3900 Series Base Station

Technical Description

Issue 03

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About This Document

Overview

This document describes the 3900 series base stations in terms of the logical structure, networking, transmission and clock scheme, technical specification, and operation and maintenance.

Product Version

The following table provides the mapping between a product name and product version.

<table>
<tr><th>Product Name</th><th>Product Version</th></tr>
<tr><td>BTS3900</td><td rowspan="5">MBTS: V100R007C00
● GSM: V100R014C00
● WCDMA: V200R014C00
● LTE: V100R005C00</td></tr>
<tr><td>BTS3900A</td></tr>
<tr><td>BTS3900L</td></tr>
<tr><td>BTS3900AL</td></tr>
<tr><td>DBS3900</td></tr>
<tr><td>BTS3900C</td><td>MBTS: V100R007C00
● WCDMA: V200R014C00</td></tr>
</table>

Intended Audience

This document is intended for:

- Network planning engineers
- Field engineers
- System engineers

Organization

1 Changes in the 3900 Series Base Station Technical Description

This section describes changes in the 3900 Series Base Station Technical description about each version.

2 3900 Series Base Stations

The 3900 series base stations launched by Huawei is a future-oriented solution that meets customers' requirements of network evolution. It adopts the unified design for modules of different modes and unified operation & maintenance (O&M). It also supports the co-existence of devices of different modes at the same site, sharing of base station resources. With these features, it meets operators' requirements of multi-mode base station.

3 Network Structure

This section describes the position of a 3900 series base station in a network.

4 About 3900 Series Base Stations

The 3900 series base stations include macro base stations (BTS3900, BTS3900L, BTS3900A, and BTS3900AL), a distributed base station (DBS3900), micro base stations (BTS3900C, BTS3900E, and BTS3902E), and a Pico base station (BTS3900B). Different types of base stations can be used in various scenarios to achieve fast deployment and low operating expenditure (OPEX). This technical description focuses on macro base stations, the distributed base station DBS3900, and the micro base station BTS3900C. For a description of the other types of 3900 series base stations, see the production documentation of the base station in question.

5 Logical Structure

A 3900 series base station mainly consists of BBUs, RF modules, and the antenna system. Its functional subsystem includes the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power supply system.

6 Clock Synchronization

Synchronization refers to that within a specific time, the phase variation or frequency variation between two or more signals stays within the specified range. Clock synchronization refers to that a base station synchronizes its clock signals with a reference clock source. Through clock synchronization, the variation in the clock frequency between a base station and other devices in the related network and the variation in the clock signals between the base station and other devices in the network are within the specified range. This prevents transmission performance from deteriorating due to such variations.

7 Transport Network Topologies

The 3900 series base stations support multiple transmission schemes and transport network topologies in various scenarios.

8 CPRI-based Topologies

This section describes CPRI-based topologies for 3900 series base stations and specifications of CPRI ports on boards or modules. CPRI stands for common public radio interface.

9 Operation and Maintenance

The 3900 series base stations are managed by an operation and maintenance (O&M) system using either man-machine language (MML) commands or a graphical user interface (GUI). This system is hardware-independent and provides comprehensive functions to meet users' various O&M requirements.

10 Product Specifications

Product specifications of the 3900 series base stations include technical specifications of the BBU3900, radio frequency unit (RFU), and remote radio unit (RRU) and engineering specifications of each type of base station.

11 Reliability

3900 series base stations use the Huawei SingleBTS platform, support hardware sharing, and provide mature communications technologies and stable transmission reliability.

Conventions

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠ DANGER	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazard with a medium or low level of risk, which if not avoided, could result in minor or moderate injury.
⚠ CAUTION	Indicates a potentially hazardous situation, which if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results.
TIP	Indicates a tip that may help you solve a problem or save time.
NOTE	Provides additional information to emphasize or supplement important points of the main text.

General Conventions

The general conventions that may be found in this document are defined as follows.

Convention	Description
Times New Roman	Normal paragraphs are in Times New Roman.
Boldface	Names of files, directories, folders, and users are in **boldface**. For example, log in as user **root**.
Italic	Book titles are in *italics*.
`Courier New`	Examples of information displayed on the screen are in Courier New.

Command Conventions

The command conventions that may be found in this document are defined as follows.

<table>
<tr><th>Convention</th><th>Description</th></tr>
<tr><td>Boldface</td><td>The keywords of a command line are in boldface.</td></tr>
<tr><td>Italic</td><td>Command arguments are in italics.</td></tr>
<tr><td>[ ]</td><td>Items (keywords or arguments) in brackets [ ] are optional.</td></tr>
<tr><td>{ x | y | ... }</td><td>Optional items are grouped in braces and separated by vertical bars. One item is selected.</td></tr>
<tr><td>[x | y | ...]</td><td>Optional items are grouped in brackets and separated by vertical bars. One item is selected or no item is selected.</td></tr>
<tr><td>{ x | y | ... }*</td><td>Optional items are grouped in braces and separated by vertical bars. A minimum of one item or a maximum of all items can be selected.</td></tr>
<tr><td>[x | y | ...]*</td><td>Optional items are grouped in brackets and separated by vertical bars. Several items or no item can be selected.</td></tr>
</table>

GUI Conventions

The GUI conventions that may be found in this document are defined as follows.

Convention	Description
Boldface	Buttons, menus, parameters, tabs, window, and dialog titles are in **boldface**. For example, click **OK**.
>	Multi-level menus are in **boldface** and separated by the ">" signs. For example, choose **File** > **Create** > **Folder**.

Keyboard Operations

The keyboard operations that may be found in this document are defined as follows.

Format	Description
Key	Press the key. For example, press **Enter** and press **Tab**.
Key 1+**Key 2**	Press the keys concurrently. For example, pressing **Ctrl**+**Alt**+**A** means the three keys should be pressed concurrently.
Key 1, **Key 2**	Press the keys in turn. For example, pressing **Alt**, **A** means the two keys should be pressed in turn.

Mouse Operations

The mouse operations that may be found in this document are defined as follows.

Action	Description
Click	Select and release the primary mouse button without moving the pointer.
Double-click	Press the primary mouse button twice continuously and quickly without moving the pointer.
Drag	Press and hold the primary mouse button and move the pointer to a certain position.

Contents

1 Changes in the 3900 Series Base Station Technical Description

This section describes changes in the 3900 Series Base Station Technical description about each version.

03 (2012-05-11)

This is issue 03.

Compared with 02 (2012-04-28), this issue does not include any new topics.

Compared with 02 (2012-04-28), this issue incorporates the following changes:

Topic	Change Description
8.3 eNodeB CPRI-based Topologies	Modified the specifications of CPRI ports.
10.3.22 RRU3841 Technical Specifications	Updated the environmental specifications of an RRU3841.

Compared with 02 (2012-04-28), this issue does not exclude any topics.

02 (2012-04-28)

This is issue 02.

Compared with 01 (2012-03-30), this issue does not include any new topics.

Compared with 01 (2012-03-30), this issue incorporates the following changes:

Topic	Change Description
4.1.3 RRU	Removed UL from **Applicable Mode** for the RRU3942.
4.6 DBS3900	Optimized the description.

Topic	Change Description
5.4.2 Logical Structure of a Dual-Mode Base Station	● Adjusted the table **Typical scenarios for a dual-mode base station**. ● Removed **RXU (UL)** from **Logical structure of a dual-mode base station (UL)**.
5.4.3 Logical Structure of a Triple-Mode Base Station	● Removed **UL** from **Working Mode of RF Modules**. ● Removed **RXU (UL)** from **Logical structure of a triple-mode base station (GU+L) with BBU interconnection** and **Logical structure of a triple-mode base station (GU+UL) with BBU interconnection**.
6.3 eNodeB Clock Synchronization Modes	Added the note: When the **Clock Working Mode** is set to **AUTO(Auto)**, it does not take effect on an eNodeB, and each eNodeB can be configured with only one type of external clock source.
6.4 MBTS Clock Synchronization Modes	Added the note: In an MBTS, the **Clock Working Mode** cannot be set to **AUTO (Auto)**, and each SiteUnit can be configured with only one type of external clock source.
6.4.2 Common Reference Clock Mode	Optimized the description.
Common Transmission with TDM	Changed the title to *Co-Transmission with TDM*.
Common Transmission with IP	Modified the description about common transmission through backplane interconnection. Added the figure **Common transmission with IP (Single BBU, GU backplane interconnection)**, the figure **Common transmission with IP (Single BBU, UL backplane interconnection)**, and the figure **Common transmission with IP (BBU interconnection)**.
9.1.2 GBTS Operation & Maintenance Functions	Added the note: The security of the USB loading port is ensured by encryption.
9.3.2 eNodeB Operation & Maintenance Functions	Added the note: The security of the USB loading port is ensured by encryption.

Topic	Change Description
Common Part Management	Added the notes: ● For the UTRPc board, the SiteUnit priority descends from eNodeB, to NodeB, and then to GBTS. ● Loading control rights cannot take effect and none of the SiteUnits of an MBTS manages software of common parts if the following configuration conflicts arise and each SiteUnit does not work in engineering mode.
Software Upgrade	● Added the note: The security of the USB loading port is ensured by encryption. ● Added the note: During a one-sided upgrade, start event of common parts can be reported only by the SiteUnit that is being upgraded.
Commissioning Mode	Added the note: The security of the USB loading port is ensured by encryption.
Alarm Management	● Added the description: Alarms reported by unilaterally managed common parts may affect the operation of other SiteUnits. On the **Browse Current Alarm** tab page, the **Additional Information** column lists the **RAT_INFO** and **AFFECTED_INFO** information. With the information, maintenance personnel can know the mode information about the base station where the alarm is generated and the modes that are affected by the alarm. ● Added the **Browse Current Alarm** tab page of the M2000.
9.4.3 Maintenance Between Modes	● Modified the operation impact for **Resetting a board** and **Resetting a board in power-off mode**: When the CPRI-based topology on an MBTS uses the dual-star topology, services of the other modes may be interrupted if one main control board is abnormally reset or the board is removed and inserted again. ● Added the operation impact for **Resetting a base station**: During an MBTS reset, start event of common parts can be observed by the related managing SiteUnits.

Topic	Change Description
10.1 BBU3900 Technical Specifications	Updated the maximum number of UEs in RRC_CONNECTED mode per eNodeB.
10.2 Technical Specifications of RFUs	Added the size and weight of the RFU.
10.2.4 WRFUd Technical Specifications	Updated the output power.
10.2.10 LRFUe Technical Specifications	Updated the power consumption.
10.3.14 RRU3942 Technical Specifications	Removed UL-related specifications.
10.3.15 RRU3201 Technical Specifications	Updated the receiver sensitivity.
10.3.22 RRU3841 Technical Specifications	• Updated the receiver sensitivity. • Updated the weight.

Compared with 01 (2012-03-30), this issue does not exclude any topics.

01 (2012-03-30)

This is the first official release.

Compared with issue Draft A (2012-02-10), this issue does not include any new topics.

Compared with issue Draft A (2012-02-10), this issue incorporates the following changes:

Topic	Description
4.1.3 RRU	Removed RRU3223.
8.3 eNodeB CPRI-based Topologies	Removed RRU3223 specifications.
8.4 MBTS CPRI-based Topologies	Modified specifications of CPRI MUX topology.
10.2 Technical Specifications of RFUs	Added receiver sensitivity and power consumption specifications for LTE.
10.3 Technical Specifications of RRUs	Added receiver sensitivity and power consumption specifications for LTE.

Compared with Draft A (2012-02-10), this issue excludes the following topics:

- RRU3223 Technical Specifications

Draft A (2012-02-10)

This is the release of Draft A.

Compared with issue 05 (2011-11-30) of MBTS V100R004, issue 07 (2011-11-30) of GSM V100R013C00, issue 07 (2011-11-30) of WCDMA V200R013C00, and issue 03 (2011-12-24) of LTE V100R004C00, this issue includes the following new topics:

- **2 3900 Series Base Stations**
- **4 About 3900 Series Base Stations**
- **10.1 BBU3900 Technical Specifications**
- **10.2.8 CRFUd Technical Specifications**
- **10.3.8 RRU3829 Technical Specifications**
- **10.3.11 RRU3926 Technical Specifications**
- **10.3.14 RRU3942 Technical Specifications**
- **10.3.20 RRU3229 Technical Specifications**
- **10.3.22 RRU3841 Technical Specifications**
- RRU3223 Technical Specifications
- **10.4 Engineering Specifications**
- **11.1 GBTS Reliability**

Compared with issue 05 (2011-11-30) of MBTS V100R004, this issue incorporates the following changes:

Topic	Description
5.4 MBTS Logical Structure	• Added description about BBU interconnection and inter-BBU SDR. • Added logical structures of MBTSs where BBU interconnection is applied.
6.4 MBTS Clock Synchronization Modes	• Edited the document again for clarity and readability purposes. • Added description about clock signal sharing when BBU interconnection is applied.
Common Transmission with IP	• Edited the document again for clarity and readability purposes. • Added description about common transmission with IP when backplane interconnection is applied.
8.4 MBTS CPRI-based Topologies	• Added a dual-star topology for RF modules when inter-BBU SDR is applied. • Added description about the CPRI MUX topology. • Added the number of cells supported by different CPRI data rates.
10.2.5 MRFU Technical Specifications	Modified description about supported modes, frequency bands, and RF specifications.
10.2.6 MRFUd Technical Specifications	Modified RF specifications.
10.2.7 MRFUe Technical Specifications	Modified supported modes, frequency bands, and RF specifications.

Topic	Description
10.3.10 RRU3908 Technical Specifications	Modified supported modes, frequency bands, and RF specifications.
10.3.12 RRU3928 Technical Specifications	Modified RF specifications.
10.3.13 RRU3929 Technical Specifications	Modified supported modes, frequency bands, and RF specifications.
Common Part Management	● Edited the document again for clarity and readability purposes. ● Added description about the mode priority.
Configuration Management	Modified initial configuration methods.
Software Upgrade	Modified software upgrade scenarios.
Commissioning Mode	Modified commissioning modes.
Alarm Management	● Edited the document again for clarity and readability purposes. ● Modified alarm management methods.
Mode Evolution	Modified typical evolution scenarios.
9.4.3 Maintenance Between Modes	Added description about adding, removing, and modifying control links to the list of maintenance operations performed at all SiteUnits.
11.4 MBTS Reliability	Modified description about MBTS reliability.

Compared with issue 07 (2011-11-30) of GSM V100R013C00, this issue incorporates the following changes:

Topic	Description
6.1 GBTS Clock Synchronization Modes	Modified description about GBTS clock synchronization modes.

Compared with issue 07 (2011-11-30) of WCDMA V200R013C00, this issue incorporates the following changes:

Topic	Description
5.2 NodeB Logical Structure	● Added description about BBU interconnection. ● Added logical structures of NodeBs where BBU interconnection is applied.

Topic	Description
6.2 NodeB Clock Synchronization Modes	Modified description about NodeB clock synchronization modes.
7.2 NodeB Transport Network Topologies	● Edited the document again for clarity and readability purposes. ● Added description about transmission networking limitations when BBU interconnection is applied.
8.2 NodeB CPRI-based Topologies	● Edited the document again for clarity and readability purposes. ● Added description about the inter-board cold backup ring topology.

Compared with issue 03 (2011-12-24) of LTE V100R004C00, this issue incorporates the following changes:

Topic	Description
5.3 eNodeB Logical Structure	Deleted the logical structure of the eNodeB in TDD mode.
6.3 eNodeB Clock Synchronization Modes	Modified description about eNodeB clock synchronization modes.
8.3 eNodeB CPRI-based Topologies	● Modified description about CPRI-based topologies. ● Deleted description about CPRI-based topologies in TDD mode. ● Added specifications of CPRI ports.

Compared with issue 05 (2011-11-30) of MBTS V100R004, this issue excludes the following topics:

- Overview
- MBTS Products
- MBTS Hardware Configuration
- MBTS Surge Protection Specifications

Compared with issue 07 (2011-11-30) of GSM V100R013C00, this issue excludes the following topics:

- RXU Configuration
- Logical Structure of the BBU
- BBU Transmission Ports
- Logical Structure of the RRU

- Logical Structure of the RFU
- Antenna System

Compared with issue 07 (2011-11-30) of WCDMA V200R013C00, this issue excludes the following topics:

- Logical Structure of the BBU3900
- Logical Structure of the RRU
- Logical Structure of the RFU
- Logical Structure of the RHUB3808
- Logical Structure of the pRRU3801
- Hardware Configurations of the NodeB
- NodeB Configuration Management

Compared with issue 03 (2011-12-24) of LTE V100R004C00, this issue excludes the following topics:

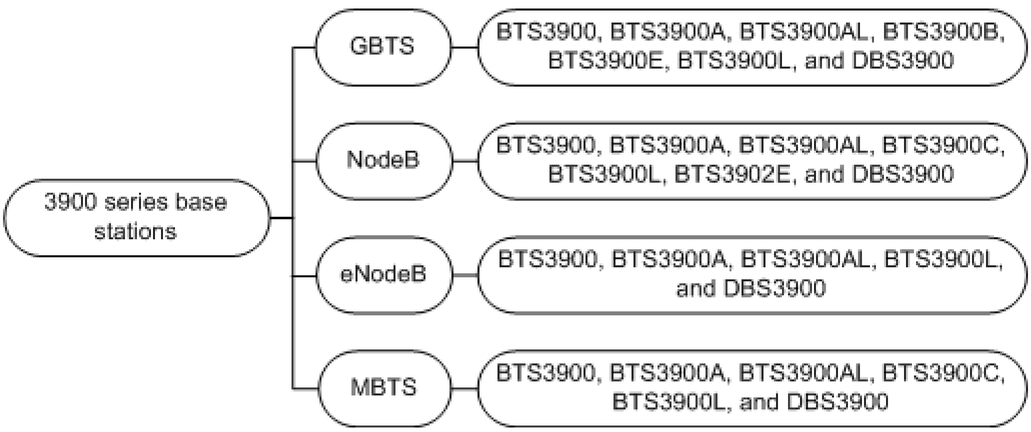
- Environment Monitoring Principles of the eNodeB
- Functions of the eNodeB
- Typical Hardware Configurations of the eNodeB
- Technical Specifications for RRU3232

2 3900 Series Base Stations

The 3900 series base stations launched by Huawei is a future-oriented solution that meets customers' requirements of network evolution. It adopts the unified design for modules of different modes and unified operation & maintenance (O&M). It also supports the co-existence of devices of different modes at the same site, sharing of base station resources. With these features, it meets operators' requirements of multi-mode base station.

Figure 2-1 lists the 3900 series base stations.

Figure 2-1 3900 Series Base Stations



These base stations can be classified into single- and multi-mode base stations according to provided services.

- A single-mode base station (GBTS, NodeB, or eNodeB) can provide services for only one mode (GSM, UMTS, or LTE), respectively.
- A multi-mode base station (MBTS) can provide services of multiple modes. MBTSs are classified into dual-mode and triple-mode base stations according to provided services.
  - A dual-mode base station, providing services of two modes, can work in GSM and UMTS (GU), GSM and LTE (GL), or UMTS and LTE (UL) mode.
  - A triple-mode base station, providing services of three modes, can work in GSM, UMTS and LTE (GUL) mode.

Base stations are classified into BTS3900, BTS3900A, BTS3900AL, BTS3900B, BTS3900C, BTS3900E, BTS3900L, BTS3902E, and DBS3900 by use of different hardware equipment, as shown in **Figure 2-2**.

Figure 2-2 3900 series base stations

3 Network Structure

About This Chapter

This section describes the position of a 3900 series base station in a network.

3.1 GBTS in the Network
The base station subsystem (BSS) consists of the base station controller (BSC), GSM base transceiver station (GBTS), and operation and maintenance center (OMC). This section describes the position of the GBTS in the network and functions of each network element (NE).

3.2 NodeB in the Network
The radio access network (RAN) system consists of the NodeB, radio network controller (RNC), and operation and maintenance center (OMC). This section describes the position of NodeBs and functions of network elements (NEs).

3.3 eNodeB in the Network
The Long Term Evolution - System Architecture Evolution (LTE-SAE) system consists of the evolved universal terrestrial radio access network (E-UTRAN) and evolved packet core (EPC). This section describes the position of E-UTRAN NodeBs (eNodeBs) and the functions of network elements (NEs).

3.4 MBTS in the Network
The SingleRAN system includes the multi-mode base station controller (MBSC), multi-mode base transceiver station (MBTS), and operation and maintenance center (OMC). This section describes the position of an MBTS in the network and functions of each network element (NE).

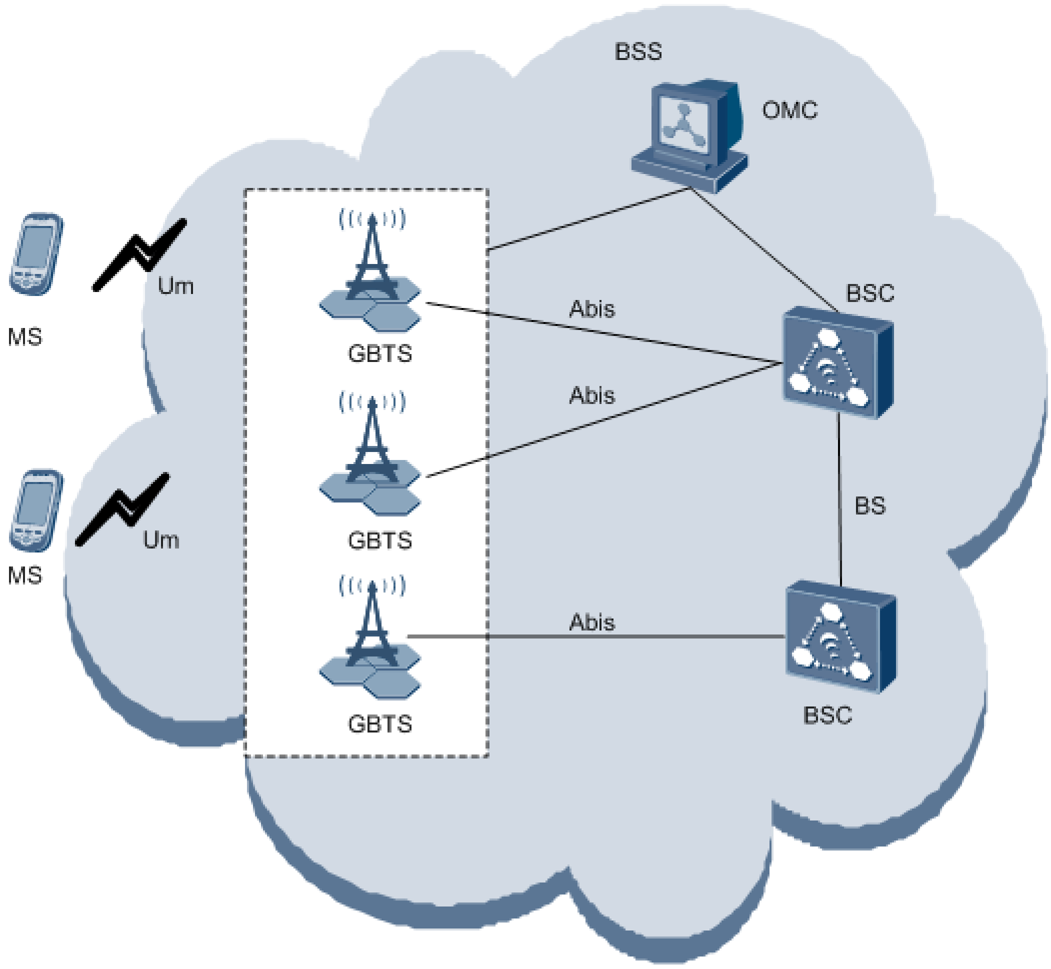
3.1 GBTS in the Network

The base station subsystem (BSS) consists of the base station controller (BSC), GSM base transceiver station (GBTS), and operation and maintenance center (OMC). This section describes the position of the GBTS in the network and functions of each network element (NE).

GBTS in the network

Figure 3-1 shows the position of the GBTS in the network.

Figure 3-1 GBTS in the network



GBTS: GSM base transceiver station	BSC: base station controller
MS: mobile station	OMC: operation and maintenance center
BSS: base station subsystem	

Functions of each NE are as follows:

GBTS

Controlled by the BSC, the GBTS is a base transceiver station that serves a cell. The GBTS communicates with the BSC through the Abis interface, over which radio channels are converted, and communicates with MSs through the Um interface, over which user data and controlling signals are transmitted and relevant control functions are implemented. The GBTS provides interfaces for communicating with the BSC, manages radio resources, provides operation and maintenance functions, and processes signaling.

BSC

The BSC manages radio resources and GBTSs, controls power and handovers, and perform traffic measurements.

OMC

The OMC includes the M2000, Configuration Management Express (CME), local maintenance terminal (LMT), and site maintenance terminal (SMT). The OMC allows you to centrally manage and maintain GBTSs and BSCs.

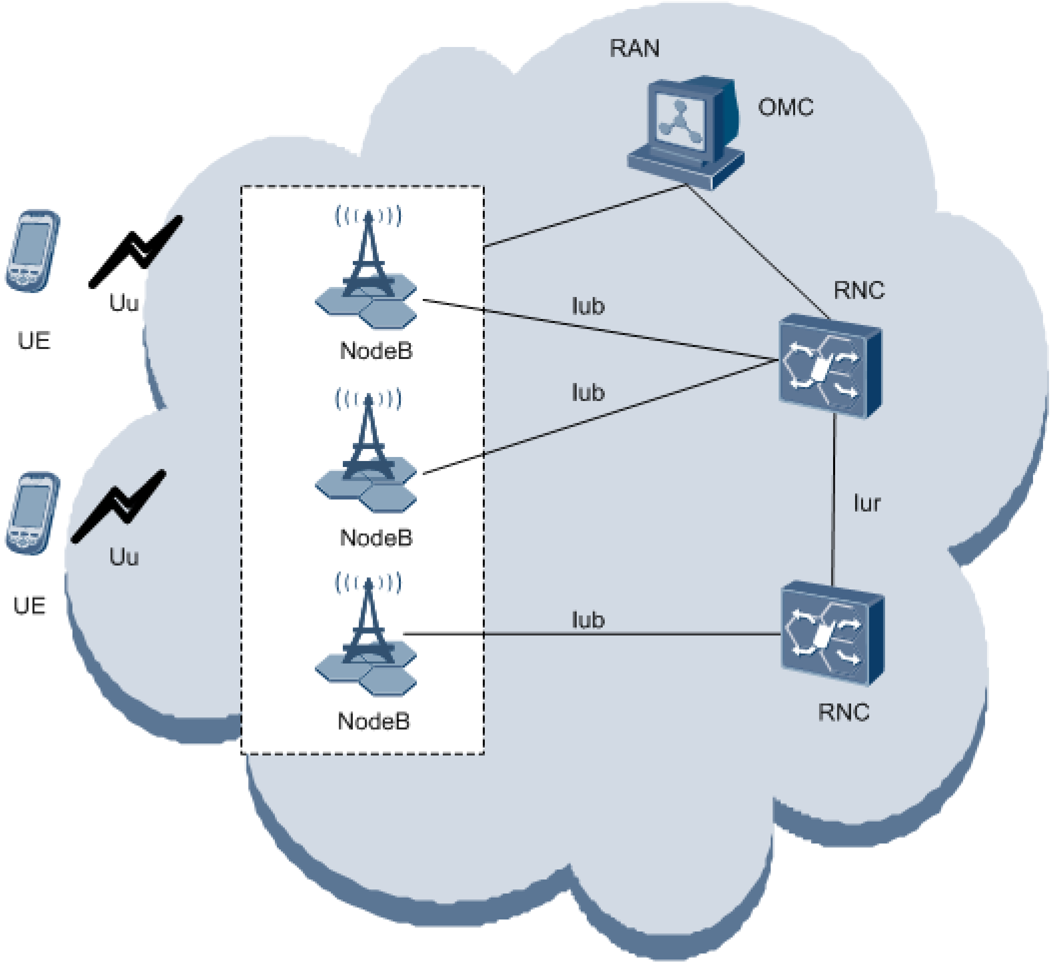
3.2 NodeB in the Network

The radio access network (RAN) system consists of the NodeB, radio network controller (RNC), and operation and maintenance center (OMC). This section describes the position of NodeBs and functions of network elements (NEs).

NodeB in the Network

Figure 3-2 shows the position of NodeBs in the network.

Figure 3-2 NodeB in the network



NodeB: WCDMA base station	RAN: radio access network	RNC: radio network controller
OMC: operation and maintenance center	UE: user equipment	-

As shown in **Figure 3-2**, NodeBs communicate with the UEs, RNC, and OMC over different interfaces.

The functions of each NE are as follows:

NodeB

As a WCDMA base station, a NodeB consists of the wireless transceiver and baseband processing unit. The NodeB communicates with the RNC and UEs over the Iub interface and Uu interface, respectively. It performs physical layer protocol processing, including frequency spreading and despreading, modulation and demodulation, channel coding and decoding, and conversion between baseband and radio frequency (RF) signals.

RNC

An RNC performs radio resource control (RRC) on the establishment and removal of RRC connections, handover, and macro diversity combining.

OMC

The OMC includes the M2000, Configuration Management Express (CME), and local maintenance terminal (LMT). Users can use the OMC to centrally manage and maintain NodeBs.

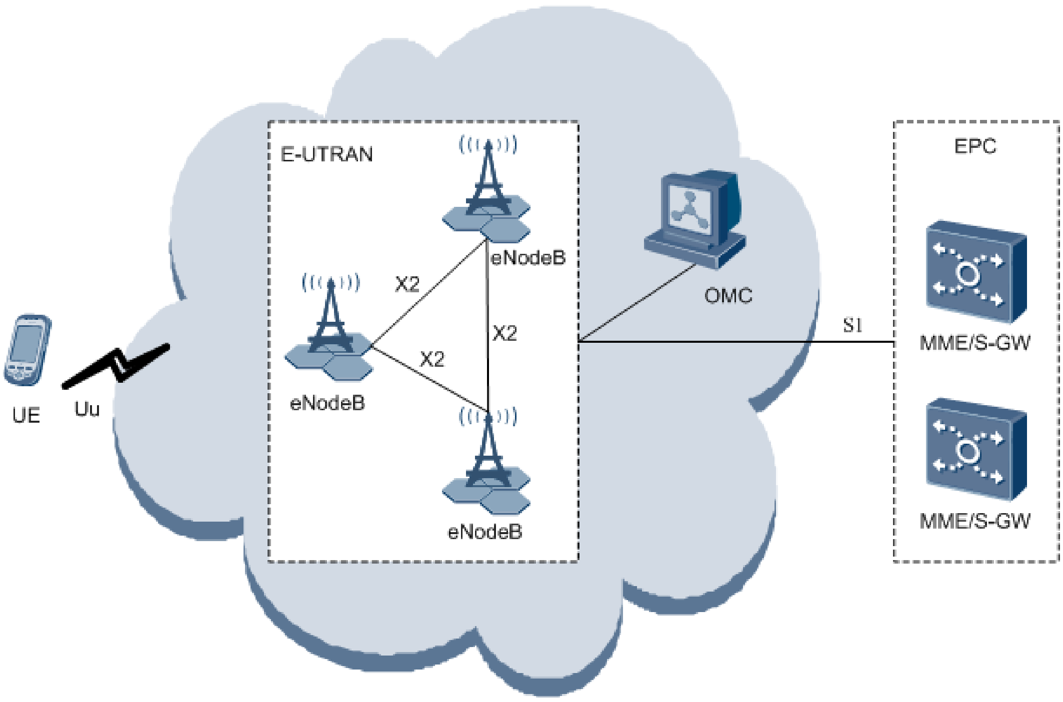
3.3 eNodeB in the Network

The Long Term Evolution - System Architecture Evolution (LTE-SAE) system consists of the evolved universal terrestrial radio access network (E-UTRAN) and evolved packet core (EPC). This section describes the position of E-UTRAN NodeBs (eNodeBs) and the functions of network elements (NEs).

eNodeB in the Network

Figure 3-3 shows the position of eNodeBs in the network.

Figure 3-3 eNodeB in the network



MME: mobility management entity S-GW: serving gateway UE: user equipment

As shown in Figure 3-3, an eNodeB is radio access equipment in the LTE-SAE system. One or more eNodeBs constitute an E-UTRAN. An eNodeB communicates with a UE, another eNodeB, or the EPC through the Uu, X2, or S1 interface, respectively.

The following sections describe functions of each network element (NE).

eNodeB

An eNodeB has the following functions:

- Radio resource management, including radio bearer control, radio admission control, connection mobility control, and scheduling
- Packet compression and ciphering
- Routing of user-plane data towards an S-GW
- MME selection
- Scheduling and transmission of broadcast information and paging messages
- Measurement and measurement reporting configuration

MME

An MME has the following functions:

- Paging message distribution
- Security control
- Mobility management in idle mode
- SAE bearer control
- Ciphering and integrity protection of non-access stratum (NAS) signaling

S-GW

An S-GW has the following functions:

- Termination of user-plane packets that are generated for paging reason
- Support for user-plane handovers caused by UE mobility

OMC

The operation and maintenance center (OMC) includes the M2000, Configuration Management Express (CME), and local maintenance terminal (LMT). Users can use the OMC to manage and maintain eNodeBs.

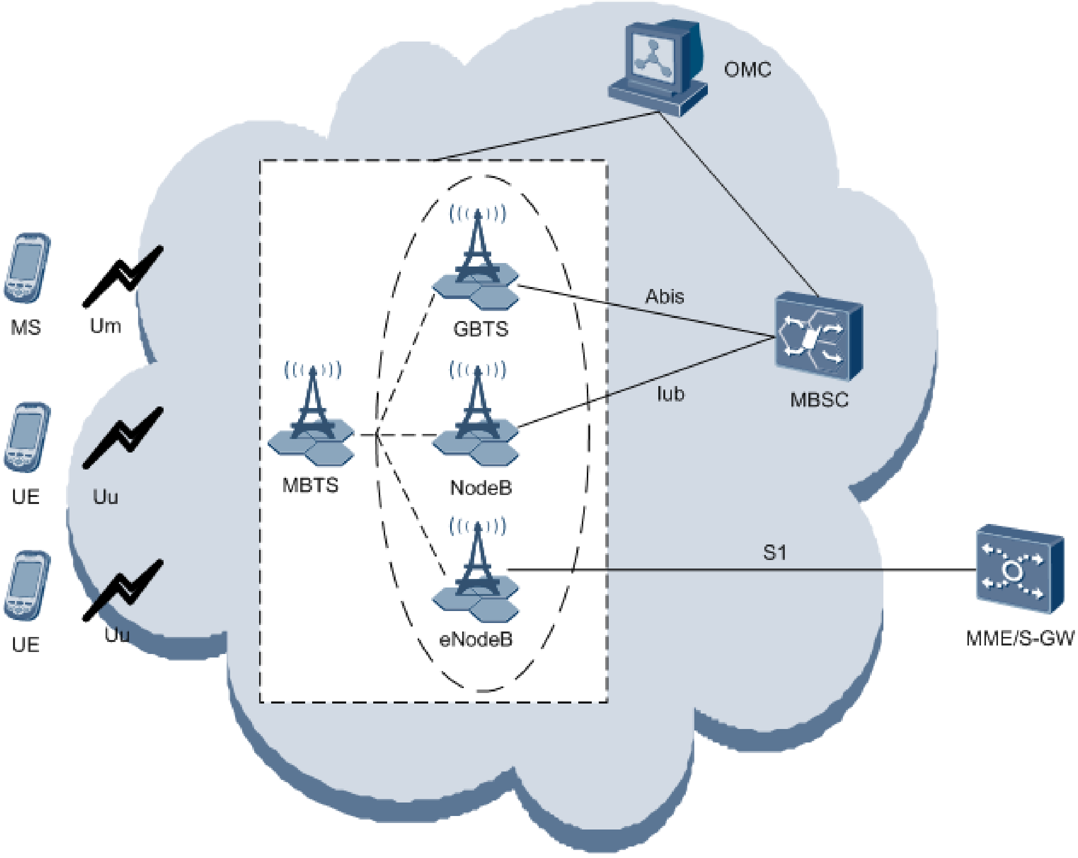
3.4 MBTS in the Network

The SingleRAN system includes the multi-mode base station controller (MBSC), multi-mode base transceiver station (MBTS), and operation and maintenance center (OMC). This section describes the position of an MBTS in the network and functions of each network element (NE).

MBTS in the network

Figure 3-4 shows the position of an MBTS in the network.

Figure 3-4 MBTS in the network



MBTS: multi-mode base transceiver station	MBSC: multi-mode base station controller	OMC: operation and maintenance center
MME: mobility management entity	S-GW: serving gateway	UE: user equipment
MS: mobile station	-	-

As shown in **Figure 3-4**, the MBTS communicates with the UE, MS, MBSC, MME or S-GW and OMC using different interfaces.

The following describes functions of each NE:

MBTS

The MBTS incorporates functions of the GBTS, NodeB and eNodeB. The MBTS is connected to a network where GSM, UMTS, and LTE services co-exist as an independent NE. An MBTS consists of multiple SiteUnits. Physically, each SiteUnit corresponds to the related boards and modules. Logically, each SiteUnit corresponds to the related NE. As shown in **Figure 3-4**, the MBTS consists of three SiteUnits, which logically correspond to GBTS, NodeB, and eNodeB, respectively. Physically, the three SiteUnits correspond to GSM boards and modules, UMTS boards and modules, and LTE boards and modules, respectively. In this technical description, SiteUnits in a triple-mode base station are GBTS, NodeB, and eNodeB.

MBSC

The MBSC incorporates functions of the radio network controller (RNC) and base station controller (BSC). The MBSC is connected to a network where GSM and UMTS services co-exist as an independent NE. The MBSC is connected to the GBTS and NodeB using the Abis and Iub interfaces, respectively.

MME/S-GW

The MME or S-GW is located in the evolved packet core (EPC) and is connected to the eNodeB using the S1 interface.

OMC

The OMC includes the M2000, Configuration Management Express (CME), local maintenance terminal (LMT), Service Maintenance Terminal (SMT), and so on. Users can use the OMC to centrally manage and maintain MBTSs and MBSCs.

4 About 3900 Series Base Stations

About This Chapter

The 3900 series base stations include macro base stations (BTS3900, BTS3900L, BTS3900A, and BTS3900AL), a distributed base station (DBS3900), micro base stations (BTS3900C, BTS3900E, and BTS3902E), and a Pico base station (BTS3900B). Different types of base stations can be used in various scenarios to achieve fast deployment and low operating expenditure (OPEX). This technical description focuses on macro base stations, the distributed base station DBS3900, and the micro base station BTS3900C. For a description of the other types of 3900 series base stations, see the production documentation of the base station in question.

With a modular design, 3900 series base stations consist of three basic modules: the BBU3900, radio frequency unit (RFU), and remote radio unit (RRU). Radio frequency (RF) modules include RFUs and RRUs. The BBU3900 communicates with RF modules using common public radio interface (CPRI) ports through cables or optical fiber cables.

As an indoor macro base station, the BTS3900 is characterized by a large capacity and small size and can be easily expanded.

As an indoor macro base station, the BTS3900L is characterized by a large capacity and high integration and can be easily expanded.

As an outdoor macro base station, the BTS3900A is applicable to the outdoor centralized installation scenario.

As an outdoor macro base station, the BTS3900AL is characterized by space saving and high integration and can be easily evolved.

As a distributed base station, the DBS3900 is applicable to installation scenarios where wide coverage is required or base station deployment is difficult.

The BTS3900C is a mini outdoor base station and applies to hot spots, tunnels, and borders.

4.1 Basic Modules

With a modular design, 3900 series base stations consist of three basic modules: the BBU3900, radio frequency unit (RFU), and remote radio unit (RRU). Radio frequency (RF) modules include RFUs and RRUs. The BBU3900 communicates with RF modules using common public radio interface (CPRI) ports through cables or optical fiber cables.

4.1.1 BBU3900

The BBU3900 (BBU for short) is a baseband processing unit and centrally manages an entire base station.

Function

The BBU provides the following functions:

- Centrally manages an entire base station in terms of operation and maintenance (O&M) and signaling processing, and provides the system clock.
- Processes uplink and downlink baseband signals and provides common public radio interface (CPRI) ports for communication with radio frequency (RF) modules.
- Provides ports for communication with environment monitoring devices, and receives and forwards signals from the environment monitoring devices.
- Provides physical ports for communication between a base station and the transport network.
- Provides the O&M channel connecting a base station to the Operation and Maintenance Center (OMC).

Boards and modules in the BBU

With a case structure, the BBU can house different types of boards and modules, as shown in **Table 4-1**.

Table 4-1 Boards and modules in the BBU

Type	Function	Board	Applicable Mode
Main processing transmission unit	Transmits signals, manages an entire base station, monitors power supply situation, provides the reference clock and O&M ports.	GSM Transmission & Timing & Management Unit (GTMU)	GSM
		WCDMA Main Processing & Transmission unit (WMPT)	UMTS

Type	Function	Board	Applicable Mode
		LTE Main Processing & Transmission unit (LMPT)	LTE
		Universal Main Processing & Transmission unit a1 (UMPTa1)	UMTS
		UMPTa2 and UMPTa6	LTE
Baseband processing board	Processes baseband signals.	WCDMA BaseBand Processing Unit (WBBP)	UMTS
		LTE BaseBand Processing Unit (LBBP)	LTE
Universal baseband radio interface unit	Provides CPRI-extension-capable optical or electrical ports, and converge or distribute CPRI signals.	Universal BaseBand Radio Interface Board (UBRI)	GSM
Universal interconnected interface unit	Makes two BBUs interconnected for the exchange of control and synchronization data.	Universal inter-Connection Infrastructure Unit (UCIU)	GSM, UMTS (supported only by MBTSs), and LTE (supported only by MBTSs)
Universal transmission processing unit	Expands transmission capabilities.	Universal Transmission Processing unit 2 (UTRP2), UTRP3, UTRP4, UTRP6, and UTRP9	UMTS
		UTRPb4	GSM and LTE
		UTRPc	GSM, UMTS, and LTE

Type	Function	Board	Applicable Mode
Universal satellite card and clock unit	Provides ports to receive GPS, RGPS, TOD, M-1PPS, and BITS signals.	Universal Satellite card and Clock Unit b11 (USCUb11)	LTE
		USCUb12	GSM, UMTS, and LTE
		USCUb21	GSM, UMTS, and LTE **NOTE** This board is not supported by MBTSs working in multiple modes.
Lightning protection unit	Provides lightning protection for E1/T1, FE, and dry contact signals.	Universal E1/T1 Lightning Protection unit (UELP), Universal FE Lightning Protection unit (UFLP), and Universal Signal Lightning Protection unit 2 (USLP2)	GSM, UMTS, and LTE
Power supply module	Converts -48 V DC or +24 V DC input power into +12 V DC.	Universal Power and Environment Interface Unit (UPEU)	GSM, UMTS, and LTE
Universal environment interface unit	Sends information about environment monitoring devices and alarm information to the main control board.	Universal Environment Interface Unit (UEIU)	GSM, UMTS, and LTE
Fan module	Controls the fan speed, detects the fan temperature, and dissipate heat for the BBU.	FAN	GSM, UMTS, and LTE

For configurations principles and functions of boards and modules, see the *DBS3900 Hardware Description*, which also provides information about ports, indicators, and DIP switches on these boards and modules.

The BBU supports plug-and-play and therefore it can be configured as required.

- When equipped with boards of one mode, the BBU serves this mode.

- When equipped with boards of two different modes, the BBU serves any two modes among GSM, UMTS, and LTE at the same time, achieving dual-mode application, such as GU, GL, or UL.
- The use of two BBUs achieves triple-mode application.

Currently, only up to two BBUs can be used in a base station at the same time.

4.1.2 RFU

Radio frequency units (RFUs) are used in a macro base station to perform modulation, demodulation, data processing and power amplification of RF and baseband signals, and conduct voltage standing wave ratio (VSWR) detection.

Table 4-2 lists RFU types.

Table 4-2 RFU types

Module	Applicable Mode
DRFU	GSM
GRFU	GSM
WRFU	UMTS
WRFUd	UMTS
CRFUd	LTE
LRFU	LTE
LRFUe	LTE
MRFU	GSM, UMTS, LTE, GU, and GL
MRFUd	GSM, UMTS, LTE, GU, and GL
MRFUe	GSM, UMTS, LTE, GU, and GL

For functions and the logical structure of an RFU, see the **Hardware Description** of the base station in question. This document also provides details about ports and indicators on the RFU. For technical specifications of an RFU, see **10.2 Technical Specifications of RFUs**.

Restrictions on using RFUs together with cabinets are as follows:

- WRFUd, CRFUd, LRFUe, MRFUd and MRFUe modules must be used with the BTS3900 (Ver.C), BTS3900L (Ver.C), BTS3900A (Ver.C), or BTS3900AL (Ver.A) cabinet.
- For other types of RFUs, there are no restrictions on which types of base stations can be used with.

4.1.3 RRU

Remote radio units (RRUs) are used in a distributed base station to perform modulation, demodulation, data processing, and power amplification of baseband and radio frequency (RF) signals, and conduct voltage standing wave ratio (VSWR) detection.

Table 4-3 lists RRU types.

Table 4-3 RRU types

Module	Applicable Mode
RRU3004	GSM
RRU3008	GSM
RRU3804	UMTS
RRU3805	UMTS
RRU3806	UMTS
RRU3808	UMTS and LTE
RRU3828	UMTS
RRU3829	UMTS
RRU3801E	UMTS
RRU3201	LTE
RRU3203	LTE
RRU3220	LTE
RRU3221	LTE
RRU3222	LTE
RRU3229	LTE
RRU3240	LTE
RRU3841	LTE
RRU3908	GSM, UMTS, LTE, GU, and GL
RRU3926	GSM, UMTS, and GU
RRU3928	GSM, UMTS, LTE, GU, and GL
RRU3929	GSM, UMTS, LTE, GU, GL, and UL
RRU3942	GSM, UMTS, LTE, GU, and GL

For functions of an RRU, see the **RRU Hardware Description** of the RRU. This document also provides details about ports and indicators on the RRU. For technical specifications of an RRU, see **10.3 Technical Specifications of RRUs**.

Restrictions on using RRUs together with cabinets are as follows:

- RRU3229, RRU3841, RRU3929, RRU3829, and RRU3942 must be used with the APM30H (Ver.C) or TMC11H (Ver.C) cabinet.

- For other types of RRUs, there are no restrictions on which types of base stations can be used with.

4.2 BTS3900

As an indoor macro base station, the BTS3900 is characterized by a large capacity and small size and can be easily expanded.

Cabinet Structure

A BTS3900 uses either of the following cabinets:

- BTS3900 (Ver.B): supports -48 V DC, +24 V DC, 220 V AC, or 110 V AC power input.
- BTS3900 (Ver.C): supports -48 V DC, 220 V AC, or 110 V AC power input.

Different power supply modules are used when different power input is used. **Figure 4-1** and **Figure 4-2** show the internal structures of a BTS3900 (Ver.B) and a BTS3900 (Ver.C) cabinets when -48 V DC power input is used, respectively.

Figure 4-1 Internal structure of a BTS3900 (Ver.B) cabinet

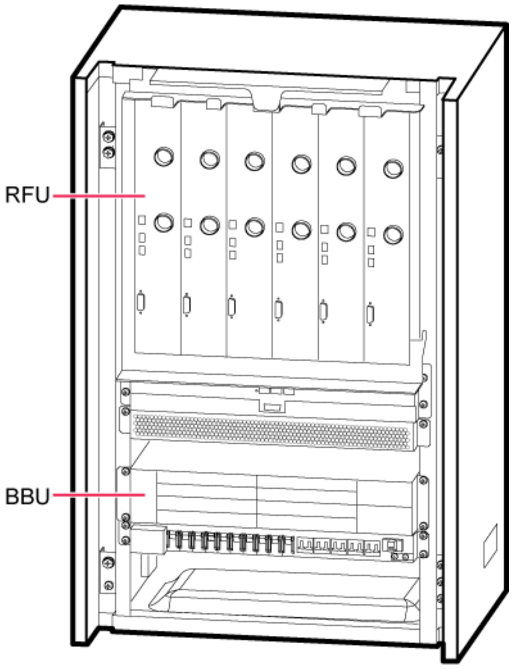
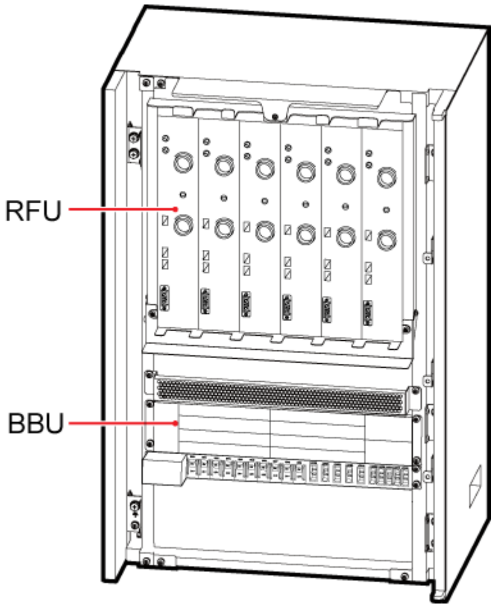


Figure 4-2 Internal structure of a BTS3900 (Ver.C) cabinet



Typical Configurations of a Single Cabinet

Table 4-4 and **Table 4-5** list the typical configurations of a single-mode BTS3900 using one cabinet and those of a multi-mode BTS3900 using one cabinet, respectively.

Table 4-4 Typical configurations of a single-mode BTS3900 using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GSM	S4/4/4	6 DRFUs	20 W (900 MHz)/18 W (1800 MHz)
	S12/12/12	6 GRFUs	12 W
	S12/12/12	6 MRFUs	12 W
	S12/12/12	6 MRFUe modules	20 W
	S8/8/8 + S8/8/8	3 MRFUd + 3 MRFUd modules	20 W (900 MHz) + 20 W (1800 MHz)
UMTS	S4/4/4	3 WRFUs	20 W
	S4/4/4 (MIMO)	3 WRFUd modules	30 W (2 x 15 W)
	S4/4/4	3 MRFUs	20 W
	S4/4/4 (MIMO)	3 MRFUd modules	40 W (2 x 20 W)
LTE	3 x 20 MHz (2 x 2 MIMO)	6 MRFUs/3 MRFUd modules	80 W (2 x 40 W)/120 W (2 x 60 W)

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (2 x 2 MIMO)	3 LRFUs	-
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (DL 4 x 2 MIMO/UL 4Rx Diversity)	6 LRFUs	-

Table 4-5 Typical configurations of a multi-mode BTS3900 using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GU	GSM S4/4/4 + UMTS S2/2/2	3 MRFUd modules	20 W + 40 W
GL	GSM S8/8/8 + LTE 3 x 20 MHz (MIMO)	3 MRFUd (GSM) + 3 MRFUd (LTE) modules	20 W + 80 W (2 x 40 W)
UL	UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (UMTS) + 3 MRFUd (LTE) modules	80 W (2 x 40 W) + 120 W (2 x 60 W)

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

Configurations of a BTS3900 (RFUs+RRUs)

When the power input is -48 V DC, a BTS3900 can be configured with radio frequency units (RFUs) and remote radio units (RRUs). A BTS3900 supports flexible networking and can be easily expanded or evolved.

Table 4-6 lists the maximum configurations of a BTS3900 (RFUs+RRUS).

- In single- or dual-mode scenarios, a maximum of 6 RFUs and 6 RRUs can be connected to the same BBU.

- In triple-mode scenarios, a maximum of 12 RFUs and 6 RRUs can be configured.

Table 4-6 Maximum configurations of a BTS3900 (RFUs+RRUs)

Usage Scenario	Number of BBUs	Number of Cabinets	Number of RFUs	Number of RRUs
Single- or dual-mode	1	1	6	6
Triple-mode	2	2	12	6

4.3 BTS3900L

As an indoor macro base station, the BTS3900L is characterized by a large capacity and high integration and can be easily expanded.

Cabinet Structure

A BTS3900L can use a BTS3900L (Ver.B) cabinet or a BTS3900L (Ver.C) cabinet. A single cabinet can house a maximum of 12 radio frequency (RF) modules and 2 baseband units (BBUs). Both types of cabinets support -48 V DC power input. The following figures **Figure 4-3** and **Figure 4-4** show the internal structures of the two cabinets.

Figure 4-3 Internal structure of a BTS3900L (Ver.B) cabinet

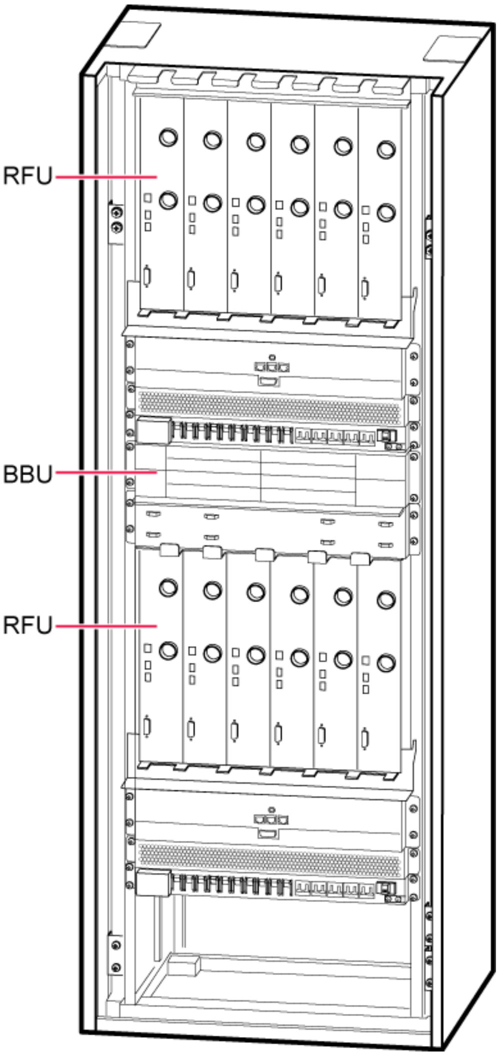
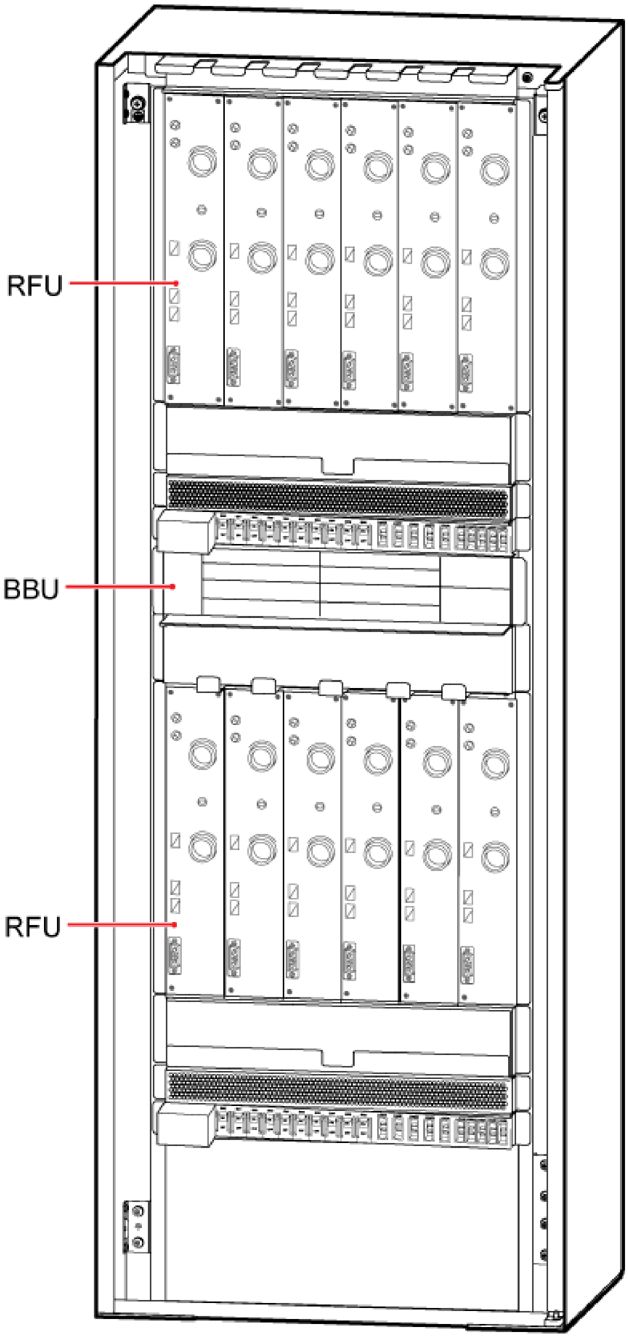


Figure 4-4 Internal structure of a BTS3900L (Ver.C) cabinet



Typical Configuration

Table 4-7 and **Table 4-8** list the typical configurations of a single-mode BTS3900L using one cabinet and those of a multi-mode BTS3900L using one cabinet, respectively.

Table 4-7 Typical configurations of a single-mode BTS3900L using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GSM	S4/4/4	6 DRFUs	20 W (900 MHz)/18 W (1800 MHz)
	S12/12/12	6 GRFUs	12 W
	S12/12/12	6 MRFUs	12 W
	S12/12/12	6 MRFUe modules	20 W
	S8/8/8 + S8/8/8	3 MRFUd + 3 MRFUd modules	20 W (900 MHz) + 20 W (1800 MHz)
UMTS	S4/4/4	3 WRFUs	20 W
	S4/4/4 (MIMO)	3 WRFUd modules	30 W (2 x 15 W)
	S4/4/4	3 MRFUs	20 W
	S4/4/4 (MIMO)	3 MRFUd modules	40 W (2 x 20 W)
LTE	3 x 20 MHz (2 x 2 MIMO)	6 MRFUs/3 MRFUd modules	80 W (2 x 40 W)/120 W (2 x 60 W)
	3 x 1.4 MHz/3 MHz/5 MHz/10 MHz/15 MHz/20 MHz (2 x 2 MIMO)	3 LRFUs	-
	3 x 1.4 MHz/3 MHz/5 MHz/10 MHz/15 MHz/20 MHz (DL 4 x 2 MIMO/UL 4Rx Diversity)	6 LRFUs	-

Table 4-8 Typical configurations of a multi-mode BTS3900L using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GU	GSM S8/8/8 + UMTS S2/2/2 (MIMO)	3 MRFUd (GSM) + 3 MRFUd (UMTS) modules	20 W + 80 W (2 x 40 W)
		6 GRFUs + 6 WRFUs	
GL	GSM S8/8/8 + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (GSM) + 3 MRFUd (LTE) modules	20 W + 120 W (2 x 60 W)

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
		6 GRFUs + 6 MRFUs (LTE)	20 W + 80 W (2 x 40 W)
UL	UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (UMTS) + 3 MRFUd (LTE) modules	80 W (2 x 40 W) + 80 W (2 x 40 W)
		6 WRFUs + 6 LTE MRFUs (LTE)	
GU + L/GL + U	GSM S8/8/8 + UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd + 3 MRFUd (UMTS) + 3 MRFUd (LTE) modules	20 W + 80 W (2 x 40 W) + 120 W (2 x 60 W)

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

Configurations of a BTS3900L (RFUs+RRUs)

A BTS3900L can be configured with radio frequency units (RFUs) and remote radio units (RRUs). A BTS3900L supports flexible networking and can be easily expanded or evolved.

Table 4-9 lists the maximum configurations of a BTS3900L (RFUs+RRUs).

- In single- or dual-mode scenarios, a maximum of 6 RFUs and 6 RRUs can be connected to the same BBU.
- In triple-mode scenarios, a maximum of 12 RFUs and 6 RRUs can be configured.

Table 4-9 Maximum configurations of a BTS3900L (RFUs+RRUs)

Usage Scenario	Number of BBUs	Number of Cabinets	Number of RFUs	Number of RRUs
Single- or dual-mode	1	1	6	6
Triple-mode	2	1	12	6

4.4 BTS3900A

As an outdoor macro base station, the BTS3900A is applicable to the outdoor centralized installation scenario.

Cabinet Structure

A BTS3900A consists of a radio frequency (RF) cabinet and a power cabinet, or of an RF cabinet and a transmission cabinet, and supports 110 V AC, 220 V AC, and -48 V DC power input.

- An RF cabinet houses RF modules, and the power cabinet or transmission cabinet can be stacked on top of the RF cabinet. Together with the RF cabinet, the power cabinet or transmission cabinet provides the power distribution and surge protection function for the baseband unit (BBU) and radio frequency units (RFUs). RF cabinets fall into two types: RFC (Ver.B) and RFC (Ver.C). An RF cabinet can house a maximum of six RF modules.
- If 110 V AC or 220 V AC power input is provided, an APM30H (Ver.B) or APM30H (Ver.C) power cabinet must be used and the BBU can be installed inside the power cabinet.
- If -48 V DC power input is provided, a TMC11H (Ver.B) or TMC11H (Ver.C) transmission cabinet must be used and the BBU can be installed inside the transmission cabinet.

A BTS3900A (Ver.B) consists of an RFC (Ver.B) and APM30H (Ver.B), or of an RFC (Ver.B) and a TMC11H (Ver.B). When power backup is required, a BTS3900A (Ver.B) can be configured with IBBS200T (Ver.B) or IBBS200D (Ver.B).

A BTS3900A (Ver.C) consists of an RFC (Ver.C) and APM30H (Ver.C), or of an RFC (Ver.C) and a TMC11H (Ver.C). When power backup is required, a BTS3900A (Ver.C) can be configured with IBBS200T (Ver.C) or IBBS200D (Ver.C).

Different power supply modules are used when different power input is used. **Figure 4-5** and **Figure 4-6** show the internal structures of a BTS3900A (Ver.B) cabinet and a BTS3900A (Ver.C) cabinet where AC power input is provided.

Figure 4-5 Internal structure of a BTS3900A (Ver.B) cabinet

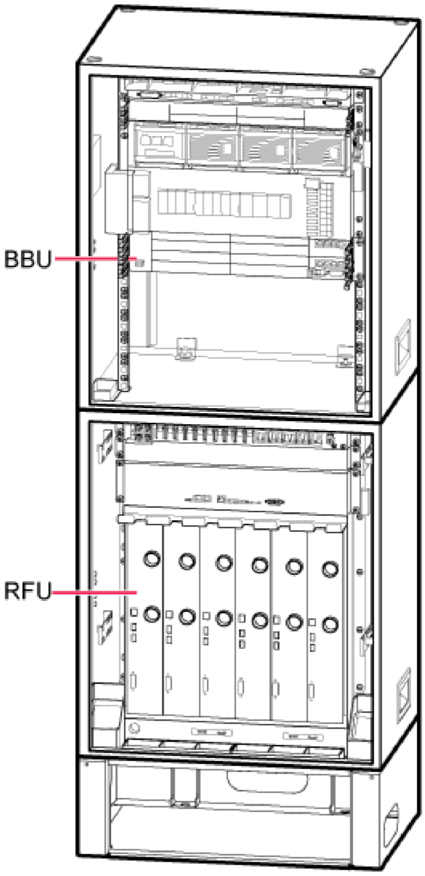
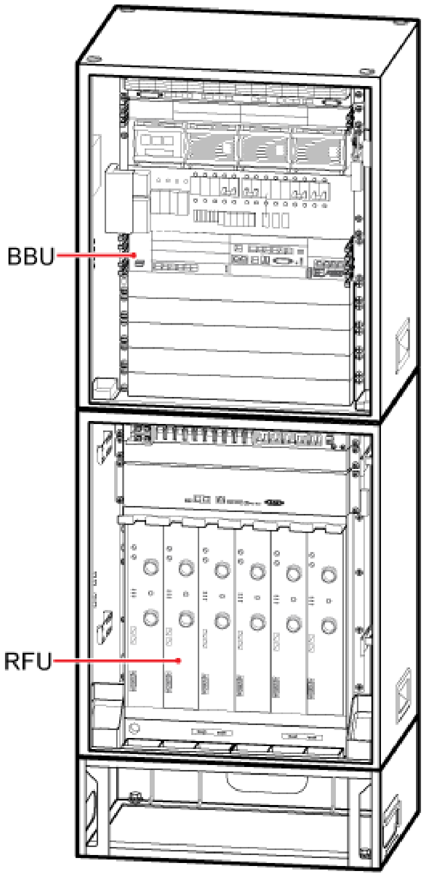


Figure 4-6 Internal structure of a BTS3900A (Ver.C) cabinet



Typical Configurations of a Single Cabinet

Table 4-10 and **Table 4-11** list the typical configurations of a single-mode BTS3900A using one cabinet and those of a multi-mode BTS3900A using one cabinet, respectively.

Table 4-10 Typical configurations of a single-mode BTS3900A using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GSM	S4/4/4	6 DRFUs	20 W (900 MHz)/18 W (1800 MHz)
	S12/12/12	6 GRFUs	12 W
	S12/12/12	6 MRFUs	12 W
	S12/12/12	6 MRFUe modules	20 W
	S8/8/8 + S8/8/8	3 MRFUd + 3 MRFUd modules	20 W (900 MHz) + 20 W (1800 MHz)
UMTS	S4/4/4	3 WRFUs	20 W

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
	S4/4/4 (MIMO)	3 WRFUd modules	30 W (2 x 15 W)
	S4/4/4	3 MRFUs	20 W
	S4/4/4 (MIMO)	3 MRFUd modules	40 W (2 x 20 W)
LTE	3 x 20 MHz (2 x 2 MIMO)	6 MRFUs/3 MRFUd modules	80 W (2 x 40 W)/120 W (2 x 60 W)
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (2 x 2 MIMO)	3 LRFUs	-
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (DL 4 x 2 MIMO/UL 4Rx Diversity)	6 LRFUs	-

Table 4-11 Typical configurations of a multi-mode BTS3900A using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GU	GSM S4/4/4 + UMTS S2/2/2 (MIMO)	3 MRFUd modules	20 W + 40 W
GL	GSM S8/8/8 + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (GSM) + 3 MRFUd (LTE) modules	20 W + 80 W (2 x 40 W)
UL	UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (UMTS) + 3 MRFUd (LTE) modules	80 W (2 x 40 W) + 120 W (2 x 60 W)

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

Configurations of a BTS3900A (RFUs+RRUs)

A BTS3900A can be configured with radio frequency units (RFUs) and remote radio units (RRUs). It supports flexible networking and can be easily expanded or evolved.

Table 4-12 lists the maximum configurations of a BTS3900A (RFUs+RRUs).

- In single- or dual-mode scenarios, a maximum of 6 RFUs and 6 RRUs can be connected to the same BBU.
- In triple-mode scenarios, a maximum of 6 RFUs and 6 RRUs can be configured.

Table 4-12 Maximum configurations of a BTS3900A (RFUs+RRUs)

Usage Scenario	Number of BBUs	Number of Cabinets	Number of RFUs	Number of RRUs
Single- or dual-mode	1	• 2 (APM30H (Ver.B) or APM30H (Ver.C)) • 1 (TMC11H (Ver.B) or TMC11H (Ver.C))	6	6
Triple-mode	2	• 2 (APM30H (Ver.B) or APM30H (Ver.C)) • 2 (TMC11H (Ver.B) or TMC11H (Ver.C))	6	6

4.5 BTS3900AL

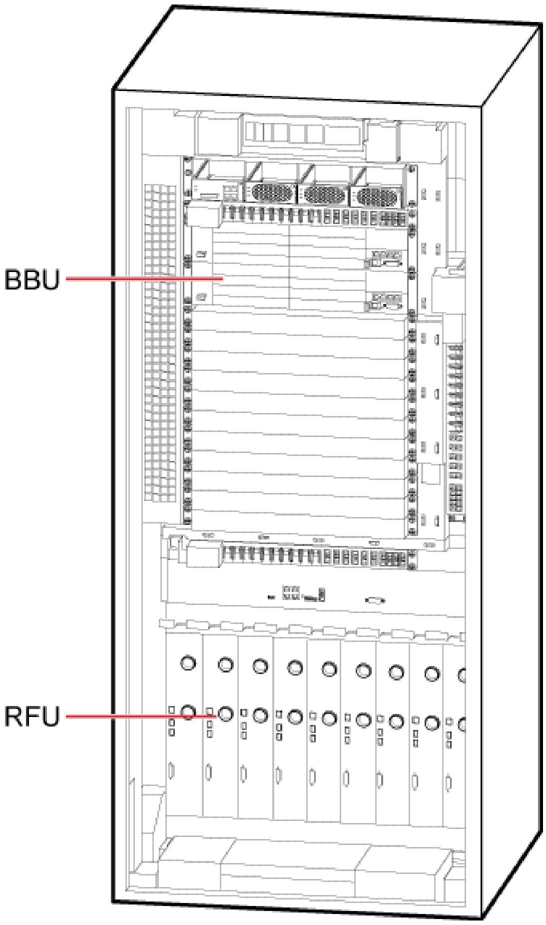
As an outdoor macro base station, the BTS3900AL is characterized by space saving and high integration and can be easily evolved.

Cabinet Structure

A BTS3900AL uses a BTS3900AL (Ver.A) cabinet and supports 220 V AC and 110 V AC power input. Using one cabinet, the BTS3900AL can house a maximum of 9 radio frequency (RF) modules and 2 baseband units (BBUs). Figure 4-7 shows the internal structure of a BTS3900AL (Ver.A) cabinet.

When power backup is required, a BTS3900AL (Ver.A) can be configured with IBBS700D or IBBS700T.

Figure 4-7 Internal structure of a BTS3900AL (Ver.A) cabinet



Typical Configurations of a Single Cabinet

The BTS3900AL mainly applies to large-capacity scenarios where multiple frequency bands or multiple modes co-exist. The BTS3900AL also supports single-mode applications. **Table 4-13** lists the typical configurations of a multi-mode BTS3900AL using one cabinet.

Table 4-13 Typical configurations of a multi-mode BTS3900AL using one cabinet

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GU	GSM S8/8/8 (900 MHz) + GSM S8/8/8 (1800 MHz) + UMTS S2/2/2 (2100 MHz)	3 MRFUd (GSM) + 3 MRFUd (GSM) + 3 WRFU (UMTS) modules	20 W + 20 W + 40 W

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
	GSM S6/6/6 (900 MHz) + UMTS S1/1/1 (900 MHz) + GSM S8/8/8 (1800 MHz) + UMTS S2/2/2 (2100 MHz)	3 MRFUd (GU) + 3 MRFUd (GSM) + 3 WRFUd (UMTS) modules	20 W + 40 W +20 W + 80 W (2 x 40 W)
GL	GSM S4/4/4 (900 MHz) + GSM S4/4/4 (1800 MHz) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 GRFUs (GSM) + 3 GRFUs (GSM) + 3 LRFUs (LTE)	20 W + 80 W (2 x 40 W)
	GSM S6/6/6 + LTE 3 x 10 MHz (2T2R)+ LTE 3 x 20 MHz (2 x 2 MIMO)	6 MRFUs (GL) + 3 LRFUs (LTE)	20 W + 2 x 20 W + 80 W (2 x 40 W)
	GSM S8/8/8 (900 MHz) + LTE 3 x 20 MHz (800 MHz, 2 x 2 MIMO)	3 MRFUd modules (GSM) + 3 LRFUs (LTE)	20 W + 120 W (2 x 60 W)
UL	UMTS S2/2/2 + LTE 3 x 20 MHz (2T2R)	3 WRFUs + 3 MRFUs (LTE)	40 W + 80 W (2 x 40 W)
		3 MRFUs (UMTS) + 3 MRFUs (LTE)	
	UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (4T4R)	3 WRFUd + 6 LRFU modules	80 W (2 x 40 W) + 80 W (2 x 40 W)
		3 MRFUd (UMTS) + 6 MRFUd (LTE) modules	
GU + L/GL + U (independent BBU)	GSM S8/8/8 + UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	3 MRFUd (UMTS) + 3 WRFUd + 3 MRFUd (LTE) modules	20 W + 80 W (2 x 40 W) + 120 W (2 x 60 W)
GU + L/GL + U (BBUs interconnected)	GSM S6/6/6 + UMTS S1/1/1 (MIMO) + GSM S6/6/6 + LTE 3 x 10 MHz (2 x 2 MIMO) + UMTS S2/2/2 (MIMO)	3 MRFUd (GU) + 3 MRFUd (GL) + 3 WRFU modules	20 W + 40 W (2 x 20 W) + 20 W + 40 W (2 x 20 W) + 80 W (2 x 40 W)

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

Maximum configurations of a BTS3900AL (RFUs+RRUs)

A BTS3900AL can be configured with radio frequency units (RFUs) and remote radio units (RRUs). It supports flexible networking and can be easily expanded or evolved.

Table 4-14 lists the maximum configurations of a BTS3900AL (RFUs+RRUs).

- In single- or dual-mode scenarios, a maximum of 6 RFUs and 6 RRUs can be connected to the same BBU.
- In triple-mode scenarios, a maximum of 9 RFUs and 9 RRUs can be configured.

Table 4-14 Maximum configurations of a BTS3900AL (RFUs+RRUs)

Usage Scenario	Number of BBUs	Number of Cabinets	Number of RFUs	Number of RRUs
Single- or dual-mode	1	1	6	6
Triple-mode	2	1	9	9

4.6 DBS3900

As a distributed base station, the DBS3900 is applicable to installation scenarios where wide coverage is required or base station deployment is difficult.

Typical installation scenarios for a DBS3900

A DBS3900 mainly consists of a BBU and RRUs. With RRUs remotely installed, the DBS3900 can be deployed in various scenarios.

Cabinets that can work with a DBS3900 are as follows:

- Power cabinets: APM30, APM30H (Ver.A), APM30H (Ver.B), and APM30H (Ver.C)
- Outdoor power cabinet: TP48600A
- Transmission cabinets: TMC, TMC11H (Ver.A), TMC11H (Ver.B), and TMC11H (Ver.C)
- Battery cabinets: BBC, IBBS200T (Ver.A), IBBS200T (Ver.B), IBBS200T (Ver.C), IBBS200D (Ver.B), IBBS200D (Ver.C), IBBS700D, and IBBS700T
- Other cabinets: OMB, IMB03, and 19-inch rack

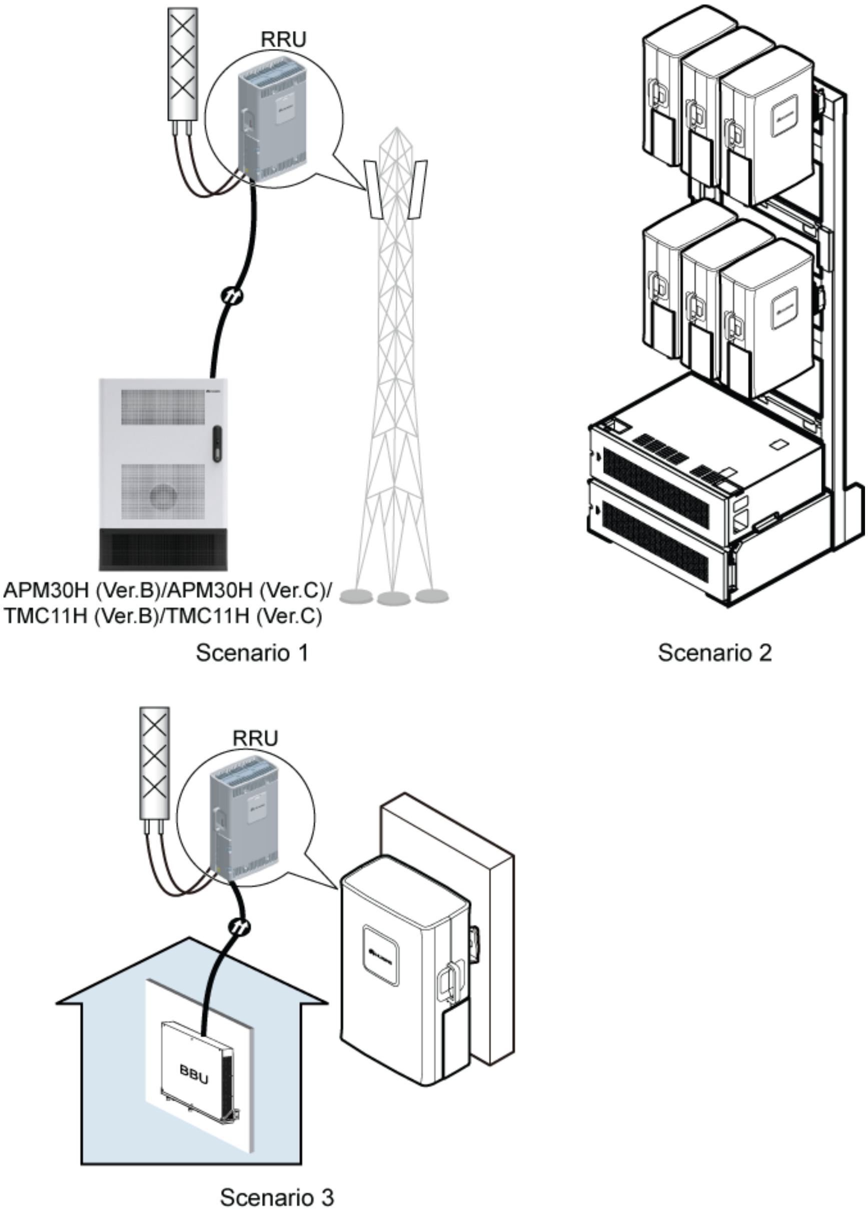
For usage scenarios of the preceding cabinets, see *DBS3900 Hardware Description*.

A maximum of 12 RRUs can be configured in a DBS3900. **Table 4-15** shows the typical installation scenario. For details, see *DBS3900 Installation Guide*.

Table 4-15 Typical installation scenarios for a DBS3900

Usage Scenario		Installation Scenario
Outdoor	Input power is 110 V AC, 220 V AC, or +24 V DC.	The BBU is installed in an APM30H (Ver.B) or APM30H (Ver.C) cabinet, and RRUs are remotely installed. The APM30H (Ver.B) or APM30H (Ver.C) cabinet feeds power to the BBU and RRUs, as shown in **Scenario 1** of **Figure 4-8**.
	Input power is -48 V DC.	The BBU is installed in a TMC11H (Ver.B) or TMC11H (Ver.C) cabinet, and RRUs are remotely installed. The TMC11H (Ver.B) or TMC11H (Ver.C) cabinet feeds power to the BBU and RRUs, as shown in **Scenario 1** of **Figure 4-8**.
Indoor	RRUs are centrally installed.	The BBU is installed in the IMB03, and RRUs and the IMB03 are installed in the IFS06, as show in **Scenario 2** of **Figure 4-8**.
	Input power is -48 V DC.	The BBU is mounted on a wall and RRUs are remotely installed outdoors, as shown in **Scenario 3** of **Figure 4-8**.

Figure 4-8 Typical installation scenarios for a DBS3900



Typical Configuration

Table 4-16 and Table 4-17 list the typical configurations of a single-mode DBS3900 and those of a multi-mode DBS3900, respectively.

Table 4-16 Typical configurations of a single-mode DBS3900

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GSM	S4/4/4	6 RRU3004s	15 W (900 MHz)/10 W (1800 MHz)

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
	S4/4/4	3 RRU3008s	20 W
	S4/4/4	3 RRU3908s	20 W
UMTS	S4/4/4	3 RRU3804s	15 W
	S4/4/4	3 RRU3806s	20 W
	S2/2/2 (MIMO)	3 RRU3908s	40 W (2 x 20 W)
LTE	3 x 20 MHz (2 x 2 MIMO)	3 RRU3908s	40 W (2 x 20 W)
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (2 x 2 MIMO)	3 RRU3220s	-
	3 x 1.4 MHz/3 MHz/ 5 MHz/10 MHz/15 MHz/20 MHz (DL 4 x 2 MIMO/UL 4Rx Diversity)	6 RRU3220s	-

Table 4-17 Typical configurations of a multi-mode DBS3900

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
GU	GSM S4/4/4 + UMTS S2/2/2 (MIMO)	3 RRU3008s + 6 RRU3804s	20 W + 60 W (2 x 30 W)
		3 RRU3008s + 3 RRU3808s	20 W + 40 W (2 x 20 W)
GL	GSM S4/4/4 + LTE 3 x 20 MHz (2 x 2 MIMO)	3 RRU3008s + 3 RRU3908s (LTE)	20 W + 40 W (2 x 20 W)
UL	UMTS S2/2/2 (MIMO) + LTE 3 x 20 MHz (2 x 2 MIMO)	6 RRU3804s + 3 RRU3908s (LTE)	60 W (2 x 30 W) + 40 W (2 x 20 W)
		3 RRU3808s +3 RRU3908s (LTE)	40 W (2 x 20 W) + 40 W (2 x 20 W)

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

4.7 BTS3900C

The BTS3900C is a mini outdoor base station and applies to hot spots, tunnels, and borders.

Cabinet Structure

A BTS3900C cabinet can house an OMB and an RRU subrack. The OMB can house a BBU, power supply modules, and monitoring boards. The RRU subrack can only house RRU3804, RRU3801E, RRU3806, or RRU3801C modules.

The BTS3900C supports -48 V DC and 220 V AC power inputs. When different power input is used, different power supply modules must be used. **Figure 4-9** and **Figure 4-10** show the internal structure of a BTS3900C cabinet.

Figure 4-9 Internal structure of a BTS3900C cabinet (-48 V DC)

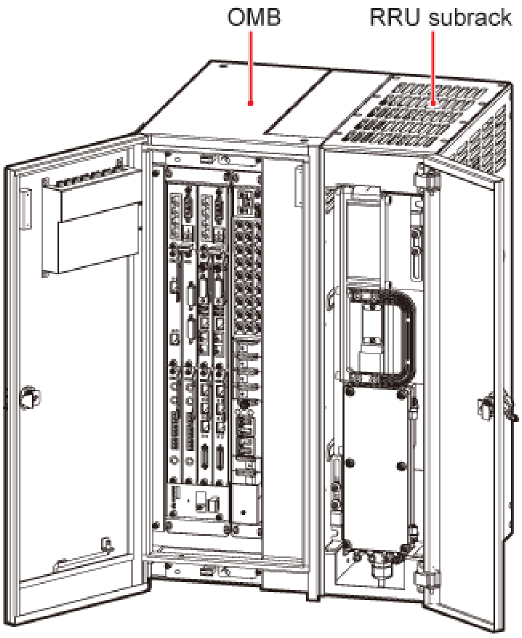
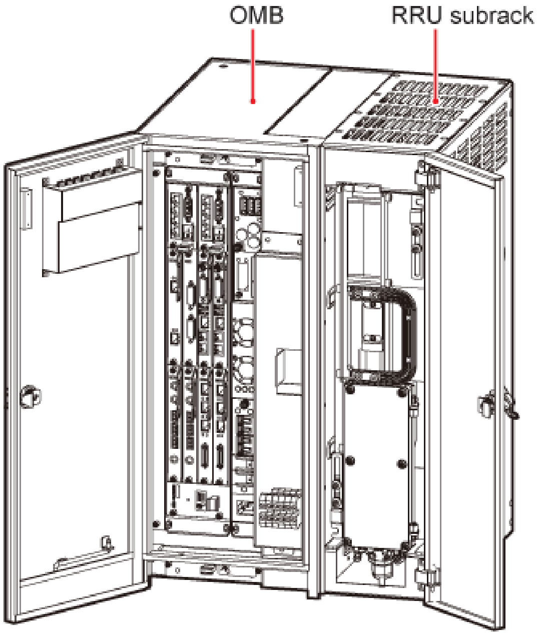


Figure 4-10 Internal structure of a BTS3900C cabinet (220 V AC)



Typical Configuration

Table 4-18 provides the typical configurations of a BTS3900C.

Table 4-18 Typical configurations of a BTS3900C

Mode	Typical Configuration	Module	Output Power of Each Carrier (W)
UMTS	S3	1 RRU3804	20 W

NOTE

- The preceding configurations assume that each cell uses one pair of dual-polarized antennas.
- SA/A/A denotes that the GSM or UMTS networks are configured with three cells and each cell has A carrier.
- B x C MHz denotes that the LTE network is configured with B cells and each cell is configured with C MHz bandwidth.
- D x E MIMO denotes that each cell has D transmit channels and E receive channels.
- F x G W denotes that F transmit channels are provided with G W transmit power per channel.

5 Logical Structure

About This Chapter

A 3900 series base station mainly consists of BBUs, RF modules, and the antenna system. Its functional subsystem includes the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power supply system.

A GSM base transceiver station (GBTS) mainly consists of the baseband unit (BBU), radio frequency (RF) module, and antenna system. Its functional subsystems comprise the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power system.

A NodeB mainly consists of a baseband unit (BBU), radio frequency (RF) modules, and the antenna system. Its functional subsystems comprise the control system, transport system, baseband system, monitoring system, interconnection system, RF system, antenna system, and power system.

An eNodeB mainly consists of a baseband unit (BBU), radio frequency (RF) modules, and the antenna system. Its functional subsystems are the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power supply system.

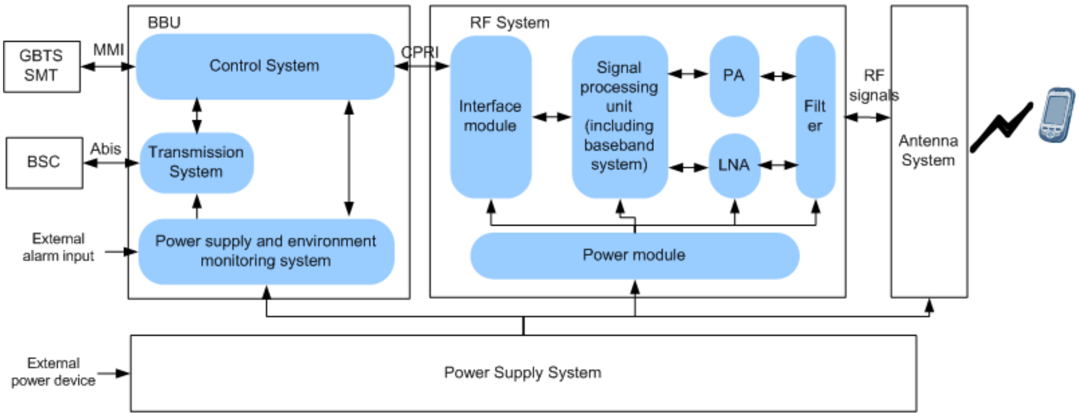
A multi-mode base transceiver station (MBTS) can work in GU, GL, or UL dual mode and can also work in GUL triple mode. In a dual-mode base station, two SiteUnits share one baseband unit (BBU). In a triple-mode base station, two BBUs are required and BBU interconnection is optional.

5.1 GBTS Logical Structure

A GSM base transceiver station (GBTS) mainly consists of the baseband unit (BBU), radio frequency (RF) module, and antenna system. Its functional subsystems comprise the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power system.

Figure 5-1 shows the GBTS logical structure.

Figure 5-1 GBTS logical structure



BBU

The BBU has a modular structure. It consists of the control system, transmission system, baseband system, and power and environment monitoring system.

- The control system manages the entire GBTS in a centralized manner. It provides operation and maintenance functions, processes signaling, and provides a system clock. The functions of the control system are implemented by the GSM Transmission and Timing and Management Unit for BBU (GTMU).
- The transmission system provides ports for communication between the GBTS and the transmission network. The functions of the transmission system are implemented by the GTMU or Universal Transmission Processing unit (UTRP). It also provides the O&M channel connecting the GBTS to the operation and maintenance center (OMC).
- The baseband system processes uplink and downlink baseband signals and provides common public radio interfaces (CPRIs) for communication between the BBU and RF modules. The functions of the baseband system are implemented by the RXU.
- The power and environment monitoring system includes the UPEU and UEIU boards. UPEU stands for Universal Power and Environment Interface Unit, and UEIU stands for Universal Environment Interface Unit. A UPEU board supplies power to the BBU and monitors power status. Both the UPEU and UEIU boards provide ports for connections to environment monitoring devices. These ports receive and forward signals from the environment monitoring devices.

RF System

The RF system modulates and demodulates baseband signals, processes data, as well as combines and distributes signals. RF modules are categorized into the radio frequency units (RFUs) used for macro base stations and the remote radio units (RRUs) used for distributed base stations.

Power System

The power supply system obtains power from external power suppliers and provides power for other systems of the GBTS.

Antenna System

The antenna system mainly receives uplink RF signals from MSs and transmits downlink RF signals from the GBTS. It also prevents the GBTS from inductive lightning. The lightning rod configured for the antenna system conducts high lightning current to the ground so that the lightning current that the GBTS is experiencing decreases significantly. The antenna system includes antennas, feeders, jumpers, and the tower-mounted amplifier (TMA).

5.2 NodeB Logical Structure

A NodeB mainly consists of a baseband unit (BBU), radio frequency (RF) modules, and the antenna system. Its functional subsystems comprise the control system, transport system, baseband system, monitoring system, interconnection system, RF system, antenna system, and power system.

Scenario

There are the single BBU scenario and BBU interconnection scenario.

- Single BBU scenario: a NodeB has one BBU. **Figure 5-4** shows the logical structure of this scenario.

  NOTE

  In the single BBU scenario, main control boards support active/standby backup.

- BBU interconnection scenario: a NodeB has two cascaded BBUs. **Figure 5-5** shows the logical structure of this scenario.

BBU interconnection enables two BBUs to exchange O&M information, service information (signaling messages and user data), clock signals, synchronization information, and baseband signals using a BBU interconnection signal cable. BBU interconnection can also expand the baseband signal processing capability of a base station.

A BBU interconnection signal cable logically corresponds to a BBU interconnection link, which can work as a control link or a baseband interconnection link. **Table 5-1** provides the mapping between a certain BBU interconnection link and a certain BBU interconnection signal cable.

Table 5-1 Mapping between a certain BBU interconnection link and a certain BBU interconnection signal cable

BBU Interconnection Link	BBU Interconnection Signal Cable	Remarks
Control link	BBU interconnection signal cable connecting UCIU to UMPT. This cable is used to connect a UCIU board in the root BBU to a UMPT board in the leaf BBU, as shown in **Figure 5-2**.	The BBU with the UCIU board installed is the root BBU and the other BBU is the leaf BBU. In this technical description, BBU0 is the root BBU while BBU1 is the leaf BBU.
Baseband interconnection link	BBU interconnection signal cable connecting WBBPf to WBBPf. This cable is used to connect a WBBPf board in the root BBU to a WBBPf board in the leaf BBU, as shown in **Figure 5-3**.	● Before a baseband interconnection link can be set up, two BBUs must be interconnected by connecting a UCIU board to a UMPT board using a BBU interconnection signal cable and a control link must be set up. ● Currently, a baseband interconnection link can be set up only on the WBBPf board in slot 2 or 3 of a BBU. Only one baseband interconnection link can be set up in one base station.

One board in the root BBU is the primary main control board while another board in the leaf BBU is the secondary main control board.

Figure 5-2 BBU interconnection signal cable connecting UCIU to UMPT

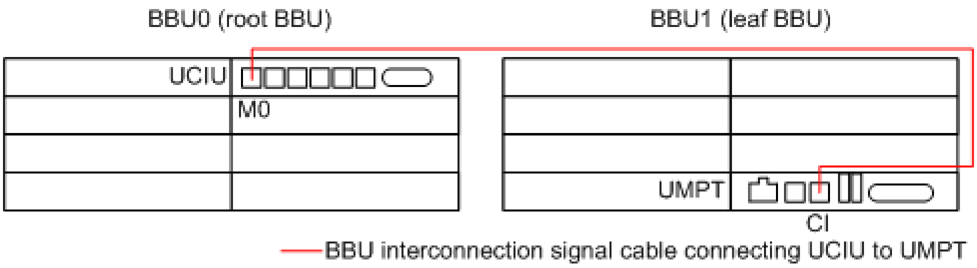
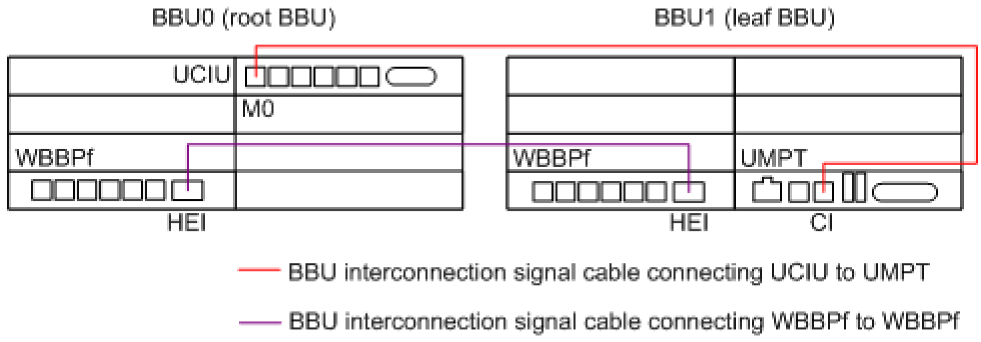


Figure 5-3 BBU interconnection signal cable connecting WBBPf to WBBPf



Logical Structure of a NodeB

Figure 5-4 Logical structure of a NodeB (single BBU)

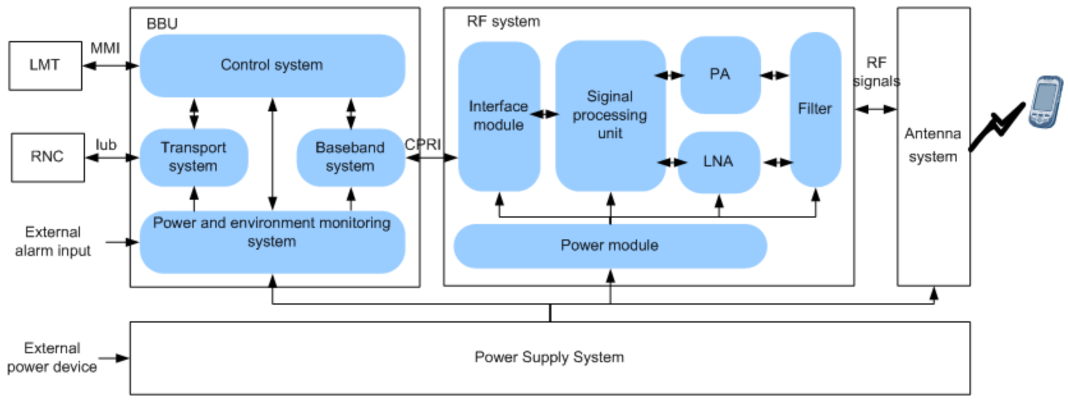
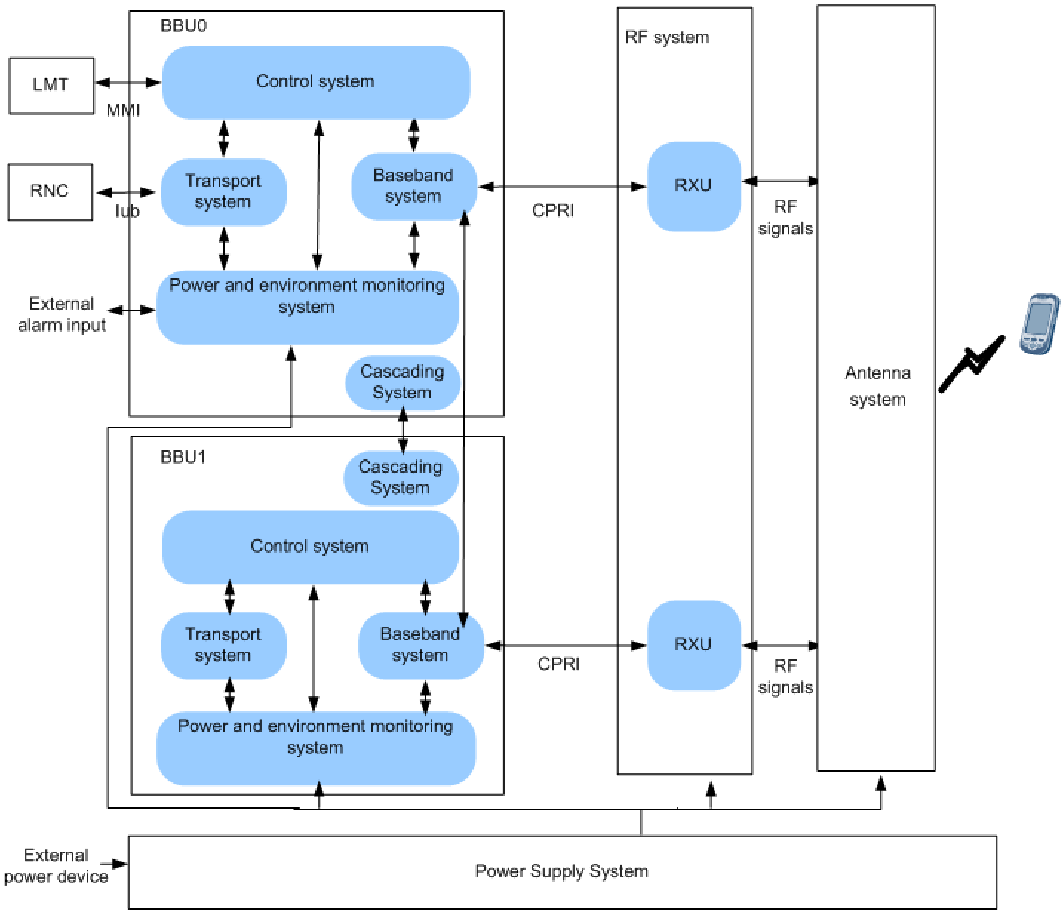


Figure 5-5 Logical structure of a NodeB (BBU interconnection)



NOTE

- The RXU logical structure in **Figure 5-5** is similar to the RF system structure in **Figure 5-4**.
- The monitoring system and local maintenance terminal (LMT) in **Figure 5-5** can be connected only to the primary main control board.

BBU

The BBU has a modular structure and consists of the control system, transport system, baseband system, power and environment monitoring system, and interconnection system.

- The control system includes the WMPT and UMPT boards. (UMPT is short for universal main processing and transmission unit. WMPT is short for WCDMA main processing and transmission unit.) This system centrally manages the entire NodeB including O&M, signaling processing, and system clock.
- The transport system includes the UMPT, WMPT, and UTRP boards. (UTRP is short for universal transmission processing unit.) It provides physical ports connecting the NodeB to the transport network for information exchange. This system also provides an OM channel connecting the NodeB to the operation and maintenance center (OMC).
- The baseband system includes WBBP boards. (WBBP is short for WCDMA baseband processing unit.) This system performs baseband processing on uplink and downlink signals and provides the common public radio interface (CPRI) for communication with RF modules.

- The power and environment monitoring system includes the UPEU and UEIU boards. UPEU stands for Universal Power and Environment Interface Unit, and UEIU stands for Universal Environment Interface Unit. A UPEU board supplies power to the BBU and monitors power status. Both the UPEU and UEIU boards provide ports for connections to environment monitoring devices. These ports receive and forward signals from the environment monitoring devices.
- The interconnection system includes the UCIU, UMPT, and WBBPf boards. This system allows transfer of operation and maintenance (O&M) information, service information (signaling and user data), clock synchronization information, baseband data between cascaded BBUs, and baseband resource extension.

RF System

RF modules (RXUs for short) include radio frequency units (RFUs) used in macro NodeBs and remote radio units (RRUs) used in distributed NodeBs. The RF system performs modulation, demodulation, data processing, combining, and splitting for baseband signals and RF signals.

Power System

The power system obtains power from external power supply devices and supplies power to other systems of the NodeB.

Antenna System

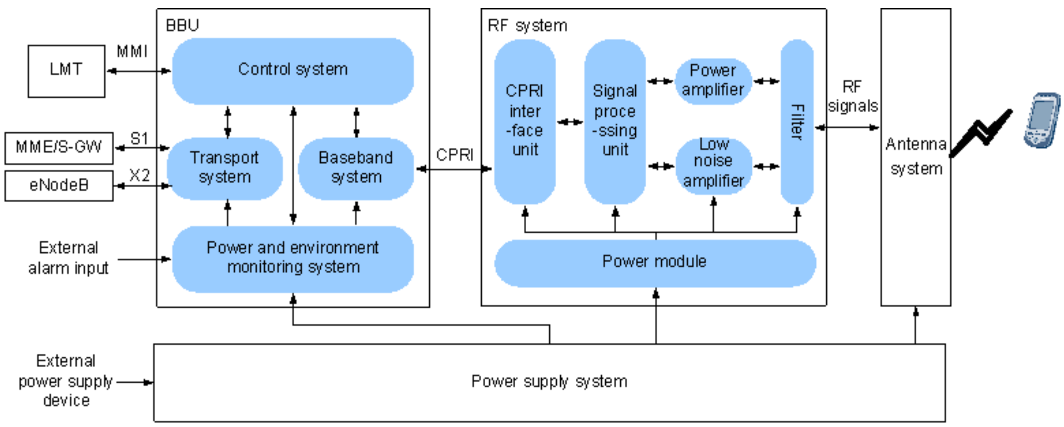
The antenna system includes antennas, feeders, jumpers, a remote control unit (RCU), and a tower mounted amplifier (TMA). This system receives and transmits RF signals. Specifically, antennas receive uplink signals from UEs and transmit downlink signals to UEs. The antenna system provides the lightning protection function (lightning induction) for the NodeB. The lightning rod in this system conducts the powerful lightning current to the ground, significantly reducing the lightning current to the NodeB.

5.3 eNodeB Logical Structure

An eNodeB mainly consists of a baseband unit (BBU), radio frequency (RF) modules, and the antenna system. Its functional subsystems are the control system, transport system, baseband system, monitoring system, RF system, antenna system, and power supply system.

Figure 5-6 shows the logical structure of an eNodeB.

Figure 5-6 Logical structure of an eNodeB



BBU

The BBU has a modular structure and consists of the control system, transport system, baseband system, and power and environment monitoring system.

- The control system includes the UMPT and LMPT boards. (UMPT is short for universal main processing and transmission unit. LMPT is short for LTE main processing and transmission unit.) The control system centrally manages the entire eNodeB including operation and maintenance (O&M), signaling processing, and system clock.
- The transport system includes the UMPT, LMPT, and UTRP boards. (UTRP is short for universal transmission processing unit.) It provides physical ports connecting the eNodeB to the transport network for information exchange. This system also provides an OM channel connecting the eNodeB to the operation and maintenance center (OMC).
- The baseband system includes the LBBP boards. (LBBP is short for LTE baseband processing unit.) This system performs baseband processing on uplink and downlink signals and provides the common public radio interface (CPRI) for communication with RF modules.
- The power and environment monitoring system includes the UPEU and UEIU boards. UPEU stands for Universal Power and Environment Interface Unit, and UEIU stands for Universal Environment Interface Unit. A UPEU board supplies power to the BBU and monitors power status. Both the UPEU and UEIU boards provide ports for connections to environment monitoring devices. These ports receive and forward signals from the environment monitoring devices.

RF System

RF modules (RXUs for short) include radio frequency units (RFUs) used in macro eNodeBs and remote radio units (RRUs) used in distributed eNodeBs. The RF system performs modulation, demodulation, data processing, combining, and splitting for baseband signals and RF signals.

Power Supply System

The power supply system obtains power from external power supply devices and supplies power to other systems of the eNodeB.

Antenna System

The antenna system includes antennas, feeders, jumpers, a remote control unit (RCU), and a tower mounted amplifier (TMA). This system receives and transmits RF signals. The antenna system provides the lightning protection function (lightning induction) for the eNodeB. The lightning rod in this system conducts the powerful lightning current to the ground, significantly reducing the lightning current to the eNodeB.

5.4 MBTS Logical Structure

A multi-mode base transceiver station (MBTS) can work in GU, GL, or UL dual mode and can also work in GUL triple mode. In a dual-mode base station, two SiteUnits share one baseband unit (BBU). In a triple-mode base station, two BBUs are required and BBU interconnection is optional.

5.4.1 Related Concepts

This section describes concepts related to baseband unit (BBU) interconnection and radio frequency (RF) modules.

BBU Interconnection

BBU interconnection enables two BBUs to exchange O&M information, service information (signaling messages and user data), clock signals, synchronization information, and baseband signals using a BBU interconnection signal cable. BBU interconnection can also expand the baseband signal processing capability of a base station.

A BBU interconnection signal cable logically corresponds to a BBU interconnection link, which can work as a control link or a baseband interconnection link. **Table 5-2** provides the mapping between a certain BBU interconnection link and a certain BBU interconnection signal cable.

Table 5-2 Mapping between a certain BBU interconnection link and a certain BBU interconnection signal cable

BBU Interconnection Link	BBU Interconnection Signal Cable	Remarks
Control link	BBU interconnection signal cable connecting UCIU to UMPT. This cable is used to connect a UCIU board in the root BBU to a UMPT board in the leaf BBU, as shown in **Figure 5-7**.	The BBU with the UCIU board installed is the root BBU and the other BBU is the leaf BBU. In this technical description, BBU0 is the root BBU while BBU1 is the leaf BBU.
Baseband interconnection link	BBU interconnection signal cable connecting WBBPf to WBBPf. This cable is used to connect a WBBPf board in the root BBU to a WBBPf board in the leaf BBU, as shown in **Figure 5-8**.	● Before a baseband interconnection link can be set up, a control link must be set up. ● Currently, a baseband interconnection link can be set up only on the WBBPf board in slot 2 or 3 of a BBU. Only one baseband interconnection link can be set up in one base station.

Currently, only the UMTS main control board can be installed in two BBUs. One such board in the root BBU is the primary main control board while another such board in the leaf BBU is the secondary main control board.

Figure 5-7 BBU interconnection signal cable connecting UCIU to UMPT

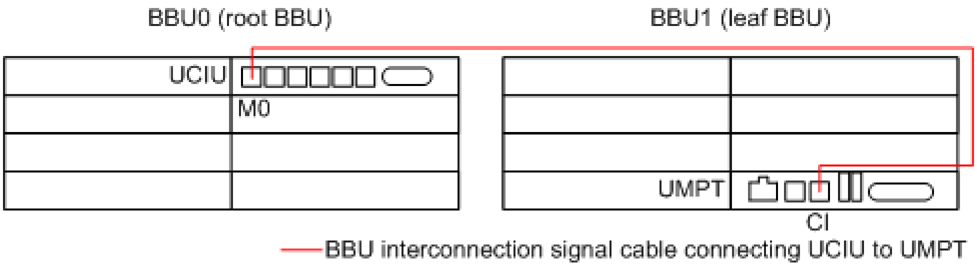
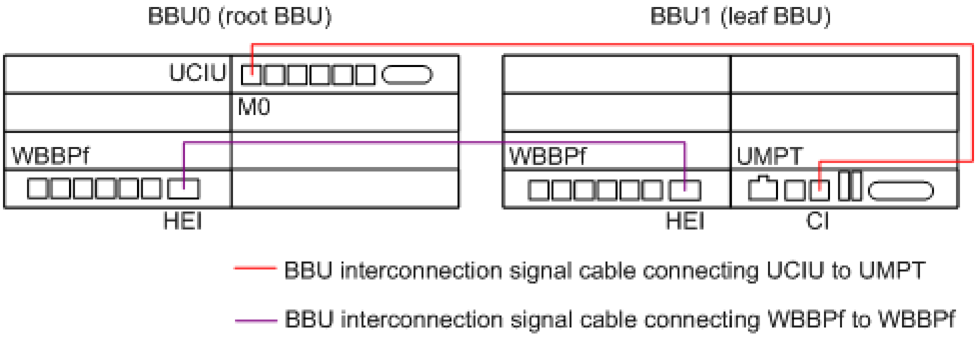


Figure 5-8 BBU interconnection signal cable connecting WBBPf to WBBPf



RF Modules

Radio frequency (RF) modules include radio frequency units (RFUs) used in macro base stations and remote radio units (RRUs) used in distributed base stations. In this technical description, RFUs and RRUs can be referred to as RXUs.

Based on the signal processing capability, RF modules fall into single-mode and multi-mode RF modules. **Table 5-3** provides description about such two types of RF modules.

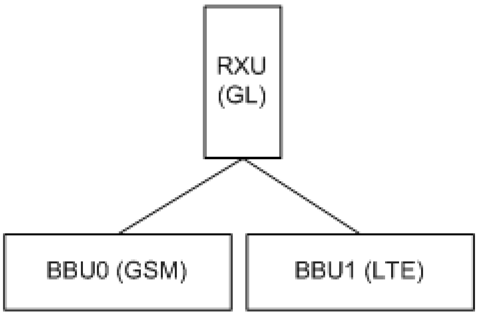
Table 5-3 RF module type

Type	Description
Single-mode RF modules	Each such module permanently processes RF signals of only one mode.
Multi-mode RF modules	Using the software-defined radio (SDR) technique, each multi-mode radio frequency (RF) module can process RF signals for a certain mode (such as, GSM, UMTS, or LTE) at a time with certain configurations. Each such module can also process RF signals for two modes (such as GU, GL, or UL) at a time. Multi-mode RF modules are also referred to as SDR modules.

Single- and multi-mode RF modules can be used in the same MBTS to achieve the application of multiple frequency bands and multiple modes. For an RXU (**), "**" indicates the working mode of the RXU. In addition, the RXU can process RF signals of this mode. For example, an RXU (GU) works in GU mode and processes GSM RF signals and UMTS RF signals.

With BBU interconnection, one RF module can be connected to two BBUs at the same time. This scenario is called inter-BBU SDR. **Table 5-4** provides description about this scenario.

Table 5-4 Inter-BBU SDR

Concept	Description
Inter-BBU SDR	One multi-mode RF module can be connected to two BBUs. For example, GSM boards are installed in BBU0 while LTE boards are installed in BBU1. RXU (GL) modules are connected to BBU0 and BBU1 at the same time. 

5.4.2 Logical Structure of a Dual-Mode Base Station

In a dual-mode base station, boards of one mode among GSM, UMTS, and LTE and boards of another mode among the three modes are installed in the same baseband unit (BBU), achieving BBU sharing across any two modes of the three modes.

Scenario

Table 5-5 lists the typical scenarios for a dual-mode base station.

NOTE

- **BBU Mode** indicates that boards of certain modes are installed in the BBU. For example, in a GU dual-mode BBU, GSM boards and UMTS boards are installed.
- **Working Mode of RF Modules** indicates the working mode of radio frequency (RF) modules connected to the BBU.

Table 5-5 Typical scenarios for a dual-mode base station

Scenario	BBU Mode	Working Mode of RF Modules	Logical Structure
GU	GU	GSM, UMTS, or GU	Figure 5-9 shows its logical structure.
GL	GL	GSM, LTE, or GL	
UL	UL	UMTS and LTE	Figure 5-10 shows its logical structure.

Scenario	BBU Mode	Working Mode of RF Modules	Logical Structure
GU+U	● BBU0: GU ● BBU1: UMTS	● BBU0 is connected to RF modules working in GSM mode, those working in UMTS mode, and those working in GU mode. ● BBU1 is connected to RF modules working in UMTS mode and those working in GU mode.	Figure 5-11 shows its logical structure. In this scenario, a UCIU board must be installed in BBU0 and the main control boards in BBU1 must be the Universal Main Processing and Transmission Unit (UMPT) board. Two BBUs are interconnected using a BBU interconnection signal cable connecting UCIU to UMPT. In this way, a BBU interconnection link is set up. If a WBBPf board is installed in slot 2 or 3 of each BBU, two WBBPf boards can be interconnected using a BBU interconnection signal cable connecting WBBPf to WBBPf. In this way, a baseband interconnection link is set up.

Logical Structure

NOTE

In the logical structure of a GU/GL dual-mode base station, A indicates the UMTS or LTE mode.

Figure 5-9 Logical structure of a dual-mode base station (GU or GL)

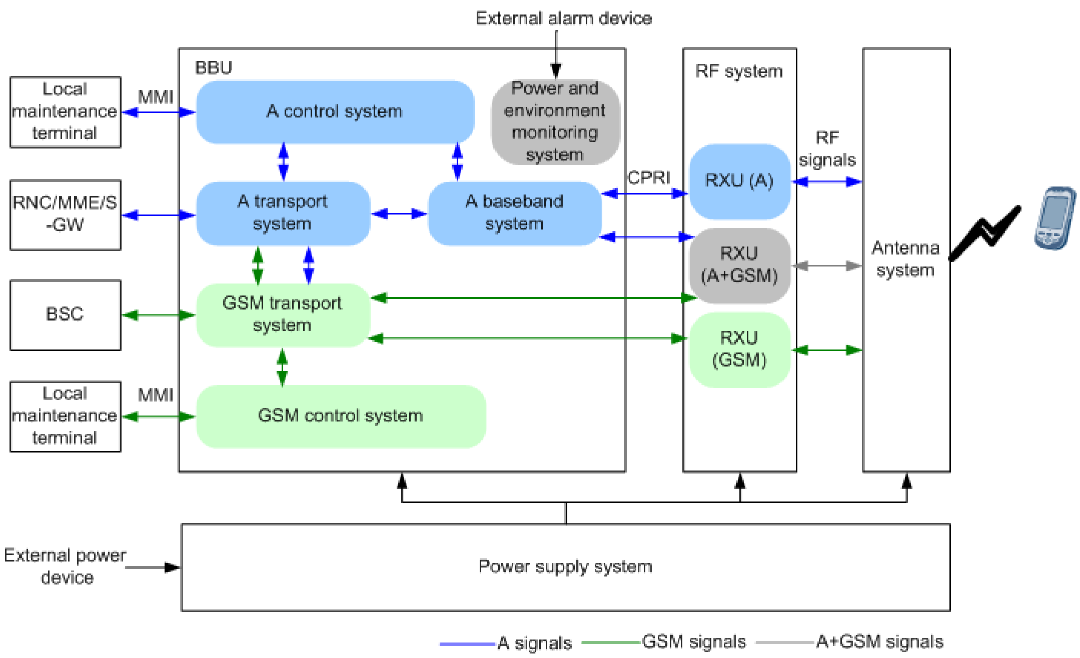


Figure 5-10 Logical structure of a dual-mode base station (UL)

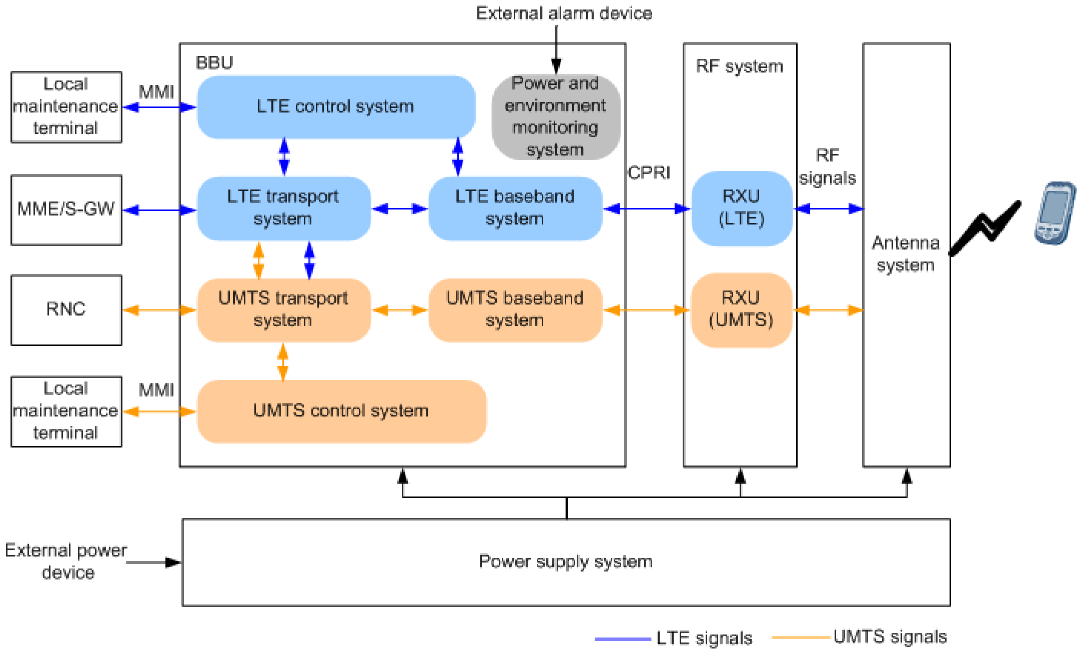
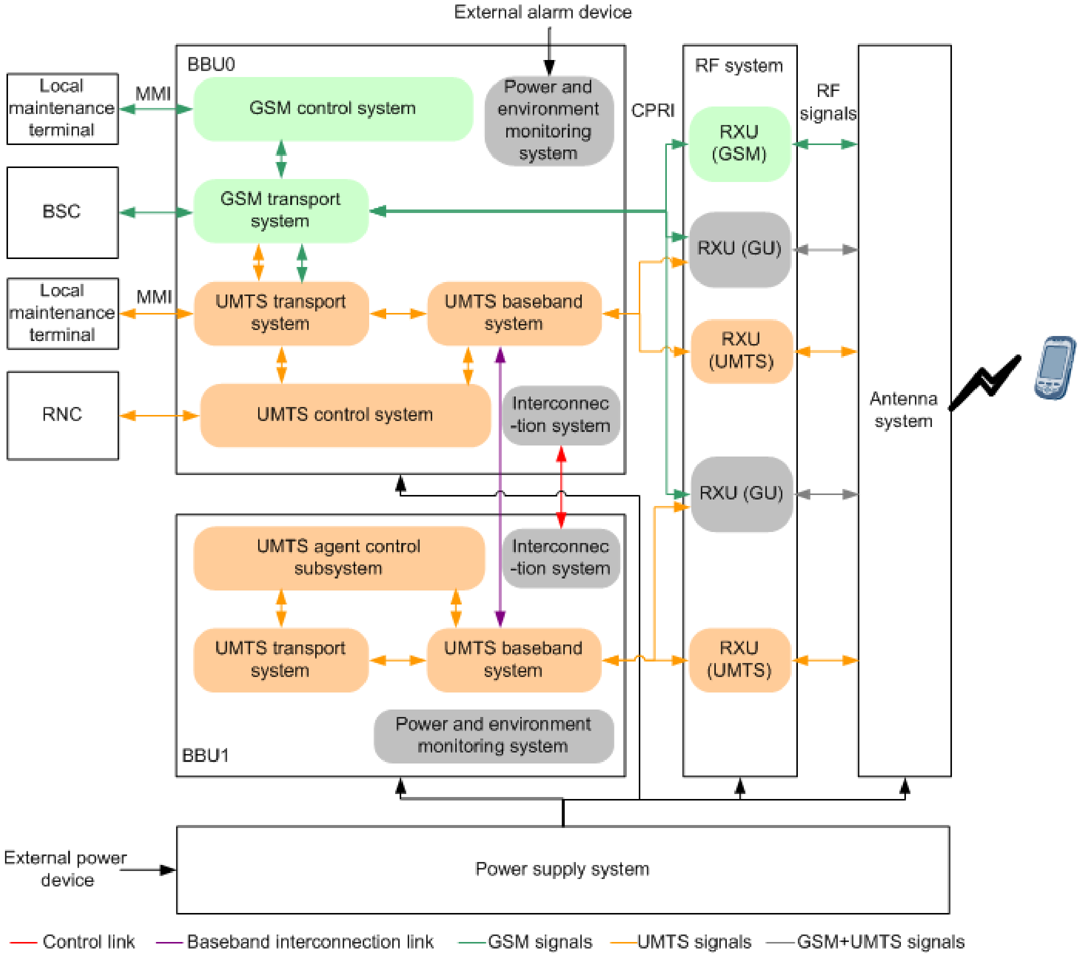


Figure 5-11 Logical structure of a dual-mode base station (GU+U)



The MBTS consists of the following parts:

BBU

The BBU has a modular structure and consists of the control system, transport system, baseband system, power and environment monitoring system, and interconnection system.

- The control system includes the GTMU, WMPT, LMPT, and UMPT boards. It centrally manages the entire base station including operation and maintenance (O&M), signaling processing, and system clock. GTMU stands for GSM Transmission, Timing, and Management Unit for BBU. WMPT stands for WCDMA Main Processing and Transmission Unit. LMPT stands for LTE Main Processing & Transmission Unit. UMPT stands for Universal Main Processing and Transmission Unit.
- The transport system includes the GTMU, WMPT, LMPT, UMPT, and UTRP boards. It provides physical ports connecting the base station to the transport network for information exchange. UTRP stands for Universal Transmission Processing unit. This system also provides an O&M channel connecting the base station to the operation and maintenance center (OMC).
- The baseband system includes the WBBP board (for UMTS) and the LBBP board (for LTE). The baseband subsystem processes uplink and downlink baseband signals and

provides CPRI ports through which the BBU exchanges information with RF modules. For GSM, the baseband system includes RF modules, and the BBU exchanges information with the RF modules using CPRI ports on the GTMU, or UBRI board. WBBP stands for WCDMA Baseband Process Unit. LBBP stands for LTE BaseBand Processing Unit. UBRI stands for Universal BaseBand Radio Interface Unit.

- The power and environment monitoring system includes the UPEU and UEIU boards. UPEU stands for Universal Power and Environment Interface Unit, and UEIU stands for Universal Environment Interface Unit. A UPEU board supplies power to the BBU and monitors power status. Both the UPEU and UEIU boards provide ports for connections to environment monitoring devices. These ports receive and forward signals from the environment monitoring devices.
- The interconnection system includes the UCIU, UMPT, and WBBPf boards. It enables two BBUs to exchange O&M information, service information (signaling messages and user data), clock signals, synchronization information, and baseband signals. With this system, baseband processing capability can be expanded.

In a dual-mode base station with a single BBU, information of the two modes is exchanged within the BBU, achieving clock signal transferring and data forwarding. In a dual-mode base station with two BBUs interconnected, information of the two modes is exchanged through the interconnection system.

RF System

The RF system modulates, demodulates, processes, combines, and splits baseband signals and RF signals. In BBU interconnection scenario, inter-BBU SDR RF modules can be used.

Power Supply System

The power supply system obtains power from external power supply devices and provides power for other systems of an MBTS.

Antenna System

The antenna system includes antennas, feeders, jumpers, a remote control unit (RCU), a tower mounted amplifier (TMA), and a Same band Antenna Sharing Unit (SASU). This system receives and transmits RF signals. Specifically, antennas receive uplink signals from terminals and transmit downlink signals to the terminals. The antenna system provides the lightning protection function (lightning induction) for the MBTS. The lightning rod in this system conducts the powerful lightning current to the ground, significantly reducing the lightning current to the MBTS.

When two radio communication systems operate in the same frequency band and cover the same area, it is recommended that the two systems share the antenna system to reduce the capital expenditure (CAPEX) on network deployment. If an MBTS uses multi-mode RF modules, signals of two radio communication systems operating in the same frequency band are transmitted from the same RF port to achieve antenna system sharing. If the MBTS uses single-mode RF modules, the use of an SASU is recommended.

5.4.3 Logical Structure of a Triple-Mode Base Station

In a triple-mode base station, two baseband units (BBUs) are required and BBU interconnection is optional.

Scenario

Table 5-6 lists the typical scenarios for a triple-mode base station.

NOTE

- **BBU Mode** indicates that boards of certain modes are installed in the BBU. For example, in a GU dual-mode BBU, GSM boards and UMTS boards are installed.
- **Working Mode of RF Modules** indicates the working mode of radio frequency (RF) modules connected to the BBU.

Table 5-6 Typical scenarios for a triple-mode base station

Scenario	BBU0		BBU1		BBU Interconnection Link	Logical Structure
	BBU Mode	Working Mode of RF Modules	BBU Mode	Working Mode of RF Modules		
GU+L (independent BBU)	GU	GSM, UMTS, or GU	LTE	LTE	N/A	Figure 5-12 shows the logical structure of a base station working in GU+L (independent BBU) mode.
GL+U (independent BBU)	GL	GSM, LTE, or GL	UMTS	UMTS	N/A	
GU+L (BBU interconnection)	GU	GSM, UMTS, GU, or GL	LTE	LTE or GL	Two BBUs are interconnected using a BBU interconnection signal cable connecting UCIU to UMPT. In this way, a BBU interconnection link is set up.	Figure 5-13 shows the logical structure of a base station working in GU+L (BBU interconnection) mode.
GL+U (BBU interconnection)	GL	GSM, LTE, GU, or GL	UMTS	UMTS or GU		

Scenario	BBU0		BBU1		BBU Interconnection Link	Logical Structure
	BBU Mode	Working Mode of RF Modules	BBU Mode	Working Mode of RF Modules		
GU +UL (BBU interconnection)	GU	GSM, UMTS, GU, or GL	UL	UMTS, LTE, GU, or GL	Two BBUs are interconnected using a BBU interconnection signal cable connecting UCIU to UMPT. In this way, a BBU interconnection link is set up. If a WBBPf board is installed in slot 2 or 3 of each BBU, two WBBPf boards can be interconnected using a BBU interconnection signal cable connecting WBBPf to WBBPf. In this way, a baseband interconnection link is set up.	**Figure 5-14** shows its logical structure.

Before implement BBU interconnection, pay attention to the following:

- GSM boards must be installed in BBU0.
- BBU0 must be configured with a Universal Cascaded Interface Unit (UCIU) board.
- When a BBU interconnection signal cable is used to connect a UCIU and a UMPT boards and a control link is set up, main control boards in BBU1 must be the Universal Main Processing and Transmission Unit (UMPT) board.

Logical Structure

Figure 5-12 Logical structure of a triple-mode base station (GU+L) with independent BBUs

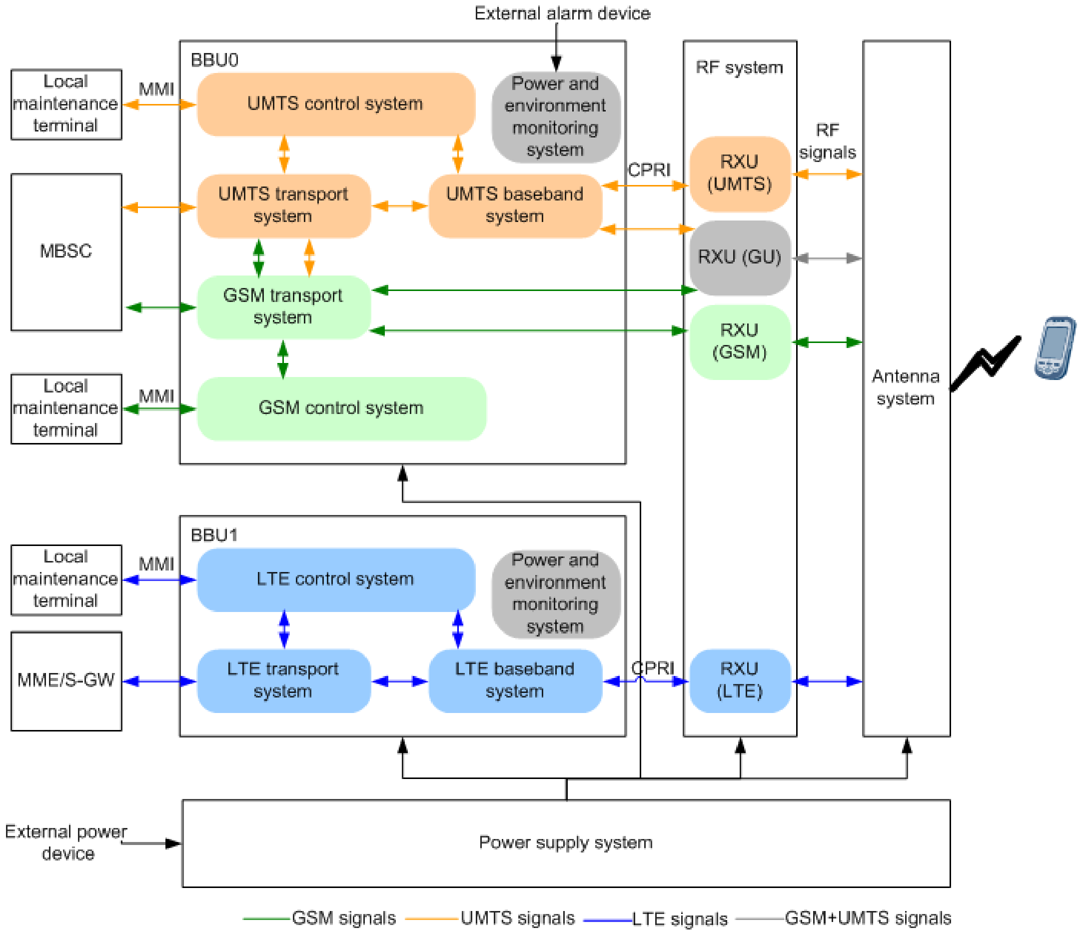


Figure 5-13 Logical structure of a triple-mode base station (GU+L) with BBU interconnection

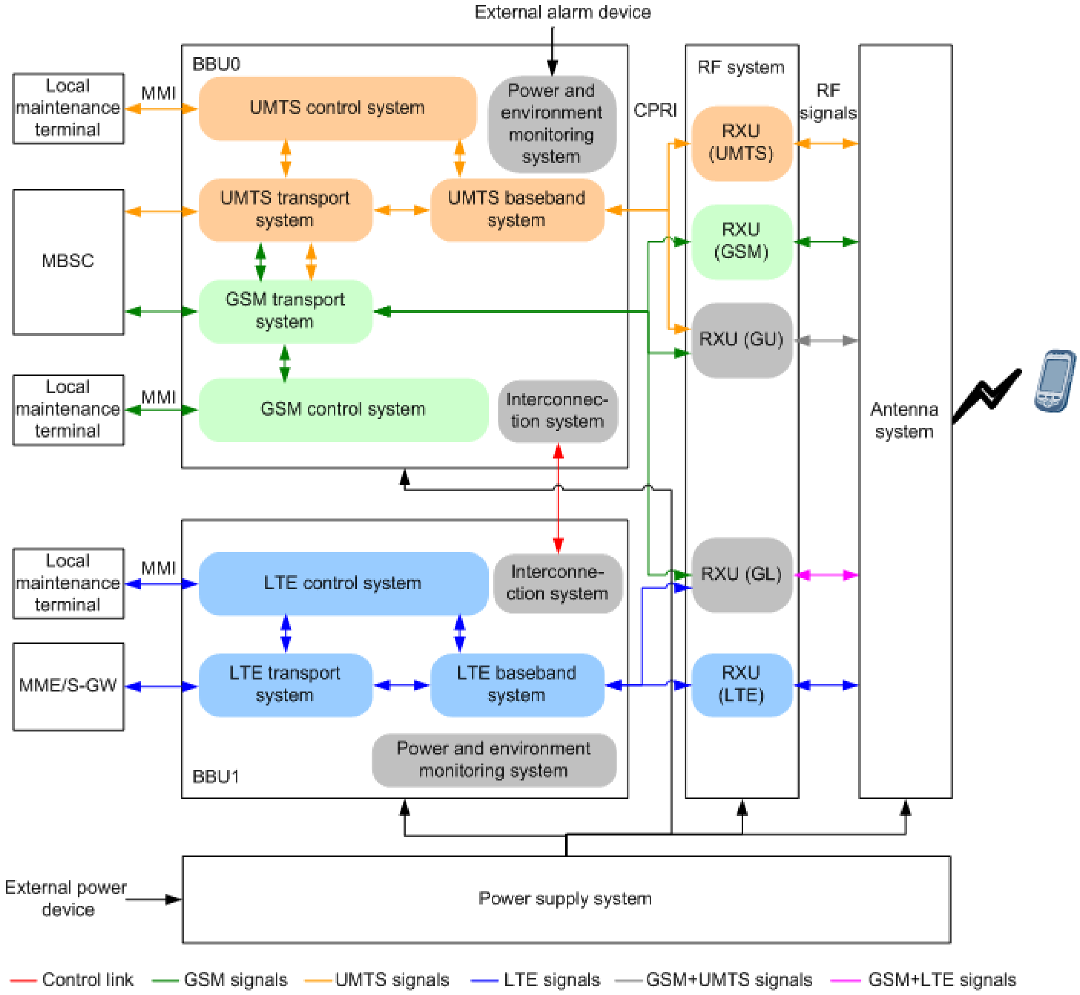
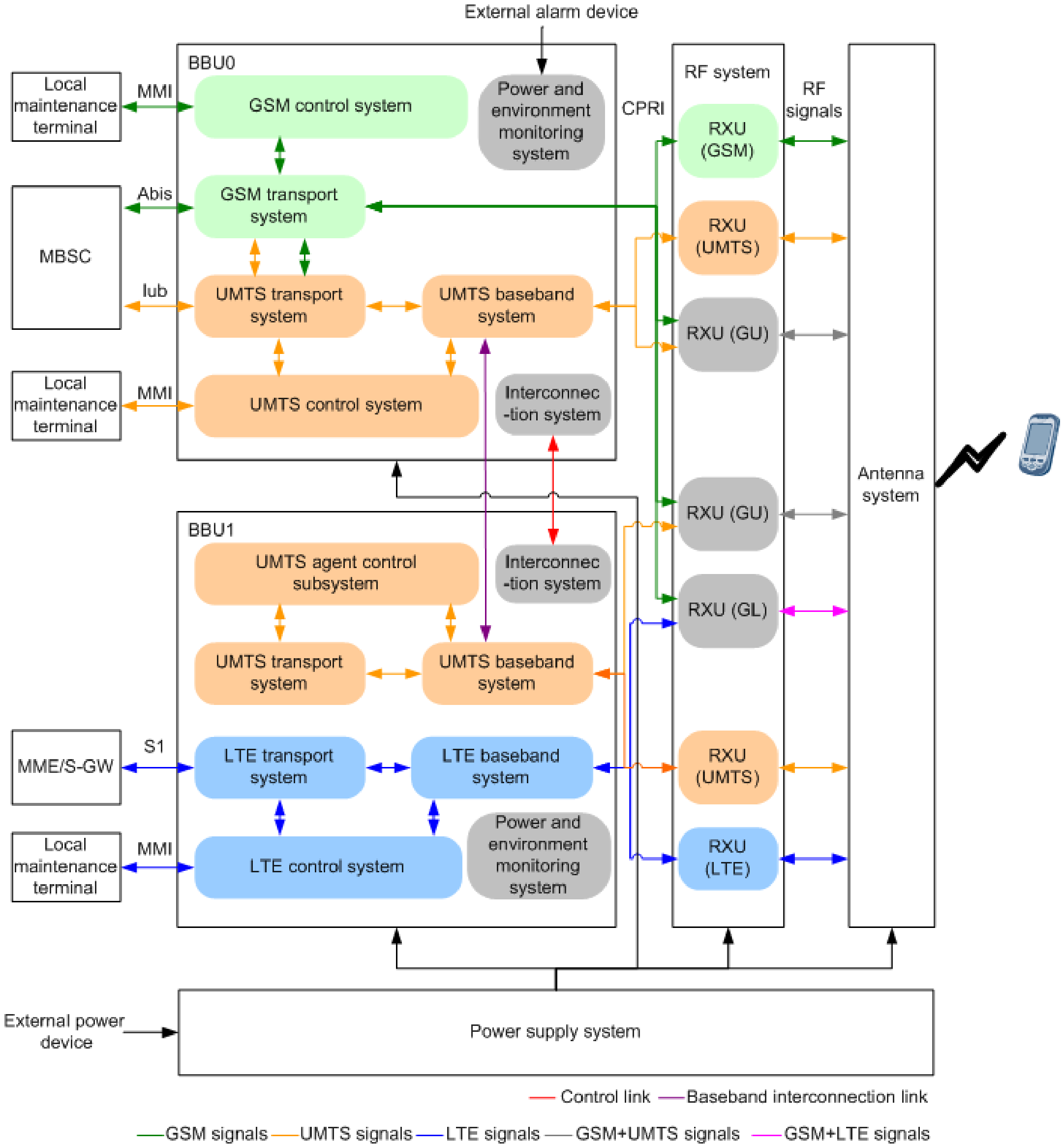


Figure 5-14 Logical structure of a triple-mode base station (GU+UL) with BBU interconnection



The MBTS consists of the following parts:

BBU

The BBU has a modular structure and consists of the control system, transport system, baseband system, power and environment monitoring system, and interconnection system.

- The control system includes the GTMU, WMPT, LMPT, and UMPT boards. It centrally manages the entire base station including operation and maintenance (O&M), signaling processing, and system clock. GTMU stands for GSM Transmission, Timing, and Management Unit for BBU. WMPT stands for WCDMA Main Processing and Transmission Unit. LMPT stands for LTE Main Processing & Transmission Unit. UMPT stands for Universal Main Processing and Transmission Unit.
- The transport system includes the GTMU, WMPT, LMPT, UMPT, and UTRP boards. It provides physical ports connecting the base station to the transport network for information

exchange. UTRP stands for Universal Transmission Processing unit. This system also provides an O&M channel connecting the base station to the operation and maintenance center (OMC).

- The baseband system includes the WBBP board (for UMTS) and the LBBP board (for LTE). The baseband subsystem processes uplink and downlink baseband signals and provides CPRI ports through which the BBU exchanges information with RF modules. For GSM, the baseband system includes RF modules, and the BBU exchanges information with the RF modules using CPRI ports on the GTMU, or UBRI board. WBBP stands for WCDMA Baseband Process Unit. LBBP stands for LTE BaseBand Processing Unit. UBRI stands for Universal BaseBand Radio Interface Unit.
- The power and environment monitoring system includes the UPEU and UEIU boards. UPEU stands for Universal Power and Environment Interface Unit, and UEIU stands for Universal Environment Interface Unit. A UPEU board supplies power to the BBU and monitors power status. Both the UPEU and UEIU boards provide ports for connections to environment monitoring devices. These ports receive and forward signals from the environment monitoring devices.
- The interconnection system includes the UCIU, UMPT, and WBBPf boards. It enables two BBUs to exchange O&M information, service information (signaling messages and user data), clock signals, synchronization information, and baseband signals. With this system, baseband processing capability can be expanded.

In the independent BBU scenario, two modes within the same BBU exchange information inside the BBU, and forward clock signals and data to each other. The other mode in the other BBU operates independently.

In the BBU interconnection scenario, three modes exchange data through the interconnection system.

RF System

The RF system modulates, demodulates, processes, combines, and splits baseband signals and RF signals.

In the independent BBU scenario, two BBUs are independently connected to different radio frequency (RF) modules and inter-BBU SDR is not supported. In the BBU interconnection scenario, inter-BBU SDR is supported.

Power Supply System

The power supply system obtains power from external power supply devices and provides power for other systems of an MBTS.

Antenna System

The antenna system includes antennas, feeders, jumpers, a remote control unit (RCU), a tower mounted amplifier (TMA), and a Same band Antenna Sharing Unit (SASU). This system receives and transmits RF signals. Specifically, antennas receive uplink signals from terminals and transmit downlink signals to the terminals. The antenna system provides the lightning protection function (lightning induction) for the MBTS. The lightning rod in this system conducts the powerful lightning current to the ground, significantly reducing the lightning current to the MBTS.

When two radio communication systems operate in the same frequency band and cover the same area, it is recommended that the two systems share the antenna system to reduce the capital expenditure (CAPEX) on network deployment. If an MBTS uses multi-mode RF modules, signals of two radio communication systems operating in the same frequency band are transmitted from the same RF port to achieve antenna system sharing. If the MBTS uses single-mode RF modules, the use of an SASU is recommended.

6 Clock Synchronization

About This Chapter

Synchronization refers to that within a specific time, the phase variation or frequency variation between two or more signals stays within the specified range. Clock synchronization refers to that a base station synchronizes its clock signals with a reference clock source. Through clock synchronization, the variation in the clock frequency between a base station and other devices in the related network and the variation in the clock signals between the base station and other devices in the network are within the specified range. This prevents transmission performance from deteriorating due to such variations.

Clock synchronization includes the following:

- Frequency synchronization: the frequency of a signal is the same as the reference frequency but the origin of the timescale for the signal does not need to be the same as that for the reference clock.
- Time synchronization (also referred to as time-of-day synchronization): the origin of the timescale for a signal needs to be synchronized with the Universal Time Coordinated (UTC). Therefore, time synchronization implies synchronization in absolute time. The UTC time is a universal timing standard, in which the atomic clock is maintained accurately to ensure time synchronization across the world, with the precision to microseconds.

6.1 GBTS Clock Synchronization Modes
GSM base transceiver stations (GBTSs) support multiple types of reference clock sources, including the IP-based clock, E1/T1 clock, synchronous Ethernet clock, building integrated timing supply (BITS) clock, Global Positioning System (GPS) clock, and Remote Global Positioning System (RGPS) clock. If a GBTS fails to obtain clock signals, it works in free-run mode for a certain period of time.

6.2 NodeB Clock Synchronization Modes
NodeBs support multiple types of reference clock sources, including the E1/T1 line clock, Global Positioning System (GPS) clock, building integrated timing supply (BITS) clock, IP-based clock, and synchronous Ethernet clock. If a NodeB fails to obtain clock signals, it works in free-run mode for a certain period of time.

6.3 eNodeB Clock Synchronization Modes
eNodeBs support multiple types of external reference clock sources, including the E1/T1 line clock, IP clock, synchronous Ethernet, building integrated timing supply (BITS) clock, Global Positioning System (GPS) clock, Remote Global Positioning System (RGPS) clock, Global

Navigation Satellite System (GLONASS) clock, and 1PPS+TOD clock (PPS is short for pulse per second, and TOD is short for time of day). If an eNodeB fails to obtain clock signals, it works in free-run mode for a certain period of time.

6.4 MBTS Clock Synchronization Modes

The MBTS supports multiple external clock sources, including an E1/T1 line clock, IP clock, synchronous Ethernet clock, GPS clock, BITS clock, and 1 PPS+TOD clock. BITS stands for building integrated timing supply, PPS stands for pulse per second, and TOD stands for time of day. Each SiteUnit in an MBTS can independently uses an external clock source or can share the clock source with other modes. If an MBTS fails to obtain external clock signals, it operates in free-run mode for a certain period of time.

6.1 GBTS Clock Synchronization Modes

GSM base transceiver stations (GBTSs) support multiple types of reference clock sources, including the IP-based clock, E1/T1 clock, synchronous Ethernet clock, building integrated timing supply (BITS) clock, Global Positioning System (GPS) clock, and Remote Global Positioning System (RGPS) clock. If a GBTS fails to obtain clock signals, it works in free-run mode for a certain period of time.

E1/T1 Line Clock Synchronization

With an E1/T1 line clock, a base station obtains frequency synchronization signals from the physical layer of an E1/T1 link to achieve clock synchronization. An E1/T1 line clock can be used when a base station uses the E1/T1 transmission scheme and clock signals are available on the E1/T1 link.

IP Clock (IEEE1588 V2) Synchronization

IEEE1588 V2 defines the Precision Time Protocol (PTP), which targets synchronization of clocks in the Ethernet, with the precision to microseconds. With an IEEE1588 V2 clock, both frequency synchronization and time synchronization are supported. An IEEE1588 V2 clock can be used when a base station works in IP over FE mode and an IP clock server is configured in the network.

Synchronous Ethernet Clock Synchronization

With a synchronous Ethernet clock, a base station traces the upstream clock by recovering clock signals from the serial data bit streams received at the physical layer to achieve synchronization. In synchronous Ethernet, only frequency synchronization is supported, with the synchronization tolerance ±0.05 ppm. A synchronous Ethernet clock can be used when a base station works in IP over FE mode and the transport network supports the synchronous Ethernet clock.

BITS Clock Synchronization

With a building integrated timing supply (BITS) clock, a base station is connected to an external synchronous equipment through the BITS clock card in the base station to obtain BITS synchronization signals. A BITS clock can be used when a base station is equipped with a universal satellite card and clock unit (USCU) board.

GPS Clock Synchronization

With a Global Positioning System (GPS) clock, a base station receives clock signals by using a GPS receiver with the precision to microseconds to achieve synchronization. With a GPS clock, both frequency synchronization and time synchronization are supported. A GPS clock can be used when a base station is equipped with a universal satellite card and clock unit (USCU) board.

RGPS Clock Synchronization

With a Remote Global Positioning System (RGPS) clock, a base station receives clock signals by using an RGPS receiver with the precision to microseconds to achieve synchronization. With an RGPS clock, both frequency synchronization and time synchronization are supported. An RGPS clock can be used when a base station is equipped with a USCU board.

Free-Run

Without an external clock source, a base station continues to work for at least 90 days in free-run mode.

6.2 NodeB Clock Synchronization Modes

NodeBs support multiple types of reference clock sources, including the E1/T1 line clock, Global Positioning System (GPS) clock, building integrated timing supply (BITS) clock, IP-based clock, and synchronous Ethernet clock. If a NodeB fails to obtain clock signals, it works in free-run mode for a certain period of time.

NOTE

The NodeB supports only frequency synchronization.

E1/T1 Line Clock Synchronization

With an E1/T1 line clock, a base station obtains frequency synchronization signals from the physical layer of an E1/T1 link to achieve clock synchronization. An E1/T1 line clock can be used when a base station uses the E1/T1 transmission scheme and clock signals are available on the E1/T1 link.

GPS Clock Synchronization

With a Global Positioning System (GPS) clock, a base station receives clock signals by using a GPS receiver with the precision to microseconds to achieve synchronization. With a GPS clock, both frequency synchronization and time synchronization are supported. A GPS clock can be used when a base station is equipped with a universal satellite card and clock unit (USCU) board.

BITS Clock Synchronization

With a building integrated timing supply (BITS) clock, a base station is connected to an external synchronous equipment through the BITS clock card in the base station to obtain BITS synchronization signals. A BITS clock can be used when a base station is equipped with a universal satellite card and clock unit (USCU) board.

IP Clock (Clock over IP) Synchronization

Clock over IP is a Huawei proprietary frequency synchronization technology, in which frequency synchronization packets are transmitted over IP. With clock over IP, only frequency synchronization is supported. When a base station uses this synchronization mode, the synchronization tolerance can be ±0.05 ppm. The ppm stands for parts per million. A clock over IP can be used when a base station works in IP over FE mode and an IP clock server is configured in the network.

IP Clock (IEEE1588 V2) Synchronization

IEEE1588 V2 defines the Precision Time Protocol (PTP), which targets synchronization of clocks in the Ethernet, with the precision to microseconds. With an IEEE1588 V2 clock, both frequency synchronization and time synchronization are supported. An IEEE1588 V2 clock can be used when a base station works in IP over FE mode and an IP clock server is configured in the network.

Synchronous Ethernet Clock Synchronization

With a synchronous Ethernet clock, a base station traces the upstream clock by recovering clock signals from the serial data bit streams received at the physical layer to achieve synchronization. In synchronous Ethernet, only frequency synchronization is supported, with the synchronization tolerance ±0.05 ppm. A synchronous Ethernet clock can be used when a base station works in IP over FE mode and the transport network supports the synchronous Ethernet clock.

Free-Run

Without an external clock source, a base station continues to work for at least 90 days in free-run mode.

6.3 eNodeB Clock Synchronization Modes

eNodeBs support multiple types of external reference clock sources, including the E1/T1 line clock, IP clock, synchronous Ethernet, building integrated timing supply (BITS) clock, Global Positioning System (GPS) clock, Remote Global Positioning System (RGPS) clock, Global Navigation Satellite System (GLONASS) clock, and 1PPS+TOD clock (PPS is short for pulse per second, and TOD is short for time of day). If an eNodeB fails to obtain clock signals, it works in free-run mode for a certain period of time.

NOTE

When the **Clock Working Mode** is set to **AUTO(Auto)**, it does not take effect on an eNodeB, and each eNodeB can be configured with only one type of external clock source.

E1/T1 Line Clock Synchronization

With an E1/T1 line clock, a base station obtains frequency synchronization signals from the physical layer of an E1/T1 link to achieve clock synchronization. An E1/T1 line clock can be used when a base station uses the E1/T1 transmission scheme and clock signals are available on the E1/T1 link.

IP Clock (Clock over IP) Synchronization

Clock over IP is a Huawei proprietary frequency synchronization technology, in which frequency synchronization packets are transmitted over IP. With clock over IP, only frequency synchronization is supported. When a base station uses this synchronization mode, the synchronization tolerance can be ±0.05 ppm. The ppm stands for parts per million. A clock over IP can be used when a base station works in IP over FE mode and an IP clock server is configured in the network.

IP Clock (IEEE1588 V2) Synchronization

IEEE1588 V2 defines the Precision Time Protocol (PTP), which targets synchronization of clocks in the Ethernet, with the precision to microseconds. With an IEEE1588 V2 clock, both frequency synchronization and time synchronization are supported. An IEEE1588 V2 clock can be used when a base station works in IP over FE mode and an IP clock server is configured in the network.

Synchronous Ethernet Clock Synchronization

With a synchronous Ethernet clock, a base station traces the upstream clock by recovering clock signals from the serial data bit streams received at the physical layer to achieve synchronization.

In synchronous Ethernet, only frequency synchronization is supported, with the synchronization tolerance ±0.05 ppm. A synchronous Ethernet clock can be used when a base station works in IP over FE mode and the transport network supports the synchronous Ethernet clock.

BITS Clock Synchronization

With a building integrated timing supply (BITS) clock, a base station is connected to an external synchronous equipment through the BITS clock card in the base station to obtain BITS synchronization signals. A BITS clock can be used when a base station is equipped with a universal satellite card and clock unit (USCU) board.

GPS Clock Synchronization

If an eNodeB synchronizes with the GPS clock, it achieves synchronization by obtaining clock signals from a GPS receiver. The GPS clock supports both frequency synchronization and time synchronization, with a precision to microseconds. To synchronize with the GPS clock, an eNodeB must be equipped with a LMPT or a UMPTa6 board, or be equipped with a UMPTa2 board where a satellite card is installed or a USCU board.

RGPS Clock Synchronization

If an eNodeB synchronizes with the RGPS clock, it achieves synchronization by obtaining clock signals from a RGPS receiver. The RGPS clock supports both frequency synchronization and time synchronization, with a precision to microseconds. To synchronize with the RGPS clock, an eNodeB must be equipped with a LMPT board, or be equipped with a UMPT board where a satellite card is installed or a USCU board.

GLONASS Clock Synchronization

If an eNodeB synchronizes with the GLONASS clock, it achieves synchronization by obtaining clock signals from a GLONASS receiver. The GLONASS clock supports both frequency synchronization and time synchronization, with a precision to microseconds. To synchronize with the GLONASS clock, an eNodeB must be equipped with a USCU board.

1PPS+TOD Clock Synchronization

With a 1PPS+TOD clock, a base station obtains 1 pulse per second (PPS) signals and time of day (TOD) signals to implement time synchronization. The 1PPS signals are used for time synchronization. The TODs signals transfer such information as time, types of reference clocks, and working status of reference clocks. A 1PPS+TOD clock can be used when a base station is equipped with a USCU board.

Free-Run

Without an external clock source, a base station continues to work for at least 90 days in free-run mode.

6.4 MBTS Clock Synchronization Modes

The MBTS supports multiple external clock sources, including an E1/T1 line clock, IP clock, synchronous Ethernet clock, GPS clock, BITS clock, and 1 PPS+TOD clock. BITS stands for building integrated timing supply, PPS stands for pulse per second, and TOD stands for time of day. Each SiteUnit in an MBTS can independently uses an external clock source or can share the clock source with other modes. If an MBTS fails to obtain external clock signals, it operates in free-run mode for a certain period of time.

NOTE

- In the co-module scenario, only frequency synchronization is supported.
- In an MBTS, the **Clock Working Mode** cannot be set to **AUTO(Auto)**, and each SiteUnit can be configured with only one type of external clock source.

6.4.1 Independent Reference Clock Mode

When an MBTS works in independent reference clock mode, each SiteUnit independently uses an external clock source and the clock synchronization mode is the same as that of a single-mode base station.

Figure 6-1 shows the independent reference clock mode of an MBTS.

Figure 6-1 Independent reference clock mode of an MBTS

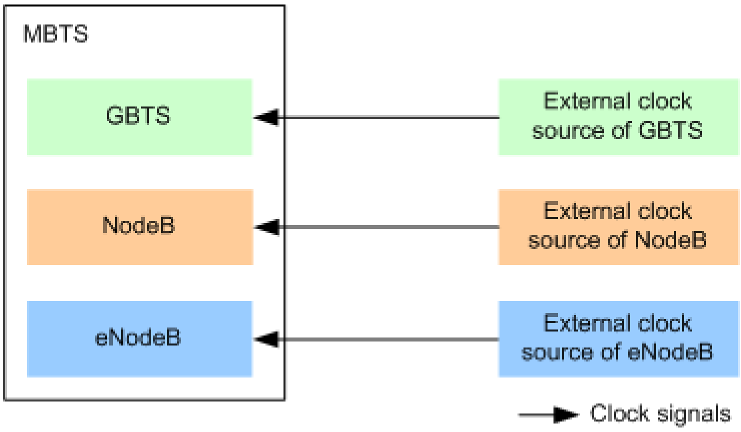


Table 6-1 lists the clock synchronization mode of each SiteUnit. For details, see the following:

- **6.1 GBTS Clock Synchronization Modes**
- **6.2 NodeB Clock Synchronization Modes**
- **6.3 eNodeB Clock Synchronization Modes**

Table 6-1 Clock synchronization mode of each SiteUnit in an MBTS

Clock Synchronization Mode	Supported By	Board Receiving Clock Signals
E1/T1 line clock synchronization	GBTS, NodeB, and eNodeB	GTMU, WMPT, UMPT, or UTRP (E1/T1 supported)
IP clock synchronization (clock over IP)	NodeB and eNodeB	WMPT, LMPT, or UMPT
IP clock synchronization (IEEE1588 V2)	GBTS, NodeB, and eNodeB	GTMU, WMPT, LMPT, or UMPT

Clock Synchronization Mode	Supported By	Board Receiving Clock Signals
Synchronous Ethernet clock synchronization	GBTS, NodeB, and eNodeB	GTMU, WMPT, LMPT, or UMPT
GPS clock synchronization	GBTS, NodeB, and eNodeB	USCU, LMPT, or UMPTa6
RGPS clock synchronization	GBTS and eNodeB	USCU or LMPT
BITS clock synchronization	GBTS, NodeB, and eNodeB	USCU
1 PPS+TOD clock synchronization	eNodeB	USCU

Each SiteUnit can use different types of external clock sources according to onsite conditions. However, pay attention to the following:

- Each SiteUnit can be configured with only one type of external clock source.
- Only one Universal Satellite Card and Clock Unit (USCU) board can be configured for an MBTS and the USCU board can be configured with only one type of external clock source.

6.4.2 Common Reference Clock Mode

When an MBTS works in common reference clock mode, all the SiteUnits share one external clock source.

Table 6-2 provides the description about the common reference clock mode of an MBTS.

Table 6-2 Common reference clock mode of an MBTS

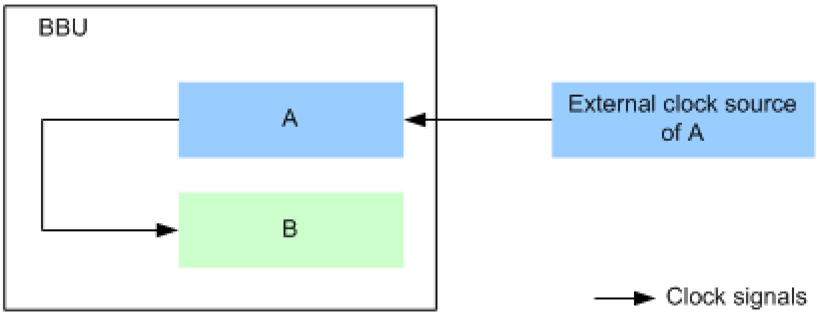
<table>
<tr><th colspan="2">Scenario</th><th>Common Reference Clock Mode</th></tr>
<tr><td colspan="2">Dual-mode base station</td><td>One SiteUnit is configured with an external clock source and the other SiteUnit uses the peer clock, as shown in Figure 6-2.</td></tr>
<tr><td rowspan="2">Triple-mode base station</td><td>Independent BBU</td><td>Two SiteUnits within the same BBU can share one external clock source, as shown in Figure 6-3.</td></tr>
<tr><td>BBU interconnection</td><td>• Any two SiteUnits can share one external clock source, as shown in Figure 6-4.
• The three SiteUnits can share one external clock source, as shown in Figure 6-5.</td></tr>
</table>

In the BBU interconnection scenario, clock signals are transmitted over a control link. An external clock source can be implemented in either the root BBU or the leaf BBU. This section assumes that an external clock source is implemented in the root BBU.

Dual-Mode Base Station

As shown in **Figure 6-2**, A and B are the two SiteUnits of a dual-mode base station. In addition, A is configured with an external clock source and B shares the clock on the A side.

Figure 6-2 Common reference clock in a dual-mode base station

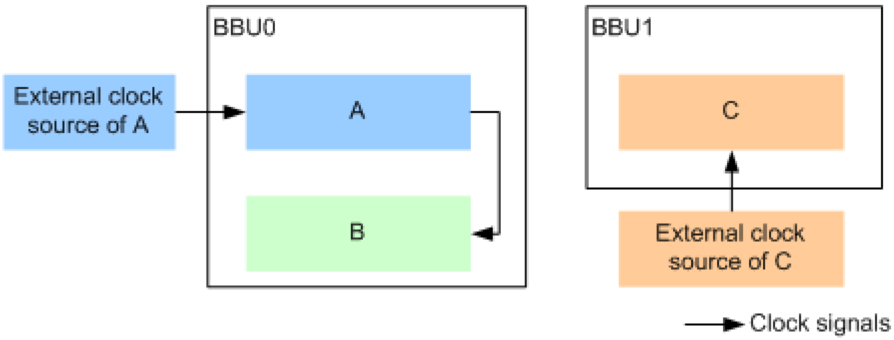


Triple-Mode Base Station

In the following figure, A, B, and C are the three SiteUnits of a triple-mode base station. In addition, A and B are configured in BBU0 and C in BBU1.

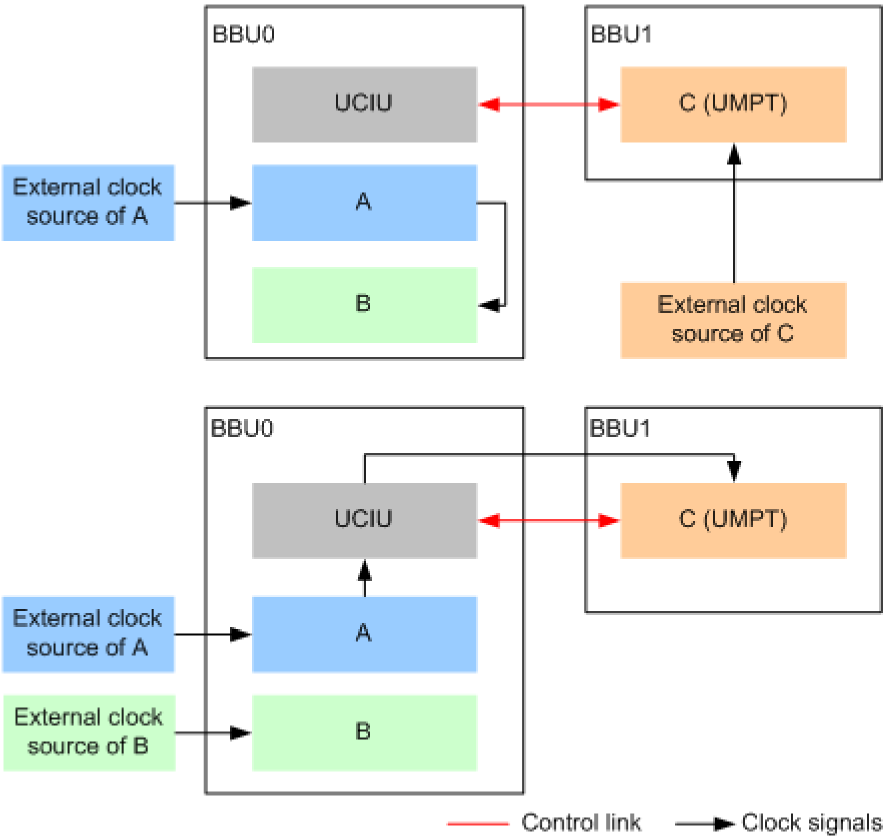
As shown in **Figure 6-3**, in the scenario of independent BBU, A and B share one external clock source, and C is separately configured with another external clock source.

Figure 6-3 Common reference clock in a triple-mode base station (independent BBU)



As shown in **Figure 6-4**, in the scenario of BBU interconnection, any two of A, B, and C can share one external clock source while the remaining one is separately configured with another external clock source. For example, A and B share one external clock source while C is separately configured with another external clock source. Alternatively, both A and B are configured with an independent external clock source, and then C can share the clock on the A or B side. In the following figure, C shares the clock on the A side.

Figure 6-4 Common reference clock in a triple-mode base station (BBU interconnection) with two SiteUnits sharing one external clock source



As shown in **Figure 6-5**, in the scenario of BBU interconnection, A, B, and C share one external clock source. In addition, A is configured with an external clock source, which is then shared by B and C.

Figure 6-5 Common reference clock in a triple-mode base station (BBU interconnection) with all the SiteUnits sharing one external clock source

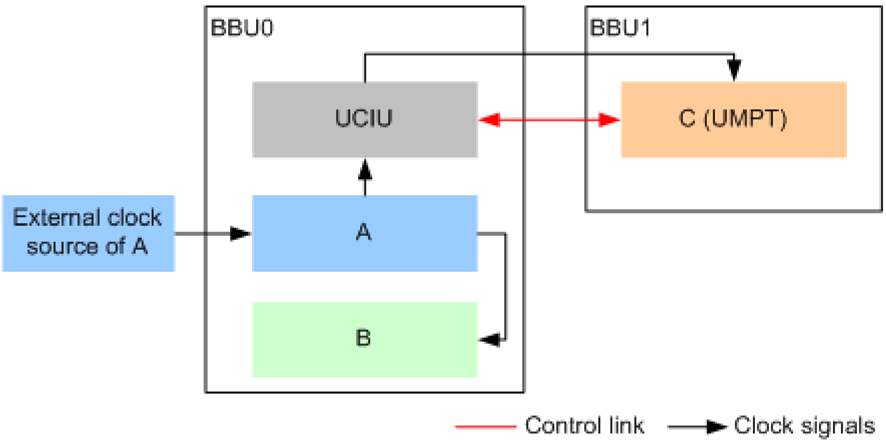


Table 6-3 lists external clock sources supported by each SiteUnit in an MBTS.

Table 6-3 External clock sources supported by each SiteUnit in an MBTS

External Clock Source	Supported By	Board Receiving Clock Signals
E1/T1 line clock synchronization	GBTS, NodeB, and eNodeB	GTMU, WMPT, UMPT, or UTRP (E1/T1 supported)
IP clock synchronization (IEEE1588 V2 frequency synchronization)	GBTS, NodeB, and eNodeB	GTMU, WMPT, LMPT, or UMPT
Synchronous Ethernet clock synchronization	GBTS, NodeB, and eNodeB	GTMU, WMPT, LMPT, or UMPT
GPS clock synchronization (frequency synchronization)	GBTS, NodeB, and eNodeB	USCU, LMPT, or UMPTa6
BITS clock synchronization	GBTS, NodeB, and eNodeB	USCU

When a Universal Satellite Card and Clock Unit (USCU) board is used to receive clock signals, the following configuration methods are available:

- This USCU board can be configured for all SiteUnits that share the external clock source and each SiteUnit has the same clock source type.
- When only one SiteUnit is configured with this USCU board, the clock source type of this SiteUnit depends on the external clock source's type and the clock source type of the other SiteUnits is PEER.

In other common reference clock modes, only one SiteUnit needs to be configured with an external clock source, and the other SiteUnits can share this external clock source by setting their clock source type to PEER.

7 Transport Network Topologies

About This Chapter

The 3900 series base stations support multiple transmission schemes and transport network topologies in various scenarios.

GSM base transceiver stations (GBTSs) support transport networks over time division multiplexing (TDM), IP, and High-Level Data Link Control (HDLC).

NodeBs support transport networks over ATM and IP.

eNodeBs support the star, chain, and tree topologies on IP networks.

The multi-mode base transceiver station (MBTS) supports multiple transport network topologies. Users can choose a certain topology according to onsite conditions. Each SiteUnit in an MBTS supports both independent transmission and common transmission.

7.1 GBTS Transport Network Topologies

GSM base transceiver stations (GBTSs) support transport networks over time division multiplexing (TDM), IP, and High-Level Data Link Control (HDLC).

TDM Networking

E1/T1 transmission is used between the GBTS and the BSC, and TDM transmission is used on the Abis interface. In TDM networking mode, the GBTS supports chain, star, tree, and ring topologies, as shown in **Figure 7-1**.

Figure 7-1 TDM networking

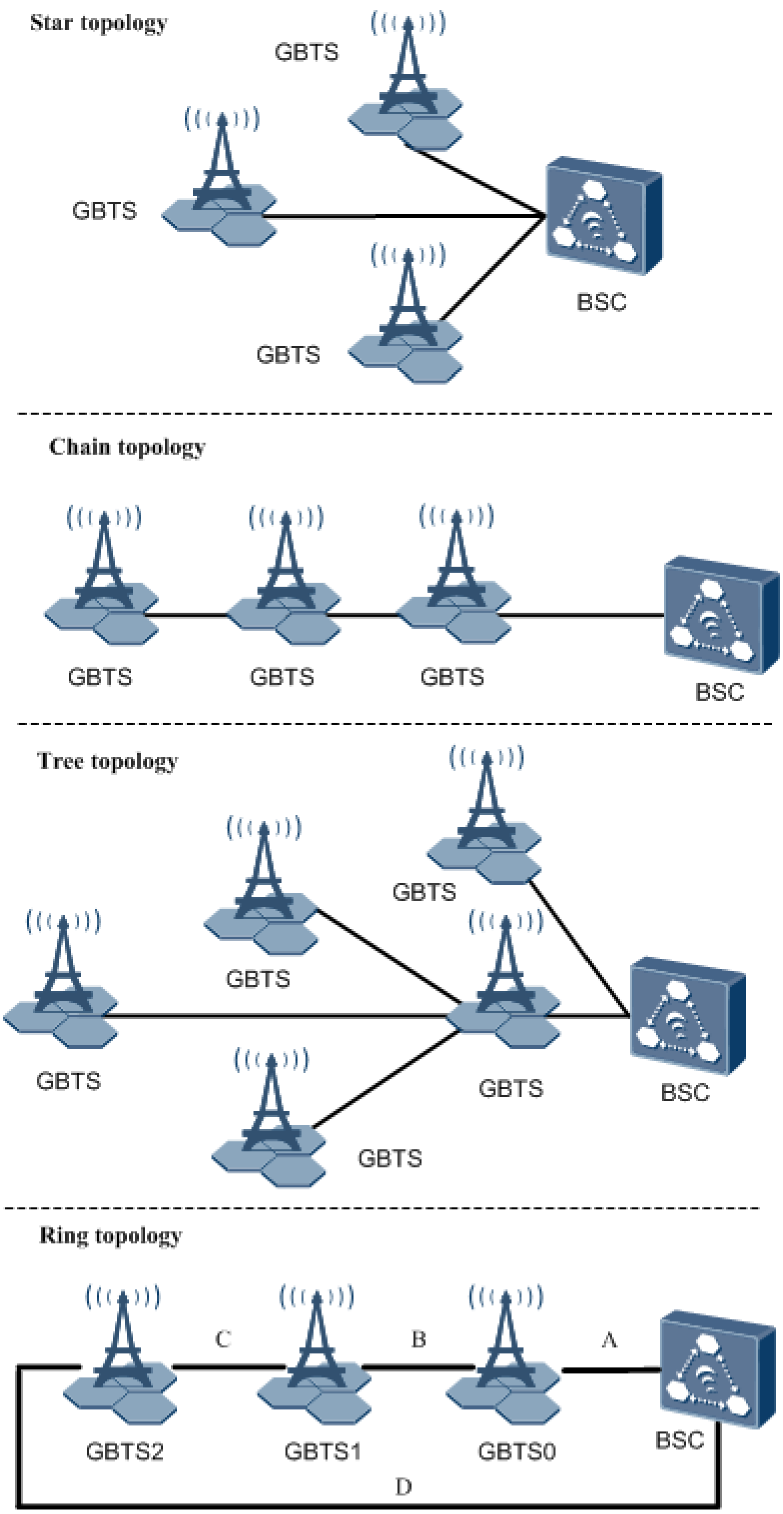
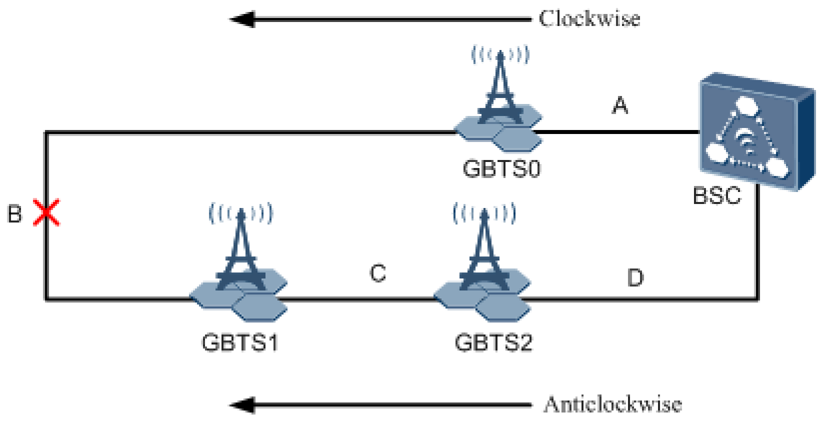


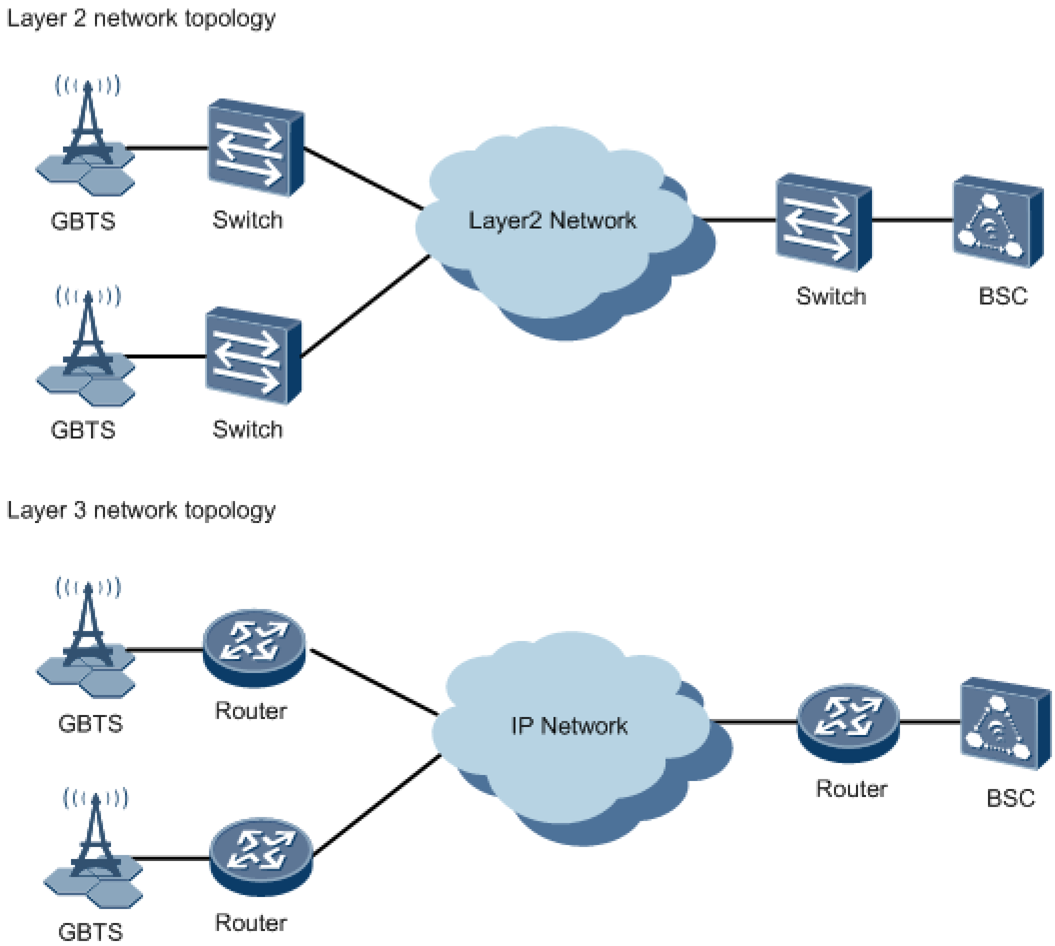
Figure 7-2 Re-established ring topology after transmission interruption



IP Networking

FE over IP transmission is used between the GBTS and BSC, and IP transmission is used on the Abis interface. IP networking at layer 2 and layer 3 has different network structures, as shown in **Figure 7-3**.

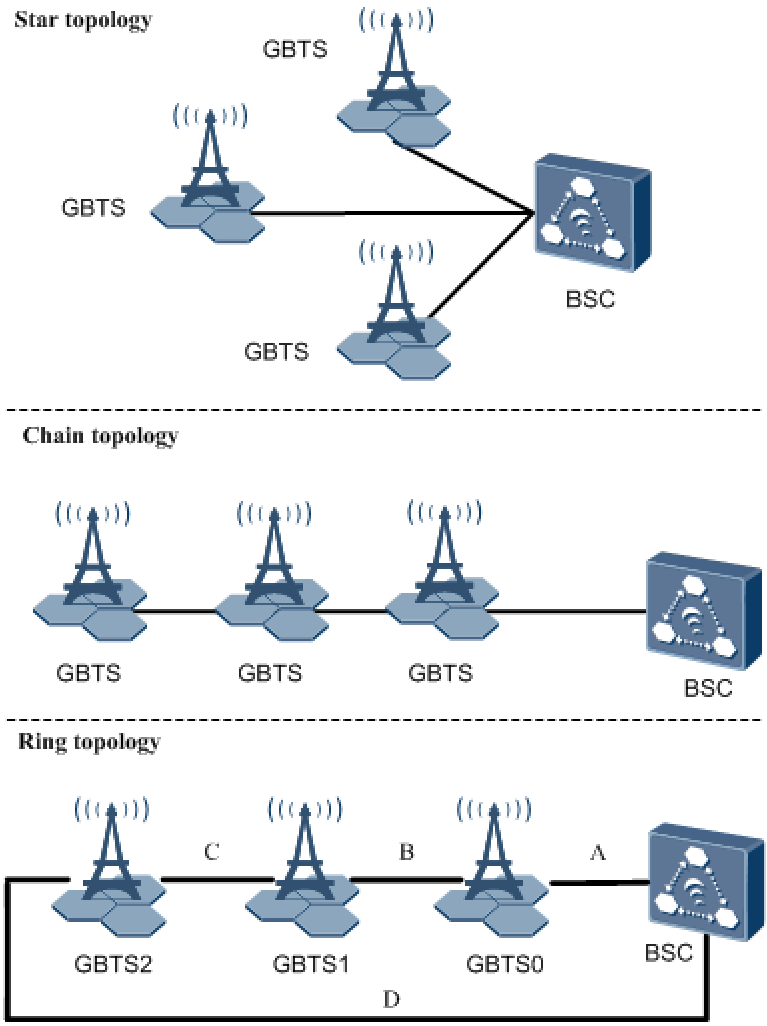
Figure 7-3 IP networking



HDLC Networking

E1/T1 transmission is used between the GBTS and BSC, and HDLC transmission is used on the Abis interface. In HDLC networking mode, the GBTS supports chain, star, and ring topologies, as shown in **Figure 7-4**.

Figure 7-4 HDLC networking



Characteristics of Each Topology

Table 7-1 lists the characteristics of each topology.

Table 7-1 Characteristics of each topology

Topology	Usage Scenario	Advantage	Disadvantage
Star	The star topology is applicable to most scenarios, especially in densely populated urban areas.	• Simple networking • Easy network deployment • Easy network maintenance • Flexible network capacity expansion • High network reliability	Compared with other topologies, the star topology requires more transmission resources.
Chain	The chain topology is applicable to strip-shaped and sparsely populated areas, such as areas along highways and railways.	Less costs of transmission equipment, construction, and transmission link lease	• Signals travel through multiple nodes, and therefore network reliability is low. • Faults in an upper-level GBTS may affect operations of its lower-level GBTSs. • The number of levels in a chain topology cannot exceed five. **NOTE** When the Abis Bypass feature is enabled in the chain topology, lower-level GBTSs can work properly even if an upper-level GBTS is powered off.

Topology	Usage Scenario	Advantage	Disadvantage
Tree	The tree topology is applicable to areas where the network architecture, site distribution, and subscriber distribution are complicated, for example, hot spot areas where subscribers are widely distributed.	Compared with the star topology, the tree topology requires fewer transmission cables.	● Signals travel through multiple nodes, and therefore transmission reliability is low and network deployment or maintenance is difficult. ● Faults in an upper-level GBTS may affect operations of its lower-level GBTSs. ● Capacity expansion is difficult because it may require big changes in the current network architecture. ● The number of levels in a tree topology cannot exceed five.
Ring	The ring topology is applicable to most scenarios. Due to its strong self-healing capability, the ring topology is recommended if there are sufficient routes.	If transmission is interrupted at a point, the ring is automatically split into two chains so that GBTSs located before and behind the point can still work properly. This improves the system robustness. For example, GBTSs 0, 1, and 2 are connected to the BSC in forward direction in the ring topology, as shown in **Figure 7-2**. When transmission is interrupted at point B, the GBTS located in front of point B (GBTS0) is still connected to the BSC in forward direction, whereas the GBTSs located behind point B (GBTSs 1 and 2) are connected to the BSC in reverse direction in the chain topology.	There is always a link segment that does not transmit any data.

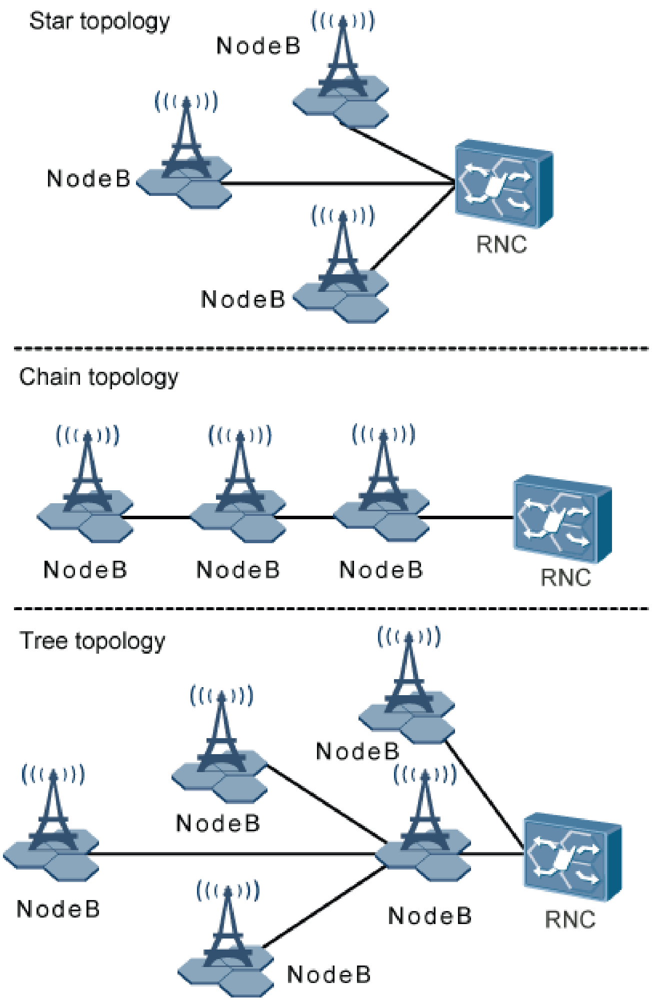
7.2 NodeB Transport Network Topologies

NodeBs support transport networks over ATM and IP.

ATM Networking

ATM networks support ATM over E1 transmission and have various networking modes, such as the star, tree, and chain topologies, as shown in **Figure 7-5**.

Figure 7-5 ATM networking



NOTE

- In the BBU interconnection scenario, either of the BBUs can be connected to the transport network. It is recommended that BBU0 (root BBU) is connected to the transport network.
- In the BBU interconnection scenario, inter-subrack transmission interconnection in ATM over E1 mode is not supported. In inter-subrack transmission interconnection, the transmission port on one BBU is connected to the upper-level network or NodeB, and the transmission port on the other BBU is connected to the lower-level NodeB.
- In ATM over E1 transmission, inter-subrack configuration of the timeslot cross function and treelink PVC is not supported.

IP Networking

IP networks support IP over E1 and IP over FE transmission. IP networking capabilities of NodeBs have been enhanced to support the IP hub networking in addition to the star, chain, and tree topologies, as shown in **Figure 7-6**. In the IP hub networking, aggregation devices can be placed at cross connections between tree topologies. Typically, a hub NodeB is used for the first-level aggregation. Based on capacity requirements, another hub NodeB or a transmission gateway can be used for the second-level aggregation. **Figure 7-7** shows the IP hub networking.

NOTE

In IP over E1 transmission, inter-subrack configuration of the timeslot cross function and MP group binding is not supported.

Figure 7-6 IP networking

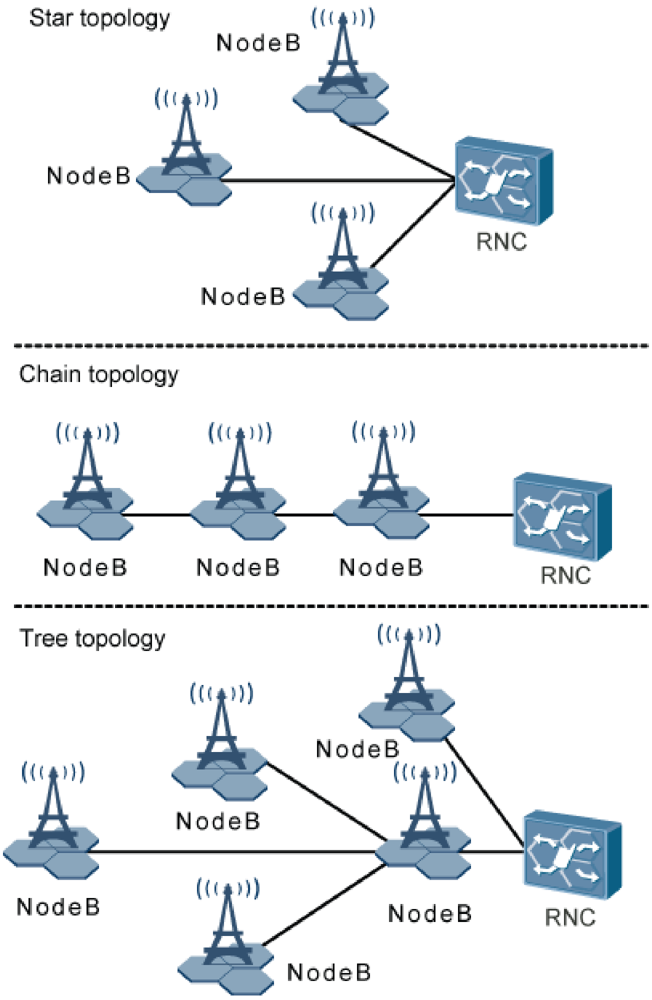
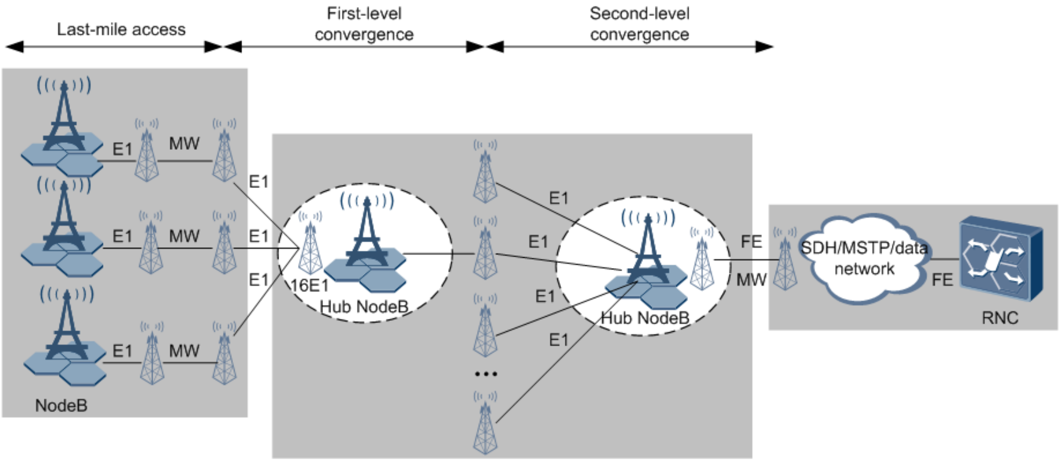


Figure 7-7 IP hub networking



Topology Characteristics

Table 7-2 describes usage scenarios and characteristics of the preceding topologies.

Table 7-2 Usage scenarios and characteristics of the topologies

Topology	Usage Scenario	Advantage	Disadvantage
Star	The star topology is the most common topology and applies to densely populated areas.	● The NodeB is directly connected to the radio network controller (RNC). This simple topology features easy engineering, maintenance, and capacity expansion. ● Data is directly transmitted between the NodeB and the RNC, reducing the number of nodes that signals travel through and enhancing transmission reliability.	Compared with other topologies, the star topology requires more transmission resources.

Topology	Usage Scenario	Advantage	Disadvantage
Chain	The chain topology applies to strip-shaped and sparsely populated areas, such as highways and railways.	This topology helps reduce expenditure on transmission equipment, engineering, and leased transmission cables.	● Signals travel through many nodes, which lowers transmission reliability. ● A faulty NodeB may affect the operation of lower-level NodeBs. ● The number of levels in a chain topology cannot exceed five.
Tree	The tree topology applies to areas with complex network architecture, site distribution, and subscriber distribution, for example, hot spot areas in which subscribers are widely distributed.	The tree topology requires fewer transmission cables than the star topology.	● Signals travel through many nodes, which lowers transmission reliability and increases engineering and maintenance difficulties. ● A faulty NodeB may affect the operation of lower-level NodeBs. ● Capacity expansion is difficult because it may require changes in the network architecture. ● The number of levels in a tree topology cannot exceed five.

7.3 eNodeB Transport Network Topologies

eNodeBs support the star, chain, and tree topologies on IP networks.

An eNodeB communicates with a mobility management entity (MME) or serving gateway (S-GW) through an S1 interface based on E1/T1 or FE/GE transmission. (FE is short for fast Ethernet, and GE is short for gigabit Ethernet.) The S1 interface supports the star, chain, and tree topologies, as shown in **Figure 7-8**.

Figure 7-8 Topologies on the S1 interface

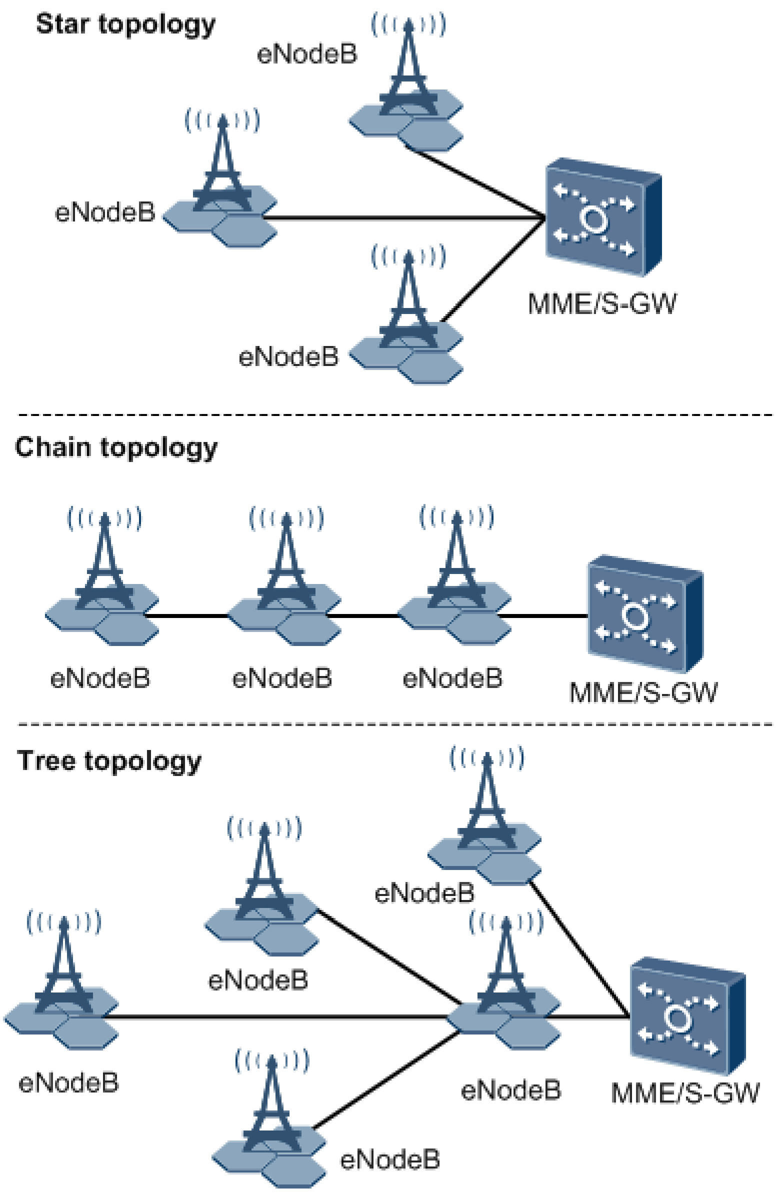


Table 7-3 describes usage scenarios and characteristics of the preceding topologies.

Table 7-3 Usage scenarios and characteristics of the topologies

Topology	Usage Scenario	Advantage	Disadvantage
Star	The star topology is the most common topology and is applicable to densely populated areas.	● Each eNodeB is directly connected to an MME or S-GW through a transport network. This simple topology features easy engineering, maintenance, and capacity expansion. ● Each eNodeB directly exchanges data with an MME or S-GW. Signals travel through few nodes, and therefore network reliability is high.	The star topology requires more transport resources than the other topologies.
Chain	The chain topology is applicable to belt-shaped and sparsely populated areas, such as areas along highways and railways.	This topology helps reduce expenditure on transmission equipment, engineering, and leased transmission cables.	● Signals travel through many nodes, which lowers network reliability. ● Each lower-level eNodeB occupies some transmission bandwidth of its upper-level eNodeB. Reliability of the upper-level eNodeB affects operation of the lower-level eNodeB. ● The number of levels in a chain topology cannot exceed five.

Topology	Usage Scenario	Advantage	Disadvantage
Tree	The tree topology is applicable to areas with complicated network architecture, site distribution, and subscriber distribution, for example, hot spot areas in which subscribers are widely distributed.	This topology helps reduce expenditure on transmission equipment, engineering, and leased transmission cables.	● Signals travel through many nodes, which lowers network reliability. ● Each lower-level eNodeB occupies some transmission bandwidth of its upper-level eNodeB. Reliability of the upper-level eNodeB affects operation of the lower-level eNodeB. ● The number of levels in a tree topology cannot exceed five.

7.4 MBTS Transport Network Topologies

The multi-mode base transceiver station (MBTS) supports multiple transport network topologies. Users can choose a certain topology according to onsite conditions. Each SiteUnit in an MBTS supports both independent transmission and common transmission.

7.4.1 Transport Network Topology

The multi-mode base transceiver station (MBTS) supports the star, chain, and ring topologies. Users can choose a certain topology according to onsite conditions.

Figure 7-9 shows the MBTS transport network topologies.

Figure 7-9 MBTS transport network topologies

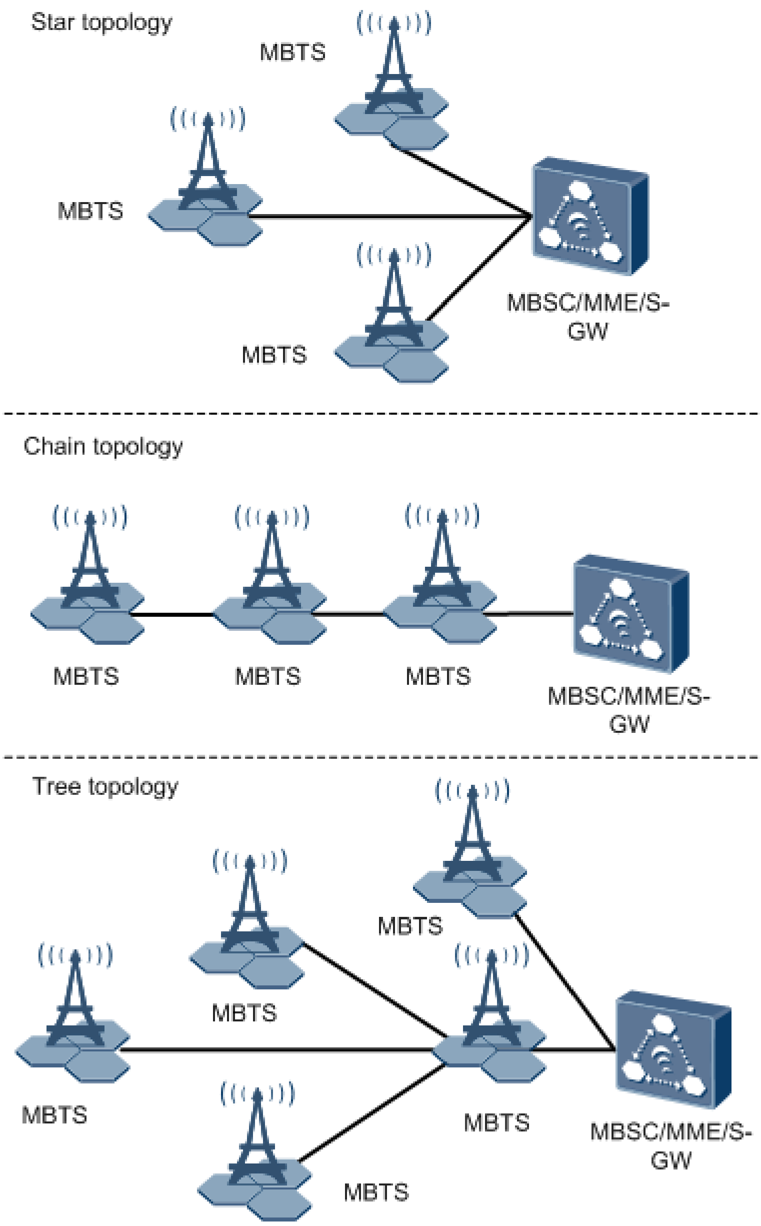


Table 7-4 describes usage scenarios and advantages of the preceding topologies.

Table 7-4 Usage scenarios and advantages of the preceding topologies

Transport Network Topology	Usage Scenario	Advantage	Disadvantage
Star	The star topology is the most common topology and is applicable to densely populated areas.	• Each MBTS is directly connected to an MBSC/MME/S-GW. Therefore, this topology is characterized by easy engineering, maintenance, and capacity expansion. • Each MBTS directly transmits data to and receives data from an MBSC/MME/S-GW. Signals travel through few nodes, and therefore line reliability is high.	The star topology requires more transmission resources than other topologies.
Chain	The chain topology is applicable to belt-shaped and sparsely populated areas, such as areas along highways and railways.	This topology helps reduce costs of transmission equipment, engineering construction, and leased transmission lines.	• Signals travel through many nodes, which lowers line reliability. • Faults in an upper-level base station may affect lower-level base stations. • The number of levels in a chain topology cannot exceed five. **NOTE** In a chain topology, if Abis bypass is enabled, lower-level base stations can work properly even if there is a power failure in an upper-level base station.

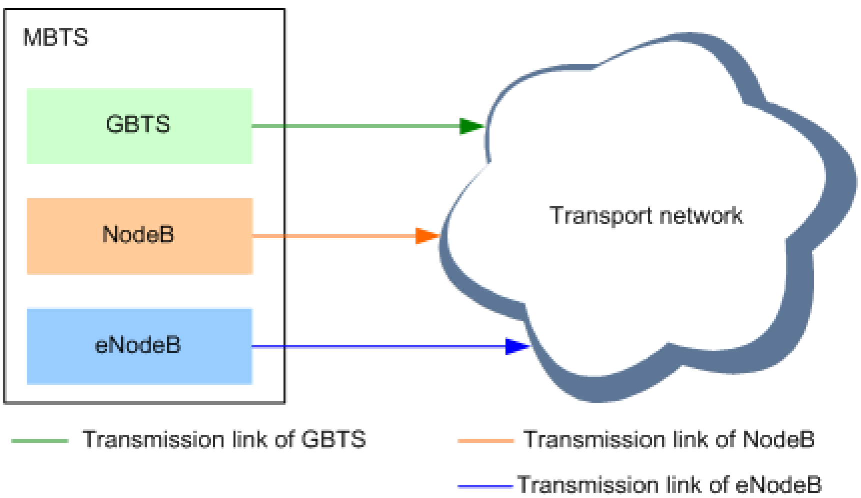
Transport Network Topology	Usage Scenario	Advantage	Disadvantage
Tree	The tree topology is applicable to areas with complicated network architecture, site distribution, and subscriber distribution, for example, hot spot areas in which subscribers are widely distributed.	The tree topology requires fewer transmission cables than the star topology.	• Signals travel through many nodes, and therefore line reliability is low and engineering and maintenance are difficult. • Faults in an upper-level base station may affect lower-level base stations. • Capacity expansion is difficult because it may require changes in the current network architecture. • The number of levels in a tree topology cannot exceed five.

7.4.2 Independent Transmission

When independent transmission is applied to an MBTS, each SiteUnit is connected to the transport network through independent physical transmission ports. In this case, no impact exists between SiteUnits in terms of transmission.

Figure 7-10 shows the independent transmission mode of an MBTS.

Figure 7-10 Independent transmission mode of an MBTS



For the transmission mode of each SiteUnit, see the following:

- **7.1 GBTS Transport Network Topologies**
- **7.2 NodeB Transport Network Topologies**
- **7.3 eNodeB Transport Network Topologies**

7.4.3 Common Transmission

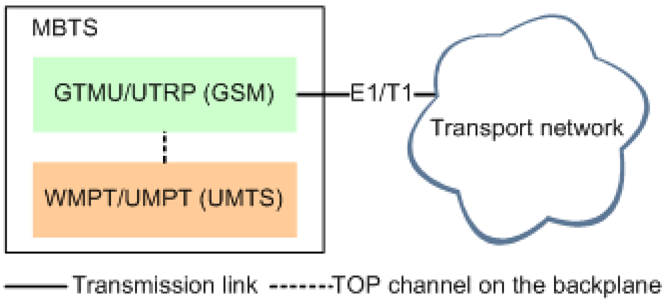
When common transmission is applied to an MBTS, each SiteUnit about to share transmission recourses is connected to the transport network through common physical transmission ports. In this case, impact exists between SiteUnits in terms of transmission. Common transmission is classified into common transmission with TDM timeslot cross and common transmission with IP. When common transmission with IP is applied, route backup and hybrid transport are supported.

Common Transmission with TDM

The TDM timeslot cross function can be used to multiplex data of two modes onto the transport network only when an MBTS works in GU mode. In this manner, E1/T1 transmission resources are shared on a timeslot basis and TDM transmission bandwidth can be shared in a semi-static way. TDM stands for time division multiplexing.

The common transmission with TDM is implemented by the GSM Transmission, Timing, and Management Unit for BBU (GTMU) board or the Universal Transmission Processing unit (UTRP) board working in GSM mode, as shown in **Figure 7-11**.

Figure 7-11 Common transmission with TDM



NOTE

- For UTRP (**), "**" indicates the mode the UTRP board serves.
- For UMPT (**), "**" indicates the mode the UMPT board serves.

The WCDMA Main Processing and Transmission Unit (WMPT) board or the Universal Main Processing & Transmission Unit (UMPT) transmits UMTS E1/T1 timeslots to the GTMU or UTRP (GSM) board through the TOP channel on the BBU backplane. The GTMU or UTRP (GSM) board provides E1/T1 ports that connect the base station to the transport network. The GSM and UMTS data is multiplexed onto transmission links by using the TDM timeslot cross function, achieving E1/T1 transmission resource sharing on the timeslot basis.

In the preceding scenario, only the following clock schemes can be used:

- The GBTS is configured with an E1/T1 clock source while the NodeB shares the GBTS' clock signals. (Recommended)
- When the BSC and RNC use the same E1/T1 clock source, the NodeB can be configured with the E1/T1 clock source and the GBTS can share the NodeB's clock or can be configured with another clock source.

Common Transmission with IP

With IP over Ethernet or IP over E1/T1, all SiteUnits in an MBTS can share physical transmission resources and dynamically share transmission bandwidth resources.

Common transmission with IP can be achieved with two methods: interconnecting front panels and interconnecting backplanes, as described in **Table 7-5**.

Table 7-5 Methods of achieve common transmission with IP

Common Transmission Mode	Description	Remarks
Front panel interconnection	Two SiteUnits sharing transmission resources are interconnected through fast Ethernet (FE) ports on a front panel. One SiteUnit is connected to the transport network using a transmission port, this SiteUnit forwards the other SiteUnit's data, and two SiteUnits' data is carried over the transmission link.	• Main control boards and UTRP boards of two SiteUnits sharing transmission resources must be installed in the same BBU. • Types of the FE ports used for front panel interconnection must be the same. Therefore, two electrical FE ports can be used and alternatively two optical FE ports can be used. • UTRP boards supporting common transmission are UTRP2 (UMTS), UTRPb4 (LTE), and UTRPc (UMTS or LTE) boards. • Configuring UTRP boards is optional. Due to limited bandwidth on UTRP boards, capacity expansion is difficult and therefore using UTRP boards to achieve common transmission with IP is not recommended.
Backplane interconnection	When this mode uses a UTRPc board to achieve common transmission with IP, SiteUnits sharing transmission resources send data to the UTRPc board through the BBU backplane, the UTRPc board is connected to the transport network using its transmission port, and all SiteUnits' data is carried over the transmission link.	• If two BBUs are not interconnected, common transmission is available to the SiteUnits that are installed in the same BBU as the UTRPc board. • If two BBUs are interconnected, the UTRPc board can be installed in either root BBU or leaf BBU, and common transmission is available to all SiteUnits using the UTRPc board.

Common Transmission Mode	Description	Remarks
	When this mode uses a main control board to achieve common transmission with IP: ● Single BBU: Main control boards of the two SiteUnits sharing transmission resources are interconnected through the BBU backplane. One SiteUnit is connected to the transport network using a transmission port, this SiteUnit forwards the other SiteUnit's data, and two SiteUnits' data is carried over the transmission link. ● BBU interconnection: SiteUnits sharing transmission resources send data to the UMPT board through the BBU backplane, the UMPT board is connected to the transport network using its transmission port, and all SiteUnits' data is carried over the transmission link.	● Main control boards supporting common transmission are the UMPT (UMTS/LTE) and LMPT boards. ● In GU+UL scenario, the UMPT (UMTS) installed in the leaf BBU does not support common transmission.

Front Panel Interconnection

Figure 7-12 shows common transmission with IP, which is applied to GU dual-mode base stations. **Table 7-6** provides information about board and port connection.

Figure 7-12 Common transmission with IP (GU front plane interconnection)

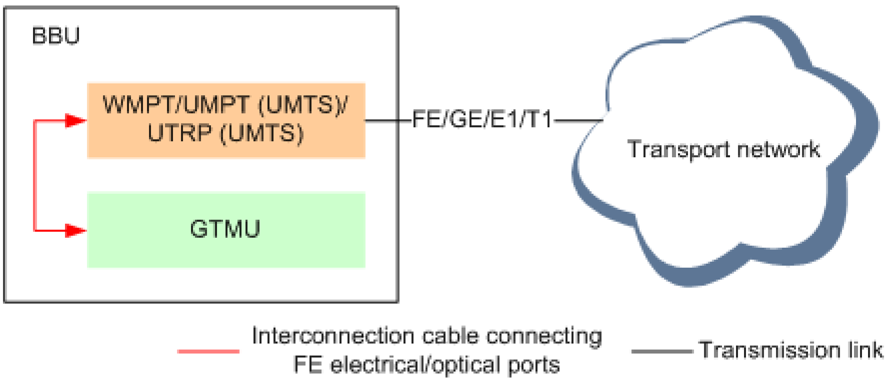


Table 7-6 Board and port connection (GU front plane interconnection)

Board and Port for Front Panel Interconnection	Board Connected to the Transport Network
● An FE port on the GTMU board is connected to an FE port on the WMPT or UMPT board. ● An FE port on the GTMU board is connected to an FE port on the UTRP (UMTS) board.	WMPT, UMPT, or UTRP (UMTS)

Figure 7-13 shows common transmission with IP, which is applied to GL dual-mode base stations. **Table 7-7** provides information about board and port connection.

Figure 7-13 Common transmission with IP (GL front plane interconnection)

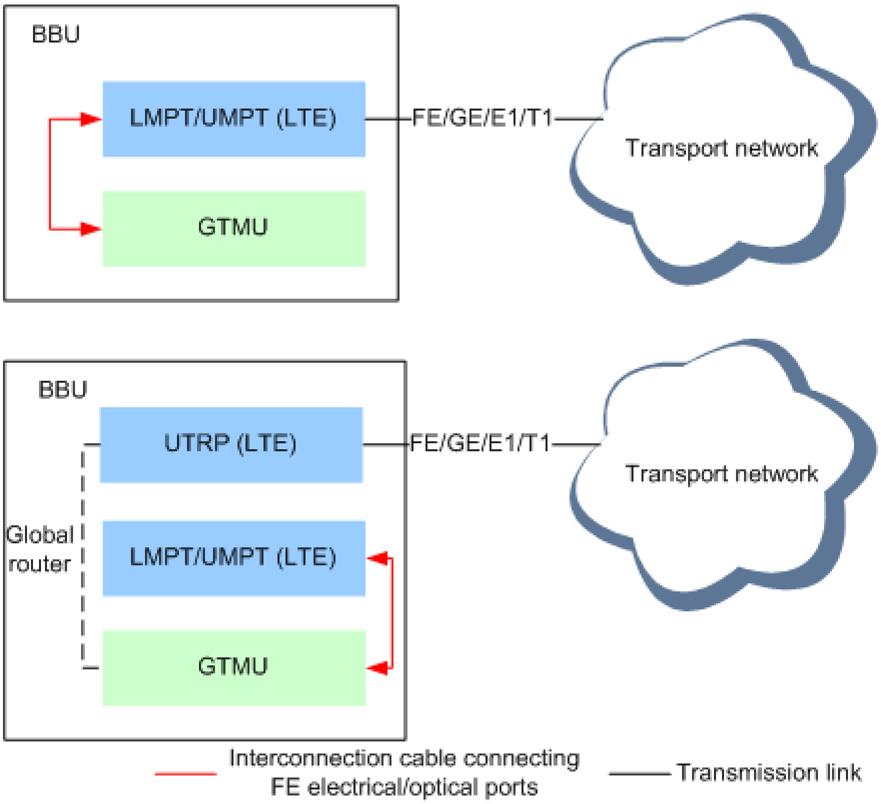


Table 7-7 Board and port connection (GL front plane interconnection)

Board and Port for Front Panel Interconnection	Board Connected to the Transport Network
An FE port on the GTMU board is connected to an FE port on the LMPT or UMPT board.	LMPT, UMPT, or UTRP (LTE)

Figure 7-14 shows common transmission with IP, which is applied to UL dual-mode base stations. Table 7-8 provides information about board and port connection.

Figure 7-14 Common transmission with IP (UL front plane interconnection)

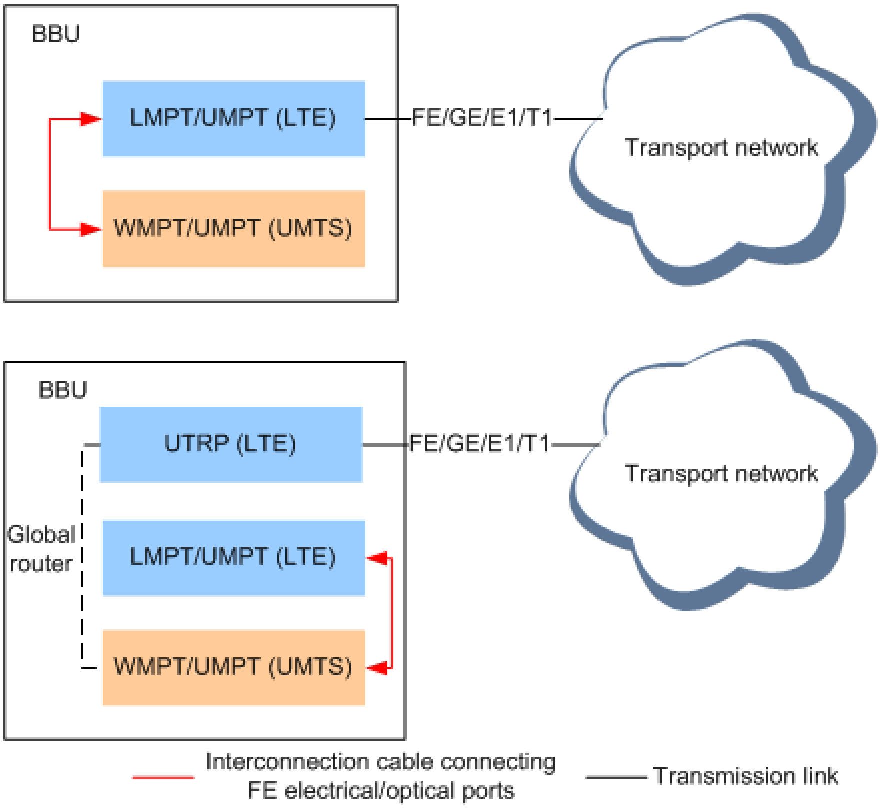


Table 7-8 Board and port connection (UL front plane interconnection)

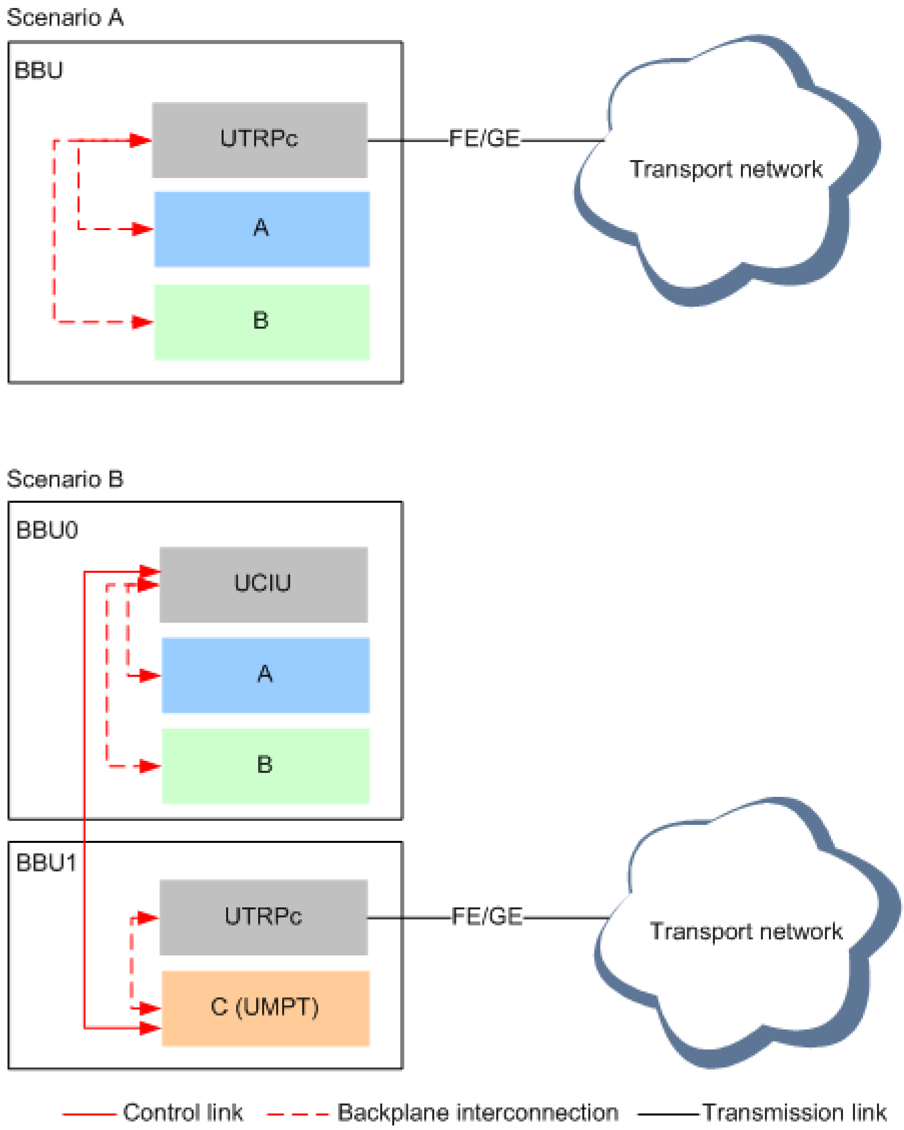
Board and Port for Front Panel Interconnection	Board Connected to the Transport Network
An FE port on the WMPT or LMPT board is connected to an FE port on the UMPT (LTE) or LMPT board.	LMPT, UMPT, or UTRP (LTE)

Backplane Interconnection

Figure 7-15 shows common transmission with IP through a UTRPc board. In this figure, A, B, and C are the three SiteUnits of the MBTS.

- When only one BBU is configured or two BBUs in an MBTS are not interconnected, common transmission can be applied only to the two SiteUnits installed in the same BBU, as shown in scenario A.
- When BBU interconnection is applied to an MBTS, common transmission can be applied to any two SiteUnits or to all the SiteUnits of this MBTS. In scenario B, common transmission is applied to the three SiteUnits of an MBTS. Specifically, A and B send their own data to the UCIU board through the BBU backplane. Using a control link, the UCIU board sends the data to the UMPT board, which in turn sends the data of A, B, and C to the UTRPc board through the BBU backplane. The UTRPc board is connected to the transport network using its transmission port, and the data of A, B, and C is carried over the transmission link.

Figure 7-15 UTRPc-based common transmission with IP through backplane interconnection



When a main control board is used to achieve common transmission with IP:

- Single BBU: **Figure 7-16**, **Figure 7-17**, and **Figure 7-18** show common transmission with IP through main control boards.
- BBU interconnection: When BBU interconnection is applied to an MBTS, common transmission can be applied to any two SiteUnits or to all the SiteUnits of this MBTS. In **Figure 7-19**, common transmission is applied to the three SiteUnits of an MBTS. Specifically, A and B send their own data to the UCIU board through the BBU backplane. Using a control link, the UCIU board sends the data to the UMPT board. The UMPT board is connected to the transport network using its transmission port, and the data of A, B, and C is carried over the transmission link.

Figure 7-16 Common transmission with IP (Single BBU, GU backplane interconnection)

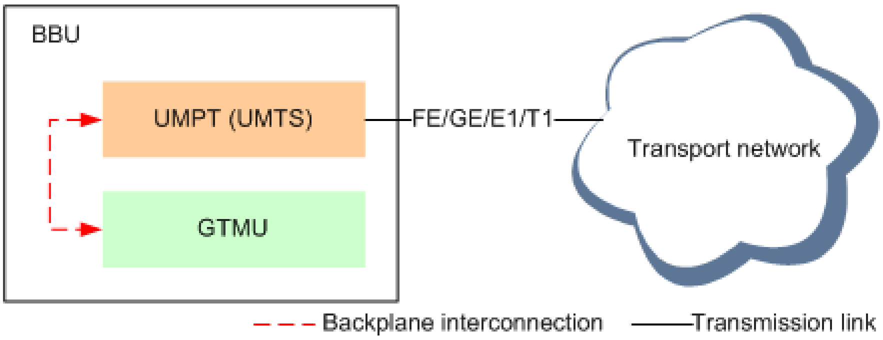


Figure 7-17 Common transmission with IP (Single BBU, GL backplane interconnection)

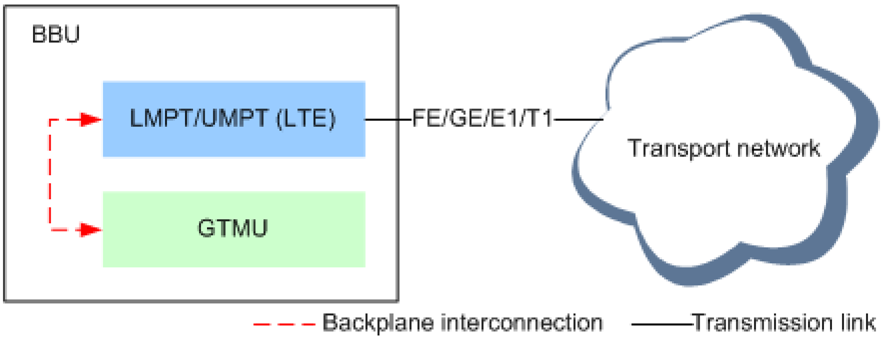


Figure 7-18 Common transmission with IP (Single BBU, UL backplane interconnection)

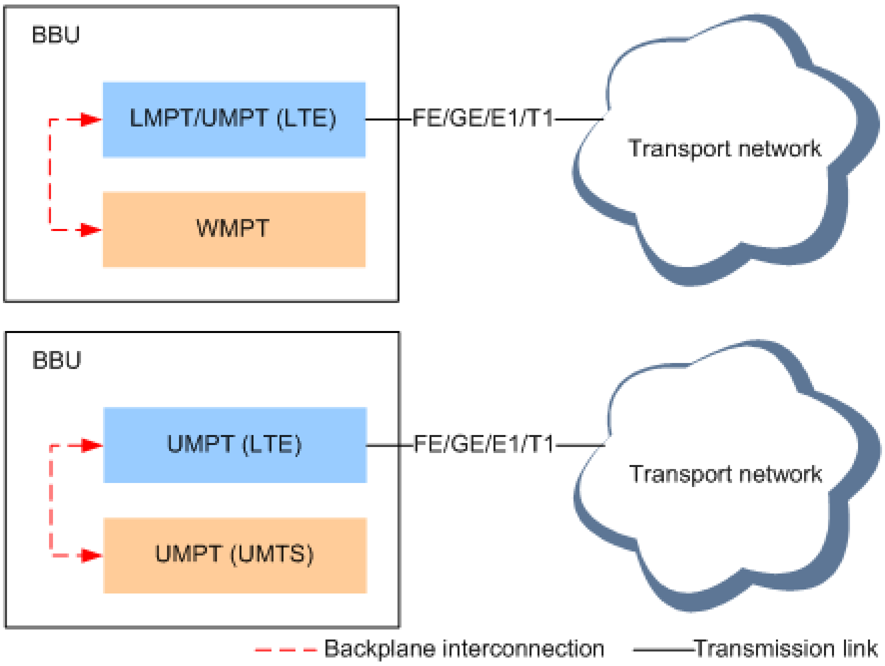
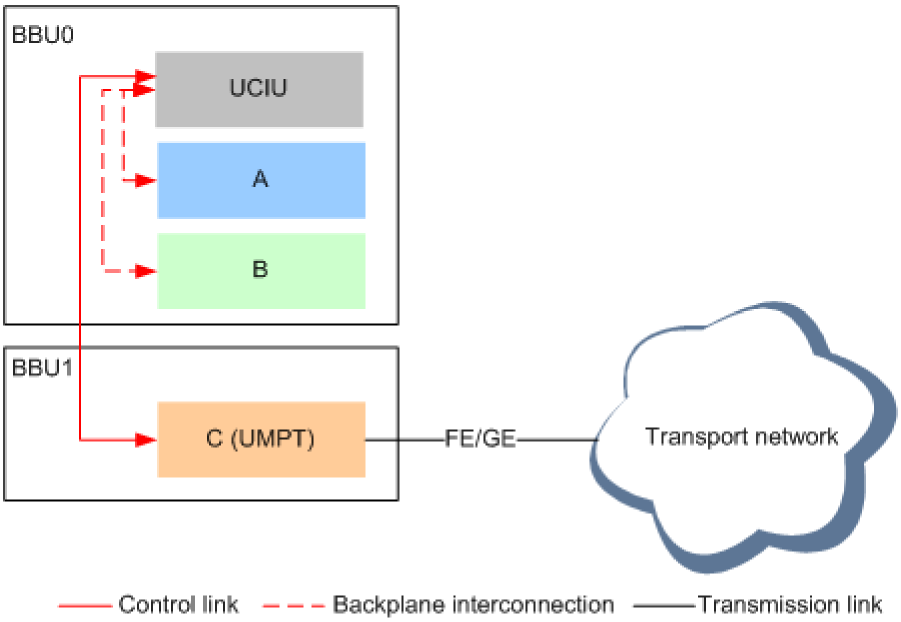


Figure 7-19 Common transmission with IP (BBU interconnection)



Route Backup

The MBTS can achieve route backup by using common transmission with IP, which enables backup between traffic channels.

When the MBTS supports route backup, each SiteUnit has two transmission channels, that is, the main channel and the backup channel.

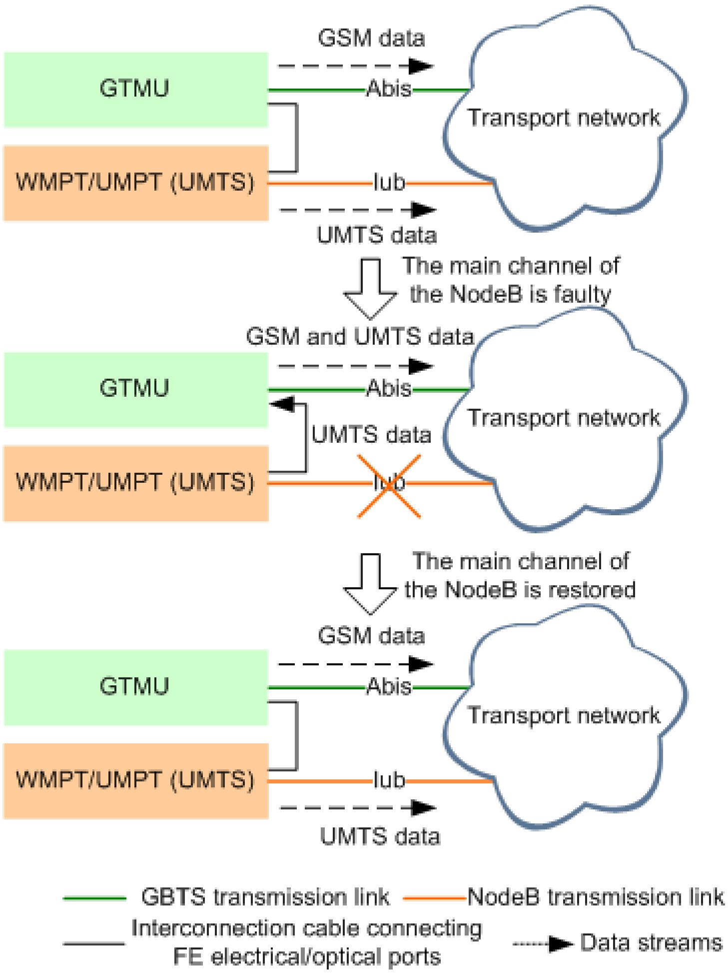
- Main channel: When each SiteUnit connects to the transport network by using an independent physical transmission port, this independent transmission link is the main channel for each SiteUnit.
- Backup channel: When the main control boards of two SiteUnits are interconnected by using FE/GE ports, each SiteUnit's independent transmission link serves as a backup channel for the other SiteUnit. FE stands for fast Ethernet and GE stands for gigabit Ethernet.

Usage scenarios of the route backup function are as follows:

Scenario	Description
The main channel is faulty.	In this case, the route backup function can be enabled to enable switchover of transmission paths. Then, the system switches to the backup channel to ensure that maintenance and service data of high priority is not affected. After the main channel restores, the system automatically switches back to the main channel.
The transmission is not ready.	In this case, a SiteUnit can use transmission links of another SiteUnit to ensure that version management and other operations can be performed and completed properly.

Figure 7-20 shows the working principle of route backup when the main channel of the NodeB in an MBTS working in GU mode is faulty. This working principle also applies to other scenarios.

Figure 7-20 Working principle of route backup



In the preceding figure, the GBTS and NodeB connect to the transport network by using independent physical transmission ports and the GTMU and WMPT/UMPT boards are interconnected by using FE ports. GTMU stands for GSM Transmission, Timing, and Management Unit for BBU. WMPT stands for WCDMA Main Processing and Transmission Unit. UMPT stands for Universal Main Processing and Transmission Unit. Under normal circumstances, the GBTS and NodeB use their own independent transmission links (main channels) to transmit data. No impact exists between the GBTS and NodeB in terms of transmission. If the main channel of the NodeB is faulty, the backup channel will be used and the NodeB's data is transferred to the GTMU board over the FE interconnection cable. Moreover, the transmission link of the GBTS (the backup channel) will be used to ensure that high-priority maintenance and service data will not be affected. After the main channel of the NodeB is restored, the system automatically switches back to the main channel to transmit data.

For route backup achieved using common transmission with IP, pay attention to the following information:

- In IP over E1 mode, route backup is not supported.
- If the route backup function has been enabled on a physical channel, the hybrid transport function cannot be enabled on this channel.

- Route backup can be enabled only by interconnecting FE ports on main control boards. Interconnecting FE ports on a UTRP board and a main control board cannot enable route backup.
- In route backup scenarios, the IEEE1588 V2 clock supports the backup switch of only unicast mode but not multicast mode.
- Route backup depends on Bidirectional Forwarding Detection (BFD). When the main channel is faulty, the operation, administration and maintenance (OAM), signaling, and key services of high priority are guaranteed preferentially. When the MBTS works in GU, GL, or UL mode, NodeB or eNodeB can use only BFD to bind the host-specific route. If UMTS or LTE does not use BFD to bind the host-specific route, the active and standby routes cannot be switched over, and therefore the route backup function cannot take effect.
- If the MBTS works in UL mode and the main channel of the eNodeB is faulty, the QoS of high-priority data streams is guaranteed preferentially when the backup channel is used. This is because the NodeB processing capability is limited and the NodeB cannot support the entire eNodeB traffic.
- If the MBTS works in GU or GL mode and the main channel of the NodeB or eNodeB is faulty, the QoS of high-priority data streams is guaranteed preferentially when the backup channel is used. This is because the GBTS processing capability is limited and the GBTS cannot support the entire NodeB or eNodeB traffic.

Hybrid Transport

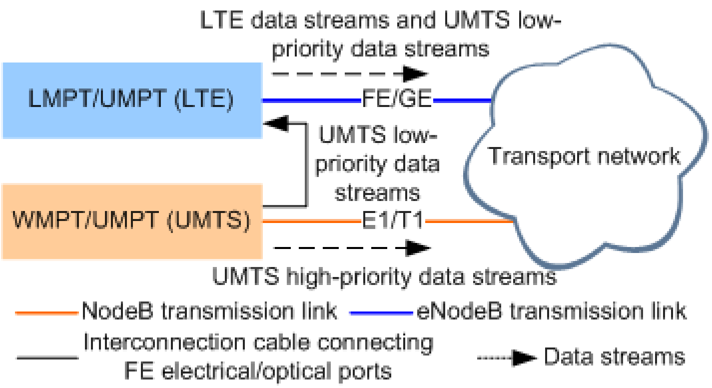
An MBTS working in UL mode can enable hybrid transport by using the common transmission with IP mode.

The MBTS working in UL mode supports the transfer of data over different transmission links by priorities. In this scenario, an FE/GE port on the main control board serving UMTS is interconnected with an FE/GE port on the main control board serving LTE to exchange information. FE stands for fast Ethernet and GE stands for gigabit Ethernet. The E1/T1 port on the main control board serving UMTS is connected to the transport network to bear high-priority services. An FE/GE port on the main control board serving LTE is connected to the transport network to bear low-priority services.

There are three scenarios for hybrid transport:

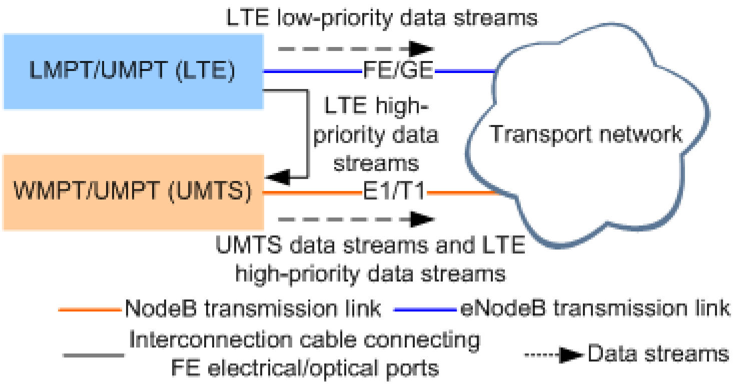
- Scenario 1: The UMTS traffic is transmitted on different paths whereas the LTE traffic is transmitted on one path, as shown in **Figure 7-21**.

Figure 7-21 Hybrid transport (scenario 1)



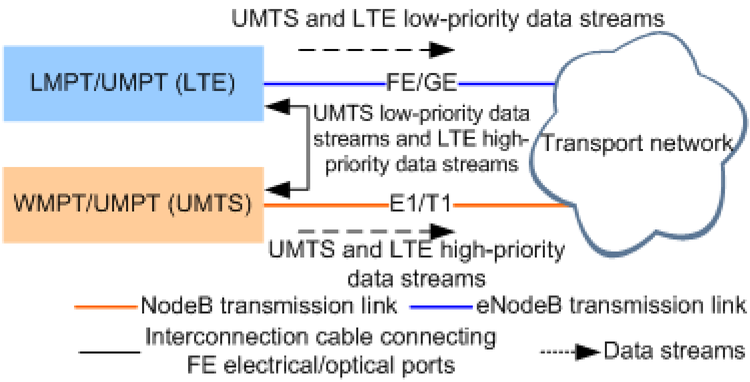
- Scenario 2: The UMTS traffic is transmitted on one path whereas the LTE traffic is transmitted on different paths, as shown in **Figure 7-22**.

Figure 7-22 Hybrid transport (scenario 2)



- Scenario 3: Both UMTS traffic and LTE traffic are transmitted on different paths, as shown in **Figure 7-23**.

Figure 7-23 Hybrid transport (scenario 3)



8 CPRI-based Topologies

About This Chapter

This section describes CPRI-based topologies for 3900 series base stations and specifications of CPRI ports on boards or modules. CPRI stands for common public radio interface.

GBTSs support various topologies on the common public radio interface (CPRI): GBTSs equipped with remote radio units (RRUs) support the star, chain, and ring topologies. GBTSs equipped with radio frequency units (RFUs) support the star and chain topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, supported topology, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

NodeBs support various topologies on the common public radio interface (CPRI): NodeBs equipped with remote radio units (RRUs) support the star, chain, and inter-board cold backup ring. NodeBs equipped with radio frequency units (RFUs) support the star and chain topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

eNodeBs support various topologies on the common public radio interface (CPRI): eNodeBs equipped with remote radio units (RRUs) support the star, chain, hot backup ring, intra-board cold backup ring, and inter-board cold backup ring topologies; eNodeBs equipped with radio frequency units (RFUs) support the star topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

The MBTS supports multiple CPRI-based topologies. Single-mode radio frequency (RF) modules support the star, chain, and ring topologies. Multi-mode RF modules support the star, dual-star, and CPRI MUX topologies. CPRI stands for common public radio interface. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or RF module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

8.1 GBTS CPRI-based Topologies

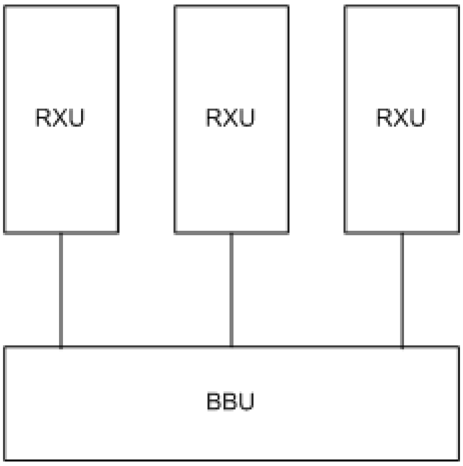
GBTSs support various topologies on the common public radio interface (CPRI): GBTSs equipped with remote radio units (RRUs) support the star, chain, and ring topologies. GBTSs equipped with radio frequency units (RFUs) support the star and chain topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, supported topology, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

CPRI-based topologies

GBTSs support star, chain, and ring topologies.

Figure 8-1 shows the star topology.

Figure 8-1 Star Topology



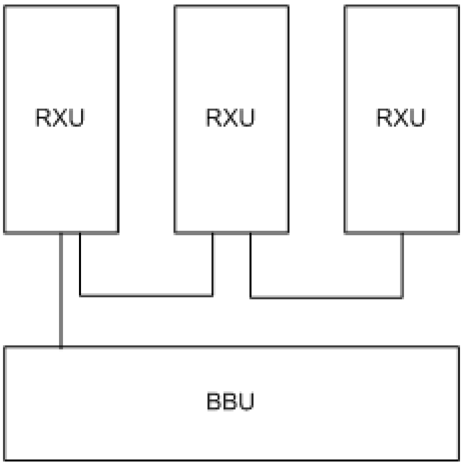
Star topologies have the following advantages:

- Transmission reliability is high. When an RXU or an optical cable is faulty, only the related sector is affected.
- This topology is easy. Installation and maintenance are convenient.

Compared with other topologies, star topology requires large numbers of optical cables.

Figure 8-2 shows the chain topology.

Figure 8-2 Chain Topology



The chain topology helps reduce expenditure on transmission equipment.

Chain topologies have the following disadvantages:

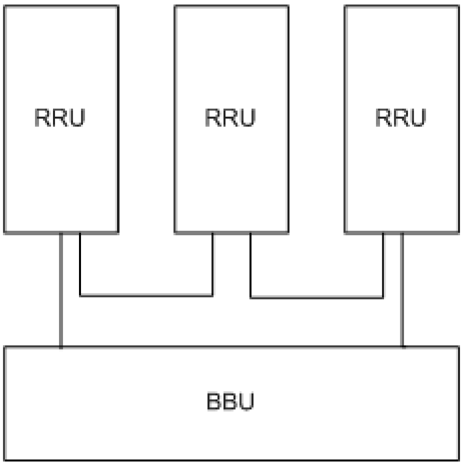
- The number of cascading levels on a chain and the cascading distance are restricted.
- RXUs working in different modes cannot be cascaded.
- Faults in an upper-level RXU may affect lower-level RXUs.

NOTE

- RFUs and RRUs cannot be cascaded.
- Data rates of two common public radio interface (CPRI) ports on an RXU must be the same. That is, the data rate of each RF module on a CPRI chain must be the same.

Figure 8-3 shows the ring topology.

Figure 8-3 Ring Topology



Ring topologies are a redundancy type of the chain topology and therefore provide higher transmission reliability.

Ring topologies have the following disadvantages:

- The number of cascading levels on a chain and the cascading distance are restricted.
- RRUs working in different modes cannot be cascaded.
- Faults in an upper-level RRU may affect lower-level RRUs.

NOTE

RFUs do not support the ring topology.

CPRI Specifications

Table 8-1 lists the CPRI port specifications on each board.

Table 8-1 CPRI port specifications on each board

Board	Number of CPRIs	CPRI Rate (Gbit/s)	Supported Topology
GTMU	6	1.25	Star, chain, or ring
GTMUb	6	1.25/2.5	Star, chain, or ring

Table 8-2 lists the CPRI port specifications on each RF module.

Table 8-2 CPRI port specifications on each RF module

RF Module	Number of CPRIs	CPRI Rate (Gbit/s)	Supported Topology	Cascading Level	Maximum Distance from the BBU (km)
DRFU	2	1.25	Star or chain	3	N/A
GRFU	2	• GRFU V1: 1.25 • GRFU V2: 1.25/2.5	Star or chain	2	N/A
RRU3004	2	1.25	Star, chain, or ring	6	40
RRU3008	2	• RRU3008 V1: 1.25 • RRU3008 V2: 1.25/2.5	Star, chain, or ring	6	40

RF Module	Number of CPRIs	CPRI Rate (Gbit/s)	Supported Topology	Cascading Level	Maximum Distance from the BBU (km)
MRFU	2	• MRFU V1: 1.25 • MRFU V2: 1.25/2.5 • MRFU V3: 1.25/2.5	Star	N/A	N/A
MRFUd	2	1.25/2.5	Star	N/A	N/A
MRFUe	2	1.25/2.5	Star	N/A	N/A
RRU3908	2	• RRU3908 V1 (850, 900, or 1900 MHz): 1.25 • RRU3908 V1 (1800 MHz) or RRU3908 V2: 1.25/2.5	Star	N/A	40
RRU3928	2	1.25/2.5	Star	N/A	40
RRU3929	2	1.25/2.5	Star	N/A	40
RRU3942	2	1.25/2.5	Star	N/A	40
RRU3926	2	1.25/2.5	Star, chain, or ring	21	40

8.2 NodeB CPRI-based Topologies

NodeBs support various topologies on the common public radio interface (CPRI): NodeBs equipped with remote radio units (RRUs) support the star, chain, and inter-board cold backup ring. NodeBs equipped with radio frequency units (RFUs) support the star and chain topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

CPRI-based Topologies

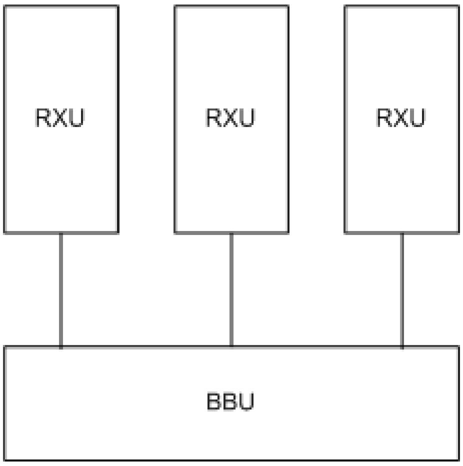
NodeBs support the star, chain, and inter-board cold backup ring topologies.

NOTE

In the BBU interconnection scenario, either of the BBUs can be connected to the CPRI cable. It is recommended that BBU0 is connected to the CPRI cable.

Figure 8-4 shows the star topology.

Figure 8-4 Star Topology



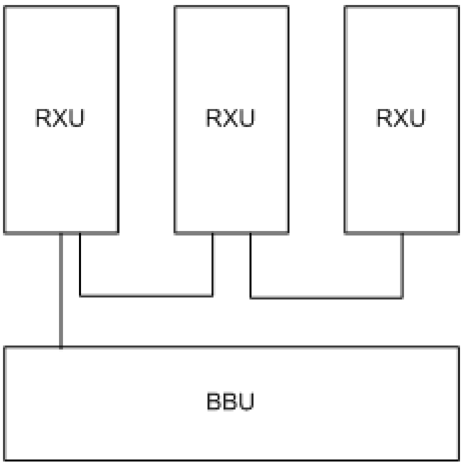
Star topologies have the following advantages:

- Transmission reliability is high. When an RXU or an optical cable is faulty, only the related sector is affected.
- This topology is easy. Installation and maintenance are convenient.

Compared with other topologies, star topology requires large numbers of optical cables.

Figure 8-5 shows the chain topology.

Figure 8-5 Chain Topology



The chain topology helps reduce expenditure on transmission equipment.

Chain topologies have the following disadvantages:

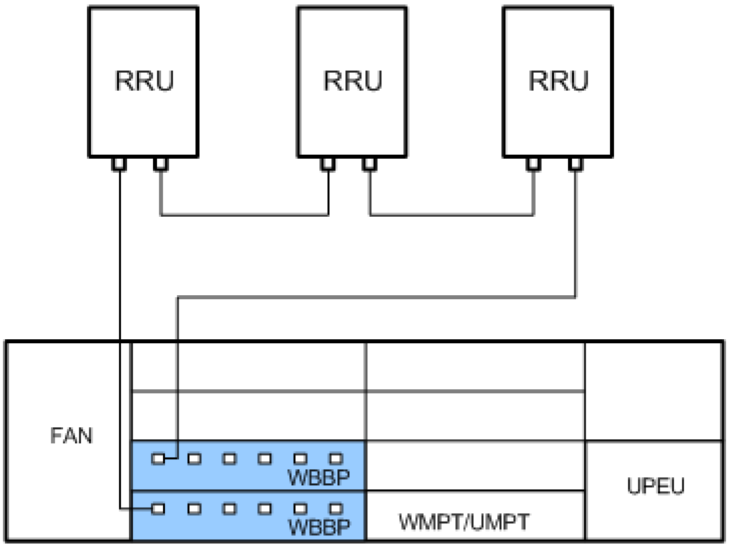
- The number of cascading levels on a chain and the cascading distance are restricted.
- RXUs working in different modes cannot be cascaded.
- Faults in an upper-level RXU may affect lower-level RXUs.

NOTE

- RFUs and RRUs cannot be cascaded.
- Data rates of two common public radio interface (CPRI) ports on an RXU must be the same. That is, the data rate of each RF module on a CPRI chain must be the same.

Figure 8-6 shows the inter-board cold backup ring topology.

Figure 8-6 Inter-board cold backup ring



Advantage of the inter-board ring topology is that it is a redundancy type of the chain topology and therefore provides higher transmission reliability.

The inter-board ring topology has the following disadvantages:

- The number of cascading levels and cascading distances are restricted, as listed in **Table 8-5**.
- RRUs working in different modes cannot be cascaded.
- Faults on the forwarding link of an upper-level RRU affect its lower-level RRUs.

NOTE

- RFUs cannot be used in the ring topology.
- A ring topology does not support inter-BBU connections. Two cascaded BBUs cannot be connected in a ring topology network.

Specifications of CPRI Ports

CPRI ports of different rates support different numbers of cells, as listed in **Table 8-3**.

Table 8-3 CPRI port rate and number of cells supported

CPRI Port Rate (Gbit/s)	Number of Cells Supported (Without MIMO or Four Antennas)
1.25	4
2.5	8

In a chain or ring topology network, set the CPRI port rate according to the number of cells to be supported.

Table 8-4 provides the CPRI port specifications of the WBBP board.

Table 8-4 CPRI port specifications of the WBBP board

Board	Number of CPRI Ports	CPRI Port Rate (Gbit/s)	Topology
WBBPa	3	1.25	Star, chain, or ring
WBBPb1/WBBPd2	3	1.25/2.5	Star, chain, or ring
WBBPb3/WBBPb4	3	1.25/2.5	Star, chain, or ring
WBBPd	6	1.25/2.5	Star, chain, or ring
WBBPf	6	1.25/2.5/4.9	Star, chain, or ring

Table 8-5 provides the CPRI port specifications of different RF modules.

Table 8-5 CPRI port specifications of different RF modules

Module	Number of CPRI Ports	CPRI Port Rate (Gbit/s)	Topology	Cascading Level	Maximum Distance from the BBU (km)
WRFU	2	1.25/2.5	Star or chain	2 (serving the same sector)	N/A
WRFUd	2	1.25/2.5	Star	N/A	N/A
MRFU	2	• MRFU V1: 1.25 • MRFU V2: 1.25/2.5	Star	N/A	N/A

Module	Number of CPRI Ports	CPRI Port Rate (Gbit/s)	Topology	Cascading Level	Maximum Distance from the BBU (km)
MRFUd	2	1.25/2.5	Star	N/A	N/A
RRU3908	2	• RRU3908 V1 (1800 MHz): 1.25/2.5 • RRU3908 V1 (other bands): 1.25 • RRU3908 V2: 1.25/2.5	Star	N/A	40
RRU3928	2	1.25/2.5	Star	N/A	40
RRU3929	2	1.25/2.5	Star	N/A	40
RRU3942	2	1.25/2.5	Star	N/A	40
RRU3926	2	1.25/2.5	Star	N/A	40
RRU3828	2	1.25/2.5	Star, chain, or ring	• 4 at 1.25 Gbit/s • 8 at 2.5 Gbit/s	40
RRU3829	2	1.25/2.5	Star, chain, or ring		
RRU3804/ RRU3806/ RRU3808/ RRU3824/ RRU3826	2	1.25/2.5	Star, chain, or ring		
RRU3801E	2	1.25/2.5	Star, chain, or ring		

Module	Number of CPRI Ports	CPRI Port Rate (Gbit/s)	Topology	Cascading Level	Maximum Distance from the BBU (km)
RRU3805	2	● RRU3805 (1800 MHz): 1.25/2.5 ● RRU3805 (other bands): 1.25	Star, chain, or ring		

NOTE
- The WRFUd, MRFUd, RRU3828, and RRU3928 cannot be cascaded.
- Limited by the transmission bandwidth of CPRI ports, one RRU supports only one cell with one TX channel and two RX channels at the maximum cascading level.

8.3 eNodeB CPRI-based Topologies

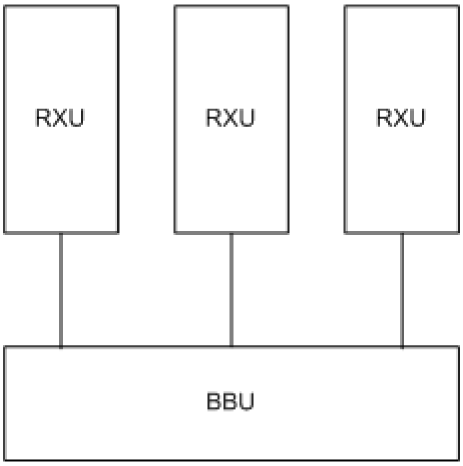
eNodeBs support various topologies on the common public radio interface (CPRI): eNodeBs equipped with remote radio units (RRUs) support the star, chain, hot backup ring, intra-board cold backup ring, and inter-board cold backup ring topologies; eNodeBs equipped with radio frequency units (RFUs) support the star topologies. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or radio frequency (RF) module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

CPRI-based Topologies

eNodeBs support the star, chain, and ring topologies.

Figure 8-7 shows the star topology.

Figure 8-7 Star Topology



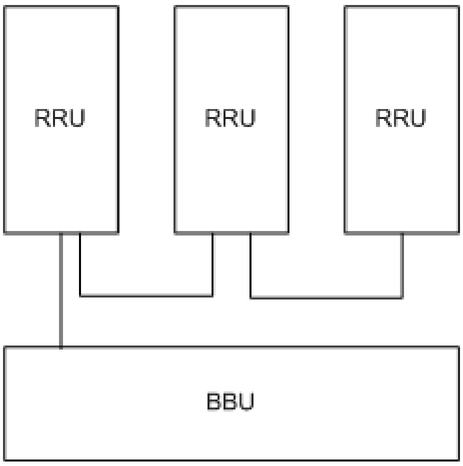
Star topologies have the following advantages:

- Transmission reliability is high. When an RXU or an optical cable is faulty, only the related sector is affected.
- This topology is easy. Installation and maintenance are convenient.

Compared with other topologies, star topology requires large numbers of optical cables.

Figure 8-8 shows the chain topology.

Figure 8-8 Chain Topology



The chain topology helps reduce expenditure on transmission equipment.

Chain topologies have the following disadvantages:

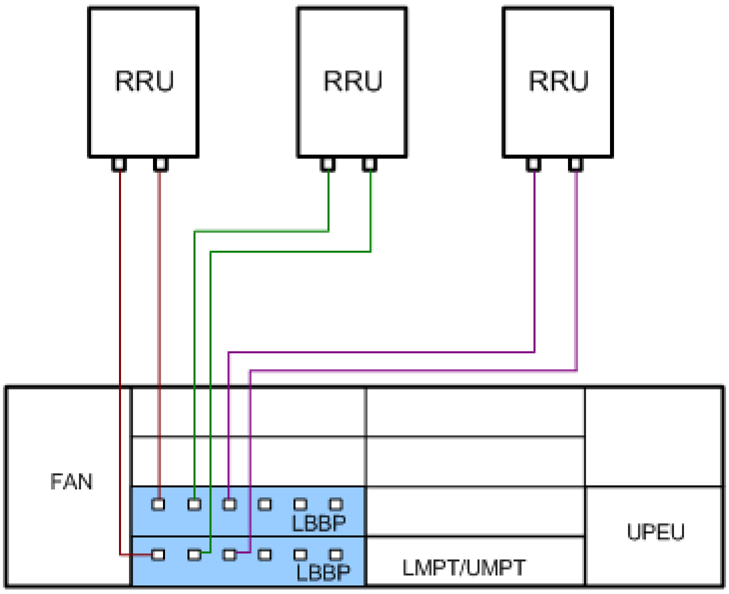
- The number of cascading levels on a chain and the cascading distance are restricted.
- RRUs working in different modes cannot be cascaded.
- Faults in an upper-level RRU may affect lower-level RRUs.

NOTE

Data rates of two common public radio interface (CPRI) ports on an RRU must be the same. That is, the data rate of each RF module on a CPRI chain must be the same.

Ring topologies are classified into the following types: hot backup ring, intra-board cold backup ring, and inter-board cold backup ring. **Figure 8-9**, **Figure 8-10**, and **Figure 8-11** show these topologies respectively.

Figure 8-9 Hot backup ring



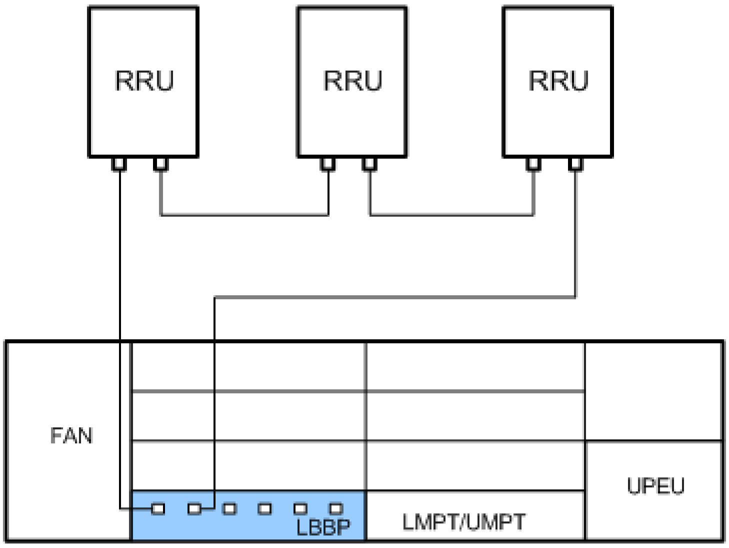
In the hot backup ring topology, two CPRI links transmit identical service data, but the LBBP where the cell is established and the RRU process data on one link only. If a CPRI port is faulty, services are switched over to the other CPRI link, with a maximum interruption time of 500 ms. If the LBBP where the cell is established is faulty, the cell is reestablished on the other LBBP, with a maximum interruption time of 20s.

NOTE

The hot backup ring topology has the following constraints:

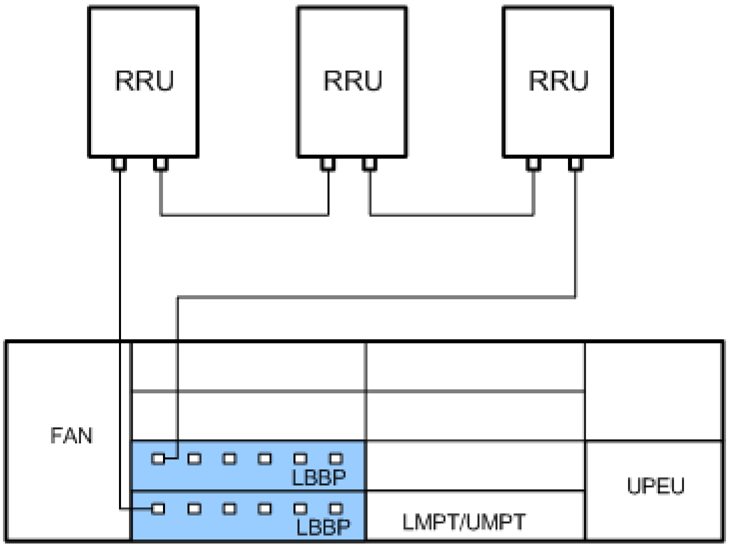
- Only ports 0, 1, and 2 on the two LTE baseband processing units (LBBPs) can be used in this topology.
- The two LBBP boards are installed in two slots among slots 0, 1, 2, and 3 in the baseband unit (BBU). If one is installed in slot 0, the other can be installed only in slot 2 or 3.
- If the two LBBP boards are installed in slots 2 and 3 in the BBU, a maximum of three rings are supported between the LBBP boards. In other situations, only one ring is supported.

Figure 8-10 Intra-board cold backup ring



In the intra-board cold backup ring topology, if a CPRI port is faulty, the cell is reestablished, with an interruption time of shorter than 20s.

Figure 8-11 Inter-board cold backup ring



In the inter-board cold-backup ring topology, if a CPRI port or LBBP board is faulty, the cell is reestablished on the LBBP board or the other LBBP board, with a service interruption time shorter than 20s.

The advantage of ring topologies is that they are a redundancy type of the chain topology and therefore provide higher transmission reliability.

Ring topologies have the following disadvantages:

- The number of cascading levels and cascading distances are restricted.
- RRUs working in different modes cannot be cascaded.
- Faults on the forwarding link of an upper-level RRU affect its lower-level RRUs.

NOTE
RFUs cannot be used in the ring topology.

Specifications of CPRI Ports

The number of cells supported varies according to CPRI data rates, as listed in **Table 8-6**.

Table 8-6 CPRI data rate and the number of cells supported

CPRI Data Rate (Gbit/s)	Number of Cells Supported (4 x 4 MIMO)	Number of Cells Supported (2 x 2 MIMO)
1.25	Due to the limited transmission bandwidth of CPRI ports, a 4 x 4 MIMO cell is not recommended to configure.	1 if the cell bandwidth is less than or equal to 10 MHz.
2.5	1 if the cell bandwidth is less than or equal to 10 MHz.	● 2 if the cell bandwidth is less than or equal to 10 MHz. ● 1 if the cell bandwidth is 15 MHz or 20 MHz.
4.9	● 2 if the cell bandwidth is less than or equal to 10 MHz. ● 1 if the cell bandwidth is 15 MHz or 20 MHz.	● 4 if the cell bandwidth is less than or equal to 10 MHz. ● 2 if the cell bandwidth is 15 MHz or 20 MHz.

Table 8-7 lists the specifications of CPRI ports on different LBBP boards.

Table 8-7 Specifications of CPRI ports on LBBP boards

Board	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology
LBBPc	6	1.25, 2.5, or 4.9	Star, chain, or ring
LBBPd	6	1.25, 2.5, 4.9, or 9.8	Star, chain, or ring

Table 8-8 lists the specifications of CPRI ports on different RF modules.

Table 8-8 Specifications of CPRI ports on RF modules

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology	Cascading Levels	Maximum Distance from the BBU (km)
CRFUd	2	1.25, 2.5, or 4.9	Star	N/A	N/A
LRFU	2	1.25 or 2.5	Star	N/A	N/A
LRFUe	2	1.25, 2.5, or 4.9	Star	N/A	N/A
MRFU V2	2	1.25 or 2.5	Star	N/A	N/A
MRFUd	2	1.25, 2.5, or 4.9	Star	N/A	N/A
RRU3201	2	1.25 or 2.5	Star, chain, or ring	**When the rate at the CPRI port is 1.25 Gbit/s:** Cascading is not recommended. **When the rate at the CPRI port is 2.5 Gbit/s:** ● Three levels are supported if the cell bandwidth is less than or equal to 5 MHz. ● Two levels are supported if the cell bandwidth is 10 MHz. ● Cascading is not recomme	20
RRU3203	2	1.25 or 2.5	Star, chain, or ring		20
RRU3220	2	1.25 or 2.5	Star, chain, or ring		20
RRU3221	2	1.25, 2.5, or 4.9	Star, chain, or ring		20
RRU3222	2	1.25 or 2.5	Star, chain, or ring		20
RRU3229	2	1.25, 2.5, or 4.9	Star, chain, or ring		20

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology	Cascading Levels	Maximum Distance from the BBU (km)
RRU3808	2	1.25 or 2.5	Star, chain, or ring	nded if the cell bandwidth is greater than or equal to 15 MHz. **When the rate at the CPRI port is 4.9 Gbit/s:** ● Four levels are supported if the cell bandwidth is less than or equal to 10 MHz. ● Two levels are supported if the cell bandwidth is greater than or	20

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology	Cascading Levels	Maximum Distance from the BBU (km)
				equal to 15 MHz.	
RRU3240	2	1.25, 2.5, or 4.9	Star, chain, or ring	**When the rate at the CPRI port is 1.25 Gbit/s:** Cascading is not recommended. **When the rate at the CPRI port is 2.5 Gbit/s:** ● Two levels are supported if the cell bandwidth is less than or equal to 5 MHz. ● Cascading is not recommended if the cell bandwidth is 10 MHz. **When the rate at the CPRI port is 4.9 Gbit/s:** ● Two levels are supported if the cell bandwidth is less than or	20

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology	Cascading Levels	Maximum Distance from the BBU (km)
RRU3841	2	1.25, 2.5, or 4.9	Star, chain, or ring	equal to 10 MHz. ● Cascading is not recommended if the cell bandwidth is greater than or	20

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Topology	Cascading Levels	Maximum Distance from the BBU (km)
				equal to 15 MHz.	
RRU3908 V1	2	1.25 or 2.5	Star	N/A	20
RRU3908 V2	2	1.25 or 2.5	Star	N/A	20
RRU3928	2	1.25, 2.5, or 4.9	Star	N/A	20
RRU3929	2	1.25, 2.5, or 4.9	Star	N/A	20
RRU3942	2	1.25, 2.5, or 4.9	Star	N/A	20

NOTE

- Due to the limited transmission bandwidth of CPRI ports, cascading is not recommended in the following conditions:
  - An RF module whose rate at the CPRI port is 1.25Gbit/s.
  - An RF module whose rate at the CPRI port is 2.5 Gbit/s and the cell bandwidth is greater than or equal to 15 MHz.
  - A 2T4R or 4T4R RF module whose rate at the CPRI port is 2.5 Gbit/s and the cell bandwidth is greater than or equal to 10 MHz.
  - A 2T4R or 4T4R RF module whose rate at the CPRI port is 4.9 Gbit/s and the cell bandwidth is greater than or equal to 15 MHz.
- The Cascading Levels column in **Table 8-8** lists the cascading capability of RF modules with a single carrier per module.

8.4 MBTS CPRI-based Topologies

The MBTS supports multiple CPRI-based topologies. Single-mode radio frequency (RF) modules support the star, chain, and ring topologies. Multi-mode RF modules support the star, dual-star, and CPRI MUX topologies. CPRI stands for common public radio interface. In addition to topologies, CPRI specifications cover the number of CPRI ports on a board or RF module, CPRI data rate, cascading capability, and maximum distance between a baseband unit (BBU) and an RF module.

CPRI-based Topologies

For CPRI-based topologies supported by multi-mode RF modules working in a single mode and single-mode RF modules, see the following:

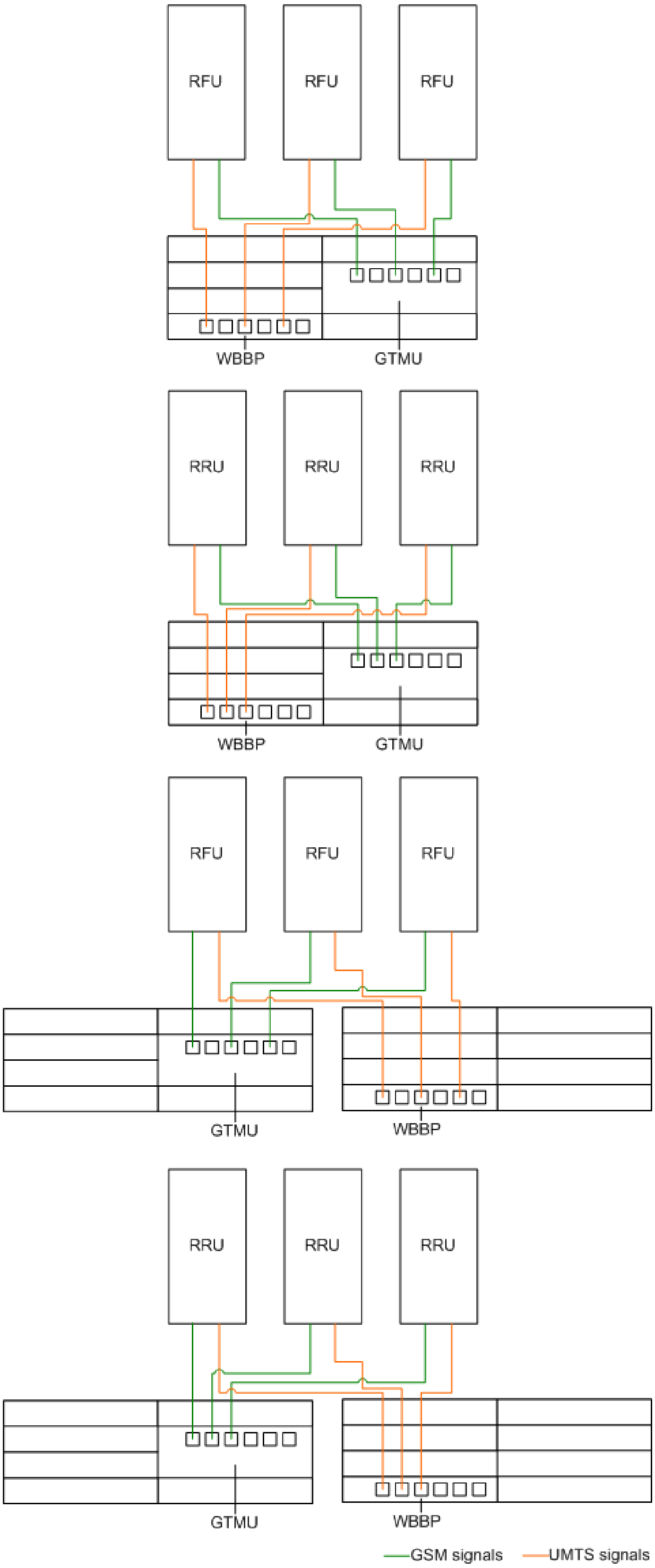
- **8.1 GBTS CPRI-based Topologies**

- **8.2 NodeB CPRI-based Topologies**
- **8.3 eNodeB CPRI-based Topologies**

Multi-mode RF modules working in multiple modes support the dual-star and CPRI MUX topologies.

Figure 8-12 shows the dual-star topology.

Figure 8-12 Dual-Star Topology



NOTE

In Figure 8-12, GU dual-mode RF modules adopt the dual-star topology.

Data of different modes is transmitted over different CPRI cables and therefore the data of one mode does not greatly affect the data of another mode.

Dual-star topologies have the following disadvantages:

- Two CPRI ports on an RXU are used by two modes separately. Therefore, RXUs cannot be cascaded.
- Data rates of two CPRI ports on an RXU must be the same and therefore the RXU only supports the lower data rate on a CPRI port.

Figure 8-13 shows the CPRI MUX topology. Currently, only RRU3929 modules that operate in the 1700 MHz frequency band and work in UL mode support the CPRI MUX topology.

Figure 8-13 CPRI MUX topology

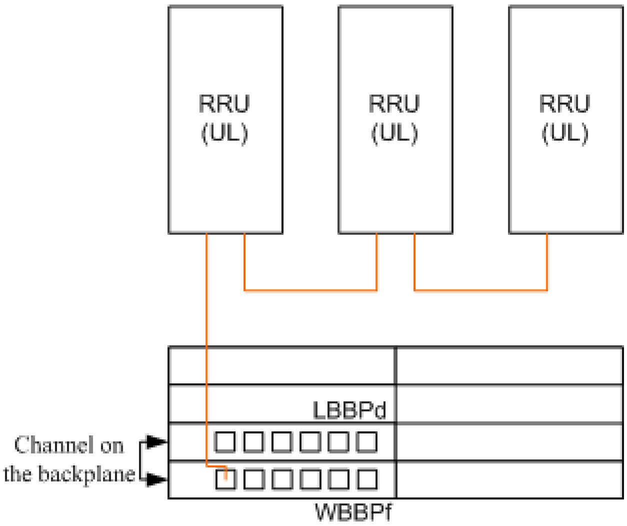
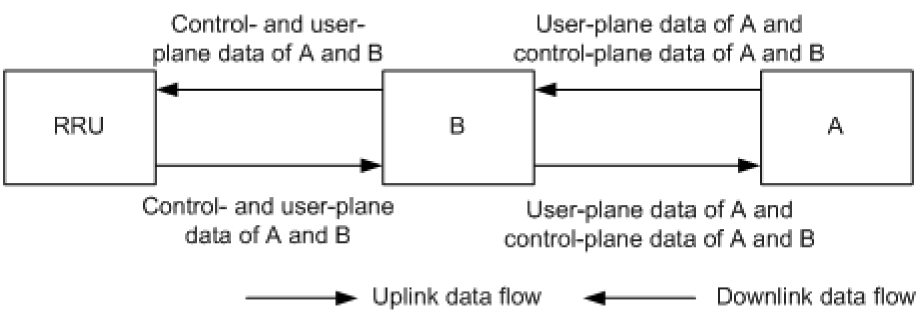


Figure 8-14 shows the uplink and downlink data flows when CPRI MUX topology is used. In this figure, A and B indicate two modes of the MBTS, respectively.

Figure 8-14 Uplink and downlink data flows



- Downlink data flow: A sends data to B through the BBU backplane. After aggregating the data of A and B, B sends the aggregated data to remote radio units (RRUs) through CPRI links.
- Uplink data flow: RRUs send B the data of A and B through CPRI links. Upon receiving the data, B separates the data and sends the control-plane data of A and B and the user-plane data of A to A through the BBU backplane.

In the preceding scenario, B aggregates data while A's data is aggregated. A does not have an independent CPRI link and therefore it shares B's CPRI links and CPRI bandwidth.

When using the CPRI MUX topology, pay attention to the following:

- One CPRI port cannot work for a distributed cell and a common cell at the same time.
- Data aggregation is allowed only between two modes within the same BBU. Only one mode is allowed to be aggregated the other mode's data. The two modes are not allowed to aggregate each other's data.
- Only UMTS can aggregate data and only LTE data can be aggregated. Only the LBBPd and WBBPf boards support CPRI MUX. In addition, the two boards must be configured in slot 3 and slot 2 in the BBU, respectively.

The advantage of the CPRI MUX topology: In the refarming scenario, if multi-mode RF modules are originally configured with only single fibers, newly added modes can share these modules with the existing modes through this topology without bothering adjusting or adding CPRI cables. This reduces engineering costs and shortens the service interruption period.

The disadvantages of the CPRI MUX topology are as follows:

- The data aggregation function is available only to modes inside the same BBU that communicate through the BBU backplane. In addition, this function is available only to boards installed in slot 2 or 3.
- The size of data that can be aggregated depends on the physical bandwidth of CPRI links and the BBU backplane. The sum of the bandwidth required by two modes sharing a CPRI link must not exceed the physical bandwidth of this CPRI link. Moreover, the physical bandwidth of the BBU backplane must not be lower than the bandwidth required for data forward by different modes. The physical bandwidth of a CPRI link equals the CPRI data rate of the related RF module, the CPRI data rate of the related baseband signal processing board, or the CPRI data rate of the related optical module, whichever is the smallest. In the following description, the physical bandwidth of a CPRI link is called panel CPRI data rate. The physical bandwidth of the BBU backplane equals the highest CPRI data rate supported by the related two modes' baseband signal processing boards. In the following description, the physical bandwidth of the BBU backplane is called BBU backplane data rate.

The 1T1R configuration applies to UMTS and the 2T2R configuration applies to LTE. **Table 8-9** and **Table 8-10** list the mapping between cell specifications and panel CPRI data rates or BBU backplane data rates.

Table 8-9 Cell specifications when the panel CPRI data rate is 4.9 Gbit/s and the BBU backplane data rate is 6.144 Gbit/s

Mode: Bandwidth (MHz)	Number of Cells Supported by Each CPRI Link on a Panel	Number of Supported CPRI Links	Total Number of Cells Supported by All CPRI Links on the BBU Backplane
• UMTS: 5 • LTE: 15	1	6	6
• UMTS: 10 (two carriers) • LTE: 15	2	5	12
• UMTS: 5 • LTE: 10	3	5	12

Table 8-10 Cell specifications when the panel CPRI data rate is 9.8 Gbit/s and the BBU backplane data rate is 9.8 Gbit/s

Mode: Bandwidth (MHz)	Number of Cells Supported by Each CPRI Link on a Panel	Number of Supported CPRI Links	Total Number of Cells Supported by All CPRI Links on the BBU Backplane
• UMTS: 5 • LTE: 15	1	6	10
• UMTS: 10 (two carriers) • LTE: 15	2	6	20
• UMTS: 5 • LTE: 10	3	6	20

Based on the distance between a BBU and an RRU, CPRI-based topologies are classified into the following:

- Short-distance remote topology: The longest distance between an RRU and a BBU on a CPRI chain does not exceed 100 m.
- Long-distance remote topology: The longest distance between an RRU and a BBU on a CPRI chain ranges from 100 m to 40,000 m.

Different CPRI optical cables are used in the preceding topologies. For details, see chapter **CPRI Optical-Fiber Cable** in the *DBS3900 Hardware Description*.

Specifications of CPRI Ports

The CPRI data rate can be 1.25, 2.5, or 4.9 Gbit/s. The CPRI data rate is related to the number of supported cells and the bandwidth. **Table 8-11** lists the number of supported cells and the bandwidth with different CPRI data rates.

Table 8-11 Number of supported cells and bandwidth with different CPRI data rates

CPRI Data Rate (Gbit/s)	Number of Cells Supported by UMTS (1T2R)	Number of Cells Supported by LTE
1.25	4	1 x 10 MHz (2T2R)
2.5	8	1 x 20 MHz (2T2R)
4.9	N/A	1 x 40 MHz (4T4R)

NOTE

- "A x B MHz" indicates that the number of cells configured for LTE is A and the bandwidth of each cell is B.
- "nMmR" indicates that the number of transmit channels is n and the number of receive channels is m.

For specifications of CPRI ports on boards, on single-mode RF modules, or on multi-mode RF modules working in a single mode, see the following:

- **8.1 GBTS CPRI-based Topologies**
- **8.2 NodeB CPRI-based Topologies**
- **8.3 eNodeB CPRI-based Topologies**

Table 8-12 lists the specifications of CPRI ports on multi-mode RF modules working in multiple modes.

Table 8-12 Specifications of CPRI ports on multi-mode RF modules working in multiple modes

Module	Number of CPRI Ports	CPRI Data Rate (Gbit/s)	Transport Network Topology	Cascading Levels	Maximum Distance from the BBU (km)
MRFU	2	• MRFU V1: 1.25 • MRFU V2: 1.25/2.5 • MRFU V3: 1.25/2.5	Dual-star	N/A	N/A
MRFUd	2	1.25/2.5	Dual-star	N/A	N/A
MRFUe	2	1.25/2.5	Dual-star	N/A	N/A
RRU3908	2	• RRU3908 V1 (850, 900, or 1900 MHz): 1.25 • RRU3908 V1 (1800 MHz) or RRU3908 V2: 1.25/2.5	Dual-star	N/A	40
RRU3926	2	1.25/2.5	Dual-star	N/A	40
RRU3928	2	1.25/2.5	Dual-star	N/A	40
RRU3929	2	1.25/2.5/4.9	Dual-star or CPRI MUX	• Dual-star: N/A • CPRI MUX: 3	• Dual-star: 40 • CPRI MUX: 10
RRU3942	2	1.25/2.5	Dual-star	N/A	40

9 Operation and Maintenance

About This Chapter

The 3900 series base stations are managed by an operation and maintenance (O&M) system using either man-machine language (MML) commands or a graphical user interface (GUI). This system is hardware-independent and provides comprehensive functions to meet users' various O&M requirements.

The operation and maintenance (O&M) system of GSM base transceiver stations (GBTSs) covers management, monitoring, and maintenance of the software, hardware, and configuration of GBTSs. In addition, GBTSs allow diversified O&M modes in different scenarios.

NodeB operation and maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of NodeBs. In addition, NodeBs allow diversified O&M modes in different scenarios.

Operation and maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of eNodeBs. In addition, eNodeBs allow diversified O&M modes in different scenarios.

Operation and Maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of the MBTSs. In addition, diversified O&M modes are provided in various scenarios.

9.1 GBTS Operation and Maintenance

The operation and maintenance (O&M) system of GSM base transceiver stations (GBTSs) covers management, monitoring, and maintenance of the software, hardware, and configuration of GBTSs. In addition, GBTSs allow diversified O&M modes in different scenarios.

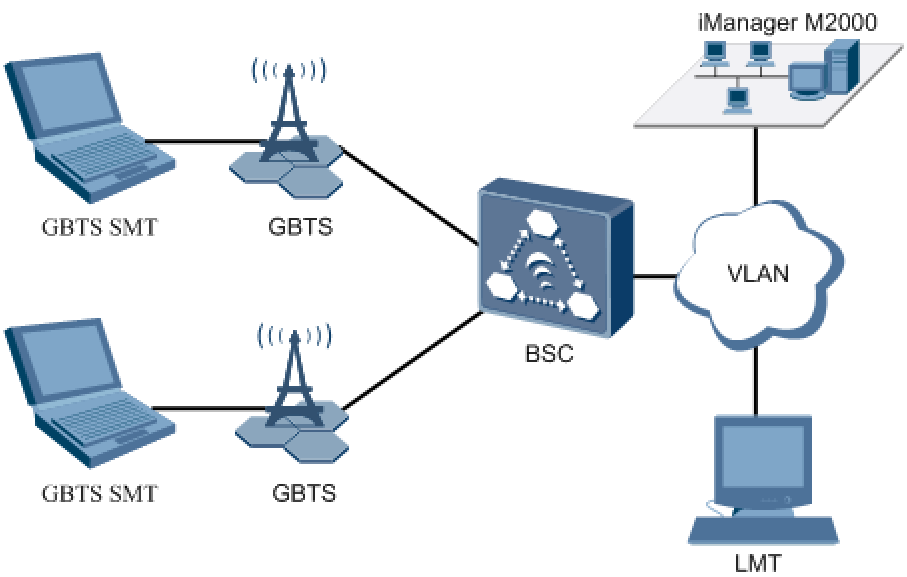
9.1.1 GBTS Operation & Maintenance Modes

GSM base transceiver stations (GBTSs) support near-end, far-end, and centralized network management operation and maintenance (O&M).

- Near-end O&M: The site maintenance terminal (SMT) is used to maintain the GBTS through the Ethernet at the near end, as well as operate and maintain sites, cells, TRXs, baseband units (BBUs), channels, and boards. This mode applies to maintenance of a single GBTS.
- Far-end O&M: The local maintenance terminal (LMT) is used to maintain the GBTS through the operation and maintenance links (OMLs) on the Abis interface at the far end, as well as operate and maintain sites, cells, TRXs, channels, and boards. The Abis interface connects the GBTS to base station controller (BSC), and the LMT communicates with the BSC through a local area network (LAN). This mode is applicable to configuration for the BSC and GBTS data.
- Centralized network management: The M2000 is used to maintain GBTSs through BSCs, as well as operate and maintain sites, cells, channels, and boards. This mode is applicable to maintenance of multiples GBTSs at the same time.

Figure 9-1 shows the GBTS O&M system.

Figure 9-1 O&M system of GBTSs



The GBTS O&M system consists of:

- SMT: used to maintain the GBTS and configure data at the near end.
- GBTS: object to be maintained.
- LMT: used to maintain the BSC and the GBTSs that connect to the BSC as well as configure data at the far end.
- M2000: used to maintain the GBTS through BSCs. It provides basic management functions, such as configuration management, performance management, fault management, security management, log management, topology management, software management, and system management, as well as various optional functions.

9.1.2 GBTS Operation & Maintenance Functions

The operation and maintenance (O&M) functions of GSM base transceiver stations (GBTSs) include equipment management, software management, configuration management, service management, performance management, security management, alarm management, and environment monitoring.

Equipment Management

Supports the ability to query the status of all the GBTS components (boards and modules) and external physical devices (power suppliers, environment monitors, and remote electrical tilt antennas) as well as provides the data configuration and status management functions for certain devices.

Software Management

Supports the ability to download and activate GBTS software, install patches, upload and download files, perform consistency checks on software and hardware versions, as well as manage and upgrade software versions.

Configuration Management

- Supports the ability to perform consistency checks on the added, deleted, and modified GBTS configuration data.
- Supports the ability to automatically back up data.
- Supports dynamic and static data configuration. In dynamic data configuration mode, the data takes effect immediately after modification. In static data configuration mode, the data takes effect only after the GBTS resets.

Service Management

- Supports the ability to set parameters and query alarms for baseband boards and environment monitoring device.
- Supports the ability to perform self-tests when installing hardware, use the GBTS software package stored in the USB flash drive to upgrade software at the near end, and support software commissioning at the far end. The software upgrade using the GBTS software package saved in the USB disk takes a shorter time than the common software upgrade.

  NOTE

  The security of the USB loading port is ensured by encryption.

Performance Management

- Supports the ability to monitor the performance of both internal and external communication networks. If the performance deteriorates, related alarms are generated.
- Supports the ability to monitor the GBTS operation, such as monitoring the traffic volume on each port and measuring performance statistics.
- Supports the ability to monitor the usage of key GBTS components, such as central processing units (CPUs) and digital signal processors (DSPs).

Security Management

Supports the ability to manage the connection between GBTS software and the operation and maintenance center (OMC) and parse interface messages between the GBTS and OMC, as well as provides the user authentication and encryption functions.

Alarm Management

- Supports the ability to query active and historical alarms.
- Supports the ability to collect information about internal and external alarms.
- Supports the ability to analyze the alarm correlation to improve the precision and accuracy in alarm reporting.
- Supports the ability to save, interpret, display, mask, filter, confirm, clear, and report alarms.
- Supports the ability to detect faults and report related alarms.

Environment Monitoring

Supports the ability to monitor environment.

The environment monitoring system is used to monitor door status, infrared, smoke, water damage, humidity, and temperature as required.

9.2 NodeB Operation and Maintenance

NodeB operation and maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of NodeBs. In addition, NodeBs allow diversified O&M modes in different scenarios.

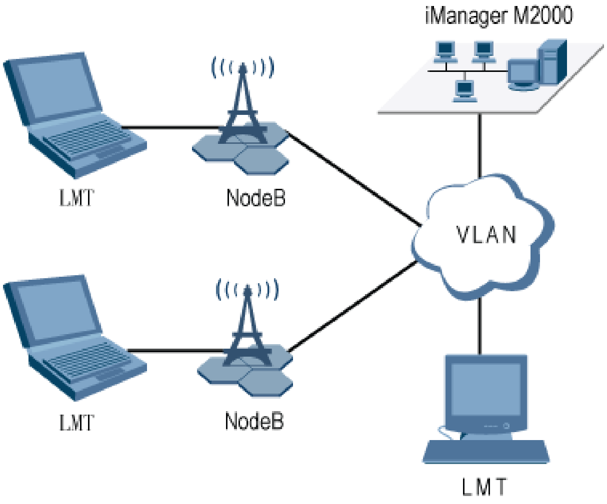
9.2.1 NodeB Operation and Maintenance Modes

NodeBs support near-end, far-end, and reverse operation and maintenance (O&M).

- In near-end O&M mode, maintenance personnel maintain NodeBs on the local maintenance terminal (LMT) through a local Ethernet maintenance port.
- In far-end O&M mode, maintenance personnel centrally maintain NodeBs on the M2000 or LMT in the radio network controller (RNC) equipment room or operation and maintenance center (OMC).
- In reverse maintenance mode, maintenance personnel maintain a NodeB under the same RNC as the current NodeB through a local Ethernet service port on the LMT. The IP route between the current NodeB and the other NodeB is established by the RNC.

Figure 9-2 shows the O&M system of NodeBs.

Figure 9-2 O&M system of NodeBs



The O&M system of NodeBs consists of the following elements:

- LMT: is mainly used to locally or remotely maintain NodeBs and configure data.
- NodeB: is the O&M object.
- M2000: short for iManager M2000 Mobile Element Management System, which centrally manages Huawei network devices; the M2000 also remotely and centrally manages multiple base stations.

NodeB O&M modes have the following features:

- Supports the Bootstrap Protocol (BOOTP), Dynamic Host Configuration Protocol (DHCP), and Adaptive and Active Cache Pool (AACP). When no data is configured for the system or when the system is faulty, the O&M channel can be automatically set up. This enhances the system reliability and facilitates remote troubleshooting.
- Supports configuration baseline, simplifying the configuration rollback process and improving configuration rollback reliability.
- Provides the RRU topology scanning function, allowing automatic monitoring of the RRU topology.
- Provides a comprehensive system self-check function, omitting local software commissioning.

9.2.2 NodeB Operation & Maintenance Functions

NodeB operation and maintenance (O&M) functions include commissioning management, equipment management, software management, alarm management, security management, and environment monitoring management.

NOTE

In BBU interconnection mode, the following operations can be performed only on the main control boards:

- Software upgrades and data configuration by using a USB flash drive
- Local operations on the LMT
- Clock tests
- VSWR tests by using a USB flash drive

Commissioning Management

Commissioning management has the following functions:

- Equipment performance tests, such as the CPU usage test, clock source quality test, and power detection
- Routine tests, such as E1/T1 performance measurement
- Service performance tests, such as uplink channel scanning and statistics for service resource usage

Equipment Management

Equipment management covers equipment maintenance and data configuration, including the following functions:

- Equipment maintenance functions, such as the board reset, equipment status management, equipment self-check, active/standby switchover, and time correction
- Configuration, query, and backup of equipment parameters, such as hardware parameters, clock parameters, algorithm parameters, and RF parameters

Software Management

Software management has the following functions:

- Software activation
- Consistency check on software and hardware versions
- Query of hardware and software versions
- Software upgrades and patch installation

Alarm Management

Alarm management consists of equipment alarm management and environment alarm management.

- Equipment alarm management

  The alarm management system can detect and report equipment faults in real time. The LMT or the M2000 can display alarm information and provide alarm handling suggestions.

  The alarm management system of the M2000 is connected to an alarm box through a serial port and supports both audible and visual alarms. The maintenance personnel can subscribe to the alarm information that can be forwarded to their handsets or pagers so that they can handle the faults in time.
- Environment alarm management

  Typically, NodeB equipment rooms are unattended and distributed over a large area. The equipment works in a relatively adverse environment, and emergency cases may occur. To help you handle such emergency cases, the NodeB provides a comprehensive alarm management system.

Alarm management has the following functions:

- Alarm detecting
- Alarm reporting

- Alarm masking
- Alarm acknowledgement
- Alarm preprocessing
- Alarm correlation processing
- Alarm help information processing

Security Management

The NodeB can M2000 perform hierarchical control on operation rights of maintenance personnel. This prevents equipment running from misoperations.

Environment Monitoring

The environment monitoring system provides customized monitoring functions, such as door control, infrared, and detection of smoke, water, humidity, and temperature.

9.3 eNodeB Operation and Maintenance

Operation and maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of eNodeBs. In addition, eNodeBs allow diversified O&M modes in different scenarios.

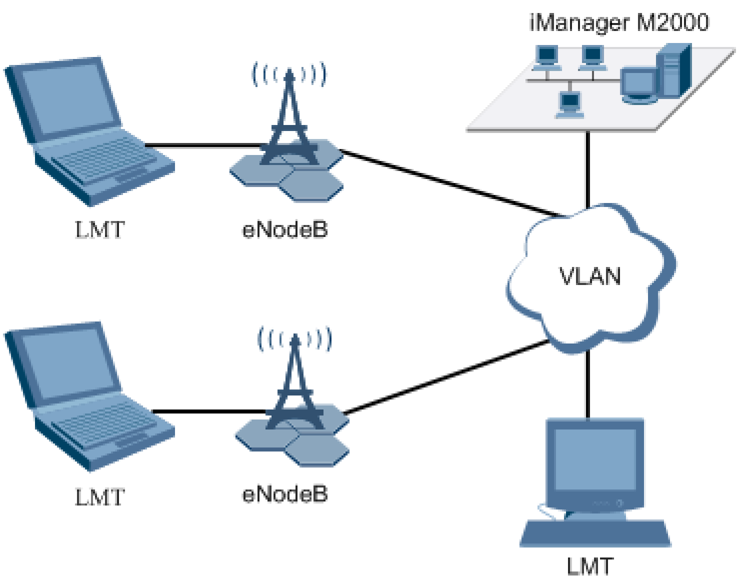
9.3.1 eNodeB Operation & Maintenance Modes

eNodeBs support both near-end and far-end operation and maintenance (O&M).

- In near-end O&M mode, maintenance personnel use the local maintenance terminal (LMT) to operate and maintain a single eNodeB.
- In far-end O&M mode, maintenance personnel use the M2000 or LMT to operate and maintain eNodeBs in a centralized manner in the operation and maintenance center (OMC).

Figure 9-3 shows the O&M system of eNodeBs.

Figure 9-3 O&M system of eNodeBs



The O&M system of eNodeBs consists of the following elements:

- LMT: is used to maintain a single base station locally or remotely.
- M2000: short for iManager M2000 Mobile Element Management System, which centrally manages Huawei network devices; the M2000 also remotely and centrally manages multiple base stations.
- eNodeB: is the O&M object.

9.3.2 eNodeB Operation & Maintenance Functions

eNodeB operation and maintenance (O&M) functions include configuration management, fault management, performance management, security management, software management, deployment management, equipment management, and inventory management.

Configuration Management

Configuration management includes data configuration, query, export, and backup and restoration, as well as configuration synchronization with the M2000.

The data configuration is based on managed objects (MOs) of the following categories: device, transport, and service. These categories are independent of each other. In most cases, modifications of the service configuration do not require modifications of the device configuration, and modifications of the device configuration do not require modifications of the service configuration either.

Fault Management

Fault management includes fault detection, fault isolation and self-healing, alarm reporting, and alarm correlation. The faults might be related to hardware, environment, software, transmission, cells, and different types of services in cells.

- Fault isolation and self-healing have the following benefits: (1) prevents a fault in a part of an eNodeB from affecting other parts; (2) reestablishes a cell of lower specifications to minimize the impact of the fault on services.
- The alarm correlation function enables the system to report only the alarm indicating the root fault and the ultimate impact on services, though there may be chains of problems caused by the root fault.

Performance Management

Performance management includes the periodic control on eNodeB performance measurements and the collection, storage, and reporting of performance statistics.

eNodeBs collect performance statistics every 15, 30, or 60 minutes and can store the results measured in a maximum of three days. The performance measurement covers eNodeB-level and cell-level performance and also covers neighboring cells, transmission, standard interfaces, and the device usage.

eNodeBs support real-time monitoring of key performance indicators (KPIs) at intervals of 1 minute, which helps detect and diagnose faults in a timely fashion.

Tracing Management

Message tracing management facilitates routine maintenance, commissioning, and fault diagnosis by tracing messages over interfaces and signaling links, messages to and from user equipment (UE), and internal messages.

Security Management

Security management provides the eNodeB authentication and access control functions, which include user account management, rights management, login management, identity authentication, and operation authentication.

In addition, security management includes security control on the channels between eNodeBs and the element management system (EMS). The channels support encryption using Secure Sockets Layer (SSL).

Security management provides network- and user-level security service. It provides the following functions:

- Encryption: encryption of important user information
- Authentication: management of user accounts and authentication of users
- Access control: control for user operations
- Security protocol: support for SSL

Software Management

Software management includes software version management, software version upgrades, and patch management.

- Software version management includes query, backup, and restoration of software versions.
- Software version upgrades can be remotely performed on a batch of eNodeBs. With the one-click upgrade wizard provided by the M2000, users can perform health checks before and after the upgrades and back up, download, and activate the software. During this process, users can check the upgrade status and results. eNodeBs support automatic updates of configurations during upgrades; users only need to follow the instructions in the upgrade wizard. In addition, eNodeBs support rapid version rollback by running a single command, reducing the impact of upgrade failures on the system.
- Patch management includes the following operations: query, download, loading, activation, deactivation, rollback, confirmation, and removal.

Deployment Management

The eNodeB deployment solutions include board-in-cabinet transportation, automatic discovery of eNodeBs, initial configuration by using a universal serial bus (USB) flash drive, and remote deployment. These solutions greatly reduce the workload and efforts of field installation personnel. No computer is required. The personnel only need to install the hardware.

- By using automatic discovery of eNodeBs, users do not need to set the IP addresses of the eNodeBs and EMS.
- Users can download software and data of an eNodeB from a USB flash drive, saving time especially when the bandwidth of transmission between the eNodeB and the EMS is insufficient.

- During remote deployment, software commissioning is performed in the operation and maintenance center (OMC) rather than on site. Customers can perform acceptance tests in the OMC.

NOTE

The security of the USB port is ensured by encryption.

Equipment Management

Equipment management includes data configuration, status management, and fault detection and handling for all the devices in an eNodeB. On the device panel, users can view device status and perform simple operations such as blocking, reset, and switchover.

Inventory Management

Inventory management includes collection and reporting of the inventory information about eNodeBs. With inventory management, users can centrally manage network equipment (NE) assets in the OMC.

9.4 MBTS Operation and Maintenance

Operation and Maintenance (O&M) covers management, monitoring, and maintenance of the software, hardware, and configuration of the MBTSs. In addition, diversified O&M modes are provided in various scenarios.

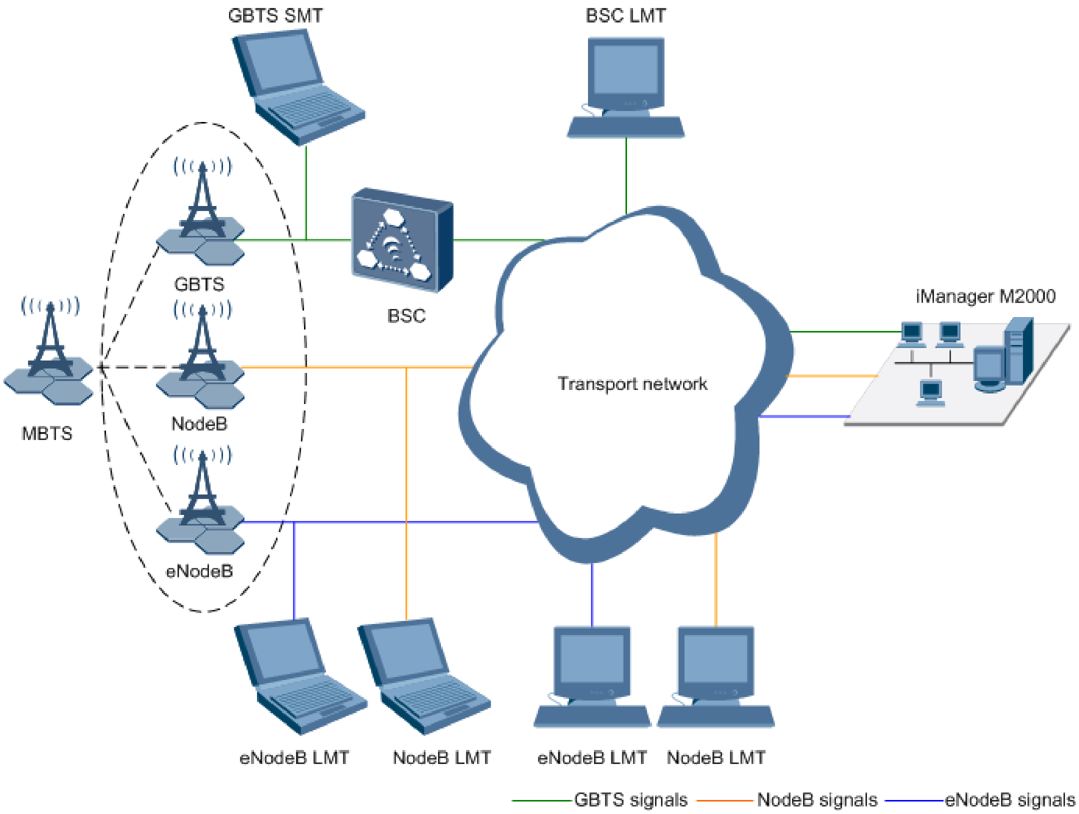
9.4.1 MBTS Operation & Maintenance Modes

An MBTS supports both near-end and far-end operation and maintenance (O&M).

- Near-end O&M: Maintenance personnel locally maintain an MBTS using a site maintenance terminal (SMT) or local maintenance terminal (LMT).
- Far-end O&M: Maintenance personnel remotely maintain one or multiple MBTSs using an LMT or the M2000.

Figure 9-4 shows the O&M system of an MBTS.

Figure 9-4 O&M system of the MBTS



The O&M system of the MBTS consists of the following items:

- MBTS: maintained object
- GBTS SMT: used to locally maintain devices controlled by the GBTS
- NodeB LMT: used to locally or remotely maintain devices controlled by the NodeB
- eNodeB LMT: used to locally or remotely maintain devices controlled by the eNodeB
- BSC LMT: used to maintain and manage the BSC and the GBTS connected to the BSC
- M2000: short for iManager M2000 Mobile Element Management System, which centrally manages Huawei network devices; the M2000 also remotely and centrally manages multiple base stations.

Maintenance personnel can operate and maintain each SiteUnit independently by using the SMT or LMT locally or using the M2000 or LMT remotely. They can also manage the MBTS as an integrated entity by using the M2000. The M2000 manages the MBTS on its own interface to perform alarm management, software upgrade, data configuration, and inventory management in a centralized manner.

Description in this technical description assumes that only one network management system is used to manage the MBTS. If two or more network management systems are used, the methods for the MBTS OM, including alarm management, software management, inventory management, topology management, NE health check, commissioning, software upgrade, and data configuration, provided in this document do not apply.

9.4.2 MBTS Operation & Maintenance Functions

Operation and maintenance (O&M) functions of a multi-mode base transceiver station (MBTS) include the common part management, configuration management, software upgrade, commissioning, alarm management, inventory management, and mode evolution functions.

Common Part Management

Common parts include multi-mode radio frequency (RF) modules working in multiple modes, monitoring devices, and remote electrical tilt (RET) antennas. Common parts also include boards and modules that can work in any mode and are within a BBU. Based on loading control rights and the mode priority, SiteUnits manage software of common parts and maintain them.

Common Parts

Common parts fall into two types. One type of common parts includes those that are managed by two or more SiteUnits, such as multi-mode RF modules working in multiple modes. The other type of common parts includes those that can be managed by any SiteUnit, such as monitoring devices.

Table 9-1 provides common parts in an MBTS and related management methods.

Parameters of bilaterally managed common parts are common parameters. All SiteUnits involved must have the same configurations for these parameters. Otherwise, a configuration conflict alarm will be generated.

For unilaterally managed common parts, users can choose a SiteUnit according to onsite conditions. For details, see the following:

- For a newly deployed MBTS, the GBTS is highly recommended, which is followed by the NodeB. The eNodeB is fairly recommended. For example, in a GU dual-mode base station, the GBTS is recommended.
- For a base station to be evolved, the original mode is recommended. For example, a base station is evolved from a single mode base station to a GU dual-mode base station, the GBTS is recommended.

Table 9-1 Common parts in an MBTS and related management methods

Common Parts	Management Method
Multi-mode RF modules working in multiple modes	Bilateral management (mandatory): They are managed by SiteUnits that are chosen on the basis of the working mode of the modules. For example, a multi-mode RF module working in GU mode is managed by a GBTS and a NodeB.
BBU3900 subracks; UPEU, UEIU, and FAN in a BBU	Bilateral management (mandatory): They are managed by two SiteUnits whose main control boards are installed in the same BBU as the UPEU, UEIU, and FAN boards.

<table>
<tr><th>Common Parts</th><th>Management Method</th></tr>
<tr><td>Local monitoring devices (monitoring devices connected to the BBU, including the PMU, TCU, CCU, FMU, and EMU)</td><td>Unilateral management: They are managed by one SiteUnit whose main control board is installed in the same BBU as the devices.
NOTE
● When monitoring boards are managed by only one SiteUnit, the following functions fail: Energy Saving, Smart TRX, and controlling fan speed by the main control board.
● Monitoring devices are all connected to BBU0 and are managed by one SiteUnit whose main control board is installed in BBU0.
● The CCU can only be managed unilaterally.</td></tr>
<tr><td>Remote monitoring devices (monitoring devices connected to RRUs)</td><td rowspan="2">Unilateral management (only):
● If RRUs work in a single mode, remote monitoring devices are managed by the SiteUnit that also manages these RRUs. For example, if RRUs work in the GSM mode, such devices are managed by the GBTS.
● If RRUs work in multiple modes, remote monitoring devices are managed by one of the SiteUnits that also manage these RRUs. For example, if RRUs work in the GU mode, such devices are managed by the GBTS.</td></tr>
<tr><td>RET antennas</td></tr>
<tr><td>USCU</td><td>Bilateral or unilateral management
● Bilateral management: It is managed by two SiteUnits whose main control boards are installed in the same BBU as the USCU board. Note that the two SiteUnits must have the same clock source type.
● Unilateral management: It is managed by one SiteUnit whose main control board is installed in the same BBU as the USCU board. Note that this SiteUnit must be configured with a clock source type that matches the clock signals received by the USCU board. For other SiteUnits, their clock source type is PEER.</td></tr>
<tr><td>UCIU</td><td>Unilateral management (only): It is managed by one SiteUnit whose main control board is installed in the same BBU as the UCIU board.
NOTE
A related alarm is generated if the UCIU board is configured for two SiteUnits in the same BBU.</td></tr>
</table>

Common Parts	Management Method
UTRPc	Unilateral management (only): It is managed by one SiteUnit whose main control board is installed in the same BBU as the UTRPc board. **NOTE** ● In the BBU interconnection scenario, the NodeB cannot manage a UTRPc board if both two BBUs are configured with a UMTS main control board and the UTRPc board is installed in the leaf BBU. ● Only the SiteUnit that manages the UTRPc board can expand its service processing capability through the UTRPc board. ● In new MBTSs, the UTRPc board is managed by the NodeB by default. ● For the UTRPc board, the SiteUnit priority descends from eNodeB, to NodeB, and then to GBTS.
Cabinet	Bilateral management (mandatory): It is managed by all the SiteUnits that are installed in the same cabinet.

Loading Control Rights

Loading control rights define the software management rights of bilaterally managed common parts. If a SiteUnit in an MBTS has loading control rights over common parts, the software versions of these common parts must be consistent with the software version of the SiteUnit. For example, if the GBTS of a GU dual-mode base station has loading control rights, the software versions of common parts managed by both the GBTS and NodeB must be consistent with the software version of the GBTS. Currently, load control rights take effect only to the USCU board and multi-mode RF modules working in multiple modes. USCU stands for Universal Satellite Card and Clock Unit.

Loading control rights need to be specified, modified, or pre-specified in the following scenarios:

- Loading control rights need to be reconfigured upon MBTS upgrade.
- Loading control rights need to be reconfigured if loading control right conflicts arise.

Parameters associated with loading control rights consist of Control Flag, Effect Immediately Flag, Self Version, Peer Version, and Mode. Description of these elements is provided in **Table 9-2**. For configuration methods, see the *MML Command Reference*. The local end indicates a SiteUnit that is setting loading control rights while the peer end indicates another SiteUnit that is involved in the operation. For example, when loading control rights are being set by the GBTS of a GU dual-mode base station, the GBTS is the local end while the NodeB is the peer end.

Table 9-2 Parameters associated with loading control rights

Parameter	Description	Description
Control Flag	Whether the local end has loading control rights	-

Parameter	Description	Description
Effect Immediately Flag	Whether the setting of loading control rights takes effect immediately	● If it is set to YES, software of common parts is updated immediately after the settings of loading control rights are complete. ● If it is set to NO, software of common parts is not updated immediately after the settings of loading control rights are complete. The software is updated next time the SiteUnit with loading control rights upgrade software.
Self Version	Software version at the local end after the setting of loading control rights takes effect	The software versions at both the local end and the peer end should be considered jointly to ensure that the setting of loading control rights can take effect. For example, a user sets Self Version to A and Peer Version to B in the GBTS of a GU dual-mode base station. In this case, the setting of loading control rights takes effect when the software versions of the GBTS and NodeB are A and B, respectively.
Peer Version	The software version at the peer end after the setting of loading control rights takes effect	
Mode	Mode information of common parts for which the setting of loading control rights takes effect. This parameter can be set to GU, GL, or UL. For example, if it is set to GU, the setting of loading control rights takes effect for common parts managed by both the GBTS and NodeB only.	For a triple-mode base station, loading control rights need to be set separately in different mode combinations. For example, in the GBTS, loading control rights of common parts managed by both the GBTS and NodeB must be set, and loading control rights of common parts managed by both the GBTS and eNodeB must be set.

For each mode combination, users can set a maximum of two different loading control right records. Two records correspond to two software version combinations in each mode combination. One software version is the live combination while the other is the combination after upgrade. For example, the live version of the GBTS of a GU dual-mode base station is A1 while the target version is A2; the live version of the NodeB is B1 while the target version is B2. In this case, users can set two loading control right records for two software version combinations (A1B1 and A2B2) respectively.

For each software version combination, the base station only saves the last loading control right record if two SiteUnits both have loading control rights or none of them has such rights. If none of them has such rights, an alarm indicating a loading control right conflict is generated. For example, for the A1B1 software version combination,

- If the GBTS has loading control rights at the beginning and the NodeB is configured with the loading control rights later, the NodeB finally has the loading control rights.

- If the GBTS has loading control rights at the beginning and the NodeB is not configured with the loading control rights later, the GBTS finally has the loading control rights.
- If neither the GBTS nor the NodeB has such rights, an alarm indicating a loading control right conflict is generated.

Loading control rights cannot take effect and none of the SiteUnits of an MBTS manages software of common parts if the following configuration conflicts arise and each SiteUnit does not work in engineering mode.

- The cabinet, subrack, and slot information of a common part are different among all SiteUnits.
- The working mode of a common part is different among all SiteUnits. For example, if a multi-mode RF module is set to work in GU mode at the GBTS but it is set to work in UO mode at the NodeB, neither the GBTS nor the NodeB manages software of the module.

Mode Priority

For bilaterally managed common parts, their alarms, configuration data, device status, and inventory information that are reported by each SiteUnit must be filtered and combined. The mode priority determines which SiteUnit's reported data is to be considered by the entire base station.

Users can set an MBTS's mode priority on the M2000. In a GUL triple-mode base station, GSM has the highest mode priority while LTE has the lowest mode priority. In such a case, for common parts managed by both the GBTS and NodeB and common parts managed by both the GBTS and eNodeB, the data reported by the GBTS is to be considered by the base station. For common parts managed by both the NodeB and eNodeB, the data reported by the NodeB is to be considered by the base station.

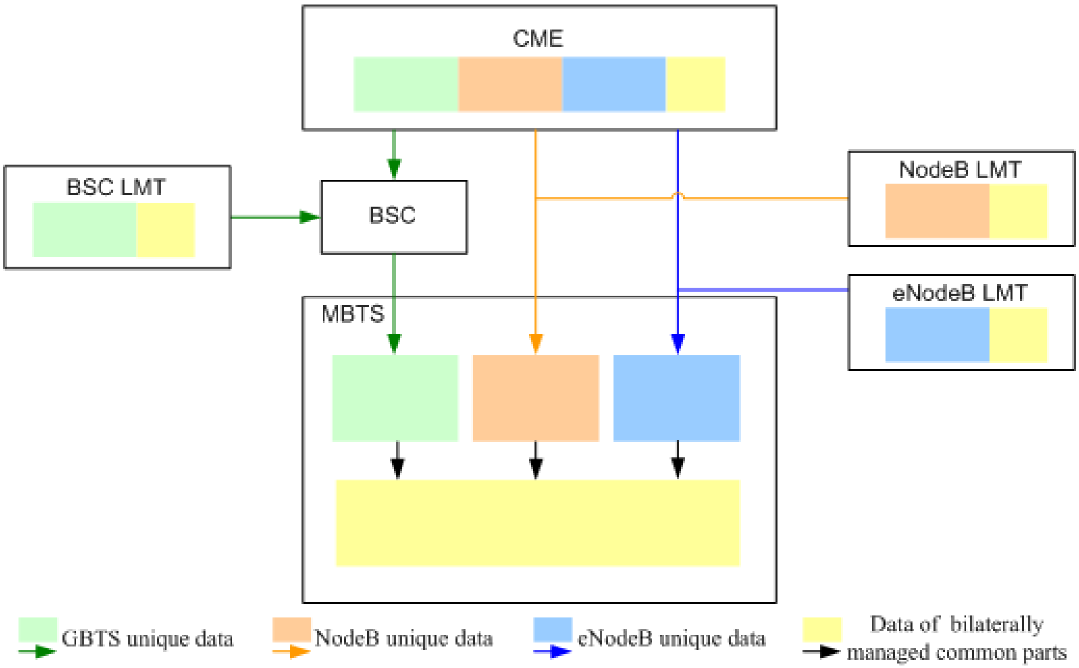
The mode priority setting takes effect not only for a single base station but also for all devices managed by the M2000 in the live network. Therefore, all the devices managed by the M2000 have the same mode priority setting.

Configuration Management

MBTS configuration management includes initial configuration and reconfiguration. In the initial network deployment phase, the basic MBTS data can be configured on the CME to enable unified network deployment. After the MBTS has started running, reconfiguration can be performed on the CME or by running MML commands to add, delete, or modify data.

Figure 9-5 shows the MBTS configuration management.

Figure 9-5 MBTS configuration management



MBTS configuration data includes the unique data of each SiteUnit and the data of common parts.

- For the unique data of each SiteUnit, the configuration method is the same as that for a single-mode base station.
- For the data of common parts, the configuration method is described in **Common Part and Management Method**. Unilaterally managed common parts need to be configured only on one SiteUnit. Bilaterally managed common parts must be configured on two related SiteUnits, which must have the consistent settings for common parameters.

Initial Configuration

In the initial network deployment phase, the basic MBTS data can be configured on the CME after hardware of the MBTS has been installed and the MBTS has gained access to the M2000 successfully. Once the initial configuration is complete, the MBTS starts to function and provide basic services.

Table 9-3 provides the initial configuration method of an MBTS. For detailed operations, see the *3900 Series Base Station Initial Configuration Guide*.

Table 9-3 Initial configuration method

Working Mode of an MBTS	GU	GL	UL	GUL
Independent deployment	Based on the GUI wizard	Based on the GUI wizard	Base station binding	Base station binding

Working Mode of an MBTS	GU	GL	UL	GUL
Batch deployment	Based on the data planning template	Based on the data planning template	Based on the data planning template	N/A

NOTE
The function of manually setting up base station binding relationship on the M2000 applies only to single-mode base stations. Before adjusting a binding relationship (because the current relationship is incorrect), remove the current relationship first and set up a new one.

Characteristics of MBTS configuration are as follows, including functions of the CME available for MBTS configuration:

- A network carrier can specify mapping between SiteUnits of an MBTS.
- The CME supports one-site configuration and configuration data consistency check.
  - Unique data of each SiteUnit is checked on the basis of check rules of each NE to ensure that the data is correct.
  - Each SiteUnit must have the correct configuration for a cabinet, subrack, or slot to prevent configuration conflicts.
  - Data of bilaterally managed common parts is checked on the basis of mode priorities specified by network carriers and of check rules specified for the common device data. If parameter configurations of the common parts are found to be inconsistent between two SiteUnits, the CME modifies configuration data automatically based on the mode priority setting.
- The CME provides an MBTS device panel view, supports unified addition or deletion of cabinets and boards, and enables unified modification of common parameters.

Reconfiguration

Reconfiguration includes data addition, data removal, and data modification after the MBTS has started functioning. MBTS reconfiguration can be performed on the LMT by running MML commands or on the CME. Operations on the CME are recommended. During reconfiguration, it is recommended that network carriers check configuration data consistency manually to ensure that parameter configurations of the common parts are consistent between SiteUnits.

Table 9-4 describes usage scenarios of reconfiguration.

Table 9-4 Usage scenario of reconfiguration

Scenario	Description
Network optimization	Network performance is adjusted and optimized on the basis of the system operation data that is obtained during network operation by means of performance measurement and drive test.

Scenario	Description
Feature configuration	Key parameters of optional features are configured to activate the features. For details, see the *SingleRAN Feature Activation Guide*.
Capacity expansion	Hardware is added to the live network or configurations are modified. This enables the system to provide services for more users. For details, see the *SingleRAN Reconfiguration Guide*.

Software Upgrade

The MBTS supports multiple upgrade methods in different scenarios.

Upgrade Scenario

Table 9-5 provides MBTS software upgrade scenarios.

Table 9-5 MBTS software upgrade scenarios

Upgrade Scenario	Upgrade Platform	References
Remote and central upgrade in the live network (recommended): all-at-once upgrade	M2000 (all-at-once upgrade)	Related **Upgrade Guide**
• Remote GBTS upgrade • Remote NodeB upgrade • Remote eNodeB upgrade	M2000	
• Local emergent upgrade • Storage upgrade • GBTS upgrade • NodeB upgrade • eNodeB upgrade	• GBTS: SMT • NodeB/eNodeB: LMT	

Upgrade Scenario	Upgrade Platform	References
• Remote emergent upgrade • GBTS upgrade	BSC6900	
• Storage upgrade • Few upgrades in the live network	USB **NOTE** The security of the USB loading port is ensured by encryption.	*3900 Series Base Station Commissioning Guide*

NOTE

During a one-sided upgrade, start event of common parts can be reported only by the SiteUnit that is being upgraded.

The M2000 can check version mapping, set loading control rights, and monitor partial steps in an upgrade. Therefore, it is recommended that the M2000 be used if MBTS software is to be remotely upgraded. If the required transmission links are unavailable, the M2000 is not installed or faulty, or the MBTS is faulty and is to be commissioned locally, a local maintenance terminal (LMT) or Service Maintenance Terminal (SMT) is recommended.

Upgrade Restrictions

When upgrading an MBTS, pay attention to the following restrictions:

- All SiteUnits' software versions must be matched. If one SiteUnit's software is to be independently upgraded, services of another SiteUnit will be interrupted if the MBTS uses common transmission and the SiteUnit whose software is to be independently upgraded provides an outgoing port used for transmission sharing.
- For a triple-mode base station, software versions of three SiteUnits must be V100R004 or later.
- All SiteUnits' software must be upgraded or rolled back together to ensure that their software versions can work with each other after the upgrade or rollback. For example, after two SiteUnits' software is upgraded together, their software must be rolled back together as well. On the M2000, an upgrade or rollback is not allowed if all SiteUnits' software version cannot work with each other before the upgrade.
- If the software version before an upgrade is V100R004, loading control rights are set on the base station automatically. If the software version before the upgrade is earlier than V100R004 and the upgrade is performed on the M2000, loading control rights are set on the M2000 automatically. If the upgrade is not performed on the M2000, loading control rights must be set manually.

Commissioning Mode

The MBTS supports multiple commissioning modes in different scenarios and commissioning engineers can choose one commissioning mode according to onsite conditions.

Commissioning Scenario

Table 9-6 provides details about each commissioning scenario. For precautions, see the *3900 Series Base Station Commissioning Guide*.

Table 9-6 MBTS commissioning scenario

Scenario	Relevant Information	Description
Dual-mode base station	Only one SiteUnit provides services during site deployment	The base station is deployed as a multi-mode base station. Due to insufficient resources and other factors, only one SiteUnit provides services temporarily.
	Two SiteUnits provide services during site deployment.	The base station is deployed as a multi-mode base station and two SiteUnits provide services.
	One SiteUnit has provided services whereas the other one is under configuration.	One SiteUnit has provided services whereas the other one is under configuration.
Triple-mode base station		The base station is commissioned on a mode combination basis. For example, in a triple-mode base station working in GU+L mode, the base station is commissioned as a GU dual-mode base station and an LO single-mode base station separately.

Commissioning Mode

An MBTS can be commissioned remotely on the M2000, on the M2000 with a USB flash drive, or on the M2000 with a local maintenance terminal (LMT). provides usage scenarios and recommendation levels of the three commissioning modes. For details, see *3900 Series Base Station Commissioning Guide*.

Commissioning Mode	Usage Scenario	Recommendation Level
Remotely commissioning on the M2000	Onsite personnel can remotely commission the MBTS when the following conditions are met: all the required transmission links are available, layer-3 devices near the MBTS and devices in layer-2 or layer-3 networking support DHCP Relay, and operators are not sensitive to downtime.	High

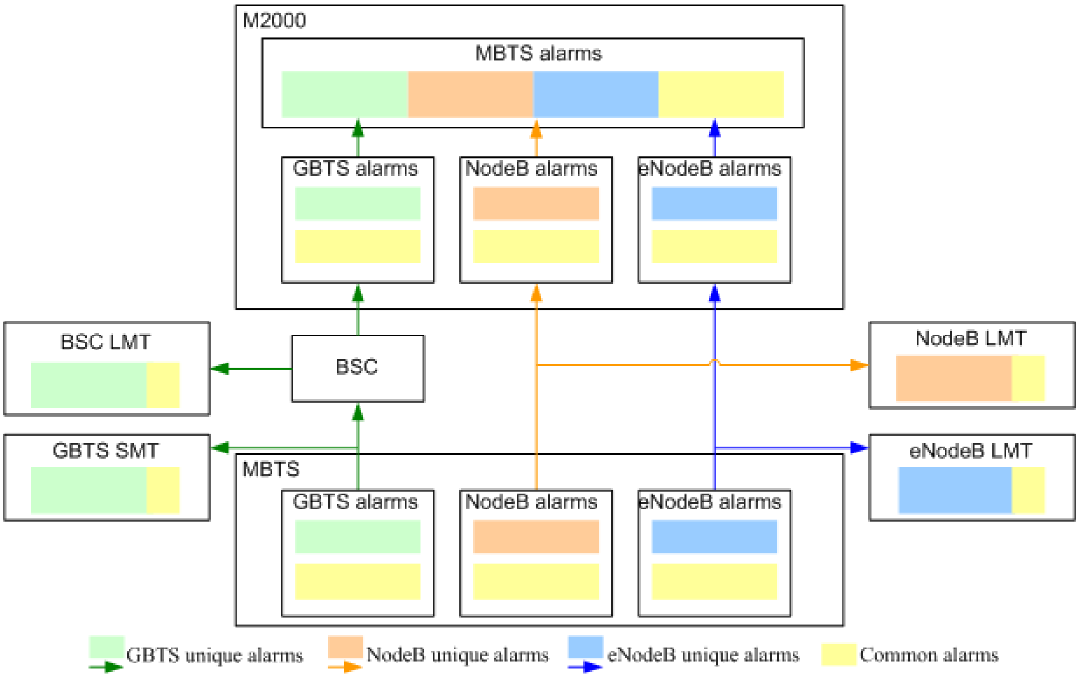
Commissioning Mode	Usage Scenario	Recommendation Level
Commissioning by using a USB flash drive with the cooperation of remote commissioning on the M2000	Onsite personnel can locally upgrade MBTS software and load the configuration file using the USB flash drive if layer-3 devices near the MBTS and devices in layer-3 networking do not support DHCP Relay, and operators limit downtime. Onsite personnel can continue with the follow-up commissioning operations on the M2000 after all the required transmission links become available. **NOTE** The security of the USB loading port is ensured by encryption.	Middle
Commissioning on an LMT or SMT with the cooperation of remote commissioning on the M2000	Onsite personnel can locally upgrade MBTS software and configure the MBTS using an LMT or SMT if all the required transmission links are unavailable. Note that the required transmission links connecting a GBTS and BSC must be available if an LMT or SMT is used for commissioning purposes. Onsite personnel can continue with the follow-up commissioning operations on the M2000 after all the required transmission links become available.	Low

Alarm Management

Each SiteUnit in an MBTS independently reports alarms. Maintenance personnel can individually manage all the SiteUnits or manage the entire MBTS as a whole.

Figure 9-6 shows MBTS alarm management. For details, see the *3900 Series Multi-Mode Base Station Alarm Reference*.

Figure 9-6 MBTS alarm management



As shown in the preceding figure, the GBTS, NodeB, and eNodeB report unique and common alarms independently and common alarms are reported with mode information such as GU common alarms and GUL common alarms. Maintenance personnel can individually manage the GBTS, NodeB, and eNodeB using the GBTS SMT, NodeB LMT, and eNodeB LMT, respectively. Alternatively, they can centrally or independently manage MBTS alarms using the M2000. When centrally managing MBTS alarms, the M2000 combines and filters alarms reported by each SiteUnit based on the user-defined mode priority and provides one alarm view only.

Alarm Type

Each SiteUnit in an MBTS reports unique and common alarms.

- Unique alarms: These alarms are unique to a SiteUnit. Generation causes and processing mechanisms are the same as those for a single-mode base station.
- Common alarms: These alarms, related to bilaterally managed common parts, include alarms that are generated because of device faults and alarms that are generated because of common parts' parameter configuration conflicts.

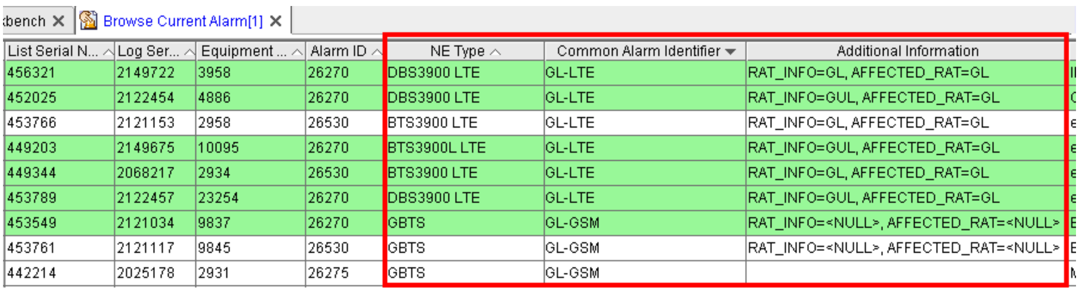
NOTE

- For unilaterally managed common parts, only the SiteUnit that manage these common parts can see the alarms of them. Alarms reported by unilaterally managed common parts may affect the operation of other SiteUnits. On the **Browse Current Alarm** tab page, the **Additional Information** column lists the **RAT_INFO** and **AFFECTED_INFO** information. With the information, maintenance personnel can know the mode information about the base station where the alarm is generated and the modes that are affected by the alarm.
- User-defined alarms specific to bilaterally managed common parts must be configured on all SiteUnits that manage these common parts. In addition, all these SiteUnits must have the same configuration for these alarms. Otherwise, a configuration conflict alarm will be generated.
- If conflicts occur in common parameter configurations, multiple relevant alarms will be generated. Therefore, configuration conflict alarms must be handled preferentially.

Figure 9-7 shows the **Browse Current Alarm** tab page of the M2000.

- **NE Type**: indicates the SiteUnit that reports the current alarm.
- **Common Alarm Identifier**: indicates whether the current alarm is a common alarm. If the value is **NA**, the current alarm is a unique alarm. Otherwise, the current alarm is a common alarm.
- **Additional Information**: **RAT_INFO** indicates the mode information about the base station where the alarm is generated and **AFFECTED_INFO** indicates the modes that are affected by the alarm. For example, if the value for **RAT_INFO** is **GUL** and the value for **AFFECTED_INFO** is **GU**, the alarm is generated on a GUL triple-mode base station and this alarm affects the GSM and UMTS modes.

Figure 9-7 Browse Current Alarm tab page of the M2000



List Serial N...	Log Ser...	Equipment ...	Alarm ID	NE Type	Common Alarm Identifier	Additional Information
456321	2149722	3958	26270	DBS3900 LTE	GL-LTE	RAT_INFO=GL, AFFECTED_RAT=GL
452025	2122454	4886	26270	DBS3900 LTE	GL-LTE	RAT_INFO=GUL, AFFECTED_RAT=GL
453766	2121153	2958	26530	BTS3900 LTE	GL-LTE	RAT_INFO=GL, AFFECTED_RAT=GL
449203	2149675	10095	26270	BTS3900L LTE	GL-LTE	RAT_INFO=GUL, AFFECTED_RAT=GL
449344	2068217	2934	26530	BTS3900 LTE	GL-LTE	RAT_INFO=GL, AFFECTED_RAT=GL
453789	2122457	23254	26270	DBS3900 LTE	GL-LTE	RAT_INFO=GUL, AFFECTED_RAT=GL
453549	2121034	9837	26270	GBTS	GL-GSM	RAT_INFO=<NULL>, AFFECTED_RAT=<NULL>
453761	2121117	9845	26530	GBTS	GL-GSM	RAT_INFO=<NULL>, AFFECTED_RAT=<NULL>
442214	2025178	2931	26275	GBTS	GL-GSM	

Management Method

Maintenance personnel can individually manage all SiteUnits in an MBTS or manage the entire MBTS as a whole. For details, see Table 9-7.

Table 9-7 Alarm management method

Alarm Management Method	Tool	Description
Individually managing all SiteUnits in an MBTS	SMT/ LMT	The alarm management method is the same as that for a single-mode base station.

Alarm Management Method	Tool	Description
	M2000	The alarm management method is the same as that for a single-mode base station.
Managing the MBTS as a whole	M2000	The M2000 exports only one alarm view, which includes common alarms and each SiteUnit's unique alarms. ● For each SiteUnit's unique alarms, the method for managing the alarms is the same as that for a single-mode base station. ● The M2000 combines and filters common alarms reported by each SiteUnit based on the user-defined mode priority and provides one alarm view only. This prevents some alarms from being repeatedly reported.

When using the M2000 to manage alarms, pay attention to the following:

- When setting parameters of common alarms, you must repeat the operation on all SiteUnits involved. Such parameters include alarm masking, alarm severity, alarm query, alarm clearance, and so on. Enabling the settings on one SiteUnit to take effect on the other SiteUnits is not allowed.
- When confirming or clearing a common alarm, you must repeat the operation on all SiteUnits involved because the confirming or clearance only takes effect on the current SiteUnit. For example, both a GBTS and NodeB report a common alarm. Based on the mode priority, the M2000 displays only the alarm reported by the GBTS. After the alarm is confirmed or cleared, the alarm is removed from the GBTS. However, on the NodeB, the alarm remains unconfirmed and therefore it persists.

Mechanism for Handling Engineering Alarms

When a base station is being deployed, upgraded, or commissioned, engineering operations cause some network elements (NEs) to being abnormal for a short period and as a result a large number of alarms are generated. This also occurs when the base station is under capacity expansion. All the generated alarms are called engineering alarms. Engineering alarms are automatically cleared after engineering operations are complete and therefore no operations are required. It is recommended that all NEs involved be set to work in engineering mode before any engineering operation is performed to mask engineering alarms. This avoids interfering network monitoring.

After the SiteUnits involved enter engineering mode, the mechanism for handling engineering alarms works as follows:

- For SiteUnits working in engineering mode, their alarms are reported as engineering alarms.
- For SiteUnits working in non-engineering mode:
  - Unique alarms are reported according to the normal procedure.
  - An alarm indicating a configuration conflict in common parameters is not reported if any of the related SiteUnits is working in engineering mode. This alarm is reported according to the normal procedure if none of the related SiteUnits is working in engineering mode.

For example, when the GBTS of a GU dual-mode base station is working in engineering mode while the NodeB is working in non-engineering mode, all the alarms generated on the GBTS are reported as engineering alarms. In addition, the NodeB's unique alarms are reported according to the normal procedure but alarms indicating conflicts in common parameters are not reported.

Inventory Management

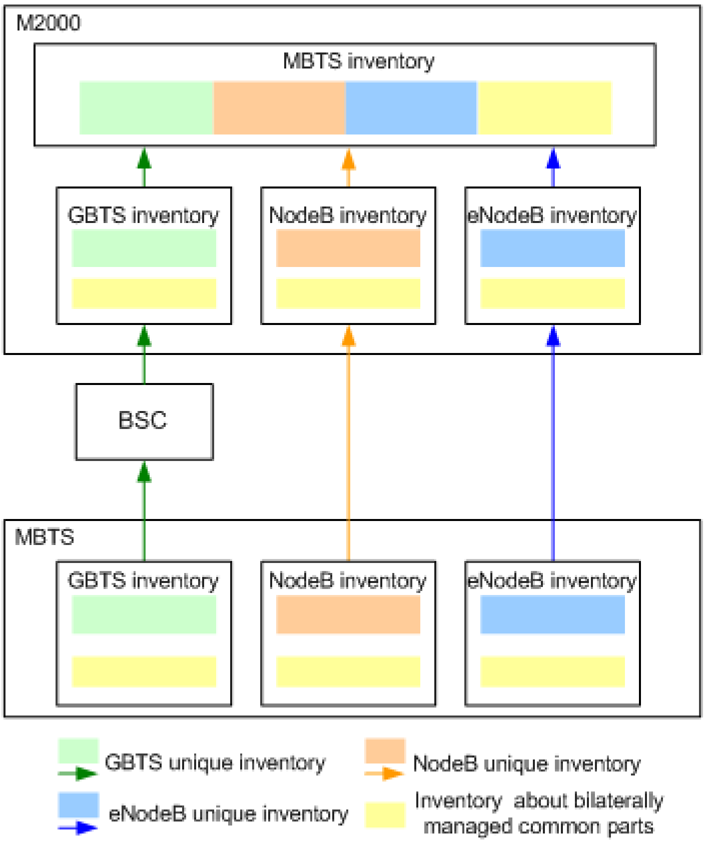
MBTS inventory information is managed on the M2000 to achieve centralized and effective management.

Inventory management involves the logical inventory management (configuration information management) and physical inventory management (asset management).

- The logical inventory management manages logical inventory objects, including cells and versions.
- The physical inventory management manages physical inventory objects, including cabinets, subracks, slots, boards, ports, and antennas.

Figure 9-8 shows the MBTS inventory management.

Figure 9-8 MBTS inventory management



Each SiteUnit of an MBTS independently reports its own inventory data, which covers inventory information about bilaterally managed common parts and this SiteUnit's unique inventory information including inventory information about unilaterally managed common parts.

On the M2000, each SiteUnit's inventory data can be viewed and exported. All SiteUnits' data can also be combined on the M2000 and an inventory document covering the data is generated. The M2000 combines all SiteUnits' data on a mode priority basis.

Mode Evolution

The MBTS supports many evolution solutions in different scenarios.

Table 9-8 lists different mode evolution solutions. For details, see the *3900 Series Base Station Standards Evolution Guide*.

Table 9-8 Typical evolution scenarios

Scenario	Evolution Scenario	Description
Single-mode to dual-mode	GO -> GU	In the scenario, GSM single-mode is evolved into GU dual-mode. Before evolution, only GSM services are provided. After evolution, GSM and UMTS services are both provided.
	UO -> GU	In the scenario, UMTS single-mode is evolved into GU dual-mode. Before evolution, only UMTS services are provided. After evolution, GSM and UMTS services are both provided.
	GO -> GL	In the scenario, GSM single-mode is evolved into GL dual-mode. Before evolution, only GSM services are provided. After evolution, GSM and LTE services are both provided.
	UO -> UL	In the scenario, UMTS single-mode is evolved into UL dual-mode. Before evolution, only UMTS services are provided. After evolution, UMTS and LTE services are both provided.
Dual-mode to single-mode	GU -> UO	In the scenario, GU dual-mode is evolved into UMTS single-mode and therefore GSM services stop to be provided.
	GL -> LO	In the scenario, GL dual-mode is evolved into LTE single-mode and therefore GSM cells are out of service.
	UL -> UO	In the scenario, UL dual-mode is evolved into UMTS single-mode and therefore LTE services stop to be provided.
	UL -> LO	In the scenario, UL dual-mode is evolved into LTE single-mode and therefore UMTS cells are out of service.
Dual-mode to triple-mode	GU -> GU+L (independent BBU)	In the scenario, GU dual-mode is evolved into GUL triple-mode. Before evolution, only GSM and UMTS services are provided. After evolution, GSM, UMTS, and LTE services are all provided.

Scenario	Evolution Scenario	Description
	GL -> GL+U (independent BBU)	In the scenario, GL dual-mode is evolved into GUL triple-mode. Before evolution, only GSM and LTE services are provided. After evolution, GSM, UMTS, and LTE services are all provided.
	GL -> GL+U (BBU interconnection)	In the scenario, GL dual-mode is evolved into GUL triple-mode. Before evolution, only GSM and LTE services are provided. After evolution, GSM, UMTS, and LTE services are all provided, and inter-BBU SDR is applied.
	GU -> GU+L (BBU interconnection)	In the scenario, GU dual-mode is evolved into GUL triple-mode. Before evolution, only GSM and UMTS services are provided. After evolution, GSM, UMTS, and LTE services are all provided, and inter-BBU SDR is applied.
	GU -> GU+UL (BBU interconnection)	In the scenario, GU dual-mode is evolved into GUL triple-mode. Before evolution, only GSM and UMTS services are provided. After evolution, GSM, UMTS, and LTE services are all provided, and inter-BBU SDR is applied.
Triple-mode to dual-mode	GU+L (independent BBU) -> U+L	In the scenario, GUL triple-mode is evolved into UL dual-mode and therefore GSM cells are out of service.
	GL+U (independent BBU) -> L+U	In the scenario, GUL triple-mode is evolved into UL dual-mode and therefore GSM cells are out of service.
	GU+L (BBU interconnection) -> U+L	In the scenario, GUL triple-mode is evolved into UL dual-mode and therefore GSM cells are out of service.
	GL+U (BBU interconnection) -> L+U	In the scenario, GUL triple-mode is evolved into UL dual-mode and therefore GSM cells are out of service.
	GU+L (independent BBU) -> G+L	In the scenario, GUL triple-mode is evolved into GL dual-mode and therefore UMTS cells are out of service.
	GU+L (BBU interconnection) -> G+L	In the scenario, GUL triple-mode is evolved into GL dual-mode and therefore UMTS cells are out of service.
	GL+U (independent BBU) -> GL	In the scenario, GUL triple-mode is evolved into GL dual-mode and therefore UMTS cells are out of service.
	GL+U (BBU interconnection) -> GL	In the scenario, GUL triple-mode is evolved into GL dual-mode and therefore UMTS cells are out of service.

MBTS mode evolution involves preparation before evolution, recording alarms, setting NEs to work in engineering mode, upgrading software, adjusting data, adjusting hardware, setting binding relationships between SiteUnits, commissioning, and setting NEs to work in normal mode.

- Preparation before evolution: In this step, ensure that hardware and matched software required during evolution are ready and that each related NE and network management device are ready.
- Recording alarms: In this step, record alarms generated on the base station for the comparison before and after evolution to ensure that no new alarm is generated after evolution.
- Setting NEs to work in engineering mode: In this step, set a SiteUnit to work in engineering mode on the M2000 and shield engineering alarms to improve network operation and maintenance efficiency.
- Upgrading software: In this step, upgrade software of the base station according to the actual situation to ensure that software versions are matched with each other.
- Adjusting data: In this step, adjust configuration data of the base station to meet the actual requirements.
- Adjusting hardware: In this step, adjust physical devices and connections of the base station to meet the actual requirements.
- Setting binding relationships between SiteUnits: In this step, set binding relations between SiteUnits on the M2000 to set up an MBTS.
- Commissioning: In this step, commission the MBTS to ensure that it can work properly after evolution.
- Setting NEs to work in normal mode: In this step, set NEs to work in normal mode on the M2000 to ensure that alarms are reported according to the normal procedure.

9.4.3 Maintenance Between Modes

During maintenance of an MBTS, maintenance operations must be performed carefully at each SiteUnit because the operations may affect other SiteUnits.

Some maintenance operations must be performed at all SiteUnits of an MBTS at the same time. For details, see **Table 9-9**.

Table 9-9 Maintenance operations performed at all SiteUnits

Operation	GSM	UMTS	LTE	Remarks
Blocking carriers or RF modules	• MML: **SET GTRXADMSTAT** • SMT: See section **Managing RCs** > **Changing the RC Management State** in the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. • LMT: See section **BTS Maintenance** > **Modifying Administrative State** in the *BSC6900 GSM LMT User Guide*.	• MML: **BLK BRD** • LMT: See section **Managing NodeB Equipment** > **NodeB Board-Level Operations** > **Blocking/ Unblocking a NodeB Board** in the *NodeB LMT User Guide*.	MML: **BLK BRD**	• To block an RF module that carries the services of two modes, block the RF module at two corresponding SiteUnits. • Blocking RF modules can be performed at the NodeB or eNodeB. At the GBTS, this operation is not supported but carriers of RF modules can be blocked.

Operation	GSM	UMTS	LTE	Remarks
Blocking cells	• MML: **SET GCELLADMSTAT** • SMT: See section **Managing Cells > Changing the Cell Management State** in the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. • LMT: See section **BTS Maintenance > Modifying Administrative State** in the *BSC6900 GSM LMT User Guide*. **TIP** Before blocking a cell, you can run the MML command **LST GCELL** to query the configuration information about the cells under the base station.	MML: **BLK LOCELL**	MML: **BLK CELL**	A dual-mode RF module does not transmit power when the related cell is blocked at the corresponding SiteUnits.
Adding control links	MML: **ADD BTSCTRLLNK**	MML: **ADD CTRLLNK**	MML: **ADD CTRLLNK**	If any of the preceding commands is to be executed on an MBTS, execute the command on all SiteUnits and ensure that the configuration data of a newly added control link is consistent on all SiteUnits.

Operation	GSM	UMTS	LTE	Remarks
Removing control links	MML: **RMV BTSCTRLLNK**	MML: **RMV CTRLLNK**	MML: **RMV CTRLLNK**	If any of the preceding commands is to be executed on an MBTS, execute the command on all SiteUnits and ensure that the configuration data of a newly removed control link is consistent on all SiteUnits.
Modifying control links	MML: **MOD BTSCTRLLNK**	MML: **MOD CTRLLNK**	MML: **MOD CTRLLNK**	If any of the preceding commands is to be executed on an MBTS, execute the command on all SiteUnits and ensure that the configuration data of a newly modified control link is consistent on all SiteUnits.

When some maintenance operations are performed at one SiteUnit, services of other SiteUnits may be affected. For details, see **Table 9-10**.

Table 9-10 Maintenance operations that may affect services of other SiteUnits

Operation	GSM	UMTS	LTE	Impact
Setting loading control rights	MML: **SET BTSLOADCTRL**	MML: **SET LOADCTRL**	MML: **SET LOADCTRL**	● The software of a common part can be loaded and upgraded at the mode that has loading control rights. ● When a multi-mode base station works in co-module mode, services at the peer end may be interrupted if the software of RF modules needs to be upgraded and Effect Immediately Flag is set to Yes.
Activating a BTS	MML: **ACT BTS**	N/A	N/A	In the following scenarios, activating a BTS at one mode may interrupt the services at the peer end: ● A multi-mode base station works in co-module mode. ● The base station adopts TDM co-transmission and the GBTS provides an outgoing port for transmission sharing.

Operation	GSM	UMTS	LTE	Impact
Deactivating a BTS	MML: **DEA BTS**	N/A	N/A	In the following scenarios, deactivating a BTS at one mode may interrupt the services at the peer end: ● A multi-mode base station works in co-module mode. ● The base station adopts TDM co-transmission and the GBTS provides an outgoing port for transmission sharing.
Activating the base station software	● MML: **ACT BTSSW** ● SMT: See section **Managing Sites** > **Activating Software** in the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. ● LMT: See **BTS Maintenance** > **Activating BTS Software** in the *BSC6900 GSM LMT User Guide*.	MML: **ACT SOFTWARE**	MML: **ACT SOFTWARE**	When activating the base station software, ● When a multi-mode base station works in co-module mode and the local end has loading control rights, services at the peer end may be interrupted if a command is executed to activate a dual-mode RF module. ● When a multi-mode base station adopts co-transmission and the local end provides an outgoing port for transmission sharing, services at the peer end may be interrupted if a command is executed to activate a board that provides an outgoing port for transmission sharing.

Operation	GSM	UMTS	LTE	Impact
Rolling back the base station software	MML: **RBK BTSSW**	MML: **RBK SOFTWARE**	MML: **RBK SOFTWARE**	In the following scenarios, rolling back the base station software may interrupt the services at the peer end: ● A multi-mode base station works in co-module mode, and the local end has loading control rights. ● A multi-mode base station adopts co-transmission, and the local end provides an outgoing port for transmission sharing.

Operation	GSM	UMTS	LTE	Impact
Resetting a base station	- MML: **RST BTS** - SMT: See section **Managing Sites** > **Resetting a Site Hierarchically** in the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. - LMT: See section **BTS Maintenance** > **Resetting the BTS by Levels** in the *BSC6900 GSM LMT User Guide*.	MML: **RST NODEB**	MML: **RST ENODEB**	- When a multi-mode base station works in co-module mode, running this command may interrupt the services at the peer end. - A multi-mode base station adopts co-transmission and the local end provides an outgoing port for transmission sharing, running this command may interrupt the services at the peer end. - When level-3 or level-4 reset is performed at the GBTS, services at the peer end carried on RF modules that work in co-module mode may be interrupted. - During an MBTS reset, start event of common parts can be observed by the related managing SiteUnits.

Operation	GSM	UMTS	LTE	Impact
Resetting a board	• MML: **RST BTSBRD** • SMT: See the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. – Resetting a board in the BBU: See section **BBU Operations** > **Resetting a Board**. – Resetting an RF module: See section **RFU Operations** or **RRU Operations** > **Resetting a Board**. • LMT: See section **BTS Maintenance** > **Maintaining TRXs** > **Resetting the TRX** in the *BSC6900 GSM LMT User Guide*.	• MML: **RST BRD** • LMT: See section **Managing NodeB Equipment** > **NodeB Board-Level Operations** > **Resetting a NodeB Board** in the *NodeB LMT User Guide*.	MML: **RST BRD**	When running this command to reset a board, pay attention to the following restrictions: • When a multi-mode base station works in co-module mode, services at the peer end carried on an RF module that works in co-module mode may be interrupted, if this command is executed to reset the RF module. • When a multi-mode base station adopts co-transmission and the local end provides an outgoing port for transmission sharing, services at the peer end may be interrupted, if this command is executed to reset the board that provides the outgoing port. • When the CPRI-based topology on an MBTS uses the dual-star topology, services of the other mode may be interrupted if one main control board is abnormally reset or the board is removed and inserted again. • When the CPRI MUX topology is used and the WBBP board converging data for all the

Operation	GSM	UMTS	LTE	Impact
				modes is reset, ongoing services on the peer end will be interrupted and the services can restore only after the WBBP board restarts and works properly.

Operation	GSM	UMTS	LTE	Impact
Resetting a board in power-off mode	SMT: See the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. ● Resetting a board in the BBU in power-off mode: See section **BBU Operations** > **Resetting a Board in Power-Off Mode**. ● Resetting an RF module in power-off mode: See section **RFU Operations** or **RRU Operations** > **Resetting a Board in Power-Off Mode**.	MML: **RST BRDPWROFF**	MML: **RST BRDPWROFF**	When running this command to reset a board in power-off mode, pay attention to the following restrictions: ● When a multi-mode base station works in co-module mode, services at the peer end carried on an RF module that works in co-module mode may be interrupted, if this command is executed to reset the RF module in power-off mode. ● When a multi-mode base station adopts co-transmission and the local end provides an outgoing port for transmission sharing, services at the peer end may be interrupted, if this command is executed to reset the board in power-off mode that provides the outgoing port. ● When the CPRI-based topology on an MBTS uses the dual-star topology, services of the other mode may be interrupted if one main control board is abnormally reset or the board is removed and inserted again.

Operation	GSM	UMTS	LTE	Impact
Starting the VSWR detection	MML: **STR BTSVSWRTEST**	MML: **STR VSWRTEST**	MML: **STR VSWRTEST**	The services at the peer end may be interrupted if the VSWR test is performed on either of the following boards: ● RF modules working in co-module mode ● RF modules that work in different modes but share the same antenna system
Starting the transmission performance test	● SMT: See section **Managing Sites** > **Testing Transmission Performance** in the *SMT User Guide* or *DBS3900 GSM Site Maintenance Terminal User Guide*. ● LMT: See section **BTS Maintenance** > **Maintaining Site** > **Testing Transmission Performance** in the *BSC6900 GSM LMT User Guide*.	N/A	N/A	A multi-mode base station adopts co-transmission and the local end provides an outgoing port for transmission sharing, running this command may interrupt the services at the peer end.

Operation	GSM	UMTS	LTE	Impact
Activating the configuration baseline (CB)	N/A	MML: **ACT CB**	N/A	Activating the CB at the local end may interrupt the services at the peer end in the following scenarios: ● A multi-mode base station works in co-module mode. ● A multi-mode base station adopts co-transmission and the NodeB provides an outgoing port for transmission sharing.
Rolling back the CB	N/A	MML: **RBK CB**	N/A	Rolling back the CB at the local end may interrupt the services at the peer end in the following scenarios: ● A multi-mode base station works in co-module mode. ● A multi-mode base station adopts co-transmission and the NodeB provides an outgoing port for transmission sharing.

Operation	GSM	UMTS	LTE	Impact
Starting the hardware test	N/A	MML: **STR HWTST**	N/A	When running this command to start a hardware test, pay attention to the following restrictions: ● When a multi-mode base station works in co-module mode, services at the peer end carried on an RF module that works in co-module mode may be interrupted, if this command is executed to start a hardware test on the RF module. ● When a multi-mode base station adopts co-transmission and the NodeB provides an outgoing port for transmission sharing, services at the peer end may be interrupted, if this command is executed to start a hardware test on the board that provides the outgoing port.

Operation	GSM	UMTS	LTE	Impact
Forcibly activating the UCIU software	MML: **ACT BTSUCIUSW**	MML: **ACT UCIUSW**	MML: **ACT UCIUSW**	During an upgrade, the UCIU software is updated along with the SiteUnit that has configuration management rights over the UCIU board. Any of the preceding commands can be executed if the corresponding controlling SiteUnit becomes faulty and cannot upgrade the UCIU software. Note that if BBU cascading and inter-BBU SDR are enabled on an MBTS, forcibly activating the UCIU software may interrupt services processed by RF modules that are enabled with inter-BBU SDR.

If an MBTS works in GU+GL mode, pay attention to the following restrictions:

- Only services at the local end will be affected if the primary or secondary GTMU, WMPT, or LMPT board is faulty, removed, or reset. Resetting each main control board will not lead to resetting of the UCIU board.
- Resetting a secondary GTMU board will lead to resetting of its controlled boards. In addition, GSM services carried by RF modules connected to the secondary GTMU board will be interrupted with LTE services being unaffected.
- Services carried by the secondary GTMU board will be interrupted if UCIU 1 or UCIU 2 is faulty, removed, or reset, or the Field Programmable Gate Array (FPGA) or Complex Programmable Logical Device (CPLD) is upgraded. In addition, relevant alarms will be generated but UMTS and LTE services remain unaffected. Services of three modes will not be affected when only CAN of the UCIU board is upgraded.
- GSM services, including services carried on the secondary GTMU board, will be interrupted and relevant alarms will be generated if the primary GTMU board is faulty, removed, or reset.
- Services carried on a secondary GTMU board will be interrupted and relevant alarms will be generated if the board is faulty, removed, or reset. Services carried on the primary GTMU board will remain unaffected.

10 Product Specifications

About This Chapter

Product specifications of the 3900 series base stations include technical specifications of the BBU3900, radio frequency unit (RFU), and remote radio unit (RRU) and engineering specifications of each type of base station.

10.1 BBU3900 Technical Specifications
This section describes the technical specifications of the BBU, which include capacity, transmission ports, input power specifications, equipment specifications, environment specifications, and surge protection specifications.

10.2 Technical Specifications of RFUs
This section describes the technical specifications of radio frequency units (RFUs), including supported modes, frequency bands, RF specifications, surge protection specifications, and antenna capabilities.

10.3 Technical Specifications of RRUs
This section provides technical specifications of RRUs, including supported modes, frequency bands, RF specifications, engineering specifications, and antenna capabilities.

10.4 Engineering Specifications
This section describes engineering specifications of each base station, including input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

10.1 BBU3900 Technical Specifications

This section describes the technical specifications of the BBU, which include capacity, transmission ports, input power specifications, equipment specifications, environment specifications, and surge protection specifications.

Capacity Specifications

Table 10-1 lists capacities of a BBU working in different modes.

Table 10-1 BBU capacity

Mode	Capacity
GSM	Up to 126 carriers at a site (TDM), up to 32 cells and 24 carriers per cell
UMTS	● Single BBU: 24 cells; 3072 CEs in the uplink and 4608 CEs in the downlink ● Two interconnected BBUs: 48 cells; 5632 CEs in the uplink and 8448 CEs in the downlink
LTE	● Maximum throughput per cell with 20 MHz bandwidth: downlink data rate at the MAC layer: 150 Mbit/s (2x2 MIMO); uplink data rate at the MAC Layer: 70 Mbit/s (2x4 MU-MIMO or 2x2 MU-MIMO) ● Maximum throughput per eNodeB: uplink and downlink data rate at the MAC layer: 1500 Mbit/s (packet size: 550bytes) ● Maximum number of UEs in RRC_CONNECTED mode per eNodeB: – 1512 with 1.4 MHz bandwidth – 3240 with 3 MHz bandwidth – 5400 with 5 MHz bandwidth – 10,800 with 10 MHz/15 MHz/20 MHz bandwidth ● Data radio bearer (DRB): a maximum of 8 DRBs can transmit data of a UE at the same time.
GU	GSM S24/24/24 + UMTS S8/8/8 (uplink: 2560 CEs; downlink: 3840 CEs)
GL	GSM S24/24/24 + LTE 12 x 20 MHz cells (2T2R, uplink and downlink data rate at the MAC layer per eNodeB: 1500 Mbit/s)

Transmission Port Specifications

Table 10-2 lists transmission ports on a single-mode BBU.

Table 10-2 Transmission ports on a single-mode BBU

Mode	Transmission Port
GSM	GTMU: 4 E1s/T1s, 1 FE electrical port, and 1 FE optical port

Mode	Transmission Port
	UTRPb4: 8 E1s/T1s
	UTRPc: 4 FE/GE electrical ports and 2 FE/GE optical ports
UMTS	WMPT: 4 E1s/T1s, 1 FE electrical port, and 1 FE optical port
	UMPT: 4 E1s/T1s, 1 FE/GE electrical port, and 1 FE/GE optical port
	UTRP2: 2 FE/GE optical ports
	UTRP3: 8 E1s/T1s
	UTRP4: 8 E1s/T1s
	UTRP6: 1 STM-1 or OC-3 port
	UTRP9: 4 FE/GE electrical ports
	UTRPc: 4 FE/GE electrical ports and 2 FE/GE optical ports
LTE	LMPT: 2 FE/GE electrical ports, 2 FE/GE optical ports, or 1 FE/GE optical port + 1 FE/GE electrical port
	UMPT: 4 E1s/T1s, 1 FE/GE electrical port, and 1 FE/GE optical port
	UTRPb4: 8 E1s/T1s
	UTRPc: 4 FE/GE electrical ports and 2 FE/GE optical ports

On a multi-mode BBU, transmission ports supported by each mode are functional. For example, on a GU dual-mode BBU, transmission ports supported by a GSM BBU and transmission ports supported by a UMTS BBU are functional.

Input Power Specifications

Table 10-3 lists the input power specifications of the BBU.

Table 10-3 Input power specifications of the BBU

Input Power	Voltage Range
-48 V DC	-38.4 V DC to -57 V DC

Equipment Specifications

Table 10-4 lists the size and weight of the BBU.

Table 10-4 Size and weight of the BBU

Item	Specification
Dimension (H x W x D)	86 mm x 442 mm x 310 mm
Weight	● ≤ 12 kg (full configuration) ● ≤ 7 kg (typical configuration)

Environment Specifications

Table 10-5 lists the environment specifications of the BBU.

Table 10-5 Environment specifications of the BBU

Item	Specification
Operating temperature	● -20ºC to +55ºC (long term) ● +55ºC to +60ºC (short term)
Relative humidity	5% RH to 95% RH
Protection rating	IP20
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

Table 10-6 describes the surge protection specifications of the ports on the BBU.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-6 Surge protection specifications of the ports on the BBU

Port	Usage Scenario	Surge Protection Mode	Specification
-48 V DC port	Applicable to the scenario where the BBU and devices interconnected through this port are	Differential mode	1 kA

Port	Usage Scenario	Surge Protection Mode	Specification
	installed indoors	Common mode	2 kA
FE/GE port	Applicable to the scenario where the BBU and devices interconnected through this port are installed indoors (surge)	Differential mode	0.5 kV (1.2/50 μs)
		Common mode	4 kV (1.2/50 μs)
	Applicable to the scenario where some devices are configured remotely or the scenario where the BBU and devices interconnected through this port are placed outdoors (surge protector configured)	Differential mode	3 kA
		Common mode	5 kA
GPS port	Applicable to the scenario where some devices are configured remotely or the scenario where the BBU and devices interconnected through this port are placed outdoors (surge	Differential mode	8 kA

Port	Usage Scenario	Surge Protection Mode	Specification
	protector configured)	Common mode	40 kA
RGPS port	Applicable to the scenario where some devices are configured remotely or the scenario where the BBU and devices interconnected through this port are placed outdoors (surge protection module configured)	Differential mode	3 kA
		Common mode	5 kA
E1/T1 port	Applicable to the scenario where the BBU and devices interconnected through this port are installed indoors	Differential mode	250 A
		Common mode	250 A
	Applicable to the scenario where some devices are configured remotely or the	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode	Specification
	scenario where the BBU and devices interconnected through this port are placed outdoors (surge protection board configured)	Common mode	5 kA
Dry contact	Applicable to the scenario where the BBU and devices interconnected through this dry contact are installed indoors	Differential mode	250 A
	Applicable to the scenario where some devices are configured remotely or the scenario where the BBU and devices interconnected through this port are placed outdoors (surge protection board configured)	Differential mode	3 kA
		Common mode	5 kA
RS485 alarm port	Applicable to the scenario where the BBU and devices interconnected	Differential mode	250 A

Port	Usage Scenario	Surge Protection Mode	Specification
	through this port are installed indoors	Common mode	250 A
	Applicable to the scenario where some devices are configured remotely or the scenario where the BBU and devices interconnected through this port are placed outdoors (surge protection board configured)	Differential mode	3 kA
		Common mode	5 kA

10.2 Technical Specifications of RFUs

This section describes the technical specifications of radio frequency units (RFUs), including supported modes, frequency bands, RF specifications, surge protection specifications, and antenna capabilities.

10.2.1 GRFU Technical Specifications

The GSM Radio Frequency Unit (GRFU) is a multi-carrier radio frequency (RF) module, which supports a maximum of six carriers.

Supported Modes and Frequency Bands

Table 10-7 lists the modes and frequency bands supported by a GRFU.

Table 10-7 Modes and frequency bands supported by a GRFU

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
GRFU V1	GSM	1900	1850 to 1890	1930 to 1970
			1870 to 1910	1950 to 1990
GRFU V2	GSM	900 PGSM	890 to 915	935 to 960
		900 EGSM	880 to 915	925 to 960
		1800	1710 to 1770	1805 to 1865
			1725 to 1785	1820 to 1880
GRFU V2a	GSM	900	885 to 910	930 to 955
		1800	1710 to 1755	1805 to 1850

RF Specifications

Table 10-8 shows RF specifications of a GRFU.

Table 10-8 RF specifications of a GRFU

Type	RX and TX Channels	Capacity	Receiver Sensitivity (dBm)		Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas		
GRFU V1	1T2R	6 carriers	-113	-116	**GRFU V1 (1900 MHz) output power**	**Power consumption (GRFU V1 operating in 1900 MHz configured)**

Type	RX and TX Channels	Capacity	Receiver Sensitivity (dBm)		Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas		
GRFU V2			• 900 MHz EGSM: -113.3 • 900 MHz PGSM/ 1800 MHz: -113.5	• 900 MHz EGSM: -116.3 • 900 MHz PGSM/ 1800 MHz: -116.5	**GRFU V2 (900 MHz) output power** **GRFU V2 (1800 MHz) output power**	**Power consumption (GRFU V2 operating in 900 MHz configured)** **Power consumption (GRFU V2 operating in 1800 MHz configured)**
GRFU V2a			-113.5	-116.5	-	-

Table 10-9 GRFU V1 (1900 MHz) output power

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
1	60 W (GMSK)/40 W (8PSK)	60 W (GMSK)/40 W (8PSK)
2	40 W (GMSK)/26 W (8PSK)	40 W (GMSK)/26 W (8PSK)
3	27 W (GMSK)/18 W (8PSK)	31 W (GMSK)/20 W (8PSK)
4	20 W (GMSK)/13 W (8PSK)	27 W (GMSK)/18 W (8PSK)
5	12 W (GMSK)/8 W (8PSK)	20 W (GMSK)/13 W (8PSK)
6	10 W (GMSK)/6.6 W (8PSK)	16 W (GMSK)/10 W (8PSK)

NOTE

The maximum output power of a GRFU V2 module in S1 configuration is 60 W. To achieve the maximum output power, you need to buy a license.

Table 10-10 GRFU V2 (900 MHz) output power

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
1	60 W (GMSK)/60 W (8PSK)	60 W (GMSK)/60 W (8PSK)
2	40 W (GMSK)/40 W (8PSK)	40 W (GMSK)/40 W (8PSK)
3	27 W (GMSK)/27 W (8PSK)	31 W (GMSK)/31 W (8PSK)
4	20 W (GMSK)/20 W (8PSK)	27 W (GMSK)/27 W (8PSK)
5	16 W (GMSK)/16 W (8PSK)	20 W (GMSK)/20 W (8PSK)
6	12 W (GMSK)/12 W (8PSK)	20 W (GMSK)/20 W (8PSK)

NOTE

- The maximum output power of a GRFU V2 module in S1 configuration is 60 W. To achieve the maximum output power, you need to buy a license.
- After design optimization, GRFU V2 modules with the configuration of S1 to S3 have the same output power in Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation mode.
- With the **GBFD-118104 Enhanced EDGE Coverage** feature, GRFU V2 modules with the configuration of S4 to S6 can also have the same output power no matter they use the GMSK or 8PSK modulation scheme.

Table 10-11 GRFU V2 (1800 MHz) output power

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
1	60 W (GMSK)/40 W (8PSK)	60 W (GMSK)/40 W (8PSK)
2	40 W (GMSK)/26 W (8PSK)	40 W (GMSK)/26 W (8PSK)
3	27 W (GMSK)/18 W (8PSK)	31 W (GMSK)/20 W (8PSK)
4	20 W (GMSK)/20 W (8PSK)	27 W (GMSK)/27 W (8PSK)
5	16 W (GMSK)/16 W (8PSK)	20 W (GMSK)/20 W (8PSK)
6	12 W (GMSK)/12 W (8PSK)	20 W (GMSK)/20 W (8PSK)

NOTE

- The maximum output power of a GRFU V2 module in S1 configuration is 60 W. To achieve the maximum output power, you need to buy a license.
- With the **GBFD-118104 Enhanced EDGE Coverage** feature, GRFU V2 modules with the configuration of S4 to S6 can also have the same output power no matter they use the GMSK or 8PSK modulation scheme.

Table 10-12 Power consumption (GRFU V1 operating in 1900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	S4/4/4, TOC = 20 W	710	1310
	S6/6/6, TOC = 16 W	710	1370
BTS3900A	S4/4/4, TOC = 20 W	790	1470
	S6/6/6, TOC = 16 W	790	1540

Table 10-13 Power consumption (GRFU V2 operating in 900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	S4/4/4, TOC = 20 W	680	1300
	S6/6/6, TOC = 20 W	710	1190
BTS3900A	S4/4/4, TOC = 20 W	760	1470
	S6/6/6, TOC = 20 W	790	1340
BTS3900L	S4/4/4 + 1800M S8/8/8, TOC = 20 W	1800	3730

Table 10-14 Power consumption (GRFU V2 operating in 1800 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	S4/4/4, TOC = 20 W	670	1290
	S6/6/6, TOC = 20 W	770	1270
BTS3900A	S4/4/4, TOC = 20 W	750	1450

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
	S6/6/6, TOC = 20 W	860	1430

NOTE

- The following features are configured: multi-carrier intelligent voltage regulation, TRX working voltage adjustment, discontinuous transmission (DTX), power control, and power sharing.
- The preceding tables use the power consumption of BTS3900 -48 V DC, BTS3900A AC, and BTS3900L -48 V DC as examples.
- TOC in the preceding tables refers to the cabinet-top power of GBTSs for which duplex ports are configured.

Engineering Specifications

Table 10-15 lists the equipment specifications of a GRFU.

Table 10-15 Equipment specifications of a GRFU

Type	Dimension (H x W x D)	Weight (kg)
GRFU V1, GRFU V2, and GRFU V2a	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-16 lists the surge protection specifications of ports on a GRFU.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-16 Surge protection specifications of ports on a GRFU

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Ports for cascading RF modules	Applicable to all scenarios	Surge		250 A
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	250 A
			Common mode	250 A

Antenna Capability

Table 10-17 shows antenna capability of a GRFU.

Table 10-17 Antenna capability of a GRFU

Type	TMA Support	RET Antenna Support
GRFU V1	Supported	AISG2.0
GRFU V2	Supported	AISG2.0
GRFU V2a	Supported	AISG2.0

NOTE

For RFUs supporting RET antennas, the feed voltage is 12 V and feed current is 2.3 A.

10.2.2 DRFU Technical Specifications

The Double Radio Frequency Unit (DRFU) is a dual-transceiver radio frequency (RF) module, which supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-18 lists the modes and frequency bands supported by a DRFU.

Table 10-18 Modes and frequency bands supported by a DRFU

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
DRFU	GSM	900 EGSM	880 to 915	925 to 960
		900 PGSM	890 to 915	935 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-19 lists RF specifications of a DRFU.

Table 10-19 RF specifications of a DRFU

Type	RX and TX Channels	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
DRFU	2T2R	2 carriers	-113	-116	-118.5	DRFU (900 MHz) output power DRFU (1800 MHz) output power	Power consumption (DRFU operating in 900 MHz configured) Power consumption (DRFU operating in 1800 MHz configured)

Table 10-20 DRFU (900 MHz) output power

Number of Carriers	BCCH Carrier Output Power
1	45 W (GMSK)/30 W (8PSK)

Number of Carriers	BCCH Carrier Output Power
2	45 W (GMSK)/30 W (8PSK)
4	20 W (GMSK)/14 W (8PSK)
1(PBT)	71 W (GMSK)/41 W (8PSK)

Table 10-21 DRFU (1800 MHz) output power

Number of Carriers	BCCH Carrier Output Power
1	40 W (GMSK)/26 W (8PSK)
2	40 W (GMSK)/26 W (8PSK)
4	18 W (GMSK)/12 W (8PSK)
1(PBT)	63 W (GMSK)/42 W (8PSK)

Table 10-22 Power consumption (DRFU operating in 900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	S2/2/2, TOC = 45 W	730	1060
BTS3900A	S2/2/2, TOC = 45 W	820	1190

Table 10-23 Power consumption (DRFU operating in 1800 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	S2/2/2, TOC = 40 W	730	1050
BTS3900A	S2/2/2, TOC = 40 W	820	1190

Engineering Specifications

Table 10-24 lists the equipment specifications of a DRFU.

Table 10-24 Equipment specifications of a DRFU

Type	Dimension (H x W x D)	Weight (kg)
DRFU	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-25 lists the surge protection specifications of ports on a DRFU.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-25 Surge protection specifications of ports on a DRFU

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Ports for cascading RF modules	Applicable to all scenarios	Surge		250 A
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	250 A
			Common mode	250 A

Antenna Capability

Table 10-26 shows antenna capability of a DRFU.

Table 10-26 Antenna capability of a DRFU

Type	TMA Support	RET Antenna Support
DRFU	Not supported	AISG2.0 not supported

NOTE

- An external bridge tap (BT) is required if a DRFU needs to be configured with a TMA.
- For RFUs supporting RET antennas, the feed voltage is 12 V and feed current is 2.3 A.

10.2.3 WRFU Technical Specifications

The WCDMA Radio Filter Unit (WRFU) is an indoor radio frequency (RF) processing unit. One WRFU supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-27 lists the modes and frequency bands supported by a WRFU.

Table 10-27 Modes and frequency bands supported by a WRFU

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
80 W WRFU	UMTS	2100	1920 to 1980	2110 to 2170
		850	824 to 835	869 to 880
40 W WRFU		2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-28 lists RF specifications of a WRFU.

Table 10-28 RF specifications of a WRFU

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
WRFU	1T2R	● 80 W WRFU: 4 carriers ● 40 W WRFU: 2 carriers	● -125.8 (2100 MHz) ● -125.6 (850 MHz)	● -128.6 (2100 MHz) ● -128.4 (850 MHz)	● -131.3 (2100 MHz) ● -131.1 (850 MHz)	Output power of 80 W WRFU in typical configuration Output power of 40 W WRFU in typical configuration	Power consumption

NOTE

- The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.
- The receiver sensitivity on the 850 MHz band is measured on its subbands.

The 80 W WRFU supports a maximum of four carriers and uneven power configuration. The output power at its antenna port is 80 W.

Table 10-29 Output power of 80 W WRFU in typical configuration

Number of Carriers	Maximum Output Power per Carrier (W)
1	60
2	40*
3	20
4	20

NOTE

- Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.
- The asterisk (*) marks the maximum output power in typical configuration.

The 40 W WRFU supports a maximum of two carriers. The output power at its antenna port is 40 W.

Table 10-30 Output power of 40 W WRFU in typical configuration

Number of Carriers	Maximum Output Power per Carrier (W)
1	40
2	20

Table 10-31 Power consumption

Cabinet	Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	3 x 1	20	410	520
	3 x 2	20	470	670
	3 x 3	20	610	830
	3 x 4	20	760	1110
BTS3900A	3 x 1	20	455	525
	3 x 2	20	525	690
	3 x 3	20	680	870
	3 x 4	20	845	1180
BTS3900L	3 x 1	20	430	570
	3 x 2	20	500	720
	3 x 3	20	640	880
	3 x 4	20	790	1170

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 or 3 x 2 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPb4 boards and one WMPT board are configured.

Engineering Specifications

Table 10-32 lists the equipment specifications of a WRFU.

Table 10-32 Equipment specifications of a WRFU

Type	Dimension (H x W x D)	Weight (kg)
WRFU	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-33 lists the surge protection specifications of ports on a WRFU.

Table 10-33 Surge protection specifications of ports on a WRFU

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-34 lists the antenna capability of a WRFU.

Table 10-34 Antenna capability of a WRFU

Type	TMA Support	RET Antenna Support
WRFU	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.4 WRFUd Technical Specifications

The WCDMA Radio Filter Unit type D (WRFUd) is an indoor radio frequency (RF) processing unit. One WRFUd supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-35 lists the modes and frequency bands supported by a WRFUd.

Table 10-35 Modes and frequency bands supported by a WRFUd

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
WRFUd	UMTS	2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-36 lists RF specifications of a WRFUd.

Table 10-36 RF specifications of a WRFUd

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
WRFUd	2T2R	• With MIMO: 4 carriers • Without MIMO: 6 carriers	-126.1	-128.9	-131.6	**Output power of WRFUd without MIMO** **Output power of WRFUd with MIMO** **Output power of WRFUd in combined configuration**	**Power consumption**

NOTE

The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.

WRFUds with MIMO and without MIMO support four carriers and six carriers, respectively. The output power at its antenna port is 2 x 60 W.

NOTE

- Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported.
- Uneven power configuration is supported.

Table 10-37 Output power of WRFUd without MIMO

Number of Carriers Related to Power Amplifier 1	Number of Carriers Related to Power Amplifier 2	Output Power per Carrier (W)
1	0	60
2	0	30
3	0	20
4	0	15
1	1	60
2	2	30
3	3	20

Table 10-38 Output power of WRFUd with MIMO

Number of MIMO Carriers	Output Power per Carrier (W)
1	50 + 50
2	30 + 30
3	20 + 20
4	15 + 15

Table 10-39 Carrier combinations supported by WRFUd in hybrid configurations

Number of MIMO Carriers	Number of Single-Output Carriers
1	5
2	4
3	2

NOTE

In combined configuration, each TX channel of the WRFUd supports a maximum of four carriers, and the WRFUd supports a maximum of six carriers. The maximum output power is 60 W.

Table 10-40 Power consumption

Cabinet	Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)		
					50 Ah	92 Ah	184 Ah
BTS3900	3 x 1	20	465	540	4.4	9.3	18.9
	3 x 2	20	545	680	3.7	7.9	16.2
	3 x 3	20	685	880	2.9	5.9	12.8
	3 x 4	20	925	1255	2.0	4.1	9.3
BTS3900A	3 x 1	20	465	540	4.4	9.3	18.9
	3 x 2	20	545	680	3.7	7.9	16.2
	3 x 3	20	685	880	2.9	5.9	12.8
	3 x 4	20	925	1255	2.0	4.1	9.3
BTS3900L	3 x 1	20	490	565	4.2	8.8	18.0
	3 x 2	20	565	700	3.6	7.6	15.6
	3 x 3	20	710	905	2.8	5.7	12.4
	3 x 4	20	945	1250	1.9	4.0	9.1

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 or 3 x 2 configuration, one WBBPd2 board and one WMPT board are configured in the BBU3900.
- In 3 x 3 or 3 x 4 configuration, two WBBPd2 boards and one WMPT board are configured in the BBU3900.

Engineering Specifications

Table 10-41 lists the equipment specifications of a WRFUd.

Table 10-41 Equipment specifications of a WRFUd

Type	Dimension (H x W x D)	Weight (kg)
WRFUd	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-42 lists the surge protection specifications of ports on a WRFUd.

Table 10-42 Surge protection specifications of ports on a WRFUd

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-43 lists the antenna capability of a WRFUd.

Table 10-43 Antenna capability of a WRFUd

Type	TMA Support	RET Antenna Support
WRFUd	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.5 MRFU Technical Specifications

Multi-Mode Radio Frequency Units (MRFUs) are classified into MRFU V1, MRFU V2, and MRFU V2a modules. Using the software-defined radio (SDR) technology, MRFUs can work in different modes with different configurations.

Supported Modes and Frequency Bands

Table 10-44 lists the modes and frequency bands supported by an MRFU.

Table 10-44 Modes and frequency bands supported by an MRFU

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
MRFU V1	GSM UMTS LTE (the 1800 MHz frequency band only) GU (the 900 MHz frequency band only) GL (the 1800 MHz frequency band only)	900	890 to 915	935 to 960
		1800	1710 to 1755	1805 to 1850
			1740 to 1785	1835 to 1880
		1900	1850 to 1890	1930 to 1970
			1870 to 1910	1950 to 1990
MRFU V2	GSM UMTS LTE (the 900 and 1800 MHz frequency bands only) GU (the 850 and 900 MHz	850	824 to 846.5	869 to 891.5
		900	890 to 915	935 to 960
			880 to 915	925 to 960
		1800	1710 to 1770	1805 to 1865

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
	frequency bands only) GL (the 900 and 1800 MHz frequency bands only)		1725 to 1785	1820 to 1880
MRFU V2a	GSM UMTS LTE (the 900 and 1800 MHz frequency bands only) GU (the 900 MHz frequency band only) GL (the 900 and 1800 MHz frequency bands only)	900	885 to 910	930 to 955
		1800	1710 to 1755	1805 to 1850

RF Specifications

Table 10-45 lists radio frequency (RF) specifications of an MRFU.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The MRFU that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The MRFU that works in GSM mode and operates in the 850 or 1900 MHz frequency band complies with the 3GPP TS 45.005 V10.2.0 and 3GPP TS 51.021 V10.2.0 standards. The MRFU that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard. The MRFU that works in UMTS, LTE, or MSR mode and operates in the 850 or 1900 MHz frequency band complies with the 3GPP TS 37.104 V10.4.0 and TS 37.141 V10.4.0 standards.
- **AB MSR** indicates that A and B are configured over the same transmit channel.

Table 10-45 RF specifications of an MRFU

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
MRFU V1	1T2R	GSM: 6 carriers UMTS: 4 carriers LTE: 1 carrier, 3/5/10 MHz bandwidth	GSM: -113 UMTS: -125.5 LTE: -106.1	GSM: -115.8 UMTS: -128.3 LTE: -108.9	GSM: -118.5 (theoretical value) UMTS: -131 LTE: -111.6	**Output power of MRFU V1 (900/1800/1900 MHz, single-mode)** **Output power of MRFU V1 (900 MHz, GU MSR)** **Output power of MRFU V1 (1800 MHz, GL MSR)**	**Power consumption (MRFU V1 operating in the 900 MHz frequency band configured)**
MRFU V2	1T2R	GSM: 6 carriers UMTS: 4 carriers LTE: ● 900 MHz: 1 carrie	GSM: ● 850 MHz: -113 ● 900 MHz PGSM: -113.5	GSM: ● 850 MHz: -115.8 ● 900 MHz PGSM: -116.3	GSM: ● 850 MHz: -118.5 (theoretical value) ● 900 MHz PGSM:	**Output power of MRFU V2 (850/900/1800 MHz, single-mode)**	**Power consumption (MRFU V2 operating in the 900 MHz frequency band**

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
MRFU		r, 1.4/3/5/10/15/20 MHz bandwidth ● 1800 MHz: 1 carrier, 5/10/15/20 MHz	● 900 MHz EGSM: -113.3 ● 1800 MHz: -113.8 UMTS: ● 850 MHz/900 MHz PGSM/1800 MHz: -125.5 ● 900 MHz EGSM: -125.3 LTE: ● 900 MHz PGSM: -105.5 ● 900 MHz EGSM: -105.3	● 900 MHz EGSM: -116.1 ● 1800 MHz: -116.6 UMTS: ● 850 MHz/900 MHz PGSM/1800 MHz: -128.3 ● 900 MHz EGSM: -128.1 LTE: ● 900 MHz PGSM: -108.3 ● 900 MHz EGSM: -108.1	-119 (theoretical value) ● 900 MHz EGSM: -118.8 (theoretical value) ● 1800 MHz: -119.3 (theoretical value) UMTS: ● 850 MHz/900 MHz PGSM/1800 MHz: -131 ● 900 MHz EGSM: -130.8 LTE: ● 900 MHz PGSM: -111	**Output power of MRFU V2 (850/900 MHz, GU MSR)** **Output power of MRFU V2 (900/1800 MHz,**	**configured)** **Power consumption (MRFU V2 operating in the 1800 MHz frequency band**

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
V2a		band width	• 1800 MHz: -105.8	• 1800 MHz: -108.6	• 900 MHz EGSM: -110.8 • 1800 MHz: -111.3	**GL MSR)**	**configured)**

NOTE

- "*" indicates that UMTS hardware is ready.
- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an MRFU is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an MRFU is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-46 Output power of MRFU V1 (900/1800/1900 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	60	60	0	0
	2	0	0	40	40	0	0
	3	0	0	27	31	0	0
	4	0	0	20	27	0	0
	5	0	0	12	20	0	0
	6	0	0	10	16	0	0
UMTS	0	1	0	0	0	60	0
	0	2	0	0	0	40	0
	0	3*	0	0	0	27*	0
	0	4*	0	0	0	20*	0
LTE	0	0	1 (1T2R)	0	0	0	60

Table 10-47 Output power of MRFU V1 (900 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	40
	1	2	40	20
	2	1	20	40
	2	2	20	20
	3	1	20	10
	3	1	16	20
	3	2	16	10
	3	2	10	20
	4	1	12	20
	4	2	10	10

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	5	1	10	10

Table 10-48 Output power of MRFU V1 (1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1	40	40
	2	1	20	40
	3	1	20	10
	3	1	16	20
	4	1	15	10
	4	1	12	20
	5	1	10	20

NOTE

To implement UMTS MIMO, two MRFU V2 modules are required.

Table 10-49 Output power of MRFU V2 (850/900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	60	60	0	0
	2	0	0	40	40	0	0
	3	0	0	27	31	0	0
	4	0	0	20	27	0	0
	5	0	0	16	20	0	0
	6	0	0	12	20	0	0
UMTS	0	1	0	0	0	60	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	1 (MIMO)	0	0	0	2 x 60	0
	0	2	0	0	0	40	0
	0	2 (MIMO)	0	0	0	2 x 40	0
	0	3*	0	0	0	27*	0
	0	3 (MIMO) *	0	0	0	2 x 27*	0
	0	4*	0	0	0	20*	0
	0	4 (MIMO) *	0	0	0	2 x 20*	0
LTE	0	0	1 (1T2R)	0	0	0	60

Table 10-50 Output power of MRFU V2 (850/900 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	40
	2	1	20	40
	2	1	31	20
	3	1	20	20
	4	1	12	20
	5	1	10	20
	1	2	40	20
	2	2	20	20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	3	2	16	10
	3	2	10	20
	4	2	10	10

NOTE

- If there are less than 4 GSM carriers, 1.4, 3, 5, 10, or 15 MHz bandwidth can be spared from the 900 MHz frequency band to set up an LTE network; 5, 10, or 15 MHz bandwidth can be spared from the 1800 MHz frequency band to set up an LTE network. If there are more than 3 GSM carriers, 1.4, 3, 5, or 10 MHz bandwidth can be spared from the 900 MHz frequency band to set up an LTE network; 5 or 10 MHz bandwidth can be spared from the 1800 MHz frequency band to set up an LTE network.
- To implement LTE MIMO, two MRFU V2 modules are required.

Table 10-51 Output power of MRFU V2 (900/1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1	40	30
	1	1	30	40
	2	1	27	20
	2	1	20	30
	3	1	20	20
	4	1	12	20
	5	1	10	20

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.
- LTE typical power consumption is measured when the base station load reaches 50% and LTE maximum power consumption is measured when the base station load reaches 100%.
- LTE power consumption is calculated based on the 2x2 MIMO configuration. Two MRFUs are configured in each sector.

Table 10-52 Power consumption (MRFU V1 operating in the 900 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900 (Ver.B) (-48 V)	GSM	3 x 2	20	700	900
		3 x 4	27	950	1350
		3 x 6	16	840	1180
	UMTS	3 x 1	20	540	670
		3 x 2	20	800	1020
		3 x 3	20	1040	1330
		3 x 4	20	1150	1450
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 40	1150	1440
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 15 • UMTS: 10	970	1260
		GSM 3 x 4 + UMTS 3 x 2	• GSM: 10 • UMTS: 10	930	1190
BTS3900 A (Ver.B) (AC)	GSM	3 x 2	20	800	1040
		3 x 4	27	1070	1540
		3 x 6	16	950	1340
	UMTS	3 x 1	20	660	840
		3 x 2	20	950	1220
		3 x 3	20	1210	1560
		3 x 4	20	1340	1700
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 40	1340	1690

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 15 • UMTS: 10	1140	1490
		GSM 3 x 4 + UMTS 3 x 2	• GSM: 10 • UMTS: 10	1100	1410
BTS3900L (Ver.B) (-48 V)	GSM	3 x 2	20	745	960
		3 x 4	27	995	1410
		3 x 6	16	885	1240
	UMTS	3 x 1	20	585	730
		3 x 2	20	845	1080
		3 x 3	20	1085	1390
		3 x 4	20	1195	1510
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 40	1195	1500
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 15 • UMTS: 10	1015	1320
		GSM 3 x 4 + UMTS 3 x 2	• GSM: 10 • UMTS: 10	975	1250

Table 10-53 Power consumption (MRFU V2 operating in the 900 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900 (Ver.B) (-48 V)	GSM	3 x 2	20	620	730
		3 x 4	20	810	1130
		3 x 6	12	710	1025
	UMTS	3 x 1	20	595	650
		3 x 2	20	630	800
	LTE	3 x 1	2 x 60	1185	1270
BTS3900A (Ver.B) (AC)	GSM	3 x 2	20	620	730
		3 x 4	20	810	1130
		3 x 6	12	710	1025
	UMTS	3 x 1	20	595	650
		3 x 2	20	630	800
	LTE	3 x 1	2 x 60	1185	1270
BTS3900L (Ver.B) (-48 V)	GSM	3 x 2	20	645	755
		3 x 4	20	835	1155
		3 x 6	12	735	1050
	UMTS	3 x 1	20	620	675
		3 x 2	20	655	825
	LTE	3 x 1	2 x 60	1210	1295

Table 10-54 Power consumption (MRFU V2 operating in the 1800 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900 (Ver.B) (-48 V)	GSM	3 x 2	20	640	750
		3 x 4	20	820	1140
		3 x 6	12	685	1100

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
	LTE	3 x 1	2 x 60	1230	1355
BTS3900A (Ver.B) (AC)	GSM	3 x 2	20	640	750
		3 x 4	20	820	1140
		3 x 6	12	685	1100
	LTE	3 x 1	2 x 60	1230	1355
BTS3900L (Ver.B) (-48 V)	GSM	3 x 2	20	645	755
		3 x 4	20	835	1155
		3 x 6	12	735	1050
	LTE	3 x 1	2 x 60	1210	1295

Engineering Specifications

Table 10-55 lists the equipment specifications of an MRFU.

Table 10-55 Equipment specifications of an MRFU

Type	Dimension (H x W x D)	Weight (kg)
MRFU V1, MRFU V2, and MRFU V2a	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-56 lists the surge protection specifications of ports on an MRFU.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-56 Surge protection specifications of ports on an MRFU

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-57 provides the antenna capability of an MRFU.

Table 10-57 Antenna capability of an MRFU

Type	TMA Support	Supported RET Antennas
MRFU V1	Supported	AISG2.0
MRFU V2 and MRFU V2a	Supported	AISG2.0

NOTE
For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.6 MRFUd Technical Specifications

Using the software-defined radio (SDR) technology, Multi-Mode Radio Frequency Unit Type D (MRFUd) modules can work in different modes with different configurations.

Supported Modes and Frequency Bands

Table 10-58 lists the modes and frequency bands supported by an MRFUd.

Table 10-58 Modes and frequency bands supported by an MRFUd

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
MRFUd	GSM UMTS LTE GU GL	900	890 to 915	935 to 960
			880 to 915	925 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-59 lists radio frequency (RF) specifications of an MRFUd.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The MRFUd that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The MRFUd that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-59 RF specifications of an MRFUd

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
MRFUd	2T2R	GSM: 8 carriers UMTS: ● Without MIMO: 6 carriers ● With MIMO: 4 carriers LTE: 2 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM: ● 900 MHz: -113.7 ● 1800 MHz: -114 UMTS (900/1800 MHz): -125.8 LTE (900/1800 MHz): -105.8	GSM: ● 900 MHz: -116.5 ● 1800 MHz: -116.8 UMTS (900/1800 MHz): -128.6 LTE (900/1800 MHz): -108.6	GSM: ● 900 MHz: -119.2 (theoretical value) ● 1800 MHz: -119.5 (theoretical value) UMTS (900/1800 MHz): -131.3 LTE (900/1800 MHz): -111.3	**Output power of MRFUd (900/1800 MHz, single-mode)** **Output power of MRFUd (900/1800 MHz, GU non-MSR)** **Output power of MRFUd (900/1800 MHz, GU MSR)** **Output power of MRFUd (900/1800 MHz, GL MSR)**	**Power consumption (MRFUd operating in the 900 MHz frequency band configured)** **Power consumption (MRFUd operating in the 1800 MHz frequency band configured)**

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an MRFUd is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an MRFUd is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-60 Output power of MRFUd (900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	80	80	0	0
	2	0	0	80	80	0	0
	3	0	0	40	40	0	0
	4	0	0	40	40	0	0
	5	0	0	27	30	0	0
	6	0	0	27	30	0	0
	7	0	0	20	27	0	0
	8	0	0	20	27	0	0
UMTS	0	1	0	0	0	80	0
	0	2	0	0	0	80	0
	0	3	0	0	0	40	0
	0	4	0	0	0	40	0
	0	5	0	0	0	25	0
	0	6	0	0	0	25	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	1 (MIMO)	0	0	0	2 x 40	0
	0	2 (MIMO)	0	0	0	2 x 40	0
	0	3 (MIMO)	0	0	0	2 x 25	0
	0	4 (MIMO)	0	0	0	2 x 20	0
LTE	0	0	1	0	0	0	5/10/15/20 MHz: 2 x 60 1.4/3 MHz: 2 x 40
	0	0	2	0	0	0	2 x 40

Table 10-61 Output power of MRFUd (900/1800 MHz, GU non-MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	80	80
	2	1	40	80
	3	1	27	80
	4	1	20	80
	5	1	16	80
	6	1	12	80
	1	2	80	40
	2	2	40	40
	3	2	27	40
	4	2	20	40
	5	2	16	40
	6	2	12	40
	1	3	80	25

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2	3	40	25
	3	3	27	25
	4	3	20	25
	5	3	16	25
	1	4	80	20
	2	4	40	20
	3	4	27	20
	4	4	20	20

NOTE

* indicates that the configuration is supported only when the MRFUd operates in the 900 MHz frequency band and that the configuration applies only to SRAN7.0.

Table 10-62 Output power of MRFUd (900/1800 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1*	1*	30*	50*
	2*	1*	30*	50*
	2	1	40	40
	3	1	40	40
	4	1	27	40
	5	1	27	20
	5	1	25	30
	5	1	20	40
	6	1	20	40
	7	1	20	20
	7	1	16	30
	1*	2*	30*	50*
	1	2	40	40

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2*	2*	30*	50*
	2	2	40	40
	3	2	30	20
	3	2	25	30
	3	2	20	40
	4	2	30	20
	4	2	25	30
	4	2	20	40
	5	2	20	20
	6	2	20	20
	1	1 (MIMO)	40	2 x 40
	1*	1 (MIMO)*	30*	2 x 50*
	2	1 (MIMO)	40	2 x 40
	2*	1 (MIMO)*	30*	2 x 50*
	3	1 (MIMO)	20	2 x 40
	3	1 (MIMO)	25	2 x 30
	4	1 (MIMO)	20	2 x 40
	4	1 (MIMO)	25	2 x 30
	4	1 (MIMO)	30	2 x 20
	1	2 (MIMO)	20	2 x 30
	1	2 (MIMO)	40	2 x 20
	2	2 (MIMO)	20	2 x 30
	2	2 (MIMO)	40	2 x 20
	3	2 (MIMO)	15	2 x 20
	4	2 (MIMO)	15	2 x 20

NOTE

** indicates that the configuration is supported only when the MRFUd operates in the 1800 MHz frequency band and that the configuration applies only to SRAN7.0.

Table 10-63 Output power of MRFUd (900/1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1 (MIMO)	40	2 x 40
	1**	1 (MIMO)**	30**	2 x 50**
	2	1 (MIMO)	40	2 x 40
	2**	1 (MIMO)**	30**	2 x 50**
	3	1 (MIMO)	30	2 x 20
	3	1 (MIMO)	25	2 x 30
	3	1 (MIMO)	20	2 x 40
	4	1 (MIMO)	20	2 x 40
	4	1 (MIMO)	25	2 x 30
	4	1 (MIMO)	30	2 x 20
	5	1 (MIMO)	16	2 x 30
	5	1 (MIMO)	20	2 x 20
	6	1 (MIMO)	15	2 x 20

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.
- LTE typical power consumption is measured when the base station load reaches 50% and LTE maximum power consumption is measured when the base station load reaches 100%.
- LTE power consumption is calculated based on the 2x2 MIMO configuration. The LTE bandwidth is 10 MHz.

Table 10-64 Power consumption (MRFUd operating in the 900 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900	GSM	3 x 2	20	620	715
		3 x 4	20	720	1040

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
(Ver.C) (-48 V)		3 x 6	20	1000	1505
		3 x 8	20	1095	1825
	UMTS	3 x 1	20	510	570
		3 x 2	20	585	750
	LTE	3 x 10 MHz	40	945	1245
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	785	965
		GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	835	1160
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	1065	1425
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1260	1635
		GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1320	1815
		GSM 3 x 4 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1380	1995
BTS3900L (Ver.C) (-48 V)	GSM	3 x 2	20	650	755
		3 x 4	20	800	1145
		3 x 6	20	1025	1610
		3 x 8	20	1130	1910
	UMTS	3 x 1	20	540	600
		3 x 2	20	615	780
	LTE	3 x 10 MHz	40	975	1275
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	850	1045

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
		GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	895	1195
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	1075	1480
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1290	1665
		GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1350	1845
		GSM 3 x 4 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1410	2025
BTS3900A (Ver.C) (-48 V)	GSM	3 x 2	20	650	755
		3 x 4	20	800	1145
		3 x 6	20	1025	1610
		3 x 8	20	1130	1910
	UMTS	3 x 1	20	540	600
		3 x 2	20	615	780
	LTE	3 x 10 MHz	40	975	1275
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	850	1045
		GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	895	1195
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	1075	1480
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1290	1665
		GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1350	1845

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
		GSM 3 x 4 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1410	2025

Table 10-65 Power consumption (MRFUd operating in the 1800 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900 (Ver.C) (-48 V)	GSM	3 x 2	20	635	730
		3 x 4	20	735	1060
		3 x 6	20	1030	1540
		3 x 8	20	1130	1860
	UMTS	3 x 1	20	510	585
		3 x 2	20	600	795
	LTE	3 x 10 MHz	40	960	1275
	GU	GSM 3 x 2 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	800	985
		GSM 3 x 3 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	850	1180
		GSM 3 x 4 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1090	1455
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1365	1755
		GSM 3 x 3 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1410	1920
		GSM 3 x 4 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1425	2070

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900L (Ver.C) (-48 V)	GSM	3 x 2	20	650	770
		3 x 4	20	800	1160
		3 x 6	20	1115	1640
		3 x 8	20	1145	1985
	UMTS	3 x 1	20	540	615
		3 x 2	20	630	825
	LTE	3 x 10 MHz	40	990	1305
	GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	865	1060
		GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	910	1225
		GSM 3 x 4 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	1075	1480
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1395	1785
		GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1440	1950
		GSM 3 x 4 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	1455	2100
BTS3900A (Ver.C) (-48 V)	GSM	3 x 2	20	650	770
		3 x 4	20	800	1160
		3 x 6	20	1115	1640
		3 x 8	20	1145	1985
	UMTS	3 x 1	20	540	615
		3 x 2	20	630	825
	LTE	3 x 10MHz	40	990	1305

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
	GU	GSM 3 x 2 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	865	1060
		GSM 3 x 3 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	910	1225
		GSM 3 x 4 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1075	1480
	GL	GSM 3 x 2 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1395	1785
		GSM 3 x 3 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1440	1950
		GSM 3 x 4 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1455	2100

Engineering Specifications

Table 10-66 lists the equipment specifications of an MRFUd.

Table 10-66 Equipment specifications of an MRFUd

Type	Dimension (H x W x D)	Weight (kg)
MRFUd	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-67 lists the surge protection specifications of ports on an MRFUd.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 µs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-67 Surge protection specifications of ports on an MRFUd

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-68 provides the antenna capability of an MRFUd.

Table 10-68 Antenna capability of an MRFUd

Type	TMA Support	Supported RET Antennas
MRFUd	Supported	AISG2.0

NOTE
For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.7 MRFUe Technical Specifications

Using the software-defined radio (SDR) technology, Multi-Mode Radio Frequency Unit Type E (MRFUe) modules can work in different modes with different configurations.

Supported Modes and Frequency Bands

Table 10-69 lists the modes and frequency bands supported by an MRFUe.

Table 10-69 Modes and frequency bands supported by an MRFUe

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
MRFUe	GSM UMTS LTE GU GL	900	880 to 915	925 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-70 lists radio frequency (RF) specifications of an MRFUe.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The MRFUe that works in GSM mode and operates in the 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The MRFUe that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard.
- **AB MSR** indicates that A and B are configured over the same transmit channel.

Table 10-70 RF specifications of an MRFUe

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
MRFUe	1T2R	GSM: 8 carriers UMTS: 4 carriers LTE: 2 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM ● 900 MHz: -113.7 ● 1800 MHz: -114 UMTS (900/1800 MHz): -125.8 LTE (900/1800 MHz): -105.8	GSM ● 900 MHz: -116.5 ● 1800 MHz: -116.8 UMTS (900/1800 MHz): -128.6 LTE (900/1800 MHz): -108.6	GSM ● 900 MHz: -119.2 (theoretical value) ● 1800 MHz: -119.5 (theoretical value) UMTS (900/1800 MHz): -131.3 LTE (900/1800 MHz): -111.3	**Output power of MRFUe (900/1800 MHz, single-mode)** **Output power of MRFUe (900/1800 MHz, GU MSR)** **Output power of MRFUe (900/1800 MHz, GL MSR)**	**Power consumption (MRFUe operating in the 1800 MHz frequency band configured)**

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an MRFUe is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an MRFUe is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-71 Output power of MRFUe (900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	80 (SRAN6.0)	80	0	0
	1	0	0	125 (SRAN7.0, 900 MHz)	125	0	0
	2	0	0	60	60	0	0
	3	0	0	40	50	0	0
	4	0	0	30	40	0	0
	5	0	0	25	30	0	0
	6	0	0	20	30	0	0
	7	0	0	15	20	0	0
	8	0	0	10	16	0	0
UMTS	0	1	0	0	0	80	0
	0	2	0	0	0	60	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	3	0	0	0	40	0
	0	4	0	0	0	30	0
LTE	0	0	1	0	0	0	5/10/15/20 MHz: 1 x 60 1.4/3 MHz: 1 x 40
	0	0	2	0	0	0	5/10/15/20 MHz: 1 x 60 1.4/3 MHz: 1 x 40

Table 10-72 Output power of MRFUe (900/1800 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	2	1	40	40
	3	1	25	30
	4	1	24	20
	4	1	20	30
	5	1	18	20
	5	1	16	30
	6	1	13	20
	7	1	10	20
	1	2	40	40
	2	2	20	30
	3	2	20	20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	3	2	15	30
	4	2	18	20
	5	2	12	20

Table 10-73 Output power of MRFUe (900/1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1 (MIMO)	60	5/10/15/20 MHz: 60 1.4/3 MHz: 40
	2	1 (MIMO)	40	40
	3	1 (MIMO)	25	30
	3	1 (MIMO)	20	40
	4	1 (MIMO)	24	20
	4	1 (MIMO)	20	30
	5	1 (MIMO)	20	5/10MHz: 20
	5	1 (MIMO)	16	5/10MHz: 30
	6	1 (MIMO)	13	20
	7	1 (MIMO)	10	20

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.

Table 10-74 Power consumption (MRFUe operating in the 1800 MHz frequency band configured)

Cabinet	Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
BTS3900 (Ver.C) (-48 V)	GSM	3 x 9	20	1715	2750
		3 x 10	20	1880	3035
		3 x 11	20	2000	3230
		3 x 12	20	2120	3425
BTS3900L (Ver.C) (-48 V)	GSM	3 x 9	20	1745	2780
		3 x 10	20	1910	3065
		3 x 11	20	2030	3260
		3 x 12	20	2150	3455
BTS3900A (Ver.C) (-48 V)	GSM	3 x 9	20	1745	2780
		3 x 10	20	1910	3065
		3 x 11	20	2030	3260
		3 x 12	20	2150	3455

Engineering Specifications

Table 10-75 lists the equipment specifications of an MRFUe.

Table 10-75 Equipment specifications of an MRFUe

Type	Dimension (H x W x D)	Weight (kg)
MRFUe	9 U x 14 HP x 308.5 mm (with the panel)	≤12

Table 10-76 lists the surge protection specifications of ports on an MRFUe.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 µs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-76 Surge protection specifications of ports on an MRFUe

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-77 provides the antenna capability of an MRFUe.

Table 10-77 Antenna capability of an MRFUe

Type	TMA Support	Supported RET Antennas
MRFUe	Supported	AISG2.0

NOTE

For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.8 CRFUd Technical Specifications

An CDMA radio frequency unit type D(CRFUd) works in frequency division duplex (FDD) mode.

Supported Modes and Frequency Bands

Table 10-78 lists the modes and frequency bands supported by an CRFUd.

Table 10-78 Modes and frequency bands supported by an CRFUd

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
CRFUd	LTE	AWS (band 4)	1710 to 1755	2110 to 2155

RF Specifications

Table 10-79 lists radio frequency (RF) specifications of an CRFUd.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-79 RF specifications of an CRFUd

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
CRFUd	2T2R	Two carriers. The bandwidth per carrier is 1.4, 3, 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 40 MHz.	-106.2	-109.0	2 x 60	480

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-80 describes the equipment specifications of the CRFUd.

Table 10-80 Equipment specifications of an CRFUd

Type	Dimensions (H x W x D)	Weight (kg)
CRFUd	9 U x 14 HP x 308.5 mm (with the panel)	12

Table 10-81 lists the surge protection specifications of ports on an CRFUd.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 µs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-81 Surge protection specifications of ports on an CRFUd

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Monitoring port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-82 provides antenna capability of an CRFUd.

Table 10-82 Antenna capability of an CRFUd

Type	TMA Support	Supported RET Antennas
CRFUd	Supported	AISG2.0

NOTE
For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.9 LRFU Technical Specifications

An LTE radio frequency unit (LRFU) works in frequency division duplex (FDD) mode.

Supported Modes and Frequency Bands

Table 10-83 lists the modes and frequency bands supported by an LRFU.

Table 10-83 Modes and frequency bands supported by an LRFU

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
LRFU	LTE	2600 (band 7)	Band C: 2500 to 2520	Band C: 2620 to 2640
			Band D: 2510 to 2560	Band D: 2630 to 2680
			Band E: 2550 to 2570	Band E: 2670 to 2690
		AWS (band 4)	1710 to 1755	2110 to 2155

RF Specifications

Table 10-84 lists radio frequency (RF) specifications of an LRFU.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-84 RF specifications of an LRFU

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
LRFU	2T2R	One carrier with a bandwidth of 5, 10, 15, or 20 MHz in the 2600 MHz band	• 2600: -105.8 • AWS: -106.1	• 2600: -108.6 • AWS: -108.9	2 x 40	• 2600: 350 • AWS: 370

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-85 describes the equipment specifications of the LRFU.

Table 10-85 Equipment specifications of an LRFU

Type	Dimensions (H x W x D)	Weight (kg)
LRFU	9 U x 14 HP x 308.5 mm (with the panel)	12

Table 10-86 lists the surge protection specifications of ports on an LRFU.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-86 Surge protection specifications of ports on an LRFU

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Monitoring port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-87 provides antenna capability of an LRFU.

Table 10-87 Antenna capability of an LRFU

Type	TMA Support	Supported RET Antennas
LRFU	Supported	AISG2.0

NOTE

For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.2.10 LRFUe Technical Specifications

An LTE radio frequency unit type E (LRFUe) works in frequency division duplex (FDD) mode.

Supported Modes and Frequency Bands

Table 10-88 lists the modes and frequency bands supported by an LRFUe.

Table 10-88 Modes and frequency bands supported by an LRFUe

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
LRFUe	LTE	DD 800 (band 20)	832 to 862	791 to 821

RF Specifications

Table 10-89 lists radio frequency (RF) specifications of an LRFUe.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-89 RF specifications of an LRFUe

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
LRFUe	2T2R	Two carriers. The bandwidth per carrier is 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 30 MHz.	-106.3	-109.1	2 x 60	440

NOTE
"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-90 describes the equipment specifications of the LRFUe.

Table 10-90 Equipment specifications of an LRFUe

Type	Dimensions (H x W x D)	Weight (kg)
LRFUe	9 U x 14 HP x 308.5 mm (with the panel)	12

Table 10-91 lists the surge protection specifications of ports on an LRFUe.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-91 Surge protection specifications of ports on an LRFUe

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Monitoring port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-92 provides antenna capability of an LRFUe.

Table 10-92 Antenna capability of an LRFUe

Type	TMA Support	Supported RET Antennas
LRFUe	Supported	AISG2.0

NOTE

For RFUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3 Technical Specifications of RRUs

This section provides technical specifications of RRUs, including supported modes, frequency bands, RF specifications, engineering specifications, and antenna capabilities.

10.3.1 RRU3004 Technical Specifications

The RRU3004 is a double-transceiver Remote Radio Unit.

Supported Modes and Frequency Bands

Table 10-93 shows the modes and frequency bands supported by an RRU3004.

Table 10-93 Modes and frequency bands supported by an RRU3004

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3004	GSM	900 EGSM	880 to 915	925 to 960
		900 PGSM	890 to 915	935 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-94 shows RF specifications of an RRU3004.

Table 10-94 RF specifications of an RRU3004

Type	RX and TX Channels	Capacity	Receiver Sensitivity (dBm)		Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas		
RRU3004	2T2R	2 carriers	-113	-116	RRU3004 (900 MHz) output power RRU3004 (1800 MHz) output power	Power consumption (RRU3004 operating in 900 MHz configured) Power consumption (RRU3004 operating in 1800 MHz configured)

Table 10-95 RRU3004 (900 MHz) output power

Number of Carriers	BCCH Carrier Output Power (900 MHz)
1	30 W (GMSK)/20 W (8PSK)
2	30 W (GMSK)/20 W (8PSK)
3	15 W (GMSK)/10 W (8PSK)
4	15 W (GMSK)/10 W (8PSK)
1 (PBT)	40 W (GMSK)/26 W (8PSK)

Table 10-96 RRU3004 (1800 MHz) output power

Number of Carriers	BCCH Carrier Output Power (1800 MHz)
1	20 W (GMSK)/13 W (8PSK)

Number of Carriers	BCCH Carrier Output Power (1800 MHz)
2	20 W (GMSK)/13 W (8PSK)
3	10 W (GMSK)/6.6 W (8PSK)
4	10 W (GMSK)/6.6 W (8PSK)
1 (PBT)	30 W (GMSK)/20 W (8PSK)

Table 10-97 Power consumption (RRU3004 operating in 900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
DBS3900	S2/2/2, TOC = 30 W	480	700

Table 10-98 Power consumption (RRU3004 operating in 1800 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
DBS3900	S2/2/2, TOC = 20 W	480	720

NOTE

- The typical and maximum power consumption in the preceding table refers to the power consumption at the temperature of 25°C.
- The typical power consumption is reached when the RRU3008 works with 30% load.
- TOC in the preceding tables refers to the cabinet-top power of GBTSs for which duplex ports are configured.
- The preceding table uses the power consumption of DBS3900 -48 V DC as an example.

Engineering Specifications

Table 10-99 shows equipment specifications of an RRU3004.

Table 10-99 Equipment specifications of an RRU3004

Type	Input Power Specifications	Dimensions (H x W x D)	Weight (kg)
RRU3004	-48 V DC, voltage range: -57 V DC to -36 V DC	485 mm x 380 mm x 130 mm (with the housing)	17 (with the housing)

Table 10-100 shows environmental specifications of an RRU3004.

Table 10-100 Environmental specifications of an RRU3004

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3004	-40°C to +50°C (without solar radiation) -40°C to +45°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-101 shows compliance standards of an RRU3004.

Table 10-101 Compliance standards of an RRU3004

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3004	Standards ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-102 lists the surge protection specifications of ports on an RRU3004.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-102 Surge protection specifications of ports on an RRU3004

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specifications
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Applicable to scenarios where GRFUs are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to scenarios where GRFUs are installed outdoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Ports for cascading RF modules	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
AISG RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	250 A

Port	Usage Scenario	Surge Protection Mode		Specifications
			Common mode	250 A
I2C port on a local power monitoring device and an alarm port	Applicable to the scenario where batteries under monitoring and RRUs are installed back to back or the scenario where the distance between them is within 1 m.	Surge		250 A

Antenna Capability

Table 10-103 shows antenna capability of an RRU3004.

Table 10-103 Antenna capability of an RRU3004

Type	TMA Support	RET Antenna Support
RRU3004	Not supported	AISG1.1

NOTE

- An external bridge tap (BT) is required if an RRU3004 needs to be configured with a tower-mounted amplifier (TMA).
- For RRUs supporting RET antennas, the feed voltage is 12 V and feed current is 2.3 A.

10.3.2 RRU3008 Technical Specifications

The RRU3008 is a multi-carrier Remote Radio Unit (RRU) applicable to the GSM network. It is usually used in scenarios requiring large capacity. One RRU3008 supports a maximum of eight carriers.

Supported Modes and Frequency Bands

Table 10-104 shows the modes and frequency bands supported by an RRU3008.

Table 10-104 Modes and frequency bands supported by an RRU3008

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3008 V1	GSM	850	824 to 849	869 to 894
		1800	1710 to 1755	1805 to 1850
			1740 to 1785	1835 to 1880
		1900	1850 to 1890	1930 to 1970
			1870 to 1910	1950 to 1990
RRU3008 V2	GSM	900 EGSM	880 to 915	925 to 960
		900 PGSM	890 to 915	935 to 960
		900 CMCC	885 to 910	930 to 955

RF Specifications

Table 10-105 shows RF specifications of an RRU3008.

Table 10-105 RF specifications of an RRU3008

Type	RX and TX Channels	Capacity	Receiver Sensitivity (dBm)		Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas		
RRU3008 V1	2T2R	8 carriers	-113	-116	**RRU3008 V1 (900/850/1800/1900 MHz) output power**	**Power consumption (RRU3008 V1 operating in 900/1800 MHz configured)** **Power consumption (RRU3008 V1 operating in 850/1900 MHz configured)**
RRU3008 V2			• 900 MHz EGSM: -113.3 • 900 MHz PGSM/ 900 MHz CMCC: -113.5	• 900 MHz EGSM: -116.3 • 900 MHz PGSM/ 900 MHz CMCC: -116.5	**RRU3008 V2 (900 MHz) output power**	**Power consumption (RRU3008 V2 operating in 900 MHz configured)**

Table 10-106 RRU3008 V1 (900/850/1800/1900 MHz) output power

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
1	40 W (GMSK)/26 W (8PSK)	40 W (GMSK)/26 W (8PSK)

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
2	40 W (GMSK)/26 W (8PSK)	40 W (GMSK)/26 W (8PSK)
3	20 W (GMSK)/13 W (8PSK)	20 W (GMSK)/13 W (8PSK)
4	15 W (GMSK)/10 W (8PSK)	20 W (GMSK)/13 W (8PSK)
5	12 W (GMSK)/8.0 W (8PSK)	12 W (GMSK)/8.0 W (8PSK)
6	10 W (GMSK)/6.6 W (8PSK)	12 W (GMSK)/8.0 W (8PSK)
7	7.0 W (GMSK)/4.6 W (8PSK)	8.0 W (GMSK)/5.3 W (8PSK)
8	5.5 W (GMSK)/3.6 W (8PSK)	7.0 W (GMSK)/4.6 W (8PSK)

Table 10-107 RRU3008 V2 (900 MHz) output power

Number of Carriers	BCCH Carrier Output Power (Power Sharing Disabled)	BCCH Carrier Output Power (Power Sharing Enabled)
1	40 W (GMSK)/40 W (8PSK)	40 W (GMSK)/40 W (8PSK)
2	40 W (GMSK)/40 W (8PSK)	40 W (GMSK)/40 W (8PSK)
3	20 W (GMSK)/20 W (8PSK)	20 W (GMSK)/20 W (8PSK)
4	20 W (GMSK)/20 W (8PSK)	20 W (GMSK)/20 W (8PSK)
5	13 W (GMSK)/13 W (8PSK)	15 W (GMSK)/15 W (8PSK)
6	13 W (GMSK)/13 W (8PSK)	15 W (GMSK)/15 W (8PSK)
7	10 W (GMSK)/10 W (8PSK)	13 W (GMSK)/13 W (8PSK)
8	10 W (GMSK)/10 W (8PSK)	13 W (GMSK)/13 W (8PSK)

NOTE

- After design optimization, RRU3008 modules with the configuration of S1 to S6 have the same output power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme.
- With the GBFD-118104 Enhanced EDGE Coverage feature, RRU3008 modules with the configuration of S7 to S8 can also have the same output power no matter they use the GMSK or 8PSK modulation scheme.
- RF standard: EN 301 502 V9.2.1.

Table 10-108 Power consumption (RRU3008 V1 operating in 900/1800 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
DBS3900	S4/4/4, TOC = 20 W	720	1260
	S6/6/6, TOC = 12 W	640	1180

Table 10-109 Power consumption (RRU3008 V1 operating in 850/1900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
DBS3900	S4/4/4, TOC = 20 W	700	1220
	S6/6/6, TOC = 12 W	620	1130

Table 10-110 Power consumption (RRU3008 V2 operating in 900 MHz configured)

Cabinet	Configuration	Typical Power Consumption (W)	Maximum Power Consumption (W)
DBS3900	S4/4/4, TOC = 20 W	640	1130
	S6/6/6, TOC = 15 W	630	1270

NOTE

- TOC in the preceding tables refers to the cabinet-top power of GBTSs for which duplex ports are configured.
- The typical power consumption is reached when the RRU3008 works with 30% load.

Engineering Specifications

Table 10-111 shows equipment specifications of an RRU3008.

Table 10-111 Equipment specifications

Type	Input Power Specifications	Dimensions (H x W x D)	Weight (kg)
RRU3008	-48 V DC, voltage range: -57 V DC to -36 V DC	485 mm x 380 mm x 170 mm (with the housing)	23 (with the housing)

Table 10-112 shows environmental specifications of an RRU3008.

Table 10-112 Environmental specifications of an RRU3008

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3008 V1	● -40°C to +50°C (without solar radiation) ● -40°C to +45°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa
RRU3008 V2	● -40°C to +55°C (without solar radiation) ● -40°C to +50°C (with solar radiation)			

Table 10-113 shows compliance standards of an RRU3008.

Table 10-113 Compliance standards of an RRU3008

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3008	Standards ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-114 and **Table 10-115** list the surge protection specifications of ports on an RRU3008.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-114 Surge protection specifications of V1 ports on an RRU3008

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Applicable to scenarios where GRFUs are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the	Surge	Differential mode	2 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specifications
	scenario where RRU3008 V2 modules are configured remotely or placed outdoors		Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Ports for cascading RF modules	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
AISG RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	250 A
			Common mode	250 A

Port	Usage Scenario	Surge Protection Mode	Specifications
I2C port on a local power monitoring device and an alarm port	Applicable to the scenario where batteries under monitoring and RRUs are installed back to back or the scenario where the distance between them is within 1 m.	Surge	250 A

Table 10-115 Surge protection specifications of V2 ports on an RRU3008

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Applicable to scenarios where GRFUs are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to scenarios where	Surge	Differential mode	2 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specifications
	GRFUs are installed outdoors		Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Ports for cascading RF modules	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Port	Usage Scenario	Surge Protection Mode	Specifications
I2C port on a local power monitoring device and an alarm port	Applicable to the scenario where batteries under monitoring and RRUs are installed back to back or the scenario where the distance between them is within 1 m.	Surge	250 A

Antenna Capability

Table 10-116 shows antenna capability of an RRU3008.

Table 10-116 Antenna capability of an RRU3008

Type	TMA Support	RET Antenna Support
RRU3008	Supported	AISG2.0 supported

NOTE

For RRUs supporting RET antennas, the feed voltage is 12 V and feed current is 2.3 A.

10.3.3 RRU3804 Technical Specifications

An RRU3804, which is a remote radio unit for UMTS, supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-117 lists the modes and frequency bands supported by an RRU3804.

Table 10-117 Modes and frequency bands supported by an RRU3804

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3804 (DC)	UMTS	2100	1920 to 1980	2110 to 2170

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
		1900	1850 to 1910	1930 to 1990
		AWS	1710 to 1755	2110 to 2155
		850	824 to 849	869 to 894
			835 to 849	880 to 894
RRU3804 (AC)		2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-118 lists radio frequency (RF) specifications of an RRU3804.

Table 10-118 RRU3804 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3804	1T2R	4 carriers	-125.8* (2100 MHz or AWS)	-128.6* (2100 MHz or AWS)	-131.3* (2100 MHz or AWS)	**RRU3804 output power**	**Power consumption of DBS3900 with RRU3804 (DC)** **Power consumption of DBS3900 with RRU3804 (AC)** **Power consumption of BTS3900C with RRU3804 (DC)**
			-125.3* (1900 MHz)	-128.1* (1900 MHz)	-130.8* (1900 MHz)		
			-125.6* (850 MHz**)	-128.4* (850 MHz**)	-131.1* (850 MHz**)		

NOTE

- *The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and that the bit error rate (BER) does not exceed 0.001.
- **The receiver sensitivity on the 850 MHz band is measured on its subbands.

The RRU3804 supports a maximum of four carriers. The maximum output power is 60 W.

Table 10-119 RRU3804 output power

Number of Carriers	Maximum Output Power per Carrier (W)
1	60
2	30
3	20
4	15

NOTE

Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.

Table 10-120 Power consumption of DBS3900 with RRU3804 (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)		
				24 Ah	50 Ah	92 Ah
3 x 1	20	390	480	2.4	5.7	11.3
3 x 2	20	480	650	1.7	4.3	9.0
3 x 3	20	630	860	1.2	3.1	6.7
3 x 4	15	630	860	1.2	3.1	6.7

Table 10-121 Power consumption of DBS3900 with RRU3804 (AC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
3 x 1	20	435	540
3 x 2	20	555	740
3 x 3	20	720	980

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
3 x 4	15	720	980

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 4 configuration, antenna port output power per carrier is 15 W in the calculation of typical and maximum power consumption values.
- In 3 x 1 or 3 x 2 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPb4 boards and one WMPT board are configured.

Table 10-122 Power consumption of BTS3900C with RRU3804 (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
1 x 1	20	190	240
1 x 2	20	220	290
1 x 3	20	260	350

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- One WBBPb4 board and one WMPT board are configured.

Engineering Specifications

Table 10-123 lists the equipment specifications of an RRU3804.

Table 10-123 Equipment specifications of an RRU3804

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3804 (DC)	• -48 V DC; voltage range: -57 V DC to -36 V DC	• 480 mm x 270 mm x 140 mm (without the housing and connectors) • 485 mm x 285 mm x 170 mm (with the housing)	• 15 kg (without the housing) • 17 kg (with the housing)
RRU3804 (AC)	• 200 V AC to 240 V AC single-phase; voltage range: 176 V AC to 290 V AC • 100 V AC to 120 V AC or 200 V AC to 240 V AC dual-phase; voltage range: 90 V AC to 135 V AC or 180 V AC to 270 V AC	• 480 mm x 270 mm x 220 mm (without the housing and connectors) • 485 mm x 285 mm x 250 mm (with the housing)	• 20.5 kg (without the housing) • 22.5 kg (with the housing)

Table 10-124 lists the environmental specifications of an RRU3804.

Table 10-124 Environmental specifications of an RRU3804

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3804 (DC)	• -40°C to +50°C (with 1120 W/m^2 solar radiation) • -40°C to +55°C (without solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa
RRU3804 (AC)				

Table 10-125 lists the compliance standards for an RRU3804.

Table 10-125 Compliance standards for an RRU3804

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3804 (DC)	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65
RRU3804 (AC)			IP55

Table 10-126 lists the surge protection specifications of ports on an RRU3804.

Table 10-126 Surge protection specifications of ports on an RRU3804

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Indoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Outdoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-127 lists the antenna capability of an RRU3804.

Table 10-127 Antenna capability of an RRU3804

Type	TMA Support	RET Antenna Support
RRU3804	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.4 RRU3805 Technical Specifications

An RRU3805, which is a remote radio unit for UMTS, supports a maximum of three carriers.

Supported Modes and Frequency Bands

Table 10-128 lists the modes and frequency bands supported by an RRU3805.

Table 10-128 Modes and frequency bands supported by an RRU3805

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3805	UMTS	1800	1749.9 to 1764.9	1844.9 to 1859.9
		1900	1850 to 1890	1930 to 1970
			1870 to 1910	1950 to 1990
		850	835 to 849	880 to 894

RF Specifications

Table 10-129 lists radio frequency (RF) specifications of an RRU3805.

Table 10-129 RRU3805 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3805	2T2R	3 carriers (1800 MHz)	-125.3 (1800 MHz)	-128.1 (1800 MHz)	-130.8 (1800 MHz)	**RRU3805 output power**	**DBS3900 power consumption (1800 MHz RRU3805 without MIMO)**

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
		2 carriers (1900 MHz or 850 MHz)	-125.2 (1900 MHz or 850 MHz)	-128.0 (1900 MHz or 850 MHz)	-130.7 (1900 MHz or 850 MHz)		**DBS3900 power consumption (1800 MHz RRU3805 with MIMO)** **DBS3900 power consumption (1900 MHz/ 850 MHz RRU3805 without MIMO)** **DBS3900 power consumption (1900 MHz/ 850 MHz RRU3805 with MIMO)**

NOTE

The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.

The RRU3805 (1800 MHz) supports a maximum of three carriers. The maximum output power is 2 x 60 W. The RRU3805 (1900 MHz or 850 MHz) supports a maximum of two carriers. The maximum output power is 2 x 30 W.

Table 10-130 RRU3805 output power

Type	Output Power
RRU3805 (1800 MHz)	The RRU3805(1800 MHz) supports a maximum of three carriers. The output power at its antenna port is 2 x 60 W. ● Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported. ● Single-output configuration: The maximum output power of each TX channel is 60 W. ● MIMO configuration: The maximum output power is 2 x 60 W. ● Combined configuration: The maximum output power of each TX channel is 60 W.
RRU3805 (1900 MHz or 850 MHz)	The RRU3805(1900 MHz or 850 MHz) supports a maximum of two carriers. The output power at its antenna port is 2 x 30 W. ● Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported. ● Single-output configuration: The maximum output power of each TX channel is 40 W. ● MIMO configuration: The maximum output power is 2 x 30 W. ● Combined configuration: The maximum output power of each TX channel is 30 W.

NOTE

Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.

Table 10-131 DBS3900 power consumption (1800 MHz RRU3805 without MIMO)

Configuration (Carrier x Sector)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
			50 Ah	92 Ah
3 x 1	540	630	3.3	6
3 x 2	805	1045	2	3.6
3 x 3	1000	1300	1.6	2.9

Table 10-132 DBS3900 power consumption (1800 MHz RRU3805 with MIMO)

Configuration (Carrier x Sector)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
			50 Ah	92 Ah
3 x 1	735	975	2.1	3.9
3 x 2	1045	1405	1.5	2.7

Table 10-133 DBS3900 power consumption (1900 MHz/850 MHz RRU3805 without MIMO)

Configuration (Carrier x Sector)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
			50 Ah	92 Ah
3 x 1	540	615	3.3	6.1
3 x 2	835	985	2.1	3.8

Table 10-134 DBS3900 power consumption (1900 MHz/850 MHz RRU3805 with MIMO)

Configuration (Carrier x Sector)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
			50 Ah	92 Ah
3 x 1	540	615	3.3	6.1

Configuration (Carrier x Sector)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
			50 Ah	92 Ah
3 x 2	835	985	2.1	3.8

Engineering Specifications

Table 10-135 lists the equipment specifications of an RRU3805.

Table 10-135 Equipment specifications of an RRU3805

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3805	-48 V DC; voltage range: -57 V DC to -36 V DC (1800 MHz)	• 485 mm x 356 mm x 140 mm (without the housing and connectors) • 485 mm x 380 mm x 170 mm (with the housing)	• 22 kg (without the housing) • 24 kg (with the housing)
	-48 V DC; voltage range: -57 V DC to -38.4 V DC (1900 MHz or 850 MHz)		

Table 10-136 lists the environmental specifications of an RRU3805.

Table 10-136 Environmental specifications of an RRU3805

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3805	• -40°C to +45°C (with 1120 W/m^2 solar radiation) • -40°C to +50°C (without solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-137 lists the compliance standards for an RRU3805.

Table 10-137 Compliance standards for an RRU3805

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3805	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Surge Protection Specifications

Table 10-138 lists the surge protection specifications of ports on an RRU3805.

Table 10-138 Surge protection specifications of ports on an RRU3805

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-139 lists the antenna capability of an RRU3805.

Table 10-139 Antenna capability of an RRU3805

Type	TMA Support	RET Antenna Support
RRU3805	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.5 RRU3806 Technical Specifications

An RRU3806, which is a remote radio unit for UMTS, supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-140 lists the modes and frequency bands supported by an RRU3806.

Table 10-140 Modes and frequency bands supported by an RRU3806

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3806	UMTS	2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-141 lists radio frequency (RF) specifications of an RRU3806.

Table 10-141 RRU3806 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3806	1T2R	4 carriers	-125.8	-128.6	-131.3	RRU3806 output power	Power consumption of DBS3900 with RRU3806 (DC) Power consumption of DBS3900 with RRU3806 (AC) Power consumption of BTS3900C with RRU3806 (DC)

NOTE

The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.

The RRU3806 supports a maximum of four carriers. The output power at its antenna port is 80 W.

Table 10-142 RRU3806 output power

Number of Carriers	Maximum Output Power per Carrier (W)
1	80
2	40
3	26
4	20

NOTE

Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.

Table 10-143 Power consumption of DBS3900 with RRU3806 (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	20	400	480	5.5	11
3 x 2	20	490	650	4.2	8.8
3 x 3	20	630	860	3.16	6.6
3 x 4	20	710	1030	2.8	5.7

Table 10-144 Power consumption of DBS3900 with RRU3806 (AC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
3 x 1	20	435	540
3 x 2	20	555	740
3 x 3	20	690	950
3 x 4	20	780	1130

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 or 3 x 2 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPb4 boards and one WMPT board are configured.

Table 10-145 Power consumption of BTS3900C with RRU3806 (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
1 x 1	20	190	240
1 x 2	20	220	290
1 x 3	20	260	350

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- One WBBPb4 board and one WMPT board are configured.

Engineering Specifications

Table 10-146 lists the equipment specifications of an RRU3806.

Table 10-146 Equipment specifications of an RRU3806

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3806 (DC)	• -48 V DC; voltage range: -57 V DC to -36 V DC	• 480 mm x 270 mm x 140 mm (without the housing and connectors) • 485 mm x 285 mm x 170 mm (with the housing)	• 15 kg (without the housing) • 17 kg (with the housing)

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3806 (AC)	• 200 V AC to 240 V AC single-phase; voltage range: 176 V AC to 290 V AC • 100 V AC to 120 V AC or 200 V AC to 240 V AC dual-phase; voltage range: 90 V AC to 135 V AC or 180 V AC to 270 V AC	• 480 mm x 270 mm x 220 mm (without the housing and connectors) • 485 mm x 285 mm x 250 mm (with the housing)	• 20.5 kg (without the housing) • 22.5 kg (with the housing)

Table 10-147 lists the environmental specifications of an RRU3806.

Table 10-147 Environmental specifications of an RRU3806

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3806 (DC) RRU3806 (AC)	• -40°C to +50°C (with 1120 W/m^2 solar radiation) • -40°C to +55°C (without solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-148 lists the compliance standards for an RRU3806.

Table 10-148 Compliance standards for an RRU3806

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3806 (DC)	Standards: • 3GPP TS25.141 V3.0.0 • ETSI EN 300019-1-4	NEBS GR63 zone4	IP65

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3806 (AC)	V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"		IP55

Table 10-149 lists the surge protection specifications of ports on an RRU3806.

Table 10-149 Surge protection specifications of ports on an RRU3806

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Indoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Outdoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-150 lists the antenna capability of an RRU3806.

Table 10-150 Antenna capability of an RRU3806

Type	TMA Support	RET Antenna Support
RRU3806	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.6 RRU3808 Technical Specifications

An RRU3808, which is a remote radio unit for UMTS, supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-151 lists the modes and frequency bands supported by an RRU3808.

Table 10-151 Modes and frequency bands supported by an RRU3808

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3808	UMTS LTE	2100	1920 to 1980	2110 to 2170
		AWS	1710 to 1755	2110 to 2155

RF Specifications

Table 10-152 lists radio frequency (RF) specifications of an RRU3808.

Table 10-152 RRU3808 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3808	2T2R	UMTS: 4 carriers LTE: 1 carrier with a bandwidth of: ● 1.4, 3, 5, 10, 15, or 20 MHz on the AWS band ● 5, 10, 15, or 20 MHz on the 2100 MHz band	UMTS: -125.8 LTE: -106.3	UMTS: -128.6 LTE: -109.1	UMTS: -131.3 LTE: N/A	**RRU3808 output power**	UMTS: ● **DBS3900 power consumption (2100 MHz RRU3808 without MIMO)** ● **DBS3900 power consumption (2100 MHz RRU3808 with MIMO)** ● **DBS3900 power consumption (AWS**

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
							RRU 3808 without MIMO) ● **DBS 3900 power consumption (AWS RRU 3808 with MIMO)** LTE: 320 W

NOTE

- The receiver sensitivity of UMTS is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-153 RRU3808 output power

Type	Mode	Output Power
RRU3808	UMTS	The RRU3808 supports a maximum of four carriers. The output power at its antenna port is 2 x 40 W. ● Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported. ● Single-output configuration: The maximum output power of each TX channel is 40 W. ● MIMO configuration: The maximum output power is 2 x 40 W. ● Combined configuration: The maximum output power of each TX channel is 40 W. ● Uneven power configuration is supported.
	LTE	2 x 40 W

NOTE

Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.

Table 10-154 DBS3900 power consumption (2100 MHz RRU3808 without MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	20	410	490	5.2	10.7
3 x 2	20	510	640	4	8.5
3 x 3	20	740	950	2.6	5.5

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 4	20	800	1060	2.4	4.9

NOTE

- In 3 x 1 or 3 x 2 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPb4 boards and one WMPT board are configured.

Table 10-155 DBS3900 power consumption (2100 MHz RRU3808 with MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	2 x 10	460	570	4.5	9.4
3 x 2	2 x 10	580	730	3.6	7.2
3 x 3	2 x 10	730	950	2.6	5.6
3 x 4	2 x 10	800	1060	2.4	4.9

NOTE

- In 3 x 1 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 2 configuration, two WBBPb4 boards and one WMPT board are configured.
- In 3 x 3 configuration, three WBBPb4 boards and one WMPT board are configured.
- In 3 x 4 configuration, four WBBPb4 boards and one WMPT board are configured.

Table 10-156 DBS3900 power consumption (AWS RRU3808 without MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	20	410	482	5.2	10.8

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 2	20	518	632	4	8.4
3 x 3	20	721	931	2.7	5.6
3 x 4	20	835	1051	2.3	4.7

NOTE

- In 3 x 1 or 3 x 2 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPb4 boards and one WMPT board are configured.

Table 10-157 DBS3900 power consumption (AWS RRU3808 with MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	2 x 10	470	572	4.4	9.2
3 x 2	2 x 10	628	766	3.2	6.7
3 x 3	2 x 10	774	975	2.5	5.1
3 x 4	2 x 10	890	1109	2.1	4.3

NOTE

- In 3 x 1 configuration, one WBBPb4 board and one WMPT board are configured.
- In 3 x 2 configuration, two WBBPb4 boards and one WMPT board are configured.
- In 3 x 3 configuration, three WBBPb4 boards and one WMPT board are configured.
- In 3 x 4 configuration, four WBBPb4 boards and one WMPT board are configured.

Equipment Specifications

Table 10-158 lists the equipment specifications of an RRU3808.

Table 10-158 Equipment specifications of an RRU3808

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3808	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 270 mm x 140 mm (without the housing and connectors) ● 485 mm x 285 mm x 170 mm (with the housing)	● 17 kg (without the housing) ● 19 kg (with the housing)

Table 10-159 lists the environmental specifications of an RRU3808.

Table 10-159 Environmental specifications of an RRU3808

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3808	● -40°C to +55°C (without solar radiation) ● -40°C to +50°C (with solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-160 lists the compliance standards for an RRU3808.

Table 10-160 Compliance standards for an RRU3808

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3808	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-161 lists the surge protection specifications of ports on an RRU3808.

Table 10-161 Surge protection specifications of ports on an RRU3808

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-162 lists the antenna capability of an RRU3808.

Table 10-162 Antenna capability of an RRU3808

Type	TMA Support	RET Antenna Support
RRU3808	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.7 RRU3828 Technical Specifications

An RRU3828, which is a remote radio unit for UMTS, supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-163 lists the modes and frequency bands supported by an RRU3828.

Table 10-163 Modes and frequency bands supported by an RRU3828

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3828	UMTS	2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-164 lists radio frequency (RF) specifications of an RRU3828.

Table 10-164 RRU3828 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3828	2T2R	● With MIMO: 4 carriers ● Without MIMO: 6 carriers	-126.1	-128.9	-131.6	**Output power of RRU3828 without MIMO** **Output power of RRU3828 with MIMO** **Output power of RRU3828 in combined configuration**	**DBS3900 power consumption (RRU3828 without MIMO)** **DBS3900 power consumption (RRU3828 with MIMO)**

NOTE

The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.

RRU3828s with MIMO and without MIMO support four carriers and six carriers, respectively. The output power at its antenna port is 2 x 40 W.

NOTE

- Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported.
- Uneven power configuration is supported.

Table 10-165 Output power of RRU3828 without MIMO

Number of Carriers Related to Power Amplifier 1	Number of Carriers Related to Power Amplifier 2	Output Power per Carrier (W)
1	0	40
2	0	20
3	0	13
4	0	10
1	1	40
2	2	20
3	3	13

Table 10-166 Output power of RRU3828 with MIMO

Number of MIMO Carriers	Output Power per Carrier (W)
1	2 x 40
2	2 x 40
3	2 x 13
4	2 x 10

Table 10-167 Carrier combinations supported by RRU3828 in hybrid configurations

Number of MIMO Carriers	Number of Single-Output Carriers
1	5
2	4
3	2

NOTE

In combined configuration, each TX channel of the RRU3828 supports a maximum of four carriers. The maximum output power is 40 W.

Table 10-168 DBS3900 power consumption (RRU3828 without MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	20	421	493	5.1	10.5
3 x 2	20	520	658	4	8.3
3 x 3	20	785	977	2.5	5
3 x 4	20	854	1109	2.2	4.5

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 or 3 x 2 configuration, one WBBPd2 board and one WMPT board are configured.
- In 3 x 3 or 3 x 4 configuration, two WBBPd2 boards and one WMPT board are configured.

Table 10-169 DBS3900 power consumption (RRU3828 with MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	2 x 10	535	604	3.9	8.1
3 x 2	2 x 10	689	824	2.9	5.9
3 x 3	2 x 10	864	1053	2.1	4.4
3 x 4	2 x 10	1011	1266	1.7	3.8

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 configuration, one WBBPd2 board and one WMPT board are configured.
- In 3 x 2 configuration, two WBBPd2 boards and one WMPT board are configured.
- In 3 x 3 configuration, three WBBPd2 boards and one WMPT board are configured.
- In 3 x 4 configuration, four WBBPd2 boards and one WMPT board are configured.

Engineering Specifications

Table 10-170 lists the equipment specifications of an RRU3828.

Table 10-170 Equipment specifications of an RRU3828

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3828	-48 V DC; voltage range: -57 V DC to -36 V DC	• 400 mm x 220 mm x 140 mm (without the housing and connectors) • 400 mm x 240 mm x 160 mm (with the housing)	• 14 kg (without the housing) • 15 kg (with the housing)

Table 10-171 lists the environmental specifications of an RRU3828.

Table 10-171 Environmental specifications of an RRU3828

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3828	• -40°C to +55°C (without solar radiation) • -40°C to +50°C (with solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-172 lists the compliance standards for an RRU3828.

Table 10-172 Compliance standards for an RRU3828

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3828	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-173 lists the surge protection specifications of ports on an RRU3828.

Table 10-173 Surge protection specifications of ports on an RRU3828

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-174 lists the antenna capability of an RRU3828.

Table 10-174 Antenna capability of an RRU3828

Type	TMA Support	RET Antenna Support
RRU3828	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.8 RRU3829 Technical Specifications

An RRU3829, which is a remote radio unit for UMTS, supports a maximum of four carriers.

Supported Modes and Frequency Bands

Table 10-175 lists the modes and frequency bands supported by an RRU3829.

Table 10-175 Modes and frequency bands supported by an RRU3829

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3829	UMTS	2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-176 lists radio frequency (RF) specifications of an RRU3829.

Table 10-176 RRU3829 RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3829	2T2R	• With MIMO: 4 carriers • Without MIMO: 6 carriers	-126.1	-128.9	-131.6	Output power of RRU3829 without MIMO Output power of RRU3829 with MIMO Output power of RRU3829 in combined configuration	DBS3900 power consumption (RRU3829 without MIMO) DBS3900 power consumption (RRU3829 with MIMO)

NOTE

The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.

RRU3829s with MIMO and without MIMO support four carriers and six carriers, respectively. The output power at its antenna port is 2 x 60 W.

NOTE

- Configurations of single-output, multiple-input multiple-output (MIMO), or combination of the two are supported.
- Uneven power configuration is supported.

Table 10-177 Output power of RRU3829 without MIMO

Number of Carriers Related to Power Amplifier 1	Number of Carriers Related to Power Amplifier 2	Output Power per Carrier (W)
1	0	60
2	0	30
3	0	20
4	0	15
1	1	60
2	2	30
3	3	20

Table 10-178 Output power of RRU3829 with MIMO

Number of MIMO Carriers	Output Power per Carrier (W)
1	50 + 50
2	30 + 30
3	20 + 20
4	15 + 15

Table 10-179 Carrier combinations supported by RRU3829 in hybrid configurations

Number of MIMO Carriers	Number of Single-Output Carriers
1	5
2	4
3	2

NOTE

In combined configuration, each TX channel of the RRU3828 supports a maximum of four carriers. The maximum output power is 60 W.

Table 10-180 DBS3900 power consumption (RRU3829 without MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 1	20	454	529	4.7	9.5
3 x 2	20	550	691	3.8	7.9

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 1 or 3 x 2 configuration, one WBBPd2 board and one WMPT board are configured.

Table 10-181 DBS3900 power consumption (RRU3829 with MIMO)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)	
				50 Ah	92 Ah
3 x 2	20 + 20	932	1214	2.0	4.1
3 x 3	20 + 20	1152	1557	1.5	3.2

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- In 3 x 2 configuration, two WBBPd2 boards and one WMPT board are configured.
- In 3 x 3 configuration, three WBBPd2 boards and one WMPT board are configured.

Equipment Specifications

Table 10-182 lists the equipment specifications of an RRU3829.

Table 10-182 Equipment specifications of an RRU3829

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3829	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 270 mm x 40 mm (without the housing and connectors) ● 485 mm x 300 mm x 170 mm (with the housing)	● 20 kg (without the housing) ● 22 kg (with the housing)

Table 10-183 lists the environmental specifications of an RRU3829.

Table 10-183 Environmental specifications of an RRU3829

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3829	● -40°C to +55°C (without solar radiation) ● -40°C to +50°C (with solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-184 lists the compliance standards for an RRU3829.

Table 10-184 Compliance standards for an RRU3829

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3829	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-185 lists the surge protection specifications of ports on an RRU3829.

Table 10-185 Surge protection specifications of ports on an RRU3829

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-186 lists the antenna capability of an RRU3829.

Table 10-186 Antenna capability of an RRU3829

Type	TMA Support	RET Antenna Support
RRU3829	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.9 RRU3801E Technical Specifications

An RRU3801E, which is a remote radio unit for UMTS, supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-187 lists the modes and frequency bands supported by an RRU3801E.

Table 10-187 Modes and frequency bands supported by an RRU3801E

Type	Mode	Frequency Band (MHz)	RX Frequency Band (MHz)	TX Frequency Band (MHz)
RRU3801E (DC)	UMTS	2100	1920 to 1980	2110 to 2170
		1900	1850 to 1910	1930 to 1990
		850	824 to 835	869 to 880
RRU3801E (AC)		2100	1920 to 1980	2110 to 2170

RF Specifications

Table 10-188 lists radio frequency (RF) specifications of an RRU3801E.

Table 10-188 RRU3801E RF specifications

Type	RX and TX Channel	Capacity	Receiver Sensitivity (dBm)			Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3801E	1T2R	2 carriers	-125.8 (2100 MHz)	-128.6 (2100 MHz)	-131.3 (2100 MHz)	RRU3801E output power	Power consumption of DBS3900 with RRU3801E (DC) Power consumption of DBS3900 with RRU3801E (AC) Power consumption of BTS3900C with RRU3801E (DC)
			-125.3 (1900 MHz)	-128.1 (1900 MHz)	-130.8 (1900 MHz)		
			-125.6 (850 MHz)	-128.4 (850 MHz)	-131.1 (850 MHz)		

NOTE

- The receiver sensitivity is measured, as recommended in 3GPP TS25.104, at the antenna connector over the full band on condition that the channel rate reaches 12.2 kbit/s and the bit error rate (BER) does not exceed 0.001.
- The receiver sensitivity on the 850 MHz band is measured on its subbands.

The RRU3801E supports a maximum of two carriers. The maximum output power is 40 W.

Table 10-189 RRU3801E output power

Number of Carriers	Maximum Output Power per Carrier (W)
1	40
2	20

NOTE

Maximum output power = Maximum output power of the PA - Internal loss. The maximum output power is measured at the antenna port.

Table 10-190 Power consumption of DBS3900 with RRU3801E (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)	Power Backup Duration Estimated Based on Typical Power Consumption of New Batteries (Hours)		
				24 Ah	50 Ah	92 Ah
3 x 1	20	390	480	2.4	5.7	11.3
3 x 2	20	480	650	1.7	4.3	9

Table 10-191 Power consumption of DBS3900 with RRU3801E (AC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
3 x 1	20	390	480
3 x 2	20	480	650

Table 10-192 Power consumption of BTS3900C with RRU3801E (DC)

Configuration (Carrier x Sector)	Output Power per Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
1 x 1	20	190	240
1 x 2	20	220	290

NOTE

- Typical power consumption refers to the power consumption when the base station runs with 40% load at the 25°C ambient temperature.
- Maximum power consumption refers to the power consumption when the base station runs with 100% load at the 25°C ambient temperature.
- One WBBPb4 board and one WMPT board are configured.

Engineering Specifications

Table 10-193 lists the equipment specifications of an RRU3801E.

Table 10-193 Equipment specifications of an RRU3801E

Type	Input Power	Dimensions (H x W x D)	Weight
RRU3801E (DC)	● -48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 270 mm x 140 mm (without the housing and connectors) ● 485 mm x 285 mm x 170 mm (with the housing)	● 15 kg (without the housing) ● 17 kg (with the housing)
RRU3801E (AC)	● 200 V AC to 240 V AC single-phase; voltage range: 176 V AC to 290 V AC ● 100 V AC to 120 V AC or 200 V AC to 240 V AC dual-phase; voltage range: 90 V AC to 135 V AC or 180 V AC to 270 V AC	● 480 mm x 270 mm x 220 mm (without the housing and connectors) ● 485 mm x 285 mm x 250 mm (with the housing)	● 20.5 kg (without the housing) ● 22.5 kg (with the housing)

Table 10-194 lists the environmental specifications of an RRU3801E.

Table 10-194 Environmental specifications of an RRU3801E

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3801E	● -40°C to +50°C (with 1120 W/m^2 solar radiation) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	(1 to 30) g/m^3	70 kPa to 106 kPa

Table 10-195 lists the compliance standards for an RRU3801E.

Table 10-195 Compliance standards of an RRU3801E

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3801E (DC)	Standards: ● 3GPP TS25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65
RRU3801E (AC)			IP55

Table 10-196 lists the surge protection specifications of ports on an RRU3801E.

Table 10-196 Surge protection specifications of ports on an RRU3801E

Port	Usage Scenario	Surge Protection Mode		Specifications
DC power port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power port	Indoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Outdoor applications	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA

Port	Usage Scenario	Surge Protection Mode		Specifications
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
Port for RF module cascading	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring and alarm port	Monitored power and RRUs are installed in back-to-back mode or within 1 m.	Surge		250 A

Antenna Capability

Table 10-197 lists the antenna capability of an RRU3801E.

Table 10-197 Antenna capability of an RRU3801E

Type	TMA Support	RET Antenna Support
RRU3801E	Supported	AISG1.1

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.10 RRU3908 Technical Specifications

RRU3908 modules are remote radio units and are classified into RRU3908 V1 and RRU3908 V2 modules. With the software-defined radio (SDR) technique, RRU3908 modules can work in different modes with different configurations.

Supported Modes and Frequency Bands

Table 10-198 lists the modes and frequency bands supported by an RRU3908.

Table 10-198 Modes and frequency bands supported by an RRU3908

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3908 V1	GSM UMTS LTE (the 1800 MHz frequency band only) GU GL (the 1800 MHz frequency band only)	850	824 to 849	869 to 894
		900	890 to 915	935 to 960
			880 to 905	925 to 950
		1800	1710 to 1755	1805 to 1850
			1740 to 1785	1835 to 1880
		1900	1850 to 1890	1930 to 1970
			1870 to 1910	1950 to 1990
RRU3908 V2	GSM UMTS LTE GU GL (the 900 MHz frequency band only)	850	824 to 849	869 to 894
		900	890 to 915	935 to 960
			880 to 915	925 to 960

RF Specifications

Table 10-199 lists radio frequency (RF) specifications of an RRU3908.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The RRU3908 that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The RRU3908 that works in GSM mode and operates in the 850 or 1900 MHz frequency band complies with the 3GPP TS 45.005 V10.2.0 and 3GPP TS 51.021 V10.2.0 standards. The RRU3908 that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard. The RRU3908 that works in UMTS, LTE, or MSR mode and operates in the 850 or 1900 MHz frequency band complies with the 3GPP TS 37.104 V10.4.0 and TS 37.141 V10.4.0 standards.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-199 RF specifications of an RRU3908

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3908 V1	2T2R	GSM: 6 carriers UMTS: 4 carriers LTE: 1 carrier, 5/10/15/20 MHz bandwidth	GSM: -113 UMTS: -125.5 LTE: -106.1	GSM: -115.8 UMTS: -128.3 LTE: -108.9	GSM: -118.5 (theoretical value) UMTS: -131 LTE: -111.6	**Output power of RRU3908 V1 (850/900/1800/1900 MHz, single-mode)** **Output power of RRU3908 V1 (850/900/1800/1900 MHz, GU non-MSR)** **Output power of RRU3908 V1 (900 MHz, GU MSR)** **Output power of RRU3908 V1 (1800**	**DBS3900 power consumption (RRU3908 V1 operating in the 900 MHz frequency band configured)**

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
						MHz, GL MSR)	

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3908 V2	2T2R	GSM: 8 carriers UMTS: ● 850 MHz: 2 carriers ● 900 MHz: 4 carriers LTE: 1 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM: ● 850 MHz: -113 ● 900 MHz PGSM: -113.5 ● 900 MHz EGSM: -113.3 UMTS: ● 850 MHz/ 900 MHz PGSM: -125.5 ● 900 MHz EGSM: -125.3 LTE: ● 900 MHz PGSM: -105.5 ● 900 MHz EGSM: -105.3	GSM: ● 850 MHz: -115.8 ● 900 MHz PGSM: -116.3 ● 900 MHz EGSM: -116.1 UMTS: ● 850 MHz/ 900 MHz PGSM: -128.3 ● 900 MHz EGSM: -128.1 LTE: ● 900 MHz PGSM: -108.3 ● 900 MHz EGSM: -108.1	GSM: ● 850 MHz: -118.5 (theoretical value) ● 900 MHz PGSM: -119 (theoretical value) ● 900 MHz EGSM: -118.8 (theoretical value) UMTS: ● 850 MHz/ 900 MHz PGSM: -131 ● 900 MHz EGSM: -130.8 LTE: ● 900 MHz PGSM: -111	**Output power of RRU3908 V2 (850/900 MHz, single-mode)** **Output power of RRU3908 V2 (850/900 MHz, GU non-MSR)** **Output power of RRU3908 V2 (850/900 MHz, GU MSR)** **Output power of RRU3908 V2 (900 MHz, GL MSR)**	**DBS3900 power consumption (RRU3908 V2 operating in the 850 or 900 MHz frequency band configured)**

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
					• 900 MHz EGSM: -110.8		

NOTE

- "*" indicates that UMTS hardware is ready.
- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an RRU3908 is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an RRU3908 is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-200 Output power of RRU3908 V1 (850/900/1800/1900 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	40	40	0	0
	2	0	0	40	40	0	0
	3	0	0	20	20	0	0
	4	0	0	15	20	0	0
	5	0	0	12	12	0	0
	6	0	0	10	12	0	0
UMTS	0	1	0	0	0	40	0
	0	1	0	0	0	2 x 20	0
	0	2	0	0	0	30	0
	0	2	0	0	0	2 x 15	0
	0	3*	0	0	0	20*	0
	0	4*	0	0	0	15*	0
LTE	0	0	1	0	0	0	2 x 30

Table 10-201 Output power of RRU3908 V1 (850/900/1800/1900 MHz, GU non-MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	30
	1	1	30	40
	1	2	30	20
	2	1	20	30
	2	1	15	40
	2	2	15	20
	3	1	10	30
	3	2	10	10

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	4	1	7.5	20
	4	2	7.5	10
	5	1	6	20

Table 10-202 Output power of RRU3908 V1 (900 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	20	20
	4	1	12	12
	4	2	10	10
	5	1	10	10

NOTE

LTE bandwidth can be 5 or 10 MHz.

Table 10-203 Output power of RRU3908 V1 (1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1	20	2 x 20
	1	1	10	2 x 20
	2	1	20	2 x 10
	2	1	10	2 x 20
	3	1	10	2 x 10
	4	1	10	2 x 10

NOTE

When operating in the 900 MHz frequency band, RRU3908 V2 supports 3 or 4 UMTS carriers.

Table 10-204 Output power of RRU3908 V2 (850/900 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	40	40	0	0
	2	0	0	40	40	0	0
	3	0	0	20	20	0	0
	4	0	0	20	20	0	0
	5	0	0	13	15	0	0
	6	0	0	13	15	0	0
	7	0	0	10	13	0	0
	8	0	0	10	13	0	0
UMTS	0	1	0	0	0	60	0
	0	1 (MIMO)	0	0	0	2 x 40	0
	0	2	0	0	0	40	0
	0	2 (MIMO)	0	0	0	2 x 20	0
	0	3	0	0	0	20	0
	0	3 (MIMO)	0	0	0	2 x 10	0
	0	4	0	0	0	20	0
	0	4 (MIMO)	0	0	0	2 x 10	0
LTE	0	0	1 (MIMO)	0	0	0	2 x 40

Table 10-205 Output power of RRU3908 V2 (850/900 MHz, GU non-MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	40
	2	1	20	40
	3	1	13	40
	4	1	10	40
	5	1	6	20
	1	2	40	20
	2	2	20	20
	3	2	13	20
	4	2	10	20

Table 10-206 Output power of RRU3908 V2 (850/900 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	20	2 x 20
	2	1	20	2 x 20
	3	1	20	20
	3	1	15	2 x 10
	4	1	13	20
	4	1	15	2 x 10
	5	1	10	30

NOTE

If there are less than 4 GSM carriers, 1.4, 3, 5, 10, or 15 MHz bandwidth can be spared from the 900 MHz frequency band to set up an LTE network. If there are more than 3 GSM carriers, 1.4, 3, 5, or 10 MHz bandwidth can be spared from the 900 MHz frequency band to set up an LTE network.

Table 10-207 Output power of RRU3908 V2 (900 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1	20	2 x 20
	2	1	20	2 x 20
	3	1	15	2 x 10
	4	1	15	2 x 10
	4	1	12	2 x 15

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.
- LTE typical power consumption is measured when the base station load reaches 50% and LTE maximum power consumption is measured when the base station load reaches 100%.

Table 10-208 DBS3900 power consumption (RRU3908 V1 operating in the 900 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	760	910
	3 x 4	20	730	1070
	3 x 6	12	730	1070
UMTS	3 x 1	20	490	590
	3 x 2	20	640	790
	3 x 3	20	880	1100
	3 x 4	15	880	1110
GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	870	1090
	GSM 3 x 4 + UMTS 3 x 1	• GSM: 10 • UMTS: 20	820	1050

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
	GSM 3 x 4 + UMTS 3 x 2	● GSM: 10 ● UMTS: 10	820	1050

Table 10-209 DBS3900 power consumption (RRU3908 V2 operating in the 850 or 900 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	550	650
	3 x 4	20	770	1085
	3 x 6	13	740	1085
UMTS	3 x 1	20	450	520
	3 x 2	20	565	710
LTE	3 x 1	2 x 20	675	800
GU	GSM 3 x 2 + UMTS 3 x 1	● GSM: 20 ● UMTS: 40	920	1170
	GSM 3 x 3 + UMTS 3 x 1	● GSM: 15 ● UMTS: 40	890	1170
	GSM 3 x 4 + UMTS 3 x 1	● GSM: 10 ● UMTS: 40	880	1180

Engineering Specifications

Table 10-210 lists the equipment specifications of an RRU3908.

Table 10-210 Equipment specifications of an RRU3908

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3908 V1	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	485 mm x 380 mm x 170 mm (with the shell)	23 (with the shell)
RRU3908 V2	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	485 mm x 380 mm x 170 mm (with the shell)	23 (with the shell)

Table 10-211 lists the environmental specifications of an RRU3908.

Table 10-211 Environmental specifications of an RRU3908

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3908 V1	-40°C to +50°C (without solar radiation) -40°C to +45°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa
RRU3908 V2	-40°C to +55°C (without solar radiation) -40°C to +50°C (with solar radiation)			

Table 10-212 lists the compliance standards for an RRU3908.

Table 10-212 Compliance standards for an RRU3908

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3908 V1	Standards:	NEBS GR63 zone4	IP65

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3908 V2	● 3GPP TS 25.141V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"		

Table 10-213 lists the surge protection specifications of ports on an RRU3908.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-213 Surge protection specifications of ports on an RRU3908

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power supply port	Applicable to the scenario where RF modules are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the scenario where RF modules are	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specification
	installed outdoors	Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring port or alarm port	Applicable to the scenario where the power supply module and the RRU are installed back to back or the scenario where the distance between them is shorter than 1 m	Surge		250 A

Antenna Capability

Table 10-214 lists the antenna capability of an RRU3908.

Table 10-214 Antenna capability of an RRU3908

Type	TMA Support	Supported RET Antennas
RRU3908 V1	Supported	AISG2.0
RRU3908 V2	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.11 RRU3926 Technical Specifications

RRU3926 modules are remote radio units and can work in different modes with different configurations and the software-defined radio (SDR) technique.

Supported Modes and Frequency Bands

Table 10-215 lists the modes and frequency bands supported by an RRU3926.

Table 10-215 Modes and frequency bands supported by an RRU3926

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3926	GSM UMTS GU	900	880 to 915	925 to 960
			890 to 915	935 to 960
		1800	1715 to 1785	1805 to 1880

RF Specifications

Table 10-216 lists radio frequency (RF) specifications of an RRU3926.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The RRU3926 that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The RRU3926 that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-216 RF specifications of an RRU3926

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas	
RRU3926	1T2R	GSM: 8 carriers UMTS: 6 carriers	GSM: • 900 MHz: -113.7 • 1800 MHz: -114 UMTS (900/1800 MHz): -125.8	GSM: • 900 MHz: -116.5 • 1800 MHz: -116.8 UMTS (900/1800 MHz): -128.6	GSM: • 900 MHz: -119.2 (theoretical value) • 1800 MHz: -119.5 (theoretical value) UMTS (900/1800 MHz): -131.3	**Output power of RRU3926 (900/1800 MHz, single-mode)** **Output power of RRU3926 (900/1800 MHz, GU MSR)**

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an RRU3926 is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an RRU3926 is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-217 Output power of RRU3926 (900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GSM	1	0	80	80	0
	2	0	40	40	0
	3	0	27	31	0
	4	0	20	27	0
	5	0	16	20	0
	6	0	12	20	0
	7	0	10	16	0
	8	0	7	12	0
UMTS	0	1	0	0	80
	0	2	0	0	40
	0	3	0	0	25
	0	4	0	0	20
	0	5	0	0	16
	0	6	0	0	12

NOTE

* indicates that configuration is supported in SRAN7.0.

Table 10-218 Output power of RRU3926 (900/1800 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	40
	1	2	40	20
	2	1	30	20
	2	1	20	40
	2	2	20	20
	3	1	20	20
	3	2	16	10
	3*	2*	13*	20*
	4	1	12	20
	4	2	12	10
	5	1	10	20
	5	2	10	10
	6	1	10	10
	6	2	8	10
	7	1	8	10

Engineering Specifications

Table 10-219 lists the equipment specifications of an RRU3926.

Table 10-219 Equipment specifications of an RRU3926

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3926	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	400 mm x 240 mm x 160 mm (with the shell) 400 mm x 220 mm x 140 mm (without the shell)	15 (with the shell) 13.5 (without the shell)

Table 10-220 lists the environmental specifications of an RRU3926.

Table 10-220 Environmental specifications of an RRU3926

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3926	-40°C to +55°C (without solar radiation) -40°C to +50°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-221 lists the compliance standards for an RRU3926.

Table 10-221 Compliance standards for an RRU3926

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3926	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-222 lists the surge protection specifications of ports on an RRU3926.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 µs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-222 Surge protection specifications of ports on an RRU3926

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)

Port	Usage Scenario	Surge Protection Mode		Specification
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power supply port	Applicable to the scenario where RF modules are installed indoors	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the scenario where RF modules are installed outdoors	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	5 kA
Local power monitoring port or alarm port	Applicable to the scenario where the power supply module and the RRU are installed back to back or the scenario where the distance between them is shorter than 1 m	Surge		250 A

Antenna Capability

Table 10-223 lists the antenna capability of an RRU3926.

Table 10-223 Antenna capability of an RRU3926

Type	TMA Support	Supported RET Antennas
RRU3926	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.12 RRU3928 Technical Specifications

RRU3928 modules are remote radio units and can work in different modes with different configurations and the software-defined radio (SDR) technique.

Supported Modes and Frequency Bands

Table 10-224 lists the modes and frequency bands supported by an RRU3928.

Table 10-224 Modes and frequency bands supported by an RRU3928

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3928	GSM UMTS LTE GU GL	900	880 to 915	925 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-225 lists radio frequency (RF) specifications of an RRU3928.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The RRU3928 that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The RRU3928 that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-225 RF specifications of an RRU3928

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3928	2T2R	GSM: 8 carriers UMTS: 4 carriers LTE: 2 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM: ● 900 MHz: -113.7 ● 1800 MHz: -114 UMTS (900/1800 MHz): -125.8 LTE (900/1800 MHz): -105.8	GSM: ● 900 MHz: -116.5 ● 1800 MHz: -116.8 UMTS (900/1800 MHz): -128.6 LTE (900/1800 MHz): -108.6	GSM: ● 900 MHz: -119.2 (theoretical value) ● 1800 MHz: -119.5 (theoretical value) UMTS (900/1800 MHz): -131.3 LTE (900/1800 MHz): -111.3	**Output power of RRU3928 (900/1800 MHz, single-mode)** **Output power of RRU3928 (900/1800 MHz, GU non-MSR)** **Output power of RRU3928 (900/1800 MHz, GU MSR)** **Output power of RRU3928 (900/1800 MHz, GL MSR)**	**DBS3900 power consumption (RRU3928 operating in the 900 MHz frequency band configured)** **DBS3900 power consumption (RRU3928 operating in the 1800 MHz frequency band configured)**

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an RRU3928 is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an RRU3928 is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-226 Output power of RRU3928 (900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	40	40	0	0
	2	0	0	40	40	0	0
	3	0	0	20	20	0	0
	4	0	0	20	20	0	0
	5	0	0	13	15	0	0
	6	0	0	13	15	0	0
	7	0	0	10	13	0	0
	8	0	0	10	13	0	0
UMTS	0	1	0	0	0	40	0
	0	2	0	0	0	40	0
	0	3	0	0	0	20	0
	0	4	0	0	0	20	0
	0	1 (MIMO)	0	0	0	2 x 40	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	2 (MIMO)	0	0	0	2 x 20	0
	0	3 (MIMO)	0	0	0	2 x 10	0
	0	4 (MIMO)	0	0	0	2 x 10	0
LTE	0	0	1	0	0	0	2 x 40
	0	0	2	0	0	0	2 x 20

Table 10-227 Output power of RRU3928 (900/1800 MHz, GU non-MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	40
	2	1	20	40
	3	1	13	40
	4	1	10	40
	1	2	40	20
	2	2	20	20
	3	2	13	20
	4	2	10	20

NOTE

* indicates that configuration is supported in SRAN7.0.

Table 10-228 Output power of RRU3928 (900/1800 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	3	1	20	20
	4	1	13	20
	5	1	10	20
	6*	1*	10*	20*
	1	1 (MIMO)	20	2 x 20
	2	1 (MIMO)	20	2 x 20
	3	1 (MIMO)	10	2 x 20
	4	1 (MIMO)	10	2 x 20
	1	2 (MIMO)	20	2 x 10
	2	2 (MIMO)	20	2 x 10
	3	2 (MIMO)	10	2 x 10
	4	2 (MIMO)	10	2 x 10

Table 10-229 Output power of RRU3928 (900/1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1 (MIMO)	20	2 x 20
	2	1 (MIMO)	20	2 x 20
	3	1 (MIMO)	10	2 x 20
	3	1 (MIMO)	15	2 x 10
	4	1 (MIMO)	10	2 x 20
	4	1 (MIMO)	15	2 x 10
	5	1 (MIMO)	10	2 x 10
	6	1 (MIMO)	10	2 x 10

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.
- LTE typical power consumption is measured when the base station load reaches 50% and LTE maximum power consumption is measured when the base station load reaches 100%.
- LTE power consumption is calculated based on the 2x2 MIMO configuration. The LTE bandwidth is 10 MHz.

Table 10-230 DBS3900 power consumption (RRU3928 operating in the 900 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	560	650
	3 x 4	20	740	1025
UMTS	3 x 1	20	510	585
	3 x 2	20	585	720
LTE	3 x 10 MHz	40	900	1110
GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	820	985
	GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	865	1120
GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	930	1140
	GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	870	1065
	GSM 3 x 4 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	850	1140

Table 10-231 DBS3900 power consumption (RRU3928 operating in the 1800 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	560	665
	3 x 4	20	755	1040
UMTS	3 x 1	20	525	585
	3 x 2	20	600	735
LTE	3 x 10 MHz	40	915	1125
GU	GSM 3 x 2 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	835	1000
	GSM 3 x 3 + UMTS 3 x 1	• GSM: 20 • UMTS: 20	880	1135
GL	GSM 3 x 2 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	945	1155
	GSM 3 x 3 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	885	1095
	GSM 3 x 4 + LTE 3 x 10 MHz	• GSM: 20 • LTE: 40	900	1155

Engineering Specifications

Table 10-232 lists the equipment specifications of an RRU3928.

Table 10-232 Equipment specifications of an RRU3928

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3928	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	400 mm x 240 mm x 160 mm (with the shell)	15 (with the shell)

Table 10-233 lists environmental specifications of an RRU3928.

Table 10-233 Environmental specifications of an RRU3928

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3928	-40°C to +50°C (without solar radiation) -40°C to +45°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-234 lists the compliance standards for an RRU3928.

Table 10-234 Compliance standards for an RRU3928

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3928	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-235 lists the surge protection specifications of ports on an RRU3928.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-235 Surge protection specifications of ports on an RRU3928

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specification
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power supply port	Applicable to the scenario where RF modules are installed indoors	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the scenario where RF modules are installed outdoors	Surge	Differential mode	2 kV (1.2/50 µs)
			Common mode	4 kV (1.2/50 µs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	5 kA
Local power monitoring port or alarm port	Applicable to the scenario where the power supply module and the RRU are installed back to back or the scenario where the distance between them is shorter than 1 m	Surge		250 A

Antenna Capability

Table 10-236 lists the antenna capability of an RRU3928.

Table 10-236 Antenna capability of an RRU3928

Type	TMA Support	Supported RET Antennas
RRU3928	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.13 RRU3929 Technical Specifications

RRU3929 modules are remote radio units and can work in different modes with different configurations and the software-defined radio (SDR) technique.

Supported Modes and Frequency Bands

Table 10-237 lists the modes and frequency bands supported by an RRU3929.

Table 10-237 Modes and frequency bands supported by an RRU3929

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3929	GSM UMTS LTE GU GL	900	880 to 915	925 to 960
			890 to 915	935 to 960
		1800	1710 to 1785	1805 to 1880

RF Specifications

Table 10-238 lists radio frequency (RF) specifications of an RRU3929.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The RRU3929 that works in GSM mode and operates in the 900 or 1800 MHz frequency band complies with the EN 301 502 V9.2.1 standard. The RRU3929 that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 900 or 1800 MHz frequency band complies with the ETSI EN 301 908 V5.2.1 standard.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-238 RF specifications of an RRU3929

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3929	2T2R	GSM: 8 carriers UMTS: ● Without MIMO: 6 carriers ● With MIMO: 4 carriers LTE: 2 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM: ● 900 MHz: -113.7 ● 1800 MHz: -114 UMTS (900/1800 MHz): -125.8 LTE (900/1800 MHz): -105.8	GSM: ● 900 MHz: -116.5 ● 1800 MHz: -116.8 UMTS (900/1800 MHz): -128.6 LTE (900/1800 MHz): -108.6	GSM: ● 900 MHz: -119.2 (theoretical value) ● 1800 MHz: -119.5 (theoretical value) UMTS (900/1800 MHz): -131.3 LTE (900/1800 MHz): -111.3	**Output power of RRU3929 (900/1800 MHz, single-mode)** **Output power of RRU3929 (900/1800 MHz, GU non-MSR)** **Output power of RRU3929 (900/1800 MHz, GU MSR)** **Output power of RRU3929 (900/1800 MHz, GL MSR)**	**DBS3900 power consumption (RRU3929 operating in the 900 or 1800 MHz frequency band configured)**

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an RRU3929 is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an RRU3929 is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.

Table 10-239 Output power of RRU3929 (900/1800 MHz, single-mode)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	60	60	0	0
	2	0	0	60	60	0	0
	3	0	0	30	30	0	0
	4	0	0	30	30	0	0
	5	0	0	20	25	0	0
	6	0	0	20	25	0	0
	7	0	0	15	20	0	0
	8	0	0	15	20	0	0
UMTS	0	1	0	0	0	60	0
	0	2	0	0	0	60	0
	0	3	0	0	0	30	0
	0	4	0	0	0	30	0
	0	5	0	0	0	20	0
	0	6	0	0	0	20	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	1 (MIMO)	0	0	0	2 x 40	0
	0	2 (MIMO)	0	0	0	2 x 30	0
	0	3 (MIMO)	0	0	0	2 x 20	0
	0	4 (MIMO)	0	0	0	2 x 15	0
LTE	0	0	1	0	0	0	5/10/15/20 MHz: 2 x 60 1.4/3 MHz: 2 x 40
	0	0	2	0	0	0	Carrier1: 2 x 30 Carrier2: 2 x 30
	0	0	2	0	0	0	Carrier1: 2 x 20 Carrier2: 2 x 40

Table 10-240 Output power of RRU3929 (900/1800 MHz, GU non-MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	60	60
	1	2	60	30
	1	3	60	20
	2	1	30	60
	2	2	30	30

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2	3	30	20
	2	4	30	15
	3	1	20	60
	3	2	20	30
	3	3	20	20
	3	4	20	15
	4	1	15	60
	4	2	15	30
	4	3	15	20
	4	4	15	15
	5	1	10	60
	5	2	10	30
	5	3	10	20
	6	1	7	60
	6	2	7	30

Table 10-241 Output power of RRU3929 (900/1800 MHz, GU MSR)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	2	30	30
	1	2	20	40
	2	1	40	20
	2	1	30	30
	2	2	20	40
	2	2	30	30
	2	2	40	20
	3	1	30	30
	3	1	20	40

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	3	2	20	20
	3	2	15	30
	4	1	20	40
	4	2	20	20
	4	2	15	30
	5	1	20	20
	5	1	15	30
	5	2	13	20
	6	1	15	30
	6	2	12	20
	7	1	10	20
	1	1 (MIMO)	20	2 x 40
	1	1 (MIMO)	30	2 x 30
	1	1 (MIMO)	40	2 x 20
	1	2 (MIMO)	20	2 x 20
	2	1 (MIMO)	20	2 x 40
	2	1 (MIMO)	30	2 x 30
	2	1 (MIMO)	40	2 x 20
	2	2 (MIMO)	20	2 x 20
	2	2 (MIMO)	30	2 x 15
	3	1 (MIMO)	20	2 x 20
	3	1 (MIMO)	15	2 x 30
	3	2 (MIMO)	15	2 x 15
	3	2 (MIMO)	20	2 x 10
	3	2 (MIMO)	10	2 x 20
	4	1 (MIMO)	20	2 x 20
	4	1 (MIMO)	15	2 x 30
	4	2 (MIMO)	15	2 x 15
	4	2 (MIMO)	20	2 x 10

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	4	2 (MIMO)	10	2 x 20

NOTE
* indicates that configuration is supported in SRAN7.0.

Table 10-242 Output power of RRU3929 (900/1800 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1 (MIMO)	40	2 x 20
	1	1 (MIMO)	30	2 x 30
	1	1 (MIMO)	20	2 x 40
	2	1 (MIMO)	40	2 x 20
	2	1 (MIMO)	30	2 x 30
	2	1 (MIMO)	20	2 x 40
	3	1 (MIMO)	20	2 x 20
	4*	1 (MIMO)*	15*	2 x 30*
	4	1 (MIMO)	20	2 x 20
	5	1 (MIMO)	12	2 x 20
	6	1 (MIMO)	12	2 x 20

NOTE
- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.
- LTE typical power consumption is measured when the base station load reaches 50% and LTE maximum power consumption is measured when the base station load reaches 100%.
- LTE power consumption is calculated based on the 2x2 MIMO configuration. The LTE bandwidth is 10 MHz.

Table 10-243 DBS3900 power consumption (RRU3929 operating in the 900 or 1800 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	675	795
	3 x 4	20	915	1260
	3 x 6	20	1005	1530
UMTS	3 x 1	20	585	675
	3 x 2	20	660	840
LTE	3 x 10 MHz	40	990	1290
GU	GSM 3 x 2 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	850	1030
	GSM 3 x 3 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1060	1360
	GSM 3 x 4 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1105	1495
GL	GSM 3 x 2 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1305	1660
	GSM 3 x 3 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1155	1525
	GSM 3 x 4 + LTE 3 x 10 MHz	● GSM: 20 ● LTE: 40	1215	1660

Engineering Specifications

Table 10-244 lists the equipment specifications of an RRU3929.

Table 10-244 Equipment specifications of an RRU3929

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3929	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	485 mm x 380 mm x 170 mm (with the shell)	25 (with the shell)

Table 10-245 lists the environmental specifications of an RRU3929.

Table 10-245 Environmental specifications of an RRU3929

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3929	-40°C to +55°C (without solar radiation) -40°C to +50°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-246 lists the compliance standards for an RRU3929.

Table 10-246 Compliance standards for an RRU3929

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3929	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-247 lists the surge protection specifications of ports on an RRU3929.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-247 Surge protection specifications of ports on an RRU3929

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power supply port	Applicable to the scenario where RF modules are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the scenario where RF modules are installed outdoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A

Port	Usage Scenario	Surge Protection Mode		Specification
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Local power monitoring port or alarm port	Applicable to the scenario where the power supply module and the RRU are installed back to back or the scenario where the distance between them is shorter than 1 m	Surge		250 A

Antenna Capability

Table 10-248 lists the antenna capability of an RRU3929.

Table 10-248 Antenna capability of an RRU3929

Type	TMA Support	Supported RET Antennas
RRU3929	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.14 RRU3942 Technical Specifications

RRU3942 modules are remote radio units and can work in different modes with different configurations and the software-defined radio (SDR) technique.

Supported Modes and Frequency Bands

Table 10-249 lists the modes and frequency bands supported by an RRU3942.

Table 10-249 Modes and frequency bands supported by an RRU3942

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3942	GSM UMTS LTE GU GL	1900	1850 to 1910	1930 to 1990

RF Specifications

Table 10-250 lists radio frequency (RF) specifications of an RRU3942.

NOTE

- The GSM receiver sensitivity is measured, as recommended in 3GPP TS51.021, over the central band at the antenna connector on condition that the channel rate reaches 13 kbit/s and the bit error rate (BER) does not exceed 2%. The central band is the 80% of the full band.
- The UMTS receiver sensitivity is measured, as recommended in 3GPP TS 25.104, over the full band at the antenna connector on condition that the channel rate reaches 12.2 kbit/s and the BER does not exceed 0.001.
- The receiver sensitivity of LTE is measured, as recommended in 3GPP TS 36.104, under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.
- The RRU3942 that works in GSM mode and operates in the 1900 MHz frequency band complies with the 3GPP TS 45.005 V10.2.0 and 3GPP TS 51.021 V10.2.0 standards. The RRU3942 that works in UMTS, LTE, or multiple service ring (MSR) mode and operates in the 1900 MHz frequency band complies with the 3GPP TS 37.104 V10.4.0 and TS 37.141 V10.4.0 standards.
- **AB non-MSR** indicates that A data is carried on one transmit channel of an RF module while B data is carried on the other transmit channel of the RF module. **AB MSR** indicates that A and B data is carried on the same transmit channel of an RF module.

Table 10-250 RF specifications of an RRU3942

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
RRU3942	2T4R	GSM: 8 carriers UMTS: ● Without MIMO: 6 carriers ● With MIMO: 4 carriers LTE: 2 carriers, 1.4/3/5/10/15/20 MHz bandwidth	GSM (1900 MHz): -113.7 UMTS (1900 MHz): -125.8 LTE (1900 MHz): -106.5	GSM (1900 MHz): -116.5 UMTS (1900 MHz): -128.6 LTE (1900 MHz): -109.3	GSM (1900 MHz): -119.2 (theoretical value) UMTS (1900 MHz): -131.3 LTE (1900 MHz): -112	**Output power of RRU3942 (1900 MHz, single-mode, 2 x 60 W)** **Output power of RRU3942 (1900 MHz, single-mode, 40 W + 80 W)** **Output power of RRU3942 (1900 MHz, GU non-MSR, 2 x 60 W)** **Output power of RRU3942 (1900 MHz, GU non-MSR, 40**	**DBS3900 power consumption (RRU3942 operating in the 1900 MHz frequency band configured)**

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)			Output Power	Power Consumption
			Receiver Sensitivity with One Antenna	Receiver Sensitivity with Two Antennas	Receiver Sensitivity with Four Antennas		
						W + 80 W) **Output power of RRU3942 (1900 MHz, GU MSR, 2 x 60 W)** **Output power of RRU3942 (1900 MHz, GU MSR, 40 W + 80 W)** **Output power of RRU3942 (1900 MHz, GL MSR)**	

NOTE

- If the power sharing feature is activated, assume that UEs in a cell are randomly located.
- If an RRU3942 is placed at an altitude of 3500 to 4500 meters, its power reduces by 1 dB. If an RRU3942 is placed at an altitude of 4500 to 6000 meters, its power reduces by 2 dB.
- After design improvements, RF modules working in GSM mode with any of the S1 to S6 configuration have the same power no matter they use the Gaussian minimum shift-frequency keying (GMSK) or 8 phase shift keying (8PSK) modulation scheme. With the GBFD-118104 Enhanced EDGE Coverage feature, RF modules working in GSM mode with the S7 or S8 configuration can also have the same power no matter they use the GMSK or 8PSK modulation scheme.
- Station spacing, frequency multiplexing factor, power control algorithm, and traffic model all affect the gains of dynamic power sharing. In most cases, network plans are designed on the basis of power specifications of dynamic power sharing.
- Before activating the dynamic power sharing feature, enable the DTX and power control functions. In GBSS8.1, the dynamic power sharing feature is mutually exclusive with the GBFD-113201 Concentric Cell, GBFD-114501 Co-BCCH Cell, GBFD-118001 BCCH Dense Frequency Multiplexing, and GBFD-117501 Enhanced Measurement Report (EMR) features. In GBSS9.0, the dynamic power sharing feature can be used together with these features. However, the dynamic power sharing feature currently cannot be used together with the GBFD-117002 IBCA (Interference Based Channel Allocation), GBFD-117001 Flex MAIO, GBFD-118701 RAN Sharing, and GBFD-114001 Extended Cell features in GBSS8.1 and GBSS9.0.
- The "40 W + 80 W" configuration does not apply to typical scenarios. When this configuration is used, only power of channel B can be 80 W.

Table 10-251 Output power of RRU3942 (1900 MHz, single-mode, 2 x 60 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	60	60	0	0
	2	0	0	60	60	0	0
	3	0	0	30	30	0	0
	4	0	0	30	30	0	0
	5	0	0	20	25	0	0
	6	0	0	20	25	0	0
	7	0	0	15	20	0	0
	8	0	0	15	20	0	0
UMTS	0	1	0	0	0	60	0
	0	2	0	0	0	60	0
	0	3	0	0	0	30	0
	0	4	0	0	0	30	0
	0	5	0	0	0	20	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	0	6	0	0	0	20	0
	0	1 (MIMO)	0	0	0	2 x 40	0
	0	2 (MIMO)	0	0	0	2 x 30	0
	0	3 (MIMO)	0	0	0	2 x 20	0
	0	4 (MIMO)	0	0	0	2 x 15	0
LTE	0	0	1	0	0	0	5/10/15/20 MHz: 2 x 60 1.4/3 MHz: 2 x 40
	0	0	2	0	0	0	Carrier1: 2 x 30 Carrier2: 2 x 30
	0	0	2	0	0	0	Carrier1: 2 x 20 Carrier2: 2 x 40

Table 10-252 Output power of RRU3942 (1900 MHz, single-mode, 40 W + 80 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
GSM	1	0	0	80	80	0	0
	2	0	0	40	40	0	0

Mode	Number of GSM Carriers	Number of UMTS Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Sharing Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)	Output Power of Each LTE Carrier (W)
	3	0	0	40	40	0	0
	4	0	0	27	27	0	0
	5	0	0	20	20	0	0
	6	0	0	20	20	0	0
	7	0	0	16	20	0	0
	8	0	0	13	15	0	0
UMTS	0	1	0	0	0	80	0
	0	2	0	0	0	60	0
	0	3	0	0	0	40	0
	0	4	0	0	0	30	0
	0	5	0	0	0	20	0
	0	6	0	0	0	20	0
	0	1 (MIMO)	0	0	0	2 x 40	0
	0	2 (MIMO)	0	0	0	2 x 30	0
	0	3 (MIMO)	0	0	0	2 x 20	0
	0	4 (MIMO)	0	0	0	2 x 15	0

Table 10-253 Output power of RRU3942 (1900 MHz, GU non-MSR, 2 x 60 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	60	60
	1	2	60	30
	1	3	60	20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2	1	30	60
	2	2	30	30
	2	3	30	20
	2	4	30	15
	3	1	20	60
	3	2	20	30
	3	3	20	20
	3	4	20	15
	4	1	15	60
	4	2	15	30
	4	3	15	20
	4	4	15	15
	5	1	10	60
	5	2	10	30
	5	3	10	20
	6	1	7	60
	6	2	7	30

Table 10-254 Output power of RRU3942 (1900 MHz, GU non-MSR, 40 W + 80 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	80	40
	1	1	40	80
	1	2	80	20
	1	2	40	40
	1	3	80	10
	1	3	40	25
	1	4	80	10

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2	1	40	40
	2	1	20	80
	2	2	40	20
	2	2	20	40
	2	3	40	10
	2	3	20	25
	2	4	40	10
	2	4	20	20
	3	1	27	40
	3	1	13	80
	3	2	27	20
	3	2	13	40
	3	3	27	10
	3	3	13	25
	3	4	27	10
	3	4	13	20
	4	1	20	40
	4	1	10	80
	4	2	20	20
	4	2	10	40
	4	3	20	10
	4	3	10	25
	4	4	20	10
	4	4	10	20
	5	1	16	40
	5	2	16	20
	5	3	16	10
	6	1	12	40
	6	2	12	20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	7	1	6	40

Table 10-255 Output power of RRU3942 (1900 MHz, GU MSR, 2 x 60 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	2	30	30
	1	2	20	40
	2	1	40	20
	2	1	30	30
	2	2	20	40
	2	2	30	30
	2	2	40	20
	3	1	30	30
	3	1	20	40
	3	2	20	20
	3	2	15	30
	4	1	20	40
	4	2	20	20
	4	2	15	30
	5	1	20	20
	5	1	15	30
	5	2	13	20
	6	1	15	30
	6	2	12	20
	7	1	10	20
	1	1 (MIMO)	20	2 x 40
	1	1 (MIMO)	30	2 x 30
	1	1 (MIMO)	40	2 x 20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	1	2 (MIMO)	20	2 x 20
	2	1 (MIMO)	20	2 x 40
	2	1 (MIMO)	30	2 x 30
	2	1 (MIMO)	40	2 x 20
	2	2 (MIMO)	20	2 x 20
	2	2 (MIMO)	30	2 x 15
	3	1 (MIMO)	20	2 x 20
	3	1 (MIMO)	15	2 x 30
	3	2 (MIMO)	15	2 x 15
	3	2 (MIMO)	20	2 x 10
	3	2 (MIMO)	10	2 x 20
	4	1 (MIMO)	20	2 x 20
	4	1 (MIMO)	15	2 x 30
	4	2 (MIMO)	15	2 x 15
	4	2 (MIMO)	20	2 x 10
	4	2 (MIMO)	10	2 x 20

Table 10-256 Output power of RRU3942 (1900 MHz, GU MSR, 40 W + 80 W)

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
GU	1	1	40	2 x 40
	1	2	40	40
	1	2	40	2 x 20
	1	3	40	20
	1	4	40	20
	2	1	40	40
	2	1	30	2 x 20
	2	2	20	2 x 20

Mode	Number of GSM Carriers	Number of UMTS Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each UMTS Carrier (W)
	2	2	40	20
	2	3	30	20
	3	1	20	40
	3	2	20	30
	4	1	20	2 x 20
	4	2	10	2 x 10
	4	2	10	40
	5	1	20	20
	6	1	10	20

Table 10-257 Output power of RRU3942 (1900 MHz, GL MSR)

Mode	Number of GSM Carriers	Number of LTE Carriers	Output Power of Each GSM Carrier (W)	Output Power of Each LTE Carrier (W)
GL	1	1 (MIMO)	40	2 x 20
	1	1 (MIMO)	30	2 x 30
	1	1 (MIMO)	20	2 x 40
	2	1 (MIMO)	40	2 x 20
	2	1 (MIMO)	30	2 x 30
	2	1 (MIMO)	20	2 x 40
	3	1 (MIMO)	20	2 x 20
	4	1 (MIMO)	20	2 x 20
	5	1 (MIMO)	12	2 x 20
	6	1 (MIMO)	12	2 x 20

NOTE

- Typical and maximum power consumption are measured when the environment temperature is 25°C.
- GSM typical power consumption is measured when the base station load reaches 30%, and the power control and DTX functions are enabled. GSM maximum power consumption is measured when the base station load reaches 100%. GSM power consumption is calculated when the dynamic power sharing function is enabled.
- UMTS typical power consumption is measured when the base station load reaches 40% and UMTS maximum power consumption is measured when the base station load reaches 100%.

Table 10-258 DBS3900 power consumption (RRU3942 operating in the 1900 MHz frequency band configured)

Mode	Configuration	Output Power of Each Carrier (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
GSM	3 x 2	20	675	795
	3 x 4	20	915	1260
	3 x 6	20	1005	1530
UMTS	3 x 1	20	585	675
	3 x 2	20	660	840
GU	GSM 3 x 2 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	850	1030
	GSM 3 x 3 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1060	1360
	GSM 3 x 4 + UMTS 3 x 1	● GSM: 20 ● UMTS: 20	1105	1495

Engineering Specifications

Table 10-259 lists the equipment specifications of an RRU3942.

Table 10-259 Equipment specifications of an RRU3942

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3942	-48 V DC; voltage range: -36 V DC to -57 V DC 220 V AC/110 V AC (single-phase); voltage range: 85 V AC to 290 V AC	485 mm x 380 mm x 170 mm (with the shell)	25 (with the shell)

Table 10-260 lists the environmental specifications of an RRU3942.

Table 10-260 Environmental specifications of an RRU3942

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3942	-40°C to +50°C (without solar radiation) -40°C to +45°C (with solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-261 lists the compliance standards for an RRU3942.

Table 10-261 Compliance standards for an RRU3942

Type	Operating Environment	Anti-Seismic Performance	Protection Rating
RRU3942	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-262 lists the surge protection specifications of ports on an RRU3942.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-262 Surge protection specifications of ports on an RRU3942

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)

Port	Usage Scenario	Surge Protection Mode		Specification
		Surge current	Differential mode	10 kA
			Common mode	20 kA
AC power supply port	Applicable to the scenario where RF modules are installed indoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	5 kA
			Common mode	5 kA
	Applicable to the scenario where RF modules are installed outdoors	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	40 kA
			Common mode	40 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RGPS port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Dry contact or RS485 alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	5 kA
Local power monitoring port or alarm port	Applicable to the scenario where the power supply module and the RRU are installed back to back or the scenario where the distance between them is shorter than 1 m	Surge		250 A

Antenna Capability

Table 10-263 lists the antenna capability of an RRU3942.

Table 10-263 Antenna capability of an RRU3942

Type	TMA Support	Supported RET Antennas
RRU3942	Supported	AISG2.0

NOTE
For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.15 RRU3201 Technical Specifications

An RRU3201, which is a remote radio unit for LTE, supports only one carrier.

Supported Modes and Frequency Bands

Table 10-264 lists the modes and frequency bands supported by an RRU3201.

Table 10-264 Modes and frequency bands supported by an RRU3201

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3201	LTE	700 (band 13)	777 to 787	746 to 756
		2600 (band 7)	Band C: 2500 to 2520	Band C: 2620 to 2640
			Band D: 2510 to 2560	Band D: 2630 to 2680
			Band E: 2550 to 2570	Band E: 2670 to 2690

RF Specifications

Table 10-265 lists radio frequency (RF) specifications of an RRU3201.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-265 RF specifications of an RRU3201

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3201	2T2R	One carrier with a bandwidth of: ● 5 or 10 MHz in the 700 MHz band ● 5, 10, 15, or 20 MHz in the 2600 MHz band	-105.8	-108.6	2 x 40	● 700 (band 13): 315 ● 2600: 370

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-266 lists the equipment specifications of an RRU3201.

Table 10-266 Equipment specifications of an RRU3201

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3201	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 270 mm x 140 mm (18 L, without the housing) ● 485 mm x 285 mm x 170 mm (23.5 L, with the housing)	● ≤ 17.5 (without the housing) ● ≤ 19 (with the housing)

Table 10-267 lists the environmental specifications of an RRU3201.

Table 10-267 Environmental specifications of an RRU3201

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3201	● -40°C to +50°C (with solar radiation of 1120 W/m^2) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-268 lists the compliance standards for an RRU3201.

Table 10-268 Compliance standards for an RRU3201

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3201	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-269 lists the surge protection specifications of ports on an RRU3201.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-269 Surge protection specifications of ports on an RRU3201

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-270 lists the antenna capability of an RRU3201.

Table 10-270 Antenna capability of an RRU3201

Type	TMA Support	Supported RET Antennas
RRU3201	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.16 RRU3203 Technical Specifications

An RRU3203, which is a remote radio unit for LTE, supports only one carrier.

Supported Modes and Frequency Bands

Table 10-271 lists the modes and frequency bands supported by an RRU3203.

Table 10-271 Modes and frequency bands supported by an RRU3203

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3203	LTE	700 (band 12)	698 to 716	728 to 746

RF Specifications

Table 10-272 lists radio frequency (RF) specifications of an RRU3203.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-272 RF specifications of an RRU3203

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3203	2T2R	One carrier with a bandwidth of 1.4, 3, 5, 10, or 15 MHz	-105.8	-108.6	2 x 40	300

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-273 lists the equipment specifications of an RRU3203.

Table 10-273 Equipment specifications of an RRU3203

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3203	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 356 mm x 140 mm (24 L, without the housing) ● 485 mm x 381 mm x 170 mm (31.4 L, with the housing)	● ≤ 21 (without the housing) ● ≤ 24 (with the housing)

Table 10-274 lists the environmental specifications of an RRU3203.

Table 10-274 Environmental specifications of an RRU3203

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3203	● -40°C to +50°C (with solar radiation of 1120 W/m²) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m³ to 30 g/m³	70 kPa to 106 kPa

Table 10-275 lists the compliance standards for an RRU3203.

Table 10-275 Compliance standards for an RRU3203

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3203	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-276 lists the surge protection specifications of ports on an RRU3203.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-276 Surge protection specifications of ports on an RRU3203

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-277 lists the antenna capability of an RRU3203.

Table 10-277 Antenna capability of an RRU3203

Type	TMA Support	Supported RET Antennas
RRU3203	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.17 RRU3220 Technical Specifications

An RRU3220, which is a remote radio unit for LTE, supports only one carrier.

Supported Modes and Frequency Bands

Table 10-278 lists the modes and frequency bands supported by an RRU3220.

Table 10-278 Modes and frequency bands supported by an RRU3220

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3220	LTE	DD 800 (band 20)	832 to 847	791 to 806
			842 to 862	801 to 821

RF Specifications

Table 10-279 lists radio frequency (RF) specifications of an RRU3220.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-279 RF specifications of an RRU3220

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3220	2T2R	One carrier with a bandwidth of 5, 10, 15, or 20 MHz	-106.1	-108.9	2 x 40	290

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-280 lists the equipment specifications of an RRU3220.

Table 10-280 Equipment specifications of an RRU3220

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3220	-48 V DC; voltage range: -57 V DC to -36 V DC	● 400 mm x 220 mm x 140 mm (12 L, without the housing) ● 400 mm x 240 mm x 160 mm (15 L, with the housing)	● ≤ 13.5 (without the housing) ● ≤ 15 (with the housing)

Table 10-281 lists the environmental specifications of an RRU3220.

Table 10-281 Environmental specifications of an RRU3220

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3220	● -40°C to +50°C (with solar radiation of 1120 W/m^2) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-282 lists the compliance standards for an RRU3220.

Table 10-282 Compliance standards for an RRU3220

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3220	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-283 lists the surge protection specifications of ports on an RRU3220.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-283 Surge protection specifications of ports on an RRU3220

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-284 lists the antenna capability of an RRU3220.

Table 10-284 Antenna capability of an RRU3220

Type	TMA Support	Supported RET Antennas
RRU3220	Supported	AISG2.0

NOTE

- When an RRU3220 uses a tower mounted amplifier (TMA), a bias tee (BT) is required.
- For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.18 RRU3221 Technical Specifications

An RRU3221, which is a remote radio unit for LTE, supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-285 lists the modes and frequency bands supported by an RRU3221.

Table 10-285 Modes and frequency bands supported by an RRU3221

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3221	LTE	2600 (band 7)	2500 to 2570	2620 to 2690

RF Specifications

Table 10-286 lists radio frequency (RF) specifications of an RRU3221.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-286 RF specifications of an RRU3221

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3221	2T2R	Two carriers. The bandwidth per carrier is 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 40 MHz.	-106.0	-108.8	2 x 40	370

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-287 lists the equipment specifications of an RRU3221.

Table 10-287 Equipment specifications of an RRU3221

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3221	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 270 mm x 140 mm (18 L, without the housing) ● 485 mm x 300 mm x 170 mm (25 L, with the housing)	● ≤ 20 (without the housing) ● ≤ 22 (with the housing)

Table 10-288 lists the environmental specifications of an RRU3221.

Table 10-288 Environmental specifications of an RRU3221

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3221	● -40°C to +50°C (with solar radiation of 1120 W/m^2) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-289 lists the compliance standards for an RRU3221.

Table 10-289 Compliance standards for an RRU3221

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3221	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-290 lists the surge protection specifications of ports on an RRU3221.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-290 Surge protection specifications of ports on an RRU3221

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Port	Usage Scenario	Surge Protection Mode		Specification
Alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-291 lists the antenna capability of an RRU3221.

Table 10-291 Antenna capability of an RRU3221

Type	TMA Support	Supported RET Antennas
RRU3221	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.19 RRU3222 Technical Specifications

An RRU3222, which is a remote radio unit for LTE, supports only one carrier.

Supported Modes and Frequency Bands

Table 10-292 lists the modes and frequency bands supported by an RRU3222.

Table 10-292 Modes and frequency bands supported by an RRU3222

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3222	LTE	DD 800 (band 20)	832 to 862	791 to 821

RF Specifications

Table 10-293 lists radio frequency (RF) specifications of an RRU3222.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-293 RF specifications of an RRU3222

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3222	2T2R	One carrier with a bandwidth of 5, 10, 15, or 20 MHz	-106.4	-109.2	2 x 40	300

NOTE
"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-294 lists the equipment specifications of an RRU3222.

Table 10-294 Equipment specifications of an RRU3222

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3222	-48 V DC; voltage range: -57 V DC to -36 V DC	• 480 mm x 270 mm x 140 mm (18 L, without the housing) • 485 mm x 300 mm x 170 mm (25 L, with the housing)	• ≤ 17.5 (without the housing) • ≤ 20 (with the housing)

Table 10-295 lists the environmental specifications of an RRU3222.

Table 10-295 Environmental specifications of an RRU3222

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3222	• -40°C to +50°C (with solar radiation of 1120 W/m^2) • -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-296 lists the compliance standards for an RRU3222.

Table 10-296 Compliance standards for an RRU3222

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3222	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-297 lists the surge protection specifications of ports on an RRU3222.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-297 Surge protection specifications of ports on an RRU3222

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	5 kA
Alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-298 lists the antenna capability of an RRU3222.

Table 10-298 Antenna capability of an RRU3222

Type	TMA Support	Supported RET Antennas
RRU3222	Supported	AISG2.0

NOTE
For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.20 RRU3229 Technical Specifications

An RRU3229, which is a remote radio unit for LTE, supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-299 lists the modes and frequency bands supported by an RRU3229.

Table 10-299 Modes and frequency bands supported by an RRU3229

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3229	LTE	2600 (band 7)	2500 to 2570	2620 to 2690

RF Specifications

Table 10-300 lists radio frequency (RF) specifications of an RRU3229.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-300 RF specifications of an RRU3229

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3229	2T2R	Two carriers. The bandwidth per carrier is 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 40 MHz.	-106.0	-108.8	2 x 60	450

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-301 lists the equipment specifications of an RRU3229.

Table 10-301 Equipment specifications of an RRU3229

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3229	-48 V DC; voltage range: -57 V DC to -36 V DC	• 480 mm x 356 mm x 140 mm (24 L, without the housing) • 485 mm x 380 mm x 170 mm (31 L, with the housing)	• ≤ 20 (without the housing) • ≤ 22 (with the housing)

Table 10-302 lists the environmental specifications of an RRU3229.

Table 10-302 Environmental specifications of an RRU3229

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3229	● -40°C to +50°C (with solar radiation of 1120 W/m^2) ● -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-303 lists the compliance standards for an RRU3229.

Table 10-303 Compliance standards for an RRU3229

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3229	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-304 lists the surge protection specifications of ports on an RRU3229.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-304 Surge protection specifications of ports on an RRU3229

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA

Port	Usage Scenario	Surge Protection Mode		Specification
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA
Alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-305 lists the antenna capability of an RRU3229.

Table 10-305 Antenna capability of an RRU3229

Type	TMA Support	Supported RET Antennas
RRU3229	Supported	AISG2.0

NOTE
For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.21 RRU3240 Technical Specifications

An RRU3240, which is a remote radio unit for LTE, supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-306 lists the modes and frequency bands supported by an RRU3240.

Table 10-306 Modes and frequency bands supported by an RRU3240

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3240	LTE	2600 (band 7)	2500 to 2570	2620 to 2690

RF Specifications

Table 10-307 lists radio frequency (RF) specifications of an RRU3240.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-307 RF specifications of an RRU3240

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3240	2T4R	Two carriers. The bandwidth per carrier is 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 40 MHz.	-106.0	-108.8	2 x 40	389

NOTE

"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-308 lists the equipment specifications of an RRU3240.

Table 10-308 Equipment specifications of an RRU3240

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3240	-48 V DC; voltage range: -57 V DC to -36 V DC	• 480 mm x 270 mm x 140 mm (18 L, without the housing) • 485 mm x 300 mm x 170 mm (25 L, with the housing)	• ≤ 20 (without the housing) • ≤ 22 (with the housing)

Table 10-309 lists the environmental specifications of an RRU3240.

Table 10-309 Environmental specifications of an RRU3240

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3240	• -40°C to +50°C (with solar radiation of 1120 W/m^2) • -40°C to +55°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-310 lists the compliance standards for an RRU3240.

Table 10-310 Compliance standards for an RRU3240

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3240	Standards: • 3GPP TS 25.141 V3.0.0 • ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-311 lists the surge protection specifications of ports on an RRU3240.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-311 Surge protection specifications of ports on an RRU3240

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-312 lists the antenna capability of an RRU3240.

Table 10-312 Antenna capability of an RRU3240

Type	TMA Support	Supported RET Antennas
RRU3240	Supported	AISG2.0

NOTE

For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.3.22 RRU3841 Technical Specifications

An RRU3841, which is a remote radio unit for LTE, supports a maximum of two carriers.

Supported Modes and Frequency Bands

Table 10-313 lists the modes and frequency bands supported by an RRU3841.

Table 10-313 Modes and frequency bands supported by an RRU3841

Type	Mode	Frequency Band (MHz)	Receive Frequency Band (MHz)	Transmit Frequency Band (MHz)
RRU3841	LTE	AWS (band 4)	1710 to 1755	2110 to 2155

RF Specifications

Table 10-314 lists radio frequency (RF) specifications of an RRU3841.

As recommended in 3GPP TS 36.104, receiver sensitivity is measured under a 5 MHz channel bandwidth based on the FRC A1-3 in Annex A.1 (QPSK, R = 1/3, 25 RBs) standard.

Table 10-314 RF specifications of an RRU3841

Type	Transmit and Receive Channels	Capacity	Receiver Sensitivity (dBm)		Output Power (W)	Power Consumption (W)
			1T1R	1T2R		
RRU3841	4T4R This unit can work in 2T4R or 4T4R mode as configured.	Two carriers. The bandwidth per carrier is 5, 10, 15, or 20 MHz; the total bandwidth between the maximum frequency and the minimum frequency of the spectrums for two carriers does not exceed 40 MHz.	-106.3	-109.1	• 2 x 60 W in the 2T4R configuration • 4 x 30 W in the 4T4R configuration	• 485 W in the 2T4R configuration • 530 W in the 4T4R configuration

NOTE
"*A* x *B*" in **Output Power (W)** denotes that each RF module provides *A* transmit channels with *B* W transmit power per channel.

Engineering Specifications

Table 10-315 lists the equipment specifications of an RRU3841.

Table 10-315 Equipment specifications of an RRU3841

Type	Input Power	Dimension (H x W x D)	Weight (kg)
RRU3841	-48 V DC; voltage range: -57 V DC to -36 V DC	● 480 mm x 356 mm x 140 mm (24 L, without the housing) ● 485 mm x 380 mm x 170 mm (31 L, with the housing)	● ≤ 24.5 (without the housing) ● ≤ 26 (with the housing)

Table 10-316 lists the environmental specifications of an RRU3841.

Table 10-316 Environmental specifications of an RRU3841

Type	Operating Temperature	Relative Humidity	Absolute Humidity	Atmospheric Pressure
RRU3841	2T4R ● -40°C to +50°C (with solar radiation of 1120 W/m^2) ● -40°C to +55°C (without solar radiation) 4T4R ● -40°C to +45°C (with solar radiation of 1120 W/m^2) ● -40°C to +50°C (without solar radiation)	5% RH to 100% RH	1 g/m^3 to 30 g/m^3	70 kPa to 106 kPa

Table 10-317 lists the compliance standards for an RRU3841.

Table 10-317 Compliance standards for an RRU3841

Type	Operating Environment	Anti-seismic Performance	Protection Rating
RRU3841	Standards: ● 3GPP TS 25.141 V3.0.0 ● ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"	NEBS GR63 zone4	IP65

Table 10-318 lists the surge protection specifications of ports on an RRU3841.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as **Maximum discharge current**, refer to **Nominal discharge current**.

Table 10-318 Surge protection specifications of ports on an RRU3841

Port	Usage Scenario	Surge Protection Mode		Specification
DC power supply port	Applicable to all scenarios	Surge	Differential mode	2 kV (1.2/50 μs)
			Common mode	4 kV (1.2/50 μs)
		Surge current	Differential mode	10 kA
			Common mode	20 kA
Antenna port	Applicable to all scenarios	Surge current	Differential mode	8 kA
			Common mode	40 kA
CPRI port	Applicable to all scenarios	Surge		250 A
RET antenna port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Port	Usage Scenario	Surge Protection Mode		Specification
Alarm port	Applicable to all scenarios	Surge current	Differential mode	3 kA
			Common mode	5 kA

Antenna Capability

Table 10-319 lists the antenna capability of an RRU3841.

Table 10-319 Antenna capability of an RRU3841

Type	TMA Support	Supported RET Antennas
RRU3841	Supported	AISG2.0

NOTE
For RRUs supporting RET antennas, the feeding voltage is 12 V and feeding current is 2.3 A.

10.4 Engineering Specifications

This section describes engineering specifications of each base station, including input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

10.4.1 BTS3900 Engineering Specifications

BTS3900 engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-320 lists the input power specifications of a BTS3900. The BTS3900 (Ver.B) cabinet supports -48 V DC, +24 V DC, 110 V AC, and 220 V AC power input while the BTS3900 (Ver.B) cabinet supports -48 V DC, 110 V AC, and 220 V AC power input.

Table 10-320 Input power specifications of a BTS3900

Input Power	Voltage Range
-48 V DC	-38.4 V DC to -57 V DC
+24 V DC	+21.6 V DC to +29 V DC

Input Power	Voltage Range
110 V AC dual-live-wire	90/180 V AC to 135/270 V AC
200 V AC single-phase	176 V AC to 290 V AC
220 V AC three-phase	176/304 V AC to 290/500 V AC

Equipment Specifications

The BTS3900 (Ver.B) and BTS3900 (Ver.C) cabinets have the same size and weight. **Table 10-321** lists the equipment specifications of a BTS3900.

Table 10-321 Equipment specifications of a BTS3900

Item	Specification
Dimension (H x W x D)	900 mm x 600 mm x 450 mm
Weight	≤ 135 kg (full configuration, with one BBU and six RFUs, and without transmission devices)

Environment Specifications

Table 10-322 lists the environment specifications of a BTS3900.

Table 10-322 Environment specifications of a BTS3900

Item	Specification
Operating temperature	-20°C to +55°C Short term: +50°C to +55°C **NOTE** Short term indicates that a base station does not work for over 15 days within a year or that a base station does not continuously work for over 72 hours.
Relative humidity	5% RH to 95% RH
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

The BTS3900 (Ver.B) and BTS3900 (Ver.C) cabinets have the same surge protection specifications. **Table 10-323** lists the surge protection specifications of ports on a BTS3900.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-323 Surge protection specifications of ports on a BTS3900

Port	Surge Protection Mode	Specification
DC power supply port	Differential mode	1 kA
	Common mode	2 kA
AC power supply port	Differential mode	5 kA
	Common mode	5 kA

Standards

Table 10-324 lists the standards with which a BTS3900 complies.

Table 10-324 Standards with which a BTS3900 complies

Item	Standard
Protection rating	IP20
Storage	ETSI EN300019-1-1 V2.1.4 (2003-04) class1.2 "Weatherprotected, not temperature-controlled storage locations"
Transportation	ETSI EN300019-1-2 V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57: Tests -Test Ff: Vibration -Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
Anti-earthquake performance	ETSI EN 300019-1-3: "Earthquake"

Item	Standard
EMC	The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8/23 ● 3GPP TS 25.113 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The GBTS meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards: ● CISPR 22 (1997) ● EN 55022 (1998) ● EN 301 489-23 V1.2.1 (2002-11) ● CISPR 24 (1998) ● IEC 61000-4-2 ● IEC 61000-4-3 ● IEC 61000-4-4 ● IEC 61000-4-5 ● IEC 61000-4-6 ● IEC 61000-4-29 ● GB 9254-1998 ● ETSI 301 489-1 V1.3.1 (2001-09) ● FCC Part 15 The eNodeB has been certified by European standards. The eNodeB meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● 3GPP TS 36.113 ● ETSI EN 301489-1/23

Item	Standard
	● ETSI EN 301908-1 V2.2.1 (2003-10) ● ITU-R SM.329-10

10.4.2 BTS3900L Engineering Specifications

BTS3900L engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-325 lists the input power specifications of a BTS3900L.

Table 10-325 Input power specifications of a BTS3900L

Input Power	Voltage Range
-48 V DC	-38.4 V DC to -57 V DC

Equipment Specifications

The BTS3900L (Ver.B) and BTS3900L (Ver.C) cabinets have the same size and weight. **Table 10-326** lists the equipment specifications of a BTS3900L.

Table 10-326 Equipment specifications of a BTS3900L

Item	Specification
Dimension (H x W x D)	1600 mm x 600 mm x 450 mm
Weight	≤ 235 kg (full configuration, with one BBU and twelve RFUs, and without transmission devices)

Environment Specifications

Table 10-327 lists the environment specifications of a BTS3900L.

Table 10-327 Environment specifications of a BTS3900L

Item	Specification
Operating temperature	-20°C to +55°C Short term: +50°C to +55°C **NOTE** Short term indicates that a base station does not work for over 15 days within a year or that a base station does not continuously work for over 72 hours.
Relative humidity	5% RH to 95% RH
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

The BTS3900L (Ver.B) and BTS3900L (Ver.C) cabinets have the same surge protection specifications. **Table 10-328** lists the surge protection specifications of ports on a BTS3900L.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-328 Surge protection specifications of ports on a BTS3900L

Port	Surge Protection Mode	Specification
DC power supply port	Differential mode	1 kA
	Common mode	2 kA

Standards

Table 10-329 lists the standards with which a BTS3900L complies.

Table 10-329 Standards with which a BTS3900L complies

Item	Standard
Protection rating	IP20
Storage	ETSI EN300019-1-1V2.1.4 (2003-04) class1.2 "Weatherprotected, not temperature-controlled storage locations"
Transportation	ETSI EN300019-1-2V2.1.4 (2003-04) class 2.3 "Public transportation"

Item	Standard
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57: Tests -Test Ff:Vibration -Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
Anti-earthquake performance	ETSI EN 300019-1-3: "Earthquake"

Item	Standard
EMC	The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8/23 ● 3GPP TS 25.113 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The GBTS meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards: ● CISPR 22 (1997) ● EN 55022 (1998) ● EN 301 489-23 V1.2.1 (2002-11) ● CISPR 24 (1998) ● IEC 61000-4-2 ● IEC 61000-4-3 ● IEC 61000-4-4 ● IEC 61000-4-5 ● IEC 61000-4-6 ● IEC 61000-4-29 ● GB 9254-1998 ● ETSI 301 489-1 V1.3.1 (2001-09) ● FCC Part 15 The eNodeB has been certified by European standards. The eNodeB meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● 3GPP TS 36.113 ● ETSI EN 301489-1/23

Item	Standard
	● ETSI EN 301908-1 V2.2.1 (2003-10) ● ITU-R SM.329-10

10.4.3 BTS3900A Engineering Specifications

BTS3900A engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-330 lists the input power specifications of a BTS3900A.

Table 10-330 Input power specifications of a BTS3900A

Input Power	Voltage Range
-48 V DC	-38.4 V DC to -57 V DC
110 V AC dual-live-wire	90/180 V AC to 135/270 V AC
220 V AC single-phase	176 V AC to 290 V AC
220 V AC three-phase	176/304 V AC to 290/500 V AC

Equipment Specifications

Table 10-331 lists the equipment specifications of a BTS3900A.

Table 10-331 Equipment specifications of a BTS3900A

Item	Cabinet	Specification
Dimension (H x W x D)	RFC (Ver.B)/RFC (Ver.C)	700 mm x 600 mm x 480 mm
	APM30H (Ver.B)/APM30H (Ver.C)/TMC11H (Ver.B)/ TMC11H (Ver.C)	700 mm x 600 mm x 480 mm

Item	Cabinet	Specification
Weight	BTS3900A (Ver.B)	≤194 kg ● ≤87 kg (with APM30H (Ver.B) in full configuration, without transmission devices and storage batteries) ● ≤107 kg (with RFC (Ver.B) in full configuration)
	BTS3900A (Ver.C)	≤194 kg ● ≤87 kg (with APM30H (Ver.C) in full configuration, without transmission devices and storage batteries) ● ≤107 kg (with RFC (Ver.C) in full configuration)

Environment Specifications

Table 10-332 lists the environment specifications of a BTS3900A.

Table 10-332 Environment specifications of a BTS3900A

Item	Specification
Operating temperature	-40°C to +50°C and +1120 W/M^2 solar radiation; an AC heater assembly unit (HAU) is required if the operating temperature is below -20°C.
Relative humidity	5% RH to 100% RH
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

The BTS3900A (Ver.B) and BTS3900A (Ver.C) cabinets have the same surge protection specifications. **Table 10-333** lists the surge protection specifications of ports on a BTS3900A.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-333 Surge protection specifications of ports on a BTS3900A

Port	Usage Scenario	Surge Protection Mode	Specification
-48 V DC output remote port	Applicable to all scenarios	Differential mode	10 kA
		Common mode	20 kA
-48 V DC input port	Applicable to the scenario where transmission cabinets, battery cabinets, or a BTS3900A (DC) is used	Differential mode	10 kA
		Common mode	20 kA
	Applicable to the scenario where only RFC cabinets are used	Differential mode	3 kA
		Common mode	5 kA
AC power supply port	Applicable to the scenario where RF modules are configured remotely or are placed outdoors together with the correspondin g base station	Differential mode	30 kA
		Common mode	30 kA

Standards

Table 10-334 lists the standards with which a BTS3900A complies.

Table 10-334 Standards with which a BTS3900A complies

Item	Standard
Protection rating	IP55
Storage	ETSI EN300019-1-1V2.1.4 (2003-04) class1.2 "Weatherprotec-ted, not temperature-controlled storage locations"

Item	Standard
Transportation	ETSI EN300019-1-2V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57: Tests -Test Ff:Vibration -Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
Anti-earthquake performance	ETSI EN 300019-1-4: "Earthquake"

<table>
<tr><th>Item</th><th>Standard</th></tr>
<tr><td>EMC</td><td>The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards:
● R&TTE Directive 1999/5/EC
● R&TTE Directive 89/336/EEC
● ETSI EN 301489-1/8/23
● 3GPP TS 25.113
● ETSI EN 301908-1
● ITU-T SM 329-10
● FCC PART15
The GBTS meets the EMC requirements and complies with the following standards:
● R&TTE Directive 1999/5/EC
● R&TTE Directive 89/336/EEC
● ETSI EN 301489-1/8
● ETSI EN 301908-1
● ITU-T SM 329-10
● FCC PART15
The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards:
● CISPR 22 (1997)
● EN 55022 (1998)
● EN 301 489-23 V1.2.1 (2002-11)
● CISPR 24 (1998)
● IEC 61000-4-2
● IEC 61000-4-3
● IEC 61000-4-4
● IEC 61000-4-5
● IEC 61000-4-6
● IEC 61000-4-29
● GB 9254-1998
● ETSI 301 489-1 V1.3.1 (2001-09)
● FCC Part 15
The eNodeB has been certified by European standards. The eNodeB meets the EMC requirements and complies with the following standards:
● R&TTE Directive 1999/5/EC
● R&TTE Directive 89/336/EEC
● 3GPP TS 36.113
● ETSI EN 301489-1/23</td></tr>
</table>

Item	Standard
	● ETSI EN 301908-1 V2.2.1 (2003-10) ● ITU-R SM.329-10

10.4.4 BTS3900AL Engineering Specifications

BTS3900AL engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-335 lists the input power specifications of a BTS3900AL.

Table 10-335 Input power specifications of a BTS3900AL

Input Power	Voltage Range
220 V AC single-phase	176 V DC to 290 V DC
220 V AC three-phase	176/304 V AC to 290/500 V AC
110 V AC dual-live-wire	105/176 V AC to 150/260 V AC

Equipment Specifications

Table 10-336 lists the equipment specifications of a BTS3900AL.

Table 10-336 Equipment specifications of a BTS3900AL

Item	Specification
Dimension (H x W x D)	1925 mm x 770 mm x 750 mm (with the base) Base: 200 mm x 770 mm x 700 mm
Weight	≤ 550 kg (full configuration, with the base and full configuration of storage batteries, and without transmission devices)

Environment Specifications

Table 10-337 lists the environment specifications of a BTS3900AL.

Table 10-337 Environment specifications of a BTS3900AL

Item	Specification
Operating temperature	-40°C to +50°C and +1120 W/M^2 solar radiation (without storage batteries); an AC heater assembly unit (HAU) is required if the operating temperature is below -20°C. -40°C to +40°C and +1120 W/M^2 solar radiation (with storage batteries); an AC heater assembly unit (HAU) is required if the operating temperature is below -20°C.
Relative humidity	5% RH to 100% RH
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

Table 10-338 lists the surge protection specifications of ports on a BTS3900AL.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-338 Surge protection specifications of ports on a BTS3900AL

Port	Surge Protection Mode	Specification
AC input power port	Differential mode	30 kA
	Common mode	30 kA

Standards

Table 10-339 lists the standards with which a BTS3900AL complies.

Table 10-339 Standards with which a BTS3900AL complies

Item	Standard
Protection rating	IP55
Storage	ETSI EN300019-1-1V2.1.4 (2003-04) class 1.2 "Weatherprotected, not temperature-controlled storage locations"
Transportation	ETSI EN300019-1-2V2.1.4 (2003-04) class 2.3 "Public transportation"

Item	Standard
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57:Tests -Test Ff:Vibration - Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
Anti-earthquake performance	ETSI EN 300019-1-4: "Earthquake"

Item	Standard
EMC	The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8/23 ● 3GPP TS 25.113 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The GBTS meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards: ● CISPR 22 (1997) ● EN 55022 (1998) ● EN 301 489-23 V1.2.1 (2002-11) ● CISPR 24 (1998) ● IEC 61000-4-2 ● IEC 61000-4-3 ● IEC 61000-4-4 ● IEC 61000-4-5 ● IEC 61000-4-6 ● IEC 61000-4-29 ● GB 9254-1998 ● ETSI 301 489-1 V1.3.1 (2001-09) ● FCC Part 15 The eNodeB has been certified by European standards. The eNodeB meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● 3GPP TS 36.113 ● ETSI EN 301489-1/23 ● ETSI EN 301908-1 V2.2.1 (2003-10)

Item	Standard
	● ITU-R SM.329-10

10.4.5 DBS3900 Engineering Specifications

DBS3900 engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-340 lists the input power specifications of a DBS3900.

Table 10-340 Input power specifications of a DBS3900

Item	Input Power	Voltage Range
baseband unit (BBU)	-48 V DC	-38.4 V DC to -57 V DC
remote radio unit (RRU)	-48 V DC	-36 V DC to -57 V DC

Equipment Specifications

The equipment specifications of a DBS3900 include the following:

- BBU equipment specifications (for details, see **10.1 BBU3900 Technical Specifications**)
- RRU equipment specifications (for details, see **10.3 Technical Specifications of RRUs**)
- Related cabinet equipment specifications (for details, see *DBS3900 Hardware Description*)

Environment Specifications

The environment specifications of a DBS3900 include the following:

- BBU environment specifications (for details, see **10.1 BBU3900 Technical Specifications**)
- RRU environment specifications (for details, see **10.3 Technical Specifications of RRUs**)

Surge Protection Specifications

The surge protection specifications of ports on a DBS3900 include the following:

- Surge protection specifications of ports on the BBU (for details, see **10.1 BBU3900 Technical Specifications**)
- Surge protection specifications of ports on a remote radio unit (RRU) (for details, see **10.3 Technical Specifications of RRUs**)

Standards

Table 10-341 lists the standards with which a DBS3900 complies.

Table 10-341 Standards with which a DBS3900 complies

Item	Standard
Storage	ETSI EN300019-1-1V2.1.4 (2003-04) class 1.2 "Weatherprotected, not temperature-controlled storage locations"
Transportation	ETSI EN300019-1-2V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57:Tests -Test Ff:Vibration -Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
Anti-earthquake performance	ETSI EN 300019-1-3: "Earthquake"

Item	Standard
EMC	The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8/23 ● 3GPP TS 25.113 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The GBTS meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards: ● CISPR 22 (1997) ● EN 55022 (1998) ● EN 301 489-23 V1.2.1 (2002-11) ● CISPR 24 (1998) ● IEC 61000-4-2 ● IEC 61000-4-3 ● IEC 61000-4-4 ● IEC 61000-4-5 ● IEC 61000-4-6 ● IEC 61000-4-29 ● GB 9254-1998 ● ETSI 301 489-1 V1.3.1 (2001-09) ● FCC Part 15 The eNodeB has been certified by European standards. The eNodeB meets the EMC requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● 3GPP TS 36.113 ● ETSI EN 301489-1/23 ● ETSI EN 301908-1 V2.2.1 (2003-10)

Item	Standard
	● ITU-R SM.329-10

10.4.6 BTS3900C Engineering Specifications

BTS3900C engineering specifications include input power specifications, equipment specifications, environment specifications, surge protection specifications, and standards that have been complied with.

Input Power Specifications

Table 10-342 lists the input power specifications of a BTS3900C.

Table 10-342 Input power specifications of a BTS3900C

Input Power	Voltage Range
-48 V DC	-38.4 V DC to -57 V DC
220 V AC	176 V DC to 290 V DC

Equipment Specifications

Table 10-343 lists the equipment specifications of a BTS3900C cabinet.

Table 10-343 Equipment specifications of a BTS3900C cabinet

Item	Specification
Dimension (H x W x D)	600 mm x 400 mm x 390 mm OMB: 600 mm x 240 mm x 390 mm
Weight	● ≤ 55 kg (AC) ● ≤ 53 kg (DC)

Environment Specifications

Table 10-344 lists the environment specifications of a BTS3900C.

Table 10-344 Environment specifications of a BTS3900C

Item	Specification
Operating temperature	● -40°C to +45°C (with solar radiation) ● -40°C to +50°C (without solar radiation)

Item	Specification
Relative humidity	5% RH to 100% RH
Atmospheric pressure	70 kPa to 106 kPa

Surge Protection Specifications

Table 10-345 lists the surge protection specifications of ports on a BTS3900C.

NOTE

- Unless otherwise specified, the surge protection specifications depend on the surge waveform of 8/20 μs.
- All the surge current items, unless otherwise specified as Maximum discharge current, refer to Nominal discharge current.

Table 10-345 Surge protection specifications of ports on a BTS3900C

Port	Surge Protection Mode		Specification
-48 V DC port	Surge current	Differential mode	10 kA
		Common mode	20 kA
220 V AC port	Surge current	Differential mode	30 kA
		Common mode	30 kA

Standards

Table 10-346 lists the standards with which a BTS3900C complies.

Table 10-346 Standards with which a BTS3900C complies

Item	Standard
Protection rating	IP55
Storage	ETSI EN300019-1-1V2.1.4 (2003-04) class 1.2 "Weatherprotected, not temperature-controlled storage locations"
Transportation	ETSI EN300019-1-2V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	IEC 60068-2-57: Environmental testing -Part 2-57:Tests -Test Ff:Vibration -Time-history method YD5083: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)

Item	Standard
Anti-earthquake performance	ETSI EN 300019-1-4: "Earthquake"
EMC	The MBTS meets the Electromagnetic Compatibility (EMC) requirements and complies with the following standards: ● R&TTE Directive 1999/5/EC ● R&TTE Directive 89/336/EEC ● ETSI EN 301489-1/8/23 ● 3GPP TS 25.113 ● ETSI EN 301908-1 ● ITU-T SM 329-10 ● FCC PART15 The NodeB has been certified by European standards. The NodeB meets the EMC requirements and complies with the following standards: ● CISPR 22 (1997) ● EN 55022 (1998) ● EN 301 489-23 V1.2.1 (2002-11) ● CISPR 24 (1998) ● IEC 61000-4-2 ● IEC 61000-4-3 ● IEC 61000-4-4 ● IEC 61000-4-5 ● IEC 61000-4-6 ● IEC 61000-4-29 ● GB 9254-1998 ● ETSI 301 489-1 V1.3.1 (2001-09) ● FCC Part 15

11 Reliability

About This Chapter

3900 series base stations use the Huawei SingleBTS platform, support hardware sharing, and provide mature communications technologies and stable transmission reliability.

11.1 GBTS Reliability

This section describes GBTS reliability, which includes system reliability, hardware reliability, and software reliability.

System Reliability

The GBTS features a reliability design, including load sharing, redundancy configuration, and optimized fault detection and isolation technologies for the boards and system, greatly enhancing system reliability.

- Redundancy design
  - The main control board, transmission board, power unit, and FAN unit in the GBTS all support redundancy. The baseband unit (BBU) supports load sharing. The radio frequency (RF) module supports backup.
  - The CPRI ports between the BBU and the RF modules supports the ring topology. When one CPRI link is faulty, the GBTS automatically switches to the other CPRI link.
  - Important data in the GBTS, such as software versions and data configuration files, supports redundancy.
- Reliability design

  The GBTS can automatically detect and diagnose faults in the software and hardware, report alarms, and take self-healing measures. If the faults cannot be rectified, the system automatically isolates the faulty NEs.

Hardware Reliability

- Anti-misinsertion design of boards

  If a board of one type is inserted into a slot for another type of board, the board cannot fit into the backplane.
- Overtemperature protection

  When the temperature near the power amplifier (PA) in an RF module is too high, the system reports an over-temperature alarm and immediately shuts down the PA.
- Reliable power supply
  - Support for wide-range voltages and surge protection
  - Power failure protection for programs and data
  - Protection of power supply against overvoltage, overcurrent, and reversed connection of positive and negative poles on boards
- Comprehensive surge protection design

  Surge protection applies to alternating current (AC) and direct current (DC) power ports and various input and output signal ports (such as E1 port, interconnection port, and Boolean alarm port), antenna connectors, and GPS port of the GBTS.

Software Reliability

Software reliability is guaranteed through data redundancy and high error tolerance.

- Data redundancy

To ensure normal operation of a GBTS when errors occur in important files or data, the GBTS provides the following redundancy functions:

- Redundancy of software versions: The GBTS stores software versions, including the BootROM version, in different partitions to provide redundancy. If the active version is abnormal, the GBTS switches to the backup version.
- Redundancy of data configuration files: The GBTS stores data configuration files in different partitions to provide redundancy. If the current file is damaged, the GBTS can continue working properly by loading the backup file.

- Error tolerance capability

  When software errors occur, the self-healing capability prevents the system from collapse. The software error tolerance capability covers the following aspects:

  - Scheduled checks of key resources: The GBTS checks software resource usage periodically. If resource cannot be released because of software errors, the GBTS can release the unavailable resources in time and export logs and alarms.
  - Task monitoring: When software is running, monitoring processes check for internal software errors or certain hardware faults. If a fault is detected, an alarm is reported and self-healing measures are taken to restore the task.
  - Data check: The GBTS performs scheduled or event-triggered data consistency checks and restores data consistency selectively or preferentially. In addition, the GBTS generates related logs and alarms.
  - Watchdog: When a software error occurs in the GBTS, the GBTS detects the error using the software and hardware watchdogs and automatically resets.

11.2 NodeB Reliability

This section describes NodeB reliability, which includes system reliability, hardware reliability, and software reliability.

System Reliability

The NodeB features a reliability design, including load sharing, redundancy configuration, and optimized fault detection and isolation technologies for the boards and system, greatly enhancing system reliability.

- Redundancy design
  - The main control board, transmission board, power unit, and FAN unit in the NodeB all support redundancy. The baseband unit (BBU) supports load sharing. The radio frequency (RF) module supports backup.
  - The CPRI ports connecting the BBU and the RF modules support the ring topology. When one CPRI link is faulty, the NodeB automatically switches to the other CPRI link.
  - Important data in the NodeB, such as software versions and data configuration files, supports redundancy.
- Reliability design

  The NodeB can automatically detect and diagnose faults in the software, hardware, and environment, report alarms, and take self-healing measures. If the faults cannot be rectified, the system automatically isolates the faulty NEs.

Hardware Reliability

- Anti-misinsertion design of boards

  If a board of one type is inserted into a slot for another type of board, the board cannot fit into the backplane. This prevents boards from damage.
- Overtemperature protection

  When the temperature near the power amplifier (PA) in an RF module is too high, the system reports an overtemperature alarm and immediately shuts down the PA.
- Reliable power supply
  - Support for wide-range voltages and surge protection
  - Power failure protection for programs and data
  - Protection of power supply against overvoltage, overcurrent, and reversed connection of positive and negative poles on boards
- Comprehensive surge protection design

  Surge protection applies to alternating current (AC) and direct current (DC) power ports and various input and output signal ports (such as E1 port, interconnection port, and Boolean alarm port), antenna connectors, and GPS port on the NodeB.

Software Reliability

Software reliability is guaranteed through data redundancy and high error tolerance.

- Data redundancy

  To ensure normal operation of a NodeB when errors occur in important files or data, the NodeB provides the following redundancy functions:
  - Redundancy of software versions: The NodeB stores software versions, including the BootROM version, in different partitions to provide redundancy. If the active version is abnormal, the NodeB switches to the backup version.
  - Redundancy of data configuration files: The NodeB stores data configuration files in different partitions to provide redundancy. If the current file is damaged, the NodeB can continue working properly by loading the backup file.
- Error tolerance capability

  When software errors occur, the self-healing capability prevents the system from collapse. The software error tolerance capability covers the following aspects:
  - Scheduled checks of key resources: The NodeB checks software resource usage periodically. If resource cannot be released because of software errors, the NodeB can release the unavailable resources in time and export logs and alarms.
  - Task monitoring: When software is running, monitoring processes are started to check for internal software errors or certain hardware faults. If a fault is detected, an alarm is reported and self-healing measures are taken to restore the task.
  - Data consistency check: The NodeB performs scheduled or event-triggered data consistency checks and restores data consistency selectively or preferentially. In addition, the NodeB generates related logs and alarms.
  - Watchdog: When a software error occurs in the NodeB, the NodeB detects the error using the software and hardware watchdogs and automatically resets.

11.3 eNodeB Reliability

This section describes eNodeB reliability, which includes system reliability, hardware reliability, and software reliability.

System Reliability

- Intra-board baseband resource pool

  Intra-board baseband resource pools are designed to enable dynamic allocation of baseband resources based on the specifications and load status of an LTE baseband processing unit (LBBP). This increases the usage of baseband resources and improves system reliability.

- Inter-board cell reestablishment

  Inter-board cell reestablishment is designed to enable mutual backup between LBBP boards.

- Cold redundancy of main control boards

  In a BBU3900, two UMPT/LMPT boards are configured and work in active/standby mode. (UMPT is short for universal main processing and transmission unit. LMPT is short for LTE main processing and transmission unit.) If the active UMPT/LMPT board experiences a major fault, an active/standby switchover is automatically performed. An active/standby switchover can also be performed if a user runs the switchover command.

- Redundancy of common public radio interface (CPRI) ports
  - Hot redundancy: A remote radio unit (RRU) is connected to two CPRI ports on different LBBP boards to form a ring topology. If a CPRI port is faulty, the service interruption time does not exceed 500 ms. If the LBBP board where the cell is established is faulty, the cell is reestablished on the other LBBP board, with a service interruption time shorter than 20s.
  - Cold redundancy: RRUs are connected to two CPRI ports to form a ring topology. The two CPRI ports are provided by either one or two LBBP boards. If a CPRI port or LBBP board is faulty, the cell is reestablished, with a service interruption time shorter than 20s.

- RRU channel cross-connection under multiple-input multiple-output (MIMO)

  RRU channel cross-connection under MIMO is implemented by cross-connections of radio frequency (RF) jumpers between RRUs/RFUs and antennas and data switching in the connected LBBP board. (RFU is short for radio frequency unit.) This function improves reliability of the entire network without adding hardware. It prevents faults in a single RRU or RFU from causing permanent failures in providing services in cells that are served by the RRU or RFU. This function partially achieves self-healing.

- Operation and maintenance (O&M) channel backup

  The M2000 detects channel connectivity by employing the handshake mechanism at the application layer. If detecting that the active channel is disconnected, the M2000 instructs the eNodeB through the standby channel to perform a channel switchover. The eNodeB automatically switches from the route for the active channel to the route for the standby channel.

- Route backup

  Route backup enhances transmission reliability by using a pair of primary and secondary routes to the same destination. The routes are prioritized: A higher priority is set for the primary route, and a lower priority for the secondary route.

Hardware Reliability

- Anti-misinsertion design of boards

  If a board of one type is inserted into a slot for another type of board, the board cannot fit into the backplane. This function protects boards.

- Over-temperature protection

  When the temperature near the power amplifier (PA) in an RF module is too high, the eNodeB reports an over-temperature alarm and immediately shuts down the PA. This function protects the PA from damage caused by over-temperature.

- Reliable power supply

  Reliable power supply is achieved using the following techniques:

  - Support for wide-range voltages and surge protection
  - Power failure protection for programs and data
  - Protection of power supply against overvoltage, overcurrent, and reversed connection of positive and negative poles on boards
  - Support for a maximum configuration of two UPEUs in an eNodeB to provide 1+1 redundancy

- Surge protection design

  An eNodeB takes surge protection measures on AC and DC power sockets, input and output signal ports (E1/T1 port, FE/GE port, interconnection port, and Boolean alarm port), antenna connectors, and GPS port.

Software Reliability

- Redundancy

  To ensure normal operation of an eNodeB when errors occur in important files or data, the eNodeB provides the following redundancy functions:

  - Redundancy of software versions: The eNodeB stores software versions, including the BootROM version, in different partitions to provide redundancy. If the active version is abnormal, the eNodeB switches to the backup version.
  - Redundancy of data configuration files: The eNodeB stores data configuration files in different partitions to provide redundancy. If the current file is damaged, the eNodeB can continue working properly by loading the backup file.
  - Redundancy of boards: Two boards of the same type can work in active/standby mode. If the active board fails or is faulty, the standby board takes over, ensuring normal operation of the eNodeB.

- Error tolerance capability

  When software errors occur, the self-healing capability prevents eNodeBs from collapse. The software error tolerance capability of an eNodeB covers the following aspects:

  - Scheduled checks of key resources: The eNodeB checks usage of software resources and generates related logs and alarms. In this way, the eNodeB can release unavailable resources.
  - Task monitoring: When software is running, monitoring processes check for internal software faults or certain hardware faults. If a fault is detected, an alarm is reported and self-healing measures are taken to restore the task.

- Data check: The eNodeB performs scheduled or event-triggered data consistency checks and restores data consistency selectively or preferentially. In addition, the eNodeB generates related logs and alarms.
- Watchdog: When a software error occurs in an eNodeB, the eNodeB detects the error using the software and hardware watchdogs and automatically resets.

11.4 MBTS Reliability

This section describes MBTS reliability, which includes system reliability, hardware reliability, and software reliability.

System Reliability

The MBTS features a reliability design, including load sharing, redundancy configuration, and optimized fault detection and isolation technologies for the boards and system, greatly enhancing system reliability.

- Redundancy design
  - The power unit and FAN unit in the MBTS both support redundancy. The baseband unit (BBU) supports load sharing.
  - The CPRI ports between the BBU and the RF modules supports the ring topology. When one CPRI link is faulty, the MBTS automatically switches to the other CPRI link.
  - Important data in the MBTS, such as software versions and data configuration files, supports redundancy.
- Reliability design

  The MBTS can automatically detect and diagnose faults in the software and hardware, report alarms, and take self-healing measures. If the faults cannot be rectified, the system automatically isolates the faulty NEs.

Hardware Reliability

- Anti-misinsertion design of boards

  If a board of one type is inserted into a slot for another type of board, the board cannot fit into the backplane.
- Overtemperature protection

  When the temperature near the power amplifier (PA) in an RF module is too high, the system reports an over-temperature alarm and immediately shuts down the PA.
- Reliable power supply
  - Support for wide-range voltages and surge protection
  - Power failure protection for programs and data
  - Protection of power supply against overvoltage, overcurrent, and reversed connection of positive and negative poles on boards
- Comprehensive surge protection design

  Surge protection applies to alternating current (AC) and direct current (DC) power ports and various input and output signal ports (such as E1 port, interconnection port, and Boolean alarm port), antenna connectors, and GPS port of the MBTS.

Software Reliability

Software reliability is guaranteed through data redundancy and high error tolerance.

- Data redundancy

  To ensure normal operation of an MBTS when errors occur in important files or data, the MBTS provides the following redundancy functions:

  - Redundancy of software versions: The MBTS stores software versions in different partitions to provide redundancy. If the active version is abnormal, the MBTS switches to the backup version.
  - Redundancy of data configuration files: The MBTS stores data configuration files in different partitions to provide redundancy. If the current file is damaged, the MBTS can continue working properly by loading the backup file.

- Error tolerance capability

  When software errors occur, the self-healing capability prevents the system from collapse. The software error tolerance capability covers the following aspects:

  - Scheduled checks of key resources: The MBTS checks software resource usage periodically. If resource cannot be released because of software errors, the MBTS can release the unavailable resources in time and export logs and alarms.
  - Task monitoring: When software is running, monitoring processes check for internal software errors or certain hardware faults. If a fault is detected, an alarm is reported and self-healing measures are taken to restore the task.
  - Data check: The MBTS performs scheduled or event-triggered data consistency checks and restores data consistency selectively or preferentially. In addition, the MBTS generates related logs and alarms.
  - Watchdog: When a software error occurs in the MBTS, the MBTS detects the error using the software and hardware watchdogs and automatically resets.