BTS3900 GSM

V300R008

Product Description

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Part Number

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About This Document

Purpose

This document provides an overview of the BTS3900 GSM. It also describes the system architecture, software and hardware structure, functional subsystems, configuration types, signal flow, clock synchronization modes, and topologies of the BTS3900 GSM. This document also lists the specifications for the capacity, radio frequency (RF), engineering, surge protection, and ports of the BTS3900 GSM.

Product Version

The following table lists the product version related to this document.

Product Name	Product Version
BTS3900 GSM (hereinafter referred to as BTS3900)	V300R008

Intended Audience

This document is intended for:

- Network planners
- Field engineers
- System engineers

Change History

For changes in the document, refer to **Changes in BTS3900 GSM Product Description**.

Organization

1 System Architecture of the BTS3900

The BTS3900 consists of the BBU3900, RFUs, and indoor macro cabinet. The BBU3900 and RFUs are installed in the indoor macro cabinet.

2 Introduction to the BTS3900

This provides an overview of the BTS3900, and describes the physical structure, logical structure, and software structure of the BTS3900.

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3 Power Distribution Modes of the BTS3900

The BTS3900 cabinet can use three types of power inputs, namely, -48 V DC, +24 V DC, and 220 V AC.

4 BTS3900 Monitoring System

The BTS3900 monitoring system enables the power monitoring, fan monitoring, and environment monitoring.

5 Reference Clocks of the BTS3900/BTS3900A

The BTS3900/BTS3900A supports two types of reference clocks: line clock and free-run clock.

6 Signal Flow of the BTS3900/BTS3900A

The signal flow of the BTS3900/BTS3900A consists of the traffic signal flow and the signaling flow of the BTS. The BTS3900/BTS3900A signal flow is classified into the DL traffic signal flow, UL traffic signal flow, and signaling flow.

7 Topologies of the BTS

The BTS supports the star, chain, tree, and ring topologies. Multiple topologies, such as star, chain, and ring, are supported by between the BBU and the RFUs. In practice, these topologies can be combined. Optimum utilization of the topologies can improve the quality of service and lower the investment on the transmission equipment.

8 Configuration of the BTS3900/BTS3900A

This describes the configuration principles of the BTS3900/BTS3900A, RF cable connections, CPRI cable connections, and typical configurations of the RFUs.

9 OM System of the BTS

The OM system implements the management, monitoring, and maintenance tasks of the BTS3900/BTS3900A. It provides various OM modes and multiple maintenance platforms to meet different maintenance requirements.

10 Technical Specifications of the BTS3900

This describes the BTS3900 technical specifications, which consist of capacity specifications, RF specifications, engineering specifications, lightning protection specifications, and other specifications related to physical ports and environment.

Conventions

1. **Symbol Conventions**

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

Symbol	Description
 DANGER	Indicates a hazard with a high level of risk that, if not avoided, will result in death or serious injury.

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Symbol	Description
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 that, if not avoided, could cause equipment damage, data loss, and performance degradation, or unexpected results.
TIP	Indicates a tip that may help you solve a problem or save your time.
NOTE	Provides additional information to emphasize or supplement important points of the main text.

2. General Conventions

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`	Terminal display is in Courier New.

3. Command Conventions

Convention	Description
Boldface	The keywords of a command line are in **boldface**.
Italic	Command arguments are in *italic*.
[ ]	Items (keywords or arguments) in square brackets [ ] are optional.
{x | y | ...}	Alternative items are grouped in braces and separated by vertical bars.One is selected.
[x | y | ...]	Optional alternative items are grouped in square brackets and separated by vertical bars.One or none is selected.
{ x | y | ... } *	Alternative items are grouped in braces and separated by vertical bars.A minimum of one or a maximum of all can be selected.
[x | y | ...] *	Alternative items are grouped in braces and separated by vertical bars.A minimum of zero or a maximum of all can be selected.

4. GUI Conventions

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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** .

5. Keyboard Operation

Convention	Description
Key	Press the key.For example,press **Enter** and press **Tab**.
Key1+Key2	Press the keys concurrently.For example,pressing **Ctrl+Alt+A** means the three keys should be pressed concurrently.
Key1,Key2	Press the keys in turn.For example,pressing Alt,A means the two keys should be pressed in turn.

6. Mouse Operation

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.

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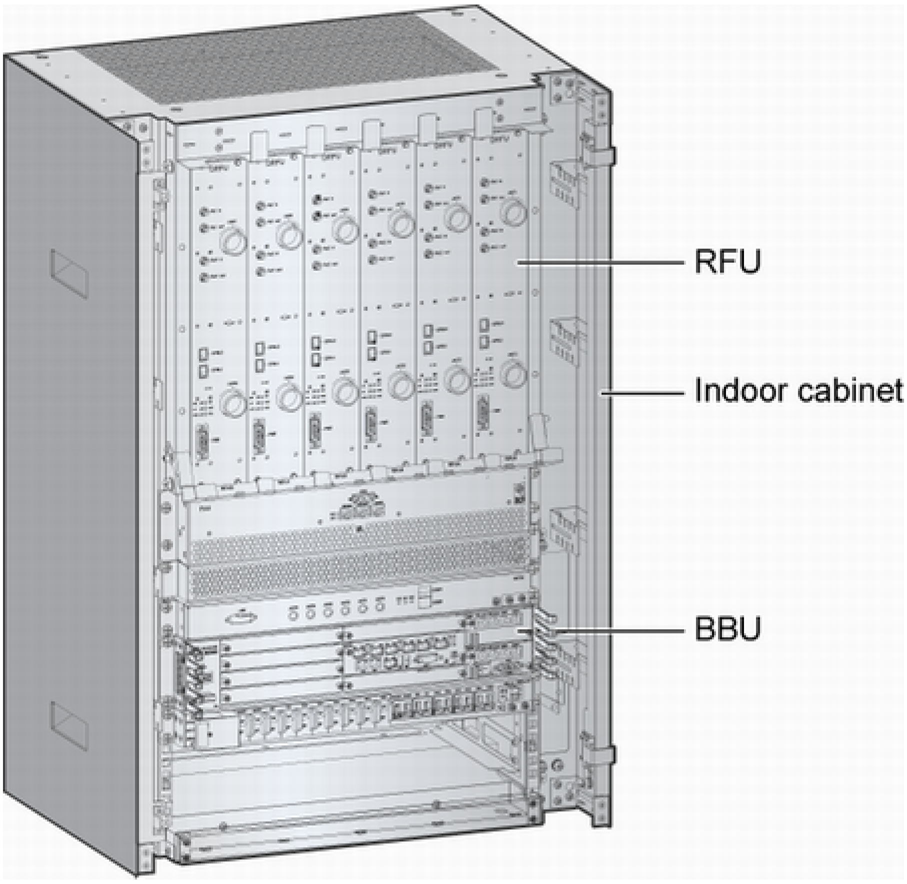
1 System Architecture of the BTS3900

The BTS3900 consists of the BBU3900, RFUs, and indoor macro cabinet. The BBU3900 and RFUs are installed in the indoor macro cabinet.

Figure 1-1 shows the BTS3900 system.

Figure 1-1 BTS3900 system



NOTE

The RFUs are of two types: DRFUs and GRFUs. This takes the DRFUs as an example.

The BTS3900 mainly consists of the following components:

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- The BBU3900 is used for baseband processing and enables interaction between the BTS and the BSC.
- The RFU is an RF filtering unit, which performs modulation, demodulation, data processing, and combining and dividing for baseband signals and RF signals.
- The indoor macro cabinet houses the BBU3900 and RFUs. In addition, the indoor macro cabinet provides the functions such as power distribution, heat dissipation, and surge protection.

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2 Introduction to the BTS3900

About This Chapter

This provides an overview of the BTS3900, and describes the physical structure, logical structure, and software structure of the BTS3900.

2.1 Overview of the BTS3900
The BTS3900 is an indoor macro base station developed by Huawei. The BTS3900 mainly consists of the BBU and the RFUs. Compared with traditional BTSs, the BTS3900 features simpler structure and higher integration.

2.2 Structure of the BTS3900 Cabinet
The BTS3900 cabinet supports three types of power input: -48 V DC, +24 V DC, and 220 V AC. The cabinets that support different types of input power are different in structure, mainly in power distribution unit.

2.3 Logical Structure of the BTS3900
The BTS3900 mainly consists of the BBU and RFUs. The logical structure of the BTS3900 consists of the RF subsystem, control subsystem, power subsystem, and antenna subsystem.

2.4 Software Structure of the BTS
The BTS software consists of the platform software, signaling protocol software, OM software, and data center. The latter three are application software, and the platform software provides support for the application software.

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2.1 Overview of the BTS3900

The BTS3900 is an indoor macro base station developed by Huawei. The BTS3900 mainly consists of the BBU and the RFUs. Compared with traditional BTSs, the BTS3900 features simpler structure and higher integration.

The BTS3900 has the following features:

- It is developed on the basis of the unified BTS platform for Huawei wireless products and enables the smooth evolution from 2G to 3G.
- It supports the Abis IP/FE interface in hardware and enables Abis over IP through software upgrade if required.
- It shares the BBU subrack, which is the central processing unit, with the DBS3900 to minimize the number of spare parts and reduce the cost.
- It can be flexibly installed in a small footprint and can be easily maintained with low cost.
- It supports multiple frequency bands, such as PGSM900, EGSM900, and DCS1800.
- It supports TX diversity (not supported by the GRFU) and PBT (not supported by the GRFU).
- It supports 2-way and 4-way RX diversity (not supported by the GRFU) to improve the uplink coverage.
- It supports the GPRS and the EGPRS.
- It supports omnidirectional cells and directional cells.
- It supports the hierarchical cell, concentric cell, and micro cell.
- It supports multiple topologies, such as star, tree, chain, ring, and hybrid topologies.
- It supports the A5/3, A5/2, and A5/1 encryption and decryption algorithms.
- It supports the cell broadcast SMS and point-to-point SMS.
- It supports coexistence with the BTS3X, BTS3012, and DBS3900.
- When the DRFU is configured for the BTS3900, a BTS3900 can support a maximum of 12 carriers in the maximum cell configuration of S4/4/4. In addition, a site configured with the BTS3900s can support a maximum of 36 carriers in the maximum cell configuration of S12/12/12.
- When the GRFU is configured for the BTS3900, a BTS3900 can support a maximum of 36 carriers in the maximum cell configuration of S12/12/12. In addition, a site configured with the BTS3900s can support a maximum of 72 carriers in the maximum cell configuration of S24/24/24.

2.2 Structure of the BTS3900 Cabinet

The BTS3900 cabinet supports three types of power input: -48 V DC, +24 V DC, and 220 V AC. The cabinets that support different types of input power are different in structure, mainly in power distribution unit.

2.2.1 Structure of the BTS3900 -48 V Cabinet
The BTS3900 cabinet (-48 V) uses the external -48 V DC input. The DC power is directly led into the DCDU-01 and the DCDU-01 distributes the DC power to each component in the cabinet.

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The BTS3900 -48 V cabinet can be installed alone, stacked on another BTS3900 -48 V cabinet, or installed side by side with another BTS3900 -48 V cabinet.

2.2.2 Structure of the BTS3900 +24 V Cabinet
The BTS3900 cabinet (+24 V) uses the external +24 V DC input. The PSUs (DC/DC) convert the external input power into -48 V DC power and supply the -48 V DC power to the DCDU-01. Then, the DCDU-01 distributes the -48 V DC power to each component in the cabinet. The BTS3900 +24 V cabinet can be installed alone or side by side with another BTS3900 +24 V cabinet.

2.2.3 Structure of the BTS3900 220 V Cabinet
The BTS3900 cabinet (220 V) uses the external 220 V AC input. The PSUs (AC/DC) convert the external input power into -48 V DC power and supply the -48 V DC power to the DCDU-01. Then, the DCDU-01 distributes the -48 V DC power to each component in the cabinet. The BTS3900 220 V cabinet can be installed alone or stacked on top of another BTS3900 -48 V cabinet.

2.2.1 Structure of the BTS3900 -48 V Cabinet

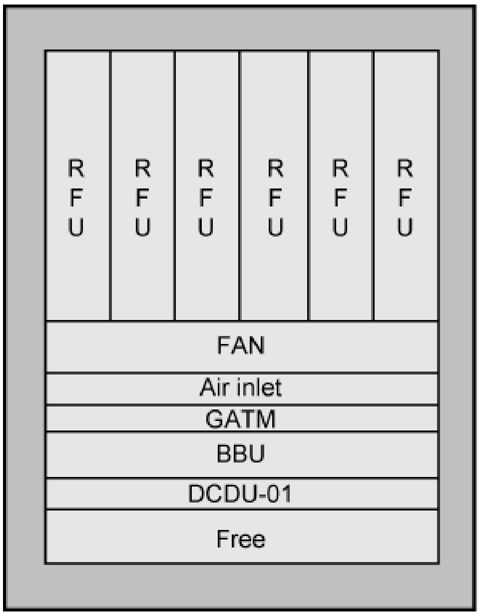
The BTS3900 cabinet (-48 V) uses the external -48 V DC input. The DC power is directly led into the DCDU-01 and the DCDU-01 distributes the DC power to each component in the cabinet. The BTS3900 -48 V cabinet can be installed alone, stacked on another BTS3900 -48 V cabinet, or installed side by side with another BTS3900 -48 V cabinet.

The BTS3900 -48 V cabinet consists of the following components: the DRFUs or GRFUs, BBU, GATM, DCDU-01, and FAN unit, among which the GATM is optional.

Single Cabinet Installation

Figure 2-1 shows the typical configuration of the cabinet in single cabinet installation.

Figure 2-1 Typical configuration of the BTS3900 -48 V cabinet in single cabinet installation



Double Cabinet Installation

Figure 2-2 shows the typical configurations of the cabinets in double cabinet installation.

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Figure 2-2 Typical configuration of two BTS3900 -48 V cabinets in side-by-side installation

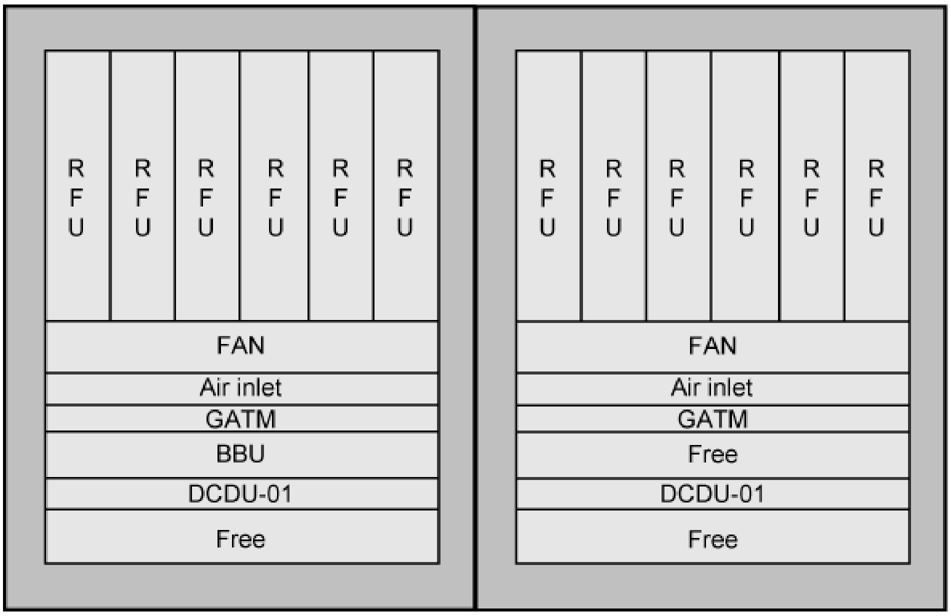

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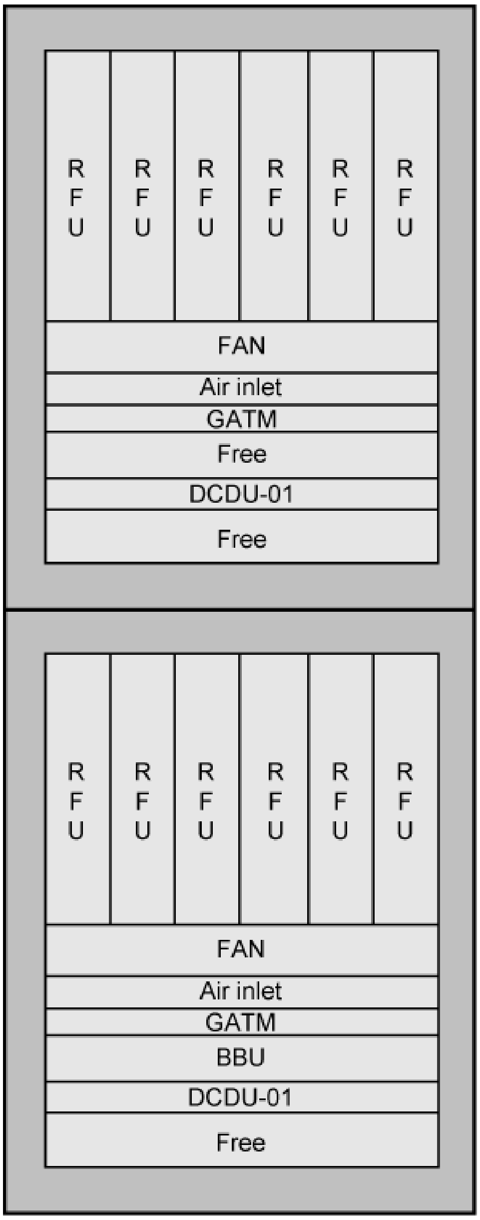
Figure 2-3 Typical configuration of two BTS3900 -48 V cabinets in stack installation



NOTE

When two BTS3900 -48 V cabinets are stacked, the BBU is installed only in the lower cabinet and serves as the baseband control unit for the two cabinets.

2.2.2 Structure of the BTS3900 +24 V Cabinet

The BTS3900 cabinet (+24 V) uses the external +24 V DC input. The PSUs (DC/DC) convert the external input power into -48 V DC power and supply the -48 V DC power to the DCDU-01. Then, the DCDU-01 distributes the -48 V DC power to each component in the cabinet. The BTS3900 +24 V cabinet can be installed alone or side by side with another BTS3900 +24 V cabinet.

The BTS3900 +24 V cabinet consists of the following components: the DRFUs or GRFUs, BBU, DCDU-01, PSUs (DC/DC), and FAN unit.

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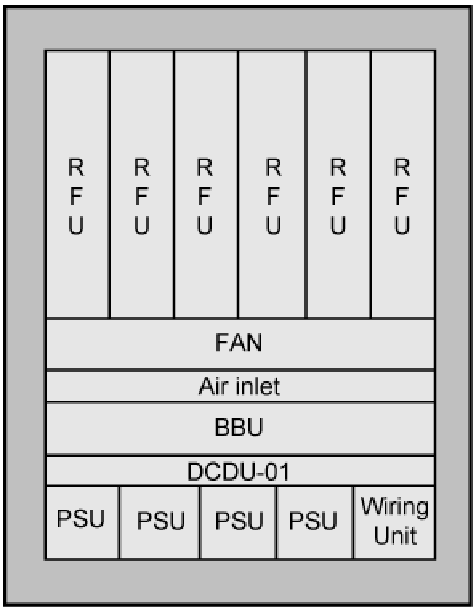
Typical Configuration of the Cabinet in Single Cabinet Installation

Figure 2-4 shows the typical configuration of the cabinet in single cabinet installation.

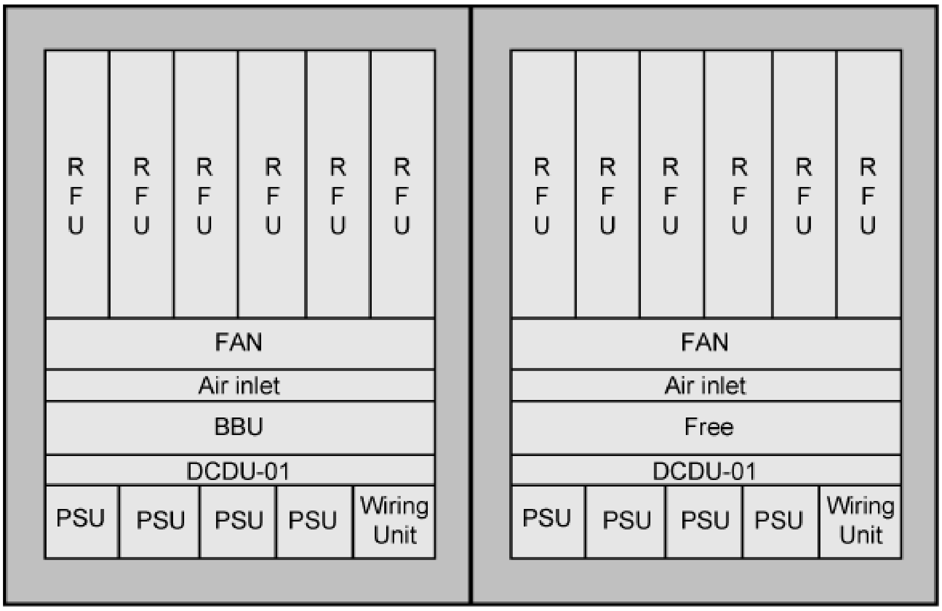
Figure 2-4 Typical configuration of the BTS3900 +24 V cabinet in single cabinet installation



Typical Configuration of the Cabinets in Double Cabinet Installation

Figure 2-5 shows the typical configuration of two cabinets in side-by-side installation.

Figure 2-5 Typical configuration of the BTS3900 +24 V cabinet in double cabinet installation



2.2.3 Structure of the BTS3900 220 V Cabinet

The BTS3900 cabinet (220 V) uses the external 220 V AC input. The PSUs (AC/DC) convert the external input power into -48 V DC power and supply the -48 V DC power to the DCDU-01.

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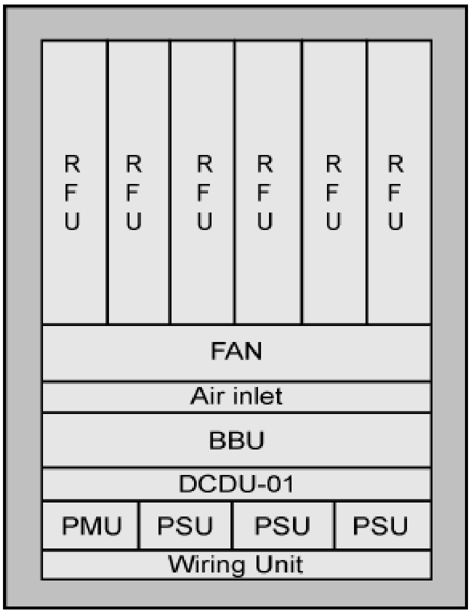
Then, the DCDU-01 distributes the -48 V DC power to each component in the cabinet. The BTS3900 220 V cabinet can be installed alone or stacked on top of another BTS3900 -48 V cabinet.

The BTS3900 220 V cabinet consists of the following components: the DRFUs or GRFUs, BBU, DCDU-01, PMU, PSUs (AC/DC), and FAN unit.

Typical Configuration of the Cabinet in Single Cabinet Installation

Figure 2-6 shows the typical configuration of the cabinet in single cabinet installation.

Figure 2-6 Typical configuration of the BTS3900 220 V cabinets in single cabinet installation



Typical Configuration of the Cabinets in Double Cabinet Installation

Figure 2-7 shows the typical configuration of two cabinets in side-by-side installation.

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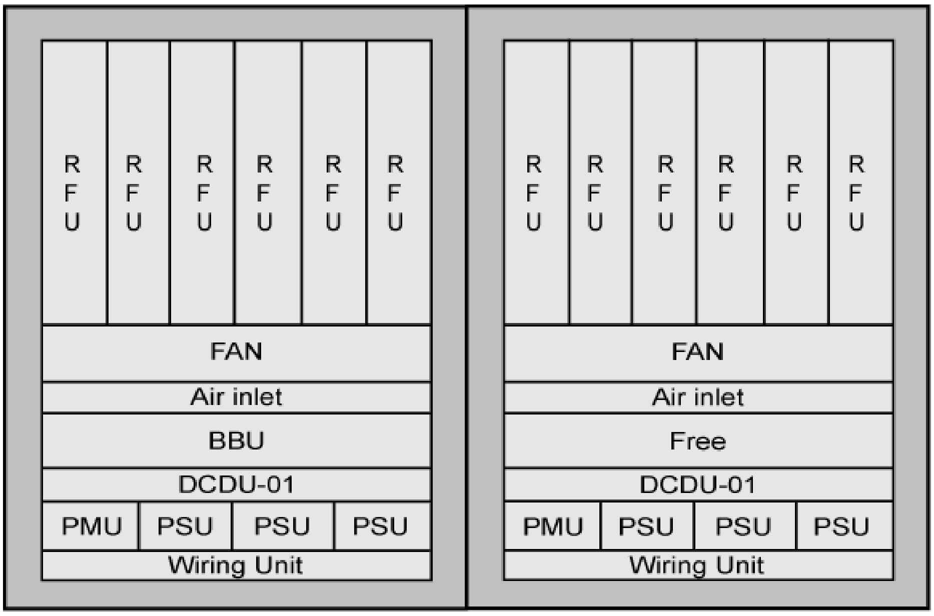
Figure 2-7 Typical configuration of the BTS3900 220 V cabinets in double cabinet installation

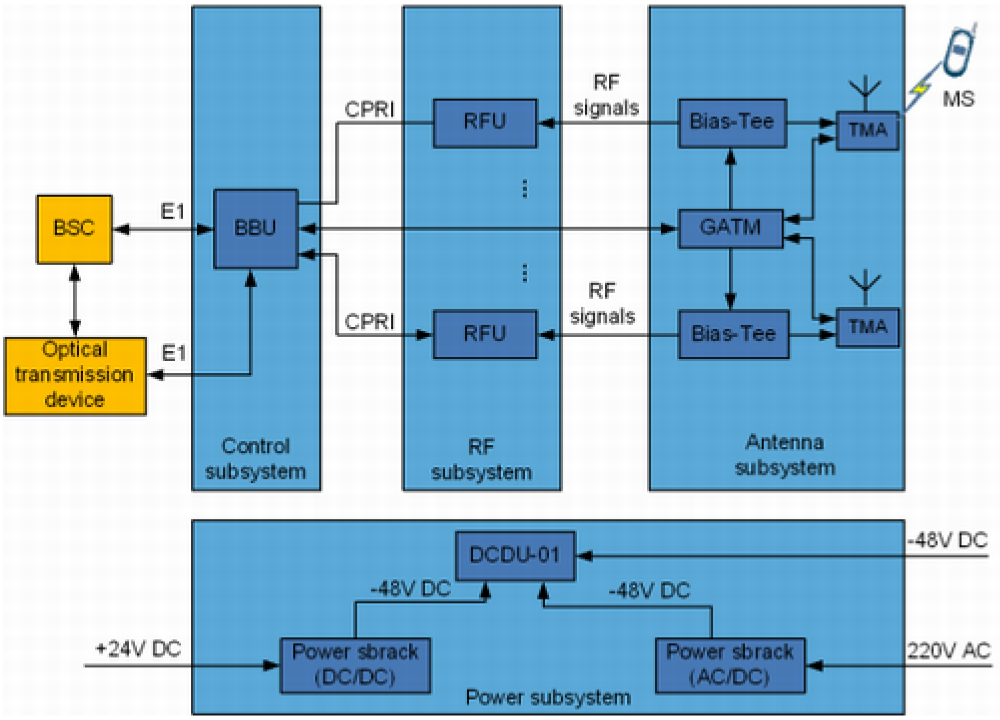


2.3 Logical Structure of the BTS3900

The BTS3900 mainly consists of the BBU and RFUs. The logical structure of the BTS3900 consists of the RF subsystem, control subsystem, power subsystem, and antenna subsystem.

Figure 2-8 shows the logical structure of the BTS3900.

Figure 2-8 Logical structure of the BTS3900



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NOTE

- In **Figure 2-8**, the power subrack (DC/DC) is configured in only the +24 V DC cabinet; the power subrack (AC/DC) is configured in only the 220 V AC cabinet.
- If the TMA is configured, the GATM and the Bias-Tee must be configured.

The logical subsystems of the BTS3900 are as follows:

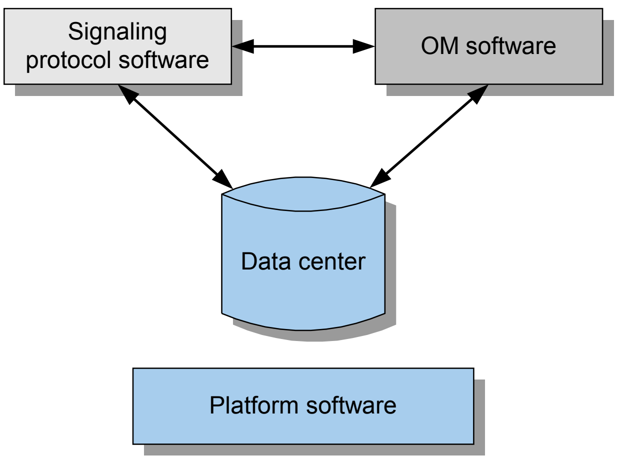
- RF subsystem, implemented by the **DRFU** or **GRFU**
- Control subsystem whose functions are implemented by the **BBU**
- Power subsystem whose functions are implemented by the following modules:
  - **DCDU-01** in the BTS3900 cabinet (-48 V DC)
  - **DCDU-01** and **Power Subrack (DC/DC)** in the BTS3900 cabinet (+24 V DC)
  - **DCDU-01** and **Power Subrack (AC/DC)** in the BTS3900 cabinet (220 V AC)
- Antenna subsystem whose functions are implemented by the following modules:
  - **GATM**
  - TMA
  - Antenna

2.4 Software Structure of the BTS

The BTS software consists of the platform software, signaling protocol software, OM software, and data center. The latter three are application software, and the platform software provides support for the application software.

Figure 2-9 shows the software structure of the BTS.

Figure 2-9 Software structure of the BTS



Platform Software

The platform software provides support for the signaling protocol software, OM software, and data center. The functions of the platform software are as follows:

- Timing management

- Task management
- Memory management
- Module management
- Managing the loading and running of the application software
- Providing the message forwarding mechanism between modules
- Tracing massages between modules to facilitate troubleshooting

Signaling Protocol Software

The functions of the signaling protocol software are as follows:

- Processing the radio network layer protocol
- Processing the transport network layer protocol, which performs transport data configuration, ALCAP processing, and SAAL processing
- Managing the internal logical resources (such as cells and channels) of the BTS and the mapping between physical resources and logical resources

OM Software

The OM software works together with the maintenance terminals such as the LMT to maintain the BTS. The functions of the OM software are as follows:

- Equipment management
- Data configuration
- Performance management
- Commissioning management
- Alarm management
- Software management
- Tracing management
- Security management
- Backup management
- Log management

Data Center

The data center stores the configuration data of all the modules.

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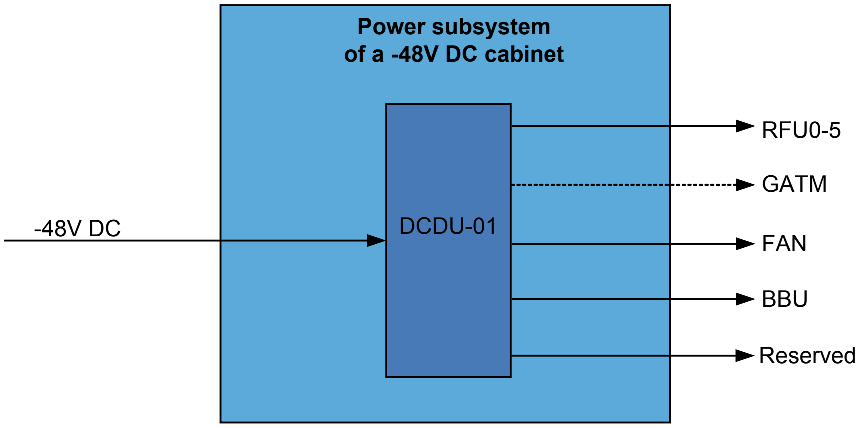
3 Power Distribution Modes of the BTS3900

The BTS3900 cabinet can use three types of power inputs, namely, -48 V DC, +24 V DC, and 220 V AC.

-48 V DC Distribution

Figure 3-1 shows the power distribution of a single -48 V DC cabinet.

Figure 3-1 Power distribution of a single -48 V DC cabinet



Power distribution of a single -48 V DC cabinet: If the external -48 V DC power input is used, no additional power system is required. The external -48 V DC input is directly connected to the power input terminals on the DCDU-01 module. Then, the DCDU-01 distributes the -48 V DC to boards and modules in the cabinet.

Figure 3-2 shows the power distribution when a -48 V DC cabinet is stacked on a -48 V DC cabinet.

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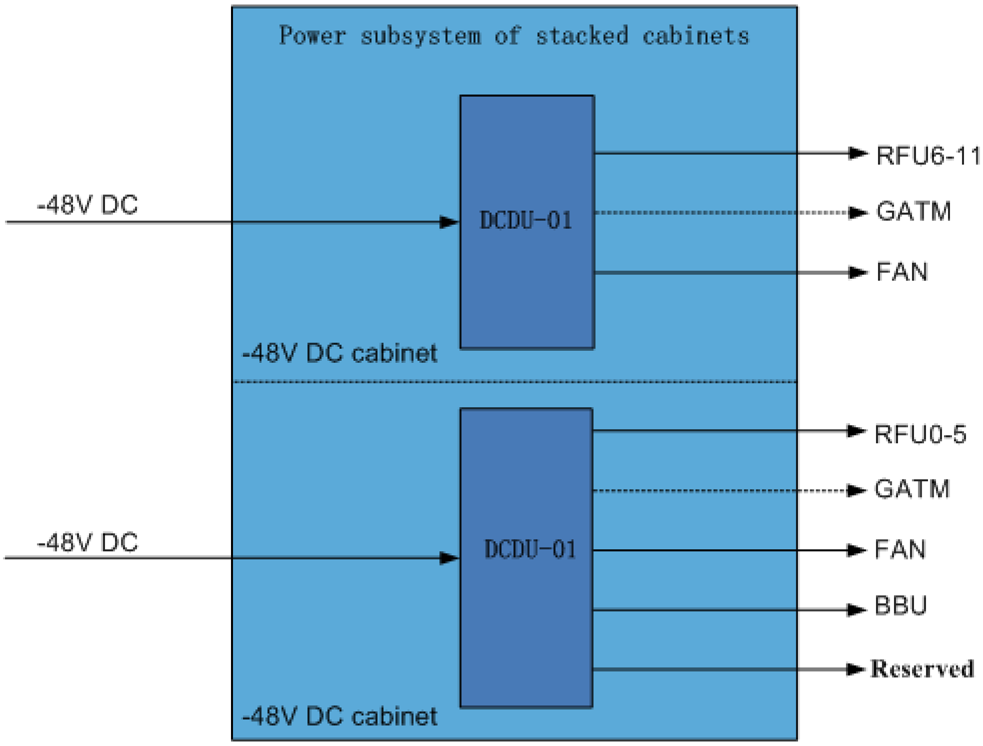
Figure 3-2 Power distribution when a -48 V DC cabinet is stacked on a -48 V DC cabinet

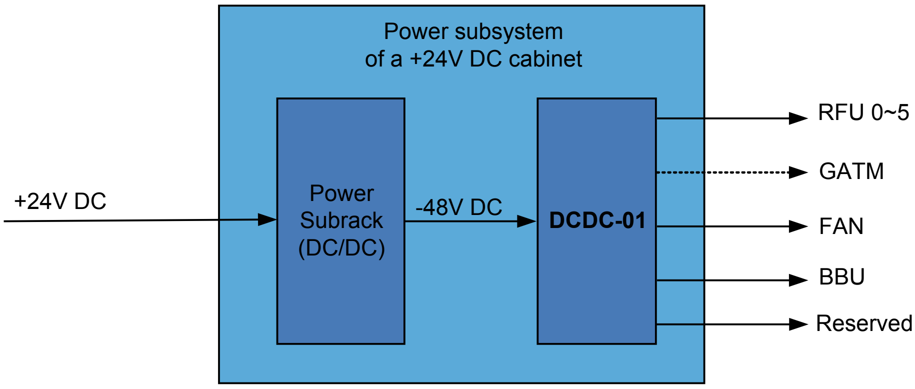


Power distribution when a -48 V DC cabinet is stacked on a -48 V DC cabinet: In stack mode, the external -48 V DC power input is directly connected to the power input terminals on the DCDU-01 modules installed in the upper and lower cabinets. Then, the DCDU-01 modules supply the -48 V DC power to each module in both cabinets.

+24 V DC Distribution

Figure 3-3 shows the power distribution of a single +24 V DC cabinet.

Figure 3-3 Power distribution of a single +24 V DC cabinet



Power distribution of a single +24 V DC cabinet: When the external +24V DC power input is used, the cabinet is installed with the power subrack (DC/DC). The power subrack (DC/DC) converts the external +24 V DC input into the -48 V DC and supplies the -48 V DC to the DCDU-01 module. Then, the DCDU-01 module distributes the -48 V DC to boards and modules in the cabinet.

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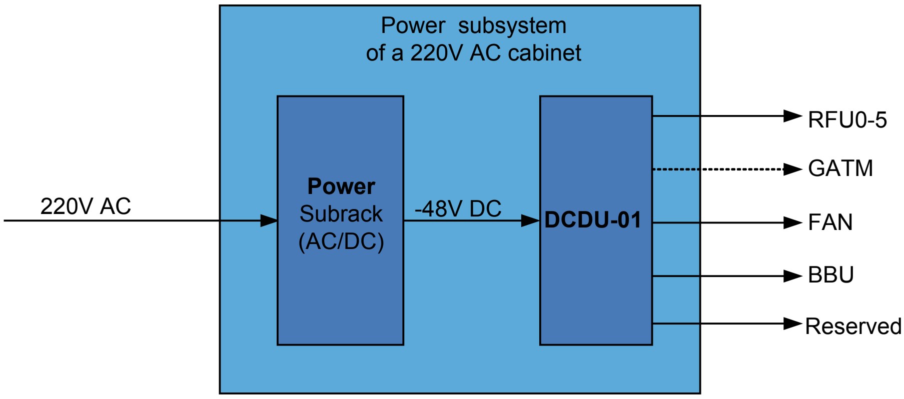
220 V AC Distribution

Figure 3-4 shows the power distribution of a single 220 V AC cabinet.

Figure 3-4 Power distribution of a single 220 V AC cabinet



Power distribution of a single 220 V AC cabinet: When the external 220V AC power input is used, the cabinet is installed with the power subrack (AC/DC). The power subrack (AC/DC) converts the external 220 V AC input into the -48 V DC and supplies the -48 V DC to the DCDU-01 module. Then, the DCDU-01 module distributes the -48 V DC to boards and modules in the cabinet.

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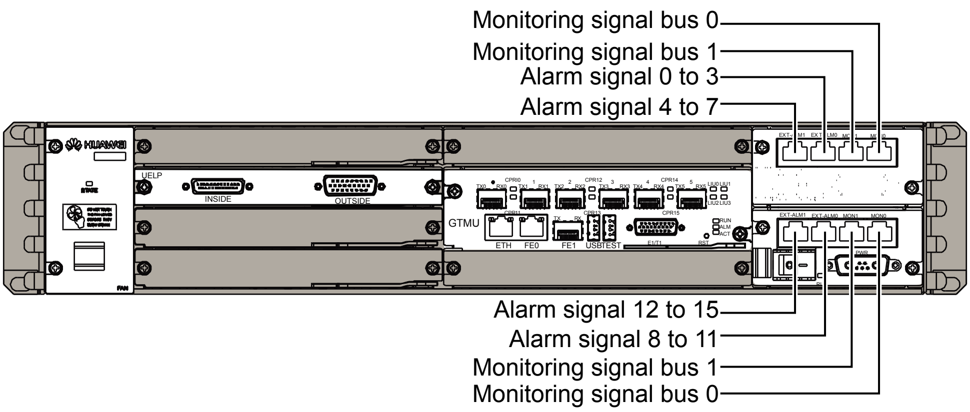
4 BTS3900 Monitoring System

The BTS3900 monitoring system enables the power monitoring, fan monitoring, and environment monitoring.

BBU Monitoring Ports

Figure 4-1 shows the monitoring ports of the BBU.

Figure 4-1 Monitoring ports of the BBU



- The BBU provides a maximum of two RS485 buses and 16 Boolean signals.
- The modules on RS485 bus 0 cannot be interchanged with the modules on RS485 bus 1.
- When two PMUs are configured, they cannot be connected to the same bus if the settings of the DIP switches on the two PMUs are the same.

Components of the Monitoring System

Figure 4-2 shows the components of the BTS3900 monitoring system.

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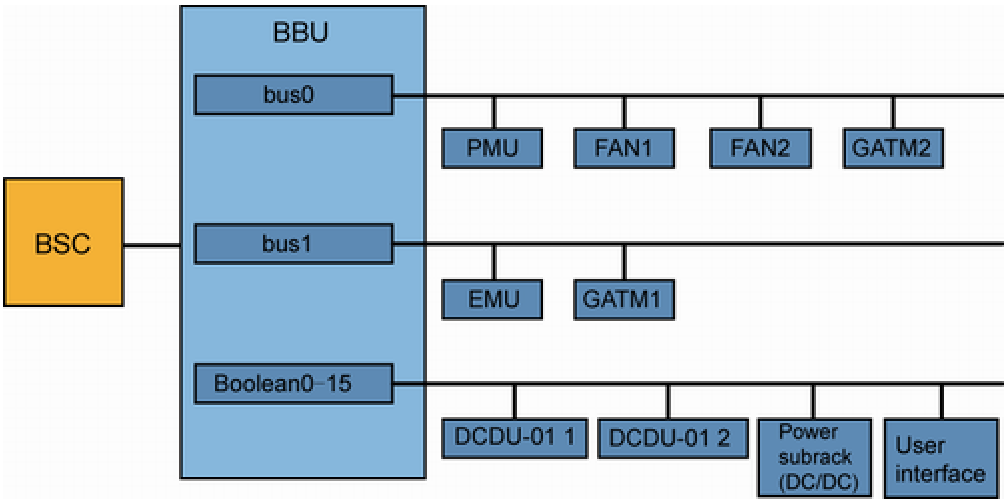
Figure 4-2 Components of the monitoring system



NOTE

The RS485 bus 0 is indicated by bus0. The RS485 bus 1 is indicated by bus1.

Table 4-1 describes the monitoring modules of the BTS3900.

Table 4-1 Monitoring modules of the BTS3900

Module	Address Bus	Pin	Description
PMU	bus0	-	Configured only in the BTS3900 cabinet (220 V AC)
FAN1	bus0	-	Mandatory
FAN2	bus0	-	Configured when two cabinets are stacked
GATM2	bus0	-	Optional
GATM1	bus1	-	Optional
EMU	bus1	-	Optional
DCDU-01 1	Boolean	Pin 1 and pin 2	Mandatory
DCDU-01 2	Boolean	Pin 7 and pin 8	Configured when two cabinets are stacked
Power subrack (DC/ DC)	Boolean	Pin 3 and pin 6	Configured only in the BTS3900 cabinet (+24 V DC)

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Functions of the BTS3900 Monitoring System

Table 4-2 describes the functions of the BTS3900 monitoring system.

Table 4-2 Functions of the BTS3900 monitoring system

Module	Monitoring Function
FAN	● Fan fault detection ● Adjusting rotation speed of the fans ● Detecting temperature and rotation speed of the fans
GATM	Reporting the RET control alarm signals
EMU	● Communicating with the central processing unit through the two RS485 ports ● Detecting the input voltage ● Providing the independent sensor port for detecting humidity and temperature (12 V DC/24 V DC current type) ● Providing the port for detecting the Boolean input signals in dry contact mode and in OC mode ● Providing six external Boolean output control ports of the relay node type
PMU	● Communicating with the central processing unit through the RS232/RS422 serial port ● Managing the power system and the battery charging and discharging ● Detecting and reporting water immersion alarms, smoke alarms, door status alarms, and standby Boolean value alarms; reporting ambient humidity and temperature, battery temperature, and standby analog values ● Detecting power distribution and reporting alarms
DCDU-01	Providing dry contact for surge protection failure

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Module	Monitoring Function
Power subrack (DC/DC)	● Detecting module fault alarms (overvoltage output, no output, and fan fault) ● Detecting module protection alarms (overtemperature protection, and overvoltage and undervoltage protection) and AC power failure alarms

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5 Reference Clocks of the BTS3900/BTS3900A

The BTS3900/BTS3900A supports two types of reference clocks: line clock and free-run clock.

Line Clock

The BBU3900 directly extracts clock signals from the E1/T1 interface. Then, the BBU exports the precise 2 MHz and 8 kHz clocks after frequency dividing, phase locking, and phase adjusting. The 2 MHz and 8 kHz clocks are used for frame synchronization and bit synchronization in the BTS3900/BTS3900A.

Free-Run Clock

When the external reference clocks are unavailable, the oven controlled crystal oscillator (OCXO) on the GTMU of the BBU3900 provides the 13 MHz clock to ensure the normal operation of the BTS.

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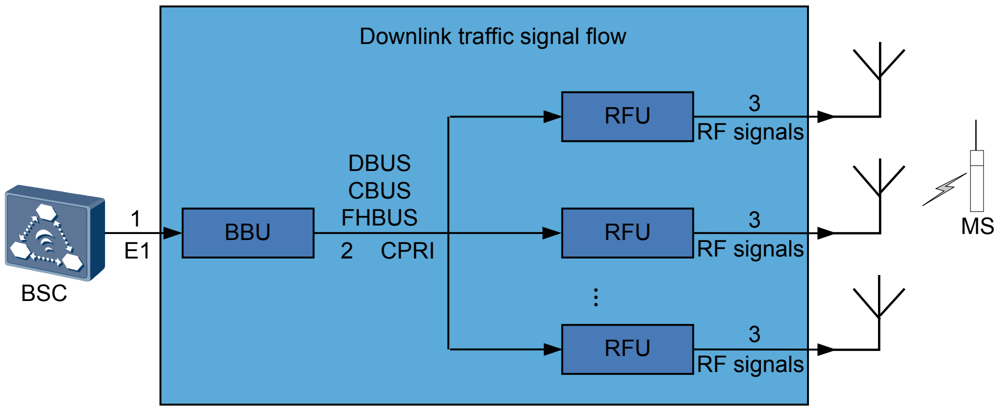
6 Signal Flow of the BTS3900/BTS3900A

The signal flow of the BTS3900/BTS3900A consists of the traffic signal flow and the signaling flow of the BTS. The BTS3900/BTS3900A signal flow is classified into the DL traffic signal flow, UL traffic signal flow, and signaling flow.

DL Traffic Signal Flow

The DL traffic signal flow is transmitted from the BSC to the MS through the BTS3900/BTS3900A. In the BTS3900/BTS3900A, the BBU and RFUs work together to process the DL traffic signals. **Figure 6-1** shows the DL traffic signal flow of the BTS3900/BTS3900A.

Figure 6-1 DL traffic signal flow



The DL traffic signal flow is as follows:

1. The BSC sends E1 signals to the BBU through E1 or optical cables.
2. After receiving the E1 signals, the BBU processes the E1 signals as follows:
   (1) Extracts clock signals from the E1 signals
   (2) Configures the BTS system based on the data configuration on the OML
   (3) Encapsulates the E1 data in the format of the CPRI frame, and then transmits the data to the RFU through the CPRI signal cable
3. After receiving the DL signals, the RFU processes the signals as follows:
   (1) Decapsulates the high-speed CPRI frames to obtain the baseband signals

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(2) Transmits the baseband signals to the relevant operation units for encapsulation and interleaving

(3) Converts the digital signals into the analog signals and modulates the analog signals into RF signals

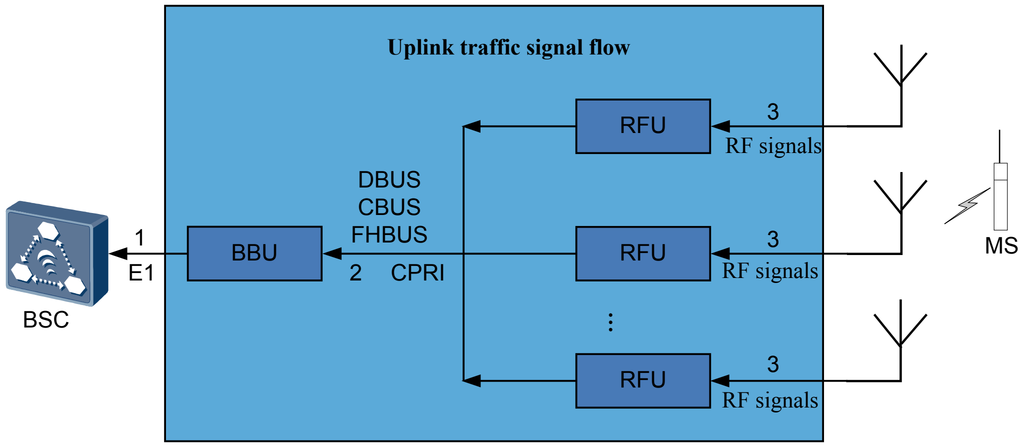
(4) Combines or divides the RF signals based on its own configuration

(5) Transmits the combined or divided signals to the antenna subsystem

UL Traffic Signal Flow

Opposite to the DL traffic signal flow, the UL traffic signal flow is transmitted from the MS to the BSC through the BTS3900/BTS3900A. In the BTS3900/BTS3900A, the BBU and RFUs work together to process the UL traffic signals. **Figure 6-2** shows the UL traffic signal flow.

Figure 6-2 UL traffic signal flow



The UL traffic signal flow is as follows:

1. The antenna receives the signals sent from the MS. If the TMA is configured, the received signals are amplified by the TMA and then transmitted to the RFU through the feeder.
2. After receiving the UL signals, the RFU processes the signals as follows:

   (1) Divides the UL signals received from the antenna, **Rx1 in**, or **Rx2 in**

   (2) Converts the divided analog signals into the digital signals to obtain the baseband signals

   (3) Transmits the baseband signals to the relevant operation units for decryption and de-interleaving

   (4) Encapsulates the processed data in the format of the CPRI frame, and then transmits the data to the BBU through the CPRI signal cable
3. After receiving the signals, the BBU processes the signals as follows:

   (1) Decapsulates the high-speed CPRI frames to obtain the baseband signals

   (2) Encapsulates the baseband signals in the format of the E1 frame, and then transmits the signals to the BSC through the E1 cable or the optical cable

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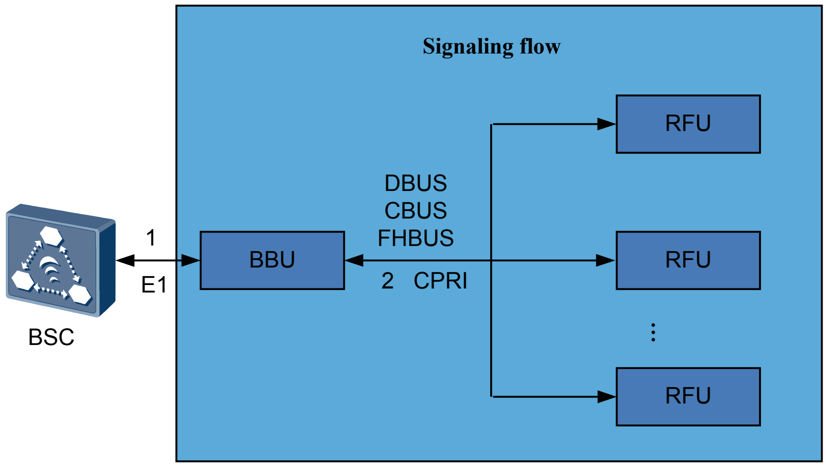
Signaling Flow

This describes the BTS3900/BTS3900A signaling flow on the Abis interface. The BBU serves as the control unit and works with the RFUs to process the signaling. **Figure 6-3** shows the signaling flow.

Figure 6-3 Signaling flow



The signaling flow is as follows:

1. The signaling data received from the BSC is transmitted to the BBU through the Abis interface.
2. The BBU encapsulates the signaling data in the format of the CPRI frame, and then transmits the signaling data to the RFU through the CPRI signal cable.
3. The RFU decapsulates the CPRI signals into the baseband signals, transmits the baseband signals to the relevant operation units for processing.
4. The RFU encapsulates the data of its own status in the format of the CPRI frame, and then transmits the data to the BBU through the CPRI signal cable.
5. The BBU decapsulates the received CPRI signals to obtain the baseband signals.
6. The BBU obtains the status of the BTS by analyzing the baseband signals. Then, the BBU transmits the information on the BTS status to the BSC through the Abis interface.

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7 Topologies of the BTS

The BTS supports the star, chain, tree, and ring topologies. Multiple topologies, such as star, chain, and ring, are supported by between the BBU and the RFUs. In practice, these topologies can be combined. Optimum utilization of the topologies can improve the quality of service and lower the investment on the transmission equipment.

Topology

Figure 7-1 shows the star topology.

Figure 7-1 Star topology

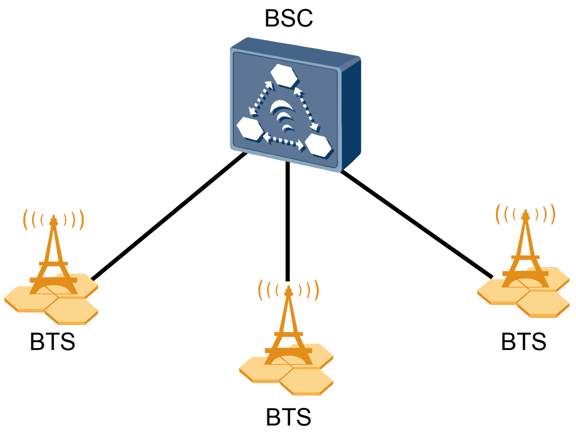

Figure 7-2 shows the chain topology.

Figure 7-2 Chain topology

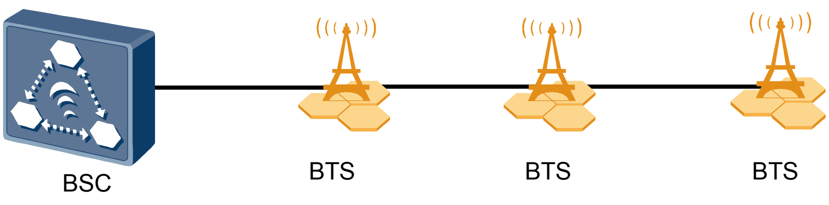

Figure 7-3 shows the tree topology.

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Figure 7-3 Tree topology

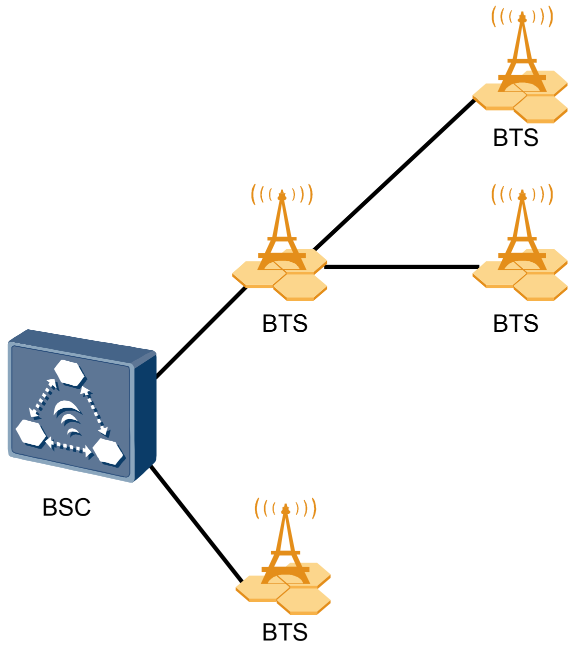
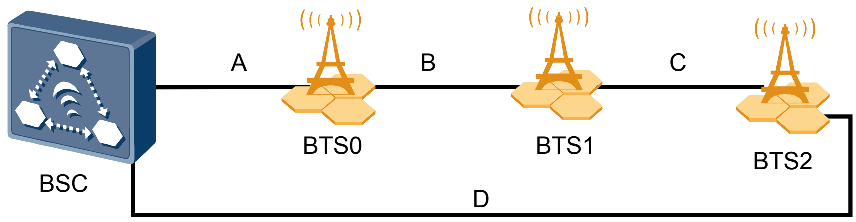


Figure 7-4 shows the ring topology.

Figure 7-4 Ring topology



Comparison Between Topologies

Table 7-1 describes the comparison of different topologies.

Table 7-1 Comparison between topologies

Topology	Application Scenario	Advantage
Star topology	Applies to common areas, especially densely populated areas, such as cities.	• Simple networking • Easy project construction • Convenient maintenance • Flexible capacity expansion • High network reliability

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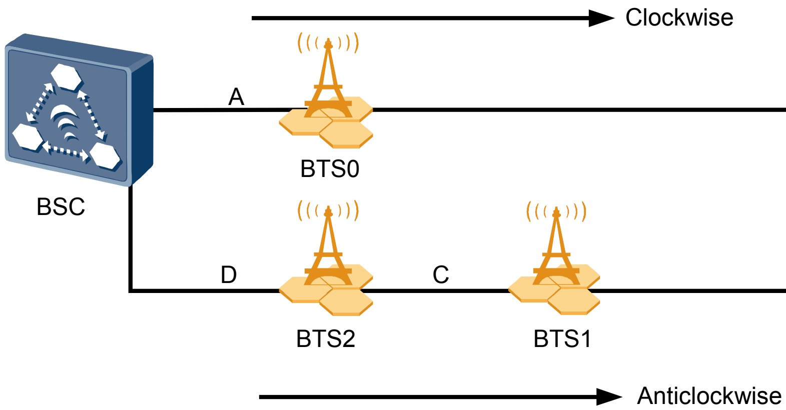
Topology	Application Scenario	Advantage
Chain topology	Applies to sparsely populated areas in strip-like terrain, such as areas along highways and railway tracks.	Reduces costs in transmission equipment, construction, and transmission link lease.
Tree topology	Applies to areas where network structures, site distribution, and subscriber distribution are complicated, for example, an area where large-scale coverage overlaps hot spot or small-scale coverage.	Requires fewer transmission cables compared with the star topology.
Ring topology	Applies to common scenarios. Due to its strong self-healing capability, the ring topology is preferred if permitted by the routing.	If there is a breaking point in the ring, the ring breaks into two chains at the breaking point automatically. In this way, the BTSs preceding and following the breaking point can work normally despite the breaking point, thus improving the robustness of the system. For example, BTS0, BTS1, and BTS2 are sequentially connected to form a ring (clockwise). When a failure occurs at B, BTS0, the BTS topology preceding B, remains unchanged, and BTS2 and BTS1, the BTSs following B form a chain (anticlockwise), as shown in **Figure 7-5**.

Figure 7-5 Regrouping for disconnection in the ring topology



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8 Configuration of the BTS3900/BTS3900A

About This Chapter

This describes the configuration principles of the BTS3900/BTS3900A, RF cable connections, CPRI cable connections, and typical configurations of the RFUs.

The BTS3900/BTS3900A is configured with RFUs. When the DRFU is configured, a single BTS3900/BTS3900A provides a maximum of 12 carriers with the maximum cell configuration of S4/4/4. When the GRFU is configured, a single BTS3900/BTS3900A provides a maximum of 36 carriers with the maximum cell configuration of S12/12/12. The BTS3900/BTS3900A is configured with the antenna system, RFUs, and BBU.

One end of the RF jumper is connected to the RF port on the DRFU and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual configuration modes.

One end of the RF jumper is connected to the RF port on the GRFU, and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual networking modes.

One end of the RF jumper is connected to the RF port on the RFU, and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual networking modes.

The RFUs support various topologies: star, chain, and ring.

This describes the typical configurations of the BTS3900/BTS3900A.

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8.1 BTS3900/BTS3900A Configuration Principles

The BTS3900/BTS3900A is configured with RFUs. When the DRFU is configured, a single BTS3900/BTS3900A provides a maximum of 12 carriers with the maximum cell configuration of S4/4/4. When the GRFU is configured, a single BTS3900/BTS3900A provides a maximum of 36 carriers with the maximum cell configuration of S12/12/12. The BTS3900/BTS3900A is configured with the antenna system, RFUs, and BBU.

Basic Configuration Principles

- If multiple hardware configurations meet the requirements for the RNP parameter settings, the configuration mode that supports the smooth upgrade is preferred.
- The DRFU supports a maximum of two carriers and it is applicable to small- and middle-capacity scenarios; the GRFU supports a maximum of six carriers and it is applicable to large-capacity scenarios. The DRFU and GRFU can be configured in the same cabinet or cell to support flexible capacity expansion.
- Wide coverage is preferred. The DRFU supports PBT, TX diversity, and 4-way RX diversity mode. Therefore, the DRFU can be applied to wide-coverage scenarios.

Antenna Configuration Principles

- One dual-polarized antenna can serve a maximum of two RFUs.
- By default, RX diversity is adopted on the GSM network. That is, two feeders connected to two single-polarized antennas or one dual-polarized antenna must be configured in a cell.
- Each sector of the BTS must be configured with the minimum number of antennas.
- For the 2-way RX diversity, each sector has two antenna channels; for the 4-way RX diversity, each sector has four antenna channels.

RF Configuration Principles

Table 8-1 describes the RF configuration principles of the BTS3900.

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Table 8-1 RF configuration principles of the BTS3900

Principle	Description	Example
Configuration principles of the DRFU ports	● ANT1 and ANT2 are the TX ports of the duplexer. They are connected to jumpers. ● Rx1 in, Rx1 out, Rx2 in, and Rx2 out are the ports for signals between interconnected DRFUs. When two carriers provided by a DRFU belong to the same cell, both Rx1 in and Rx2 in can be the input ports for RX diversity of the two carriers. When two carriers provided by a DRFU belong to different cells, Rx1 in is the input port for RX diversity of carrier 1; Rx2 in is the input port for RX diversity of carrier 2. ● CPRI_0 and CPRI_1 are the ports for high-speed electrical cables. The CPRI_1 port is connected to the CPRI port on the BBU or the upper-level RFU during the cascading. The CPRI_0 port is connected to the lower-level RFU.	In S3/3 configuration, three DRFUs need to be configured. The carriers provided by the middle DRFU belong to different cells. That is, the Rx1 in port on the middle DRFU is the input port for RX diversity of carrier 1, which belongs to the first cell. The input port for RX main of carrier 1 is ANT1. The Rx2 in port is the input port for RX diversity of carrier 2, which belongs to the second cell. The input port for RX main of carrier 2 is ANT2.

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Principle	Description	Example
Configuration principles of the GRFU ports	● The ANT_TX/RXA port supports signal reception and transmission, and the ANT_RXB port supports signal reception. They are connected to jumpers. ● RX_INB and RX_OUTA are the ports for signals between interconnected GRFUs. ● CPRI_0 and CPRI_1 are the ports for high-speed electrical cables. The CPRI_0 port is connected to the CPRI port on the BBU or the upper-level RFU during the cascading. The CPRI_1 port is connected to the lower-level RFU.	None.
Configuration principles of a single cabinet	● Star topology is adopted between the BBU and RFUs. The RFUs and the high-speed CPRI ports on the BBU have a one-to-one relationship. That is, if slot 1 on the RFU is idle, CPRI port 1 on the BBU is also idle. ● When the DRFU is configured, the maximum cell configuration of a single cabinet is S4/4/4. When the GRFU is configured, the maximum cell configuration of a single cabinet is S12/12/12.	None.
Configuration principles of multiple cabinets	When star and chain topology is adopted between the BBU and RFUs, the RFU supports 3 levels of cascading in a chain and thus the BBU supports a maximum of 18 (6 x 3) RFUs.	None.

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Principle	Description	Example
Two TRXs of one DRFU configured in one sector	● A single DRFU does not support the S1/1 application; however, three DRFUs support the S3/3 application. ● When the DRFU works in TX PBT, TX diversity, or 4-way RX diversity mode, a DRFU provides only one TRX. Therefore, you can configure the DRFU as required.	For example, for a site in S5/4/7 cell configuration, nine DRFUs are installed to meet the requirements of S6/4/8 cell configuration, but data configuration is still performed on the basis of the S5/4/7 cell configuration.
Number of DRFUs	● When the number of TRXs of the site is less than 12, an odd number of TRXs can be configured for a cell. Number of DRFUs = round up [(number of TRXs + number of S1 cells) / 2] ● When the number of TRXs of the site is greater than 12, an even number of TRXs should be configured for a cell. Number of DRFUs = round up (number of TRXs after two TRXs are configured in one sector / 2)	● S3/3/3: Number of DRFUs = round up (9 / 2) = 5; S1/2/3: Number of DRFUs = round up [(6 + 1) / 2] = 4. ● After two TRXs are configured in one sector, the S5/5/5 configuration is S6/6/6. Number of DRFUs = (6 + 6 + 6) / 2 = 9.
Number of GRFUs	● One GRFU does not server two cells. Each cell with a single antenna can be configured with a maximum of two GRFUs. ● One GRFU supports a maximum cell configuration of S6; two GRFUs supports a maximum cell configuration of S12. To support the configuration larger than S12, multiple antenna systems are used.	None.

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Principle	Description	Example
DRFU TRX allocation in double-antenna-system mode	After TRX allocation, the cells with an odd number of TRXs become neighboring cells of each other. ● S5 = S3 + S2 or S5 = S2 + S3 ● S6 = S4 + S2 or S6 = S3 + S3 ● S7 = S4 + S3 or S7 = S3 + S4 ● S8 = S4 + S4	● In S3/5/4 configuration, S5 can be divided into S3 + S2. Then, the cell configuration becomes S3/(3/2)/4. ● In S2/5/5 configuration, the first S5 is divided into S2 + S3; the second S5 is divided into S3 + S2. Then, the cell configuration becomes S2/(2/3)/(3/2).

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Principle	Description	Example
DRFUs at two bands configured in a site	● If the number of DRFUs is not more than 6 in a double-band site, the DRFUs at two bands are configured in the same cabinet. If the RF cabinet is configured with less than three 900 MHz DRFUs and three 1800 MHz DRFUs, the 900 MHz DRFUs are installed in of the three slots on the left of the RF cabinet, and the 1800 MHz DRFUs are installed in the three slots on the right of the RF cabinet. ● When two RF cabinets are configured and the number of DRFUs at each band is not more than six, the 900 MHz DRFUs are installed in the first RF cabinet and the 1800 MHz DRFUs are installed in the second RF cabinet. The DRFUs are installed in the slots according to the typical S4/4/4 configuration. When two RF cabinets are configured and the number of DRFUs at one band (for example, 900 MHz) is greater than six, other DRFUs at this band share the other RF cabinet with the DRFUs at the other band (for example, 1800 MHz). The mixed configuration of DRFUs at two bands is not allowed.	None.

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Principle	Description	Example
Coexistence configuration principles of the DRFUs and GRFUs	Coexistence configuration principles of the DRFUs and GRFUs are as follows: ● The primary BCCH is carried on a GRFU. ● When the requirements of the output power and number of carriers are met and the cell configuration is greater than S4, a single DRFU is configured with one TRX; when two DRFUs are configured, one DRFU is preferably used. ● The TX power of a DRFU and that of a GRFU within a cell are almost the same. The power difference should not exceed 0.5 dB. ● When the DRFUs and GRFUs are configured in one cell, 4-way RX diversity and TX diversity are not supported. ● The DRFUs and GRFUs are not recommended in the same new site.	None

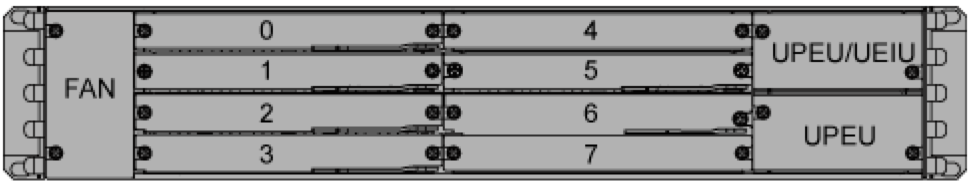
NOTE

In the mode of configuring two TRXs in one sector, a DRFU belongs to only one sector.

BBU Configuration Principles

- A BBU has 6 CPRI ports and supports a maximum of 72 carriers.
- **Figure 8-1** shows the BBU slots.

Figure 8-1 BBU slots



- **Table 8-2** describes the board configuration principles of the BBU.

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Table 8-2 Board configuration principles of the BBU

Module or Board	Description
UBFA	One UBFA must be configured.
UPEU	● One UPEU must be configured. ● A second UPEU can be configured when the backup power is required. The BBU, however, cannot be configured with the UPEU and the UEIU at the same time.
UEIU	● One UEIU must be configured when more than two BTS3900 cabinets are configured in a single site. ● In the outdoor application, one UEIU must be configured when more than one APM30 power cabinet is configured.
GTMU	● One GTMU must be configured. ● The GTMU is installed in slot 5 or slot 6.
UELP	● Not required in the BTS3900 ● One UELP must be configured in the BTS3900A. The UELP is installed in slot 0.

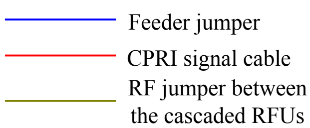
8.2 RF Signal Cable Connections of the DRFU

One end of the RF jumper is connected to the RF port on the DRFU and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual configuration modes.

RF Cable Connections of the DRFU

- The transmit mode and antenna mode described in the following list are set on the BSC side.
- The RF cables differ from each other in colors. **Figure 8-2** shows the mapping between the RF signal cables and their colors.

Figure 8-2 Mapping between the RF signal cables and their colors



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S1 Without Transmit Diversity, S1 with Transmit Diversity, and S2 Without Transmit Diversity

The S1 without transmit diversity, S1 with transmit diversity, and S2 without transmit diversity use the configuration of one DRFU and one dual-polarized antenna. **Table 8-3** describes the related configurations.

Table 8-3 Configuration (1)

Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S1 without transmit diversity	**Transmit independency or combining**	**Double Antenna**	• One DRFU module • One dual-polarized antenna
S1 with transmit diversity	**Transmit diversity**	**Double Antenna**	
S2 without transmit diversity	**Transmit independency or combining**	**Double Antenna**	

Figure 8-3 shows the cable connections.

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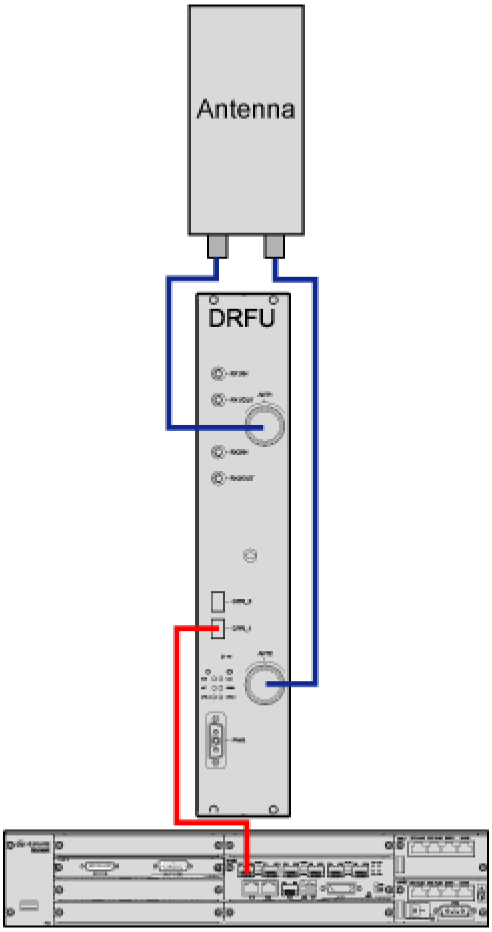
Figure 8-3 Connections of RF cables for S1 (without transmit diversity/with transmit diversity)/ S2 (without transmit diversity)



S2 with PBT, S3 Without Transmit Diversity, and S4 Without Transmit Diversity

The S2 with PBT, S3 without transmit diversity, and S4 without transmit diversity use the configuration of two DRFUs and one dual-polarized antenna. **Table 8-4** describes the related configurations.

Table 8-4 Configuration (2)

Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S2 with PBT	**PBT**	**Single Antenna Double Receiver**	• Two DRFUs • One dual-polarized antenna
S3 without transmit diversity	**Transmit independency or combining**	**Single Antenna Double Receiver**	
S4 without transmit diversity	**Transmit independency or combining**	**Single Antenna Double Receiver**	

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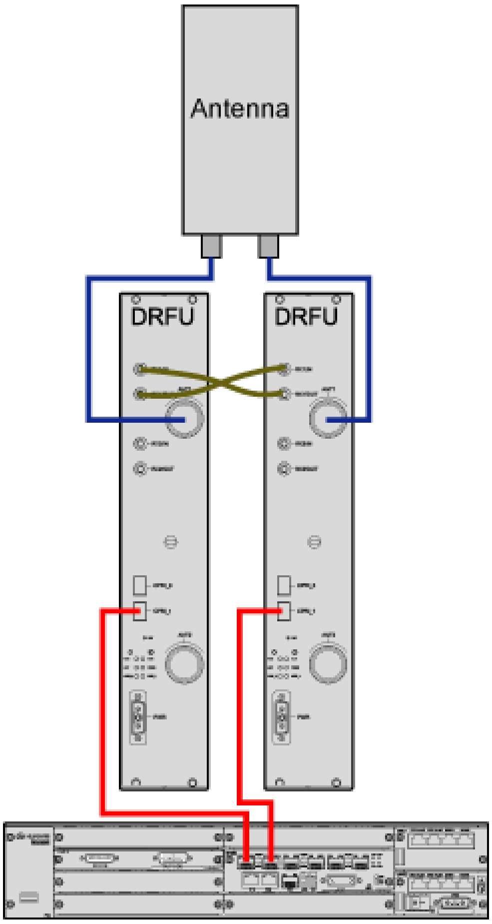
Figure 8-4 shows the cable connections.

Figure 8-4 Connections of RF cables for S2 (PBT)/S3 (without transmit diversity)/S4 (without transmit diversity)



S2 (4-Way Receive Diversity)

The S2 with 4-way receive diversity uses the configuration of two DRFUs and two dual-polarized antennas. The related configuration is as follows:

- Receive mode: **4-Way Receive Diversity**
- Set the antenna mode to **Double Antenna 4-Way Receiver**.

Figure 8-5 shows the cable connections.

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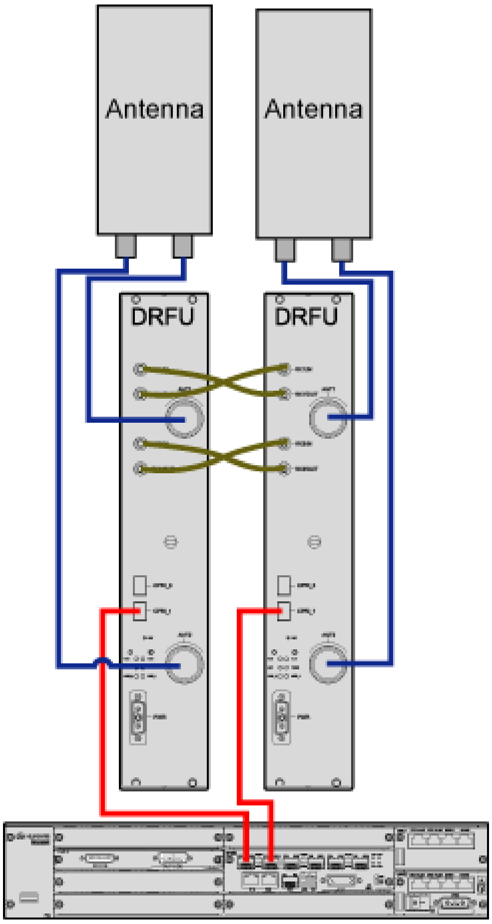
Figure 8-5 Connections of RF signal cables for S2 (4-way receive diversity)



S2 with Transmit Diversity and S4 with Transmit Independency

The S2 with transmit diversity and S4 with transmit independency use the configuration of two DRFUs and two dual-polarized antennas. **Table 8-5** describes the related configurations.

Table 8-5 Configuration (3)

Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S2 (with transmit diversity)	**Transmit diversity**	**Double Antenna**	• Two DRFUs • Two dual-polarized antennas
S4 with transmit independency	**Transmit independency or combining**	**Double Antenna**	

Figure 8-6 shows the cable connections.

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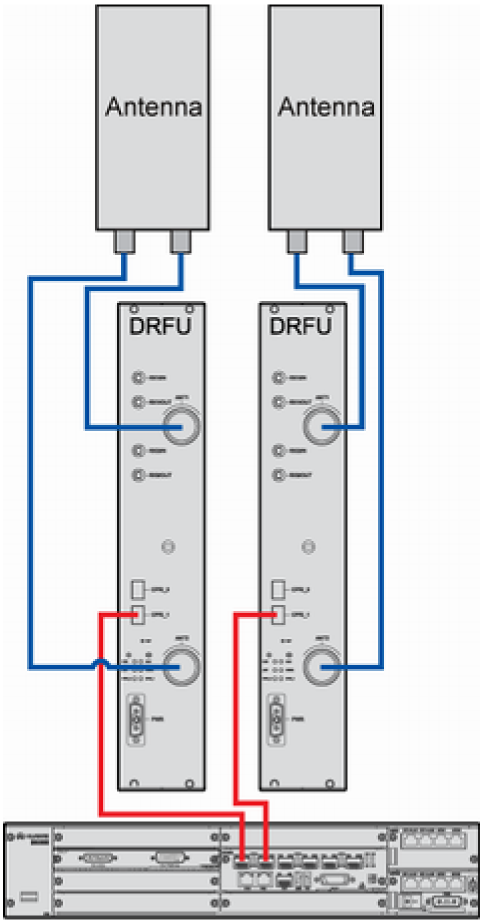
Figure 8-6 Connections of RF cables for S2 (transmit diversity)/S4 (transmit independency)



S5 Without Transmit Diversity and S6 Without Transmit Diversity

The S5 without transmit diversity and S6 without transmit diversity use the configuration of three DRFUs and two dual-polarized antennas. **Table 8-6** describes the related configurations.

Table 8-6 Configuration (4)

Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S5 without transmit diversity	**Transmit independency or combining**	• DRFU0: **Single Antenna Double Receiver** • DRFU1: **Single Antenna Double Receiver** • DRFU2: **Double Antenna**	• Three DRFUs • Two dual-polarized antennas

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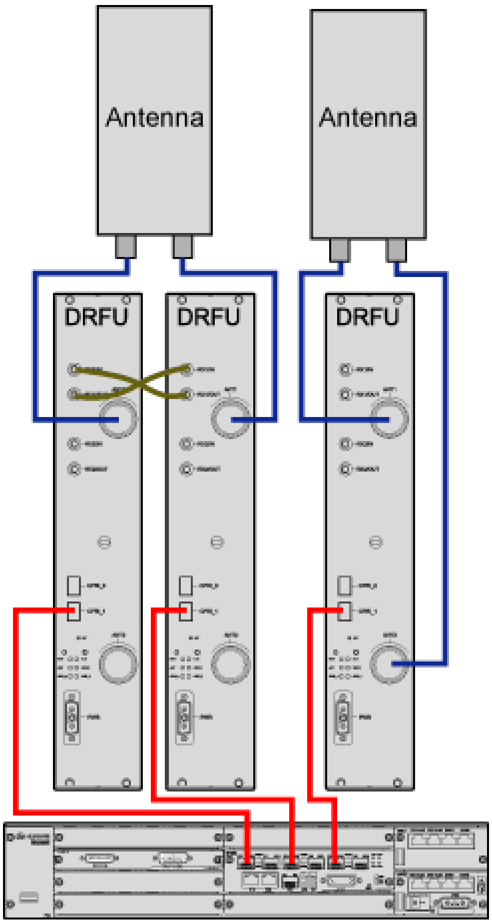
Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S6 without transmit diversity	**Transmit independency or combining**	• DRFU0: **Single Antenna Double Receiver** • DRFU1: **Single Antenna Double Receiver** • DRFU2: **Double Antenna**	

Figure 8-7 shows the cable connections.

Figure 8-7 Connections of RF cables for S5 (without transmit diversity)/S6 (without transmit diversity)



S7 Without Transmit Diversity and S8 Without Transmit Diversity

The S7 without transmit diversity and S8 without transmit diversity use the configuration of four DRFUs and two dual-polarized antennas. **Table 8-7** describes the related configurations.

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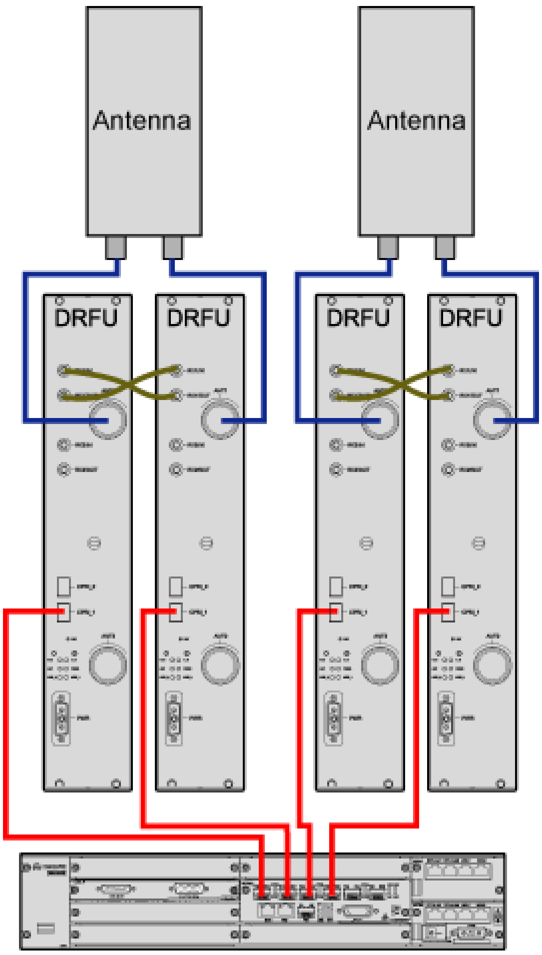
Table 8-7 Configuration (5)

Typical Configuration Mode	Transmit Mode	Antenna Mode	Cable Configuration
S7 without transmit diversity	**Transmit independency or combining**	**Single Antenna Double Receiver**	● Four DRFUs ● Two dual-polarized antennas
S8 without transmit diversity	**Transmit independency or combining**	**Single Antenna Double Receiver**	

Figure 8-8 shows the cable connections.

Figure 8-8 Connections of RF cables for S7 (without transmit diversity)/S8 (without transmit diversity)



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8.3 RF Cable Connections of the GRFU

One end of the RF jumper is connected to the RF port on the GRFU, and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual networking modes.

RF Cable Connections

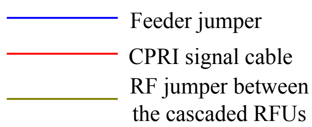
Table 8-8 describes the antenna mode on the BSC side.

Table 8-8 Atenna mode on the BSC side

GRFU Configuration	Antenna mode
Single GRFU	Double Antenna
Two GRFUs	Single Antenna Double Receiver

The RF cables differ from each other in colors. **Figure 8-9** shows the mapping between the RF signal cables and their colors.

Figure 8-9 Mapping between the RF signal cables and their colors



Cell Configuration with a Single GRFU (S3-S6)

When a dual-polarized antenna is configured, one TX channel and two RX channels are supported. The ANT_RXB and ANT_TX/RXA ports receive the signals from the antenna to achieve RX diversity.

Figure 8-10 shows cable connections.

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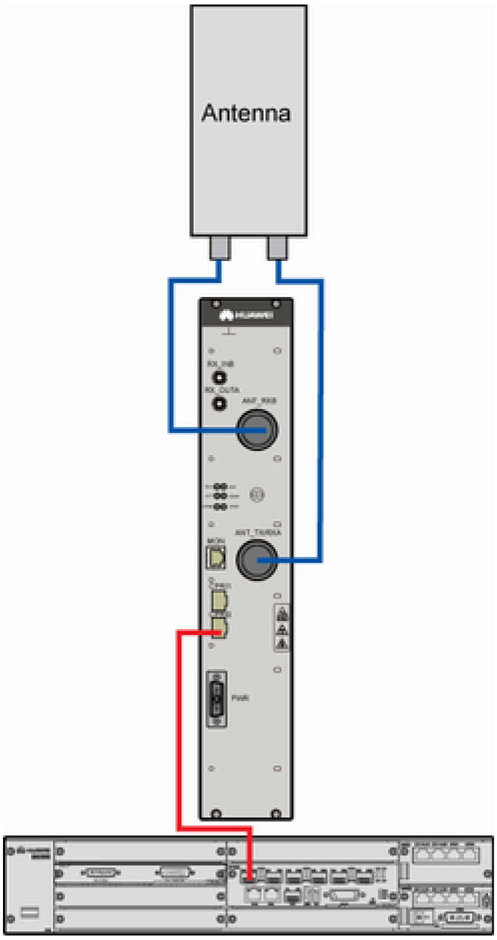
Figure 8-10 RF cable connections (S3-S6)



Cell Configuration with Two GRFUs (S7-S12)

- When the cell configuration is lower than S7, two GRFUs need to be configured because of the restriction for the output power or frequencies.
- When the cell configuration is from S7 to S12, two GRFUs need to be configured.
- The ANT_TX/RXA port on each GRFU supports the receiving and transmitting of signals. Two GRFUs provide RX signals for each other through the RF interconnection ports. Thus, the RX diversity is implemented.

Figure 8-11 shows cable connections.

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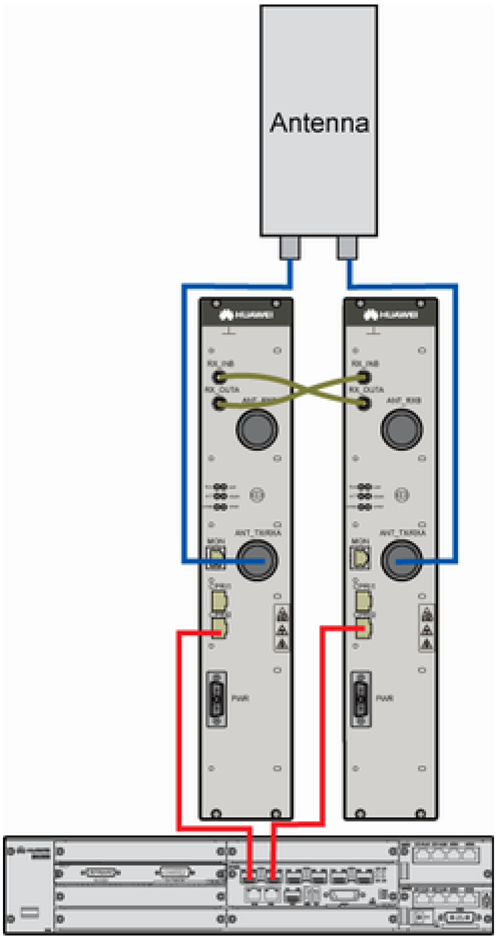
Figure 8-11 RF cable connections (S7-S12)



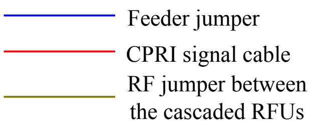
8.4 RF Cable Connections for the Coexistence of the DRFUs and GRFUs

One end of the RF jumper is connected to the RF port on the RFU, and the other end is connected to the feeder. You can determine the appropriate RF ports based on the actual networking modes.

RF Cable Connections

The RF cables differ from each other in colors. **Figure 8-12** shows the mapping between the RF signal cables and their colors.

Figure 8-12 Mapping between the RF cables and their colors



Single Antenna System Configured With One DRFU and One GRFU

When a single antenna system is configured with one DRFU and one GRFU, the DRFU supports one or two carriers. When two carriers are supported, the antenna system should be configured

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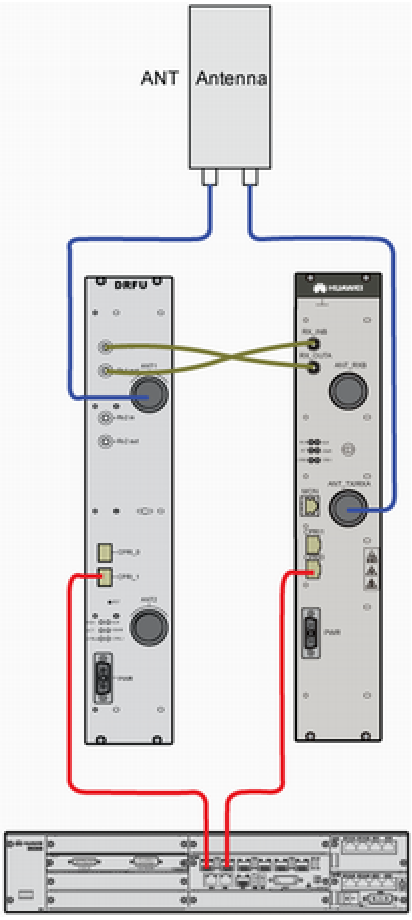
in combination mode; when one carrier is supported, the antenna system should be configured in TX independency mode. The GRFU supports a maximum of six carriers.

Figure 8-13 shows cable connections.

Figure 8-13 RF cable connections of a single antenna system configured with one DRFU and one GRFU



Double Antenna Systems Configured with One DRFU and One GRFU

When double antenna systems are configured with one DRFU and one GRFU, the DRFU supports one or two carriers and the GRFU supports a maximum of six carriers. **Figure 8-14** shows cable connections.

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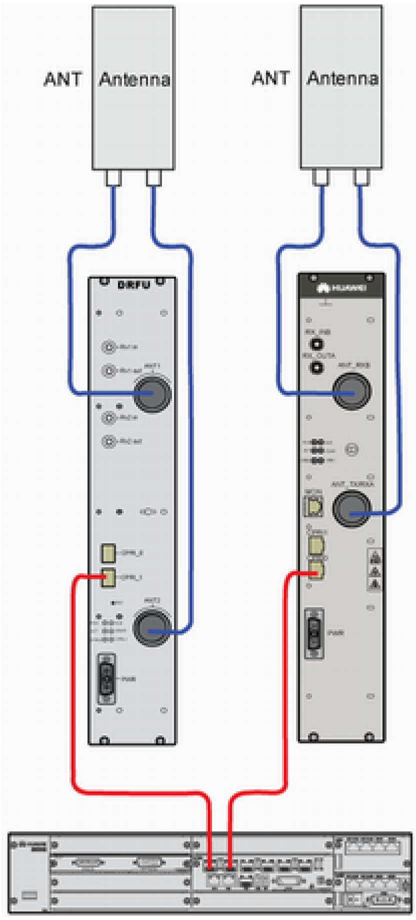
Figure 8-14 RF cable connections of double antenna systems configured with one DRFU and one GRFU



Double Antenna Systems Configured with Two DRFUs and One GRFU

When double antenna systems are configured with two DRFUs and one GRFU, the DRFU supports two to four carriers and the GRFU supports a maximum of six carriers. Figure 8-15 shows cable connections.

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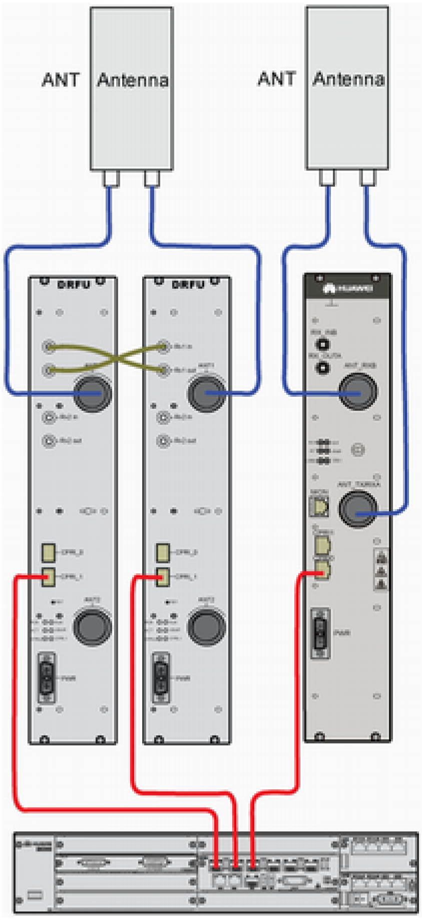
Figure 8-15 RF cable connections of double antenna systems configured with two DRFU and one GRFU



8.5 CPRI Cable Connections of the RFUs

The RFUs support various topologies: star, chain, and ring.

Figure 8-16 shows the typical topology of the DRFUs.

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Figure 8-16 Typical topology of the DRFUs

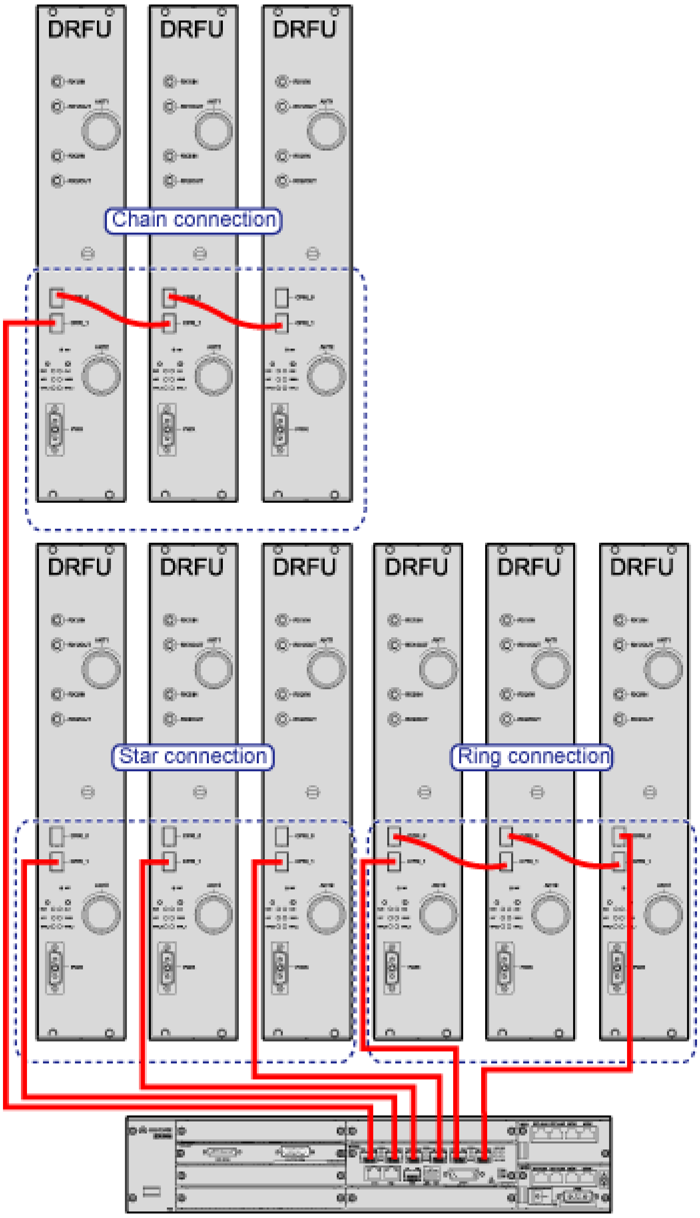

Figure 8-17 shows the typical topology of the GRFUs.

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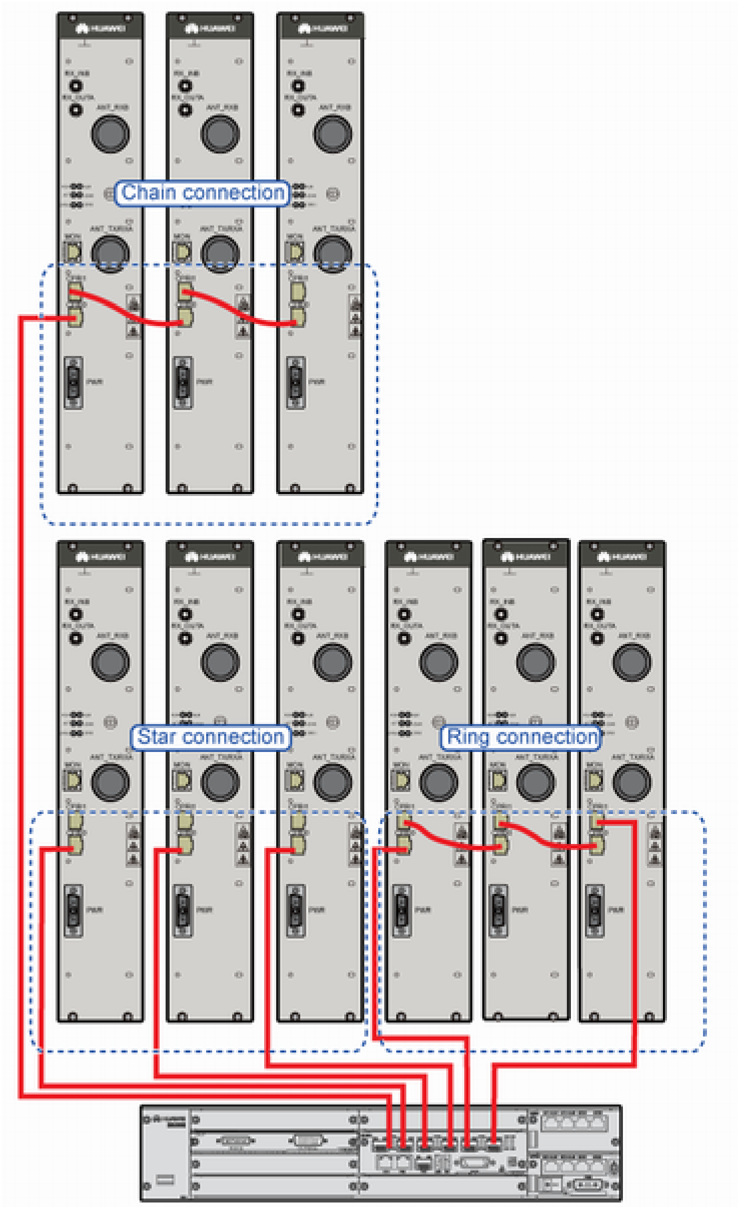
Figure 8-17 Typical topology of the GRFUs



NOTE

When the chain topology is used, a maximum of three levels of RFUs can be connected to one BBU.

Table 8-9 describes the three typical topologies of the DRFUs.

Table 8-9 Three typical topologies of the DRFUs

Topology	Application Scenario
Star	Supports the minimum configuration scenarios
Chain	Supports the maximum configuration scenarios

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Topology	Application Scenario
Ring	Supports the high reliability scenarios

8.6 Typical Configuration of the BTS3900/BTS3900A

This describes the typical configurations of the BTS3900/BTS3900A.

Table 8-10 describes the typical configurations of the BTS3900A.

Table 8-10 Typical configurations of the BTS3900A

Typical Configuration	Description
APM30+RFC	DRFU (S4/4/4)/GRFU (S12/12/12): 20-minutes backup power (24 Ah).
TMC+RFC	Provides installation space for user devices. The site has DC power supply, and no backup power is provided.
APM30+RFC+BBC	DRFU (S4/4/4)/GRFU (S12/12/12): backup power (184 Ah) of 5 hours.
APM30+RFC+TMC+BBC	DRFU (S4/4/4)/GRFU (S12/12/12): backup power (184 Ah) of 4 hours. **NOTE** The power consumption of the transmission cabinet is less than 200 W.

NOTE

The BTS3900A, an outdoor macro base station, is applicable to the outdoor centralized installation scenario. The RFUs are installed in the RF cabinet, and the BBU3900 is installed in the APM30 or transmission cabinet.

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9 OM System of the BTS

About This Chapter

The OM system implements the management, monitoring, and maintenance tasks of the BTS3900/BTS3900A. It provides various OM modes and multiple maintenance platforms to meet different maintenance requirements.

The OM modes of the BTS consist of the Site Maintenance Terminal mode, Local Maintenance Terminal mode, and centralized network management mode.

The OM functions of the BTS3900/BTS3900A consist of equipment management, software management, configuration management, service management, performance management, security management, alarm management, and environment monitoring.

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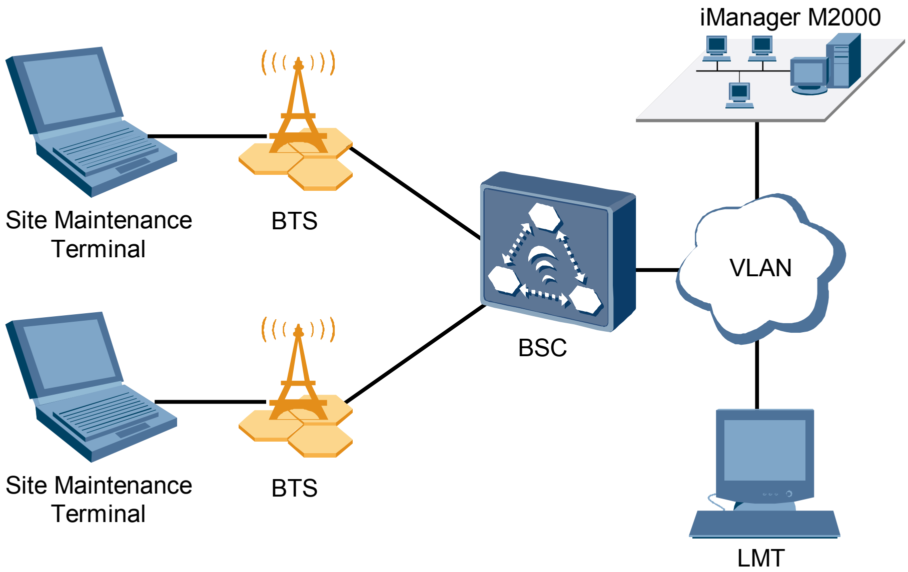
9.1 OM Modes of the BTS

The OM modes of the BTS consist of the Site Maintenance Terminal mode, Local Maintenance Terminal mode, and centralized network management mode.

Figure 9-1 shows the components of the BTS OM system.

Figure 9-1 Network structure of the OM system



You can maintain the BTS3900/BTS3900A in the following modes:

- Site Maintenance Terminal mode: The Site Maintenance Terminal is locally connected to the BTS through the Ethernet. You can use the Site Maintenance Terminal to operate and maintain the site, cell, Radio Carrier (RC), Baseband Transceiver (BT), channel, and board. In this mode, only one BTS can be maintained at a time.
- LMT mode: The LMT is used to maintain the BTS through the OM links on the Abis interface, which is an interface between the BSC and the BTS. The LMT communicates with the BSC through a LAN. You can use the LMT to operate and maintain the site, cell, RC, channel, and board. This mode is used in configuring and modifying the data of the BSC and BTS.
- Centralized network management mode: The Huawei iManager M2000 is used to maintain the BTS through the BSC. The M2000 can operate and maintain the site, cell, channel, and board. In this mode, multiple BTSs can be maintained at a time.

Table 9-1 lists the functions of the BTS OM system.

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Table 9-1 Functions of the BTS OM system

Maintenance Object	Maintenance Items for the Site Maintenance Terminal	Maintenance Items for the LMT	Maintenance Items for the M2000
Maintaining sites	Viewing resources Performing site Opstart Testing the RF specifications Providing site management rights Forcibly loading software Activating software Resetting a site hierarchically Testing sites Monitoring environment Testing transport performance Querying the ring topology parameters Querying the bar codes Querying alarm delay time Managing the site board parameters Providing the optical transmission board command console Testing the E1 BER Managing the RET antenna	Downloading the BTS software Configuring the BTS software Loading the BTS software Activating NodeB software Querying BTS running status Querying BTS attributes Resetting BTSs hierarchically Browsing the BTS initialization progress Querying the software version running on the BTS Testing the BTS Monitoring BTS resources Monitoring environment Viewing BTS logs Testing transport performance Performing the BTS hard reset Providing the optical transmission board command console Querying the temperature in the equipment room Maintaining the ring network	Managing the reporting of performance data Managing NE users Monitoring NE status Centralizing user management Monitoring NE performance Monitoring NEs in real time Viewing file information of NEs

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Maintenance Object	Maintenance Items for the Site Maintenance Terminal	Maintenance Items for the LMT	Maintenance Items for the M2000
Maintaining cells	Managing cell attributes Managing cell extended attributes Performing cell Opstart Performing cell performance tests Modifying the administrative state of the cell	Modifying the administrative state Performing force handovers Sending cell system messages Querying frequency scanning Configuring frequency scanning	Viewing the statistics of the cell distribution Viewing the basic configuration of the cell Viewing the configuration of the CCH of a cell Viewing neighbor cells Monitoring the configuration of an object Collecting the alarms of the monitored object Blocking/unblocking cells
Maintaining BT	Performing BT Opstart Re-Initializing a BT Setting the TRX full power emission Modifying the administrative state of the BT Performing BT tests Viewing the channel status	-	-

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Maintenance Object	Maintenance Items for the Site Maintenance Terminal	Maintenance Items for the LMT	Maintenance Items for the M2000
Maintaining RC	Managing RC attributes Managing RC extended attributes Performing RC Opstart Re-Initializing an RC Modifying the administrative state of the RC Viewing the automatic power correction type Obtaining the power mode of the RC	Modifying the administrative state Testing the RC performance Viewing the power mode of the RC Viewing the automatic power correction type Conducting loopback tests on the RC Testing idle timeslots Testing codec modes Resetting RCs Controlling the RC power	-
Maintaining channels	Managing channel attributes Performing channel Opstart Modifying the administrative state of the channel Performing loopback tests	Modifying the administrative state Monitoring the channel status Monitoring the channel interference band Performing the loopback test on a channel Testing the channel performance	Viewing the basic configuration of the cell Viewing the configuration of the CCH of a cell

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Maintenance Object	Maintenance Items for the Site Maintenance Terminal	Maintenance Items for the LMT	Maintenance Items for the M2000
Maintaining boards	Configuring racks Configuring boards Managing boards	Querying the software version running on the board Querying the matching of boards Querying bar codes of boards Querying board information Maintaining clocks Resetting boards Performing switchover of boards Querying the power module status Resetting smoke alarms Managing batteries Setting/Querying power module parameters Performing the loopback test on board communication links Querying the cavity state and the cavity frequency Setting the TMA feeder Resetting the auxiliary equipment Maintaining the RET antenna	Viewing NE board reports Querying inventory data

9.2 OM Functions of the BTS

The OM functions of the BTS3900/BTS3900A consist of equipment management, software management, configuration management, service management, performance management, security management, alarm management, and environment monitoring.

Equipment Management

Provides the query function for the status of all the components (boards/modules) and all the external devices (power supply/environment monitoring/RET). You can also perform data configuration and status management for some devices.

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Software Management

Provides various functions, such as downloading and activating the BTS software, upgrading patches, and loading and downloading files. The associated tasks involve consistency check on the software and hardware releases, release management, and software upgrade.

Configuration Management

- Checks whether the added, deleted, or changed BTS data is consistent with the actual situation.
- Supports automatic data backup.
- Supports dynamic and static data configuration. In dynamic data configuration, the data immediately takes effect after modification; in static data configuration, the modified data takes effect after the BTS is reset.

Service Management

- Supports parameter setting and alarm query for the baseband boards and environment monitoring devices.
- Supports complete self-test on hardware installation. The BTS software can be upgraded through the software package saved in the USB disk; thus, shortening the upgrade period. In addition, the local commissioning is not required.

Performance Management

- Monitors the performance of the internal and external telecommunications networks and generates alarms when the performance deteriorates.
- Monitors the operating status of the BTS, such as monitors the traffic volume on the ports and measures the technical data of the BTS.
- Monitors the usage of key components in the board, such as the CPU and DSP.

Security Management

Provides security management functions, such as connection management, user authentication, encryption, and forward and backward resolution of the interface messages between the BTS software and the OMC.

Alarm Management

- Supports query of real-time alarms and history alarms
- Collects internal and external alarms, such as the environment monitoring device inputs and Boolean inputs
- Processes alarm correlation to ensure precision and accuracy in locating alarms
- Provides functions of saving, interpreting, prompting, shielding, filtering, confirming, clearing, post processing, and reporting of alarms
- Provides functions of detecting and reporting alarms, and processing alarm correlation in the system

Environment Monitoring

- Provides a perfect environment monitoring system.

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- Provides monitoring solutions regarding, for example, door control, infrared, smoke, water immersion, and temperature, according to users' requirements.

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10 Technical Specifications of the BTS3900

About This Chapter

This describes the BTS3900 technical specifications, which consist of capacity specifications, RF specifications, engineering specifications, lightning protection specifications, and other specifications related to physical ports and environment.

The capacity of the BTS3900/BTS3900A is represented by the number of carriers and that of cells.

The RF specifications of the BTS3900/BTS3900A involve the working bands, transmission, and reception.

This provides the engineering specifications of the BTS3900. The specifications consist of the dimensions, weight, power supply, and power consumption.

The BTS3900 provides surge protection for its ports. The surge protection specifications of the BTS3900 ports consist of the DC or AC supply, antenna, transmission, and dry contact alarms.

The BTS3900 provides various physical ports for connections to external equipment. The ports of the BTS3900 consist of power ports, transmission ports, and alarm ports.

The BTS3900/BTS3900A complies with the standards of power distribution, EMC, surge protection, safety, operating environment, transportation adaptability, and storage adaptability.

The environmental requirements related to the BTS3900 refer to the requirements on the environment during its operation, transportation, and storage.

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10.1 Capacity Specifications of the BTS3900/BTS3900A

The capacity of the BTS3900/BTS3900A is represented by the number of carriers and that of cells.

- A single cabinet can be configured with a maximum of six DRFUs or GRFUs.
- A single cabinet serves a maximum of six sectors.
- When the DRFU is configured, a single cabinet supports a maximum of 12 carriers with the maximum cell configuration of S4/4/4.
- When the DRFU is configured, a single site supports a maximum of 36 carriers with the maximum cell configuration of S12/12/12.
- When the GRFU is configured, a single cabinet supports a maximum of 36 carriers with the maximum cell configuration of S12/12/12.
- When the GRFU is configured, a single site supports a maximum of 72 carriers with the maximum cell configuration of S24/24/24.

10.2 RF Specifications of the BTS3900/BTS3900A

The RF specifications of the BTS3900/BTS3900A involve the working bands, transmission, and reception.

TX Specifications

Table 10-1 lists the bands supported by the BTS3900/BTS3900A with the DRFUs. The spacing between two frequencies is 200 kHz.

Table 10-1 Working bands and output power of the DRFU

Working Band	Frequency Range	Working Mode	Output Power (GMSK/8PSK)
PGSM 900 MHz/ EGSM 900 MHz	PGSM: ● TX: 935-960 MHz ● RX: 890-915 MHz EGSM: ● TX: 925-960 MHz ● RX: 880-915 MHz	Non-combination	45 W/30 W
		Combination	20 W/14 W
		PBT	71 W/47 W
GSM 1800 MHz	● TX: 1805-1880 MHz ● RX: 1710-1785 MHz	Non-combination	40 W/26 W
		Combination	18 W/12 W
		PBT	63 W/42 W

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Table 10-2 lists the frequency bands supported by the BTS3900/BTS3900A configured with the GRFUs. The maximum DL bandwidth of a single GRFU is 15 Mbit/s.

Table 10-2 Working bands of the GRFU

Working Band	Sub-Band	TX Bandwidth	RX Bandwidth
900 MHz	Full band of PGSM	935-960 MHz	890-915 MHz
1800 MHz	45 MHz lower than the band of DCS	1805-1850 MHz	1710-1755 MHz
	45 MHz higher than the band of DCS	1835-1880 MHz	1740-1785 MHz
850 MHz	Full band	869-894 MHz	824-849 MHz
1900 MHz	40 MHz lower than the band of 1900 MHz	1930-1970 MHz	1850-1890 MHz
	40 MHz higher than the band of 1900 MHz	1950-1990 MHz	1870-1910 MHz

Table 10-3 lists the output power when the GRFU is configured.

Table 10-3 Output power of the GRFU

Working Band	Configuration	Output Power (GMSK/ 8PSK)
PGSM 900 MHz / GSM1800 MHz/850 MHz/1900 MHz	S3	31 W/20 W
	S4	27 W/17 W
	S5	18 W/12 W
	S6	16 W/10 W

RX Specifications

Table 10-4 lists the static RX sensitivity of the BTS3900/BTS3900A configured with DRFUs.

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Table 10-4 RX sensitivity of the DRFU

RX Diversity Mode	Working Band	Static Sensitivity (Typical Value)	TU50 (NO FH)	RA250	HT100
Single antenna	900 MHz	-113 dBm	-111.4 dBm	-111.4 dBm	-110.0 dBm
	1800 MHz	-113 dBm	-111.4 dBm	-111.4 dBm	-110.0 dBm
2-way antenna	900 MHz	-116 dBm	-114.4 dBm	-114.4 dBm	-113.0 dBm
	1800 MHz	-116 dBm	-114.4 dBm	-114.4 dBm	-110.0 dBm
4-way antenna	900 MHz	-118.5 dBm	-116.4 dBm	-116.4 dBm	-115.0 dBm
	1800 MHz	-118.5 dBm	-116.4 dBm	-116.4 dBm	-115.0 dBm

Table 10-5 lists the static RX sensitivity of the BTS3900/BTS3900A configured with GRFUs.

Table 10-5 RX sensitivity of the GRFU

RX Diversity Mode	Working Band	Static Sensitivity (Typical Value)
Single antenna	900 MHz	-113 dBm
	1800 MHz	-113 dBm
2-way antenna	900 MHz	-116 dBm
	1800 MHz	-116 dBm
4-way antenna	900 MHz	-
	1800 MHz	

10.3 Engineering Specifications of the BTS3900

This provides the engineering specifications of the BTS3900. The specifications consist of the dimensions, weight, power supply, and power consumption.

Dimensions

Table 10-6 lists the dimensions of the BTS3900 cabinet.

Table 10-6 Dimensions

Configuration Type	Width (mm)	Depth (mm)	Height (mm)
Cabinet	600	450	900

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Configuration Type	Width (mm)	Depth (mm)	Height (mm)
Base	600	420	40

Weight

Table 10-7 lists the weight of the BTS3900 cabinet.

Table 10-7 Weight

Configuration Type	Weight (kg)
Empty cabinet	57 (including the power supply modules, cables, and fans but excluding the BBU and RFUs)
Full configuration	132 (DRFU or GRFU: 12 kg/pcs)

Power Input

Table 10-8 lists the specifications of the power input to the BTS3900.

Table 10-8 Specifications of the input power

Power Type	Rated Voltage	Operating Voltage Range
-48 V DC	-48 V DC	-38.4 V DC to -57 V DC
+24 V DC	+24 V DC	+21.6 V DC to +29 V DC
220 V AC	220 V AC	176 V AC to 280 V AC
110 V AC	110 V AC	90 V AC to 135 V AC

NOTE

The +24 V DC power cabinet, 220 V AC power cabinet, and 110 V AC power cabinet are installed with power conversion modules. Therefore, an external power cabinet is not required.

Power Consumption

Table 10-9 lists the power consumption of the BTS3900 configured with DRFUs.

Table 10-9 Power consumption of the BTS3900 configured with DRFUs

Configuration		Output Power (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
900M	S2/2/2	45	750	1050

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Configuration		Output Power (W)	Typical Power Consumption (W)	Maximum Power Consumption (W)
	S4/4/4	20	1140	2000
1800M	S2/2/2	40	740	1030
	S4/4/4	18	1130	1960

Table 10-10 lists the power consumption of the BTS3900 configured with GRFUs.

Table 10-10 Power consumption of the BTS3900 configured with GRFUs

Configuration		Typical Power Consumption (W)	Maximum Power Consumption (W)
900M	S3/3/3	1030	1360
	S4/4/4	1000	1360
	S5/5/5	870	1200
	S6/6/6	870	1200
1800M	S3/3/3	1090	1360
	S4/4/4	1060	1360
	S5/5/5	910	1250
	S6/6/6	870	1250

NOTE

The typical power consumption is the measurement value when the traffic load is 30%.

10.4 Surge Protection Specifications of the BTS3900

The BTS3900 provides surge protection for its ports. The surge protection specifications of the BTS3900 ports consist of the DC or AC supply, antenna, transmission, and dry contact alarms.

NOTE

The unspecified surge current with maximum discharge current is called nominal discharge current.

Table 10-11 Surge protection specifications of the BTS3900

Port	Surge Protection Mode	Surge Current
DC power port	Differential mode	3 kA (8/20 us surge current)

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Port	Surge Protection Mode	Surge Current
	Common mode	5 kA (8/20 us surge current)
AC power port	Differential mode	3 kA (8/20 us surge current)
	Common mode	5 kA (8/20 us surge current)
Antenna port (including the GPS port)	Differential mode	8 kA (8/20 us surge current)
	Common mode	40 kA (8/20 us surge current)
Indoor signal port	Differential mode	250 A (8/20 us surge current)
	Common mode	250 A (8/20 us surge current)
Indoor dry contact input	Differential mode	250 A (8/20 us surge current)
	Common mode	250 A (8/20 us surge current)
Indoor dry contact output	Voltage resistance	1500 V AC
Outdoor E1/T1 signal port	Differential mode	3 kA (8/20 us surge current)
	Common mode	5 kA (8/20 us surge current)
RET antenna	Differential mode	3 kA (8/20 us surge current)
	Common mode	5 kA (8/20 us surge current)
Outdoor dry contact input	Differential mode	3 kA (8/20 us surge current)
	Common mode	5 kA (8/20 us surge current)

10.5 Ports on the BTS3900

The BTS3900 provides various physical ports for connections to external equipment. The ports of the BTS3900 consist of power ports, transmission ports, and alarm ports.

Power Supply Port

Table 10-12 Power ports on the BTS3900

Port	Cabinet Type	Description
Power input terminal	-48 V DC cabinet	-48 V DC input
Power input terminal	+24 V DC cabinet	+24 V DC input
L and N terminals	220 V AC cabinet	220 V AC input

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Transmission Ports

Table 10-13 Transmission ports on the BBU

Label	Connector Type	Description
INSIDE	DB25 male	Transmits four E1s/T1s between the UELP and the GTMU.
OUTSIDE	DB26 male	Transmits four E1s/T1s between the BBU and the BSC.
CPRI0-CPRI5	SFP female	Transmits the optical and electrical signals between the BBU and the RFU.
E1/T1	DB26 male	Transmits four E1s/T1s between the GTMU and the UELP or between the GTMU and the BSC.
FE0	RJ45	Reserved port that performs the following function: Connects the BBU to a routing device in the equipment room through the Ethernet cable to transmit network information.
FE1	DLC	Reserved port that performs the following function: Connects the BBU to a routing device in the equipment room through the Ethernet cable to transmit network information.

Table 10-14 Transmission ports on the DRFU

Label	Connector Type	Description
CPRI0	SFP female	Connected to the BBU or to the upper-level cascaded DRFU
CPRI1	SFP female	Connected to the lower-level cascaded DRFU

Table 10-15 Transmission ports on the GRFU

Label	Connector Type	Description
CPRI1	SFP female	Connected to the BBU or to the upper-level cascaded GRFU

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Label	Connector Type	Description
CPRI0	SFP female	Connected to the lower-level cascaded GRFU

Alarm Ports

In the BTS3900 system, the alarms ports vary with the optional modules configured in the BBU3900.

- When the BBU3900 is configured with 1 UPEU, 2 RS485 buses and 8 dry contact signals are provided.
- When the BBU3900 is configured with 2 UPEUs or 1 UPEU plus 1 UEIU, 4 RS485 buses and 16 dry contact signals are provided.

Table 10-16 Alarm ports on the BTS3900

Label	Connector Type	Description
MON0	RJ45	Receives and transmits the collected environment monitoring signals in the format of RS485 frames to communicate with the GTMU.
MON1	RJ45	Reserved
EXT-ALM0	RJ45	Transmits the collected environment monitoring signals in the format of dry contact signals to the GTMU.
EXT-ALM1	RJ45	Reserved

Other Ports

Table 10-17 Other external ports of the BBU3900

Label	Connector Type	Description
ETH	RJ45	For local maintenance and commissioning
USB	USB	Reserved port that performs the following function: Software upgrade is automatically performed when a USB disk is inserted.
TST	USB	Connected to a tester to test the clock signals from the BTS3900

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10.6 Compliance Standards of the BTS3900/BTS3900A

The BTS3900/BTS3900A complies with the standards of power distribution, EMC, surge protection, safety, operating environment, transportation adaptability, and storage adaptability.

Power Distribution Standards

The compliance standards are as follows:

- ETS300132-1-1 *Power Supply Interface at the Input to Telecommunication Equipment*
- ETS300132-1-2 *Power Supply Interface at the Input to Telecommunication Equipment*

EMC Standards

The compliance standards are as follows:

- CISPR 22 (1997): *limits and methods of measurement of radio disturbance characteristics of information*
- EN55022 (1998): *limits and methods of measurement of radio disturbance characteristics of information*
- CISPR 24 (1998): *Information Technology Equipment --Immunity characteristics --Limits and methods measurement*
- IEC61000-4-2: *Electromagnetic compatibility (EMC) Part 2: Testing and measurement techniques Section 2: Electrostatic discharge immunity test Basic EMC Publication*
- IEC61000-4-3: *Electromagnetic compatibility; Part 3: Testing and measurement techniques Section 3 radio frequency electromagnetic fields; immunity test*
- IEC61000-4-4: *Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 4: Electrical fast transient/burst immunity test Basic EMC publication*
- IEC61000-4-5: *Electromagnetic compatibility (EMC) Part 5: Testing and measurement techniques Section 5: Surge immunity test*
- IEC61000-4-6: *Electromagnetic compatibility: Part 6: Testing and measurement techniques: Section 6 conducted disturbances induced by radio-frequency fields; immunity test*
- IEC61000-4-29: *Electromagnetic compatibility: Part 29: Testing and measurement techniques and voltage variations on d.c. Input power port immunity test*
- ETSI 301 489-1 V1.3.1 (2001-09): *Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements*
- FCC Part 15: *Federal Communication Committee - part 15- radio frequency device*

Surge Protection Standards

The compliance standards are as follows:

- IEC 61312-1(1995) Protection Against Lightning Electromagnetic Impulse Part I : *General Principles*

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- IEC 61643-1(1998) Surge Protective devices connected to low-voltage power distribution systems
- ITU-T K.11(1993) Principles of Protection Against Overvoltage and Overcurrents
- ITU-T K.27(1996) Bonding Configurations and Earthing Inside a Telecommunication Building
- ETS 300 253(1995) Equipment Engineering; Earthing and bonding of telecommunication equipment in telecommunication centers

Safety Standards

The compliance standards are as follows:

- 3G TR34.907 V3.0.0 Report on electrical safety requirements and regulations
- IEC 60950-1 *Safety of information technology equipment*
- EN 60950-1 *Safety of information technology equipment*
- IEC60215 *Safety requirement for radio transmitting equipment*

Operating Environment Standards

The compliance standards are as follows:

- EUROPEAN ETS 300 019-1-3 Class 3.1 "Stationary use at weatherprotected locations"
- EUROPEAN ETS 300 753: *Equipment Engineering(EE) Acoustic noise emitted by telecommunications equipment 1997*
- EUROPEAN ETS 300 019-1-3-Amd

Transportation Adaptability Standards

The compliance standard is as follows:

EUROPEAN ETS 300 019-1-2 Class 2.3 "PUBLIC transportation"

Storage Adaptability Standards

The compliance standard is as follows:

EUROPEAN ETS 300 019-1-1 Class 1.2 "not temperature-controlled storage"

10.7 Environmental Requirements of the BTS3900

The environmental requirements related to the BTS3900 refer to the requirements on the environment during its operation, transportation, and storage.

10.7.1 Environment Requirements for Operating the BTS3900
This describes the environment requirements for operating the BTS3900. It focuses on the climatic, biological, air purity, and mechanical stress requirements for operating the BTS3900.

10.7.2 Environment Requirements for Transporting the BTS3900
This describes the optimal transportation environment of the BTS3900. It focuses on the climatic, waterproofing, biological, air cleanness, and mechanical stress requirements for transporting the BTS3900.

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This describes the optimal storage environment of the BTS3900. It focuses on the climatic, waterproofing, biological, air purity, and mechanical stress requirements for storing the BTS3900.

10.7.1 Environment Requirements for Operating the BTS3900

This describes the environment requirements for operating the BTS3900. It focuses on the climatic, biological, air purity, and mechanical stress requirements for operating the BTS3900.

Climatic Requirements

Table 10-18 lists the climatic requirements for the normal operation of the BTS.

Table 10-18 Climatic requirements

Item	Specification
Temperature	-20℃ to +50℃ (long-term operating environment) +50℃ to +55℃ (short-term operating environment)
Temperature variation rate	≤ 3℃/min
Relative humidity	5% RH to 95% RH
Altitude	● The BTS operates normally when the altitude ranges from -60 m to 3,000 m. ● When the altitude ranges from 3,000 m to 4,000 m, the operating temperature of the BTS drops by 1ºC each time the altitude increases by 200 m.
Air pressure	70 kPa to 106 kPa
Solar radiation	≤ 1120 W/s^2
Heat radiation	≤ 600 W/s^2
Wind speed	≤ 50 m/s

NOTE

Long term working environment refers to the conditions in which the BTS works properly for a long time. Short term working environment refers to the conditions in which the hardware is kept undamaged and the BTS works properly for less than 96 hours each time and less than 15 days each year in total.

Biological Environment Requirements

The biological requirements related to the operating environment are as follows:

- The environment should not be conducive for the growth of fungus or mildew.
- There should be no rodents, such as rats.

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Air Purity Requirements

The air purity requirements related to the operating environment are as follows:

- The air should be free from explosive, conductive, magneto-conductive, or corrosive dust.
- The density of chemically active substances should comply with the requirements listed in **Table 10-19**.

Table 10-19 Requirements for the density of chemically active substances

Chemically Active Substance	Unit	Density
SO_2	mg/m^3	⩽ 0.30
H_2S	mg/m^3	⩽ 0.10
NH_3	mg/m^3	⩽ 1.00
Cl_2	mg/m^3	⩽ 0.10
HCl	mg/m^3	⩽ 0.10
HF	mg/m^3	⩽ 0.01
O_3	mg/m^3	⩽ 0.05
NO_x	mg/m^3	⩽ 0.05

Mechanical Stress Requirements

Table 10-20 lists the mechanical stress requirements for the normal operation of the BTS.

Table 10-20 Mechanical stress requirements

Item	Sub Item	Specification	
Sinusoidal vibration	Offset	⩽ 3 mm	None
	Acceleration speed	None	⩽ 10.0 m/s^2
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz
Unsteady impact	Impact response spectrum II	⩽ 250 m/s^2	
	Static payload	0	

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NOTE

- Impact response spectrum refers to the maximum acceleration response curve generated by the equipment under specified impact excitation. Impact response spectrum II means that the duration of semi-sine impact response spectrum is 6 ms.
- Static payload refers to the capability of the equipment in package to bear the pressure from the top in normal pile-up method.

10.7.2 Environment Requirements for Transporting the BTS3900

This describes the optimal transportation environment of the BTS3900. It focuses on the climatic, waterproofing, biological, air cleanness, and mechanical stress requirements for transporting the BTS3900.

Climatic Requirements

Table 10-21 lists the climatic requirements for transporting the BTS.

Table 10-21 Climatic requirements

Item	Specification
Temperature	-40℃ to +70℃
Temperature variation rate	⩽ 3 ℃/min
Relative humidity	10% to 100% (irrespective of air speed)
Altitude	⩽ 3,000 m
Air pressure	70 kPa to 106 kPa
Solar radiation	⩽ 1,120 W/m^2
Thermal radiation	⩽ 600 W/m^2
Wind speed	⩽ 50 m/s
Road class	2K4, including 2K3 and package transportation on 3rd-level roads without environment protection (except in high altitude areas)

Waterproofing Requirements

The waterproofing requirements related to the transportation of the BTS are as follows:

- The package should be intact.
- Waterproofing measures should be taken to prevent rainwater from leaking into the package.
- There should be no water accumulated inside transportation vehicles.

Biological Environment Requirements

The biological requirements related to the transportation of the BTS are as follows:

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- The environment should not be conducive for the growth of fungus or mildew.
- There should be no rodents, such as rats.

Air Purity Requirements

The air purity requirements related to the transportation of the BTS are as follows:

- The air should be free from explosive, conductive, magneto-conductive, or corrosive dust.
- The density of mechanically active substances should comply with the requirements listed in **Table 10-22**.

Table 10-22 Requirements for the density of mechanically active substances

Mechanically Active Substance	Unit	Density
Suspended dust	mg/m^3	≤ 35
Falling dust	mg/m^2h	≤ 0.2
Sand	mg/m^3	≤ 30
NOTE ● Suspended dust: diameter ≤ 75 μm ● Falling dust: 75 μm ≤ diameter ≤ 150 μm ● Sand: 150 μm ≤ diameter ≤ 1,000 μm		

- The density of chemically active substances should comply with the requirements listed in **Table 10-23**.

Table 10-23 Requirements for the density of chemically active substances

Chemically Active Substance	Unit	Density
SO_2	mg/m^3	≤ 0.30
H_2S	mg/m^3	≤ 0.10
NO_x	mg/m^3	≤ 0.05
NH_3	mg/m^3	≤ 1.00
Cl_2	mg/m^3	≤ 0.10
HCl	mg/m^3	≤ 0.10
HF	mg/m^3	≤ 0.01
O_3	mg/m^3	≤ 0.05

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Mechanical Stress Requirements

Table 10-24 lists the mechanical stress requirements for transporting the BTS.

Table 10-24 Mechanical stress requirements

Item	Sub Item	Specification		
Sinusoidal vibration	Offset	≤ 3.5 mm	None	None
	Acceleration speed	None	≤ 10.0 m/s^2	≤ 15.0 m/s^2
	Frequency range	2-9 Hz	9-200 Hz	200-500 Hz
Random vibration	Spectrum density of accelerated speed	30 m^2/s^3	3 m^2/s^3	1 m^2/s^3
	Frequency range	2-10 Hz	10-200 Hz	200-500 Hz
Unsteady impact	Impact response spectrum II	≤ 250 m/s^3		
	Static payload	≤ 10 kPa		

NOTE

- Impact response spectrum refers to the maximum acceleration response curve generated by the equipment under specified impact excitation. Impact response spectrum II means that the duration of semi-sine impact response spectrum is 6 ms.
- Static payload refers to the capability of the equipment in package to bear the pressure from the top in normal pile-up method.

10.7.3 Environment Requirements for Storing the BTS3900

This describes the optimal storage environment of the BTS3900. It focuses on the climatic, waterproofing, biological, air purity, and mechanical stress requirements for storing the BTS3900.

Climatic Requirements

The storage of the BTS should meet the climatic requirements listed in **Table 10-25**.

Table 10-25 Climatic requirements

Item	Specification
Temperature	-40℃ to +70℃
Temperature variation rate	≤ 1 ℃/min
Relative humidity	10% to 100% (irrespective of air speed)
Altitude	≤ 3,000 m
Air pressure	70 kPa to 106 kPa

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Item	Specification
Solar radiation	≤ 1,120 W/m^2
Thermal radiation	≤ 600 W/m^2
Wind speed	≤ 50 m/s

Waterproofing Requirements

The storage environment of the BTS should be waterproofed. The waterproofing requirements related to the indoor storage environment of the BTS are as follows:

- There should be no water on the ground, and water should not leak into the package of the equipment.
- The equipment must be kept away from the auto fire-protection devices and air-conditioners that are prone to leakage.

If the equipment has to be placed outdoors, ensure that:

- The package is intact.
- Waterproofing measures are taken to prevent rainwater from leaking into the package.
- There is no water on the ground and water does not leak into the package.
- The package is not exposed to direct sunlight.

Biological Environment Requirements

The biological requirements related to the indoor storage environment of the BTS are as follows:

- The environment should not be conducive for the growth of fungus or mildew.
- There should be no rodents, such as rats.

Air Purity Requirements

The air purity requirements related to the indoor storage environment of the BTS are as follows:

- There should be no explosive, conductive, magneto-conductive, or corrosive dust in the air.
- The density of mechanically active substances should comply with the requirements listed in **Table 10-26**.

Table 10-26 Requirements for the density of mechanically active substances

Mechanically Active Substance	Unit	Density
Suspended dust	mg/m^3	≤ 5.00
Falling dust	mg/m^2h	≤ 500.00
Sand	mg/m^3	≤ 300

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Mechanically Active Substance	Unit	Density
NOTE ● Suspended dust: diameter ⩽ 75 µm ● Falling dust: 75 µm ⩽ diameter ⩽ 150 µm ● Sand: 150 µm ⩽ diameter ⩽ 1,000 µm		

- The density of chemically active substances should comply with the requirements listed in **Table 10-27**.

Table 10-27 Requirements for the density of chemically active substances

Chemically Active Substance	Unit	Density
SO_2	mg/m^3	⩽ 0.30
H_2S	mg/m^3	⩽ 0.10
NO_x	mg/m^3	⩽ 0.50
NH_3	mg/m^3	⩽ 1.00
Cl_2	mg/m^3	⩽ 0.10
HCl	mg/m^3	⩽ 0.10
HF	mg/m^3	⩽ 0.01
O_3	mg/m^3	⩽ 0.05

Mechanical Stress Requirements

The storage of the BTS should meet the mechanical stress requirements listed in **Table 10-28**.

Table 10-28 Mechanical stress requirements

Item	Sub Item	Specification	
Sinusoidal vibration	Offset	⩽ 1.5 mm	-
	Acceleration speed	-	⩽ 5.0 m/s^2
	Frequency range	2-9 Hz	9-200 Hz
Unsteady impact	Impact response spectrum II	⩽ 250 m/s^2	
	Static payload	⩽ 5 kPa	

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Item	Sub Item	Specification
NOTE • Impact response spectrum refers to the maximum acceleration response curve generated by the equipment under specified impact excitation. Impact response spectrum II means that the duration of semi-sine impact response spectrum is 6 ms. • Static payload refers to the capability of the equipment in package to bear the pressure from the top in normal pile-up method.		

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