System Description of DBS3800

Huawei Technologies Co., Ltd.

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Chapter 1 Introduction to the DBS3800

1.1 About This Chapter

This chapter introduces the following:

- Solutions of the DBS3800
- Benefit Summary of the DBS3800

1.2 Solutions of the DBS3800

Developed by Huawei Technologies Co., Ltd. (Huawei), the DBS3800 family complies with the protocols of 3GPP R99/R4/R5/R6 FDD and Common Public Radio Interface (CPRI).

Compared with traditional NodeBs, the distributed NodeB system consists of the following two physically separate parts:

- Baseband Unit (BBU): processes baseband signals.
- Remote Radio Unit (RRU): processes RF signals.

The two parts support separate installation, capacity expansion, and evolution; thus meeting WCDMA network construction requirements.

The parts can be connected through electrical or optical cables on the CPRI interface. This facilitates site acquisition, device transportation, equipment room construction, and equipment installation.

1.2.1 Products of the DBS3800 Family

The DBS3800 family has the following four products.

I. BBU3806

The BBU3806 is an indoor baseband unit. It can be mounted in any standard cabinet with the 19 inch x 1U free space.

The BBU3806 requires very small floor space, and it is easy to install. It provides comprehensive functions, and consumes a small amount of power. It can also be installed easily at your existing site.

You can expand system capacity by stacking BBU3806s at the same site.

II. BBU3806C

The BBU3806C is an outdoor baseband unit. It can be mounted outdoors on a pole or a wall.

The BBU3806C has a strong environment adaptability. It requires very small floor space, and it is easy to install. The BBU3806C provides comprehensive functions, and consumes a small amount of power.

You can expand system capacity by combing two BBU3806Cs.

III. RRU3801C

The RRU3801C is an outdoor remote radio unit. It can be mounted close to the antennas on a pole or a wall.

The RRU3801C is small, light, and easy to install.

IV. BTS3803C

The BTS3803C consists of one BBU3806C and three RRU3801Cs. The BBU3806C and one RRU3801C are installed in one compact cabinet. The other two RRU3801Cs are installed in the other compact cabinet.

The BTS3803C can be mounted on a pole or a wall where the antennas are installed.

1.2.2 Auxiliary Products of the DBS3800

The DBS3800 family can work with the following auxiliary products:

- Advanced Power Module (APM)
- Auxiliary Facility Box (AFB)
- SPD40R: an outdoor surge protection device
- SPBC or SPBT: surge protection box

By working with the four auxiliary products, the DBS3800 can provide flexible solutions and enable you to deploy the network quickly.

I. APM

The APM is an auxiliary power backup system for outdoor applications.

The APM has the following functions:

- Providing built-in batteries and 220 V AC surge protection module
- Supplying –48 V DC 60 A power
- Providing 4U space for your devices

II. AFB

The AFB can be used for outdoor applications. It has a high integrity and a strong environment adaptability. The AFB is easy to install.

The AFB has the following functions:

- Power supply
- Surge protection
- Temperature control
- 5U space for your devices

III. SPD40R

The SPD40R is an independent outdoor surge protection box. It can be mounted on a wall or a pole.

The SPD40R has the following functions:

- Surge protection
- Simple power distribution
- Remote fault alarm reporting
- Alarm reporting through local alarm Light Emitting Diodes (LEDs)

IV. Surge Protection Box

- SPBC

    The Surge Protection Box for Coaxial (SPBC) is a small indoor box that protects E1 signals of the BBU3806 from lightning surge.

- SPBT

    The Surge Protection Box for Twisted-pair (SPBT) is a small indoor box. Surge protection units can be separately configured for the SPBT. The SPBT without the surge protection unit can work as the Digital Distribution Frame (DDF) for twisted pair cables. The SPBT with the surge protection unit can work as the surge protection box.

1.2.3 Scenarios for the DBS3800

As shown in Figure 1-1, the three products support the following solutions in different scenarios:

- **Distributed solution**

    The BBU3806 and the RRU3801C are separately installed and connected through electrical or optical cables.

The BBU3806C and the RRU3801C are separately installed and connected through electrical or optical cables.

- **Integrated mini NodeB solution**

The BBU3806C and the RRU3801C are installed in one BTS3803C cabinet. The two units are connected through electrical or optical cables.
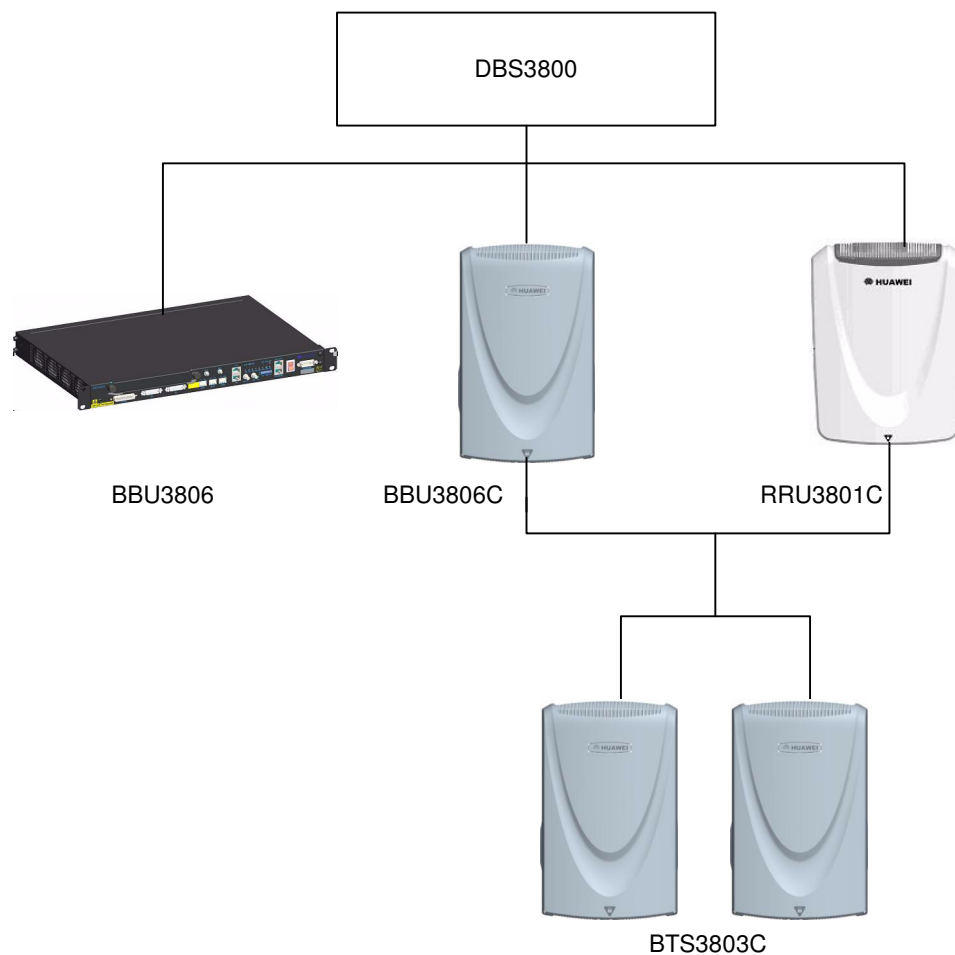
Figure 1-1 DBS3800 family and related solutions

📖 **Note:**

Figure 1-1 takes the 20 W RRU3801C as an example.

Table 1-1 lists the scenarios for the DBS3800 family.

Table 1-1 Scenarios for the DBS3800 family

Model	Qty. of Cells	Capacity	Scenario
BBU3806	3	Medium	• Indoors • In the existing 2G BTS, APM, or AFB
BBU3806C	3	Medium	• Outdoors • On a pole or a wall where the antennas are installed
RRU3801C	2	Small	• Outdoors • Distributed NodeB coverage in cities, roads, and railways
BTS3803C	3	Small	• Outdoors • Coverage in hot spots, marginal networks, and blind spots such as tunnels

The DBS3800 provides various customized solutions for the WCDMA Radio Access Network (W-RAN), depending on your network environments and requirements. This enables you to achieve radio coverage in urban areas, suburban areas, rural areas, expressways, railways, and hot spots.

The DBS3800 family products can be used in the following five scenarios.

I. Scenario 1

Figure 1-2 shows the DBS3800 family products in scenario 1.

Figure 1-2 DBS3800 family products in scenario 1

Table 1-2 describes scenario 1 for the DBS3800 family products.

Table 1-2 Scenario 1 for the DBS3800 family products

Item	Description
Site Requirements	If you have no equipment room, you must meet the following requirements when launching a new 3G site: • The power supply system is available. • The 3G NodeB can be installed outdoors.
Solution	APM + –48 V BBU3806 + –48 V RRU3801C

Item	Description
Benefits	• Depending on the field conditions, the RRU3801C can be mounted on a pole or a wall, or next to the APM. • One APM can accommodate two stacked BBU3806s that work in a baseband resource pool. • The APM has a built-in 220 V AC surge protection module. • The APM with the batteries of different capacities can meet the power backup requirements for the site. • The configuration can be smoothly upgraded from 1 x 1 to 3 x 2. With new plugboards, the 3 x 4 configuration will be supported by RAN 7.0.

II. Scenario 2

Table 1-3 describes scenario 2 for the DBS3800 family products.

Table 1-3 Scenario 2 for the DBS3800 family products

Item	Description
Site Requirements	When launching a new 3G site, you must meet the following requirements: • The power backup system is available. • The power backup system can provide space for the BBU3806.
Solution	–48 V BBU3806 + –48 V RRU3801C
Benefits	• The BBU3806 can be installed in the power backup system. This helps save the site space and the operating costs. The site can be set up relatively quickly. • Depending on the field conditions, the RRU3801C can be mounted on a pole or a wall, or next to the power backup system. • A maximum of two BBU3806s can be stacked for smooth capacity expansion from 1 x 1 to 3 x 2. This can meet the requirements for a high traffic volume in some areas. • With new plugboards, the 3 x 4 configuration will be supported by RAN 7.0.

III. Scenario 3

Figure 1-3 shows the DBS3800 family products in scenario 3.
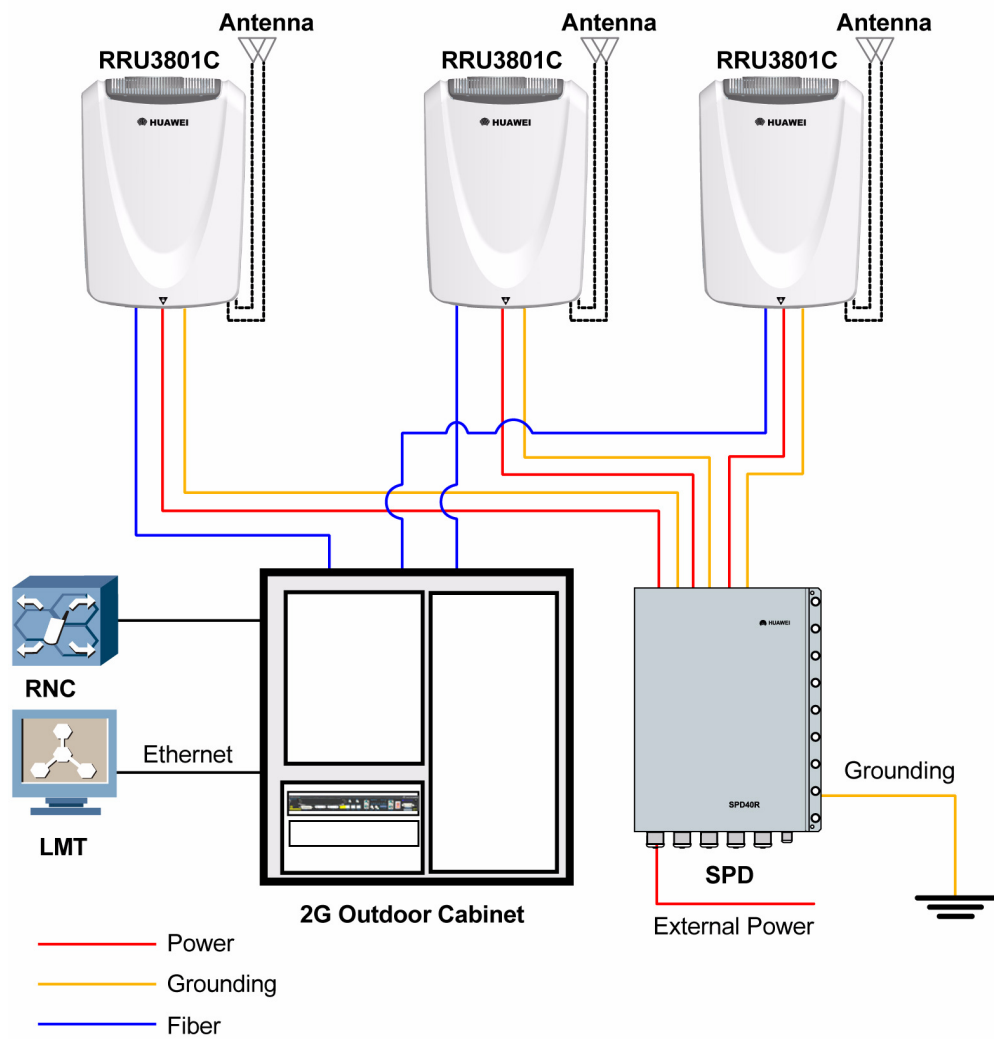
Figure 1-3 DBS3800 family products in scenario 3

Table 1-4 describes scenario 3 for the DBS3800 family products.

Table 1-4 Scenario 3 for the DBS3800 family products

Item	Description
Site Requirements	When launching 3G services on the basis of a 2G site, you must meet the following requirements: ● The 2G BTS is available in the site. ● The 2G BTS has spare space. ● The 3G NodeB does not occupy much space. ● The 3G NodeB shares the antenna system with the 2G BTS.

Item	Description
Solution	BBU3806 + 220 V RRU3801C
Benefits	• Depending on the conditions in the existing equipment room, you can mount the BBU3806 on a wall, or on a cabinet or a transmission device cabin with a 19 inch x 1U space. You can make full use of the existing outdoor 2G macro BTS. This helps facilitate site acquisition and save the rent. • The BBU3806 supports nominal power input and the fractional ATM technology. In this sense, the BBU3806 can share the power backup system and the transport system with the existing 2G BTS. • In one word, this solution helps you to launch 3G services on the basis of the existing 2G network (for example, shared antenna system) at a relatively low cost.

IV. Scenario 4

Figure 1-4 shows the DBS3800 family products in scenario 4.
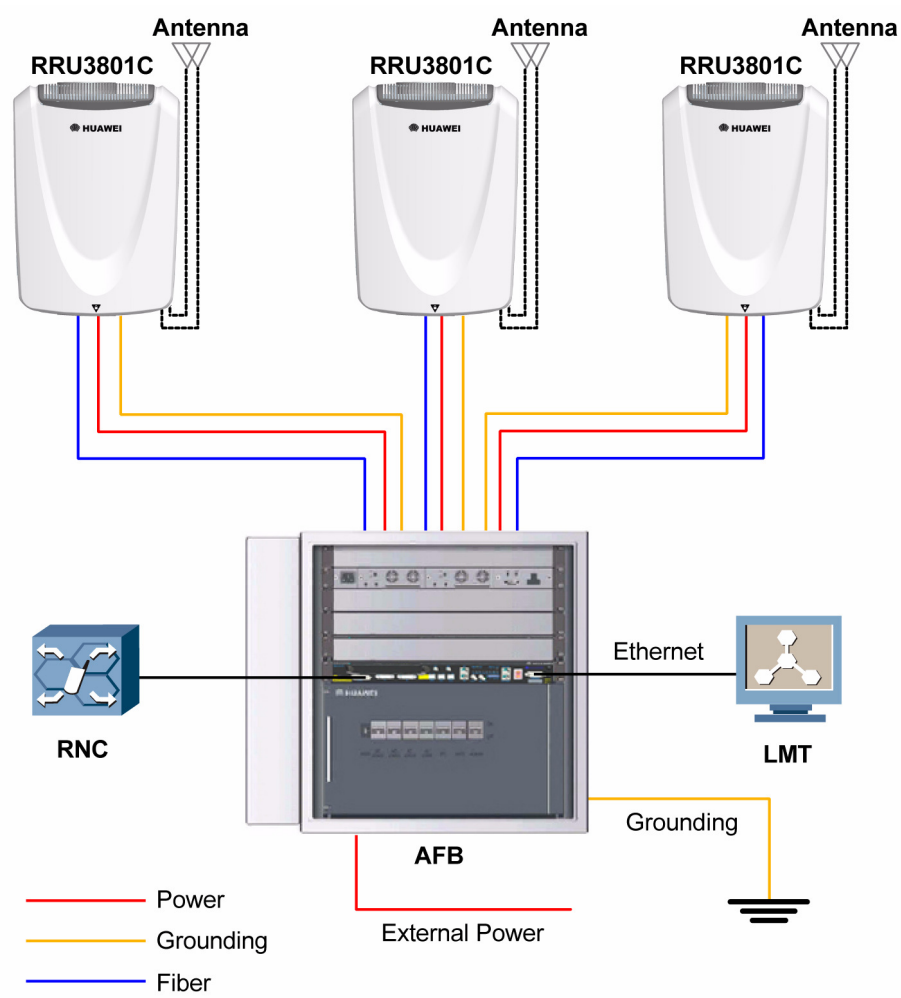
Figure 1-4 DBS3800 family products in scenario 4

Table 1-5 describes scenario 4 for the DBS3800 family products.

Table 1-5 Scenario 4 for the DBS3800 family products

Item	Description
Site Requirements	When launching a new outdoor 3G site, you must meet the following requirements: • The equipment room is available. • The power backup is not required. • The 3G NodeB can be installed outdoors.
Solution	AFB + –48 V BBU3806 + 220 V RRU3801C

Benefits	• The BBU3806 or the transmission device is placed in the AFB, which facilitates site acquisition and saves the rent.
	• With an internal AC/DC rectifier and a power distribution unit, the AFB can supply power to the BBU3806, the RRU3801C, and the transmission device.
	• One AFB can accommodate two stacked BBU3806s that work in a baseband resource pool.
	• The configuration can be smoothly upgraded from 1 x 1 to 3 x 2.
	• With new plugboards, the 3 x 4 configuration will be supported by RAN 7.0.

V. Scenario 5

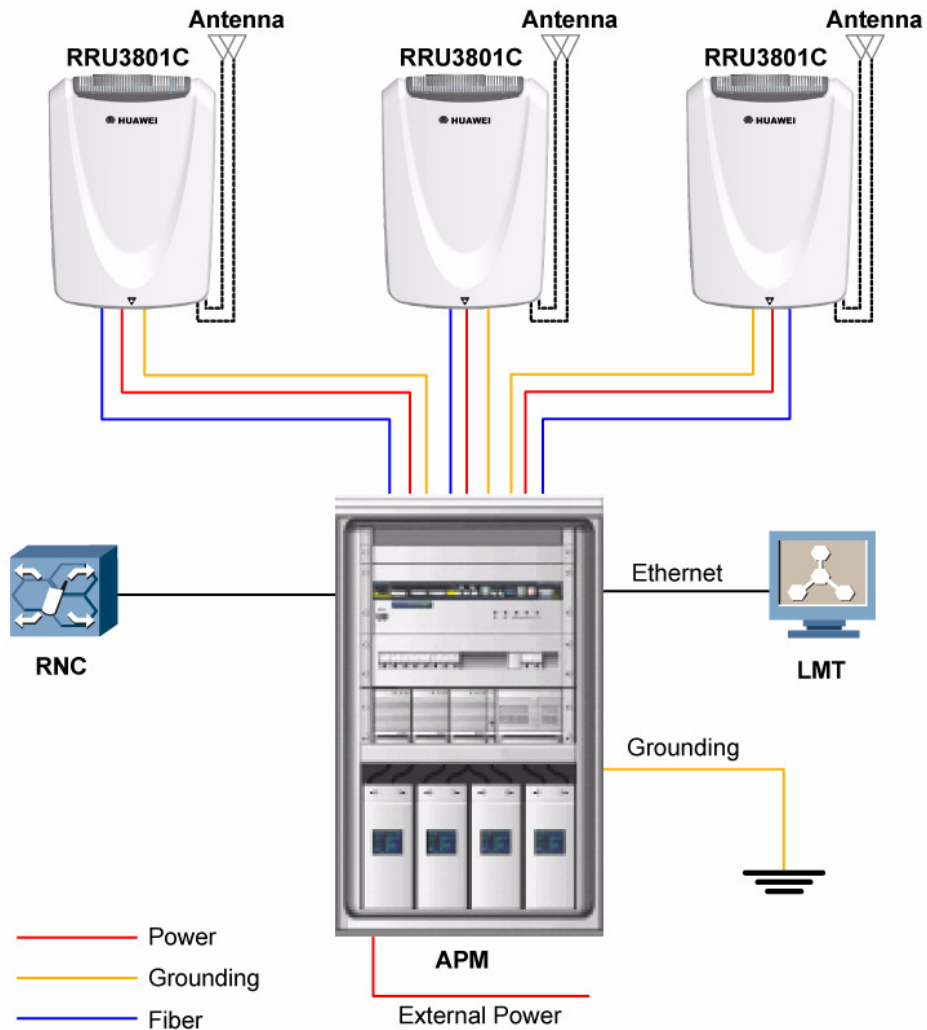Figure 1-5 shows the DBS3800 family products in scenario 5.
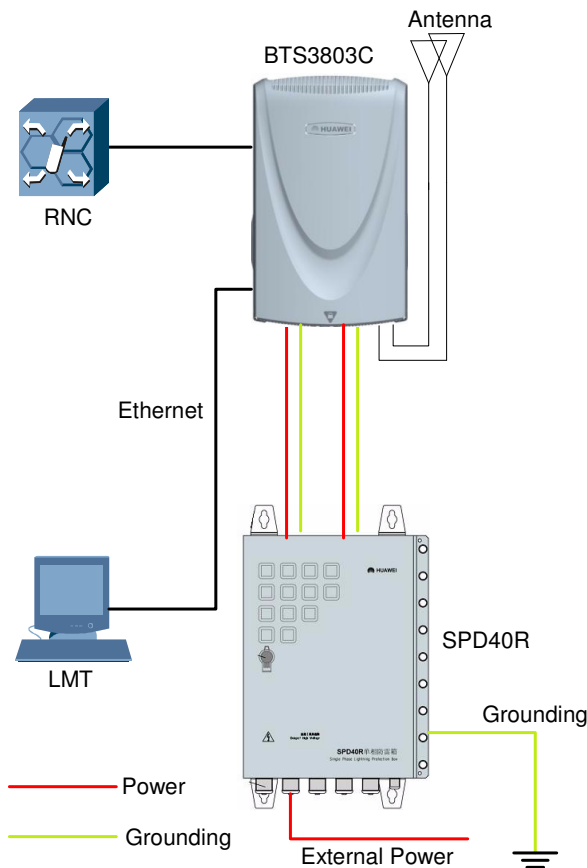
Figure 1-5 DBS3800 family products in scenario 5

Table 1-6 describes scenario 5 for the DBS3800 family products.

Table 1-6 Scenario 5 for the DBS3800 family products

Item	Description
Site Requirements	When launching a new 3G site, you must meet the following requirements: ● The equipment room is available. ● The NodeB is used in an indoor environment, hot spots, marginal networks, and blind spots such as tunnels.
Solution	BTS3803C + SPD40R
Benefits	● The BTS3803C is small, light, and flexible to install. It has a low requirement for floor space and load capacity. ● Depending on the number of required sectors, the BTS3803C enables you to make multiple configurations.

1.3 Benefit Summary of the DBS3800

From the perspective of basic performance, the DBS3800 is equal to a macro NodeB. The DBS3800 can bring a number of benefits to you.

1.3.1 Fast and Economical Network Deployment

The distributed NodeB system completely replaces the networking of traditional BTSs in terms of physical dimensioning and installation modes. A compact design and distributed installation allow you to mount BBUs and RRUs in the available space. You do not have to care much about load capacity or extra installation space.

The negotiation with associated proprietors becomes much less difficult because of the following factors:

● Distributed installation of the BBU and RRU

● Ease in moving the units

● No limitation to floor space or load capacity

● No need for extra site construction

The factors facilitate an economical and speedy network deployment.

1.3.2 Low Operating Costs

You can reduce operating costs because of the following reasons:

● The BBU3806 does not require any equipment room. It can be mounted in a corridor, staircase, or basement. The BBU3806 can also be mounted inside an

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existing device such as outdoor BTS, transmission device, and power supply system. Either case helps to reduce the investment in floor space.

- The BBU3806 enables you to take advantage of the existing site and equipment such as outdoor BTS, rack, and power supply facilities. This helps you to revitalize previous investments and reduce future investments.

- A single BBU3806 can meet the requirements for the baseband processing capability in 3 x 1 full configuration. This greatly reduces costs in small configurations.

- With the Digital Pre-Distortion (DPD) technology, the RRU3801C enhances the efficiency of Power Amplifiers (PAs) and reduces power consumption of the entire NodeB system. The RRU3801C can be mounted close to the antennas to cut the costs incurred in feeders and power consumption.

1.3.3 Simple Upgrade

You can expand system capacity by stacking BBU3806s at the existing site. Depending on the capacity and coverage requirements, you can configure different numbers of BBU3806s and RRU3801Cs.

1.3.4 High Reliability

The DBS3800 is high reliable because of the following reasons:

- When you expand system capacity by stacking BBUs with the same functions, all the BBUs form a distributed system. Any two BBUs support load sharing.

- The two high speed ports on each RRU can connect to two BBUs to form a ring network. This ensures that there are backup channels between the BBU and RRU.

- Each sector allows two RRUs to support transmit diversity, more carriers, and stronger power. The two RRUs in the sector and the BBU can form a ring network. This ensures normal services in the sector when one RRU fails.

Chapter 2 Key Benefits

2.1 About This Chapter

This chapter describes the following key benefits of the DBS3800:

- Capacity
- Coverage
- Multiband Applications
- Networking Capability
- Transmission Interfaces
- Transmission Modes
- Clock and Synchronization
- HSDPA
- HSUPA
- MBMS
- Installation
- Environment Adaptability
- Enhanced Antenna Technologies
- Operation and Maintenance
- Access of High Velocity UEs
- Softer Handover
- Evolution

 Note:

Unless otherwise stated, BBU in the later sections refers to both BBU3806 and BBU3806C.

2.2 Capacity

Table 2-1 describes the capacities supported by different versions of BBU.

Table 2-1 Capacities supported by different versions of BBU.

Version	CEs (Uplink)	CEs (Downlink)	HDSPA Cells	Configuration
V100R008	192	256	3	3 x 1

Version	CEs (Uplink)	CEs (Downlink)	HDSPA Cells	Configuration
V100R009	256	384	6	3 x 2

Note:

- *CE is the abbreviation of channel element.*
- *You can expand the distributed NodeB system capacity by stacking a maximum of two BBU3806s. With new plugboards, the stacked BBU3806s can support the maximal configuration of 3 x 4 or 6 x 2 in no transmit diversity mode.*
- *The baseband processing capability of V100R009 is provided by the BBU with a plugboard.*

2.3 Coverage

The DBS3800 has the following coverage benefits:

- The RRU3801C and the BBU can be connected through the optical cable. The BBU supports cascaded RRU3801Cs of multiple levels. The longest distance of a single-level cascading is 40 km, and that of a multi-level cascading is 100 km.
- The power efficiency of the entire RRU3801C can reach 9.5%. The RRU3801C supports two types of highly efficient PAs: 20 W and 40 W.

  - The efficiency of the 20 W PA can reach 19%.

  - The efficiency of the 40 W PA can reach 33%.

- To enhance the performance in downlink (DL) coverage and capacity, two RRU3801Cs in parallel connections can support open loops in both Space Time Transmit Diversity (STTD) and Time Switched Transmit Diversity (TSTD) modes and closed loops in transmit diversity mode.
- To enhance the performance in the uplink (UL) demodulation and receiver sensitivity, the DBS3800 supports 2-way receive diversity and 4-way receive diversity (two RRUs).
- The 1-way receiver sensitivity is better than –125 dBm.

2.4 Multiband Applications

The DBS3800 supports the following frequency bands to meet your requirements in different regions:

- 850 MHz
- 900 MHz
- 1800 MHz
- 1900 MHz
- 2100 MHz

2.5 Networking Capability

2.5.1 Networking Between the RNC and BBUs

The Radio Network Controller (RNC) and BBUs can support multiple topologies such as star, chain, tree, and ring. The chain and tree topologies support up to five levels of cascading.

Figure 2-1 shows the typical topologies of the RNC and BBUs by taking the BBU3806 as an example.
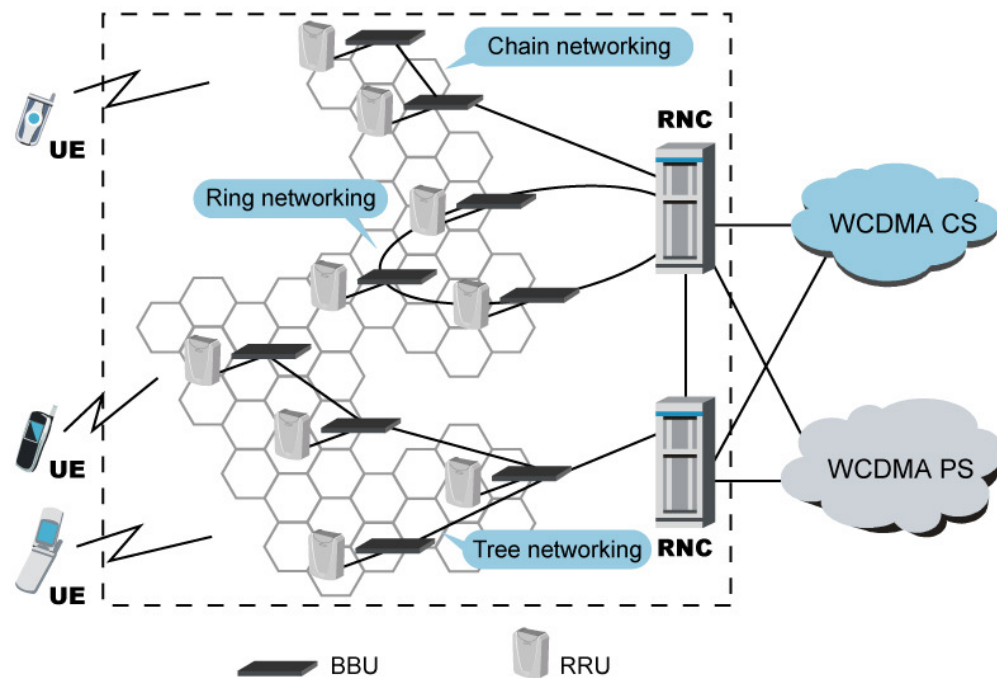
Figure 2-1 Typical topologies of the RNC and BBUs

📖 **Note:**

The BBUs in the ring topology require additional transmission equipment.

2.5.2 Networking Between the BBU and RRU3801Cs

The BBU and RRU3801Cs can support multiple topologies such as star, chain, ring, and hybrid.

When 1.25 Gbit/s optical modules are used, the RRU3801Cs can be cascaded at four levels.

Figure 2-2 shows the typical network topologies of the BBU3806 and its cascaded RRU3801Cs by taking the BBU3806 as an example.
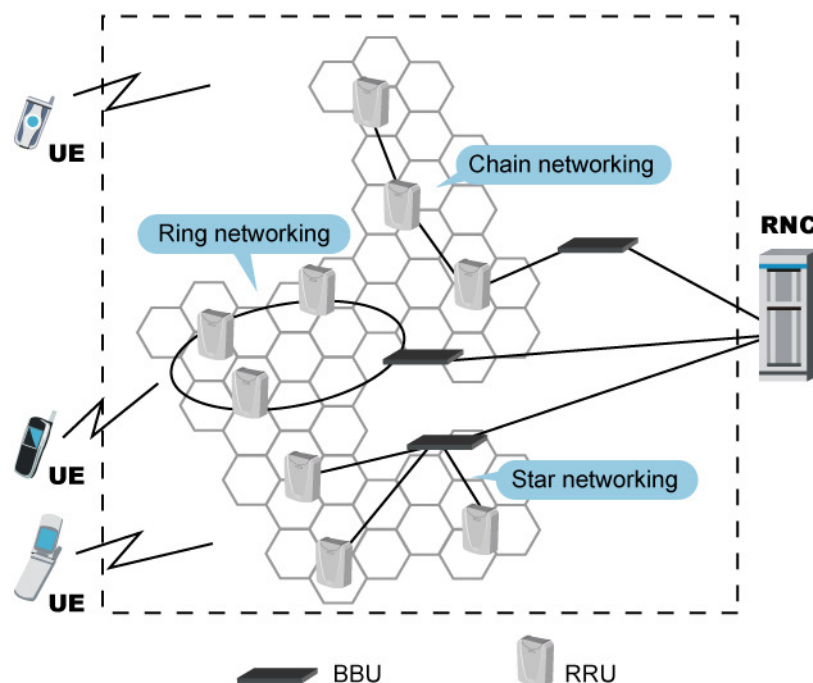
Figure 2-2 Typical topologies of the BBU and RRU3801Cs

📖 **Note:**

- The star topology is mostly applicable to a site with multiple sectors where the BBU stays close to the RRUs. The BBU and RRUs can form a cellular site, for example, a 3-sector one.
- In Figure 2-2, the RRUs that lie in different cellular sites in the star topology only serve as an example. This mode is rarely used.

2.6 Transmission Interfaces

2.6.1 Iub Interface

To connect to the RNC, the BBU supports the following two transmission modes:

- ATM transmission based on E1/T1, channelized STM-1/OC-3, and non-channelized STM-1/OC-3
- IP transmission based on E1/T1 and FE

To connect to the RNC through the STM-1/OC-3 port, the BBU requires an additional transmission plugboard.

2.6.2 Interface from the BBU to the RRU3801C

The BBU provides the standard Common Public Radio Interface (CPRI) ports for connections to the RRU3801C. Each BBU has three CPRI ports, and each RRU3801C has two CPRI ports.

The CPRI interface between the BBU and the RRU3801C supports electrical or optical (for example, 1.25 Gbit/s) connections in different applications. The electrical ports and optical ports use the same socket.

📖 **Note:**

- The CPRI is an industry cooperation aimed at defining publicly available specifications for the open and standard interface between the BBU and the RRU.
- The parties cooperating to define the specifications are Ericsson AB, Huawei Technologies Co. Ltd., NEC Corporation, Nortel Networks SA, and Siemens AG.

2.6.3 Inter-BBU Interface

The MDR (Mini D Ribbon) ports allow baseband data to be shared between BBUs.

Each BBU3806 has two MDR electrical ports: EIa and EIb.

Each BBU3806C has only one EIa port.

2.7 Transmission Modes

2.7.1 ATM

The ATM transmission mode can be based on the following:

- **User Network Interface (UNI)**

  This mode is applicable when your network has poor transmission resources and low traffic.

- **Inverse Multiplexing for ATM (IMA)**

  This mode is applicable when your network has rich transmission resources. It is high reliable and has a fast data rate and low delay.

- **Fractional ATM**

  This mode enables co-transmission between 2G and 3G networks.

2.7.2 IP RAN

The IP RAN transmission mode enables all-IP transmission on the Iub interface. Data services can be transmitted over low rate links. This helps you make full use of the rich IP transmission resources. A new or leased IP network is less expensive than the transmission network.

In the IP RAN transmission mode, the data can be transmitted over the following:

- IPv4
- IP over E1/T1 and IP over FE
- FE/MAC/IP/UDP, E1/PPP/MLMCPPP/PPPMUX, and FE/PPPoE links

The DBS3800 in IP RAN transmission mode supports Differentiated Service (DiffServ) to enhance QoS.

The DBS3800 in IP RAN transmission mode supports hybrid transmission. Services can be transmitted over different links to meet their QoS requirements.

2.8 Clock and Synchronization

The BBU supports the following clock and synchronization modes in different network environments:

- Synchronization with the clock extracted from the Iub interface (default)
- Synchronization with the Global Positioning System (GPS)
- Synchronization with an external clock such as the 2 MHz Building Integrated Timing Supply System (BITS)
- Synchronization with the internal clock

  The DBS3800 has an internal stratum 3 clock source that can keep the NodeB operational for at least 90 days in case of loss of an external clock.

📖 **Note:**

Currently, the BBU3806 rather than the BBU3806C can extract signals from the 2 MHz BITS clock.

2.9 HSDPA

In the DBS3800, a single HSDPA cell supports:

- HSDPA and R99/R4 services supported by the same carrier
- Peak rate of 14.4 Mbit/s (DL) and 384 kbit/s (UL)
- 15 codes per cell and dynamic code resource allocation
- Supporting 12 categories of UE at various rates
- Supporting 64 HSDPA UEs per cell
- Dynamic power allocation

📖 **Note:**

- The High Speed Downlink Packet Access (HSDPA) is a new technology specified by 3GPP R5 to meet the requirement for unsymmetrical UL/DL data services.
- The HSDPA increases the NodeB downlink peak throughput to 14.4 Mbit/s per cell without changing the existing WCDMA network architecture.
- To enhance the downlink capacity and data rate, the HSDPA is usually implemented at a later phase of the WCDMA network construction.

2.10 HSUPA

The HSUPA is a technology that is introduced by 3GPP R6. This technology can enhance the uplink packet processing capability. It involves 2 ms frame, Hybrid Automatic Repeat Request (HARQ), and NodeB scheduling.

The HSUPA can enhance system capacity by 50% to 70% and can reduce the delay of packet services by 20% to 55%. The data rate of a single UE can be enhanced by about 50%.

The DBS3800 has the following HSUPA benefits:

- HSUPA and R99/R4 services supported by the same carrier
- HSUPA phase 1 supported through software upgrade only
- Peak rate of 1.44 Mbit/s (UL) at the application layer and 1.92 Mbit/s on the Uu interface
- 20 UEs per cell
- E-DCH TTI 10 ms (Transmission Time Interval)
- Fast scheduling in the uplink

2.11 MBMS

The Multimedia Broadcast and Multicast Service (MBMS) is a point-to-multipoint technology that is introduced by 3GPP R6. With this technology, the DBS3800 can save resources on the Uu interface in the following ways:

- Sending multimedia broadcast services to the UEs in a cell on common channels
- Sending multicast services subscribed by the UEs in the cell

The DBS3800 has the following MBMS benefits:

- 8 SCCPCHs per cell
- 4 FACHs per SCCPCH
- 31 FACHs per cell

2.12 Installation

The DBS3800 family is easy to install.

2.12.1 BBU3806 Installation

The BBU3806 has the following installation benefits:

- The BBU3806 is a standard small-sized case that is 19 inches wide and 1U high. The BBU3806 is small and light. It has low requirements for floor space, load capacity, and installation costs and complexity. The BBU3806 helps you to reduce operating costs during its entire life cycle and deploy the network relatively quickly and inexpensively.
- The BBU3806 can be installed in any 19-inch indoor cabinet or rack with spare space. No extra space is required.
- The multi-mode site with the BBU3806 and existing 2G equipment allows you to fully utilize the existing space to cut site rent.
- The BBU3806 can be mounted on a wall.

2.12.2 BBU3806C Installation

The BBU3806C has the following installation benefits:

- The BBU3806C and the RRU3801C can be installed in a small cabinet to save space.
- The BBU3806C is used outdoor. No equipment room or air conditioner is required. You can set up a site relatively quickly and inexpensively.
- The BBU3806C with its cables led out from the bottom facilitates cable connections to the RRU3801C.

- The BBU3806C is easy to install or relocate. You man install or pull out the BBU3806C using its front handle.

2.12.3 RRU3801C Installation

The RRU3801C has the following installation benefits:

- The RRU3801C is small and light. It has low requirements for load capacity. You can mount the RRU3801C on a wall. No special tower is required.
- The RRU3801C can be mounted on a pole, wall, or stand, or next to the 2G equipment, depending on field installation.
- The RRU3801C is used outdoor. No equipment room or air conditioner is required. You can set up a site relatively quickly and inexpensively.
- The RRU3801C and the BBU3806C can be installed in a small cabinet to save space.
- Cables are led out from the bottom of the RRU3801C. You can mount multiple RRU3801C modules in one cabinet or install RRU3801Cs in different locations.
- The RRU3801C with its cables led out from the bottom facilitates cable connections to other RRU3801Cs in parallel or distributed connections.
- You can install or pull out a single RRU3801C module or multiple modules in parallel using the front handle.

2.13 Environment Adaptability

The BBU3806C and the RRU3801C are outdoor equipment and have a great adaptability to adverse environments.

- **Compact and totally-enclosed design**
  The BBU3806C and RRU3801C comply with the IP65 (International Protection) standard in terms of protection from water and dust. Both satisfy class 1 standards regarding protection from damp, mould, and salt mist. The compact plastic cabinet prevents them from solar radiation and adverse environments.
- **Wide operating temperature range**
  The BBU3806C and RRU3801C can work in the temperature range –40℃ to +50℃.
- **Wide operating voltage range**
  The BBU3806C and the RRU3801C can work in the voltage range 150 V AC to 300 V AC or–40 V DC to –60 V DC.
- The built-in surge protection module ensures strict protection.
- Huawei can supply a series of outdoor auxiliary devices that can work with the BBU3806C and the RRU3801C. The auxiliary devices include the Auxiliary Facility Box (AFB), Advanced Power Module (APM), Uninterruptible Power Supply (UPS), and outdoor AC surge protection box. These devices can provide a

package of solutions for the BBU3806C and the RRU3801C in terms of power supply, surge protection, transmission, transmission equipment installation, and power backup.

2.14 Enhanced Antenna Technologies

The DBS3800 supports the Antenna Interface Standards Group (AISG) protocols.

 Note:

The AISG is a standardization organization established by several equipment suppliers. It aims to achieve internationally accepted antenna interfacing.

- The AISG protocols specify unified standards for antenna line devices such as Remote Electrical Tilt (RET) and Tower Mounted Amplifier (TMA). These standards apply to layer 1 (physical), layer 2 (link), and layer 7 (application).
- The AISG protocol also defines the specifications for hardware such as connectors and sockets.
- The RRU3801C supplies power to the Smart TMA (STMA) and the RET and controls them through AISG connectors.

The DBS3800 can be configured with the following devices:

- **TMA and STMA**
  Both TMA and STMA can be mounted close to the antennas. The STMA has AISG connectors. The TMA performs the following functions:

  - Amplifying weak signals from the antennas

  - Compensating feeder loss

  - Improving UL receiver sensitivity

  - Improving UL coverage

  - Reducing UE transmit power

  - Reducing interference and noise inside the system

  - Enhancing speech quality

- **RET**
  The RET is used to remotely adjust antenna downtilt to optimize network performance.

3G RET antennas can be cascaded with 2G RET antennas. On the 3G Operation and Maintenance Center (OMC), you can control the downtilt of a 2G RET antenna. The

cascading helps you save costs of Smart Bias-Tees (SBTs) and STMAs when 2G and 3G RET antennas are installed in the same place.

📖 **Note:**

- The RET antenna is installed with a Remote Control Unit (RCU). The RCU is a motor with a built-in CPU.
- On receipt of the commands from the Local Maintenance Terminal (LMT), the RCU adjusts the downtilt to a specified value with its internal driving devices.
- Maintenance and network optimization personnel can monitor the adjustment in real time in the equipment room. This facilitates maintenance and saves costs.

2.15 Operation and Maintenance

The DBS3800 supports the following maintenance modes:

- Local maintenance
- Remote maintenance
- Reverse maintenance

The DBS3800 has the following O&M functions:

- Supporting BOOP Protocol (BOOTP)

  When no data is configured for the DBS3800 or when the DBS3800 is faulty, the IPoA maintenance channel can be automatically set up. This function improves system reliability and the capability in remote fault recovery

- Providing the RRU topology scanning function

  The DBS3800 monitors the RRU topology in real time, which helps to reduce manual intervention.

- Providing OMStar, an enhanced O&M system

  OMStar helps you improve the efficiency in NodeB maintenance and reduce maintenance costs.

The CPRI ports accommodate Enhanced Small Form-Factor Pluggable (ESFP) connectors that support plug-and-play. You can open the cabling cavity and replace a faulty interface module.

The maintenance cavity of the RRU3801C has two labeled buttons that can be used to:

- Measure the Voltage Standing Wave Ratio (VSWR) at the antenna connectors
- Test loops at the CPRI ports

When installing or troubleshooting the RRU3801C, press the buttons to check the status of the antenna connectors and the CPRI ports.

2.16 Access of High Velocity UEs

The DBS3800 allows UEs to move in a cell at the velocity of up to 400 km/h. The UEs can make calls on express trains or magnetic suspension trains.

2.17 Softer Handover

One basic NodeB plus several remotely connected RRU3801Cs can form multiple physical sites. The intra-frequency cells in neighboring sites share the baseband resources of the same BBU. This helps implement softer handover and improve network quality.

2.18 Evolution

The DBS3800 allows smooth capacity expansion.

2.18.1 Capacity Expansion

- The case-shaped BBU3806 facilitates installation during capacity expansion. You can expand system capacity by stacking a maximum of four BBU3806s that are interconnected through high speed electrical ports.

2.18.2 Carrier Expansion

You can expand system capacity in the following ways:

- A single RRU3801C can support two carriers. When upgrading the DBS3800 from 1 x 1 to 1 x 2 or from 3 x 1 to 3 x 2, you do not need to add any RRU3801C.
- If you connect two RRU3801Cs in one sector, the system can support transmit diversity and 4-way receive diversity.
- If you connect two RRU3801Cs in one sector, the system can support three or four carriers.
- The RRU3801C is easy to install because the RRU3801C can support multiple installation modes and the connections between the BBU3806 and the RRU3801C are quite simple.

2.18.3 Smooth Evolution of Protocol Releases

The present DBS3800 is based on 3GPP R4/R5/R6 protocols. It supports smooth evolution to a later 3GPP protocol release.

To support HSUPA phase II functions such as HSUPA 2 ms TTI, you only need to add a transmission plugboard or replace the existing BBU, and then upgrade the software loaded to the DBS3800.

2.18.4 Transmission Interface Extension

The DBS3800 of V100R008 supports the transmission modes over the following interfaces:

- E1/T1
- Non-channelized STM-1/OC-3
- FE

In a later release, the DBS3800 can be added with a transmission plugboard to support other transmission interfaces such as E3/T3.

Chapter 3 System Architecture

3.1 About This Chapter

This chapter describers the following:

- Appearance
- Logical Structure of the BBU
- Logical Structure of the RRU3801C
- Configuration

3.2 Appearance

3.2.1 BBU3806

Figure 3-1 shows the BBU3806.

Figure 3-1 BBU3806

3.2.2 BBU3806C

Figure 3-2 shows the BBU3806C.
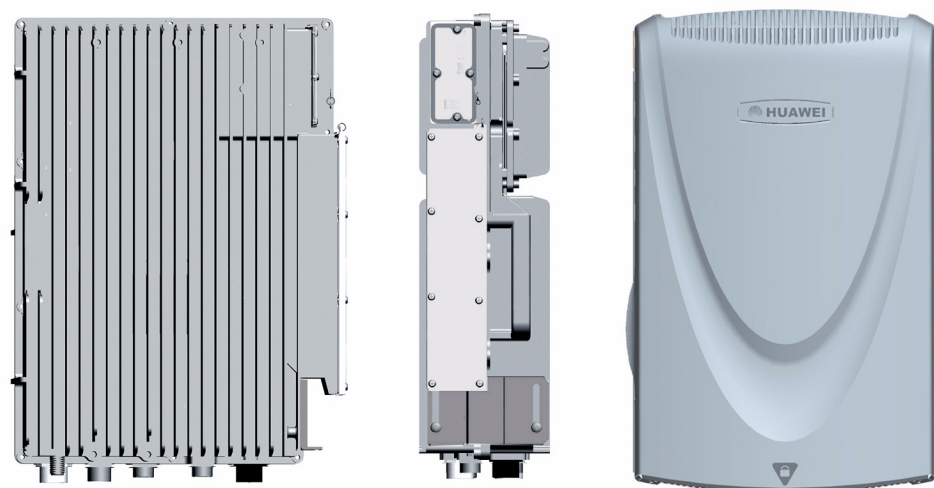
Figure 3-2 BBU3806C

In Figure 3-2, the left part is a side view of the BBU3806C module, the middle part is the front view of the module, and the right part is the front view of the BBU3806C with the housing.

3.2.3 RRU3801C

Figure 3-3 shows the 20 W RRU3801C.
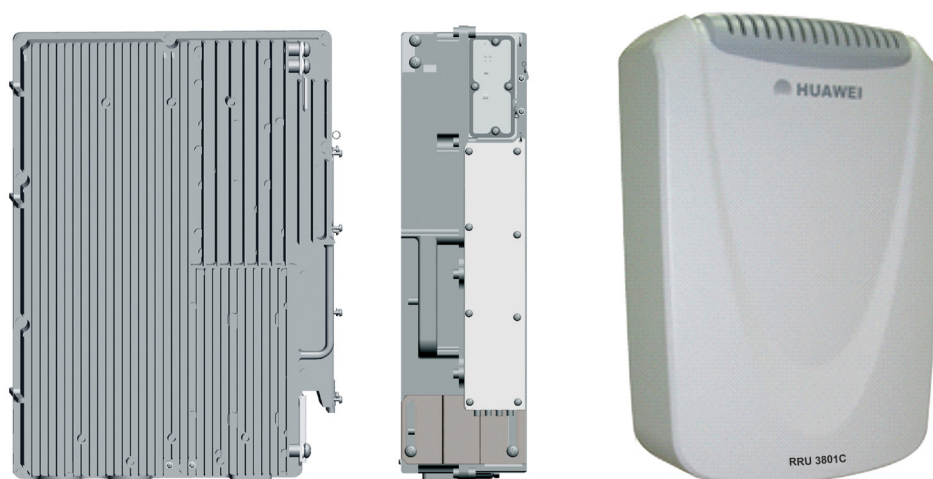
Figure 3-3 20 W RRU3801C (side view on left and front view in middle & on right)

In Figure 3-3, the left part is a side view of the RRU3801C module, the middle part is the front view of the module, and the right part is the front view of the RRU3801C with the housing.

Figure 3-4 shows the 40 W RRU3801C.

Figure 3-4 40 W RRU3801C

In Figure 3-4, the left part is a side view of the RRU3801C module, the middle part is the front view of the module, and the right part is the front view of the RRU3801C with the housing.

3.2.4 BTS3803C

Figure 3-5 shows the BTS3803C.

Figure 3-5 BTS3803C

In Figure 3-5, the BTS3803C contains one BBU3806C and one RRU3801C. The left part shows the front view of the BTS3803C without the housing, and the right part is the front view of the BTS3803C with the housing.

3.3 Logical Structure of the BBU

The BBU3806 and the BBU3806C have a similar logical structure.

3.3.1 Functional Modules

Figure 3-6 shows the functional modules in the BBU.
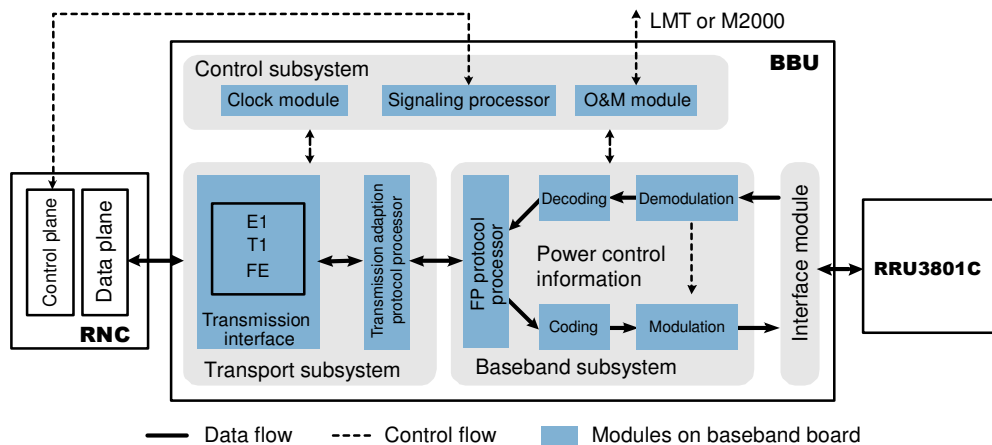
Figure 3-6 Functional modules in the BBU

The BBU consists of the following functional parts:

- Transport subsystem
- Baseband subsystem
- Control subsystem
- Interface modules

In addition, the BBU has internal fans and power modules.

3.3.2 Transport Subsystem

The transport subsystem has the following functions:

- Providing physical interfaces from the BBU to the RNC for data communication
- Providing IPoA maintenance channels between the BBU and the LMT or the M2000 for BBU operation and maintenance

3.3.3 Baseband Subsystem

The baseband subsystem processes both UL and DL baseband signals. The functions of the subsystem are performed by the following modules:

- **UL baseband signal processing module**
  The module consists of the demodulation unit and the decoding unit. Before sending UL baseband signals to the RNC through the transport subsystem, the module processes them as follows:
  - Uplink baseband signals are processed into despreading soft decision symbols after access channel searching, access channel demodulation, and dedicated channel demodulation.
  - The signals are then sent to the RNC through the transport subsystem after decoding and FP processing.
- **DL baseband signal processing module**
  The module consists of the modulation unit and the coding unit. Before sending signals received from the transport subsystem to the optical module, the module process them as follows:
  - The module sends service data received from the transport subsystem to the Frame Protocol (FP) processor.
  - After FP processing, the module processes the signals through transmission channel mapping, physical channel generation, framing, spreading, demodulating, transmit diversity control, and power control combination.
  - The module finally sends the processed signals to the interface module.

3.3.4 Control Subsystem

The control subsystem manages the entire distributed NodeB system. The subsystem performs operation and maintenance, processes various types of signaling, and provides system clocks.

- **O&M module**

  The module has the following functions:

  - Managing the equipment
  - Managing the configuration
  - Managing alarms
  - Managing the software
  - Managing commissioning

- **Signaling processor**

  The processor has the following functions:

  - Processing NodeB Application Part (NBAP) signaling
  - Processing Access Link Control Application Part (ALCAP) signaling
  - Processing Stream Control Transmission Protocol (SCTP) signaling
  - Managing logical resources

- **Clock module**

  The module has the following functions:

  - Providing a phase-locked Iub interface clock, GPS clock, or external clock such as the BITS
  - Generating a synchronization clock for the entire system
  - Providing a system clock required by the NodeB

3.3.5 Interface Module

In accordance with the CPRI protocol:

- Each BBU3806 provides three Enhanced Small Form-Factor Pluggable (ESFP) optical or electrical ports to receive UL baseband data from the RRU3801C and to transmit DL baseband data to the RRU3801C.
- Each BBU3806 provides two Mini D Ribbon (MDR) electrical ports to share synchronization data, baseband data, power control data, and transmission data between the BBUs.
- Each BBU3806C provides three ESFP optical or electrical ports to receive UL baseband data from the RRU3801C and to transmit DL baseband data to the RRU3801C.
- Each BBU3806C provides one MDR electrical port to share synchronization data, baseband data, power control data, and transmission data between two BBUs.

3.4 Logical Structure of the RRU3801C

3.4.1 Functional Modules

Figure 3-7 shows the functional modules in the RRU3801C.
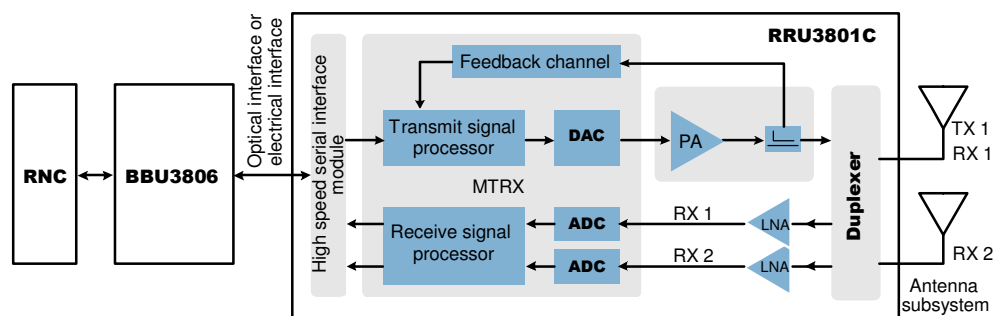
Figure 3-7 Functional modules in the RRU3801C

The RRU3801C consists of the following parts:

- High speed serial interface module
- Multi-Carrier Transceiver (MTRX)
- Power Amplifier (PA)
- Lower Noise Amplifier (LNA)
- Duplexer

3.4.2 High Speed Serial Interface Module

The module has the following functions:

- Receiving downlink baseband data from its upper-level equipment such as BBU or macro NodeB
- Transmitting uplink baseband data to the upper-level equipment
- Transferring the data from a cascaded RRU3801C

3.4.3 MTRX

The MTRX has two receive (RX) channels and one transmit (TX) channel for RF signals.

The receive channel performs the following functions:

- Down-conversion of the received signals to Intermediate Frequency (IF) signals
- Amplification of the IF signals
- Analog-to-digital conversion

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- Digital down-conversion
- Matched filtering
- Digital Automatic Gain Control (DAGC)

The transmit channel performs the following functions:

- Shaping and filtering of downlink spread signals
- Digital-to-analog conversion
- Up-conversion of RF signals to the transmitting band

3.4.4 PA

The PA amplifies small RF signals from the MTRX.

3.4.5 Duplexer

The duplexer has the following functions:

- Multiplexing receive signals and transmit signals

  This enables receive signals and transmit signals to share the same antenna path.

- Filtering both receive signals and transmit signals

3.4.6 LNA

The LNA amplifies the signals received from the antennas.

3.5 Configuration

Table 3-1 lists some recommended configurations of the DBS3800.

Table 3-1 Recommended configurations of the DBS3800

Configuration	Qty. of BBUs	Qty. of RRU3801Cs		Qty. of BTS3803Cs	
		No TX Diversity	TX Diversity	BBU3806C	RRU3801C in No TX Diversity Mode
1 x 1	1	1	2	1	1
1 x 2	1	1	2	1	1
2 x 1	1	2	4	1	2
2 x 2	2	2	4	1	2
3 x 1	1	3	6	1	2
3 x 2	2	3	6	1	2

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Configuration	Qty. of BBUs	Qty. of RRU3801Cs		Qty. of BTS3803Cs	
		No TX Diversity	TX Diversity	BBU3806C	RRU3801C in No TX Diversity Mode
3 x 3	3	6	Not supported	Not supported	
3 x 4	4	6	Not supported	Not supported	
6 x 2	4	6	Not supported	Not supported	
Note: • *N x M = sector x carrier* • *3 x 1 indicates that each of the three sectors has one carrier.*					

In terms of configuration, the DBS3800 has the following features:

- Supporting omni-directional, 2-sector, and 3-sector configurations.
  You may choose different configurations, depending on the locations and the number of UEs.
- Supporting smooth capacity expansion from 1 x 1 to 3 x 2 if RRU3801Cs and BBUs are added.
  In the initial phase of network deployment, you can use some small capacity configurations such as omni-directional and 3 x 1 configurations. With an increase in the number of UEs, you can smoothly upgrade the system to large capacity configurations such as 3 x 2.
- The output power of the RRU3801C can be 20 W or 40 W; thus meeting your different site requirements. No additional RRU3801Cs are required when single-carrier configuration is upgraded to dual-carrier configuration.

Chapter 4 Services and Functions

4.1 About This Chapter

This chapter describes the following:

- Voice and Data Services
- Location Service
- Handover
- Diversity
- License
- RET
- HSDPA
- HSUPA

4.2 Voice and Data Services

The BBU supports Circuit Switched (CS) domain services and Packet Switched (PS) domain services at various rates. It also supports the combination of CS and PS services.

4.2.1 CS Services

The CS services such as Adaptive Multi Rate (AMR) voice service and data service (fax) have relatively high real-time requirements. There are two types of CS service: transparent and non-transparent.

I. AMR Voice Service

The DBS3800 supports the AMR voice service at the following rates:

- 12.2 kbit/s
- 10.2 kbit/s
- 7.95 kbit/s
- 7.4 kbit/s
- 6.7 kbit/s
- 5.9 kbit/s
- 5.15 kbit/s
- 4.75 kbit/s

The uplink and downlink AMR voice rates can be asymmetrical.

II. Transparent Data Service

The DBS3800 supports the transparent data service at the following rates:

- 64 kbit/s
- 56 kbit/s
- 32 kbit/s
- 28.8 kbit/s

The uplink and downlink data rates can be asymmetrical.

III. Non-Transparent Data Service

The DBS3800 supports the non-transparent data service at the following rates:

- 57.6 kbit/s
- 28.8 kbit/s
- 14.4 kbit/s

The uplink and downlink data rates can be asymmetrical.

4.2.2 PS Services

The WCDMA system allows higher data rates than the 2G system. This function gives UEs a high speed access to the Internet and enables the system to support services such as web browsing, data downloading, e-mail, video on demand, and audio on demand.

The DBS3800 supports the PS services at the following rates:

- 16 kbit/s
- 32 kbit/s
- 64 kbit/s
- 128 kbit/s
- 144 kbit/s
- 384 kbit/s

The DBS3800 supports Transmission Time Intervals (TTIs) of 10 ms, 20 ms, 40 ms, and 80 ms. The uplink and downlink data rates can be asymmetrical.

The DBS3800 supports the HSDPA. It can greatly improve the peak data rate in the downlink to 14.4 Mbit/s.

4.2.3 Combined Services

The DBS3800 supports the following combined services:

- AMR voice service + PS service

- AMR voice service + CS non-transparent data service
- AMR voice service + CS transparent data service
- CS transparent data service + PS service
- CS non-transparent data service + PS service

4.3 Location Service

The DBS3800 supports the location services based on Cell ID, Observed Time Difference of Arrival (OTDOA), and Network-Assisted GPS (A-GPS).

4.4 Handover

The DBS3800 supports soft handover, softer handover, and hard handover.

4.4.1 Soft Handover

Soft handover takes place between intra-frequency neighboring cells that belong to different NodeBs.

In the distributed NodeB system, intra-frequency neighboring cells can belong to the same BBU or different BBUs. If two BBUs belong to different RNCs, the two RNCs must be connected on the Iur interface.

4.4.2 Softer Handover

The softer handover, a special type of soft handover, takes place between intra-frequency neighboring cells that belong to the same NodeB.

During the softer handover, the UE establishes radio links with two cells in the NodeB. The NodeB merges the diversity signals that the two cells receive from the UE. Typically, the communication quality during softer handover is better than that during soft handover.

Within the same distributed NodeB system, softer handover takes place when the UE moves from the coverage of one RRU3801C to another at the same frequency.

4.4.3 Hard Handover

During the hard handover, the UE is disconnected from the existing cell. After the UE is connected to a new cell, the hard handover is complete.

The DBS3800 supports the following types of hard handover:

- **Intra-frequency hard handover**
  The handover takes place between intra-frequency cells in the RNCs that are not interconnected on the Iur interface.
- **Inter-frequency handover**
  The handover takes place between cells at different frequencies.
- **Handover between Core Networks (CNs)**
- **Handover between GSM and WCDMA systems**
  The DBS3800 supports seamless handover from GSM to WCDMA and the handover of dual-mode UEs between GSM and WCDMA.

4.5 Diversity

4.5.1 Transmit Diversity

The RRU3801C supports the following transmit diversity modes:

- Space Time Transmit Diversity (STTD)
- Time Switched Transmit Diversity (TSTD)
- Closed loop in transmit diversity modes

Transmit diversity is optional, depending on your requirements.

4.5.2 Receive Diversity

The RRU3801C supports the following receive diversity modes:

- 2-way: basic
- 4-way: optional

4.6 License

Traditionally, you can expand system capacity simply by purchasing more hardware elements, for example, boards. The capacity expansion depends on the number of purchased boards.

A license provides a mechanism for precise capacity control. With the license, you may run a small capacity system with less investment at the initial phase of network deployment.

With the license, you can also acquire enhanced functions and services and provide related value added services. You may choose network functions applicable to a specific phase to protect your investment as much as possible.

The license for the DBS3800 has the following control items:

- Number of uplink CEs

- Number of downlink CEs
- Number of local cells
- Output power
- HSDPA
- HSUPA

With these items, the DBS3800 controls its resources.

4.7 RET

The RET function complies with the AISG1.1 protocols. The DBS3800 supports Remote Electrical Tilt (RET). This function facilitates downtilt adjustment and maximizes the performance in network coverage.

The DBS3800 controls RET in the following two modes:

- AISG_M

  This mode is applicable to the scenario where RRUs are installed close to the antennas. The DBS3800 controls RET through the AISG control cable

- AISG_C

  This mode is applicable to the scenario where RRUs are installed away from the antennas. The RET control signals go into the feeder through the Bias-Tee that couples DC power or On-Off-Keying (OOK) signals to the feeder.

The 40 W RRU3801C has a built-in Bias-Tee and the 20 W RRU3801C has an external Bias-Tee.

4.8 HSDPA

HSDPA is a major feature of 3GPP R5. The theoretical downlink peak data rate on the Uu interface can reach 14.4 Mbit/s.

The HSDPA feature has the following characteristics:

- Employing 2 ms frames on the Uu interface
- Employing adaptive link technologies such as Hybrid Automatic Repeat Request (HARQ) and Adaptive Modulation and Coding (AMC)
- Employing the 16 Quadrature Amplitude Modulation (16QAM) algorithm to improve spectral efficiency
- Supporting flexible scheduling between UEs through code division and time division

4.9 HSUPA

The HSUPA is another major of 3GPP R6. The theoretical uplink peak data rate on the Uu interface can reach 5.76 Mbit/s.

The HSDPA feature has the following characteristics:

- Employing 2 ms frames on the Uu interface
- Employing the HARQ technology

The MAC-e entity is added to the DBS3800 to support fast scheduling in the uplink. New physical channels such as E-DPCCH and E-DPDCH are available for the uplink, and E-AGCH, E-RGCH, and E-HICH channels are available for the downlink.

Chapter 5 Operation and Maintenance

5.1 About This Chapter

This chapter describes the following:

- Operation and Maintenance System
- Operation and Maintenance Functions

5.2 Operation and Maintenance System

The Operation and Maintenance (O&M) system of the DBS3800 provides Graphical User Interfaces (GUIs) and Man Machine Language (MML) commands to support customized man-machine interfaces.

The system provides the following types of management:

- Security management
- Data configuration
- Equipment management
- Software management
- Alarm management
- Test management
- Environment monitoring

Figure 5-1 shows the O&M system of the DBS3800.
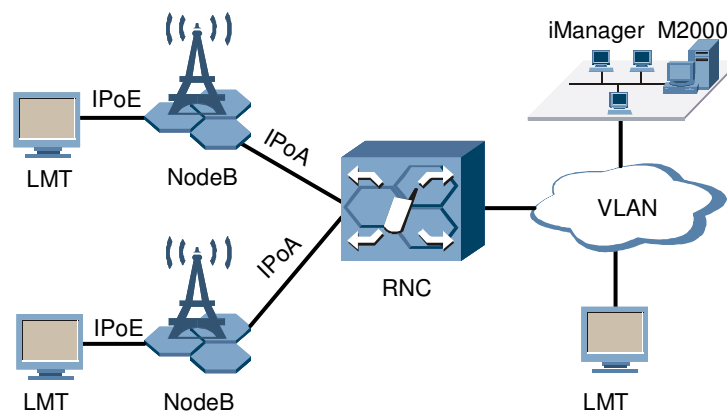
iManager M2000: Huawei Mobile Element Management System
IPoA: IP over ATM
IPoE: IP over Ethernet
LMT: Local Maintenance Terminal
NodeB: UMTS Base Transceiver Station

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RNC: Radio Network Controller
VLAN: Virtual Local Area Network

Figure 5-1 O&M system of the DBS3800 (ATM-based)

The O&M terminals of the DBS3800 include Local Maintenance Terminal (LMT) and the M2000, a centralized network management center.

The DBS3800 supports the following maintenance modes:

- **Remote maintenance**

  Generally, the DBS3800 is unmanned. Maintenance personnel can log in to the system on the M2000 in the network management center, and then perform maintenance over the IP route that the RNC provides. You must provide the access to the Internet or intranet.

- **Local maintenance**

  The maintenance engineer connects the LMT to the NodeB through an Ethernet cable and logs in to the NodeB for maintenance.

- **Reverse maintenance**

  Maintenance personnel can connect to the LMT to the system through an Ethernet cable and log in to the system to perform maintenance.

- **Automatic setup of the default IPoA maintenance channel**

  Generally, after hardware installation, the BBU is loaded only with the software. The data configuration file is not loaded. An IPoA maintenance channel (ATM-based) with default parameters can be automatically set up between the RNC and the DBS3800. This function enables maintenance personnel to download the data configuration file to the BBU at the far end. This function facilitates data and software loading to the BBU and enhances maintainability and maintenance quality.

5.3 Operation and Maintenance Functions

The O&M system of the DBS3800 places great emphasis on your requirements for operation and maintenance and offers powerful functions in this aspect.

5.3.1 Security Management

The DBS3800 provide the powerful security management function to control the operations and the performance of the equipment.

5.3.2 Equipment Management

Equipment management involves equipment maintenance and data configuration.

5.3.3 Data Configuration

The O&M system of the DBS3800 allows the addition, deletion, modification, and consistency check of the NodeB data.

The O&M system supports both static and dynamic data configurations.

- Dynamic data configuration takes effect at once.
- Static data configuration takes effect only after the NodeB resets.

5.3.4 Software Management

Software management covers the following aspects:

- Check on the version compatibility between software and hardware
- Version management
- Software version upgrade

5.3.5 Alarm Management

The Alarm Management System of the DBS3800 can detect and report equipment faults in real time, display alarm information, and give alarm handling suggestions on the LMT or the M2000.

The Alarm Management System of the M2000 can connect to an alarm box through a serial port, and can support both audible and visible alarms. The alarms can be subscribed to and forwarded to the handsets or pagers of maintenance personnel so that the personnel can handle the faults as quickly as possible.

5.3.6 Test Management

Test management covers the following aspects:

- Equipment performance statistics on CPU occupancy, clock source quality, and power detection
- Routine test on E1/T1 performance and STM-1 performance
- Service test on RF performance (141 test), uplink channel scanning and service resource utilization

5.3.7 Environment Monitoring

Typically, the equipment rooms are unmanned and distributed over a vast area. The equipment in such a room works in a relatively adverse environment, and may incur fires, water immersion, or flood.

To handle such emergencies, the DBS3800 can provide customized solutions regarding door control, infrared, smoke, water immersion, humidity, and temperature.

5.3.8 Performance Management

The DBS3800 provides an HSDPA performance management counter that can monitor the operating conditions of the HSDPA cells in the DBS3800.

NodeB performance statistics cover the following two aspects:

- HSDPA cell monitoring

  The status and performance of the HSDPA cells can be monitored regarding the following items:

  - Duration in which HSDPA UEs are camped on the cells
  - Duration in which cell data is accessed by HSDPA UEs
  - Average number of HSDPA RABs
  - Average number of RABs when HSDPA data is accessed
  - HSDPA code resource utilization
  - HARQ distribution statistics
  - CQI distribution statistics
  - Mean HSDPA MAC-hs throughput
  - Mean power of HSDPA
  - Data drop rate due to HSDPA timeout
  - Iub interface measurement at the NodeB

  The following items are measured on the Iub interface at the NodeB:

  - Total bandwidth of AAL2
  - Bandwidth allocated to R99
  - Bandwidth allocated to HSDPA
  - Bandwidth reserved for HSDPA
  - Bandwidth utilized by HSDPA
  - Bandwidth allocation ratio of HSDPA

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Chapter 6 Reliability

6.1 About This Chapter

This chapter describes the following:

- System Reliability
- Hardware Reliability
- Software Reliability

6.2 System Reliability

6.2.1 Reliability of the BBU

Figure 6-1 shows the 1+1 redundancy scheme, in which there are one active BBU3806 and one standby BBU3806.
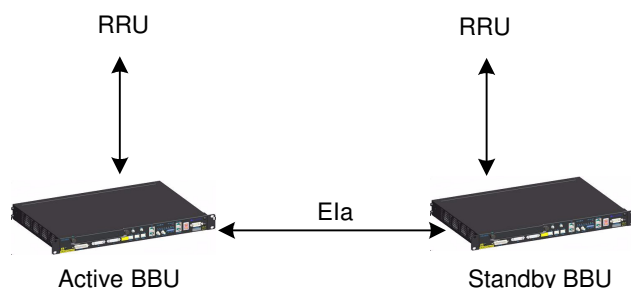
Figure 6-1 1+1 redundancy scheme for BBU3806s

This scheme ensures system reliability because of the following reasons:

- The active BBU3806 and its standby BBU3806 support redundancy. When the active BBU3806 is faulty, the system can switch to the standby BBU3806.
- The active BBU3806, when faulty, only affects its own services rather than the services of the standby BBU3806.

6.2.2 Chain and Ring Topologies

I. Cain Topology

In the chain topology, one RRU3801C can connect to two BBUs, as shown in Figure 6-2. When one CPRI channel is faulty, it does not affect BBU services.
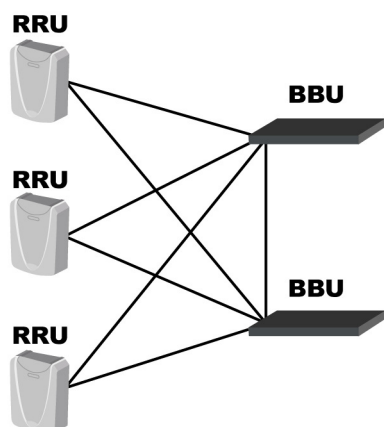
Figure 6-2 Chain topology of BBUs and RRU3801Cs

II. Ring Topology

The BBUs and multiple RRU3801Cs can form a ring network, as shown in Figure 6-3. When a part in the ring is faulty, the part does not affect normal services of the entire distributed NodeB system. This topology enhances system reliability.
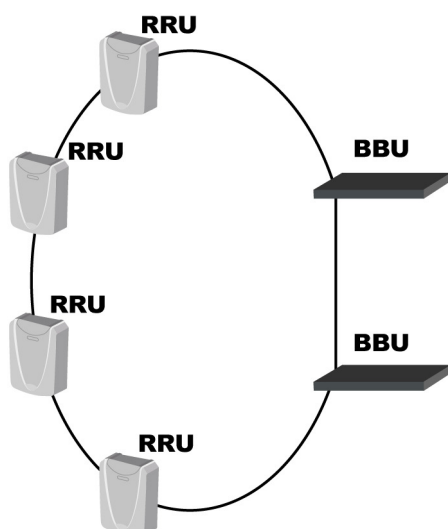
Figure 6-3 Ring topology of BBUs and RRU3801Cs

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📖 **Note:**

Both Figure 6-2 and Figure 6-3 take only the BBU3806 as an example.

6.3 Hardware Reliability

6.3.1 Hardware Reliability of the BBU

The BBU hardware is extremely reliable because of the following features:

- The BBU3806 has built-in and redundant fans. While assuring normal system heat dissipation, the BBU3806 can automatically adjust the fan speed to reduce noise and fan abrasion. This improves the life span and reliability of the heat dissipation system. The BBU3806 supports functions such as fan start, fan shutoff, and fan alarm reporting.
- The redundancy design of the BBU3806 guarantees normal system operations even when any of the fans fails and the temperature is 10°C below the nominal value.
- The BBU3806C works within a wide voltage range, and it has internal primary power supply. For AC power input, the BBU3806C allows the voltage in the range 150 V to 300 V. The BBU3806C is operational even at 350 V; thus preventing damage caused by instable power input.
- The power supply module prevents the BBU from the damage caused by overcurrent.
- The BBU supports overtemperature protection.
- The optical modules of the BBU are hot swappable.
- The BBU allows environment check. It can report related alarms.
- The BBU has a mechanism to prevent misinsertion and reverse insertion.

6.3.2 Hardware Reliability of the RRU3801C

I. Input Power

The RRU3801C works within a wide voltage range, and it has internal primary power supply. For AC power input, the RRU3801C allows the voltage in the range 150 V to 300 V. The RRU3801C is operational even at 350 V; thus preventing damage caused by instable power input.

II. Overtemperature Protection

When the internal temperature of the RRU3801C is too high or too low due to ambient factors, the system automatically enables the auto protection function to reduce power or to shut down power amplifiers, depending on the severity. When the ambient temperature comes back to normal, the system automatically disables this function.

6.4 Software Reliability

The DBS3800 software has a very high error tolerance. The whole system does not break down even if the software fails. This means that the system has the capability of self-healing.

6.4.1 Switchover Between Active and Standby BBUs

To ensure the normal operations of the system when one BBU fails, the DBS3800 allows switchover between the active BBU and the standby BBU.

6.4.2 Baseband Resource Pool

The DBS3800 supports baseband resource pool. This ensures normal operations of the other boards and normal cell services when one board in the baseband resource pool fails.

6.4.3 Transport Data Plane Symmetry on the Iub Interface

The transport data plane of the BBU on the Iub interface allows both symmetry and asymmetry.

- Symmetry means multiple BBUs can provide transmission interfaces at the same time. In this mode, the BBU supports load sharing between different cells.
- Asymmetry indicates that only one BBU can provide transmission interfaces.

6.4.4 Regular Check of Critical Resources

The BBU enables seizure check on various software resources in the system. If a resource failure occurs due to software faults, the check mechanism ensures that the system can immediately release failed resources, export related logs, and report alarms.

6.4.5 Parameter Validity Check

The validity of all LMT/OMC command parameters must be checked by the software. The validity of the data in the data configuration file is checked when the system is started. This ensures normal system operations.

6.4.6 Software Fault Protection

Locally, the NodeB saves two software releases and data releases. If a fault occurs during the software upgrade, the system automatically rolls back to the previous version. This greatly increases the success rate of software downloading and makes remote maintenance more practical.

Chapter 7 Technical Specifications

7.1 About This Chapter

This chapter describes the following:

- Working Frequency Bands
- Transmitter Specifications
- Receiver Sensitivity
- Capacity
- Mechanical Dimensions
- Weight
- Power Supply
- Power Consumption
- Ports
- Surge Protection Specifications for External Ports
- Operating Environment
- Electromagnetic Compatibility
- Acoustic Noise
- Storage
- Transportation
- Anti-Seismic Performance
- Operation

7.2 Working Frequency Bands

Table 7-1 Working frequency bands of the DBS3800

Band	Receiving Band	Transmitting Band
2100 MHz	1920 MHz to 1980 MHz	2110 MHz to 2170 MHz
1900 MHz	1850 MHz to 1910 MHz	1930 MHz to 1990 MHz
1800 MHz	1710 MHz to 1785 MHz	1805 MHz to 1880 MHz
900 MHz	880 MHz to 915 MHz	925 MHz to 960 MHz
850 MHz	824 MHz to 849 MHz	869 MHz to 894 MHz

7.3 Transmitter Specifications

Table 7-2 lists the rated output power per carrier at the TX antenna connector of the DBS3800.

Table 7-2 Output power of a sector with a single RRU3801C

PA Type	Single or Two Carriers	Output Power per Carrier	Configuration
20 W	Single carrier	20 W	1 x 1
	Two carriers	10 W	1 x 2
40 W	Single carrier	40 W	1 x 1
	Two carriers	20 W	1 x 2

7.4 Receiver Sensitivity

Table 7-3 lists the static RF sensitivity at the RX antenna connector of the DBS3800 that handles 12.2 kbit/s traffic.

Table 7-3 Receiver sensitivity

Receive Diversity Mode	Receiver Sensitivity
1-way	−125 dBm
2-way	−127.7 dBm
4-way	−130.5 dBm

7.5 Capacity

Table 7-4, Table 7-5, and Table 7-6 list the capacities of the BBU3806, BBU3806C, and RRU3801C.

Table 7-4 Capacity of the BBU3806

UL/DL	Single BBU3806	Two Stacked BBU3806s
UL	192 CE	384 CE
DL	256 CE	512 CE

Table 7-5 Capacity of the BBU3806C

UL/DL	Single BBU3806C
UL	192 CE
DL	256 CE

Table 7-6 Capacity of the RRU3801C

Item	Value
Max. number of sectors	1
Max. number of carriers	2

7.6 Mechanical Dimensions

Table 7-7 Mechanical dimensions of the DBS3800 family

Model	Width (mm)	Depth (mm)	Height (mm)
BBU3806	436	300	42
20 W RRU3801C with the housing	390	165	565
40 W RRU3801C with the housing	380	200	610
BBU3806C with the housing	380	200	610
BTS3803C with the housing (Single cabinet)	380	430	610

7.7 Weight

Table 7-8 Weight of the DBS3800 family

Model	Max. Weight (kg)
BBU3806	≤ 5
BBU3806C	≤ 15
20 W RRU3801C	≤ 18
40 W RRU3801C	≤ 20
BTS3803C	≤ 35

7.8 Power Supply

7.8.1 Power Supply of the BBU3806

Table 7-9 Power supply of the BBU3806

Parameter		Specification
–48 V DC	Rated voltage	–48 V DC
	Allowed voltage range	–40 V DC to –60 V DC
+24 V DC	Rated voltage	+24 V DC
	Allowed voltage range	+19 V DC to +29 V DC

7.8.2 Power Supply of the BBU3806C and the RRU3801C

Table 7-10 Power supply of the BBU3806C and the RRU3801C

Parameter		Specification
AC power	Rated voltage range	200 V AC to 240 V AC
	Allowed voltage range	150 V AC to 300 V AC/47 Hz to 63 Hz
DC power	Rated voltage range	–48 V DC
	Allowed voltage range	–40 V DC to –60 V DC

7.8.3 Power Supply of the BTS3803C

Table 7-11 Power supply of the BTS3803C

Parameter		Specification
AC power	Rated voltage range	200 V AC to 240 V AC
	Allowed voltage range	150 V AC to 300 V AC/47 Hz to 63 Hz
DC power	Rated voltage	–48 V DC
	Allowed voltage range	–40 V DC to –60 V DC

7.9 Power Consumption

Table 7-12 Power consumption of the DBS3800

Model	PA Type	Max. Power Consumption (W)
BBU3806	–	60 (without the plugboard)
		80 (with the plugboard)
BBU380C	–	100 (without the plugboard)
		120 (with the plugboard)
RRU3801C	20 W	210
	40 W	240
BTS3803C	20 W	730
	40 W	820

7.10 Ports

7.10.1 Transmission Ports on the BBU3806

Table 7-13 Transmission ports on the BBU3806

Application	Port	Quantity	Data Rate	Connector Type
Iub interface	E1	1 (8 E1s)	2 Mbit/s	DB44 male
	T1	1 (8 T1s)	1.5 Mbit/s	DB44 male
	STM-1/OC-3	2	155 Mbit/s	ESFP socket
	FE	2	100 Mbit/s	RJ45
Interface between BBU and RRU	CPRI (optical or electrical)	3	1.25 Gbit/s or 2.5 Gbit/s	ESFP socket
Inter-BBU interface	Ela	1	3 x 2.5 Gbit/s	MDR36
	Elb	1	3 x 2.5 Gbit/s	MDR36

 Note:

- The EIa electrical port connects to the MDR36 connector to achieve high speed interconnection between the active BBU3806 and its standby BBU3806. Signals transmitted through the EIa port include three 2-way high speed electrical signals, clock signals, and switchover signals; thus enabling clock synchronization and active/standby switchover.
- The EIb electrical port connects to the MDR36 connector to achieve high speed interconnection between the active BBU3806 and its standby BBU3806 or between the standby BBU3806 and its extended BBU3806s. Signals transmitted through the EIb port include three 2-way high speed electrical signals and 8 KHz clock signals; thus enabling clock synchronization and active/standby switchover.

7.10.2 External Alarm Ports on the BBU3806

Table 7-14 External alarm ports on the BBU3806

Application	Port	Quantity	Connector Type
External alarms	RS485	1	7W2 male (sharing the socket with the power supply)
	Four dry contacts	1	RJ45 (1)

Table 7-15 Specifications for the external alarm ports on the BBU3806

Parameter		Specification
External alarm input	Open resistance	> 51 kilohms
	Closed resistance	< 0.2 kilohms

7.10.3 Other External Ports on the BBU3806

Table 7-16 Other external ports on the BBU3806

Application	Port	Quantity	Connector Type
Power supply	–48 V DC or +24 V DC power	1	7W2 male
GPS signal input	–	1	SMA female
Clock signal input/output	BITS clock signal input	1	SMA female

Application	Port	Quantity	Connector Type
	10 MHz clock signal output	1	SMB male
Testing	8 kHz Transmission Time Interval (TTI) signal	1	SMB male
Commissioning	Serial or Ethernet	1	RJ45

7.10.4 Transmission Ports on the BBU3806C

Table 7-17 Transmission ports on the BBU3806C

Application	Port	Quantity	Data Rate	Connector Type
Iub interface	E1	1 (8 E1s)	2 Mbit/s	32-pin, round and waterproof
	T1	1 (8 T1s)	1.5 Mbit/s	32-pin, round and waterproof
	STM-1/OC-3	2	155 Mbit/s	4-pin, round and waterproof
	Fast Ethernet	2	100 Mbit/s	8-pin, round and waterproof
Interface between BBU and RRU	CPRI (optical or electrical)	3	1.25 Gbit/s or 2.5 Gbit/s	ESFP socket

7.10.5 External Alarm Port on the BBU3806C

Table 7-18 External alarm port on the BBU3806C

Application	Port	Quantity	Connector Type
External alarms	RS485	1	DB15 waterproof
	Four dry contacts		

Table 7-19 Specifications for the external alarm port on the BBU3806C

Parameter		Specification
External alarm	Open resistance	> 51 kilohms

Parameter		Specification
input	Closed resistance	< 0.2 kilohms

7.10.6 Other External Ports on the BBU3806C

Table 7-20 Other external ports on the BBU3806C

Application	Port	Quantity	Connector Type
Power supply	220 V AC/–48 V DC power	1	9-pin, round and waterproof
E1 grounding selection	Grounding connections for eight coaxial E1s	1	19-pin, round and waterproof
GPS signal input	–	1	N-type
Clock signal input/output	10 MHz clock signal output	1	SMB male
Testing	8 kHz TTI signal	1	SMB male
Commissioning	Serial or Ethernet	1	RJ45

7.10.7 Transmission Ports on the RRU3801C

Table 7-21 Transmission ports on the RRU3801C

Type	Quantity	Data Rate	Connector Type
Optical/electrical	2	1.25 Gbit/s or 2.5 Gbit/s	ESFP socket

7.10.8 External Alarm Port on the RRU3801C

Table 7-22 External alarm port on the RRU3801C

Application	Port	Quantity	Connector Type
Alarms	Four dry contacts	1	DB15 (1)

Table 7-23 Specifications for the external alarm port on the RRU3801C

Parameter		Specification
External alarm input	Open resistance	> 51 kilohms
	Closed resistance	< 0.2 kilohms

7.10.9 Other External Ports on the RRU3801C

Table 7-24 Other external ports on the RRU3801C

Application	Port	Quantity	Connector Type
Power supply	220 V AC/–48 V DC power	1	• 9-pin, round and waterproof for the RRU3801C (DC) • 9-pin, round and waterproof for the RRU3801C (AC)
RET	AISG	1	DB15
RF	Main TX/RX	1	DIN, round and waterproof
	RX diversity	1	DIN, round and waterproof
	Interconnection between the combined cabinets	1	DB2W2
Clock signal input/output	10 MHz clock signal output	1	SMB male
Commissioning	Serial or Ethernet	1	RJ45

📖 **Note:**

The DC power port of the RRU3801C also handles 1-channel RS485 alarms (to the APM). The dry contact alarm cable connects to the SPD, AFB, or UPS. The two are mutually exclusive.

7.10.10 Transmission Ports on the BTS3803C

Table 7-25 Transmission ports on the BTS3803C

Application	Port	Quantity	Data Rate	Connector Type
Iub interface	E1	1 (8 E1s)	2 Mbit/s	32-pin, round and waterproof
	T1	1 (8 T1s)	1.5 Mbit/s	32-pin, round and waterproof
	STM-1/OC-3	2	155 Mbit/s	4-pin, round and waterproof
	Fast Ethernet	2	100 Mbit/s	8-pin, round and waterproof

7.10.11 External Alarm Ports on the BTS3803C

Table 7-26 External alarm ports on the BTS3803C

Application	Port	Quantity	Connector Type
External alarms	Four dry contacts (BBU3806C)	1	DB15 waterproof
	Four dry contacts (RRU3801C)	1	DB15 waterproof

7.10.12 Other External Ports on the BTS3803C

Table 7-27 Other external ports on the BTS3803C

Application	Port	Quantity	Connector Type
Power supply	220 V AC/–48 V DC power	1 x 2	• 9-pin, round and waterproof (for BBU3806C) • 9-pin, round and waterproof (for RRU3801C) ***Note:*** *The BBU3806C or the RRU3801C has only one power supply port.*
RF	Main TX/RX	1	DIN, round and waterproof
	RX diversity	1	DIN, round and waterproof

Application	Port	Quantity	Connector Type
	Interconnection between combined cabinets	1	DB2W2
GPS signal input	–	1	N-type
Commissioning	Serial or Ethernet	1 x 2	RJ45 **Note:** *The BBU3806C or RRU3801C has only one commissioning port.*
Clock signal input/output	10 MHz clock signal output	1 x 2	SMB male **Note:** *The BBU3806C or the RRU3801C has only one 10 MHz clock signal output port.*
Testing	8 kHz TTI signal	1	SMB male
RET antenna	AISG	1	DB15

For more details about the external ports on the BTS3803C, refer to section 7.10.8 "External Alarm Port on the RRU3801C."

7.11 Surge Protection Specifications for External Ports

📖 **Note:**

- The surge protection specifications are based on the surge waveform of 8/20 µs.
- Unless otherwise specified, the surge current refers to a nominal discharge current.

7.11.1 Surge Protection Specifications for the BBU3806

Table 7-28 Surge protection specifications for the external ports on the BBU3806

Application	Surge Protection Mode	Surge Current
Power supply	Differential mode	2 kA
	Common mode	4 kA
E1	Differential mode	250 A
	Common mode	250 A

Application	Surge Protection Mode	Surge Current
	Differential mode (SPBC)	3 kA
	Common mode (SPBC)	5 kA
	Differential mode (SPBT)	5 kA
	Common mode (SPBT)	8 kA
GPS signal input	Differential mode (GPS arrester)	8 kA
	Common mode (GPS arrester)	20 kA
Dry contact alarms	Differential mode	250 A
	Common mode	

7.11.2 Surge Protection Specifications for the BBU3806C

Table 7-29 Surge protection specifications for the external ports on the BBU3806C

Application	Surge Protection Mode	Surge Current
–48 V DC power supply	Differential mode	10 kA
	Common mode	15 kA
220 V AC power supply	Differential mode	5 kA
	Common mode	
E1	Differential mode	3 kA
	Common mode	5 kA
GPS signal input	Differential mode (GPS arrester)	8 kA
	Common mode (GPS arrester)	20 kA
Dry contact alarms	Differential mode	250 A
	Common mode	

7.11.3 Surge Protection Specifications for the RRU3801C

Table 7-30 Surge protection specifications for the external ports on the RRU3801C

Application	Surge Protection Mode	Surge Current
–48 V DC power supply	Differential mode	10 kA
	Common mode	15 kA
220 V AC power	Differential mode	5 kA

Application	Surge Protection Mode	Surge Current
supply	Common mode	
	Differential mode (external surge protector)	60 kA (maximum discharge current)
	Common mode (external surge protector)	
RF	Differential mode	8 kA
	Common mode	20 kA
Dry contact alarms	Differential mode	250 A
	Common mode	
RET	Differential mode	3 kA
	Common mode	5 kA

7.12 Operating Environment

7.12.1 Operating Environment of the BBU3806

Table 7-31 Operating environment of the BBU3806

Parameter	Specification
Temperature	−5°C to +55°C
Relative humidity	5% to 95%

7.12.2 Operating Environment of BTS3803C, RRU3801C, and BBU3806C

Table 7-32 Operating environment of BTS3803C, RRU3801C, and BBU3806C

Parameter	Specification
Temperature	• −40°C to +50°C (without solar radiation) • −40°C to 45°C (with solar radiation) • Cold start at −33°C ***Note:*** *All counters turn to normal after half an hour.*
Relative humidity	5% to 100%
Absolute humidity	1 g/m^3 to 30 g/m^3

Parameter	Specification
Air pressure	70 KPa to 106 KPa

7.13 Electromagnetic Compatibility

The DBS3800 meets the electromagnetic compatibility (EMC) requirements in compliance with the following standards:

- R&TTE Directive 99/5/EC
- 3GPP TS 25.113 V4.4.0 (2002-12)
- ETSI EN 301 489-1 V1.2.1 (2000-08)
- ETSI EN 301 908-1 V2.2.1 (2003-10)

7.14 Acoustic Noise

The Sound Power Level (SPL) of acoustic noise generated by the BBU3806 is lower than 61 dBA as stipulated in ETS300 753.

There is no fan in the RRU3801C, BBU3806C, or BTS3803C. So there is no acoustic noise.

7.15 Storage

The DBS3800 complies with the following standard:

- ETSI EN 300 019-1-1 V2.1.4 (2003-04) Class 1.2: "Weatherprotected, not temperature-controlled storage locations"

7.16 Transportation

The DBS3800 complies with the following standard:

- ETSI EN 300019-1-2 V2.1.4 (2003-04) Class 2.3: "Public transportation"

7.17 Anti-Seismic Performance

The BBU3806 complies with the IEC 60068-2-57 (1999-11) standard.

The BBU3806C, RRU3801C, and BTS3803C comply with the NEBS GR63 zone4 standard.

7.18 Operation

The BBU3806 complies with the following standard:

- ETSI EN 300019-1-3 V2.2.2 (2004-07) Class 3.1: "Temperature-controlled locations"

The RRU3801C and the BTS3803C comply with the following standards:

- 3G TS25.141 V3.0.0
- ETSI EN 300019-1-4 V2.1.2 (2003-04) Class 4.1: "Non-weatherprotected locations"

Chapter 8 Installation

At factory, all the BBU software and hardware are debugged and the RRU3801C is installed. Field installation personnel only need to secure the BBU and connect the external cables. After the data configuration file is downloaded either from the far end or the near end, the NodeB can start to operate.

You do not have to care much about the load capacity and extra installation space that is getting more valuable. Just mount the BBU3806 in any spare place of an indoor 19-inch cabinet or rack, outdoor 2G macro BTS, AFB, and APM. The BBU3806 can also be mounted on the wall.

The RRU3801C is small and light. It can be mounted on a prefabricated concrete pole, staying tower, or a wall. You can install the RRU3801C and the BBU3806C in the BTS3803C. The RRU3801C can work with mains supply. No special tower, equipment room, or air conditioner is required. Therefore, the RRU3801C can be mounted quickly and inexpensively. The labeled ports for external cables on the RRU3801C and BTS3803C are at the1 cabinet bottom, which facilitates cable connections.

Huawei provides all necessary auxiliary devices for the DBS3800 such as AFB, outdoor SPD, UPS, and APM. The package of RRU solutions covers the following fields:

- Power distribution
- Surge protection
- Transmission cables
- Transmission equipment
- Backup power

The BBU supports the automatic setup of a default IPoA maintenance channel. This function helps you decrease operation and maintenance costs and enhances maintainability and maintenance quality.

The software and hardware of the DBS3800 can be installed easily and quickly. You can quickly set up a network and provide services.

Chapter 9 Environment Requirements

9.1 About This Appendix

This appendix describes the optimal environment requirements for the DBS3800. It consists of the following sections:

- Storage Environment
- Transportation Environment
- Operating Environment

 📖 **Note:**

The RRU3801C is used outdoors. The BBUs are of two types: indoor and outdoor. The environmental conditions for the DBS3800 comply with the specifications stated in the following:

- NEBS GR-63-CORE ISSUE 2
- ETSI EN 300 019-1: Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment

The specifications are based on the following standards:

- GB4798 electrical and electronic product environmental conditions
- ETS 300019 Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment
- IEC 60721 Classification of environmental conditions
- GR-63-core

9.2 Storage Environment

This section describes the optimal storage environment for the DBS3800, and focuses on the climate, waterproof, biological, air purity, and mechanical stress requirements of the equipment during storage.

9.2.1 Climate Requirements

The storage environment of NodeB should meet the climate requirements listed in Table 9-1.

Table 9-1 Requirements for equipment storage

Item	Range
Altitude	≤ 5000 m
Air pressure	70 kPa to 106 kPa
Temperature:	−40°C to +70°C
Temperature change rate	≤ 1°C/min
Relative humidity	10% to 100%
Solar radiation	≤ 1120 W/s²
Thermal radiation	≤ 600 W/s²
Wind speed	≤ 30 m/s

9.2.2 Waterproof Requirements

The indoor storage environment should meet the following waterproof requirements:

- There is no water on the ground.
- The DBS3800 is stored far away from fire suppression devices, radiators, or other heating facilities, which prevents water from leaking into the package.

If you have to place the BTS3812E outdoors, ensure that:

- The package is intact.
- Waterproof measures are applied to prevent rain from entering the package.
- There is no water on the ground or no water may enter the package.
- The package is not exposed to direct sunlight.

9.2.3 Biological Requirements

The storage environment of the DBS3800 should meet the following biological requirements:

- No fungus or mildew may grow.
- There are no rodent animals such as rats.

9.2.4 Air Cleanness Requirements

The storage environment of the DBS3800 should meet the following air purity requirements:

- There is no explosive, conductive, magneto-conductive or corrosive dust in the air.
- The density of mechanically active materials complies with the requirements listed in Table 9-2.

Table 9-2 Requirements for physically active materials

Physically Active Material	Unit	Density
Suspended dust	mg/m³	≤ 5.00
Falling dust	mg/m²h	≤ 20.0
Sand	mg/m³	≤ 300
Note:		
Suspended dust: diameter $\leq 75~\mu m$		
Falling dust: $75~\mu m \leq diameter \leq 150~\mu m$		
Sand: $150~\mu m \leq diameter \leq 1000~\mu m$		

- The density of chemically active materials must comply with the requirements listed in Table 9-3.

Table 9-3 Requirements chemically active materials

Chemically Active Material	Unit	Density
SO_2	mg/m³	≤ 0.30
H_2S	mg/m³	≤ 0.10
NO_2	mg/m³	≤ 0.50
NH_3	mg/m³	≤ 1.00
Cl_2	mg/m³	≤ 0.10
HCl	mg/m³	≤ 0.10
HF	mg/m³	≤ 0.01
O_3	mg/m³	≤ 0.05

9.2.5 Mechanical Stress Requirements

The storage environment of the DBS3800 should meet the mechanical stress requirements listed in Table 9-4.

Table 9-4 Requirements for storage environment

Item	Subitem	Range	
Sinusoidal vibration	Offset	≤ 7.0 mm	–
	Accelerated speed	–	≤ 20.0 m/s²
	Frequency range	2 Hz to 9 Hz	9Hz to 200 Hz

Item	Subitem	Range
Unsteady impact	Impact response spectrum II	≤ 250 m/s²
	Static payload	≤ 5 kPa

Note:

- *Impact response spectrum*

  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*

  The capability of the equipment in package to bear the pressure from the top in normal pile-up method.

9.3 Transportation Environment

The section describes the optimal transportation environment for the DBS3800. It focuses on the climate, waterproof, biological, air purity, and mechanical stress requirements of the equipment during transportation.

9.3.1 Climate Requirements

The transportation environment of the DBS3800 should meet the climate requirements listed in Table 9-5.

Table 9-5 Requirements for equipment transportation

Item	Range
Altitude	≤ 5000 m
Air pressure	70 kPa to 106 kPa
Temperature:	−40°C to +70°C
Temperature change rate	≤ 3°C/min
Relative humidity	5% to 100%
Solar radiation	≤ 1120 W/s²
Thermal radiation	≤ 600 W/s²
Wind speed	≤ 30 m/s

9.3.2 Waterproof Requirements

The transportation environment of the DBS3800 should meet the following waterproof requirements:

- The package is intact.
- Waterproof measures are applied to prevent rain from entering the package.
- There is no water on the transportation vehicle.

9.3.3 Biological Requirements

The transportation environment of the DBS3800 should meet the following biological requirements:

- No fungus or mildew may grow.
- There are no rodent animals such as rats.

9.3.4 Air Cleanness Requirements

The transportation environment of the DBS3800 should meet the following air purity requirements:

- There is no explosive, conductive, magneto-conductive or corrosive dust in the air.
- The density of mechanically active materials complies with the requirements listed in Table 9-6.

Table 9-6 Requirements for physically active materials

Physically active material	Unit	Density
Suspended dust	mg/m³	No requirement
Falling dust	mg/m²·h	≤ 3.0
Sand	mg/m³	≤ 100
Note: *Suspended dust: diameter ≤ 75 µm* *Falling dust: 75 µm ≤ diameter ≤ 150 µm* *Sand: 150 µm ≤ diameter ≤ 1000 µm*		

- The density of chemically active materials complies with the requirements listed in Table 9-7.

Table 9-7 Requirements for chemically active materials

Chemically Active Material	Unit	Density
SO_2	mg/m³	≤ 0.30

Chemically Active Material	Unit	Density
H_2S	mg/m³	≤ 0.10
NO_2	mg/m³	≤ 0.50
NH_3	mg/m³	≤ 1.00
Cl_2	mg/m³	≤ 0.10
HCl	mg/m³	≤ 0.10
HF	mg/m³	≤ 0.01
O_3	mg/m³	≤ 0.05

9.3.5 Mechanical Stress Requirements

The transportation environment of NodeB should meet the mechanical stress requirements listed in Table 9-8.

Table 9-8 Requirements for transportation

Item	Subitem	Range		
Sinusoidal vibration	Offset	≤ 7.5 mm	–	–
	Accelerated speed	–	≤ 20.0 m/s²	≤ 40.0 m/s²
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz	200 Hz to 500 Hz
Random vibration	Spectrum density of accelerated speed	1 m²/s³	–3dB	Total accelerated speed: 0.781Grms
	Frequency range	5 Hz to 20 Hz	20 Hz to 200 Hz	
Unsteady impact	Impact response spectrum II	≤ 300 m/s²		
	Static payload	≤ 10 kPa		
Fall	Fall	Weight (kg)	Height (m)	
		< 15	1.0	
		< 20	0.8	
		< 30	0.6	
		< 40	0.5	
		< 50	0.4	

Item	Subitem	Range	
		< 100	0.3
		> 100	0.1
Fall (GR63)	Unpackage fall	Weight (kg)	Height (m)
		0–10 kg	100 mm
		10–25 kg	75 mm
		25–50 kg	50 mm
		> 50 kg	25 mm

Note:

- *Impact response spectrum*

  The maximum acceleration response curve generated by the equipment under the specified impact excitation. Impact response spectrum II refers to the semi sinusoidal impact response spectrum whose duration is 6 ms.

- *Static payload*

  The capability of the equipment in package to bear the pressure from the top in normal pile-up method.

9.4 Operating Environment

This section describes the optimal operating environment for the DBS3800. It focuses on the climate, waterproof, biological, air purity, and mechanical stress requirements of the equipment during operation.

9.4.1 Climate Requirements

The operating environment of the DBS3800 should meet the climate requirements listed in Table 9-9.

Table 9-9 Requirements for climax factors

Item	Range
Altitude	≤ 4000 m
Air pressure	70 kPa to 106 kPa
Temperature	−40°C to +55°C −5°C to +55°C (indoor)
Temperature change rate	≤ 3°C/min
Relative humidity	15% to 95%

Item	Range
Solar radiation	$\leq$ 11200 W/m² (outdoor) $\leq$ 700 W/m² (indoor)
Thermal radiation	$\leq$ 600 W/m²
Wind speed	$\leq$ 67 m/s
Acoustic noise	Indoor: Sound pressure level: $\leq$ 60 dBA Sound power < 7.2 bel Outdoor: Sound pressure level: $\leq$ 65 dBA Sound power: $\leq$ 6.1 bel (day); $\leq$ 5.6 bel (night)
Protection from dust and water	Indoor: IP20 Outdoor: IP55

9.4.2 Biological Requirements

The operating environment of the DBS3800 should meet the following biological requirements listed below.

- No fungus or mildew may grow.
- There are no rodent animals such as rats.

9.4.3 Air Cleanness Requirements

The operating environment of the DBS3800 should meet the following air purity requirements:

- There is no explosive, conductive, magneto-conductive or corrosive dust in the air.
- The density of mechanically active materials complies with the requirements listed in Table 9-10.

Table 9-10 Requirements for physically active materials

Physically Active Material	Unit	Density
Suspended dust	mg/m³	$\leq$ 0.01
Falling dust	mg/m²h	$\leq$ 10
Sand	mg/m³	No obvious sand

Physically Active Material	Unit	Density
Note: *Suspended dust: diameter $\leq$ 75 μm* *Falling dust: 75 $\mu m \leq$ diameter $\leq$ 150 μm* *Sand: 150 $\mu m \leq$ diameter $\leq$ 1000 μm*		

- The density of chemically active maerials complies with the requirements listed in Table 9-11.

Table 9-11 Requirements for chemically active materials

Chemically Active Material	Unit	Density
SO_2	mg/m³	≤ 1.5
H_2S	mg/m³	≤ 0.03
NH_3	mg/m³	≤ 0.15
Cl_2	mg/m³	≤ 0.3

9.4.4 Mechanical Stress Requirements

Table 9-12 lists the mechanical stress that the equipment can endure during operation.

Table 9-12 Requirements during equipment operation

Item	Subitem	Range	
Sinusoidal vibration	Offset	$\leq$ 3.5 mm	–
	Accelerated speed	–	$\leq$ 10.0 m/s²
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz
Sinusoidal vibration (GR63)	Frequency range: 5–100 Hz Accelerated speed: 1.0 g Sweeping frequency: 0.25 oct/min A triaxial test is conducted.		
Unsteady impact	Impact response spectrum II	$\leq$ 100 m/s²	
	Static payload	0	
Protection from quake	Quake	Frequency range: 0.3 Hz to 50 Hz ZPA (m/s2): 1.5 g 30s	

Item	Subitem	Range

Note:

- *Impact response spectrum*

  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*

  The capability of the equipment in package to bear the pressure from the top in normal pile-up method.

Chapter 10 Acronyms and Abbreviations

3

3GPP   3rd Generation Partnership Project

A

AC   Alternating Current

A-GPS   Network-Assisted GPS

AISG   Antenna Interface Standard Group

ALCAP   Access Link Control Application Part

AMR   Adaptive Multi-Rate

ANSI   American National Standard Institute

APM   Advanced Power Module

ATM   Asynchronous Transfer Mode

B

BBU   Baseband Unit

BITS   Building Integrated Timing Supply System

C

CE   Channel Element

CES   Circuit Emulation Service

CMB   Cell Multimedia Broadcast

CN   Core Network

CPRI   Common Public Radio Interface

CPU   Center Processing Unit

CS   Circuit Service

D

DAGC   Digit Automatic Gain Control

DC   Direct Current

DPD   Digital Pre-Distortion

DSP   Digital Signal Processor

E

EMC   Electromagnetic Compatibility

ETS   European Telecommunication Standards

ETSI	European Telecommunications Standards Institute

F

FACH	Forward Access Channel
FE	Fast Ethernet
Flash	Flash memory

G

GPS	Global Positioning System
GSM	Global System for Mobile Communications
GUI	Graphic User Interface

H

HARQ	Hybrid Automatic Repeat Request
HBBI	NodeB HSDPA Baseband Processing and Interface Unit
HBOI	NodeB HSDPA Baseband Processing and Optical Interface Unit
HDLP	NodeB HSDPA Supported Downlink Processing Unit
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
HULP	NodeB HSDPA Supported Uplink Processing Unit

I

IMA	Inverse Multiplexing on ATM
IP	Internet Protocol
IPoA	IP over ATM
IPoE	IP over Ethernet
ITU	International Telecommunications Union
Iub	Iub interface

L

LMT	Local Maintenance Terminal
LNA	Low Noise Amplifier

M

MAFU	Multicarrier Antenna Filter Unit
MBMS	Multimedia Broadcast and Multicast Service
MML	Man Machine Language
MTRX	Multi-Carrier Transceiver
MUD	Multiuser Detection

N

NAOI	NodeB ATM Optical Interface Unit
NBAP	NodeB Application Part
NBBI	NodeB Baseband Processing and Interface Unit
NBOI	NodeB Baseband Processing and Optical Interface Unit
NCCU	NodeB Cable Connected Unit
NDTI	NodeB Digital Trunk Interface Unit
NFAN	NodeB Fan Box
NMON	NodeB Monitor Unit
NMPT	NodeB Main Processing & Timing Unit

O

OMC	Operation and Maintenance Center
OTDOA	Observed Time Difference of Arrival

P

PA	Power Amplifier
PS	Packet Switched

R

RCU	**Remote Control Unit**
RET	Remote Electrical Tilt
RF	Radio Frequency
RH	Relative Humidity
RNC	Radio Network Controller
RRU	Remote Radio Unit

S

SA	Smart Antenna
SAAL	Signaling ATM Adaptation Layer
SCCPCH	Secondary Common Control Physical Channel
SCSI	Small Computer Systems Interface
SFP	Small Form-Factor Pluggable
SGSN	Serving GPRS Support Node
STM-1	Synchronous Transport Mode-1
STMA	Smart Tower Mounted Amplifier
STTD	Space Time Transmit Diversity

T

TMA	Tower Mount Amplifier

TSTD   Time Switched Transmit Diversity

TTI   Transmission Time Interval

U

UE   User Equipment

UMTS   Universal Mobile Telecommunications System

UNI   User-Network Interface

UPS   Uninterruptible Power Supply

UTRAN   UMTS Terrestrial Radio Access Network

Uu   Uu interface

V

VLAN   Virtual LAN

W

WCDMA   Wideband Code Division Multiple Access