MOTOROLA

BTS Optimization/ATP

CDMA LMF

Software Release 2.16.X

SC™4812ET

1.9 GHz and 800 MHz CDMA

English
Apr 2001
68P09253A74–O

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Model & Options Charts

Refer to the *SC 4812ET Field Replaceable Units* manual (68P64113A24) for detailed model structure and option information

This document covers only the steps required to verify the functionality of the Base transceiver Subsystem (BTS) equipment prior to system level testing, and is intended to supplement site specific application instructions. It also should be used in conjunction with existing product manuals. Additional steps may be required.

FCC Part 15 Requirements

This section conveys FCC Part 15 requirements for the T/ET/ETL series BTS cabinets.

Part 15.19a(3) – INFORMATION TO USER

NOTE

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

Part 15.21 – INFORMATION TO USER

CAUTION

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

15.105(b) – INFORMATION TO USER

NOTE

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

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

FCC Part 68 Requirements

This equipment complies with Part 68 of the Federal Communications Commission (FCC) Rules and regulations. A label inside the cabinet frame easily visible with the door open in the upper portion of the cabinet contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. If requested, this information must be provided to the telephone company.

The REN is useful to determine the quantity of the devices which may connect to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to incoming calls. In most, but not all areas, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to the line as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area.

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

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

If you experience trouble with the dial–in site access modem, please contact:

Motorola Cellular Service Center (MCSC)
1501 W. Shure Drive
Arlington Heights, Illinois 60004
Phone Number: (847) 632–5390

for repair and/or warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you to disconnect the equipment from the network until the problem is solved. You should not attempt to repair this equipment yourself. This equipment contains no customer or user–serviceable parts.

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

Foreword

Scope of manual

This manual is intended for use by cellular telephone system craftspersons in the day-to-day operation of Motorola cellular system equipment and ancillary devices. It is assumed that the user of this information has a general understanding of telephony, as used in the operation of the Public Switched Telephone Network (PSTN), and is familiar with these concepts as they are applied in the cellular mobile/portable radiotelephone environment. The user, however, is not expected to have any detailed technical knowledge of the internal operation of the equipment.

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

Text conventions

The following special paragraphs are used in this manual to point out information that must be read. This information may be set-off from the surrounding text, but is always preceded by a bold title in capital letters. The 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 equipment damage could occur, thus avoiding damage to equipment.

WARNING

Presents information to warn you of a potentially hazardous situation in which there is a possibility of personal injury.

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The following typographical conventions are used for the presentation of software information:In text, `typewriter` style characters represent prompts and the system output as displayed on a Hyperterminal screen.

Changes to manual

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

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

To ensure that your facility receives updates to your manuals, it is important that the information in our database is correct and up-to-date. Therefore, if you have corrections or wish to make changes to the information in our database (i.e., to assign a new *"key" individual*), please contact Technical Education & Documentation at:

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24-hour support service

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

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

Material Available from Motorola Infrastructure Group Worldwide Cellular Services

Material available from Motorola Infrastructure Group Worldwide Cellular Services, identified by a Motorola part number can be ordered from your sales account manager or by calling (800) 453–7988.

Remember! . . . Safety depends on you!!

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

Ground the instrument

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

Do not operate in an explosive atmosphere

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

Keep away from live circuits

Operating personnel must:

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

Do not service or adjust alone

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

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

68P09253A74–1

Manual Title

SC™4812ET BTS Optimization/ATP — CDMA LMF
CDMA 1.9 GHz and 800 MHz

Version Information

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

Version Level	Date of Issue	Remarks
1	April 2001	Preliminary DRAFT of document

Patent Notification

Patent numbers

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

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

Notes

Chapter 1: Introduction

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Optimization Overview

Scope of This Document

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

This document assumes the following prerequisites: The BTS frames and cabling have been installed per the *BTS Hardware Installation Manual* – 68P64114A22, which covers the physical “bolt down” of all SC series equipment frames, and the specific cabling configurations.

Document Composition

This document covers the following major areas:

- Introduction, consisting of preliminary background information (such as component and subassembly locations and frame layouts) to be considered by the Cell Site Field Engineer (CFE) before optimization or tests are performed.
- Preliminary Operations, consisting of cabinet power up and power down procedures.
- Optimization/calibration, covering topics of Local Maintenance Facility (LMF) connection to the BTS equipment, Global Positioning System (GPS) Verification, test equipment setup, downloading all BTS processor boards, RF path verification, Bay Level Offset (BLO) calibration and calibration audit, and Radio Frequency Diagnostic System (RFDS) calibration.
- Acceptance Test Procedures (ATPs), consisting of ATP tests executed by the LMF and used to verify all major transmit (TX) and receive (RX) performance characteristics on all BTS equipment.
- Preparing to leave the site, presents instructions on how to properly exit customer site, ensure that all equipment is operating properly, and all work is complete according to Motorola guidelines.
- Basic troubleshooting, consisting of procedures for installation, calibration, transmit and receive tests, backplane problems, GPS failures, and module connectors.
- Appendices contain pertinent Pseudorandom Noise (PN) Offset, frequency programming, output power data tables, data sheets that are filled out manually by the CFE at the site, and information on test equipment preparation.

CDMA LMF Product Description

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

- Installation
- Maintenance
- Calibration
- Optimization

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

Online Help

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

Why Optimize?

Proper optimization and calibration assures:

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

What Is Optimization?

Optimization compensates for the site-specific cabling and normal equipment variations. Cables that interconnect the BTS and Duplexer assemblies (if used), for example, are cut and installed at the time of the BTS frame installation at the site. Site optimization guarantees that the combined losses of the new cables and the gain/loss characteristics and built-in tolerances of each BTS frame do not accumulate, causing improper site operation.

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

- The RX path starts at the ancillary equipment frame RFDS RX directional coupler antenna feedline port, through the RX input port on the rear of the frame, through the DDRCs, Multicoupler Preselector Card (MPC), and additional splitter circuitry, ending at a CDMA Channel Processor (C–CCP) backplane Broad Band Transceiver (BBX) slot in the C–CCP shelf.
- A transmit path starts at the BBX, through the C–CCP backplane slot, travels through the LPA/Combiner TX Filter and ends at the rear of the input/output (I/O) Panel. If the RFDS option is added, then the TX path continues and ends at the top of the RFDS TX directional coupler antenna feedline port installed in the ancillary equipment frame.

. . . continued on next page

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

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

When to Optimize

New Installations

After the initial site installation, the BTS must be prepared for operation. This preparation includes verifying hardware installation, initial power up, and GPS verification. Basic alarm tests are also addressed.

A calibration audit of all RF transmit paths is performed to verify factory calibration.

A series of ATP CDMA verification tests are covered using the actual equipment set up. An ATP is also required before the site can be placed in service.

Site Expansion

Optimization is also required after expansion of a site.

Periodic Optimization

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

Repaired Sites

Verify repair(s) made to the BTS by consulting an Optimization/ATP Test Matrix table. This table outlines the specific tests that must be performed *anytime* a BTS subassembly or RF cable associated with it is replaced.

IMPORTANT

Refer to Appendix B for detailed basic guideline tables and detailed Optimization/ATP Test Matrix.

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 plans
  - Power levels
  - Site PN
  - Site paging and traffic channel allocation
  - Board placement
  - Site wiring lists
  - Cell–site Data Files (CDF)
- Demarcation document (scope of work agreement)
- Equipment manuals for non-Motorola test equipment.

Additional Information

For other information, refer to the following manuals:

- *CDMA LMF Operators Guide*
  Delivered as on-line help with your system
- *4812ET Field Replacement Units Guide*
  (Motorola part number 68P09253A48)
- *SC 4812ET RF & Power Cabinet Hardware Installation Manual*
  (Motorola part number 68P09253A93)
- *Logical BTS Implementation*
  (Motorola part number 68P09253A79)

Test Equipment Overview

The LMF is used in conjunction with Motorola recommended test equipment, and it is a part of a "calibrated test set." To ensure consistent, reliable, and repeatable optimization test results, only recommended test equipment supported by the LMF must be used to optimize the BTS equipment. Table 1-1 outlines the supported test equipment that meets the technical criteria required for BTS optimization.

Table 1-1: CDMA LMF Test Equipment Support Table

Item	Description
Hewlett Packard, model HP 8921A	Cellular communications analyzer (includes 83203B CDMA interface option)
Hewlett Packard, model HP 83236A	PCS interface for PCS band

. . . continued on next page

Table 1-1: CDMA LMF Test Equipment Support Table	
Item	**Description**
Hewlett Packard, model HP 8935	Cellular cmmunications analyzer
Motorola CyberTest	Cellular communications analyzer
Advantest R3465 with 3561 CDMA option	Cellular communications analyzer
Gigatronix 8541C	Power meter
HP437B	Power meter

To ensure consistent, reliable, and repeatable optimization test results, test equipment meeting the following technical criteria should be used to optimize the BTS equipment. You can, of course, substitute test equipment with other test equipment models supported by the LMF *meeting the same technical specifications*.

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
- 4 Gbyte internal hard disk drive
- Color display with 1024 x 768 (recommended) or 800 x 600 pixel resolution
- 64 MB RAM
- CD ROM drive
- 3 1/2 inch floppy drive
- Serial port (COM 1)
- Parallel port (LPT 1)
- PCMCIA Ethernet interface card (for example, 3COM Etherlink III) with a 10Base–T–to–coax adapter
- Windows 98/NT operating system

NOTE

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

Required Test Equipment

To ensure consistent, reliable, and repeatable optimization test results, test equipment meeting the following technical criteria should be used to optimize the BTS equipment. You can, of course, substitute test equipment with other test equipment models supported by the LMF *meeting the same technical specifications*.

NOTE

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

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

Test Equipment Calibration

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

Test Cable Calibration

Equipment test cables are very important in optimization. Motorola recommends that the cable calibration be run at every BTS with the test cables attached. This method compensates for test cable insertion loss within the test equipment itself. No other allowance for test cable insertion loss needs to be made during the performance of tests.

Another method is to account for the loss by entering it into the LMF during the optimization procedure. This method requires accurate test cable characterization in a shop. The cable should be tagged with the characterization information prior to field optimization.

Equipment Warm–up

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

- Communications test set
- Rubidium time base
- Power meter

Test Equipment List

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

NOTE

Always refer to specific OEM test equipment documentation for detailed operating instructions.

10BaseT/10Base2 Converter

Ethernet LAN transceiver *(part of CGDSLMFCPQ1700)*

- PCMCIA Ethernet Adpater + Ethernet UTP adapter: 3COM model – Etherlink III 3C589B

Transition Engineering model E–CX–TBT–03 10BaseT/10Base2 converter

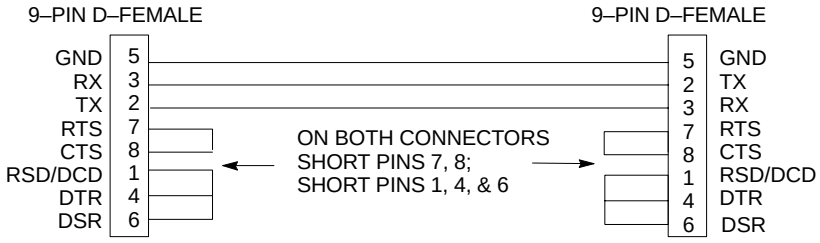
NOTE

Xircom model PE3–10B2 or equivalent can also be used to interface the LMF Ethernet connection to the frame.

RS–232 to GPIB Interface

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

Figure 1-1: Null Modem Cable Detail



Model SLN2006A MMI Interface Kit

- Motorola Model TRN9666A null modem board. Connectors on opposite sides of the board must be used as this performs a null modem transformation between cables. This board can used for 10–pin to 8–pin, 25–pin to 25–pin and 10–pin to 10–pin conversions.
- Motorola 30–09786R01 MMI cable or equivalent ; used to interface the LMF serial port connection to GLI2, CSM and LPA debug serial ports.
- 25 pin D to 25 pin D serial cable from PC to null modem board.

Communications System Analyzer

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

(1) Frequency counter
(2) RF power meter (average and code domain)
(3) RF Signal generator (capable of CDMA modulation)
(4) Spectrum analyzer
(5) CDMA code domain analyzer

Four types of communication system analyzers are currently supported by the LMF:

HP8921A/600 Analyzer – Including 83203B CDMA Interface, manual control system card, and 83236A/B PCS Interface for 1900 MHz BTSs.

Advantest R3465 Analyzer – Including R3561L test source unit

HP8935 Analyzer

CyberTest Communication 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.

Power Meter

One of the following power meters is required for TX calibration and audit if an HP8921A or Advantest R3465 analyzer is used:

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

Timing Reference Cables

- *Two* BNC–male to BNC–male RG316 cables; 3 meters (10 ft.) long, used to interconnect the HP8921A/600 or Advantest R3465 communications analyzer to the CSM front panel timing references in the BTS.

NOTE

Two Huber & Suhner 16MCX/11BNC/K02252D or equivalent; right angle MCX–male to standard BNC–male RG316 cables; 10 ft. long are required to interconnect the HP8921A/600 communications analyzer to SGLN4132A and SGLN1145A CSM board timing references.

- BNC "T" adapter with 50 ohm termination.

NOTE

This BNC "T" adapter (with 50 ohm termination) is required to connect between the HP 8921A/600 (or Advantest R3465) EVEN SECOND/SYNC IN and the BNC cable. The BNC cable leads to the 2–second clock connection on the TIB. Erroneous test results may occur if the "T" adapter with the 50 ohm termination is not connected.

Digital Multimeter

- Fluke model 8062A with Y8134 test lead kit or equivalent; used for precision DC and AC measurements, requiring 4–1/2 digits.

Directional Coupler

- Narda model 30661 30 dB (Motorola part no. 58D09732W01) coupler terminated with two Narda Model 375BN–M loads, or equivalent.

RF Attenuators

- 20 dB fixed attenuators, 20 W (Narda 768–20); used with test cable calibrations or during general troubleshooting procedures.
- Narda Model 30445 30 dB (Motorola Part No. 58D09643T01) coupler terminated with two Narda Model 375BN–M loads, or equivalent.

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.

High–impedance Conductive Wrist Strap

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

RF Load (at least three for trunked cabinets)

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

RF Network Box (and calibrated cables)

- Motorola model SGLN5531A 18:3 Passive Antenna Interface used to interface test equipment to the BTS receive and transmit antenna inputs during optimization/ATP or general troubleshooting procedures.

Optional Equipment

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 tests other than standard Receive band spectral purity and TX LPA IM reduction verification tests performed by the LMF.

Local Area Network (LAN) Tester

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

Span Line (T1/E1) Verification Equipment

- As required for local application

RF Test Cable (if not Provided with Test Equipment)

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

Oscilloscope

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

2–way Splitter

- Mini–Circuits model ZFSC–2–2500 or equivalent; provide 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.

Abbreviations and Acronyms

Table 1-2: Abbreviations and Acronyms	
Acronym	**Definition**
AMR	Alarm Monitor Reporting
ATP	Acceptance Test Plan
BBX2	Broadband Transceiver
BLO	Bay Level Offset
BTS	Base Transceiver Subsystem
CBSC	Centralized Base Station Controller
C–CCP	Combined CDMA Channel Processor
CCD	CDMA Clock Distribution
CDMA	Code Division Multiple Access
CE	Channel Element
CHI	Concentration Highway Interface
CLI	Command Line Interface
CIO	Combiner Input/Output
CM	Channel Module
CMR	Cellular Manual Revision
CSM	Clock Synchronization Manager
CSU	Clock Synchronization Unit
DBPF	Dual Bandpass Filter
DBM	Debug Monitor
DMAC	Digital Metering and Alarm Control (also see MAP)
DRDC	Duplexer/RX Filter/Directional Coupler
DSP	Digital Signal Processor
EMPC	Expansion Multicoupler Preselector Card
FRU	Field Replaceable Unit
FSI	Frame Status Indicator
GLI 2	Group Line Interface II
GPS	Global Positioning System
HSO	High Stability Oscillator
IFM	Integrated Frame Modem
I&Q	Interphase and Quadrature
ISB	InterShelf Bus
LAPD	Link Access Protocol “D”
LFR	Low Frequency Receiver
LMF	Local Maintenance Facility

. . . continued on next page

Table 1-2: Abbreviations and Acronyms	
Acronym	**Definition**
LORAN	LOng RAnge Navigational
LPA	Linear Power Amplifier
MAP	Meter Alarm Panel (also refered to as DMAC)
MCC	Multi–Channel CDMA
MGLI	Master Group Line Interface
MM	Mobility Manager
MMI	Man Machine Interface
MPC	Multicoupler Preselector Card
OMCR	Operations Maintenance Center – Radio
PCS	Personal Communication System
PCSC	Personal Communication System Controller
PN	Pseudo–random Noise
PSTN	Public Switched Telephone Network
QPSK	Quadrature Phase Shift Keyed
RFDS	Radio Frequency Diagnostic Subsystem
RSSI	Received Signal Strength Indicator
SCAP	Super Cell Application Protocol
TCH	Traffic Channel
TSI	Time Slot Interchanger

Equipment Overview

The SC 4812ET BTS consists of an RF Cabinet that is an outdoor, weatherized version of the SC 4812T. The RF cabinet is powered by 27 Vdc and each cabinet has the capability to support up to 4 carriers (at 3 sector) or 2 carriers (at 6 sector).

The RF Cabinet houses the fan modules, C–CCP, LPA modules, LPA trunking backplane, Bandpass 2:1 & 4:1 Combiners, Duplexer/Receive Filter/Directional Couplers (DRDC) and a DC Power distribution assembly. The Power Cabinet (PC) provides +27 Vdc distribution and battery backup for the SC 4812ET. The Power Cabinet houses batteries, battery heaters, rectifiers, an AC Load Center (ACLC), a power distribution assembly, and two duplexed GFCI convenience outlets.

Logical BTS

A logical BTS can consist of up to four SC 4812ET 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 CDF file that includes equippage information for all of the logical BTS frames and their devices is required. A Centralized Base Station Controller (CBSC) file that includes channel data for all of the logical BTS fames is also required.

The first frame of a logical BTS has a **–1** suffix (e.g., **BTS–812–1**) and 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 will only be one tab (e.g., **FRAME–282–1**) for BTS–282. If a logical BTS has more than one frame, there will be a separate **FRAME** tab for each frame (e.g. **FRAME–438–1**, **FRAME–438–101**, and **FRAME–438–202** for a **BTS–438** that has all three frames). If an RFDS is included in the CDF file, an **RFDS** tab (e.g., **RFDS–438–1**) will be displayed.

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

C–CCP Shelf Card/Module Device ID Numbers

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

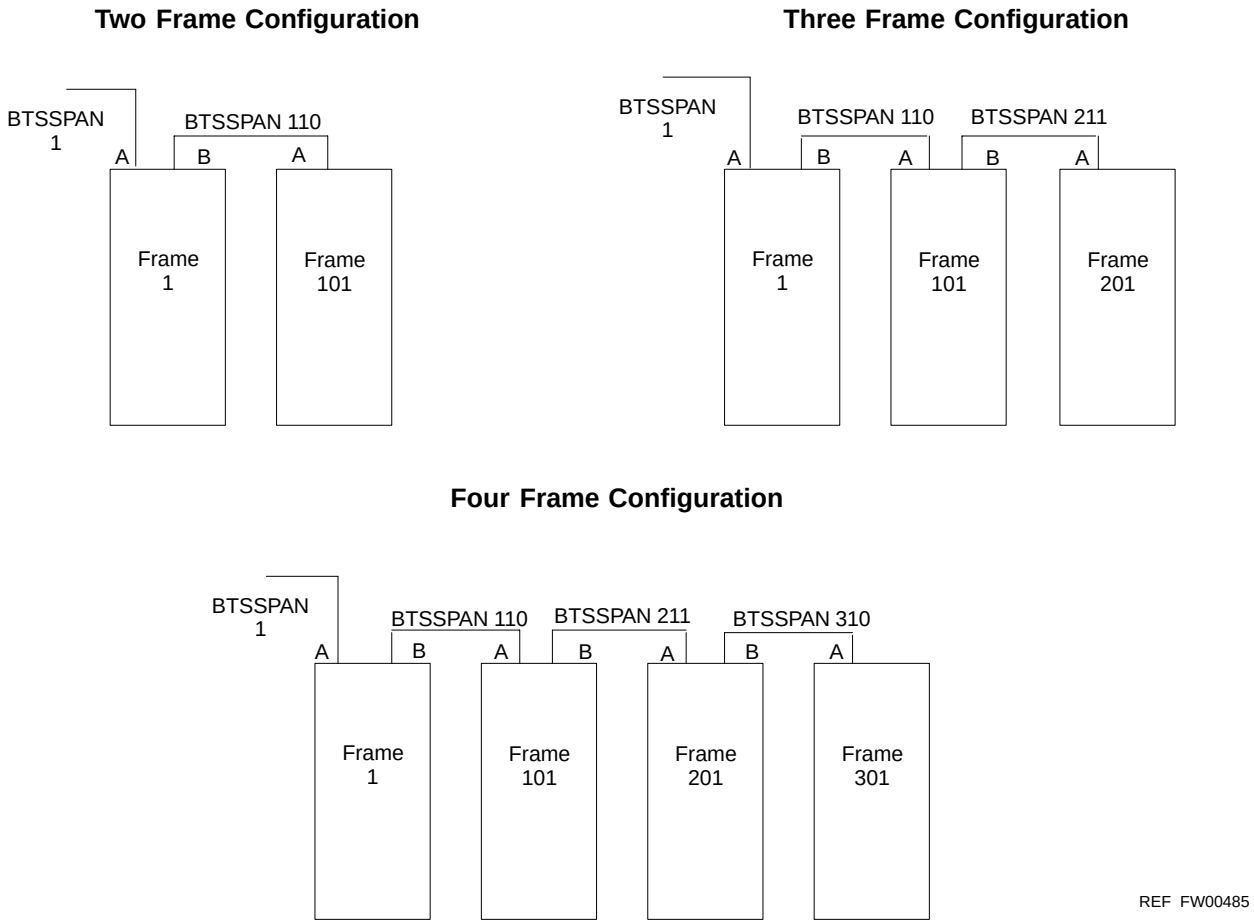
Table 1-3: C–CCP Shelf/Cage Card/Module Device ID Numbers (Top Shelf)

Frame #	Card/Module ID Number (Left to Right)																			
	Power (PS–1)	Power (PS–2)	Power (PS–3)	AMR –1	GLI2 –1	MCC2						BBX2						BBX2 –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	GLI2– 2	MCC2						BBX2						SW	MPC/ EMPC –2
1	–	1	2	–	–	–	2	2	7	8	9	10	11	12	7	8	9	10	11	12	–	–
101	–	101	102	–	–	–	102	102	107	108	109	110	111	112	107	108	109	110	111	112	–	–
201	–	201	202	–	–	–	202	102	207	208	209	210	211	212	207	208	209	210	211	212	–	–
301	–	301	302	–	–	–	302	102	307	308	309	310	311	312	307	308	309	310	311	312	–	–

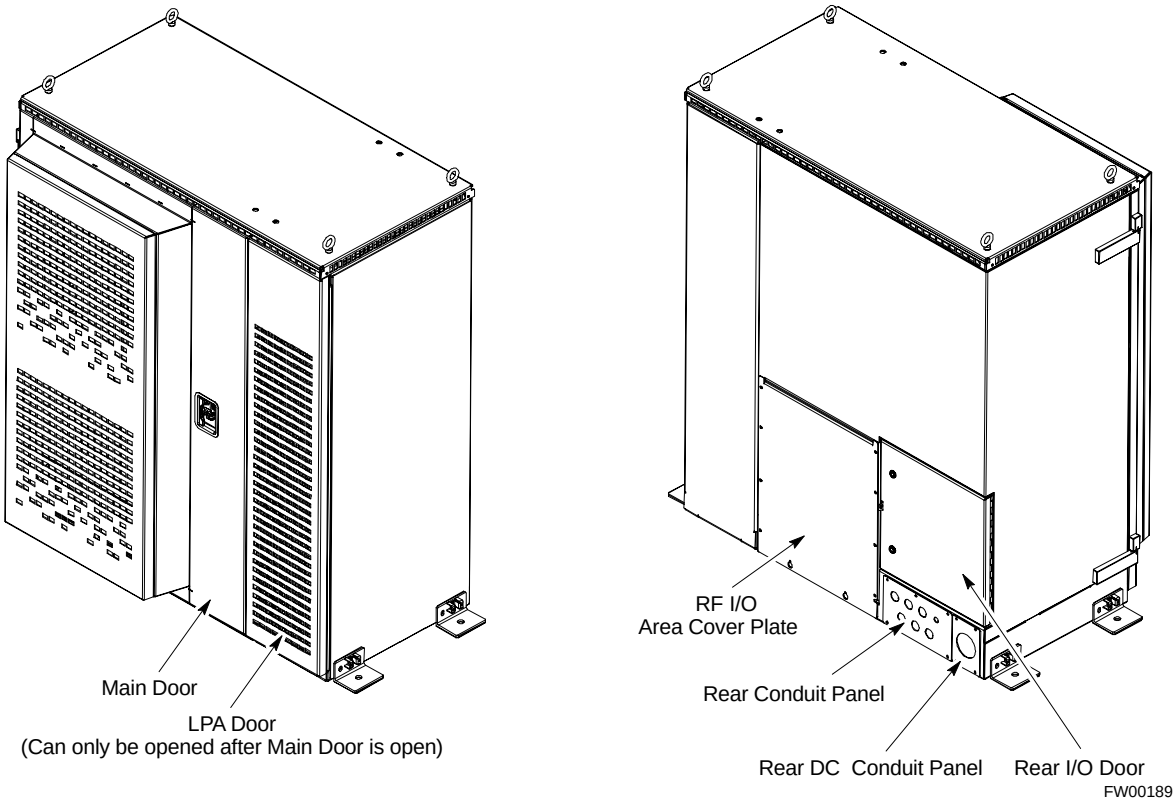
Figure 1-2: Typical Logical BTS Configurations



Major Components

The major components that make up the Motorola SC 4812ET are illustrated in this section: the RF Cabinet (see Figure 1-3) and the Power Cabinet (see Figure 1-10).

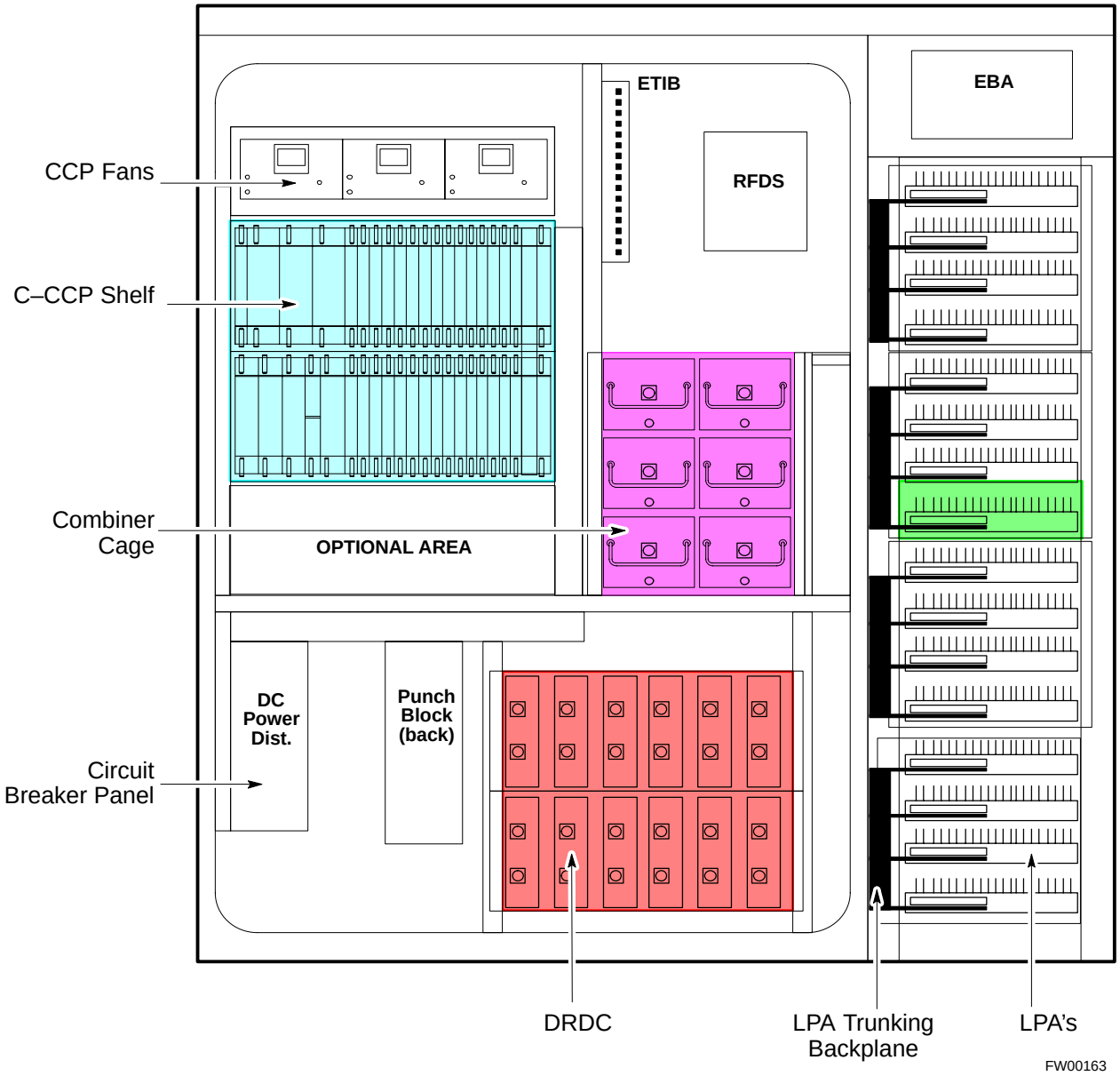
Figure 1-3: SC 4812ET RF Cabinet



RF Cabinet Internal FRUs

Figure 1-4 shows the location of the Internal Field Replaceable Units (FRUs). A brief description of each Internal FRU is found in the following paragraphs.

Figure 1-4: RF Cabinet Internal FRUs



Duplexer/Directional Coupler

The DRDC combines, in a single module, the functions of antenna duplexing, receive band pass filtering, and surge protection (see.Figure 1-8).

Combiner Cage (2:1, 4:1, or Band pass Filter)

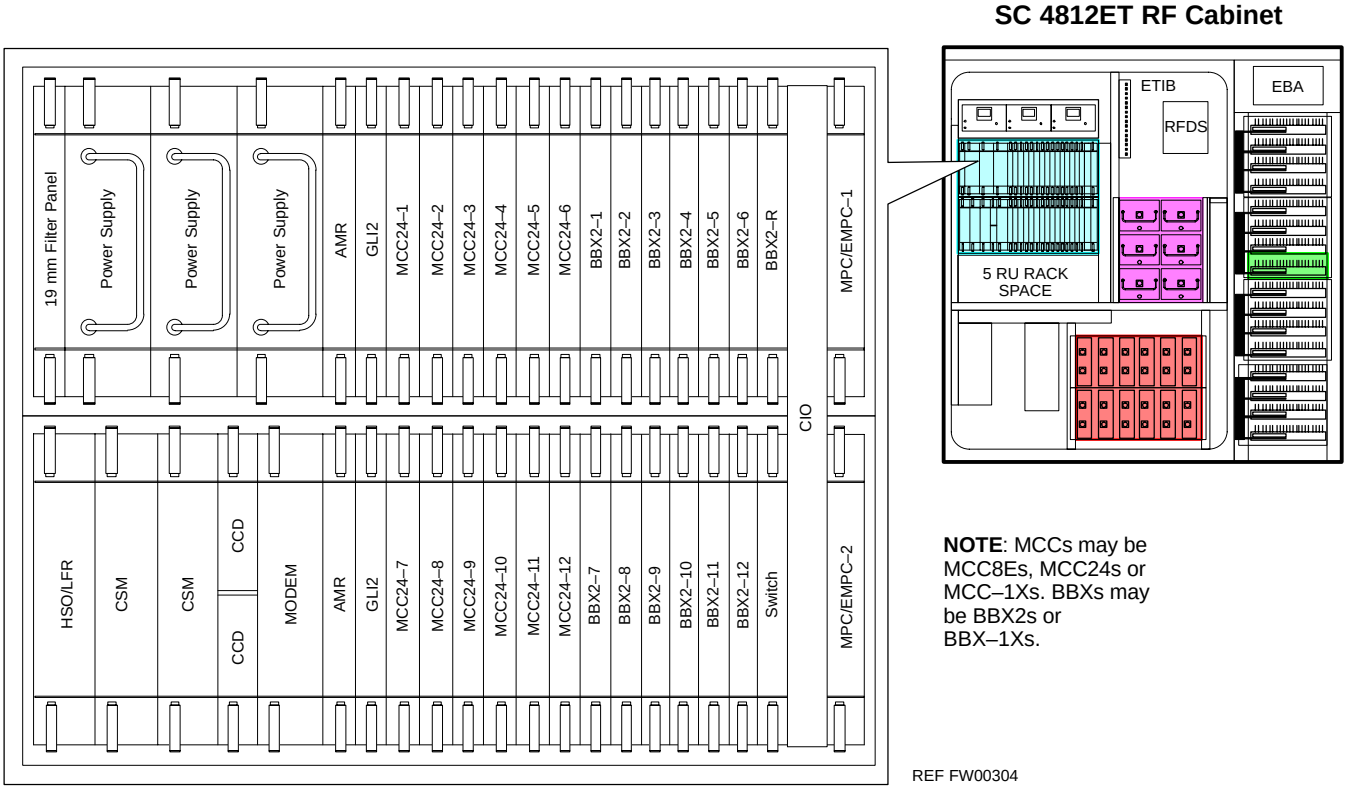
The Combiner Cage holds the transmit band pass filters, 2:1 combiners, or 4:1 combiners, depending on system configuration.

Combined CDMA Channel Processor Shelf

The C–CCP shelf contains the following (see Figure 1-5):

- High Stability Oscillator (HSO) or Low Frequency Receiver (LFR) card (1)
- Clock Synchronization Manager (CSM)card (2 – one with GPS receiver)
- CDMA Clock Distribution (CCD) cards (2)
- Power Supply cards (2 minimum, 3 maximum)
- Multicoupler Preselector Cards (MPC) or Expansion Multicoupler Preselector Cards (EMPC) (2)
- Alarm Monitoring and Reporting (AMR) cards (2)
- Multi Channel CDMA (MCC8E, MCC24s or MCC–1Xs) cards (up to 12)
- Broadband Transceiver (BBX2s or BBX–1Xs) cards (up to 13)
- Combined Input/Output (CIO) card (1)
- Group Line Interface (GLI2) cards (2)
- BBX2 Switch card (1)
- Modem (optional)
- Filler Panels (as required)
- Fan Module (3)

Figure 1-5: SC 4812ET C–CCP Shelf



Punch Block

The Punch Block is the interface point of the RF Cabinet between the T1/E1 span lines, the Customer I/O, alarms, multi–cabinet timing (RGPS and RHSO), and Pilot Beacon control (optional). (see Figure 1-7).

Span I/O Board

The Span I/O Board provides the interface for the span lines from the CSU to the C–CCP backplane (see Figure 1-7).

RF Diagnostic Subsystem

The RFDS provides the capability for remotely monitoring the status of the SC 4812ET RF Transmit and Receive paths (Figure 1-8).

Heat Exchanger

The Heat Exchanger provides cooling to the internal compartment of the RF Cabinet. The fan speed of the heat exchangers adjusts automatically with temperature. The Heat Exchanger is located in the primary front door of the RF Cabinet.

SC 4812ET Interface Board (ETIB) & LPA Control Brd (LPAC)

The ETIB is an interconnect board showing status LEDs for the RF Cabinet, as well as providing secondary surge protection. The LPAC board provides the interface for the LPA connection.

SC 4812ET Trunking Backplane

The Trunking Backplane contains a complex passive RF network that allows RF signals to share the resources of a bank of four LPAs. It also provides DC Power and digital interconnect.

Figure 1-6: SC 4812ET Intercabinet I/O Detail (Rear View)

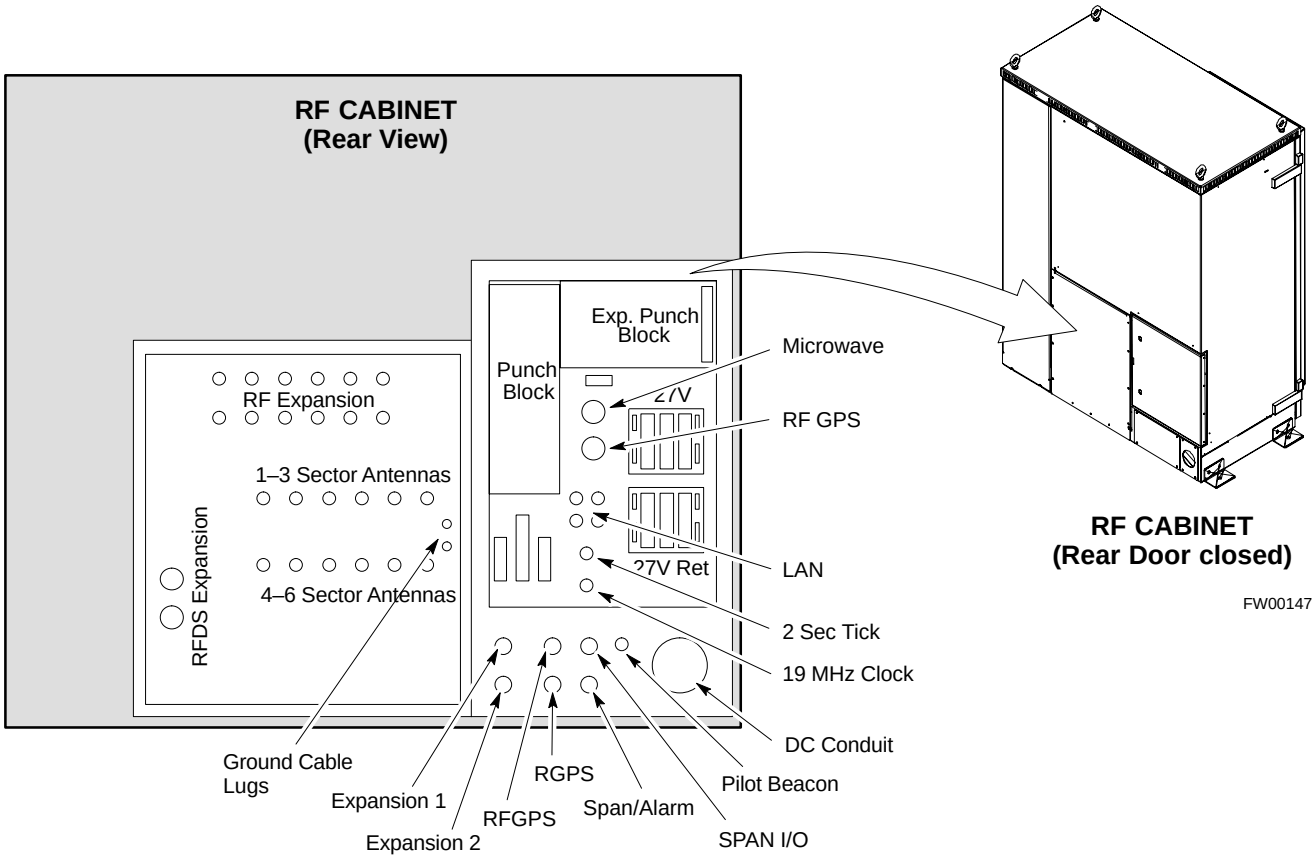


Figure 1-7: SC 4812ET I/O Plate Diagram

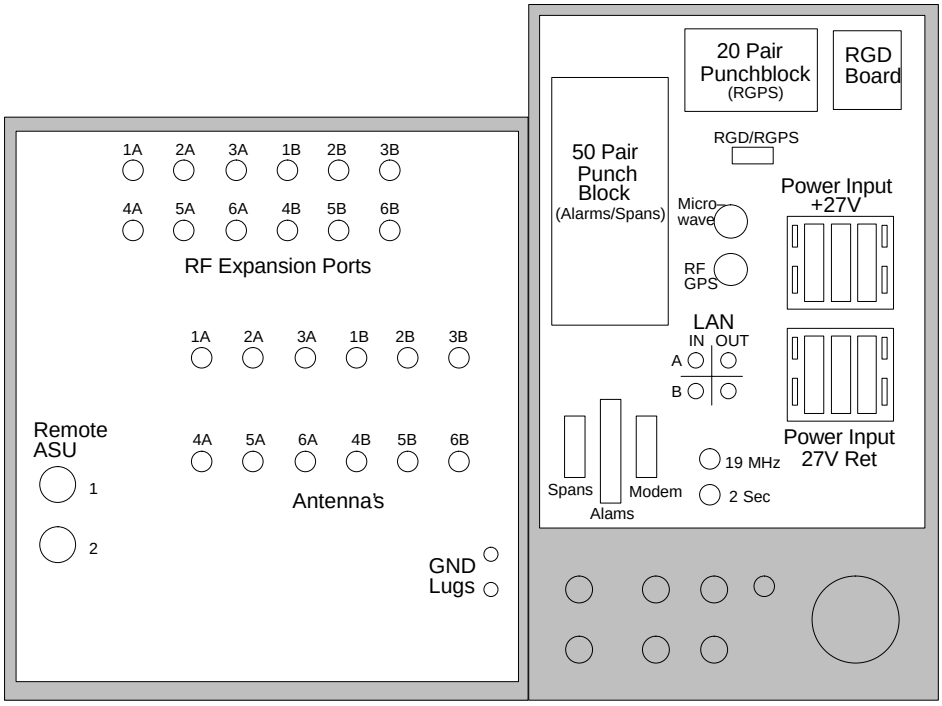


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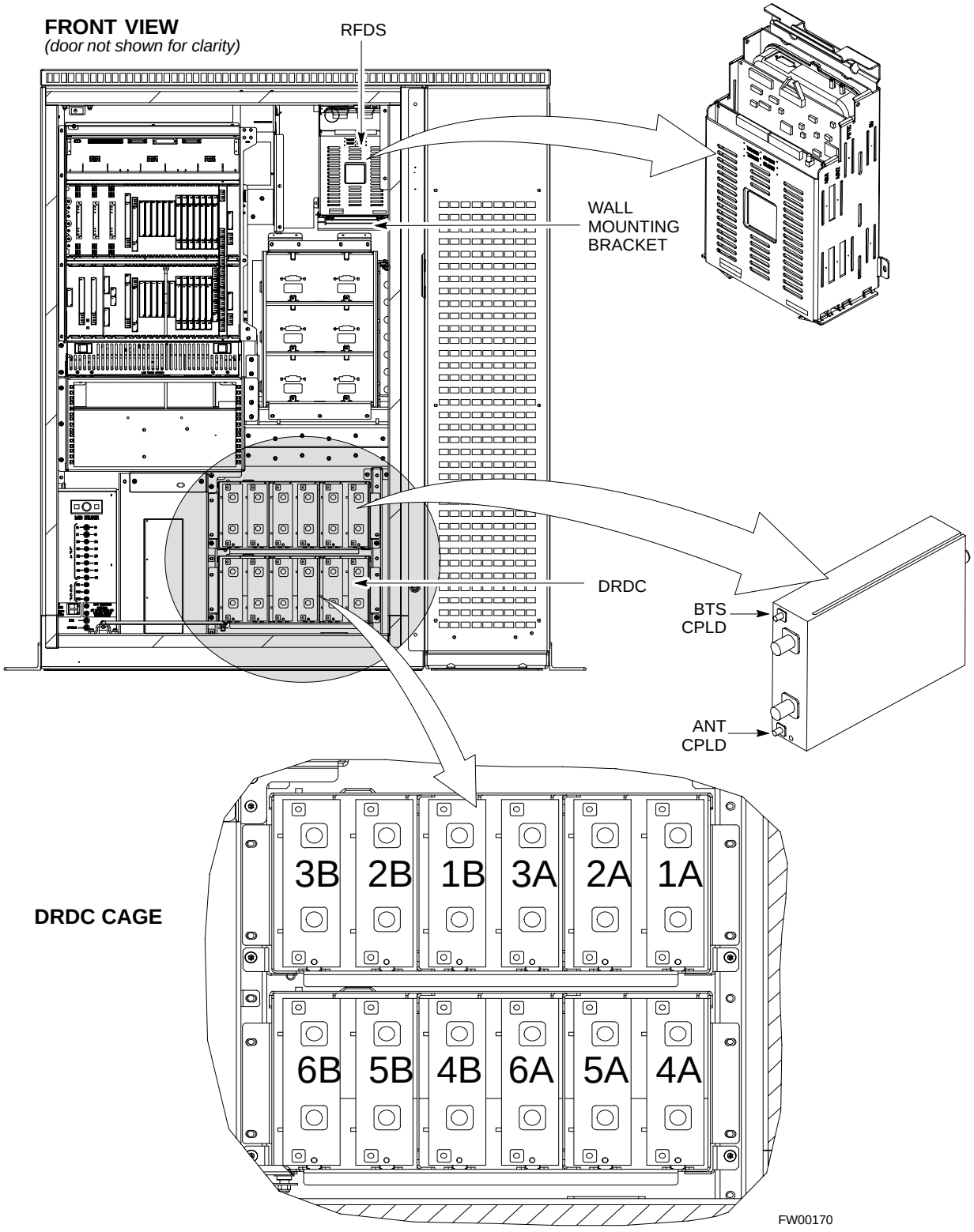
Figure 1-8: RFDS Location in an SC 4812ET RF Cabinet



Sector Configuration

There are a number of ways to configure the BTS frame. Table 1-5 outlines the basic requirements. When carrier capacity is greater than two, a 2:1 or 4:1 cavity combiner must be used. For one or two carriers, bandpass filters or cavity combiners may be used, depending on sectorization and channel sequencing.

Table 1-5: BTS Sector Configuration

Number of carriers	Number of sectors	Channel spacing	Filter requirements
1	3 or 6	N/A	Bandpass Filter, Cavity Combiner (2:1 or 4:1)
2	6	Non–adjacent	Cavity Combiner (2:1 Only)
2	6	Adjacent	Dual Band Pass Filter
2	3	Non–adjacent	Cavity Combiner (2:1 or 4:1)
2	3	Adjacent	Bandpass Filter
3,4	3	Non–adjacent	Cavity Combiner (2:1 or 4:1)
3,4	3	Adjacent	Cavity Combiner (2:1 Only)

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

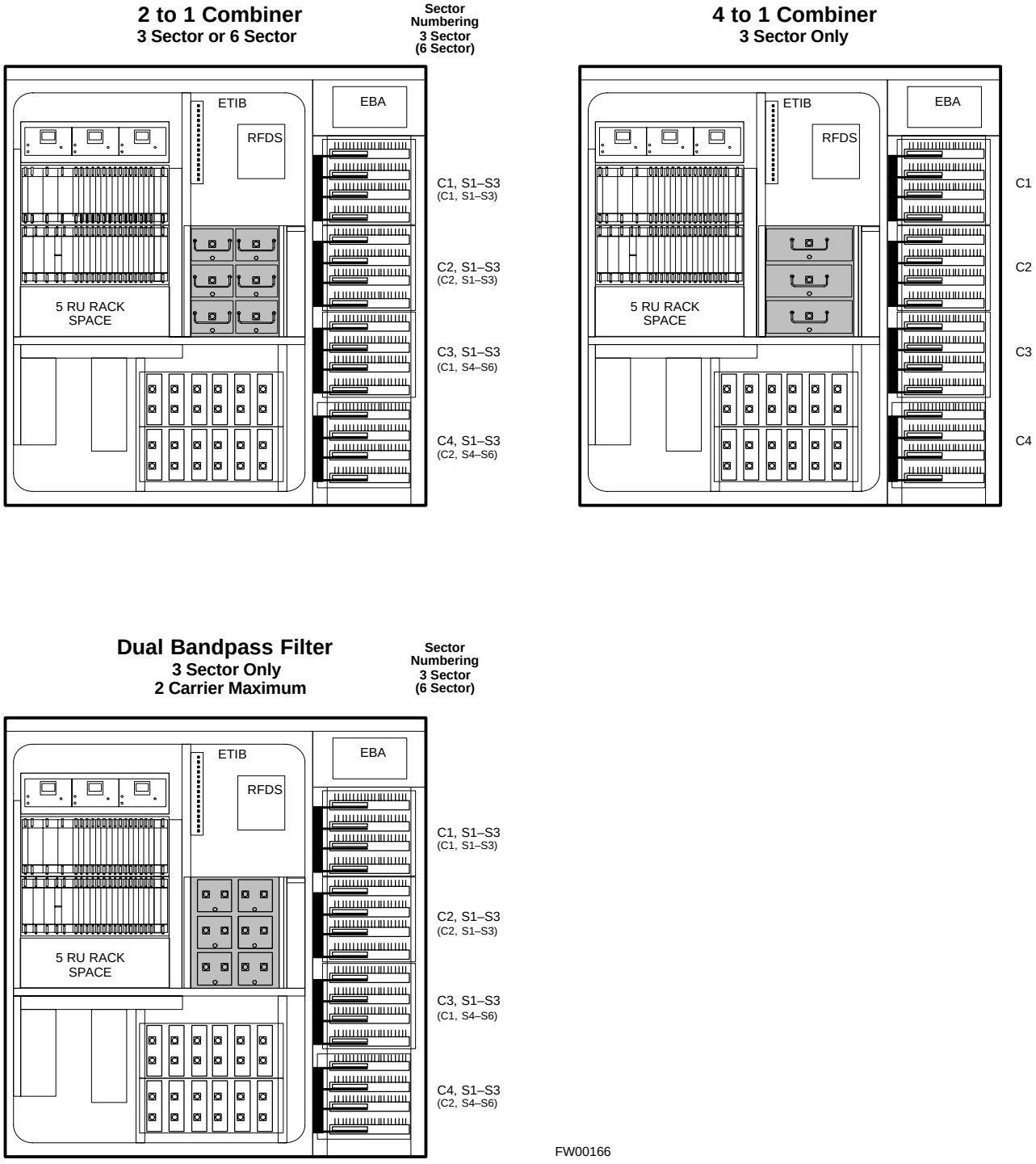
NOTE

In Table 1-6, BBXs may be BBX2s or BBX–1Xs.

Table 1-6: Sector Configurations

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

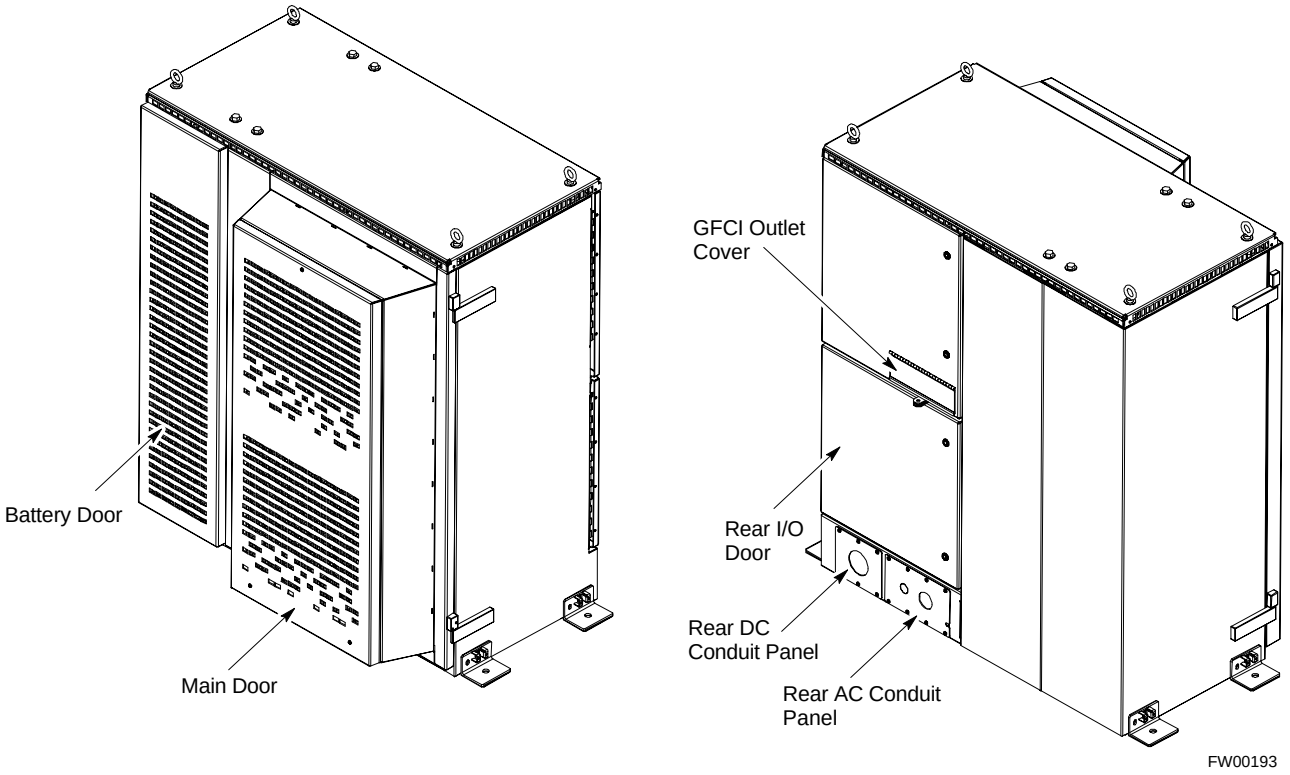
Figure 1-9: SC4812ET LPA Configuration with Combiners/Filters



Power Cabinet

Figure 1-10 illustrates the Power Cabinet design.

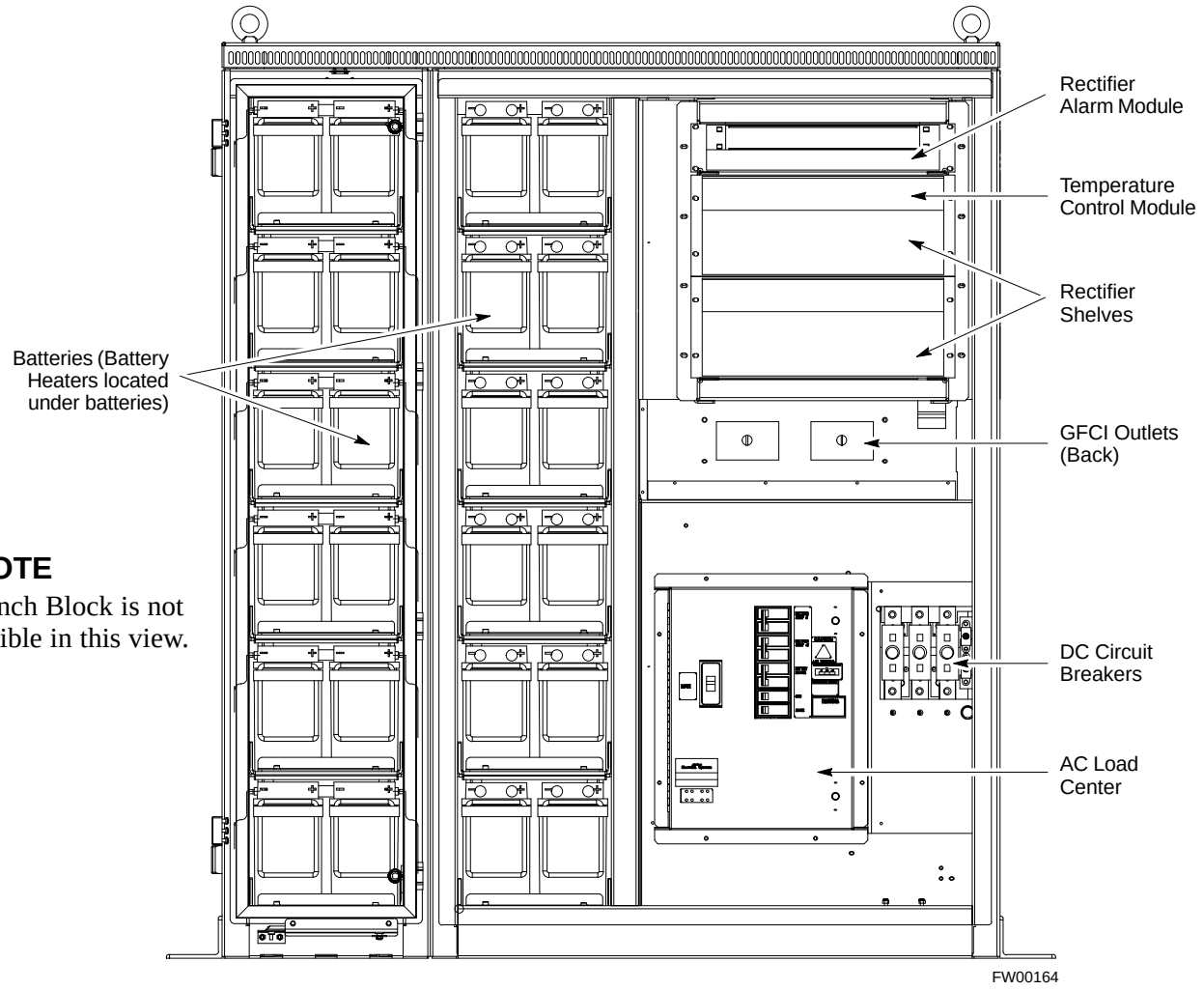
Figure 1-10: Power Cabinet



Power Cabinet Internal FRUs

Figure 1-11 shows the location of the Internal Field Replaceable Units (FRUs). A brief description of each Internal FRU is found in the following paragraphs.

Figure 1-11: Power Cabinet with Batteries Installed (Doors Removed for Clarity)



FRONT VIEW POWER CABINET

NOTE
Punch Block is not visible in this view.

Batteries

The batteries provide a +24 Vdc backup to the RF Cabinet should AC Power be lost. The Power Cabinet can accommodate a total of 24 12–V batteries, configured in 12 strings of 2 batteries each. The time duration of backup provided depends on system configuration.

Battery Heater

The battery heaters provide heating to the batteries in the Power Cabinet. A separate heater is required for each string of batteries. The heater is a pad the batteries sit on located top of each battery shelf. The number of heaters is dependent on system configuration.

Battery Compartment Fan

The battery compartment fan provides air circulation for the two battery compartments. It is located on the inside of the battery compartment door.

Heat Exchanger

The Heat Exchanger provides cooling to the rectifier compartment of the Power Cabinet. The Heat Exchanger is located in the primary front door of the Power Cabinet.

Rectifiers

The +27 Vdc rectifiers convert the AC power supplied to the Power Cabinet to +27 Vdc to power the RF Cabinet and maintain the charge of the batteries.

AC Load Center

The ACLC is the point of entry for AC Power to the Power Cabinet. It incorporates AC power distribution and surge protection.

Punch Block

The Punch Block is the interface for the alarm signalling between the Power Cabinet and the RF Cabinet.

Chapter 2: Preliminary Operations

Table of Contents

Notes

Preliminary Operations: Overview

Introduction

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

Cellsite Types

Sites are configured as with a maximum of 4 carriers, 3–sectored with a maximum of 4 carriers, and 6–sectored with a maximum of 2 carriers. Each type has unique characteristics and must be optimized accordingly.

CDF

The Cell-site Data File (CDF) contains site type and equipage data information and passes it directly to the LMF during optimization. The number of modem frames, C–CCP shelves, BBX2 and MCC24E/MCC8E boards (per cage), and linear power amplifier assignments are some of the equipage data included in the CDF.

Site Equipage Verification

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

CAUTION

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

Initial Installation of Boards/Modules

Table 2-1: Initial Installation of Boards/Modules

Step	Action
1	Refer to the site documentation and install all boards and modules into the appropriate shelves as required. **Verify they are NOT SEATED at this time.**
2	As the actual site hardware is installed, record the serial number of each module on a “Serial Number Checklist” in the site logbook.

2

Setting Frame C–CCP Shelf Configuration Switch

If the frame is a Starter BTS, the backplane switch settings behind the fan module should be set to the ON position (see Figure 2-1).

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

Figure 2-1: Backplane DIP Switch Settings