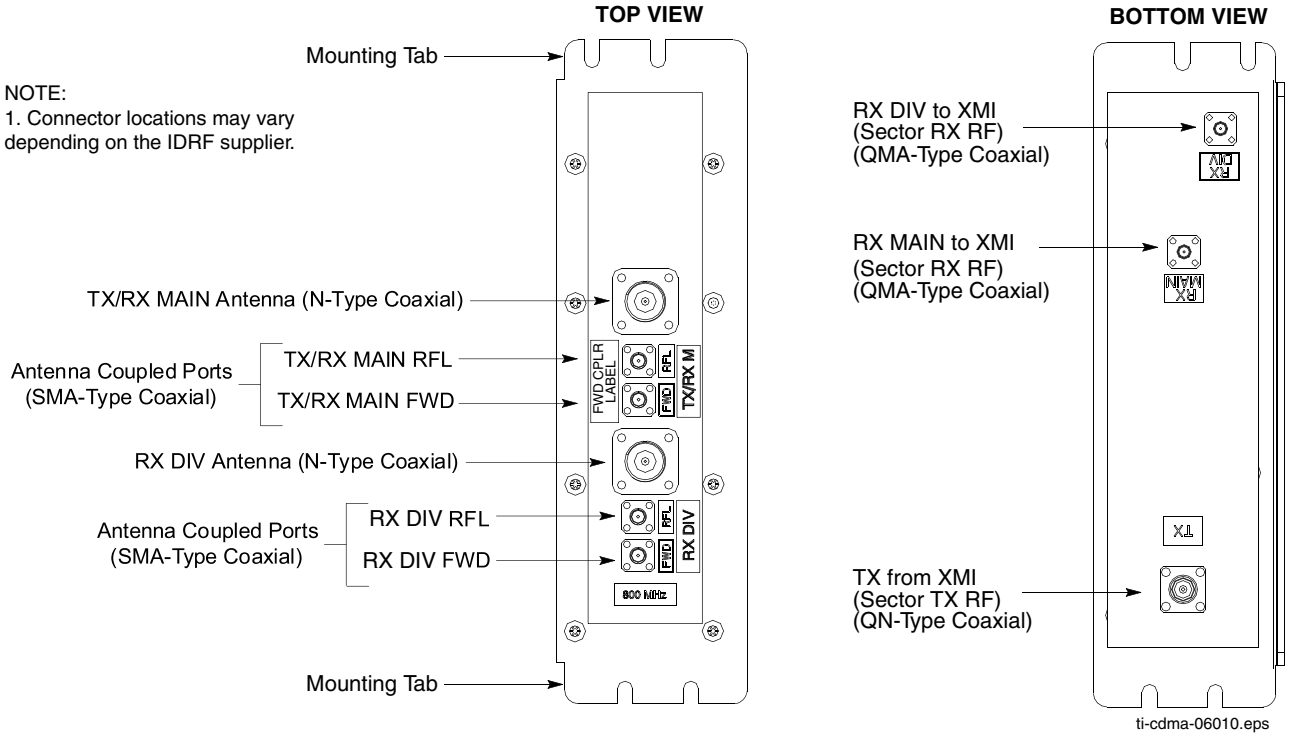
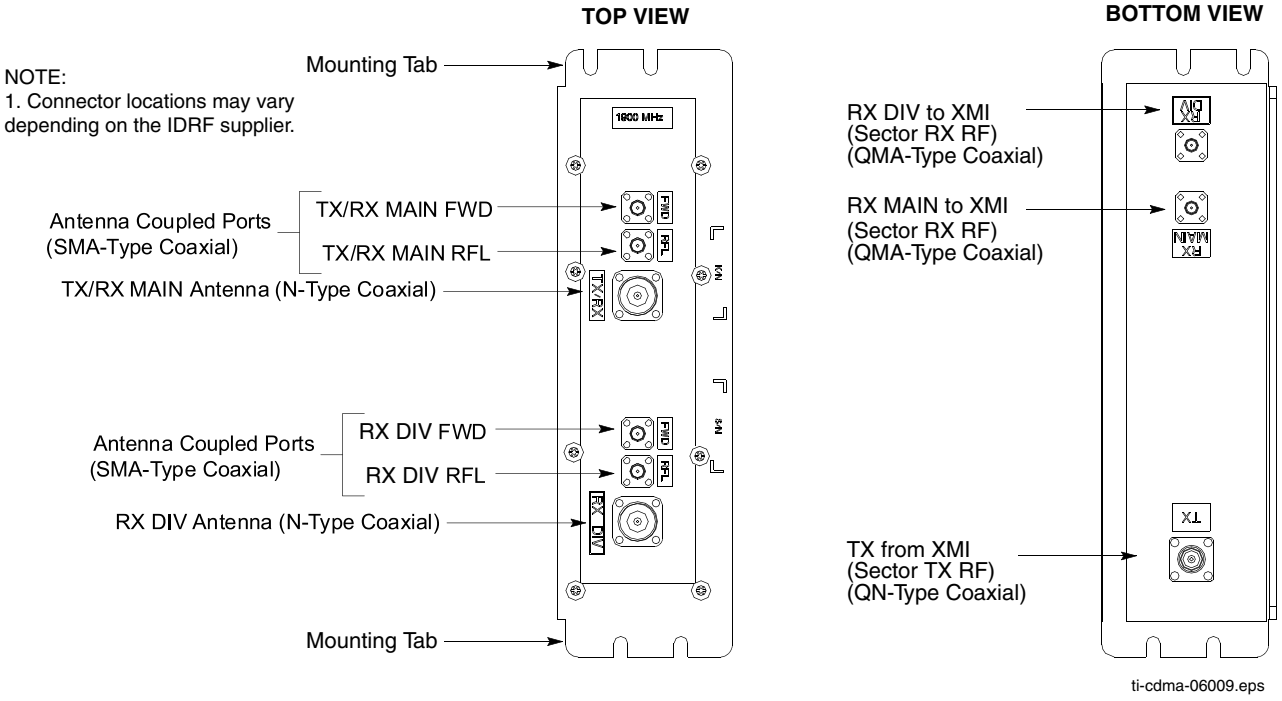


Figure 1-6 1.9 GHz IDRF I/O Details

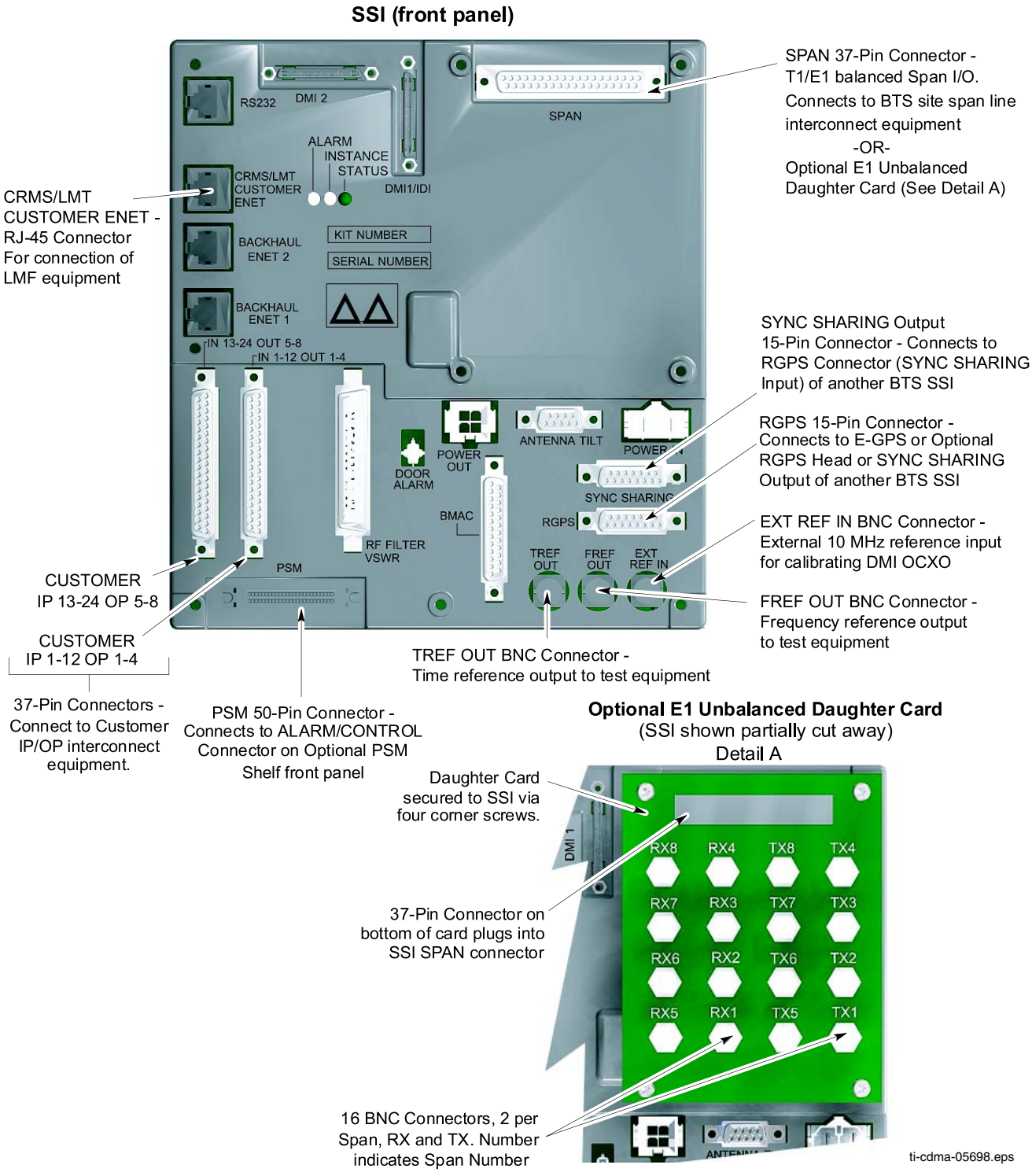


Site Span I/O (SSI) Module Equipment Identification

SSI I/O Details

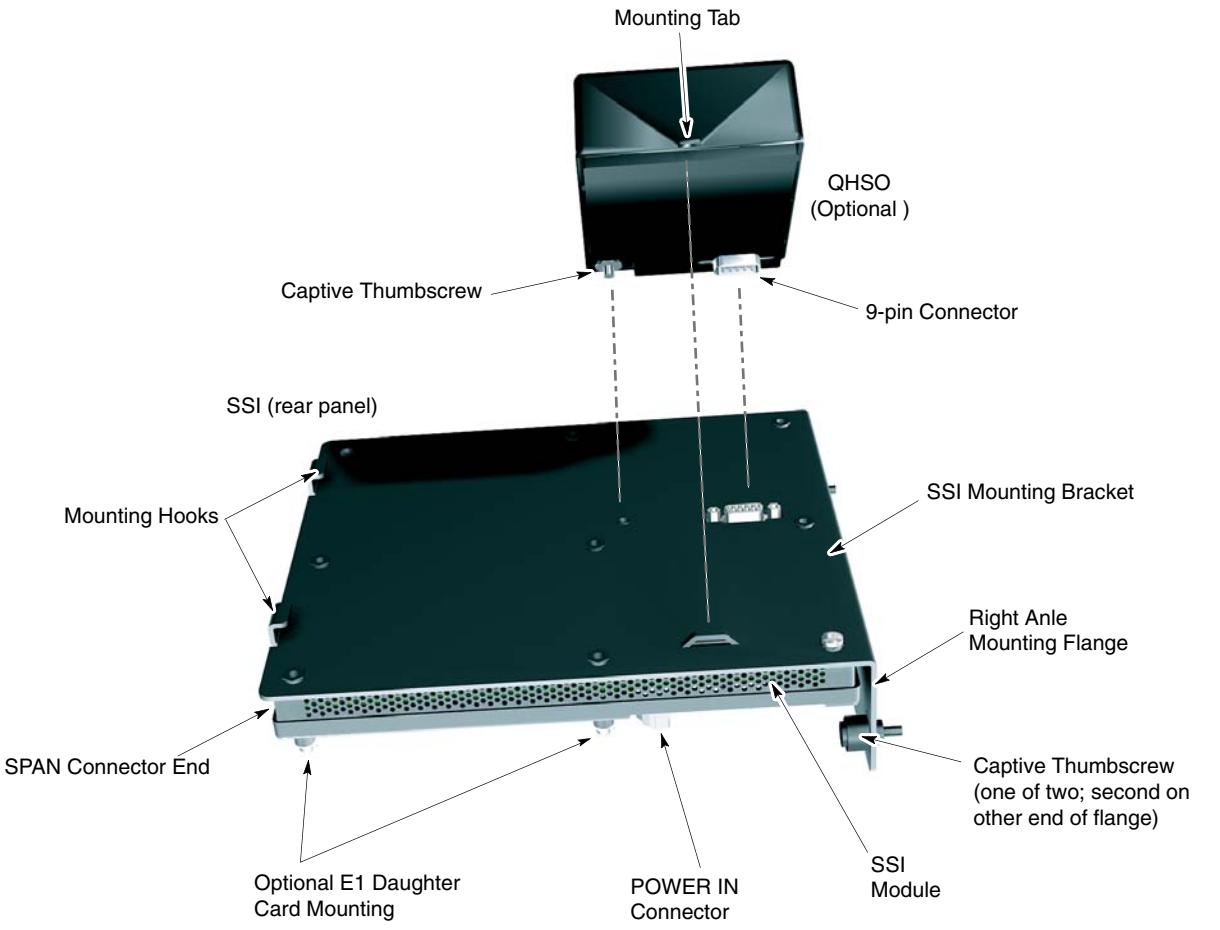
See Figure 1-7 for SSI front panel I/O connectors location and details.

Figure 1-7 SSI front panel details



See Figure 1-8 for SSI rear panel I/O connector location and details.

Figure 1-8 SSI rear panel details



Transceiver Module Internal (XMI) Equipment Identification

XMI I/O Details

Figure 1-9 shows I/O connectors on the front panel of the UBS Macro BTS 800 MHz XMI. Figure 1-10 shows I/O connectors on the front panel of the UBS Macro BTS 1.9 GHz XMI. The top-to-bottom positioning of the XMI shown in the figures is the same as when it is installed in the rack. These figures show connector/port locations, connector types and brief cabling details.

Figure 1-9 800 MHz XMI Module Front Panel I/O Detail

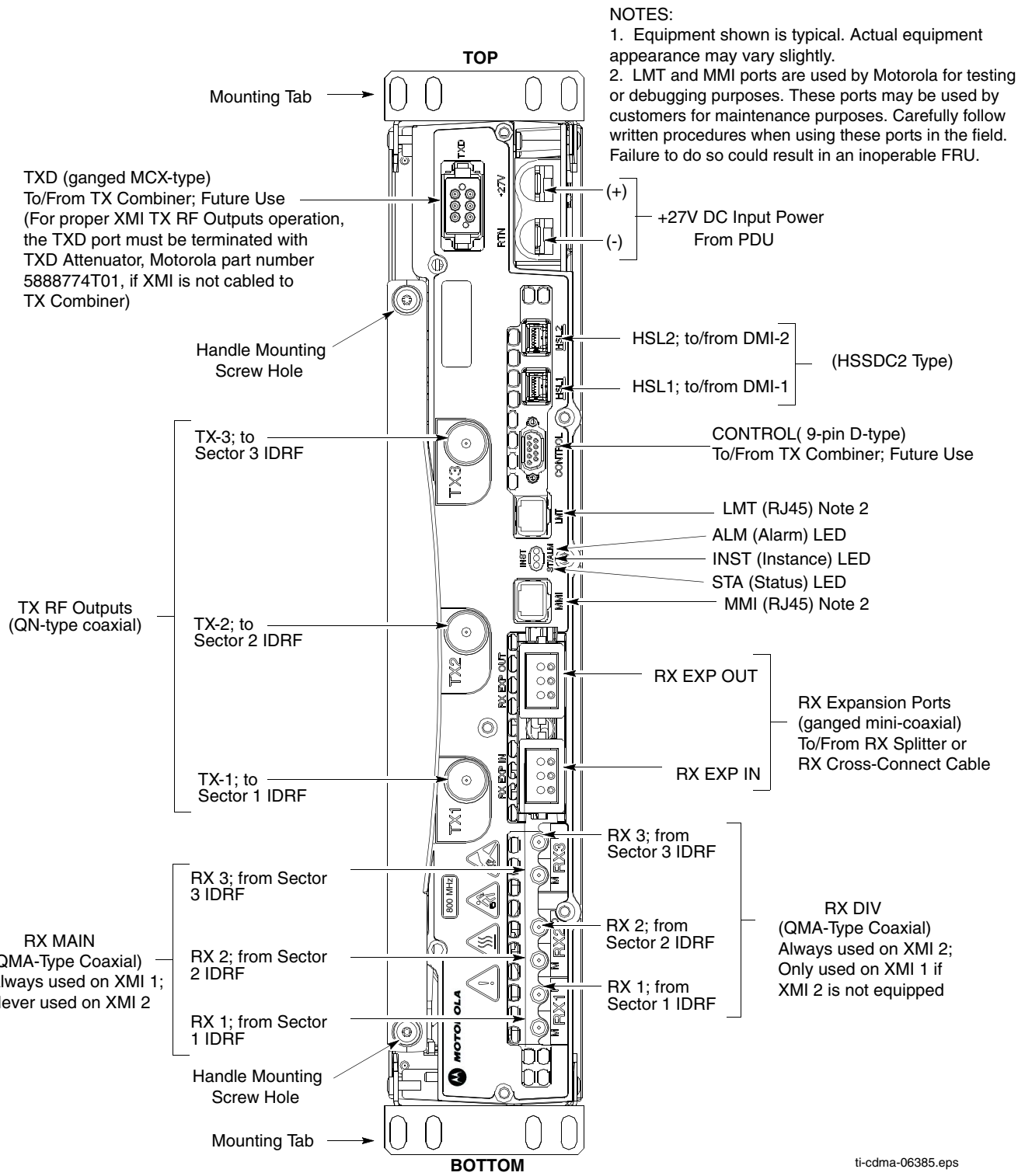
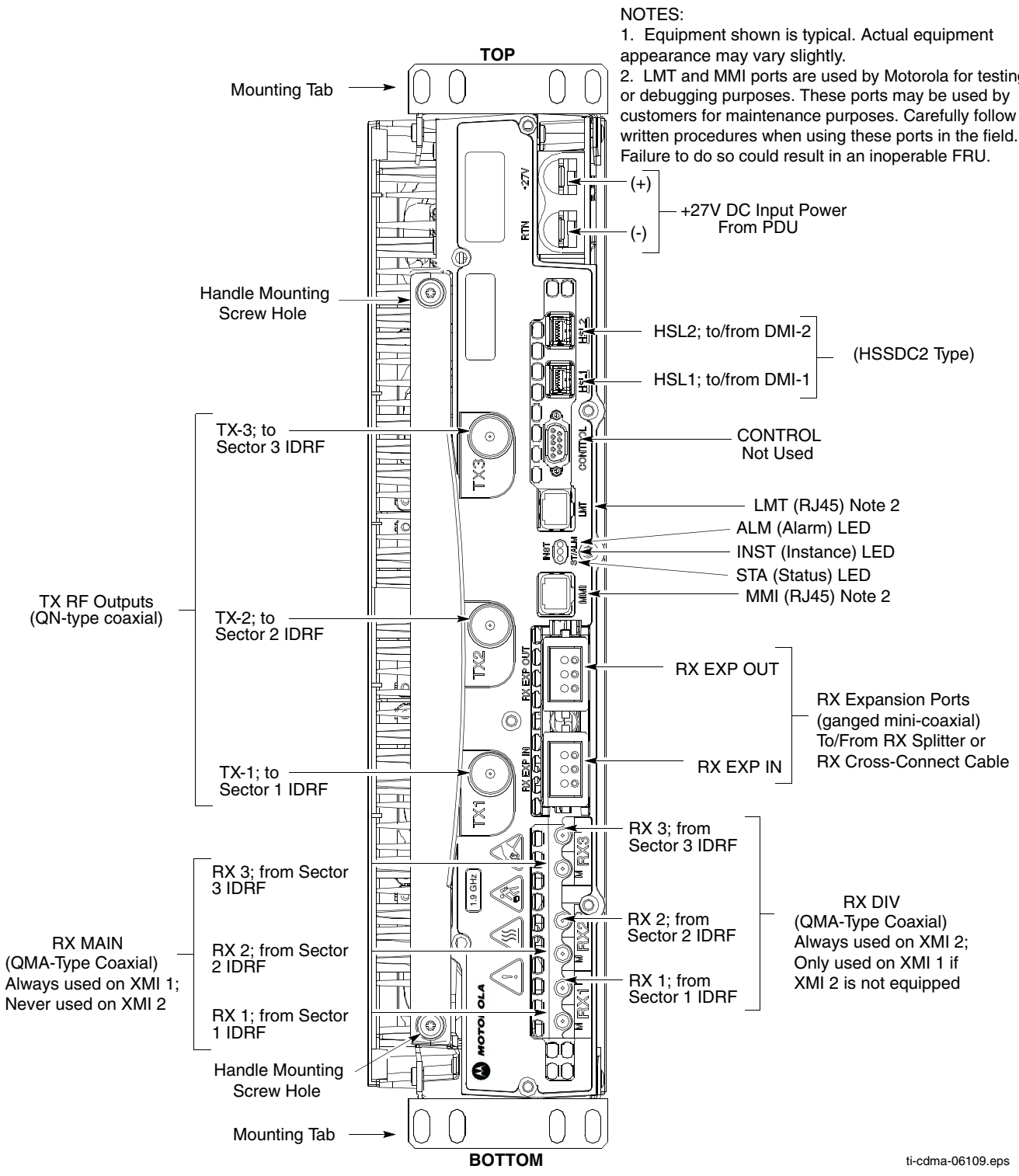


Figure 1-10 1.9 GHz XMI Module Front Panel I/O Detail

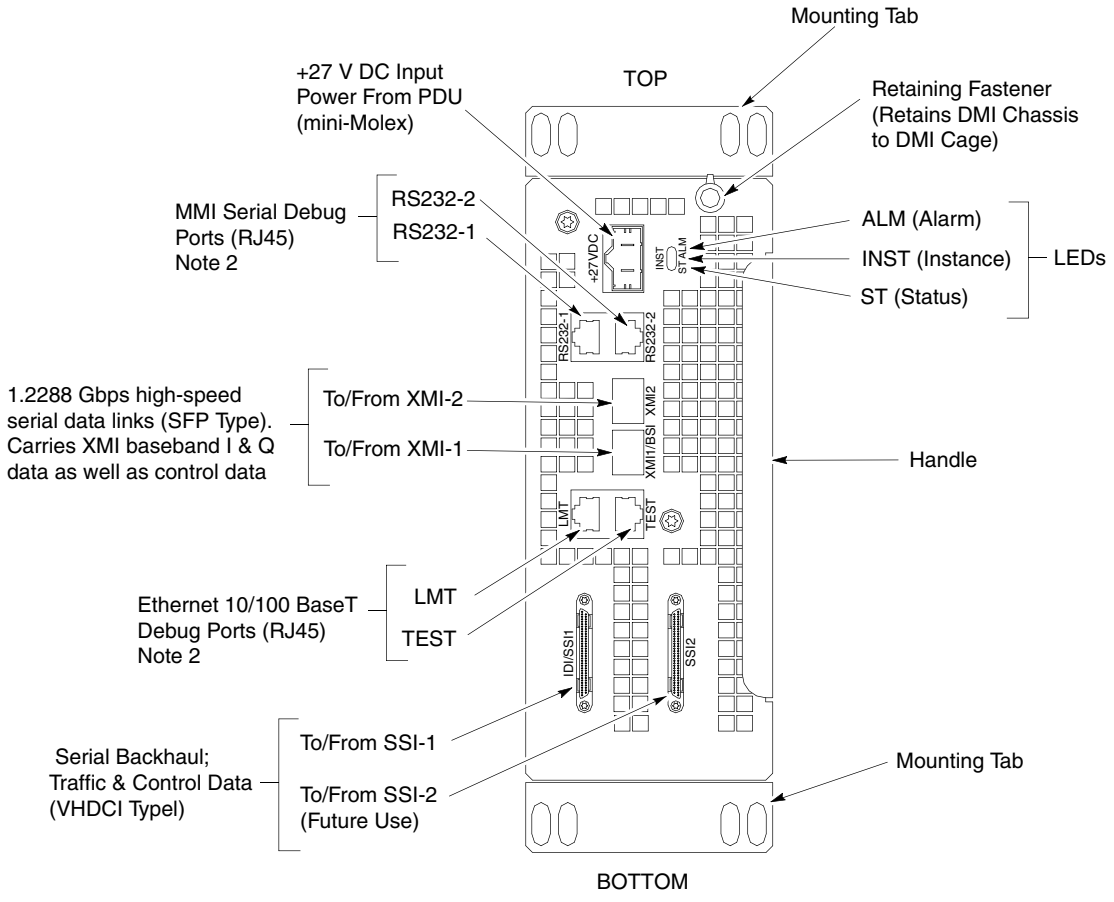


Digital Module Internal (DMI) Equipment Identification

DMI I/O Panel

Figure 1-11 shows I/O connectors on the front panel of the UBS Macro BTS DMI. The top-to-bottom positioning of the DMI shown in the figure is the same as when it is installed in the rack. This figure shows connector/port locations, connector types and brief cabling details.

Figure 1-11 DMI Module Front Panel Detail



NOTES:
1. Equipment shown is typical. The actual equipment appearance may vary slightly.
2. The debug ports are intended to be used primarily for testing or debugging purposes by Motorola. These ports may be used in the field for maintenance purposes by customers. Carefully follow written procedures when using these ports in the field. Failure to do so could result in an inoperable FRU.

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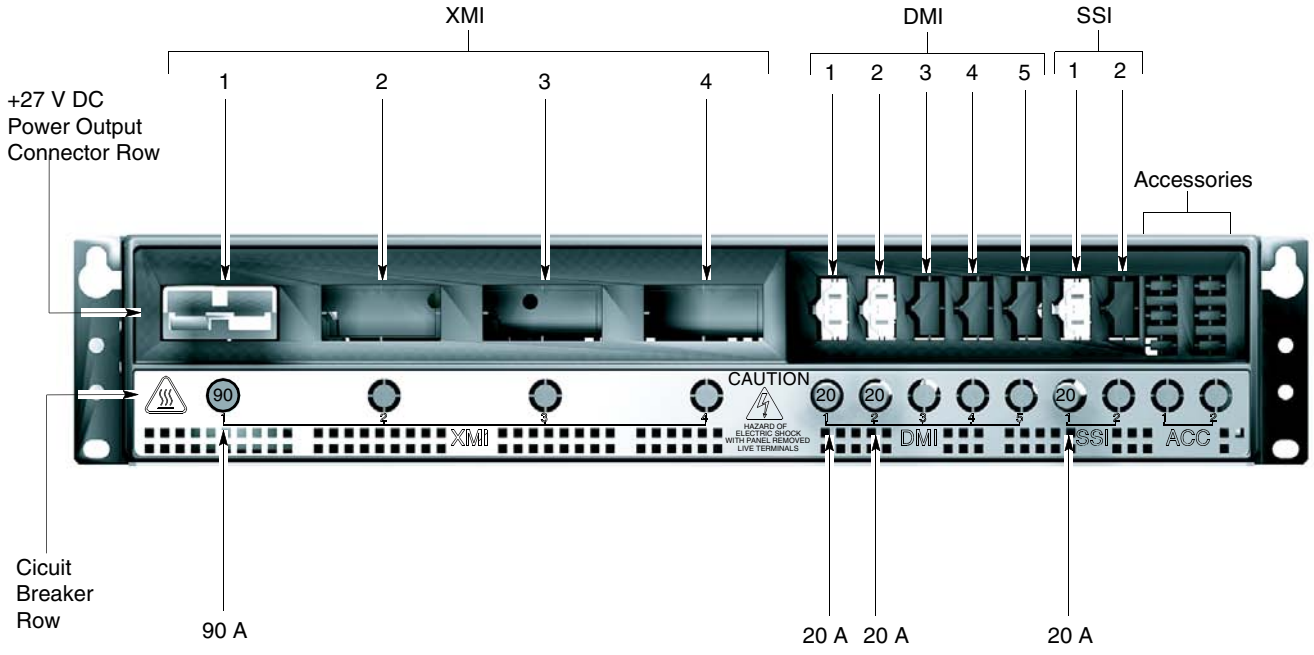
Power Distribution Unit (PDU) Equipment Identification

PDU I/O Panels

Figure 1-12 shows I/O connectors on the front panel of the UBS Macro BTS PDU. This figure shows connector and circuit breaker locations and usage details.

Figure 1-13 shows I/O cable and connectors on the rear panel of the UBS Macro BTS PDU. This figure shows cable/connector locations and brief cabling details.

Figure 1-12 PDU front panel detail



NOTES:
1. Equipment shown is typical. The actual equipment appearance may vary slightly.
2. The power output connector and associated circuit breaker are an intergral unit.
   The power output connector is always positioned directly above the associated circuit breaker.
3. Usually only power output connectors and circuit breakers are populated when the associated XMI, DMI, SSI or ACC is equipped. The actual equipage is customer dependent.

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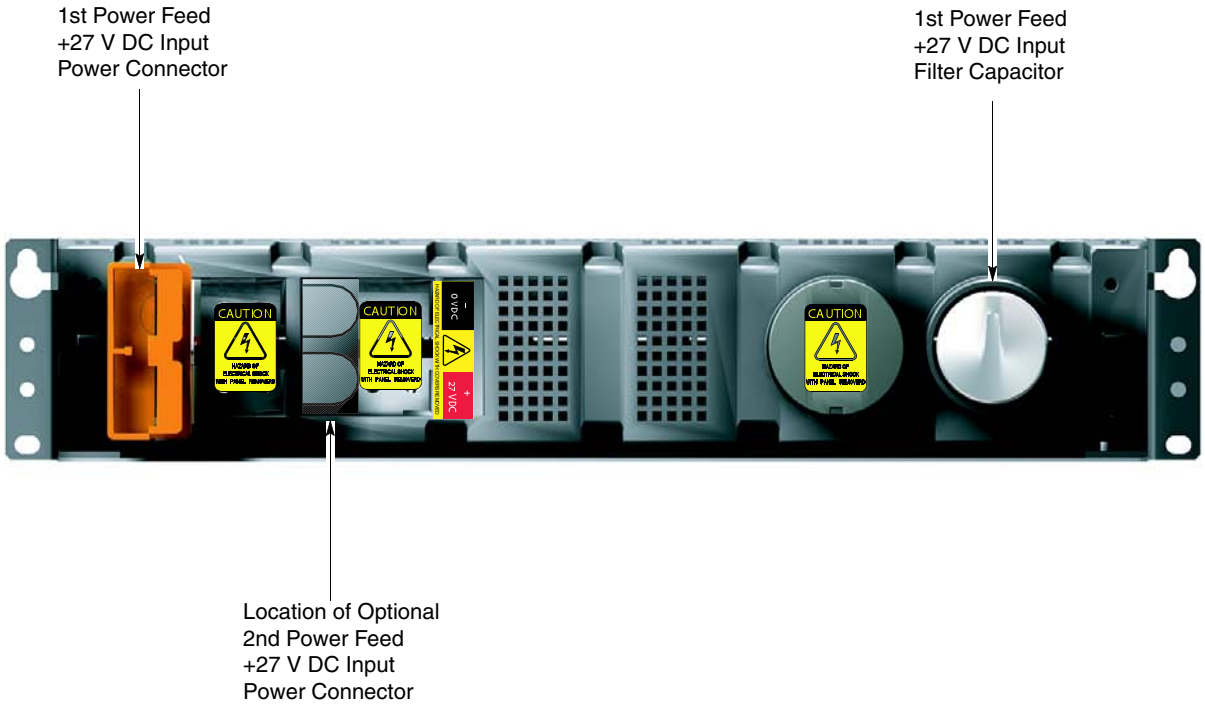
Figure 1-13 PDU rear panel detail



NOTES:
1. Equipment shown is typical. The actual equipment appearance may vary slightly.
2. The optional 2nd power feed input connector is populated when more than 2 XMIs are equipped.

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