ZXC10 CBTS

cdma2000 Compact Base Transceiver Station

Technical Manual

Version 1.0

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FCC & IC STATEMENT

Before using this product, read this important RF energy awareness and control information and operational instructions to ensure compliance with the FCC and IC RF exposure guidelines.

NOTICE: Working with the equipment while in operation, may expose the technician to RF electromagnetic fields that exceed FCC rules for human exposure. Visit the FCC website at www.fcc.gov/oet/rfsafety to learn more about the effects of exposure to RF electromagnetic fields.

Changes or modifications to this unit not expressly approved by the party responsible for compliance will void the user's authority to operate the equipment. Any change to the equipment will void FCC and IC grant.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the FCC and IC Rules. 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.

For OUTDOOR use, a PNALE Antenna with a maximum gain of 17dBi is authorized for use with this unit. Outside antennas must be positioned to observe minimum separation of 3.0M (9.84 feet.) for 800MHz unit and 2.5M (8.2 feet.) for 1900MHz unit from all users and bystanders. For the protection of personnel working in the vicinity of outside (uplink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of an OUTDOOR antenna must be such that, under normal conditions, all personnel cannot come within 3.0M (9.84 feet.)for 800MHz unit and 2.5M (8.2 feet.) for 1900MHz unit from the outside antenna. Exceeding this minimum separation will ensure that the worker or bystander does not receive RF-exposure beyond the Maximum Permissible Exposure according to section 1.1310 i.e. limits for Controlled Exposure.

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About this Manual

Purpose of This Manual

Current radio mobile networks include CDMA and GSM systems, both are on the way to evolving into 3G radio mobile networks. The purpose of this book is to provide a clear understanding of the technology adopted in 3rd-generaton (3G) networks and build a systematic understanding of the working principles, performance indices, hardware structure and system configuration of ZTE 3G cdma2000 compact-model base station transceiver. This book is intended to help readers make better use of other relevant product literature and lay the foundation for system operation and maintenance.

The all-IP base station mentioned in this manual refers to the base station of cdma2000 system.

In this book, ZXC10 CBTS is briefed as BTS, ZXC10 BSCB, as BSC and ZXC10 BSSB, as BSS.

How to Use This Manual

This manual consists of five chapters:

Chapter 1 System Overview

It describes the position and functions of the BTS in the CDMA system and presents the standards followed by ZXC-BTS.

Chapter 2 Hardware

It describes the overall hardware structure and module functions of the BTS.

Chapter 3 Software

It describes the software structure and function modules of the software in BTS.

Chapter 4 Networking and Configuration

It describes the connection, networking modes and configurations of BTS.

Chapter 5 Technical Indices

It describes briefly the performance indices of BTS.

Appendix A Abbreviations

It lists the abbreviations used in this manual and other common ones concerning CDMA topics.

Typographical Conventions

ZTE documents employ with the following typographical conventions.

TYPOGRAPHICAL CONVENTIONS

Typeface	Meaning
Italics	References to other guides and documents.
	Note: Provides additional information about a certain topic.

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Chapter 1

System Overview

In this chapter, you will learn about:

- Position of BTS in the CDMA system
- Architecture, functions and features of BTS
- Standards followed by BTS

Position of BTS in the CDMA System

The Base Transceiver Station (BTS) connects a Mobile Station (MS) to the mobile network in a mobile communications system through its radio interface functionalities. It best reflects the radio transmission features in a CDMA system.

BTSB (all-IP BTS), developed by ZTE Corporation, is an IP-based new generation BTS that is designed to fill in the varying needs of our customers. It features large capacity, abundant transmission modes and high adaptability.

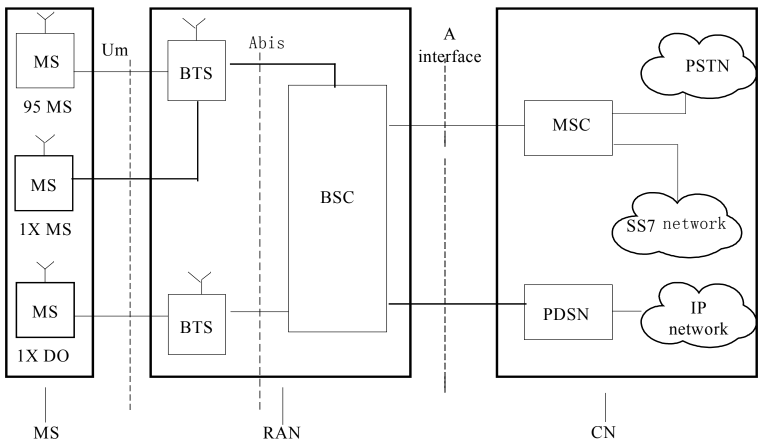
An all-IP network is made up of three parts: MS (Mobile Station), RAN (Radio Access Network) and CN (Core Network).

- MS: A mobile phone, mobile station or mobile terminal;
- RAN: Located between MS and CN and connects these two parts. It processes radio signals and consists of two parts: BSCB/PCF/IWF (combined as BSCB) and BTS;
- CN: Provides authentication at the network side and interfaces with a public network.

As a member of the BTSB family, ZXC10 CBTS is special for its compact structure, in addition to other advantages such as large capacity and high integration level.

The position of BTS in Base Station Subsystem (BSS) is shown in Fig. 1.

FIG. 1 POSITION OF BTS IN BSS



As seen from the diagram, BTS is located between mobile stations (MSs) and the Base Station Controller (BSC). It encodes, decodes, modulates and demodulates CDMA signals, performs up-conversion and down-conversion for subscriber data, amplifies RF power, and transmits / receives radio signals.

System Features

Multiple Frequency Bands Supported

BTS supports frequency bands of 450 MHz, 800 MHz, 850 MHz, 1900 MHz and 2100 MHz, as shown in Table 1.

TABLE 1 FREQUENCY BANDS SUPPORTED BY BTS

Serial No.	Frequency Band	Upper Frequency Limit (MHz)	Lower Frequency Limit (MHz)
1	800 MHz (Band Class 0)	824~849	869~894
2	1900 MHz (Band Class 1)	1850~1910	1930~1990
3	450 MHz (Band Class 5)	450~457.5	460~467.5
4	2100 MHz (Band Class 6)	1920~1980	2110~2170
5	850 MHz (Band Class 10)	806~821	851~866

Large Capacity

- The LRFS (Local RFS) in one cabinet supports up to 12 carrier sectors and another 12 carrier sectors by connecting an RRFS (Remote RFS).
- Two combined BTS cabinets support up to 8-carrier 3-sector or 4-carrier 6-sector configuration, and another 8-carrier 3-sector or 4-carrier 6-sector configuration by connecting an RRFS.
- One BDS supports at least 4-carrier 3-sector configuration (CE resource of 4-carrier 3-sector for EV-DO, and 8-carrier 3-sector or 4-carrier 6-sector for 1X).
- The large capacity advantage of BTS allows for less BTS needed for traffic-hot areas, and in turn saves investment in transmission device, equipment room, power supply and telecom towers.

Compactness

- The compact BTS, as its name implies, is small in size and one cabinet (W700 × H800 × D800, unit: mm) has only two shelves. It is actually the smallest BTS ever produced by the industry.
- The compactness advantage plus high capacity requires less space for installing the BTS and also other auxiliary equipment.

Technological Advantages

- Support smooth evolution to 1X EV-DV and CDMA2000-3X.
- Employ all-IP architecture with large switching capacity, high QoS guarantee and robust reliability.

- Adopt the IP-based cUDP/PPPMux/MultilinkPPP for its Abis interface for higher transmission efficiency at a lower cost.
- Use the multi-frequency digital intermediate frequency technology to make do with less RF modules.
- Support transmission diversity, intelligent antenna and linear pre-distortion amplifier.
- High channel efficiency.
- Support different configurations such as 4-carrier 3-sector, 2-carrier 6-sector and 1-carrier 12-sector.
- Adopt high reuse-efficiency transmission system between its BDS and RFS subsystems and data of 24 carrier sectors can be transmitted over one fibre pair.
- Support dynamic downloading of board software, making upgrade and maintenance convenient.

High Reliability

- Advanced EMC (Electromagnetic Compatibility) and EMI (Electromagnetic Interference) design.
- The RRFS supports ring networking through fibres and link backup for switchover when necessary. Link switchover is independent of board switchover to enhance transmission reliability.
- The clock system is compatible with the GPS and GLONASS system.
- All important boards are configured in 1+1 hot backup mode.
- The GCM provides reliable clock for a short term and ensures the locked status of clock during 72 hours after the GPS synchronous signal is lost.

Flexible Networking

Abis interface for flexible networking:

- Support Ethernet direct connection for when BTS and BSC are installed in the same room or not far from each other.
- Support star, chain, tree and ring networking.
- Support 75 Ω / 120 Ω E1 interface, 100Ω T1 interface, and built-in SDH transmission interface.
- The BTS can use 220V AC or –48V DC and it has the built-in primary power supply.

Smooth Expansion and Upgrade

- All boards support hot swapping, convenient for online upgrade and maintenance.
- The Channel Module (CHM) can be configured easily as a subcard.

- One BDS supports up to 24 carrier sectors and more BDS shelves can be added to expand capacity.
- Capacity can be expanded with more channel modules and RF modules.
- Support RRFS with multiple sectors.
- Support CHM configuration of different scales in 1X system, as well as mixed configuration EV-DO and EV-DV CHMs.

Easy Operation and Maintenance

- Support order wire phone from a BTS to its BSC or to another BTS through the network management access of SDH.
- The RRFS is also available with an orderwire interface for communicating with the BDS and BSC.
- Provide online test and performance evaluation for the BTS through its BTM (BTS Test Module).
- Support local operation & maintenance of BTS through its 10M Ethernet test port to control BDS and RFS, test their functions and collect their performance parameters.
- Support online upgrade. Support remote downloading of logic, MCU MCU program, BOOT program and FLASH file.
- Provide graphical user interface for easy operation and maintenance. The interface shows the topology maps, tool bars and real rack layout.

Functions

BTS functions as a bridge connecting mobile stations to BSC in the CDMA system. Details are given below:

- BTS communicates with MS (mobile station) through a CDMA air interface.
- BTS communicates with BSC (Base Station Controller) through an Abis interface.
- In the forward link, BTS first receives data from BSC through the Abis interface, then encodes and modulates the data, next converts baseband signals into radio frequency signals, finally transmits them through a power amplifier, the radio frequency front end (RFE) and an antenna.
- In the reverse link, BTS first receives weak radio signals through the antenna feeder and RFE. The signals then undergo low noise amplification, down frequency conversion, and decoding and demodulation. Finally, BTS sends the data through the Abis interface to BSC.

International Standards Followed by BTS

1. 3GPP2 C.S0002-A version 6.0 (IS-2000 Release A).
2. 3GPP2 A.S0001-A version 2.0 (3G-IOSv4.1).
3. 3GPP2 A.S0011-A v1.0 (3G-IOS v4.3).
4. ANSI J-STD-008, Personal Station-Base Station Compatibility Requirement for 1.8 to 2.0 GHz Code Division Multiple Access (CDMA) Personal Communications System, 1996.
5. TIA/EIA/TSB-74, Support for 14.4 Kbps Data Rate and PCS Interaction for Wideband Spread Spectrum Cellular System, 1995.
6. TIA/EIA/IS-95-A, Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular Systems.
7. TIA/EIA/IS-95, Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular Systems.
8. TIA/EIA/IS-637 Short Message Services for Wideband Spread Spectrum Cellular Systems, 1997.
9. TIA/EIA/IS-127, Enhanced Variable Rate Codec Speech Service Option 3 for Wideband Spread Spectrum Digital Systems, 1996.
10. TIA/EIA/IS-658, Data Service Interworking Function Interface for Wideband Spread Spectrum Systems.
11. CDG RF36, Markov Service Option for Wideband Spread Spectrum Communications Sytems.
12. TIA/EIA/IS-725, Over-the-Air Service Provisioning of Mobile Stations in Wideband Spread Spectrum Systems, 1997.
13. TIA/EIA/IS-728, Inter-System Link Protocol.
14. TIA/EIA/IS-733, High Rate Speech Service Option 17 for Wideband Spread Spectrum Communication Systems.
15. TIA/EIA/IS-707, Data Service Options for Wideband Spread Spectrum Systems, 1998.
16. TIA/EIA/IS-707-A-2 Data Service Options for Spread Spectrum Systems Addendum 2, 2000.
17. ITU-T Q.714 Signaling connection control part (SCCP).
18. ITU-T Q.704 Signal link (MTP3).
19. ITU-T Q.703 Signal link (MTP2).
20. 3GPP2 C.S0024, cdma2000 High Rate Packet Data Air Interface Specification，December 2001.
21. 3GPP2 A.S0007, 1xEV-DO Inter-Operability Specification (IOS) for cdma2000 Access Network Interface, June 2001.

22. 3GPP2 C.S0029, Test Application Specification (TAS) for High Rate Packet Data Air Interface, July 2001.

23. TIA/EIA/IS-97D，Recommended Minimum Performance Standards for Base Stations Supporting Dual Mode Spread Spectrum Systems, 2001.

Chapter 2

BTS Hardware

In this chapter, you will learn about:

- Hardware structure
- Composition of subsystems
- Features and functions of each subsystem

Hardware Structure

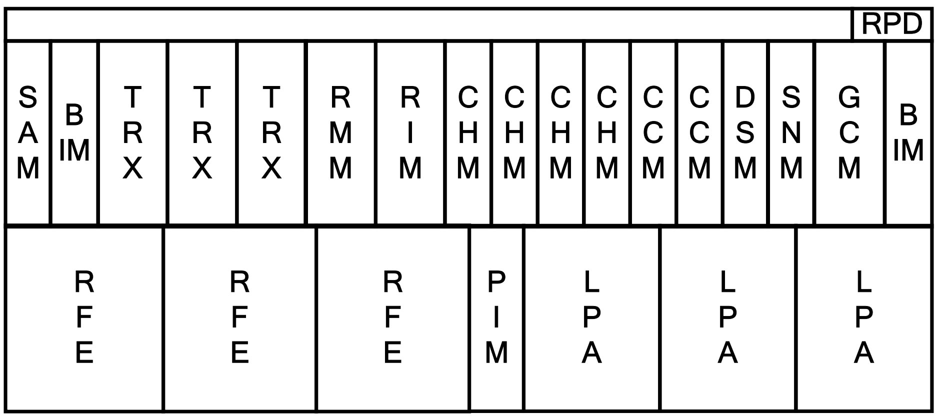
A BTS is made up of BDS, RFS and PWS (optional) in terms of hardware. Physically, they are racks, shelves and boards.

The hardware structure of BTS can be seen either from a physical or logical point of view. This chapter describes the hardware structure of BTS, however, for more information on the boards, please refer to *ZXC10 CBTS (V1.0) cdma2000 Compact Base Transceiver Station Hardware Manual*.

BTS Physical Structure

Fig. 2 shows the physical structure of a BTS cabinet.

FIG. 2 BTS PHYSICAL STRUCTURE

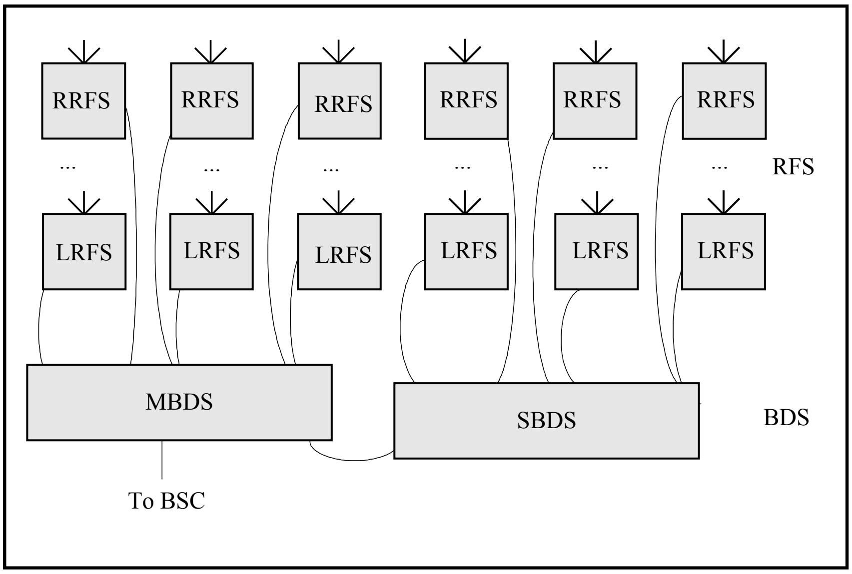


As the above figure shows, BTS is physically divided into two shelves. The top one has 17 slots for accommodating the BDS and TRX boards and the bottom one has 7 slots for the RFE, LPA and PIM boards.

Logical Structure

BTS is logically divided into BDS and RFS, as shown in Fig. 3. The PWS is also necessary in case there is no available −48V DC secondary power supply on site.

FIG. 3 BTS LOGICAL STRUCTURE



1. BDS

   BDS is further divided into three functional entities: BCS (BTS Communication Subsystem), BBS (BTS Baseband Subsystem) and TFS (Time Frequency Subsystem).

   One BTS suffices for configuration no higher than 12 carrier sectors. Two BTS cabinets can be combined for configuration higher than 12 carrier sectors. For two combined cabinets, one is the master one (Master BDS, MBDS) and the other is the slave one (Slave BDS, SBDS). MBDS and SBDS have the same structure and working principle but with different configurations.

2. RFS

   RFS is further divided into two parts: TRX and PA + RFE amplifier + RFE subsystem. Its work includes some baseband processing, IF processing, digital-to-analog conversion, RF modulation and demodulation, forward signal power amplification, and backward signal low noise amplification.

   Please note that an RFS can be an LRFS (Local RFS) or RRFS (Remote RFS), to meet different networking needs. If no otherwise specified, the RFS in this book refers to an LRFS.

3. PWS

   This subsystem supplies power to the whole BTS and it comprises primary power supply (converts 200 V/1110 V AC to −48 V DC, optional part) and secondary power supply (converts –48 V DC to what is needed by the BTS boards).

A description of BTS hardware (logical) focused on board functions is given below.

List of All BTS Boards

All BTS boards are listed in Table 2.

TABLE 2 BTS BOARDS

Abbreviations	Full Name
BDS	
CCM	Communication Control Module
DSM	Data Service Module
CHM	Channel Processing Module
RIM	RF Interface Module
GCM	GPS Control Module
SNM	SDN Network Module
SAM	Site Alarm Module
BIM	BDS Interface Module
RFS	
RMM	RF Management Module
TRX	Transmitter and Receiver
BTM	BTS Test Module
LPA	Linear Power Amplifier
PIM	Power Amplifier Interface Module
RFE	Radio Frequency End
PWS	
APD	AC Power Distribute
PMM	Power Monitor Module
PRM	Power Rectifier Module
RPD	RFS Power Distribute

BDS

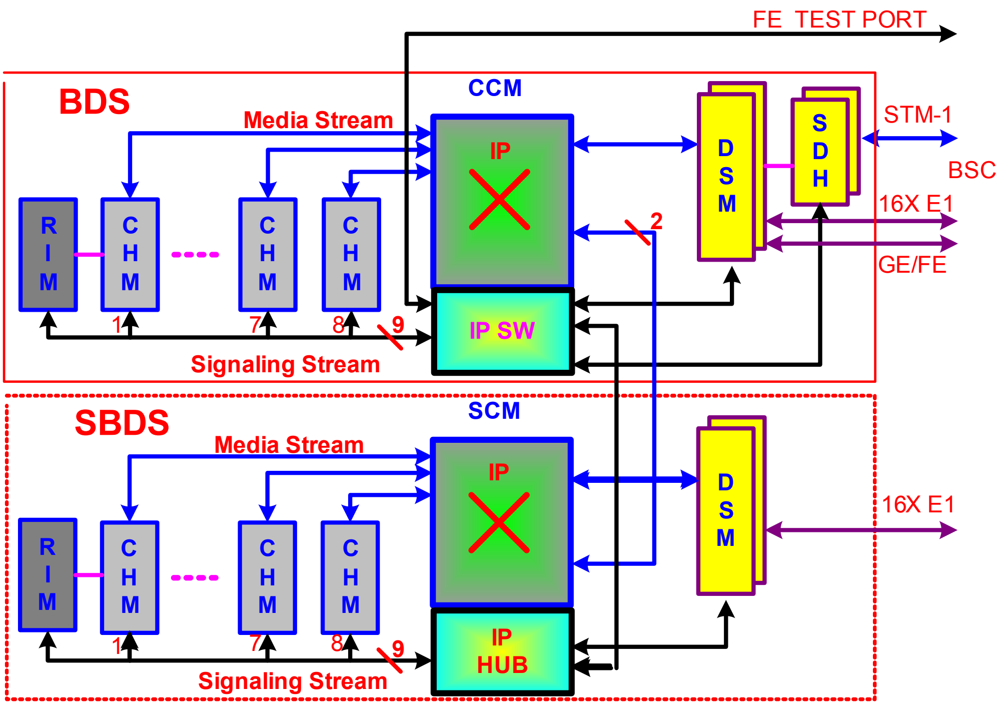
BDS is the control center and communication platform of the BTS. In BDS we see many key CDMA technologies, such as diversity technology, RAKE reception, softer handoff and power control. .

Located between BSC and RFS, BDS connects the two and it is responsible for baseband signal modulation / demodulation and encoding / decoding, and generation / distribution of clocks for the whole BTS.

BDS Schematic Diagram

Fig. 4 shows the working principle of BDS.

FIG. 4 BDS SCHEMATIC DIAGRAM



As seen from the diagram above, the components of BDS are:

- CHM: performs CE processing (spread-spectrum modulation and despread-spectrum demodulation). The CHM of each BDS is a CE resource-sharing pool.
- RIM: provides interface to connect BDS and RFS, and performs forward signal summation and backward signal distribution. It also distributes clocks from GCM to CHM and CCM.

- CCM: performs BTS control and network switching. Two CCM boards can be configured, one active and the other standby. For a single rack or in the MBDS of combined racks, it’s the CCM board. In the SMDS of combined racks, it’s the SCM board.
- DSM: provides Abis interface to connect with BSC.
- SNM: An optional board that works as the SDH interface.
- SAM: monitors environment indices, including temperature, humidity, smog and dust.
- GCM: receives synchronous signals from the satellite to generate system clocks consistent with the UTC (Coordinated Universal Time). Two GCMs (active + standby) can be configured.
- BIM: provides interfaces between master and slave racks, between BDS and RFS, and between BTS and BSC.

BDS Working Principle

The call processing flow in BDS is as follows.

- Forward call processing flow

  In the forward link, DSM receives and decompresses the packets coming from the Abis interface. After that, the packets are resolved into media stream and control stream.

  The media stream is switched on the media stream IP communication platform of CCM, then goes to CHM, gets encoded and modulated, changed to forward baseband data stream. Next it goes to RIM for summation and is finally sent to RFS.

  The control stream is switched on the control stream IP communication platform of CCM. Then it goes to CHM or CCM.

- Reverse call processing flow

  The reverse call data stream coming from RFS is distributed by RIM to all CHMs. In CHM the data stream is decoded and demodulated and then put into packets again before being sent to CCM for switching. The switched packets are then sent to DSM to be packaged and compressed once again. Finally the packets are sent to BSC.

Technological Advantages of BDS

- An all-IP platform. It uses two Ethernets to switch and control the media stream and control stream.
- Two Ethernets for the switching and transmission of media stream and signaling (control) stream
- High integration: baseband CE resource of 12 carrier sectors for EV-DO and 24 carrier sectors for 1X
- Channel sharing: the baseband CE resource (a shared pool) for 12/24 carrier sectors can be used by any sectors through static or dynamic CE assignment.

- With the standard "BDS-RFS interface", the BDS and RFS can be installed in the same or different cabinets.
- The future-proof design of BTS supports a smooth evolution path to 1X EV-DO, 1X EV-DV or CDMA2000-3X. Different CHMs (CHM0 and CHM1) can be used in BDS, therefore the same BTS can support both CDMA2000-1X and EV-DO services at the same time.
- In the case BSC and BTS are installed in the same room, BDS can provide Ethernet interface so as to avoid complex Abis protocol processing. This is an economy and also reliability-enhancing approach.

BDS Hardware Configuration

The BDS shelf has 17 slots as shown below. All boards given here are BDS boards.

FIG. 5 BDS CONFIGURATION

BDS																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SAM						RIM	CHM	CHM	CHM	CHM	CCM	CCM	DSM	SNM	GCM	BIM

Note:

There are two types of CHM boards, CHM0 and CHM1, for 1X and EV-DO services respectively.

As seen from the board layout, two CCM boards are configured: one active and the other standby. SNM is an optional board that is necessary only when there is no available optical transmission on site. For a full configuration of BDS, there are four CHM slots to deliver pure 1X service with 24 carrier sectors, or pure EV-DO service with 12 carrier sectors. Besides, the number of CHM boards can be adjusted to adapt to the capacity requirement.

The SBDS is required if there are more than 12 carrier sectors. Fig. 6 below shows a fully configured SBDS shelf.

FIG. 6 SBDS CONFIGURATION

SBDS																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SAM						RIM	CHM	CHM	CHM	CHM	SCM	SCM				BIM

The SBDS has no GCM, DSM and SNM boards (while the MBDS does). The CCM board in MBDS is changed to SCM in SBDS.

RFS

The RFS (radio frequency subsystem) in a mobile cellular network is used basically for air interfacing through the antenna. The RFS in a CDMA system equipped by such technologies as power control, cell breathing, soft handoff, GPS timing, and diversity reception is different from those in other cellular networks.

Besides the function related with the air interface, RFS connects to BDS through the RMM board. It also transmits CDMA signals after modulation and receives CDMA signals after demodulation. It has other functions such as detection, monitoring, configuration, control, and cell breathing, blossoming and wilting.

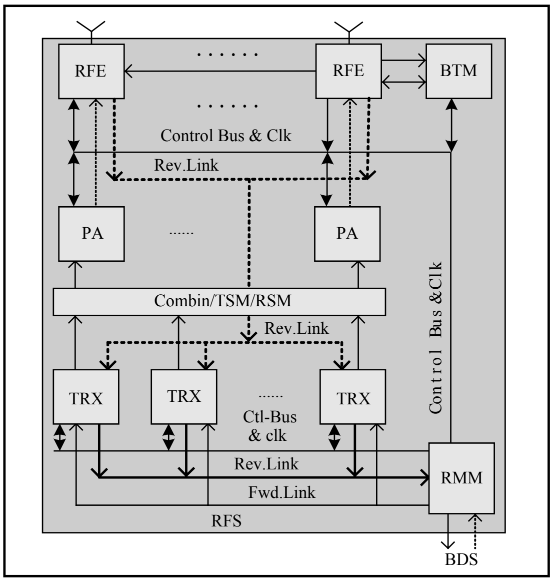
The whole RFS subsystem consists of the antenna feeder system outside BTS and the TRX, HPA and RFE (the parts that are involved in signal transmission and reception) inside BTS. A typical antenna feeder system is made up of the antenna, antenna jumper, main feeder, lightning arrester, rack-top jumper, and other components for grounding.

Further description on the antenna feeder system is omitted in this book. If not otherwise specified, the RFS in this book refers to its parts inside BTS.

RFS Schematic Diagram

Located between BDS and MS (Mobile Station), RFS connects to the BDS through a data interface and to the MS through the air RF interface. Its working principle is shown in Fig. 7.

FIG. 7 RFS SCHEMATIC DIAGRAM



Functions of RFS are:

- TRX: performs signal up- and down-frequency conversion.
- RMM: Connects RFS and BDS.
- LPA: performs signal power amplification on the forward link.
- RFE: performs low noise amplification, being the interface between RFS and the antenna feeder.
- BTM: performs the radio test for the BTS.
- PIM: works as the interface of power amplifier.

RFS Working Principle

Call processing flow in RFS is as follows.

- In the forward link, the data stream from the BDS converges in RMM and then is distributed to TRX. The stream in TRX changes to intermediate frequency (IF) signals first and then goes to RFE for up-conversion. The RF signals generated are finally transmitted through RFE and antenna feeder after power amplification.

- In the reverse link, the radio signals received from the antenna run through the LPA of RFE to the TRX for down-conversion processing. They become IF signals first, undergo digital IF processing, then turn into sample signals of the BDS, and are finally sent to RMM. RMM puts all data sent from TRX into a packet and sends it to BDS.
- The GCM board in BDS provides clock signal for RIM. RIM then provides RFS with the clock signal.

Technological Advantages of RFS

- LRFS and RRFS are both RFS but with different applications. As one BTS may have no more than one LRFS, it may connect to several RRFSs. While LRFS is always set up in the same equipment room as the BDS, RRFS can be placed miles away from the BDS in the cave, subway or other irregular locations.
- BDS and RFS can be connected in the star, chain or ring networking modes through the RIM.
- One TRX may provide the capacity of 4 carriers and adopt the LPA for 4 carriers.
- In a single cabinet, there can be 12 carrier sectors (1~4 carriers × 1~3 sectors).

Hardware Configuration

The RFS boards are located in both shelves of the BTS as shown below.

FIG. 8 RFE CONFIGURATION

RFS																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	BTM	TRX	TRX	TRX	RMM											

1	2	3	4	5	6	7
RFE	RFE	RFE	PIM	LPA	LPA	LPA

PWS

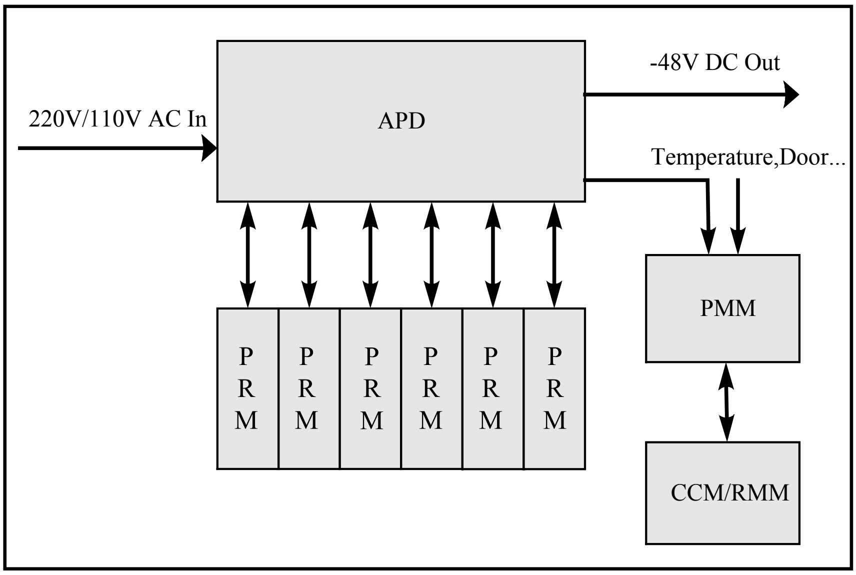
The PWS subsystem supplies power for the whole BTS cabinet. It converts AC to DC, performs power distribution and monitoring, and manages the storage battery.

A PWS can comprise the primary (not required if the –48 V is usable on site) and secondary power supply. The primary one converts 220 V/110 V AC to -48 V while the secondary one converts and distributes the –48 V DC again to ±12 V, ±5 V, 27 V, 3.3 V and 2.5V.

PWS Schematic Diagram

In the case the 220 V/110 V AC is available on site, the PWS works in the way as shown below:

FIG. 9 PWS SCHEMATIC DIAGRAM



Components of PWS include:

- PMM (Power Monitor Module): monitors the power system and reporting the status.
- APD (AC Power Distribution Module): Converts the 220 V/110 V AC to -48 V DC, used when the user provides the 220 V/110 V AC only.
- PRM (Power Rectifier Module): used for AC input and can be configured in 5+1 mode.
- RPD (RFS Power Distribute): converts –48 V to provide suitable power supplies for the RFS boards.

PWS Working Principle

The 220 V/110 V AC is distributed by APD first, then rectified by PRM, converted to primary power supply, next output as –48 V DC.

The primary –48 V DC is again converted and distributed by RPD into ±12 V, ±5 V, 27 V, 3.3 V and 2.5V for the RFS boards.

Hardware Configuration

The primary power supply part of PWS is an optional configuration that can be detached from the BTS. The RPD board is the secondary power supply part of PWS that is inseparable from the BTS.

This section covers the hardware configuration of the primary power supply only (see the diagram below). For configuration details of the secondary power supply, please refer to the hardware manual.

FIG. 10 PRIMARY POWER SUPPLY OF PWS

APD					
1	2	3	4	5	6
PMM	PRM	PRM	PRM	PRM	PRM

Chapter 3

BTS Software

In this chapter, you will learn about:

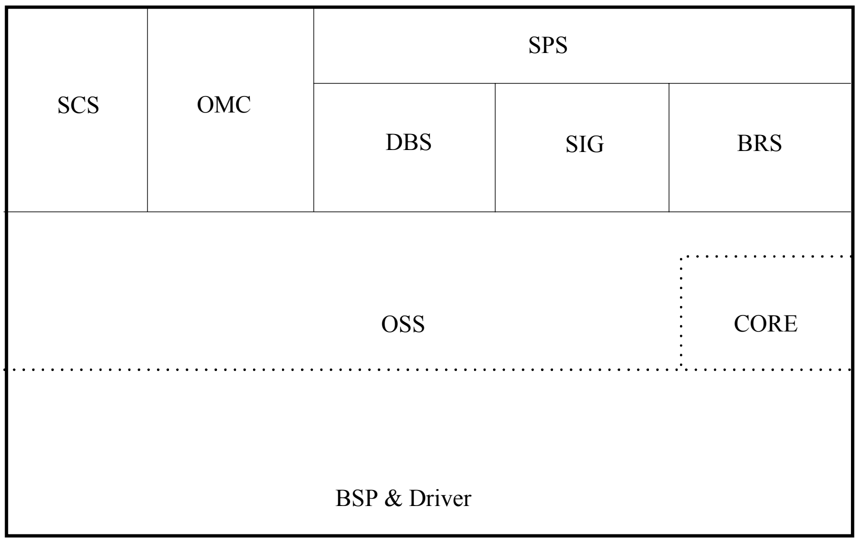
- BTS software subsystems and functions
- Software of CCM, CHM, RMM and TRX boards

BTS Software Overview

This chapter covers a brief introduction to the BTS software system, especially the software functions of boards CCM, CHM, RMM and TRX. For details of the BTS composition of software that is the same as that of BSC, refer to *ZXC10 BSCB (V1.0) cdma2000 Base Station Controller Technical Manual*.

In terms of functions, BTS software is composed of the following parts: OSS (Operation System Subsystem), SCS (System Control Subsystem), SPS (Service Processing Subsystem), OMC (Operation and Maintenance Center), BSP&Driver (operation system subsystem) and DBS (Database Subsystem), as shown in Fig. 11.

FIG. 11 BTS SOFTWARE STRUCTURE



The BTS software is distributed in various boards and the OMC.

1. SPS delivers cdma2000 1X, EV-DV services based on the air U_m interface standard (IS-2000).
2. OMC provides interfaces to authorized administrators and upper NM system for the purpose of operation & maintenance of the whole BTS.
3. DBS provides centralized management on BSS data and is the support system of the upper-layer applications (SPS and OMS).
4. BSP&Driver is the basis of all the other subsystems. It shields the hardware details from the subscriber process, and provides process dispatching, timer, communication and memory management services. The core of BSP&Drive is the commercial operating system kernel. Above the kernel is the encapsulation layer, which encapsulates the kernel system invoking and shields unnecessary functions from the

subscriber process. The encapsulation layer provides the subscriber process with necessary primitive and function invoking interfaces.

5. SCS performs monitoring, startup and version downloading of the BTS software system. It runs on the operating system and database subsystem.

CCM Software

CCM, Communication Control Module, is located in the BDS shelf. Functions of CCM software include:

- Allocate all BTS radio resources.
- Process related signaling for the voice and data services of the BTS it is responsible for.
- Implement centralized management on BTS data, including physical configuration data and wireless data.
- Communicate through the Ethernet and HDLC communication with the BSC and other boards of BTS.
- Monitor BDS and RFS boards and report alarms.
- Control power-on and configuration of other BTS boards.
- Support active / standby changeover of CCM.
- Support downloading and query of software version and logic of BTS boards.

CHM0 Software

CHM0 is responsible for the cdma20001x channel modulation and demodulation. Its functions are as follows.

- Provide communication interface with CCM.
- Modulate voice and data frames coming from CCM in the forward link, and send the modulated data to RIM.
- Demodulate antenna signals coming from the RIM through the BDS interface in the reverse link into voice and data frames, and send them to CCM for switching.
- Support the cdma2000 physical layer protocol: IS-2000-2 RELASE A.
- Support OTD (Orthogonal Transmit Diversity) and STS.
- Support forward links, including: pilot channels such as F-PICH, F-TDPICH, F-APICH and F-ATDPICH; control channels such as F-SYNCH, F-PCH, F-BCH, F-QPCH, F-CPCCH, F-CACH and F-CCCH; and traffic channels such as F-DCCH, F-FCH, F-SCH and F-SCCH. .
- Support reverse links, including: access channels such as R-ACH, R-EACH and R-CCCH; and traffic channels such as R-DCCH, R-FCH, R-SCH and R-SCCH.
- Support board hot swapping.
- Allow online version downloading via a transmission bus.
- Control system’s remote soft reset and backplane interface disabling .

CHM1 Software

Software CES-HRPD runs on CHM1 to deliver EV-DO service. It is designed on the CSM5500 chip.

CHM-HRPD runs under CES-HRPD control, and processes HRPD air interface control channel signaling and service data frames.

RMM Software

Functions of RMM software include:

- Monitor the RFS boards.
- Communicate with BDS boards and other RFS boards.
- Support downloading and query of RFS boards' software version and logic.
- Support power-on, address acquisition and data configuration of RFS boards.
- Manage RFS boards' status.
- Control the switchover of RFS fiber links.
- Control TRX switchover.
- Control PA switchover.
- Support the diagnostic test for RFS boards.

TRX Software

The TRX board is the core of RFS in a BTS. It is responsible for signal conversion in both forward and reverse links, including conversion from digital baseband signal to analog RF signals. It uses the digital IF and multi-carrier technologies.

TRX software provides the following functions.

- Query and report RSSI signal energy.
- Attenuation and gain control in both forward and reverse links.
- Configure RFS boards.
- Monitor board status.
- DSP configuration.
- Auto-scaling control.
- Diagnostic test of TRX board.
- Support cell blossom, wilting and breathing.
- Board backup control.
- If BTM is configured, it provides test signals for the transceiving devices located in the BTS sectors with the help of test MS, for the purpose of online test on system performance.

Chapter 4

BTS Networking and Configuration

In this chapter, you will learn about:

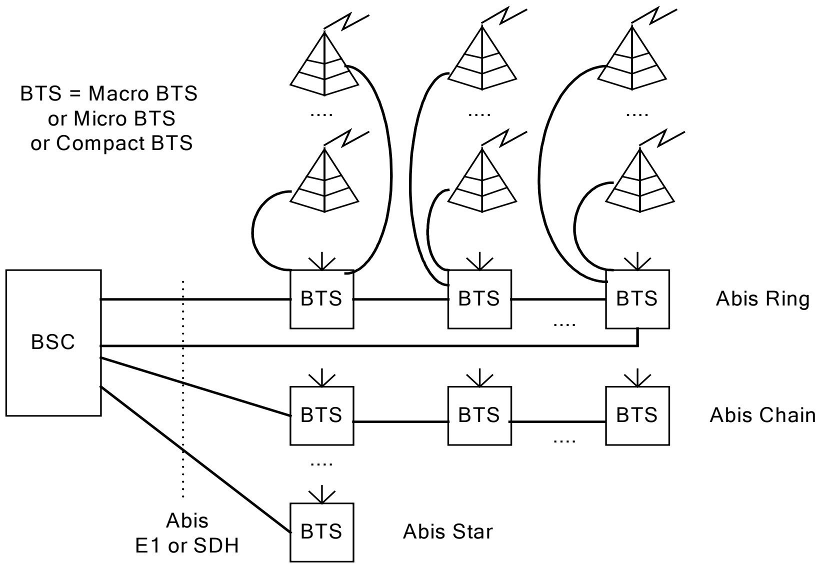
- BTS networking modes
- BTS networking configuration

Networking through Abis Interface

This chapter starts with describing the BSS networking mode, next BTS networking mode and finally BTS networking configuration.

BSS (Base Station System) includes BTS (Base Transceiver Station) and BSC (Base Station Controller). BTS is composed of BDS, local RFS (LRFS) and remote RFS (RRFS). Multiple networking modes are workable as shown in Fig. 12

FIG. 12 CDMA2000 BSS NETWORKING



BSC connects with BTS (macro or micro) through the Abis interface to form various network shapes, such as star, chain, and ring.

- Star networking

  By star-shaped networking, it means that each BTS connects with BSC individually and directly, or indirectly through external transmission device.

- Ring networking

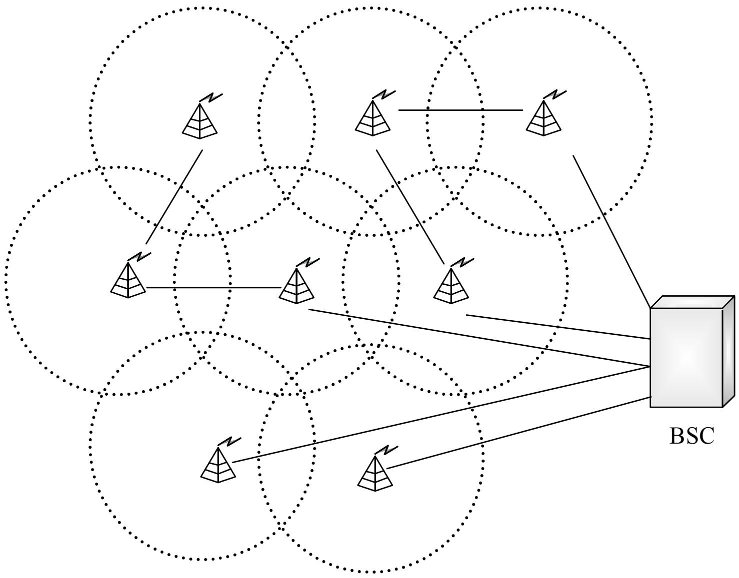
  Several BTS connect in serial to BSC as in a ring structure.

- Chain networking

  In a chain networking mode, several BTS are connected to form a chain with the last BTS connecting to BSC through E1/T1 or SDH.

Actual BSS networking may adopt a combined mode of ring, star and chain, as shown in Fig. 13.

FIG. 13 BSS NETWORKING



BSC connects with BTS through E1/T1, SDH or Ethernet interface. The Ethernet approach applies when BSC is near BTS and in this way, the complex Abis link compression protocol is avoided, the networking cost cut down and reliability enhanced.

BTS Networking

BTS is in terms of hardware a set of radio transceiving devices that serve a cell, which can be of omni-directional, 2-sector, 3-sector or 6-sector structure. It modulates and demodulates signals, but in a more complex way than a regular modem.

BTS bears radio service functions of BSS, including radio transmission with the MS (Mobile Station) through IS2000 air interface and control over the radio channel. It is connected with BSC through Abis interface and controlled by BSC.

In BTS, BDS and RFS are connected flexibly through a standard interface to fill in different networking needs.

Table 3 lists some commonly used BTS networking modes.

TABLE 3 BTS NETWORKING MODES

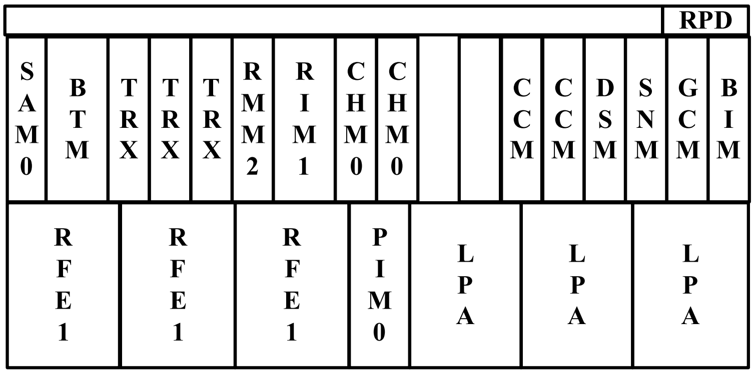
Mode	Full Name	Description
LS	Local Single Mode	Support 4-carrier 3-sector (1X/EV-DO), not support RRFS
RS	Remote Single Mode	May work as the RRFS, support 4-carrier 3-sector (1X/DO)
LEA	Local Extend Mode A	RFS added in combined cabinet to support voice service (1X) for configuration of 8-carrier 3-sector or 4-carrier 6-sector
LEB	Local Extend Mode B	BDS and RFS added in combined cabinet to support 1X/EV-DO for configuration of 8-carrier 3-sector or 4-carrier 6-sector
RE	Remote Extend Mode	Remote CBTS or MBTS-RFS added through fiber connection. LRFS+RRFS supports 12 carrier sectors for EV-DO or nearly 24 carrier sectors for 1X
ME	MIX Extend Mode	BDS and RFS added in combined cabinet, with remote CBTS or MBTS-RFS added through fiber connection, to support 24 carrier sectors for EV-DO or nearly 48 carrier sectors for 1X

LS Mode

The LS networking mode is suitable for the economy configuration of 12 carrier sectors for EV-DO and 24 carrier sectors for 1X service.

With the 4-carrier 3-sector configuration in this mode, 2 (max. 3) CHM0 can be used with 2 slots left idle to deliver pure 1X service, or 4 CHM1 be used for pure EV-DO service. Fig. 14 shows the slot diagram.

FIG. 14 BTS BOARD LAYOUT IN LS MODE

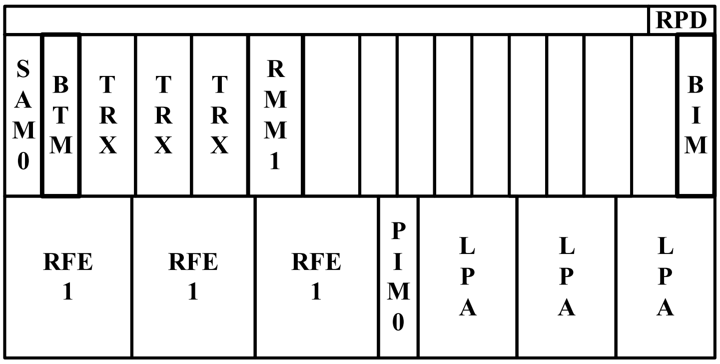


RS Mode

The RS networking mode applies when the RRFS is used independently and 4-carrier 3-sector is configured. It is another economy approach.

In the RS mode, the BDS is locally installed and it can be a super BTS, single macro BTSB or CBTS; while the remote CBTS accommodates only the RFS. Such configuration (see below) supports 12 carrier sectors for either EV-DO or 1X.

FIG. 15 RS MODE



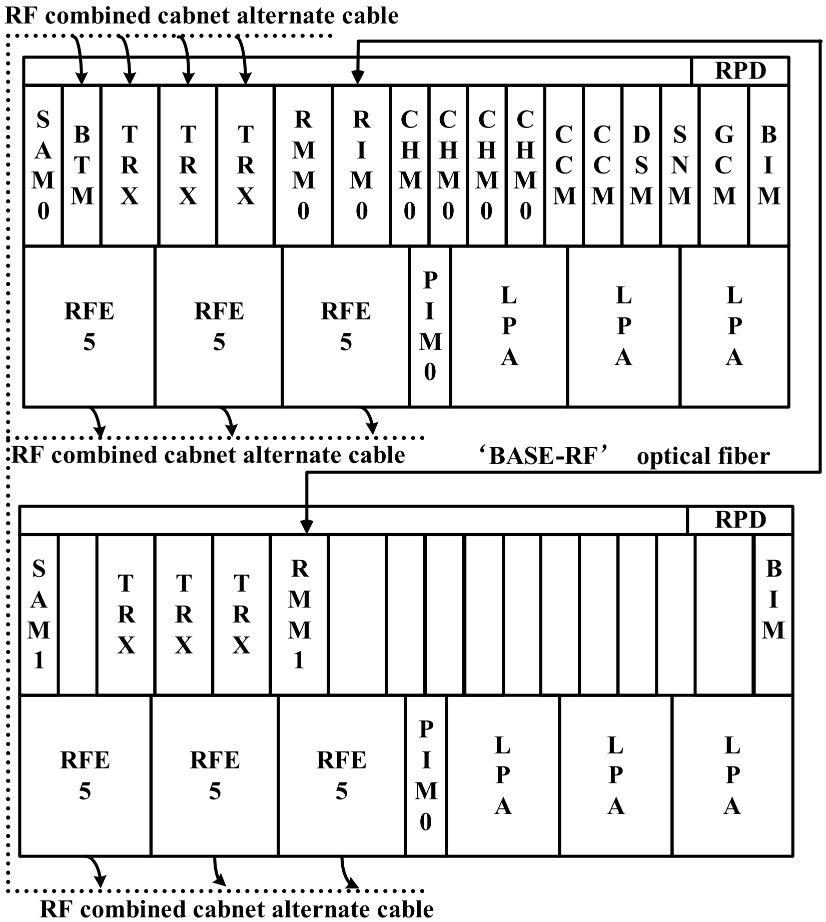
LEA Mode

The LEA networking mode applies when the CBTS system is deployed with 4-carrier 3-sector to deliver pure 1X or 1X + EV-DO services, however the local RFS has to be extended to fit in system configuration (while the baseband resource is enough).

In the LEA mode, two CBTS cabinets are combined with the additional one configured with only RFS (no BDS). This mode provides a capacity of 24 carrier sectors to deliver pure 1X service, or 4-carrier 3-sector for 1X + EV-DO. (In this mode, the BDS supports only 12 carrier sectors to deliver pure EV-DO service. That's why the LS mode is more preferable for pure EV-DO service.)

There are two workable approaches for local RFS extension: carrier extension (more than 4 carriers) and sector extension (more than 3 sectors). The two extension modes differ in the RFE board and the cable that connects two cabinets. Fig. 16 shows the board layout in LEA mode.

FIG. 16 LEA MODE



LEB Mode

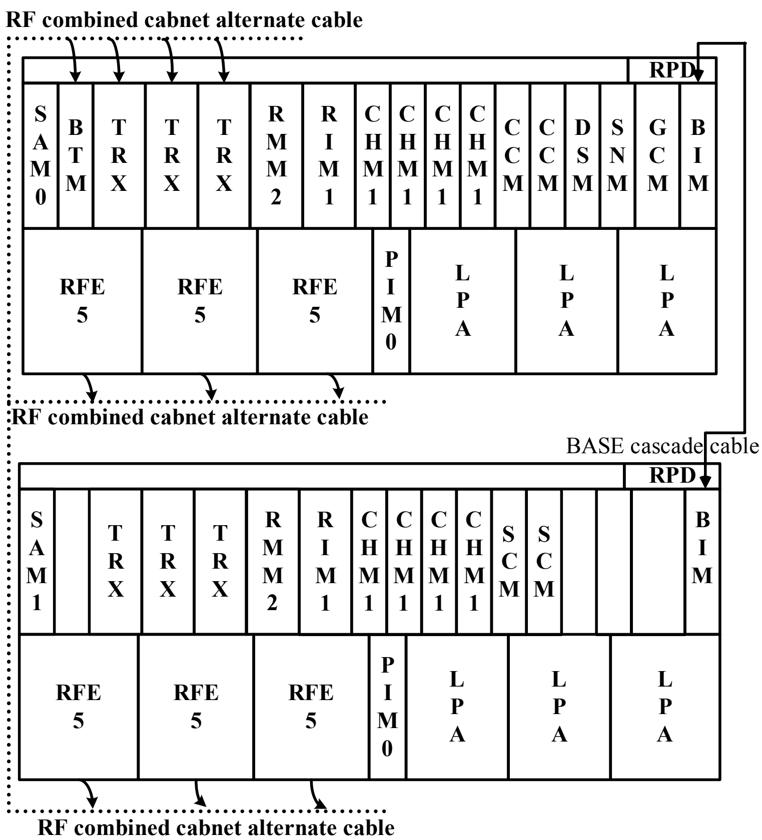
The LEB mode is basically a BDS + RFS extension approach to deliver pure DO or 1X + DO service.

Two BTS cabinets are combined in this mode with the additional cabinet configured with both baseband and RF resource. This mode allows no sharing of baseband, that is, both master BTS and slave BTS have their own baseband and RF resource. However, both cabinets share the CCM and Abis interface.

This mode provides a capacity of 24 carrier sectors to deliver pure DO service, or 4-carrier 3-sector for 1X + DO.

There are two extension approaches for this mode: carrier extension (more than 4 carriers) and sector extension (more than 3 sectors). The two extension modes differ in the RFE board and the cable that connects two cabinets. Fig. 17 shows the board layout in LEA mode.

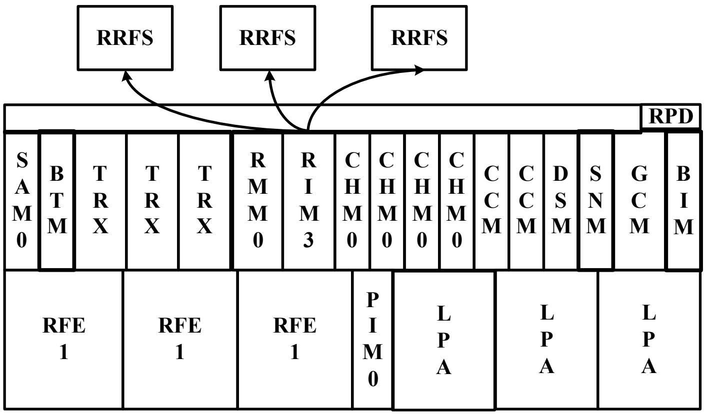
FIG. 17 LEB MODE



RE Mode

In the RE mode, the RFS is installed in a remote place from the BTS with the fiber used for connection. This mode applies when the remote RFS needs to share the local surplus BDS resource. For the BDS (4×CHM) in a single BTS, this mode provides a capacity of 12 carrier sectors to deliver pure EV-DO service and 24 carrier sectors to deliver pure 1X service. See below for the configuration.

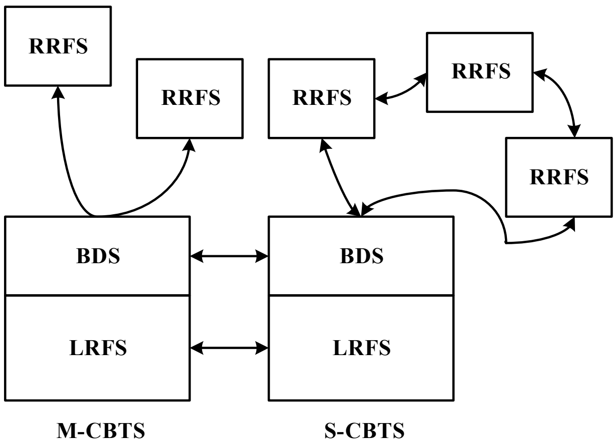
FIG. 18 RE MODE



ME Mode

The ME mode is a combination of LEB and RE modes. Both local extension (BDS and RFS) and remote extension (RFS, with fiber used for connection) are necessary for this mode. After BDS extension, the mode provides a max. capacity of 24 carrier sectors to deliver pure EV-DO service, or 48 carrier sectors to deliver 1X service. If the local master BTS is configured with 4-carrier 3-sector or less, the slave BTS may have no local RFS configured. If the local master BTS is configured with more than 4-carrier 3-sector, then the slave BTS should have RFS configured. The redundant BDS resource can be shared with the remote RFS. See below for the configuration.

FIG. 19 ME MODE



BTS Configuration

BDS Configuration

A master BDS includes SAM, GCM, CHM, RIM, CCM, DSM, SNM, BIM and RPD boards.

A slave BDS is configured to suit different networking modes.

Configuration requirement:

CCM: usually configured in active/standby pairs.

SNM: optional, usually not needed.

CHM: configured according to the number of carriers.

CHM0: As one CHM0 provides 256 CEs for 1X service, the number of CHM0 needed is k/256 (k is the total traffic erl).

CHM1: As one CHM1 provides the capacity of 3 carrier sectors for EV-DO service, the number of CHM1 is n/3 (n is the total number EV-DO carrier sectors).

CHM0 and CHM1 can be used together in the same shelf.

RFS Configuration

An RFS can be made up of LRFS and RRFS. LRFS works for the local BTS, while RRFS can work either for the local BTS or another BTS.

This sector covers the configuration of LRFS only.

The LRFS has such boards as BTM, TRX, RMM, LPA and RFE.

The number of TRX and LPA to be configured depends on number of carriers and sectors. If 4 carriers are enough for continuous coverage, number of TRX/LPA is the same as that of sectors. If two 4 × carriers are needed, number of TRX/LPA is twice that of sectors. For example:

- 3 TRX and 3 LPA for 1-carrier 3-sector.
- 3 TRX and 3 LPA for 2-carrier (continuous) 3-sector.
- 3 TRX and 3 LPA for 3-carrier (continuous) 3-sector.
- 3 TRX and 3 LPA for 4-carrier (continuous) 3-sector.
- TRX and 6 LPA for 8-carrier (continuous) 3-sector (3 of the 6 TRX and 3 of the 6 LPA can be installed in the added cabinet).
- TRX and 6 LPA for 4-carrier (continuous) 6-sector (3 of the 6 TRX and 3 of the 6 LPA can be installed in the added cabinet).

Neither LPA nor TRX is configured in active/standby pairs.

PWS Configuration

The primary power shelf can be omitted if the –48 VDC is ready on site.

The primary power shelf needs to be prepared if there is only 220 V/110VAC ready on site.

Chapter 5

Technical Indices

In this chapter, you will learn about:

- Environment indices of the BTS system
- Performance indices (parameter requirements) of the functional components of the BTS system

Environment Indices

The environment indices set requirements on the physical parameters, power supply, grounding, temperature, humidity and cleanness, which are given in Table 4.

TABLE 4 ENVIRONMENT INDICES

Environment Indices		Requirements	
Physical Index	Dimension (mm)	Single cabinet (mm): W700 × D800 × H800 PWS cabinet (optional): W700 × D600 × H400	
	Weight (kg)	4-carrier 1–sector: 155 4-carrier 3-sector: 211 4-carrier 6-sector or 8-carrier 3-sector: 422	
	Load-bearing of the floor (kg/m^2)	>377	
Power supply	Primary power supply input	150 V~300 V for 200 V AC or 90 V ~138 V for 100 V AC	
	Secondary power supply input	−42.3 V ~ −56.5 V if -48 V DC is used	
	Power consumption	Varies with the configuration (refer to Table 5.1-2)	
Grounding		Joint grounding resistance ≤ 1 Ω	
Temperature		Long-term: -5°C~50°C	Short-term: -20°C~60°C
Humidity		Long-term: 15%~80%	Short-term:5%~95%
Cleanness		Dust granule diameter <5 μm, dust granule density ≤ 13 × 10^4 granules/m^3 (dust granules should be non-conductive, non-magnetic and non-corrosive)	

Note:

Temperature and humidity values are measured 2m above floor and 0.4m in front of equipment that has no fender at the front or back.

By "short-term" it means less than continuous 48 hours or less than cumulative 15 days in a year.

TABLE 5 BTS POWER CONSUMPTION

Configuration	Power Amplifier Output	Working Voltage	Max. Power Consumption for 1X	Max. Power Consumption for DO
Single-carrier single-sector	LPA, 40 W	-48 V	Approx. 1400 W	Approx. 1400 W
2-carrier 1–sector	LPA, 40 W	-48 V	Approx. 1400 W	Approx. 1400 W
3-carrier 1–sector	LPA, 40 W	-48 V	Approx. 1400 W	Approx. 1400 W
5-carrier 1-sector	LPA, 40 W	-48 V	Approx. 2000 W	Approx. 2000 W
7-carrier 1-sector	LPA, 40 W	-48 V	Approx. 2000 W	Approx. 2100 W
1-carrier 3–sector	LPA, 40 W	-48 V	Approx. 2500 W	Approx. 2600 W
2-carrier 3–sector	LPA, 40 W	-48 V	Approx. 2600 W	Approx. 2600 W
3-carrier 3-sector	LPA, 40 W	-48 V	Approx. 2600 W	Approx. 2700 W
4-carrier 3-sector	LPA, 40 W	-48 V	Approx. 2600 W	Approx. 2700 W
5-carrier 3-sector	LPA, 40 W	-48 V	Approx. 4400 W	Approx. 4500 W
7-carrier 3-sector	LPA, 40 W	-48 V	Approx. 4500 W	Approx. 4600 W
8-carrier 3-sector	LPA, 40 W	-48 V	Approx. 4500 W	Approx. 4700 W
1-carrier 6-sector	LPA, 40 W	-48 V	Approx. 4300 W	Approx. 4400 W
2-carrier 6-sector	LPA, 40 W	-48 V	Approx. 4400 W	Approx. 4500 W
3-carrier 6-sector	LPA, 40 W	-48 V	Approx. 4500 W	Approx. 4600 W
4-carrier 6-sector	LPA, 40 W	-48 V	Approx. 4500 W	Approx. 4700 W

Performance Indices

The performance indices set requirements on the reliability, interface, capacity, frequency band and clock.

Reliability

- Mean Time Between Critical Faults (MTBCF): > 100000 hours;
- Mean Time Between Faults (MTBF): > 63492 hours;
- Mean Time To Recovery (MTTR): 0.5 hours.
- Availability: > 99.987%.

Interface

Abis interface: E1/T1 and SDH connection;

Interface between BDS and RRFS: fiber connection.

Capacity

- A single BTS cabinet can be configured with 24 carrier sectors for 1X service or 12 carrier sectors for EV-DO service.
- RRFS networking: star-, chain- or ring-shaped networking.
- RRFS: One BDS can work with at most 24 RRFS sites.
- A single LRFS (indoor) can be configured with at most 24 carrier sectors.

Frequency Band

The system supports five frequency bands as set forth in IS-97D "CDMA BTS Minimum Performance Standard": Band Class 0 (800 MHz), Band Class 1 (1.9 GMHz), Band Class 5 (450 MHz), Band Class 6 (2.1 GMHz) and Band Class 10 (850 MHz).

Specs of Bands 800 MHz, 450 MHz and 850 MHz

1. Receiver (with an LNA)

TABLE 6 RECEIVER INDEX AT 800 MHZ, 450 MHZ AND 850 MHZ

Working bands	**800 MHz, 450 MHz and 850 MHz**
Channel bandwidth	1.23 MHz(800 MHz), 1.25 MHz (450 MHz, 850 MHz)

Working bands	**800 MHz, 450 MHz and 850 MHz**
Rx sensibility	≤ -125 dBm
Rx dynamic range	Rx sensibility ≤ dynamic range ≤ Noise level -65 dBm/1.23 MHz (Eb/N0 = 10 dB ± 1 dB), FER < 1%
Block-proof	800 MHz: ± 750 kHz offset center freq; if monotone = 50dB (as opposed to CDMA signal level), when FER < 1.5%; increase of MS output power ≤ 3 dB; ± 900 kHz offset center freq; if monotone = 87dB (as opposed to CDMA signal level), when FER < 1.5%; increase of MS output power ≤ 3 dB; 450 MHz: ± 900 kHz offset center freq; if monotone = 87dB (as opposed to CDMA signal level), when FER < 1.5%; increase of MS output power ≤ 3 dB; 850 MHz: ± 1.25MHz offset center freq; if monotone = 80dB (as opposed to CDMA signal level), when FER < 1.5%; increase of MS output power ≤ 3 dB;
Inter-modulation spurious response attenuation sensibility	800 MHz and 450 MHz: 900kHz ~ 1.7MHz and –900kHz ~ -1.7MHz offset center freq; if dual-tone = 72dB (as opposed to CDMA signal level, when FER < 1.5%; increase of MS output power ≤ 3 dB; 850 MHz: 1.25MHz ~ 2.05MHz and -1.25MHz ~ -2.05MHz offset center freq; if dual-tone = 72dB (as opposed to CDMA signal level, when FER < 1.5%; increase of MS output power ≤ 3 dB;
Rx conductive and emissive spurious range	< -80 dBm (within the BTS Rx frequency) < -60 dBm (within the BTS Tx frequency) < -47 dBm (at other frequencies), RBW = 30 kHz
VSWR of RFE (Rx)	< 1.50

2. Transmitter

TABLE 7 TRANSMITTER INDEX AT 800 MHZ, 450 MHZ AND 850 MHZ

Working bands	**800 MHz, 450 MHz and 850 MHz**
Transmitter frequency tolerance	≤ 5×10^{-8}
Channel bandwidth	1.23 MHz (800 MHz), 1.25 MHz (450 MHz, 850 MHz)
Tx modulation	Quadrature modulation
Conductive / emissive spurious transmission	< -45 dBc @±750 kHz offset center freq (RBW 30 kHz) < -60 dBc @±1.98 MHz offset center freq(RBW

Working bands	800 MHz, 450 MHz and 850 MHz
suppression	30kHz) > 4 MHz offset: < -36 dBm (RBW 1 kHz) @ 9KHz < f < 150 kHz < -36 dBm (RBW 10 kHz) @ 150KHz < f < 30 MHz < -30 dBm (RBW 1 MHz) @ 1GHz < f < 12.5 GHz 4MHz ~ 6.4 MHz offset: < -36 dBm (RBW 1kHz) @ 30 MHz < f < 1 GHz 6.4MHz ~ 16MHz offset: < 36 dBm (RBW 10 kHz) @ 30 MHz < f < 1 GHz > 16 MHz offset: < -36 dBm (RBW 100 kHz) @ 30 MHz < f < 1 GHz
Code domain power (inactive channel)	32 dB less than the total output power
Total power	Rated power -4 dB ~ rated power + 2 dB (refer to IS-97D for the definition and test of total power)
Waveform quality (multi-carrier)	ρ> 0.97
Pilot time tolerance	< 3 us; ±1 us between every two CDMA channels of the same BTS; If the outer system clock is interrupted, the time difference between the BTS and CDMA should be kept no more than ±10 us during 8 hours' time
Pilot channel and code-division channel time tolerance	< ±50 ns in the same CDMA channel
Pilot channel and code-division channel phase tolerance	≤ 0.05 (in radian) in the same CDMA channel
Pilot power	Ratio of pilot power / total power ≤ ±0.5 dB of the configured value
Rated output power of amplifier	LPA: 40 W; DPA: 40 W /80 W
Output linear dynamic range	> 30 dB
RF (Tx) front end VSWR	< 1.50

Specs of 1.9 GHz and 2.1GHz

1. Receiver (with an LNA)

TABLE 8 RECEIVER INDEX AT 1.9 GHZ AND 2.1GHZ

Working band	**1.9 GHz、2.1GHz**
Channel bandwidth	1.25 MHz
Rx sensibility	< -125 dBm
Rx dynamic range	Rx sensibility (less than –127dBm) ≤ dynamic range ≤ Noise level of the antenna (no less than -65 dBm/1.25 MHz, when Eb/N0 = 10 dB ± 1 dB, FER < 1%
Block-proof	± 1.25 MHz offset center freq; if monotone = 80dB (as opposed to CDMA signal level without interference), when FER < 1.5%; increase of MS output power ≤ 3 dB
Inter-modulation spurious response attenuation sensibility	1.25 MHz ~ 2.05 MHz and -1.25 MHz ~ -2.05 MHz offset center freq; if dual-tone = 70dB (as opposed to CDMA signal level without interference), FER < 1.5%; increase of MS output power ≤ 3 dB
Rx conductive and emission spurious range	< -80 dBm (in BTS Rx band); < -60 dBm (in BTS Tx band) 1.9 GHz: < -47 dBm, RBW(30kHz) and all other frequencies 2.1 GHz: -57dBm (RBW 100KHz) 30MHz < f < 1GHz -47dBm (RBW 1MHz) 1GHz < f < 12.75GHz
RF (Rx) front end VSWR	< 1.50

2. Transmitter

TABLE 9 TRANSMITTER INDEX AT 1.9 GHZ AND 2.1GHZ

Working bands	**1.9 GHz and 2.1GHz**
Transmitter frequency tolerance	≤ 5×10-8
Channel bandwidth	1.25 MHz
Tx modulation	Quadrature modulation
Conductive / emissive spurious transmission suppression	In Band Class 6: < -45 dBc @±885 kHz offset center freq (RBW 30 kHz) < -55 dBc @±1.98MHz offset center freq (RBW 30 kHz) < -13 dBm @±2.75MHz offset center freq

Working bands	**1.9 GHz and 2.1GHz**
	(RBW 1MHz) > 4MHz offset: < -36 dBm(RBW 1 kHz) @ 9KHz < f < 150 kHz < -36 dBm(RBW 10 kHz) @ 150KHz < f < 30 MHz < -36 dBm(RBW 100 kHz) @ 30MHz < f < 1 GHz 4-16MHz offset: < -30 dBm (RBW 30 kHz) @ 1 GHz < f < 12.5 GHz 16 M ~ 19.2 M offset: < -30 dBm (RBW 300 kHz) @ 1 GHz < f < 12.5 GHz
Code domain power (inactive channel)	32 dB less than the total output power
Total power	Rated power -4 dB ~ rated power + 2 dB (refer to IS-97D for the definition and test of total power)
Waveform quality	ρ > 0.97
Pilot time tolerance	< 3 us; ±1 us between every two CDMA channels of the same BTS; If the outer system clock is interrupted, the time difference between the BTS and CDMA should be kept no more than ±10 us during 8 hours' time
Pilot channel and code-division channel time tolerance	< ±50 ns in the same CDMA channel
Pilot channel and code-division phase tolerance	≤ 0.05 (in radian) in the same CDMA channel
Pilot power	Ratio of pilot power / total power ≤ ±0.5 dB of the configured value
Output power of amplifier	LPA: 40W; DPA: 40W /80W
Output linear dynamic range	> 30 dB
RF (Tx) front end VSWR	< 1.50

Clock

1. BTS Clock technical parameters

- Frequency benchmark: The accuracy of frequency 10 MHz is better than 10^{-11} in GPS locked status and is better than 10^{-10} in the holdover status.
- The temperature variation is required to be less than $\pm 0.5 \times 10^{-9}$.

2. Clock Synchronization Source

The GCM provides reliable clock for a short term and ensures the locked status of clock during 72 hours after the GPS synchronous signal is lost.

3. Clock System Performance

   The frequency difference is less than 0.05 ppm, and phase difference less than 10 us.

Noise

The ambient noise of BTS is no greater than 75dBA.

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Appendix A

Abbreviations

Abbreviation	Full name
1X EV	1X Evolution
1X EV-DO	1X Evolution Data Only
1X EV-DV	1X Evolution Data & Voice
2G BTS	2G Base Station Transceiver
3G BTS	3G Base Station Transceiver
3GPP2	3rd Generation Partnership Project 2
A	
AAA	Authentication, Authorization, Accounting
Abis	Abis Interface—the interface of BSC--BTS
AN	Access network
APD	AC Power Distribution Module
AUC	Authentication Center
A interface	A Interface—the interface of BSC-MSC
B	
BBDS	Backplane of BDS
B-BDS	Backplane of Baseband Digital Subsystem
BBS	BTS Baseband Subsystem
BCS	BTS Communication Subsystem
BDM	Baseband Digital Module
BDS	Baseband Digital System
BGPS	Backplane of GPS
BIM	BDS Interface Module
BLPA	Backplane of LPA
BPD	BDS Power Distribute
BPWS	Backplane of PWS

Abbreviation	Full name
BRFE	Backplane of RFE
BRFS	Backplane of TRX and BDM/RFM
BS	Base Station
BSC	Base Station Controller
BSS	Base Station System
BTM	BTS Test Module
BTRX	Backplane of TRX
BTS	Base Transceiver Station
C	
CDMA	Code Division Multiple Address
CDMA2000-1X	CDMA2000 Phase One
CHM	Channel Processing Module
CHM-1X	Channel Processing Module for CDMA2000
CHM-95	Channel Processing Module for IS-95
CLK	Clock
CN	Core Network
CSM5000	Cell Site Modem ASIC 5000
CSM5500	Cell Site Modem ASIC 5500
CTDMA	Code and Time Division Multiple Address
D	
DBS	Database Subsystem
DS-CDMA	Direct-Sequence Code Division Multiple Address
DSM	Data Service Module
DUP	Duplexer
E	
EMC	Electromagnetic Compatibility
EMF	Network Element Mediation Function
EMI	Electromagnetic interference
EMS	electromagnetic susceptibility
F	
FD	Full duplex
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
G	
GCM	GPS Control Module

Abbreviation	Full name
GLI	GE Line Interface
GPS	Global Position System
GSM	Globe System for Mobil Communication
H	
HA	Home Agent
HLR	Home Location Register
HPA	High Power Amplifier
HRPD	High rate packet data
I	
I/O	Input/Output
ID	Identifier
IMT-2000	International Mobile Telecommunications 2000
IP	Internet Protocol
ISO	International Standardization Organization
ISP	Internet Service Provider
ITU	International Telecommunications Union
K	
kbps	kilo-bits per second
L	
LPA	Linear Power Amplifier
M	
MSC	Mobile Switching Center
O	
OIM	Optical Interface Module
OMC	Operation Maintenance Centre
OMF	Operation Maintenance Function
OMI	Operation Maintenance Interface
OMM	Operation Maintenance Module
OSS	Operating Systems Subsystem
OTD	Orthogonal Transmit Diversity
P	
PA	Power Amplifier
PCF	Packet Control Function
PCH	Paging Channel
PDSN	Packet Data Service Node

Abbreviation	**Full name**
PI	Page Indicator
PLMN	Public Land Mobile Network
PMM	Power Monitor Module
PPM	Power Process Module
PRM	Power Rectifier Module
PSMC	Power Supplier Module C
PSMD	Power Supplier Module D
PSTN	Public Switched Telephone Network
PWS	Power System
Q	
QoS	Quality of Service
R	
RFS	RFIM
RIM	RF Interface Module
RMM	RF Management Module
RPD	RFS Power Distribute
RX	Receiver
RXB	Receiver Board
S	
SAM	Site Alarm Module
SDH	Synchronous Digital Hierarchy
SPS	Signal Process Subsystem
SS7	Signaling System No.7
STS	
T	
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TD-CDMA	Time Division-Code Division Multiple Access
TDD	Time Division Duplex
TDMA	Time Division Multiple Address
TOD	Time of Date
TRX	Transmitter and Receiver
TX	Transmit
TXB	Transmitter Board
U	

Abbreviation	Full name
UI	User Interface
Um interface	Um Interface—the interface of MS-BTS
Z	
ZXC10 AGWB	cdma2000 Access Gateway
ZXC10 BDSB	cdma2000 Baseband Digital System
ZXC10 BSCB	cdma2000 Base Station Controller
ZXC10 BTSB	cdma2000 Base Transceiver Station
ZXC10 CBTS	cdma2000 Compact Base Transceiver Station
ZXC10 MBTS	cdma2000 Micro Base Transceiver Station
ZXC10 MGWB	cdma2000 Media Gateway)
ZXC10 PBTS	cdma2000 Pico Base Transceiver Station
ZXC10 PWSB	cdma2000 Power System
ZXC10 RFSB	cdma2000 Radio Frequency System

Figures

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Tables