Application Scope	Worldwide	**Product Name**	BTS3900/BTS3900A LTE
Object	Survey engineers	**Product Version**	
Compiled by	Wireless Product Ingress Department	**Document Version**	V1.0
Suitable for	BTS3900/ BTS3900A LTE eNodeB	**Updated on**	2009-10-15

BTS3900/ BTS3900A LTE eNodeB Survey Guide

Prepared by		**Date**	2009-1-4
Reviewed by		**Date**	
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Revision History

Date	Revision Version	Description	Author
2009-10-15	V1.0	The initial draft is complete.	

Contents

Preface

BTS3900/ BTS3900A LTE eNodeB Survey Guide describes the onsite survey operations such as the creation, relocation, and expansion of Huawei BTS3900/ BTS3900A eNodeB. The guide describes the operation methods and requirements of the survey based on the product features and the survey design standards, explains main survey items, and provides certain product knowledge and data used in the survey for the surveyor. This guide helps readers quickly understand the contents and knowledge of the survey for BTS3900/ BTS3900A eNodeB, improve the survey skills, and thus perform the survey task efficiently, quickly, and completely.

1 Introduction to Survey

1.1 Preparations

On receiving a survey notice, the engineer must carefully read the contract, technical proposal, and networking diagram, make clear equipment configurations at each site and inter-site connections. For any questions, consult the relevant person in time. After knowing about the entire project, the engineer can contact the customer ahead of time to determine the date of the survey coordination meeting, designate the onsite surveyors, and work out a survey schedule.

1.1.1 Equipment Configuration List and Technical Proposal

Study the *Technical Proposal* and equipment configuration list, and have a general picture of the project. For any question about the *Technical Proposal* and equipment configuration, or if the *Technical Proposal* is unclear as to technical solution, engineering interface and project schedule, talk with the contract owner in time, to reach a consensus. The contract and *Technical Proposal* may contain some errors, and the survey design engineer is expected to review the technical solution regarding the project feasibility and easy operability by taking full advantage of his knowledge about the project. For any problem found in the review, give a feedback to the sales and R&D personnel in time. Then, revise the technical solution and contract configuration, so as not to cause unnecessary or even impossible trouble to later engineering.

1.1.2 Prepared Documents

Survey Notice and the name, phone number, and contact information of the customer's project owner.

Technical Proposal and equipment configuration list

BTS3900/ BTS3900A LTE eNodeB Survey Guide- 20091015-V1.0

Guide to Customer's Preparation for DBS3900/BTS3900/BTS3900A LTE Installation

1.1.3 Tools

The tools include drawing appliances such as rulers, propelling pencils, erasers, and white papers, measuring tapes that are longer than 4.5 meters, and laptops. Site survey requires special tools, such as the GPS, compass, angle instrument, telescope, and digital camera.

1.2 Coordination Meeting of Field Preparations

The survey coordination meeting is an opportunity for Huawei technical engineers to talk face-to-face with the customer's executives. This meeting will give the customer's executives a basic, rough and perceptual vision of the project and win their understanding of and support for the survey. Survey coordination meetings may vary with projects.

For a common project or a customer of low value, a small talk is enough. For a project of key importance, complexity, or high value, the project team must seek help from other departments of the company and clarify Huawei scheme to the customer's executives through technical interaction meetings. After arriving at the site, the design engineer should contact the customer's staff responsible for engineering and maintenance or network construction and their engineers. Explain in detail the entire implementation process to customer's relevant staff to let the customer know what to prepare and work out a project implementation schedule.

1.3 Site Survey

Carry out the onsite survey for the sites meeting the survey conditions. Ask for auxiliary equipment such as the power supply, grounding bar, air-conditioner, and cabling rack or movable floor from the customer in advance. Determine together with the customer where to position the equipment, how to route the cables and which area to reserve for the future expansion. Consult the customer for the involved data, such as the building parameters, the distance between equipment rooms, and the number of available optical cable cores. When carrying out the onsite survey, carefully survey and record each item as required by the contract and the survey report rather than subjectively guess or assume it by experience.

1.4 Site Preparation Before the Installation

During the onsite survey, the survey engineer needs to check the environment for the initial installation and make sure that the basic conditions for equipment installation are available based on the *Guide to Customer's Preparation for DBS3900/BTS3900/BTS3900A LTE Installation*, thus guiding the customer to make preparations before the installation.

2 Introduction to eNodeB Products

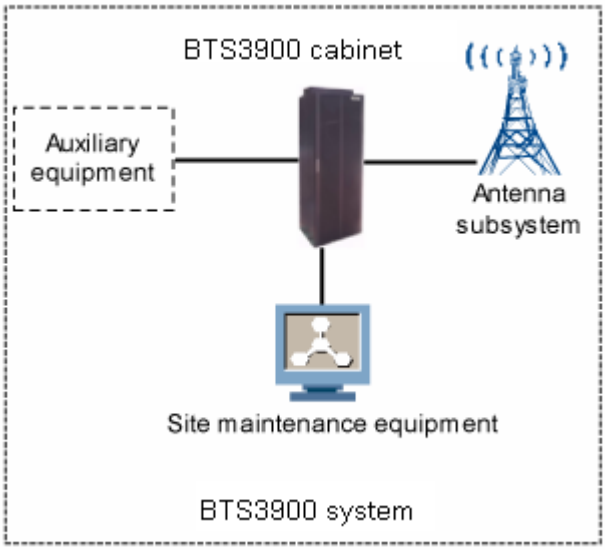
2.1 Introduction to the BTS3900 LTE

2.1.1 BTS3900 System Overview

As shown in Figure 2-1, the BTS3900 system consists of the cabinet, antenna, operation and maintenance (OM) equipment, and auxiliary equipment. The BTS3900 cabinet is the core of the BTS system. It processes baseband signals and RF signals. The antenna system receives uplink signals and transmits downlink signals.

The OM equipment implements the following operation and maintenance functions for the BTS3900: security management, equipment management, configuration management, software management, alarm management, environment monitoring, and performance management. The BTS3900 supports two OM modes: local maintenance and remote maintenance.

Figure 2-1 BTS3900 system



The BTS3900 cabinet, a purplish gray vertical cabinet, is designed based on the IEC297 standard. Figure 2-2 shows the appearance of a BTS3900 cabinet.

Figure 2-2 Appearance of a BTS3900 cabinet

The BTS3900 and BTS3900A feature the modular design. They have two types of basic modules:

the baseband control unit (BBU3900) and the LTE Radio Filter Unit (LRFU). The BBU3900 and the LRFU communicate with each other through the high-rate CPRI interfaces.

BBU3900

The BBU3900 is a baseband control unit performing interaction between the eNodeB and the EPC. The BBU3900 features a compact case structure that requires a 19-inch-wide and 2 U-high space. It can be installed on an indoor wall, on the staircase, in the storeroom, or in an outdoor cabinet on the existing network. Figure 2-3 shows the appearance of the BBU3900.

Figure 2-3 Appearance of the BBU3900

LRFU

LRFU is equipped inside of indoor cabinet or outdoor cabinet with protective function. Figure 2-4 shows the LRFU panel.

Figure 2-4 LRFU panel

2.1.2 BTS3900 Cabinet

The BTS3900 cabinet, which has the functions such as power distribution and lightning protection, provides space for the installation of the BBU3900 and the WRFU modules. A single cabinet holds a maximum of six LRFUs.

The indoor macro-cabinet of the BTS3900 supports the -48V DC power input, and it can support +24V DC and 220V AC power inputs when configured with different power modules. Figure 2-5, Figure 2-6 and Figure 2-7 show the internal structures of the indoor macro-cabinets that respectively support the preceding three power inputs.

Figure 2-5 -48 V BTS3900 cabinet

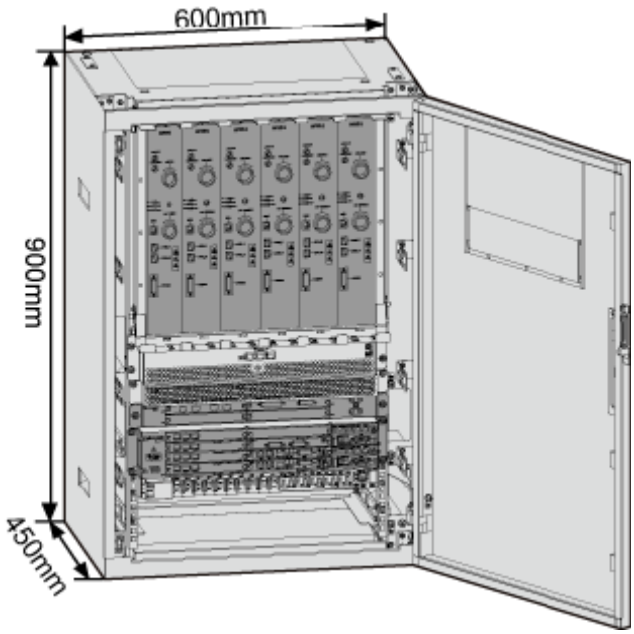


Figure 2-6 +24 V BTS3900 cabinet

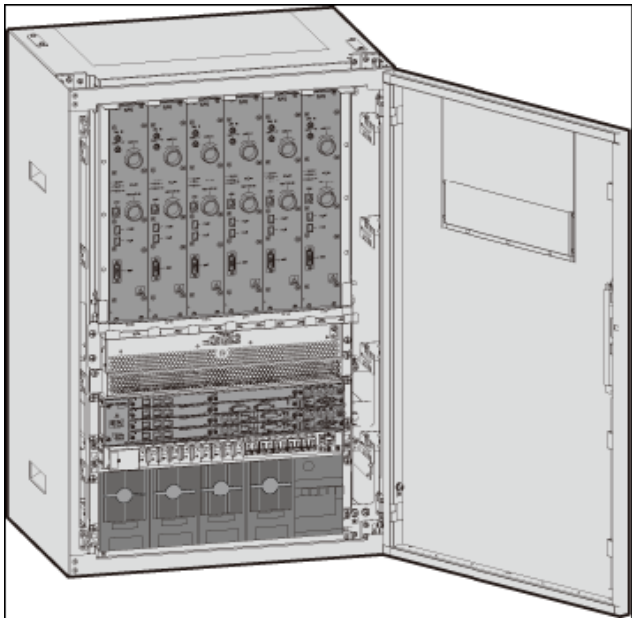
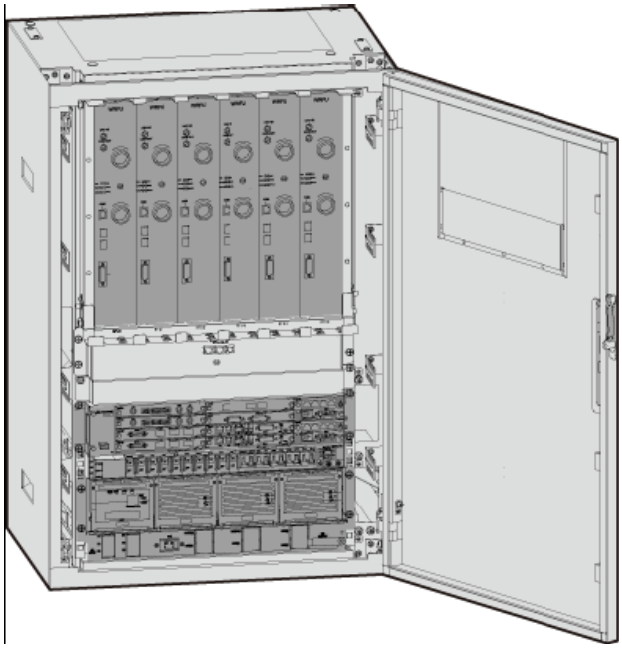


Figure 2-7 220 V BTS3900 cabinet



Cable Connections of the BTS3900 Cabinets

The cables of the BTS3900 consist of the RF cables, signal cables, and power cables.

For details, see the *BTS3900 LTE Hardware Description*.

2.1.3 BTS3900 Technical Specification

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.

Item	Specification		
Frequency band	Frequency Band	RX Band (MHz)	TX Band (MHz)
	Band I (2.6 GHz)	2500 to 2570	2620 to 2690
Capacity	Maximum number of Cells	6 cells when the cell bandwidth is 5 MHz or 10 MHz. 3 cells when the cell bandwidth is 15 MHz or 20 MHz.	
	Minimum configuration	One BBU (with one LBBP) + one LRFU	

Item	Specification		
	Typical configuration	• 3×5 MHz/10MHz 2×2 MIMO: 1 BBU (with 1 LBBPs) + 3 LRFUs • 3×15 MHz/20MHz 2×2 MIMO: 1 BBU (with 3 LBBPs) + 3 LRFUs	
	Maximum configuration	• 6×5 MHz/10MHz 2×2 MIMO: 1 BBU (with 2 LBBPs) + 6 LRFUs • 3×15 MHz/20MHz 2×2 MIMO: 1 BBU (with 3 LBBPs) + 3 LRFUs	
	Maximum throughput per cell	**Downlink**	**Uplink**
		• At the physical layer: 172 Mbit/s (2x2 MIMO, 64QAM, 20 MHz) • At the MAC layer: 150 Mbit/s (2x2 MIMO, 64QAM, 20 MHz)	• At the physical layer: 165 Mbit/s (2x2 MU-MIMO, 64QAM, 20 MHz) • At the MAC layer: 100 Mbit/s (2x2 MU-MIMO, 64QAM, 20 MHz)
	Maximum throughput per UE	**Downlink**	**Uplink**
		• At the physical layer: 172 Mbit/s (2x2 MIMO, 64QAM, 20 MHz) • At MAC layer: 150 Mbit/s (2x2 MIMO, 64QAM, 20 MHz	• At the physical layer: 64 Mbit/s (1x2 SIMO, 64QAM, 20 MHz) • At MAC layer: 50 Mbit/s (1x2 SIMO, 64QAM, 20 MHz)
	Maximum throughput per eNB	• Downlink: 350Mbit/s • Uplink: 200Mbit/s	
	Number of users in active state per cell	If the bandwidth is 5 MHz: 200/cell	
		If the bandwidth is 10 MHz, 15 MHz, or 20 MHz: 400/cell	
	Number of users in inactive state per cell	If the bandwidth is 5 MHz: 400/cell	
		If the bandwidth is 10 MHz, 15 MHz, or 20 MHz: 800/cell	

Item	Specification	
	Maximum number of users (active + inactive) per eNodeB	3,600
	DRB (Data Radio Bearer)	• 8 DRB working at the same time per user • 10800 DRB working at the same time per eNodeB
CPRI	• 6 CPRI ports • Supporting standard CPRI 4.1 interface, and compatible with CPRI 3.0	
Output power	LRFU: 2 x 40 W	
Power consumption	• 3×5MHz / 10MHz: 1314W • 6×5MHz / 10MHz: 2493W • 3×15MHz / 20MHz: 1464W	
Coverage radius per cell	15km, 30km, 100km	
Clock synchronization	Ethernet (1TU-T G.8261), GPS clock, free-run clock, clock over IP, or IEEE1588V2 clock, 1PPS, E1/T1 accuracy: 0.05 ppm	
Dimensions (height x width x depth)	900mm×600mm×450mm	
Weight (kg)	• ≤ 124 kg (with 3 LRFUs) • ≤ 160 kg (with 6 LRFUs)	
Input power	• –48 V DC; voltage range: –38.4 V DC to –57 V DC • +24 V DC; voltage range: +21.6 V DC to +29 V DC • +220 V AC; voltage range: +176 V AC to +280 V AC, 50/60Hz • +110 V AC; voltage range: +90 V AC to +135 V AC, 50/60Hz	
Temperature	–20°C to +55°C	
Relative humidity	5% RH to 95% RH	
Air pressure	70 kPa to 106 kPa	
Protection degree	IP20	
Storage environment	ETSI EN300019-1-1 V2.1.4 (2003-04) class1.2 "Weatherprotected, not temperature-controlled storage locations"	

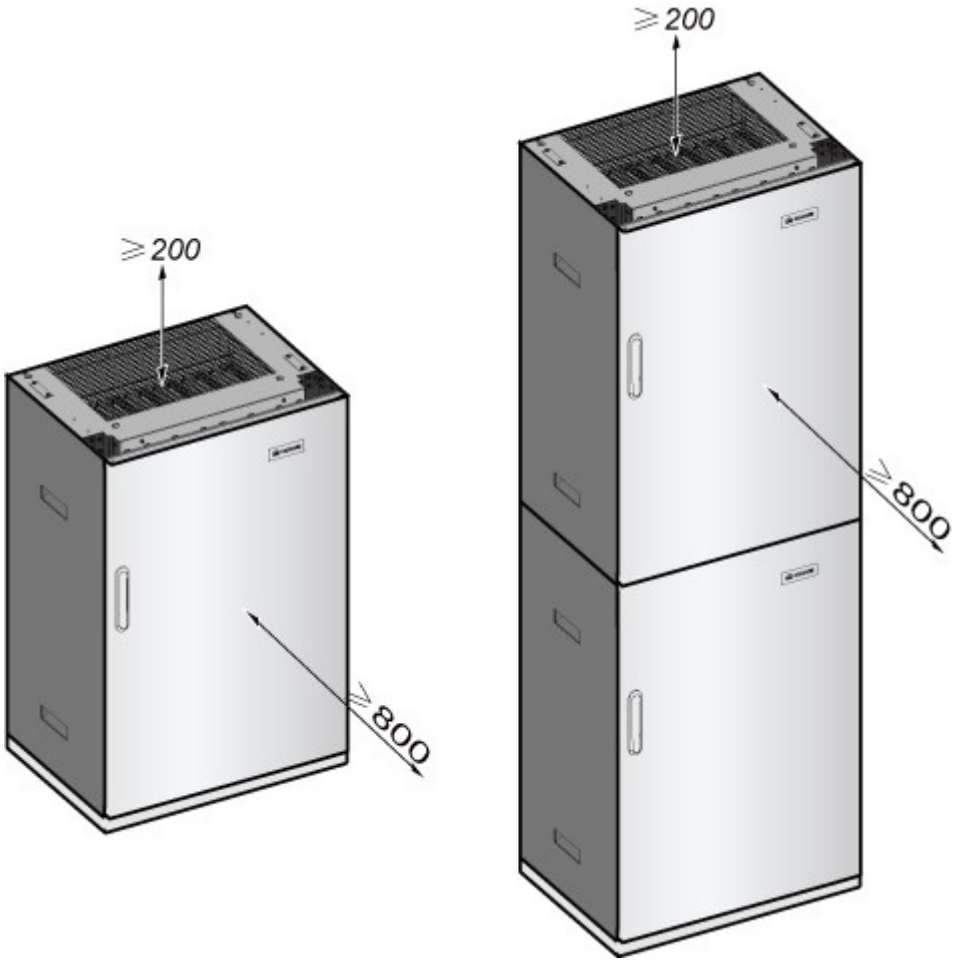
Item	Specification
Transport environment	ETSI EN300019-1-2 V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	• IEC 60068-2-57 (1999-11) Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history method • YD5083-99: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
EMC	The BTS3900 meets the Electro Magnetic Compatibility (EMC) requirements and complies with the following standards: • R&TTE Directive 1999/5/EC • R&TTE Directive 89/336/EEC • 3GPP TS 36.113 • ETSI EN 301489-1/23 • ETSI EN 301908-1 V2.2.1 (2003-10) • ITU-R SM.329-10
System availability	> 99.999%
Mean Time Between Failures (MTBF)	≥120,000 hr (when working under temperature of 25°C, configured with 3 sectores 1/1/1 and with 1+1 LMPT backup)
Mean Time To Repair (MTTR)	≤ 1 hr
System restarting time	< 120s

2.1.4 Space and Location Requirements of the BTS3900

The deployment of the equipment room needs to meet the requirements such as the design rationality, installation feasibility, and beautiful appearance. The BTS3900 cabinet can be installed against the wall.

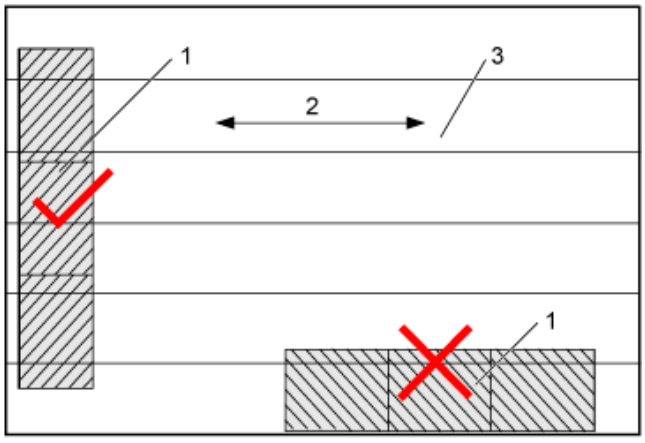
Space Requirements of the BTS3900

The following figure shows the space requirements of the BTS3900 cabinet (unit: mm)



The space requirements of the BTS3900 cabinet are as follows:

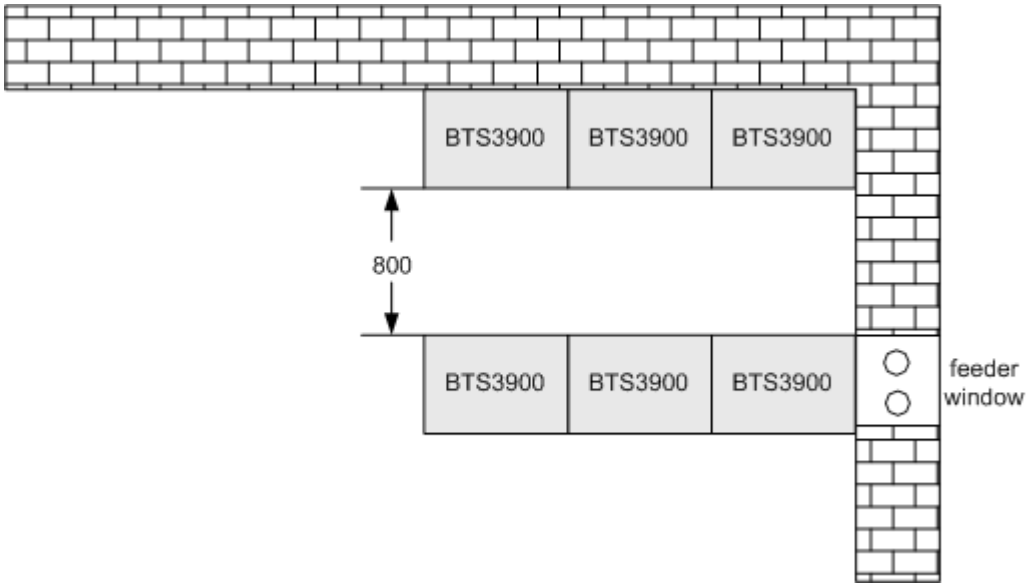
- As shown in the following figure, in the storied buildings using precast slabs, you are not allowed to place multiple cabinets on only one floor slab.



(1) Cabinet (2) Precast slab trend (3) Precast slab

- You can place the back surface of the cabinet against the wall.
- You can also place the sides of the cabinet against the wall.
- You are suggested to reserve a space not less than 800 mm in width in front of the cabinet for maintenance.
- You should reserve a space not less than 200 mm in height above the cabinet when installing the cabinet, thus facilitating the feeder cabling.
- You should reserve a space not less than 200 mm in height above the upper cabinet when stacking the cabinets, thus facilitating the feeder cabling.

Layout Requirements of the BTS3900 Cabinet



- You should place the cabinet as close to the feeder window as possible, thus reducing the length of the feeder.
- You need not reserve any space when the cabinet is installed in parallel with other equipment.

2.1.5 Requirements for the Power System of the BTS3900

Both AC power and DC power can be used in the BTS3900 power supply system. The parameters of the supplied power must meet the corresponding specifications to ensure proper operation of the power system.

lists the power supply requirements of the BTS3900.

Figure 2-4 Power supply requirements of the BTS3900

Power	Permitted Range
-48 V DC	-38.4 V DC to -57 V DC
+24 V DC	+21.6 V DC to +29 V DC
+220 V AC	+176 V AC to +280 V AC, 50/60Hz
+110 V AC	+90 V AC to +135 V AC, 50/60Hz

When DC power is led into the BTS3900 equipment room, the power supply system must meet the following requirements:

- When planning the capacity of the DC power supply system, you should consider the maximum load of the system in dynamic and static modes and reserve a certain capacity.
- The power equipment is placed nearest possible to the communication equipment to minimize the DC feeder consumption.

When AC power is led into the BTS3900 equipment room, the power supply system must meet the following requirements:

- When planning the capacity of the AC power supply system, you must consider the working current and fault current of the equipment.
- Each equipment has an independent AC distribution protection device.
- The current threshold of the distribution protection switch for the equipment is greater than that for the lower-level equipment.

2.1.6 Grounding Requirements of the BTS3900

The BTS3900 equipment installation must meet the grounding requirements to ensure stable running of the NodeB.

For a single BTS3900 cabinet,

- The PGND cable of the cabinet should be connected to the nearby external grounding bar. The green and yellow PGND cable should be copper-based and plastic-insulated with a cross-sectional area of at least 25 mm^2.

When two BTS3900 cabinets installed in stacked mode, the following requirements must be met:

- The cabinets should be interconnected through a copper-based cable to ensure equal electric potential. Note that the cable must be copper-based and insulated with green and yellow plastic jackets and the cross-sectional area is at least 16 mm2.
- The PGND cable of the lower cabinet should be connected to the grounding bar in the equipment room. The PGND cable should be copper-based and insulated with green and yellow plastic jackets. The cross-sectional area of the PGND cable is at least 25 mm2.

NOTE

Fuses or switches are not allowed on the PGND cable.

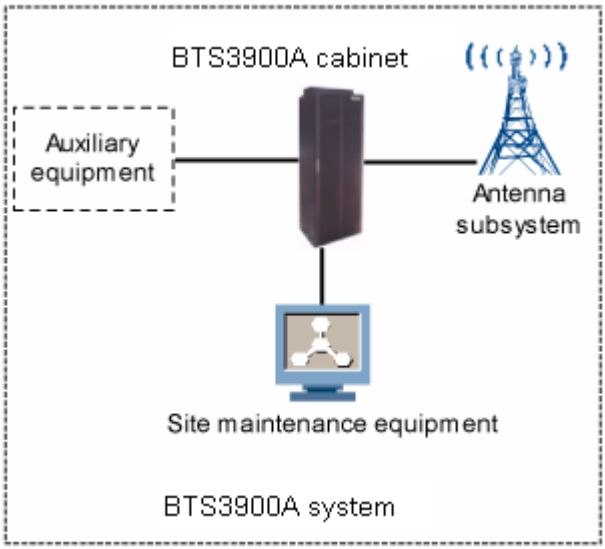
The grounding terminals should be anti-corrosive and antirust. Connection of the PGND cable is secure.

The grounding bar should be located nearest possible to the NodeB equipment. The maximum distance permitted is 30 miff the distance between the grounding bar and the NodeB equipment is greater than 30 m, reinstall the grounding bar nearby.

2.2 Introduction to the BTS3900A

2.2.1 BTS3900A System Overview

As shown in the following figure, the BTS3900A system is composed of the cabinet, antenna, OM equipment, and the auxiliary equipment. The BTS3900A cabinet is the core of the BTS3900A system. It processes baseband signals and RF signals. The antenna system receives uplink signals and transmits downlink signals on the Um interface. The OM equipment performs the following OM functions: security management, equipment management, configuration management, software management, alarm management, environment monitoring, and performance management. The BTS3900A supports two OM modes: local maintenance and remote maintenance.



The BTS3900 and BTS3900A feature the modular design. They have two types of basic modules:

the baseband control unit (BBU3900) and the LTE Radio Filter Unit (LRFU). The BBU3900 and the LRFU communicate with each other through the high-rate CPRI interfaces.

BBU3900

The BBU3900 is a baseband control unit performing interaction between the eNodeB and the EPC. The BBU3900 features a compact case structure that requires a 19-inch-wide and 2 U-high space. It can be installed on an indoor wall, on the staircase, in the storeroom, or in an outdoor cabinet on the existing network.

The following figure shows the appearance of the BBU3900.

LRFU

LRFU is equipped inside of indoor cabinet or outdoor cabinet with protective function. The following figure shows the LRFU panel.

The BTS3900A can be configured with various auxiliary equipment. The auxiliary equipment consists of the APM30H power distribution cabinet, outdoor radio cabinet RFC, battery cabinet BBC and transmission cabinet TMC.

The auxiliary equipment converts the power, monitors the equipment room environment, detects environment variables of the eNodeB, and reports various environment alarms.

2.2.2 BTS3900A Cabinet

Appearance of the BTS3900A Cabinet

The BTS3900A cabinet is designed in compliance with the IEC297 standard. It is a white vertical cabinet. As shown in the following figure, the upper cabinet is an APM30H power distribution cabinet and the lower cabinet is an RF cabinet.

Structure of the BTS3900A Cabinet

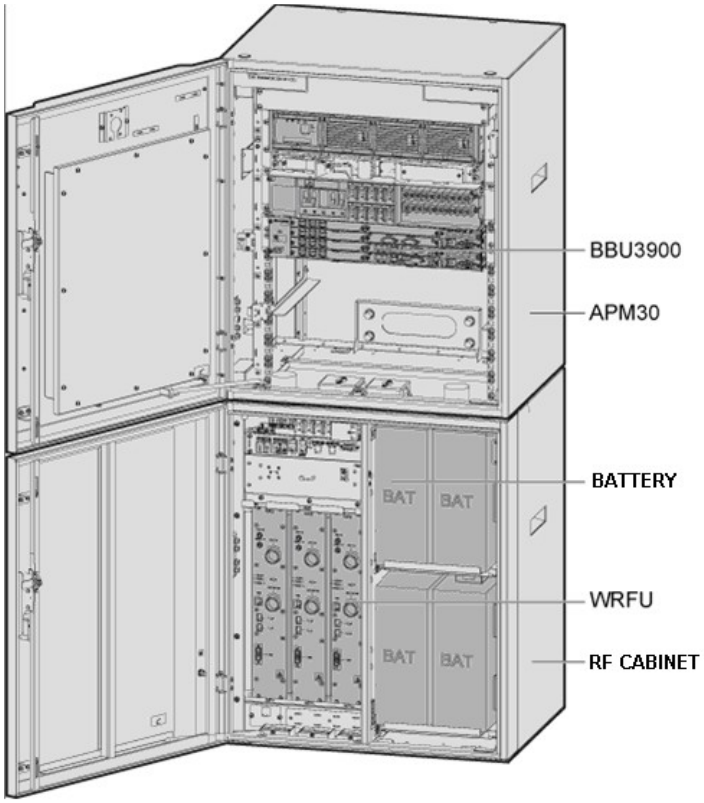
A BTS3900A cabinet consists of a radio frequency cabinet (RFC) and an APM30 power cabinet. Optional configuration equipment includes an APM30 battery cabinet or APM30 transmission cabinet. If configured, an APM30 battery cabinet can provide long standby power time for the NodeB, and an APM30 transmission can provide the installing space for your transmission equipment.

The BTS3900A cabinet consists of the WRFU module, BBU, DCDU, FMUA, and FAN unit.

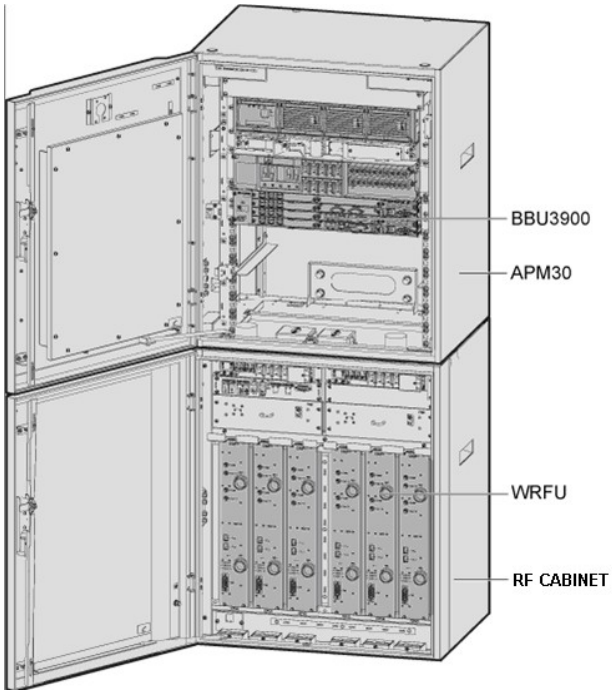
The outdoor macro NodeB, known as the BTS3900A, applies to the outdoor centralized installation and swapping of the traditional outdoor macro NodeB. The BTS3900A, renowned as one of the most compact outdoor macro base stations in the industry, features easy transportation due to its stacking design and light weight. The BTS3900A can be categorized as the AC BTS3900A and DC BTS3900A.

The AC BTS3900A consists of the RF cabinet and the APM30, which are installed in stacked mode. The BBU can be installed in the APM30, and the WRFU can be installed in the RF cabinet. The configurations of the AC BTS3900A vary with the application scenarios.

AC BTS3900A (1)

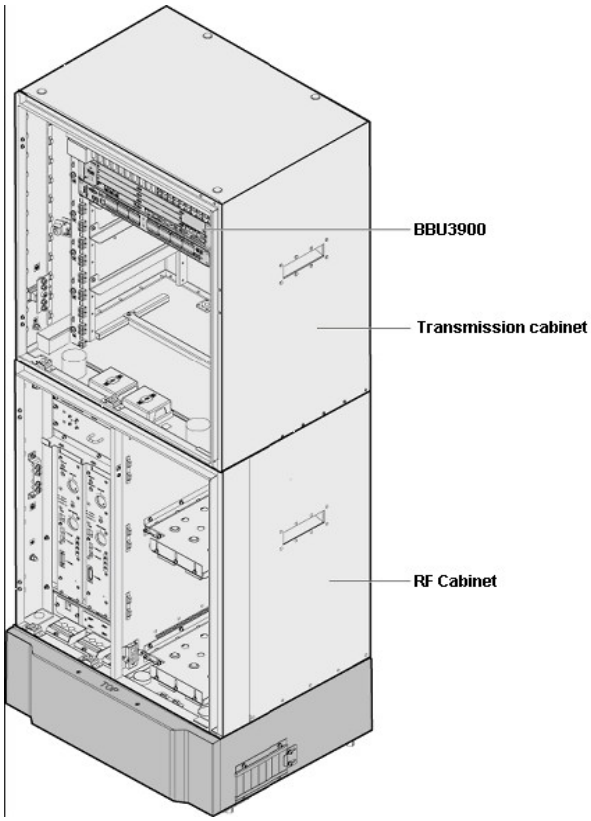


AC BTS3900A (2)



The DC BTS3900A consists of the RF cabinet and the transmission cabinet. The BBU3900 is installed in the transmission cabinet, and the WRFU is installed in the RF cabinet.

DC BTS3900A



Cable Connections of the BTS3900A Cabinets

The cables of the BTS3900A consist of the RF cables, signal cables, and power cables.

For details, see the *BTS3900A LTE hardware Description*.

2.2.3 Technical Specifications of the BTS3900A

Item	Specification		
Frequency band	Frequency Band	RX Band (MHz)	TX Band (MHz)
	Band I (2.6 GHz)	2500 to 2570	2620 to 2690
Capacity	Maximum number of Cells	6 cells when the cell bandwidth is 5 MHz or 10 MHz. 3 cells when the cell bandwidth is 15 MHz or 20 MHz.	
	Minimum configuration	One BBU (with one LBBP) + one LRFU	
	Typical configuration	• 3×5 MHz/10MHz 2×2 MIMO: 1 BBU (with 1 LBBPs) + 3 LRFUs • 3×15 MHz/20MHz 2×2 MIMO: 1 BBU (with 3 LBBPs) + 3 LRFUs	
	Maximum configuration	• 6×5 MHz/10MHz 2×2 MIMO: 1 BBU (with 2 LBBPs) + 6 LRFUs • 3×15 MHz/20MHz 2×2 MIMO: 1 BBU (with 3 LBBPs) + 3 LRFUs	
	Maximum throughput per cell	**Downlink**	**Uplink**
		• At the physical layer: 172 Mbit/s (2x2 MIMO, 64QAM, 20 MHz) • At the MAC layer: 150 Mbit/s (2x2 MIMO, 64QAM, 20 MHz)	• At the physical layer: 165 Mbit/s (2x2 MU-MIMO, 64QAM, 20 MHz) • At the MAC layer: 100 Mbit/s (2x2 MU-MIMO, 64QAM, 20 MHz)
	Maximum	**Downlink**	**Uplink**

Item	Specification		
	throughput per UE	• At the physical layer: 172 Mbit/s (2x2 MIMO, 64QAM, 20 MHz) • At MAC layer: 150 Mbit/s (2x2 MIMO, 64QAM, 20 MHz	• At the physical layer: 64 Mbit/s (1x2 SIMO, 64QAM, 20 MHz) • At MAC layer: 50 Mbit/s (1x2 SIMO, 64QAM, 20 MHz)
	Maximum throughput per eNB	• Downlink: 350Mbit/s • Uplink: 200Mbit/s	
	Number of users in active state per cell	If the bandwidth is 5 MHz: 200/cell	
		If the bandwidth is 10 MHz, 15 MHz, or 20 MHz: 400/cell	
	Number of users in inactive state per cell	If the bandwidth is 5 MHz: 400/cell	
		If the bandwidth is 10 MHz, 15 MHz, or 20 MHz: 800/cell	
	Maximum number of users (active + inactive) per eNodeB	3,600	
	DRB (Data Radio Bearer)	• 8 DRB working at the same time per user • 10800 DRB working at the same time per eNodeB	
CPRI	• 6 CPRI ports • Supporting standard CPRI 4.1 interface, and compatible with CPRI 3.0		
Output power	LRFU: 2 x 40 W		
Power consumption	• 3×5MHz / 10MHz: 1354W • 6×5MHz / 10MHz: 2533W • 3×15MHz / 20MHz: 1504W		
Coverage radius per cell	15km, 30km, 100km		
Clock synchronization	Ethernet (1TU-T G.8261), GPS clock, free-run clock, clock over IP, or IEEE1588V2 clock, 1PPS, E1/T1 accuracy: 0.05 ppm		

Item	Specification
Dimensions (height x width x depth)	RFC: 700mm×600mm×480mm APM30H: 700mm×600mm×480mm
Weight (kg)	• RFC≤ 91 kg (with 3 LRFUs); RFC≤ 127 kg (with 6 LRFUs) • APM30H: 87 kg
Input power	• –48 V DC; voltage range: –38.4 V DC to –57 V DC • +24 V DC; voltage range: +21.6 V DC to +29 V DC • +220 V AC; voltage range: +176 V AC to +280 V AC, 50/60Hz • +110 V AC; voltage range: +90 V AC to +135 V AC, 50/60Hz
Temperature	–20°C to +55°C
Relative humidity	5% RH to 95% RH
Air pressure	70 kPa to 106 kPa
Protection degree	IP20
Storage environment	ETSI EN300019-1-1 V2.1.4 (2003-04) class1.2 "Weatherprotected, not temperature-controlled storage locations"
Transport environment	ETSI EN300019-1-2 V2.1.4 (2003-04) class 2.3 "Public transportation"
Anti-seismic performance	• IEC 60068-2-57 (1999-11) Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history method • YD5083-99: Interim Provisions for Test of Anti-seismic Performances of Telecommunications Equipment (telecom industry standard in People's Republic of China)
EMC	The BTS3900 meets the Electro Magnetic Compatibility (EMC) requirements and complies with the following standards: • R&TTE Directive 1999/5/EC • R&TTE Directive 89/336/EEC • 3GPP TS 36.113 • ETSI EN 301489-1/23 • ETSI EN 301908-1 V2.2.1 (2003-10) • ITU-R SM.329-10
System availability	> 99.999%
Mean Time Between Failures (MTBF)	≥120,000 hr (when working under temperature of 25°C, configured with 3 sectores 1/1/1 and with 1+1 LMPT backup)
Mean Time To Repair (MTTR)	≤ 1 hr

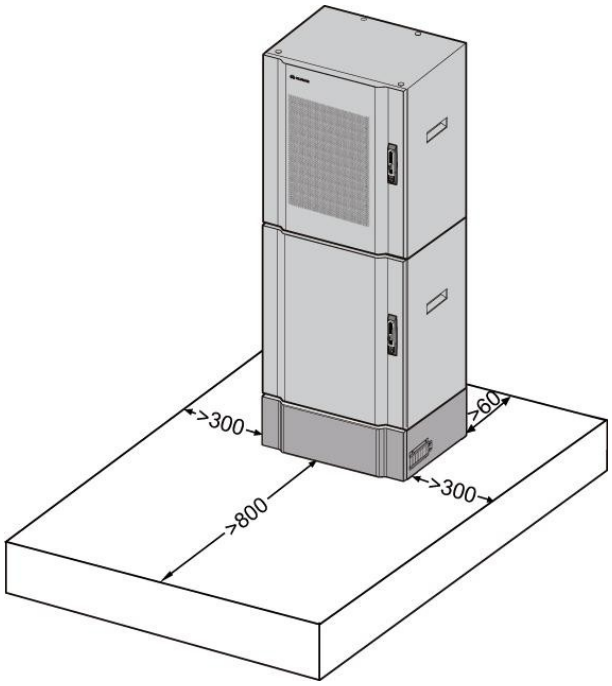
Item	Specification
System restarting time	< 120s

2.2.4 Space and Location Requirements of the BTS3900A

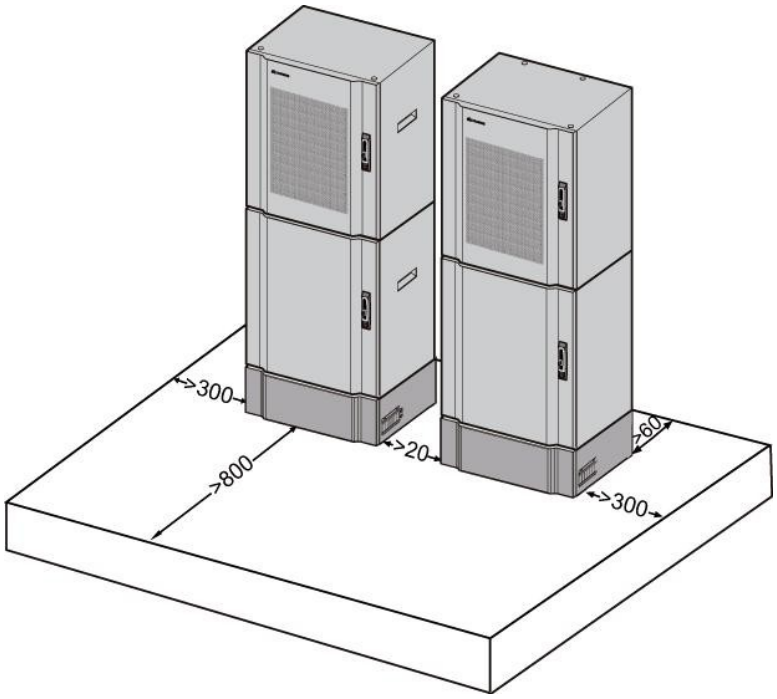
The space for installing the BTS3900A must be planned in compliance with the space requirements to facilitate the later installation and maintenance.

The following figures show the space requirements for installing the BTS3900A configured with the RF cabinet and power cabinet.

Space requirements for installing the BTS3900A configured with the RF cabinet and power cabinet (unit: mm)



Space requirements for installing the BTS3900A configured with the RF cabinet, power cabinet, and extension cabinet (unit: mm)



2.2.5 Requirements for the Power System of the BTS3900A

To ensure the proper operation of the power system of the BTS3900A, the power supply of all the functional modules must comply with the related specifications. Table lists the power supply requirements of the BTS3900A.

Figure 2-4 Power supply requirements of the BTS3900A

Power	Permitted Range
-48 V DC	-38.4 V DC to -57 V DC
+24 V DC	+21.6 V DC to +29 V DC
+220 V AC	+176 V AC to +280 V AC, 50/60Hz
+110 V AC	+90 V AC to +135 V AC, 50/60Hz

NOTE

If the voltage stability does not meet the requirements, you need to use voltage regulators to ensure a proper power voltage range.

When AC power is led into the BTS3900A cabinet, the power system must meet the following requirements:

- When planning the capacity of the AC power supply system, you should consider the working current and fault current of the equipment.
- Each device should have an independent AC distribution protection device.
- The current threshold of the distribution protection switch for the equipment should be greater than that for the lower-level equipment.

2.2.6 Grounding Requirements of the BTS3900A

The BTS3900A equipment installation must meet the grounding requirements to ensure stable running of the NodeB.

- The PGND cable of the BTS3900A cabinet is connected to the external grounding bar. The green and yellow PGND cable is copper-based and plastic-insulated with a cross-sectional area of at least 25 mm^2.
- The combined BTS3900A cabinets must be interconnected through the green and yellow PGND cable to ensure equal electric potential. Note that the PGND cable is copper-based and plastic-insulated with a cross-sectional area of at least 16 mm^2.

NOTE

Fuses or switches are not allowed on the PGND cable.

The grounding terminals should be anti-corrosive and antirust. Connection of the PGND cable is secure.

The grounding bar should be located nearest possible to the NodeB equipment. The maximum distance permitted is 30 m. If the distance between the grounding bar and the NodeB equipment is greater than 30 m, reinstall the grounding bar nearby.

3 Introduction to Auxiliary Equipment

This chapter describes certain auxiliary equipment such as the APM30 series and APM30H series products.

3.1 Introduction to APM30 Series Products

To enable the easy, flexible, and convenient power distribution of the power supply of the separated BTS and distributed BTS, adapt the BBU and user transmission equipment to harsh environment, and back up power for separated BTSs and distributed BTSs, Huawei provides the APM30.

The APM30 system supplies -48 DC power and battery power backup for separated BTSs and distributed BTSs, provides installation space for the BBU and user transmission equipment, implements the functions such as battery management, power system monitoring communication, lightning protection, and temperature control.

The auxiliary cabinets configured for the APM30 include the transmission cabinet and battery cabinet. The transmission cabinet provides a space of 11U for user transmission equipment. The battery cabinet provides a maximum of 48 V 184 Ah backup power.

The APM30, which is small and light, can be installed on the rooftop, concrete floor, mast, overhead platform, or wall.

3.1.1 APM30

Appearance of the APM30

Function List of the APM30

Function Item	Function Description
Providing installation space for user equipment	The power cabinet provides a space of 5 U to 7 U for the user equipment. Without batteries, the power cabinet provides a space of 7 U for user equipment. With a -48 V 24 Ah built-in battery group, the power cabinet provides a space of 5 U for user equipment.
Back up power	The power cabinet can house two groups of the -48 V 12 Ah batteries, which work as a -48 V 24 Ah battery system to provide backup power supply for the distributed BTS in a limited duration. The power cabinet supports a battery group with the power up to -48 V 184 Ah when configured with an external battery cabinet.
Built-in PSU module	The PSU module converts the AC input mains into the -48 V DC power. The PSU module is hot-swappable.

Function Item	Function Description
Built-in PMU module	The PMU module provides the functions such as PSU management and battery charge and discharge management. The PMU module provides RS485 communication ports and dry contact alarm ports, thus achieving remote monitoring and unattended operation. Supports the battery low voltage disconnect (BLVD) and load low voltage disconnect (LLVD) functions. The PMU is hot-swappable.
AC power distribution	The built-in AC/DC embedded power system supports three AC power inputs (220 V single-phase, 110 V dual-live-wire, and 220 V three-phase) and two-way AC power output.
DC power distribution	See "*Function List of APM30 DC Power Distribution*."
Lightning protection for power supply ports and signal ports	In the APM30, the lightning protection circuit is designed for the dry contact alarm ports, the communication ports, and the built-in lightning protection module at the AC/DC power supply ports. In this way, the APM30 provides safe and reliable surge protection and inductive lightning protection.
Heat dissipation	The power cabinet implements heat dissipation through a combination of one breathable film and two fans, thus achieving a good temperature adaptability.
Grounding mode	The general ground cable of the cabinet and the ground cables of the lightning arrester and other equipment are connected with the cabinet grounding bar.

Function List of APM30 DC Power Distribution

Application	DC Output	DC Power Supply Unit	DC Output Terminal	MCB Specification	MCB Quantity	Remarks
Distributed BTS	Six LLVD outputs	RRU	LOAD4 to LOAD9	20 A	6	Six 20 A MCBs control six DC output to supply power for six RRUs.
	Four BLVD outputs	BBU	LOAD3	12 A	1	One 12 A MCB controls one DC output to supply power to the BBU.
		FAN	LOAD2	12 A	1	One 12 A MCB controls one DC output to supply power for the fan.
		TM	LOAD0, LOAD1	4 A	2	Two 4 A MCBs control two DC outputs to supply power to the transmission equipment.

Application	DC Output	DC Power Supply Unit	DC Output Terminal	MCB Specification	MCB Quantity	Remarks
Separated BTS	Four LLVD outputs	RFU	LOAD7 to LOAD9	30 A	3	Three 30 A MCBs control three DC outputs to supply power for the RF cabinet, and each MCB supports three RFU modules.
		Reserved	LOAD6	30 A	1	One 30 A MCB DC output is reserved.
	Six BLVD outputs	BBU	LOAD5	12 A	1	One 12 A MCB controls one DC output to supply power to the BBU.
		FAN	LOAD4	12 A	1	One 12 A MCB controls one DC output to supply power for the fan.
		TM	LOAD0 to LOAD3	4 A	4	Four 4 A MCBs control four DC output to supply power for the transmission equipment.

Electrical Specifications of the APM30

Parameter		Specification
Characteristic of AC inputs	Typical input voltage	200 V AC to 240 V AC (220 V AC single-phase)
		200/346 V AC to 240/415 V AC (220/380 V AC three-phase)
		100/200 V AC to 120/240 V AC (110 V AC dual-live-wire)
		120/208 V AC to 127/220 V AC (110 V AC dual-live-wire)
	Input voltage range	176 V AC to 290 V AC (220 V AC single-phase)
		176/304 V AC to 290/500 V AC (220 V AC three-phase)
		90/180 V AC – 135/270 V AC (110 V AC dual-live-wire)
		105/176 V AC to 150/260 V AC (110 V AC dual-live-wire)
	Input voltage frequency	50 Hz or 60 Hz
	Maximum input current	16 A (220/380 V AC three-phase)
		30 A (110 V AC dual-live-wire/220 V AC single-phase)

Parameter		Specification
	Input mode	• Supports the voltage of 220/380 V AC three-phase. • Supports 110 V AC dual live wires. • Supports the voltage of 220 V AC single-phase.
Characteristic of DC outputs	Output voltage range	-44 V DC to -58 V DC
	Output current range	• 0 A to 60 A when two PSUs are configured • 0 A to 90 A when three PSUs are configured
	Typical output voltage	-53.5 V DC
	DC outputs	The APM30 provides 10 DC outputs. • The auxiliary distributed BTS uses: Six LLVD MCBs and four BLVD MCBs • The auxiliary separated BTS uses: Four LLVD MCBs and six BLVD MCBs
Power consumption	DC output power	≤4800W **Note:** When the -48 V 24 Ah batteries are configured in the cabinet, the DC output power is less than or equal to 2300 W.
	Maximum heat consumption inside the cabinet	≤ 500 W
Protection	Input protection	Overvoltage protection: The system generates an alarm when the input voltage exceeds the AC overvoltage alarm threshold (280 V by default). Undervoltage protection: The system generates an alarm when the input voltage is lower than the AC undervoltage alarm threshold (180 V by default).
	Output protection	• Overvoltage protection: The system generates an alarm when the busbar voltage exceeds the DC overvoltage alarm threshold (-58 V by default). • Undervoltage protection: The system generates an alarm when the busbar voltage is lower than the DC undervoltage alarm threshold (-45 V by default). • Overcurrent protection and short-circuit protection
Lightning Protection Indexes	Lightning protection for AC input ports	In differential mode: • Rated through-current capacity In (8/20 us): 25 kA • Maximum through-current capacity Imax (8/20 us): 60 kA
		In common mode: • Rated through-current capacity In (8/20 us): 25 kA • Maximum through-current capacity Imax (8/20 us): 60 kA

Parameter		Specification
	Lightning protection for the DC output port of the cabinet	• In differential mode (8/20 us): 10 kA • In common mode (8/20 us): 15 kA The DC output corresponds to the secondary load.
	Lightning protection for the signal port	• In differential mode (8/20 us): 3 kA • In common mode (8/20 us): 5 kA

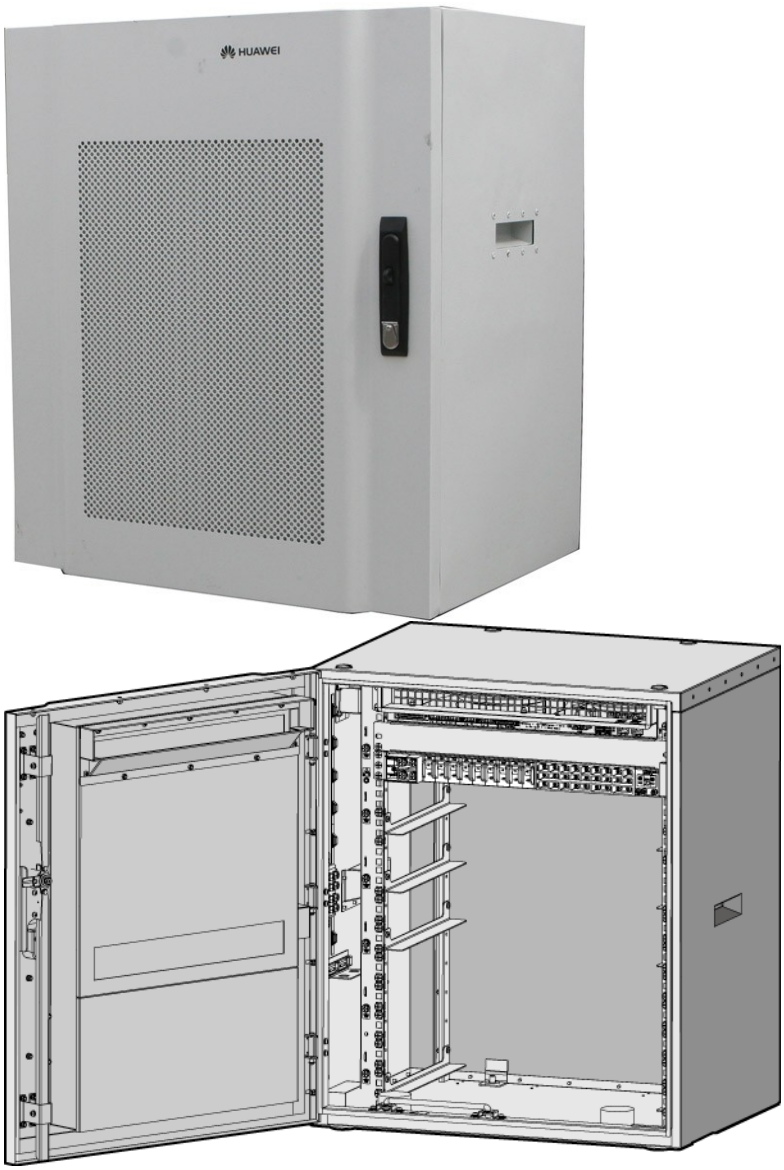
Engineering Specifications of the APM30

Parameter	Specification	Remarks
Cabinet weight	≤ 65 kg	Without batteries and transmission equipment
Weight	12 V 12 Ah mono-batteries: 3.83 kg	Can be expanded to 48 V 24 Ah (two groups of 48 V 12 Ah batteries)
Dimensions of the cabinet (width x height x depth)	600 mm x 700 mm x 480 mm	Without bases
Dimensions of the base (width x height x depth)	600 mm x 200 mm x 480 mm	-
Space of user equipment (width x height x depth)	PS4890 equipped with 48 V 24 Ah built-in batteries: 19 inches (482.6 mm) x 5 U (222.25 mm) x 310 mm PS4890 not equipped with built-in batteries: 19 inches (482.6 mm) x 7 U (311.15 mm) x 310 mm (or 290 mm)	The depth refers to the distance between the post and the rear of the cabinet. When batteries are not installed, the bottom 3 U space is 290 mm in depth. In this case, the heat dissipation from the rear of the user equipment cannot be supported.
Cabling and maintenance space at the front	32 mm	-
Installation mode	The APM30 can be installed on the ground, metal mast, or wall. It can be also installed with the RF cabinet or battery cabinet in stack mode.	-

Parameter		Specification	Remarks
Working environment	Working temperature	-40 °C to +55 °C	When the APM30 works under -20 °C, the heater is required. Note: The working temperature for configuring the heater refers to the local average lowest temperature of each day in the coldest month of the year.
	Solar radiation	≤ 1120 W/m2	
	Relative humidity	5% RH to 100% RH	
	Altitude	< 4000 m	From the altitude of 2000 m, the maximum working temperature drops by 1 °C each time the altitude increases by 300 m.
Dustproof and waterproof		IP55 (excluding the battery cavity)	
Annual failure rate of the rectifier		< 1%	
Annual failure rate of the monitoring module		< 0.5%	

3.1.2 APM30 Transmission Cabinet

Appearance of the APM30 transmission cabinet



Electrical specifications of the APM30 transmission cabinet

Parameter		Specification
Characteristic of DC inputs	Typical input voltage	-48 V DC
	Input voltage range	-38.4 V DC to -57 V DC
	Maximum input current	20 A

Parameter		Specification
	Input mode	Support M6 dual-OT terminal.
Power distribution of the DC output	Typical output voltage	-48 V DC
	DC distribution	Nine outputs: LOAD0 to LOAD8 LOAD0: One 12 A output used to supply power for the AFMU of the transmission cabinet LOAD1 to LOAD8: Eight 4 A outputs used to supply power for the transmission equipment of the transmission cabinet
Power consumption	Maximum power consumption of the user equipment inside the cabinet	≤ 1000 W
	Maximum heat consumption inside the cabinet	≤ 500 W
Note: To meet the requirements for various input currents and DC output distribution specifications, you can configure the transmission cabinet with various DCDUs.		

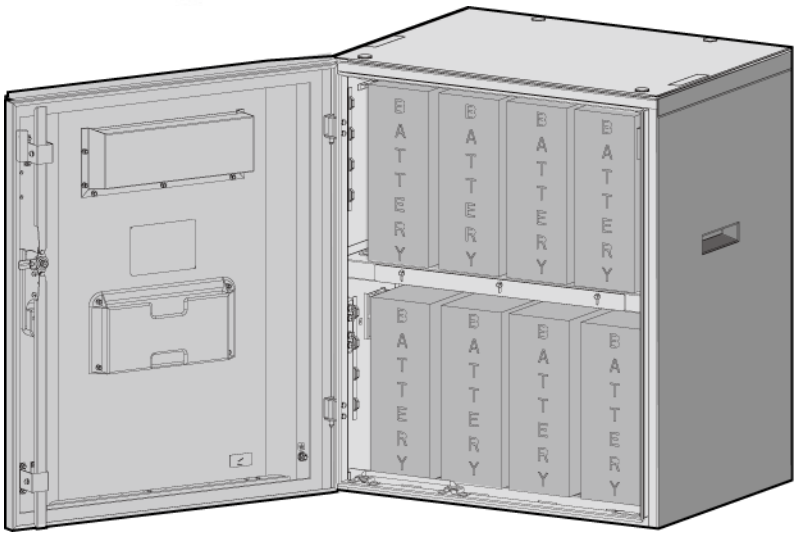
Engineering specifications of the APM30 transmission cabinet

Parameter	Specification	Remarks
Cabinet weight	< 40 kg	without user equipment
Cabinet dimensions (width x height x depth)	600 mm x 700 mm x 480 mm	The appearance and base of the transmission cabinet is consistent with the APM30 cabinet.
Dimensions of the base (width x height x depth)	600 mm x 200 mm x 480 mm	
Space of user equipment (width x height x depth)	Provide a space of 11 U for the installation of user equipment. Without the bottom space of 3 U: 19 inches (482.6 mm) x 8 U (355.6 mm) x 310 mm The bottom space of 3 U, 19 inches (482.6 mm) x 3 U (133.35 mm) x 290 mm, does not support the heat dissipation for the back side of user equipment.	The depth refers to the distance between the post and the rear of the cabinet.
Cabling and maintenance space at the front	32 mm	-

Installation mode		The APM30 transmission cabinet can be installed on the ground, metal mast, or wall. It can be also installed with the RF cabinet or battery cabinet in stack mode.	-
Working environment	Working temperature	Consistent with the APM30 cabinet	
	Solar radiation		
	Relative humidity		
	Altitude		
Dustproof and waterproof		Consistent with the APM30 cabinet.	

3.1.3 APM30 Battery Cabinet

Appearance of the APM30 battery cabinet



Engineering specifications of the APM30 battery cabinet

Parameter	Specification	Remarks
Cabinet weight	≤ 41 kg	without user equipment

Parameter		Specification	Remarks
Weight		Front-access battery group supporting 48 V 50 Ah or 48 V 92 Ah. 12 V 50 Ah mono-batteries: 21.5 kg 12 V 92 Ah mono-batteries: 33.5 kg	Can be expanded to 48 V 184 Ah (two groups of 48 V 92 Ah batteries)
Cabinet dimensions (width x height x depth)		600 mm x 700 mm x 480 mm	The appearance and base of the battery cabinet is consistent with those of the APM30 cabinet.
Dimensions of the base (width x height x depth)		600 mm x 200 mm x 480 mm	
Installation mode		The APM battery cabinet can be installed on the ground. It can be also installed with the power cabinet in stack mode.	-
Working environment	Working temperature	Consistent with the APM30 cabinet	
	Solar radiation		
	Relative humidity		
	Altitude		
Dustproof and waterproof		IP34	

3.2 Introduction to APM30H Series Products

The APM30H, an advanced power module cooled by the heat exchanger, is designed to operate in low-air-quality areas where heat dissipation of the cabinet always deteriorates due to dust block. In addition, the APM30H can work with the diesel. In one word, the air quality has little impact on the performance of the APM30H.

The APM30H applies to the distributed BTSs and separated BTSs. It provides space for installing the BBU and user equipment. The APM30H performs the following functions:

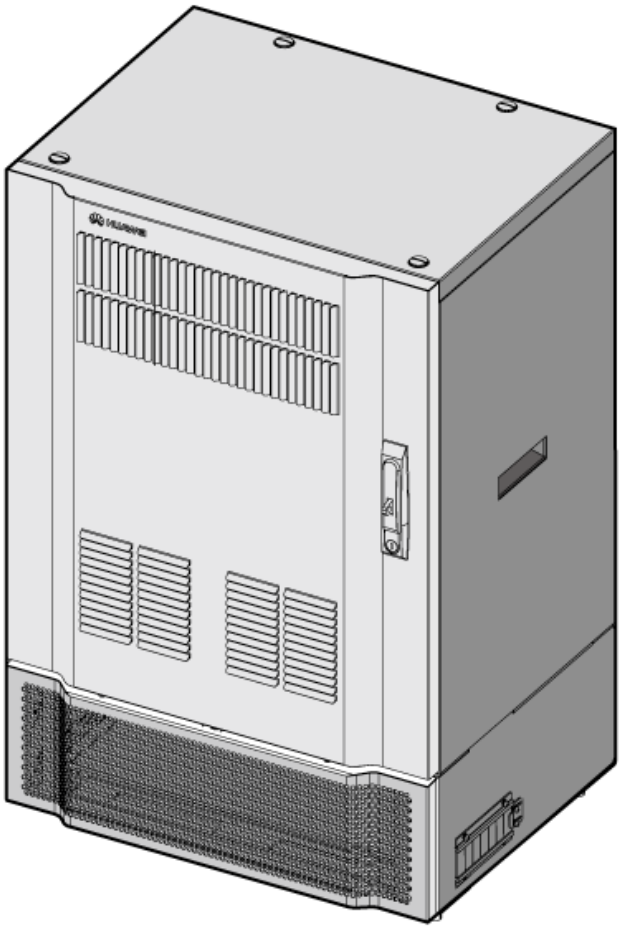
The TEC cooler is installed on the inner side of the IBBS200T cabinet door, enabling the IBBS200T to adapt to high ambient temperature. In this way, the normal working temperature of the batteries can be guaranteed, and the life span of the batteries can be prolonged. The IBBS200T can provide a maximum backup power of 48 V 200 Ah.

When the APM30H is configured with an IBBS200T, it can meet the long-term power requirements of the distributed and separated BTSs.

The APM30H can be installed on the rooftop or concrete floor. It can be also installed with the IBBS200T or RF cabinet in stack mode.

3.2.1 APM30H

Appearance of the APM30H



Functions of the APM30H

DC power distribution functions of the APM30H working with the separated BTS

Application	AC Input Mode	PDU Type	DC Power Supply Unit	DC Output Terminal	MCB Specification	MCB Quantity	Remarks
Distributed BTS	Three-phase 220/380 V AC	PDU-01	RRU	LOAD4 to LOAD9	20 A	6	The six 20 A MCBs control six DC outputs for the power supply of six to twelve RRUs.
	Single-phase 220 V AC		BBU	LOAD3	12 A	1	One 12 A MCB controls one DC output to supply power to the BBU.
	Dual-live-wire 110 V AC	PDU-02	AFMU	LOAD2	12 A	1	One 12 A MCB controls one DC output to supply power to the AFMU.
			TM	LOAD0, LOAD1	4 A	2	Two 4 A MCBs control two DC outputs to supply power to the transmission equipment.

DC power distribution functions of the APM30H working with the distributed BTS

Application	AC Input Mode	PDU Type	DC Power Supply Unit	DC Output Terminal	MCB Specification	MCB Quantity	Remarks
Separated BTS	Three-phase 220/380 V AC	PDU-03	DCDU-02 in the RF cabinet	LOAD7 to LOAD9	30 A	3	Three 30 A MCBs control three DC outputs to supply power for the RF cabinet, and each MCB supports three RFU modules.
	Single-phase 220 V AC		DCDU-03 in the RF cabinet	LOAD6	30 A	1	Spare
			BBU	LOAD5	12 A	1	One 12 A MCB controls one DC output to supply power to the BBU.
			FAN	LOAD4	12 A	1	One 12 A MCB controls one DC output to supply power to the AFMU.
	Dual-live-wire 110 V AC	PDU-04					
			TM	LOAD0 to LOAD3	4 A	4	Four 4 A MCBs control four DC outputs to supply power to the transmission equipment.

Function Item	Function Description
Providing installation space for user equipment	Provides a space of 7 U for the installation of user equipment.

Function Item	Function Description
Built-in PSU	The PSU converts the AC input mains into the -48 V DC power. The PSU is hot-swappable.
Built-in PMU	The PMU provides the functions such as PSU management and battery charge and discharge management. The PMU provides RS485 communication ports and dry contact alarm ports for remote and unmanned monitoring. Supports the battery low voltage disconnect (BLVD) and load low voltage disconnect (LLVD) functions. The PMU is hot-swappable.
AC power distribution	The APM30H provides an AC/DC built-in power system. When configured with a suitable power distribution box, the built-in power system can support different input power such as 220 V single-phase AC input, 220 V three-phase AC input, and 110 V AC dual-live wire input. The APM30H provides two AC outputs.
Lightning protection for power supply ports and signal ports	In the APM30H, the lightning protection circuit is designed for the dry contact alarm ports and the communication ports. In this way, the APM30H provides safe and reliable surge protection and inductive lightning protection.
Heat dissipation	The core of the heat exchanger and fans in the APM30H work together for heat dissipation. Therefore, the APM30H is adaptable to the variation of ambient temperature.
Grounding mode	The grounding bus of the cabinet, the grounding cable of the surge protector, and the grounding cables of other equipment are connected to the grounding bar of the cabinet.
DC power distribution	You can choose various PDU modules based on various AC input modes and applications to implement the DC power distribution function. For details, see the *APM30H DC Power Distribution for Distributed BTS* and *APM30H DC Power Distribution for Separated BTS*.

Electrical Specifications of the APM30H

Parameter		Specification
Characteristic of AC inputs	Typical input voltage	200 V AC to 240 V AC (220 V AC single-phase)
		200/346 V AC – 240/415 V AC (220/380 V AC three-phase)
		100/200 V AC – 120/240 V AC (110 V AC dual-live-wire)
		120/208 V AC – 127/220 V AC (120 V AC dual-live-wire)
	Input voltage range	176 V AC – 290 V AC (220 V AC single-phase)
		176/304 V AC to 290/500 V AC (220 V AC three-phase)

Parameter		Specification
		90/180 V AC – 135/270 V AC (110 V AC dual-live-wire)
		105/176 V AC –150/260 V AC (120 V AC dual-live-wire)
	Input voltage frequency	50 Hz or 60 Hz
	Maximum input current	16 A (220/380 V AC three-phase)
		30 A (110 V AC dual-live-wire/220 V AC single-phase)
	Input mode	Supports the voltage of 220/380 V AC three-phase. Supports the 110 V dual-live-wire AC power input. Supports the 120 V dual-live-wire AC power input. Supports the voltage of 220 V AC single-phase.
Characteristic of DC outputs	Output voltage range	-44 V DC to -58 V DC
	Output current range	0 A to 60 A when two PSUs are configured 0 A to 90 A when three PSUs are configured
	Typical output voltage	-53.5 V DC
	DC outputs	The APM30H provides 10 DC outputs.
	10	The distributed BTS uses: Six LLVD MCBs and four BLVD MCBs The separated BTS uses: Four LLVD MCBs and six BLVD MCBs
	DC output power	≤ 4800 W
Heat consumption inside the cabinet		≤ 500 W
Protection	Input protection	Overvoltage protection: The system generates an alarm when the input voltage exceeds the AC overvoltage alarm threshold (280 V by default). Undervoltage protection: The system generates an alarm when the input voltage is lower than the AC undervoltage alarm threshold (180 V by default).
	Output protection	Overvoltage protection: The system generates an alarm when the busbar voltage exceeds the DC overvoltage alarm threshold (-58 V by default). Undervoltage protection: The system generates an alarm when the busbar voltage is lower than the DC undervoltage alarm threshold (-45 V by default). Overcurrent protection and short-circuit protection

Parameter		Specification
Lightning Protection Indexes	Lightning protection for AC input ports	In differential mode: Rated through-current capacity In (8/20us):25kA Maximum through-current capacity Imax (8/20 us): 60 kA
		In common mode: Rated through-current capacity In (8/20us):25kA Maximum through-current capacity Imax (8/20 us): 60 kA
	Lightning protection for DC output port of the cabinet	In differential mode (8/20 us): 10 kA In common mode (8/20 us): 15 kA The DC output corresponds to the secondary load.
	Lightning protection for signal ports	In differential mode (8/20 us): 3 kA In common mode (8/20 us): 5 kA

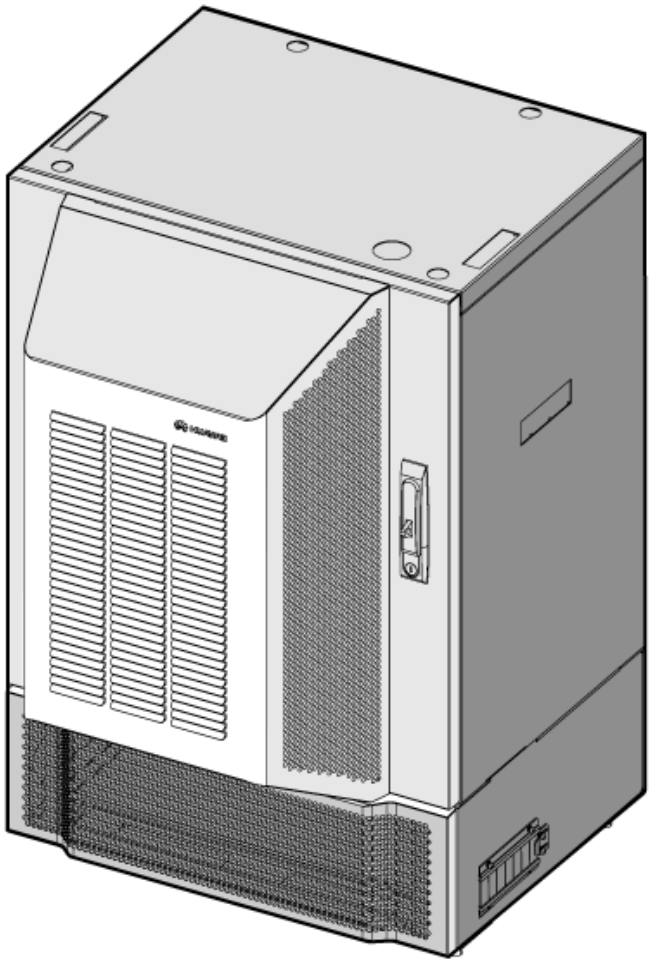
Engineering Specifications of the APM30H

Parameter	Specification	Remarks
Cabinet weight	≤ 76.5 kg	Total weight of the equipment Including cabinet, core of the heat exchanger, power subrack (AC/DC), PDU, HEUA, HPMI, and cables Excluding BBU, transmission equipment, PMU, and PSU
	≤ 95.5 kg	The weight in the case of full configuration Including the cabinet, core of the heat exchanger, power subrack (AC/DC), PDU, HEUA, HPMI, cables, one PMU, three PSUs, and one BBU Excluding the user transmission equipment
Cabinet dimensions (width x height x depth)	600 mm x 700 mm x 480 mm	Without bases
Dimensions of the base (width x height x depth)	600 mm x 200 mm x 480 mm	-
Cabling and maintenance space at the front	≥ 70 mm	-

Parameter		Specification	Remarks
Installation mode		The APM30H can be installed on the rooftop, concrete floor, and overhead platform. It can be also installed with the RF cabinet or battery cabinet in stack mode.	-
Working environment	Working temperature	-40 °C to +50 °C	When the APM30 works under –20 °C, the heater is required. Note: The working temperature for configuring the heater refers to the local average lowest temperature of each day in the coldest month of the year.
	Solar radiation	1120 ± 10% W/m^2	-
	Relative humidity	5% RH to 100% RH	-
	Altitude	≤ 4700 m	At the altitude from 3,500 m to 4,700 m, the maximum operating temperature drops by 1°C each time the altitude increases by 100 m.
Dustproof and waterproof		IP55 (excluding the battery cavity)	
Annual failure rate of the rectifier		< 1%	
Annual failure rate of the monitoring module		< 0.5%	

3.2.2 IBBS200T

Appearance of the IBBS200T



Engineering Specifications of the IBBS200T

Parameter	Specification	Remarks
Cabinet weight	≤ 55 kg	The weight is the total weight of the equipment containing the cabinet, TEC cooler, MCBs, and cables.
Battery capacity	A maximum of 48 V 184 Ah	Mono-battery capacity: 12 V 92 Ah
Cabinet dimensions (width x height x depth)	600 mm x 700 mm x 480 mm	Excluding the height of the base Excluding the depth of the TEC
Dimensions of the base (width x height x depth)	600 mm x 200 mm x 480 mm	-

Parameter		Specification	Remarks
Installation mode		The IBBS200T can be installed on the rooftop or on the concrete floor. In addition, an IBBS200T can be installed with the APM30H, RF cabinet, or another IBBS200T in stack mode.	-
Working environment	Working temperature	-10 °C to +50 °C	
	Solar radiation	1120 ± 10% W/m^2	
	Relative humidity	5% RH to 100 RH	
	Altitude	≤ 4700 m	At the altitude from 3,500 m to 4,700 m, the maximum operating temperature drops by 1 ºC each time the altitude increases by 100 m.
Dustproof and waterproof		IP34	

4 eNodeB Design Principles

4.1 Design Principles in the Equipment Room

- Cabinet Layout Principles
  - The layout meets the bearing requirements.
  - Enough space is reserved for expansion.
  - The layout facilitates cabling. Avoid conflict of AC power cables, DC power cables, and signal cables.
  - The design should be reasonable and feasible, and the layout of the equipment room should be beautiful.
- Specific Principles
  - The power rectifier should be located near the AC power distribution cabinet.
  - The indoor grounding bar should be located near the cable rack.
  - The outdoor lightning protection alarm box should be installed two meters away from the RRU.
  - The environment alarm chest should be installed at a height of 1,500 mm.
- Cabling Principles
  - The power cables are routed separately from the transmission cables, signal cables, alarm cables, and feeders. If they must be routed in parallel, the spacing between them must be greater than 200 mm.
  - The cabling should meet the requirements for feeder bending radius: 7/8″ feeder ≥ 250 mm; 5/4″ feeder ≥ 380 mm.

- The back edge of the cable rack should be level with the back edge of the cabinet to facilitate cabling.
- The design of the indoor cable rack should consider the cabling of all the equipment in the equipment room. Use the fewest cable rack to route all the cables. The layout of cable racks should consider the installation of the specific equipment to facilitate cabling. The width of the cable ladder should be 400 mm, and the installation height should be 2,400 mm.
- The dimension of the feeder window is 400 mm x 400 mm, and the dimension of the corresponding feeder hole on the wall is 250 mm x 250 mm. The lower edge of the feeder hole should be 100 mm higher than the higher edge of the indoor cable rack.

4.2 Design Principles for the Antenna System

- Summary of engineering parameters: The primary principle of the antenna design is to achieve the early radio network planning. Before the design, you must obtain the summary of the engineering parameters specified during the early network planning. The summary of the engineering parameters, which is the basis of the antenna design, includes the contents such as the antenna mount height, sector azimuth angle, sector down tilt angle, and antenna model.
- Antenna mount: To facilitate the installation of the antenna mount, you should consider the tower platform, the roof of the building, the physical dimension of the antenna, and the requirements for diversity distances and intervals. When installing the antenna on the tower platform, you must ensure that the horizontal interval between the antenna and the tower or other metal objects is greater than two meters. When the antenna is installed on the roof of a building, the effective height of the lower edge compared with the floor in the antenna radiation direction (h) and the distance between the roof edge in the antenna radiation direction and the antenna mount (d) should meet certain requirements. The following table lists the relations between h and d.

H	Diameter
0.5 m	0 m to 2m
1 m	2 m to 10 m
2 m	More than 10 m

- Roof mast: When the height of the building cannot meet the requirement for the antenna mount height, you can mount a mast on the roof of the building. In addition, you should consider other objects on the roof and avoid shielding the antenna.
- Outdoor cable rack: You should try to lay the cable rack along the wall, choose the shortest routing, reduce the difficulty of the installation, and facilitate the grounding of the feeder. The width of the cable rack should meet the cabling requirements.
- Lightning protection requirements: You should install the antenna within the protection range of the lightning rod. You can install a lightning rod on a mast when a directional antenna is installed on the roof. In other scenarios, however, you must install a professional lightning rod. The protection angle of the lightning rod should be not greater

than 45° in plain areas and not greater than 30° in mountainous areas or the areas where lightning occurs frequently.

- Antenna isolation requirements: The horizontal interval between two antennas in different sectors of a same system should be greater than three meters. Between two systems, when two antennas of a same sector are in the same direction, the horizontal interval between the antennas should be equal to or greater than three meters, and the vertical interval should be equal to or greater than 0.5 meter. (Antenna diversity requirements: When the diversity receiving is achieved by using the space diversity, the horizontal interval between two antennas should be equal to or greater than ten wavelengths. In engineering implementation, the horizontal interval is recommended to be equal to or greater than three meters.)

5 Requirements of eNodeB Survey Photos

5.1 Photo Description

Photos can objectively reflect the actual situation of the onsite survey and directly affect the quality of the eNodeB cutover scheme made in later period. Taking photos is an important operation in the eNodeB survey, and you must ensure the quality and quantity of the photos.

The following section lists the photo requirements, and you can add shooting spots and the photo quantity according to the actual situation. If no equipment is available for taking photos, you can omit this operation.

5.2 Photos and Requirements

1. eNodeB panoramic photo: The photo must clearly display the panorama of the NodeB. At least one photo is required.
2. Tower panoramic photo: The photo must clearly display the panorama of the tower. At least one photo is required.
3. Antenna photo: The photo must clearly display the panorama of the antenna. At least one photo is required.
4. External and internal views of the original cabinet: The photo must clearly display the original cabinet in its location, model, RF modules, jumper connections, power supply, and grounding. At least four photos are required.

5. Location of the new cabinet: The photo must clearly display the environment around the new cabinet. At least three photos are required.
6. Cable rack: The photo must clearly display the location and installation mode of the cable rack. At least two photos are required for a single cable rack.
7. External and internal views of the transmission equipment: The photo must clearly display the location and model of the transmission equipment. For optical fiber transmission equipment, the photo must display the terminals and terminal types used in the existing network, number of free terminals of the transmission equipment, and connector types of the optical fiber between the BBU and the RRU; for microwave transmission equipment, the photo must display the equipment model, outlet line terminals, and labels (especially for the label of the transmission office direction). At least four photos are required.
8. Microwave outdoor unit: The photo must display the panorama and model of the microwave outdoor unit. At least two photos are required.
9. External view of the equipment room: The photo must clearly display the panorama of the equipment room. At least one photo is required.
10. Internal view of the equipment room: The photo must display all devices and spaces in the equipment room. If multiple photos are required, the photos must keep coherent with each other in the following way, that is, each photo should contain certain parts of the former photo. At least six photos are required.
11. External and internal views of the microwave equipment: The photo must display the location, model, and connection mode of the microwave equipment. At least two photos are required.
12. External and internal views of the power supply equipment: The photo must clearly display power supply equipment model, location of the supply line connection terminal in the existing network, location of the supply line connection terminal of the new equipment, free terminals of the cabinet, number of the equipment modules, MCB usage in the power supply equipment, and internal parts at the back of the power supply equipment. At least five photos are required.
13. External and internal views of the external alarm box: The photo must clearly display the connection mode and alarm cable type of the external alarm box. At least two photos are required.
14. Outdoor and indoor protection grounding bar: The photo must clearly display the location, occupied hole location, and free hole location. At least two photos are required.
15. Outdoor and indoor views of the feeder window: The photo must clearly display the quantity, location, number of occupied hole locations, and number of free hole locations. At least two photos are required for a single feeder window.
16. Jumper panoramic photo: The photo must cover the panorama of the jumper between the RF port of the original cabinet and the connection port of the jumper and feeder and clearly display the cabling mode and quantity. At least two photos are required.
17. Jumper and cabinet side: The photo must clearly display the connection between the jumper and the cabinet, including the jumper connection location and jumper terminal type. At least two photos are required.
18. Jumper and feeder side: The photo must clearly display the connection between the jumper and the feeder, including the connection location and connection terminal type. At least two photos are required.

19. Staircase, elevator, and other portals: At least one photo is required for each portal.
20. Auxiliary equipment: If the original equipment is configured with auxiliary equipment such as power splitter, combiner, tower amplification, repeater, coupler, and indoor feeder lightning arrester, the photo must display the equipment model, location, and connector model. Certain auxiliary equipment are located on the outdoor antenna, you need to search and identify them carefully. To display the complete site, you are required to take two photos for a single auxiliary equipment, including the distant view and close view.
21. Others: You can shoot other locations of the eNodeB, especially for the parts that may affect the eNodeB installation.

6 Note to Fill in the eNodeB Survey Report

To facilitate the survey engineers to effectively perform site surveys and output comprehensive and accurate survey information, this chapter provides a detailed description on the use of the *Site Survey Report Template for the 3900 series LTE eNodeB*.

Based on the types of the BTSs, Huawei provides three kinds of BTS survey report templates, which are the *DBS3900 LTE Survey Report Template*, *BTS3900 LTE Survey Report Template*, *BTS3900A LTE Survey Report Template*.

The actual conditions of the projects are different; therefore, each project team can add, delete, or modify the specific survey items in the corresponding survey report templates based on the actual requirements of the project.

The survey report templates provided by Huawei share the same structure, including the following two parts: site common information and site material information. For the BTS3900/BTS3900A, the feedback on the delivery method is required. The following sections describe the survey report templates for BTS3900 and BTS3900A.

6.1 Description on Filling in the BTS3900 LTE Survey Report Template

Common Site information: Mainly includes the site basic information such as site ID, site name, detailed address, site engineering type, etc. This information is obtained from the customer before the site survey. If the survey result is different from the information provided by the customer, you must update the information based on the survey result.

Delivery method: You need to determine whether the BTS3900 is delivered with boards. By default, the BTS3900 is delivered with boards. When the BTS3900 is delivered with boards, the internal modules and cables of the cabinet are connected. Therefore, you can save much time when installing the internal modules and connecting the cables. If the BTS3900A is not delivered with boards, you need to provide the reasons.

Site material information: Includes the information such as the major device, auxiliary device, power supply system, grounding cables, S1/X2 port transmission information, alarm device, antenna system, other materials, etc.

1. In the major device survey, you need to survey the requirements on the lightning protection board and power input cable of the BTS3900 indoor macro cabinet.

2. In the auxiliary device survey, you need to survey the adopted auxiliary devices, such as the length of the power input cable of the DCDU-03 DC power distribution box. Note: The V210 transmission cabinet of Huawei is delivered with the matched materials by default. Therefore, the site survey is not required. You need to perform the survey only when the DCDU DC power distribution box is configured separately.

3. In the power supply system survey, you need to survey the type of the power supply provided by the customer. For the site that requires the primary power supply system, you need to survey the length and mode of the power cable required by the primary power supply system. For example, when the PS4890 indoor power supply cabinet is used, you need to determine the length and mode of the power cable between the 220 V AC power supply port provided by the customer and the power input port of the PS4890 indoor power supply cabinet

4. In the grounding cable survey, you need to determine the length of the grounding cable required by each device and then make a statistics report. During the survey, you must pay attention to the color of the PGND cable and type of the grounding terminal. (Huawei provides only the single-hole OT terminals.

5. In the S1/X2 transmission survey, you need to confirm the transmission cable type provided by the customer. The types include: GE port electrical network cable, single-mode optical cable, and multi-mode optical cable.

   If GE optical transmission is applied, single-mode optical module is delivered by default. For single-mode optical transmission, you need to survey the connector type on the customer side. During the survey, you need to confirm the transmission cable length (the distance between the transmission cable on the customer side and the cabling router on the device access side). If the optical transmission is used, you also need to survey the related information of the auxiliary parts.

6. In the alarm cable survey, you need to survey the required length and quantity of the alarm cable on site. If no site survey is performed, deliver a 5 m alarm cable for each site. Based on the alarm cable quantity, the complete set department determines whether the UEIU board or EMU module is delivered.

7. In the antenna system survey, you need to pay attention to the following four points:

   1) Antenna feeder. If the required feeder length is less than 14 m, you can use the 1/2 inch jumper as the feeder. If the required feeder length is more than 14 m and less than

50 m, you can use the 7/8 inch feeder. If the required feeder length is more than 50 m, you can use the 5/4 inch feeder. If the customer has special requirement, you can use the 13/8 inch feeder.

2) Jumper. The jumper (with fixed length of 2.5 m) on the antenna side is delivered with the feeder package. When the site survey on the cabinet top jumper is not performed, the jumper with fixed length of 4 m on the cabinet top side is delivered. The connector for the jumper is DIN50 straight male connector and DIN50 bend mail connector. During the survey, you need to confirm the required jumper length and connector type. If the jumper with non-fixed length is required, make some remarks.

3) Feeder window. During the survey, you need to confirm whether the existing feeder window meets the requirements. If it does not meet the requirements, you need to survey the feeder window type.

4) Electric regulator. If the AISG multi-core cable is used, you need to confirm the length of the cable. When no site survey is performed, the 5 m multi-core cable is delivered by default. If the distance is from 5 m to 20 m, you need to deliver the 15 m multi-core extended cable. If the distance exceeds 20 m, you need to adopt other modes (SMBT or STMA).

8. In the GPS survey, for FDD system, GPS is optional. According to BoQ deciding whether it is needed or not. If the contact has some provisions on the GPS, you need to survey the length of the GPS antenna jumper. When no site survey is performed, each GPS antenna system requires 25 m 1/2 inch super flexible jumper. If the customer has special requirements on the jumper length, you need to make some remarks. The greatest jumper length is not more than 100 m. If the required length is more than 100 m, you need to use the 7/8 inch feeder.

9. In the auxiliary material survey, you need to survey the MCB, pole, DDF, cable ladder, grounding bar, shockproof components, and installation bracket on anti-static floor.

6.2 Description on Filling in the BTS3900A LTE Survey Report Template

Common Site Information: Mainly includes the basic information such as the site name, detailed address, site engineering type, etc. This information is obtained from the customer before the site survey. If the survey result is different from the information provided by the customer, you must update the information based on the survey result.

Delivery method: You need to determine whether the BTS3900A is delivered with boards and whether the APM30 cabinet and RF cabinet are delivered together. By default, the BTS3900A is delivered with boards, APM30 cabinet and RF cabinet are delivered together. When the BTS3900A is delivered with boards, the internal modules and cables of the cabinet are connected. Therefore, you can save much time in installing the internal modules and connecting the cables. If the BTS3900A is not delivered with boards, you need to provide the reasons. If the APM30 cabinet and RF cabinet are to be combined or to be deployed in the remote installation scenario, the APM30 cabinet and RF cabinet can be delivered separately.

Site material information: Includes the information such as the major device, auxiliary device, power supply system, power input cables, CPRI optical cables, grounding cables, S1/X2 port transmission information, alarm device, antenna system, and other materials.

1. In the auxiliary device survey, you need to survey the adopted auxiliary devices, such as the TMC DC transmission cabinet and BBC Battery cabinet. During the survey, you must specify the length and installation mode of the power input cable. The length of the power input cable refers to the length of the power cable between the power port provided by the customer and the power input port on the cabinet. In the survey of cable installation mode, you need to check whether the cabinet is installed on a pole, on a wall, or on the ground. In different installation modes, the installation parts are different

2. In the power supply system survey, you need to survey the type of the power supply provided by the customer.

3. In the grounding cable survey, you need to determine the length of the grounding cable required by each device and then make a statistics report. During the survey, you must pay attention to the color of the PGND cable and type of the grounding terminal. (Huawei provides only the single-hole OT terminals.)

4. In the S1/X2 transmission survey, you need to confirm the transmission cable type provided by the customer. The types include: GE port electrical network cable, single-mode optical cable, and multi-mode optical cable.

   If GE optical transmission is applied, single-mode optical module is delivered by default. For single-mode optical transmission, you need to survey the connector type on the customer side. During the survey, you need to confirm the transmission cable length (the distance between the transmission cable on the customer side and the cabling router on the device access side). If the optical transmission is used, you also need to survey the related information of the auxiliary parts.

5. In the alarm cable survey, you need to survey the required length and quantity of the alarm cable on site. If no site survey is performed, deliver a 5 m alarm cable for each site. Based on the alarm cable quantity, the complete set department determines whether the UEIU board or EMU module is delivered.

6. In the antenna system survey, you need to pay attention to the following four points:

1) Antenna feeder. If the required feeder length is less than 14 m, you can use the 1/2 inch jumper as the feeder. If the required feeder length is more than 14 m and less than 50 m, you can use the 7/8 inch feeder. If the required feeder length is more than 50 m, you can use the 5/4 inch feeder. If the customer has special requirement, you can use the 13/8 inch feeder.

2) Jumper. The jumper (with fixed length of 2.5 m) on the antenna side is delivered with the feeder package. When the site survey on the cabinet top jumper is not performed, the jumper with fixed length of 3 m on the cabinet top side is delivered. The connector for the jumper is DIN50 straight male connector and DIN50 bend mail connector. During the survey, you need to confirm the required jumper length and connector type. If the jumper with non-fixed length is required, make some remarks.

3) Feeder window. During the survey, you need to confirm whether the existing feeder window meets the requirements. If it does not meet the requirements, you need to survey the feeder window type.

4) Electric regulator. If the AISG multi-core cable is used, you need to confirm the length of the cable. When no site survey is performed, the 5 m multi-core cable is delivered by default. If the distance is from 5 m to 20 m, you need to deliver the 15 m multi-core extended cable. If the distance exceeds 20 m, you need to adopt other modes (SMBT or STMA).

7. In the GPS survey, for FDD system, GPS is optional. According to BoQ deciding whether it is needed or not. If the contact has some provisions on the GPS, you need to survey the length of the GPS antenna jumper. When no site survey is performed, each GPS antenna system requires 25 m 1/2 inch super flexible jumper. If the customer has special requirements on the jumper length, you need to make some remarks. The greatest jumper length is not more than 100 m. If the required length is more than 100 m, you need to use the 7/8 inch feeder.

8. In the auxiliary material survey, you need to survey the MCB, pole, DDF, cable ladder, grounding bar, bellow, shockproof components, and installation bracket on anti-static floor.

7 Survey Information Sorting and Survey Report Delivery

7.1 Sorting and Confirmation of Survey Information

Handle the collected information as soon as possible. The handled documents must be confirmed by the customer and delivered to the related departments.

- Complete the installation environment checklist based on the site conditions.
- Prepare engineering drawings based on the rough drawings and the survey records. The design of the equipment room and antenna system should comply with the related design specifications. The drawing should comply with the drawing specifications.
- Fill in the survey report according to the contract list, engineering responsibility interface, engineering drawings, and survey records. The special requirements on site can be describes in the remarks column in the survey report.
- If you come across a contract quotation problem, you should fill in the Contract Problem Feedback List and submit it to the project manager and order manager.
- After the primary survey tasks are complete, summarize the site conditions, special problems, possible problems that may occur during engineering implementation, problems that occur during survey, and solutions, and then output a survey summary.
- After the information is handled, to avoid the customer making change, which may cause installation failure or wrong delivery, and to urge the customer to complete the

preparatory tasks, ensure that the installation environment checklist, engineering drawings, and survey report are signed by the customer.

- For the preparatory tasks that are not completed, the customer must promise the completion date in the installation environment checklist. In special cases, if the customer does not want to modify the items that do not meet the requirements, you can sign a survey demo with the customer.

7.2 Survey Documents Handling

Deliver the documents confirmed by the customer to the related department according to the procedure to ensure the normal operation of the project.

- Send the survey report, engineering drawings, and work report to the survey review department. After the review, send the survey report to the order configuration department to guide placing order and delivering equipment.
- Submit the primary installation environment checklist to the project manager. The project manager monitors the preparatory tasks performed by the customer.
- Submit the engineering drawings to the system design department and the hardware department to generate engineering files. After the review, send the engineering files to the site to guide engineering construction.
- Submit the Contract Problem Feedback List to the project manager and order manager so that they can confirm the contract problems and handle delivery problems.
- Send the survey summary and demo to the project manager and send the copy to the system design department. The written documents that are signed by the customer must be archived in Huawei.