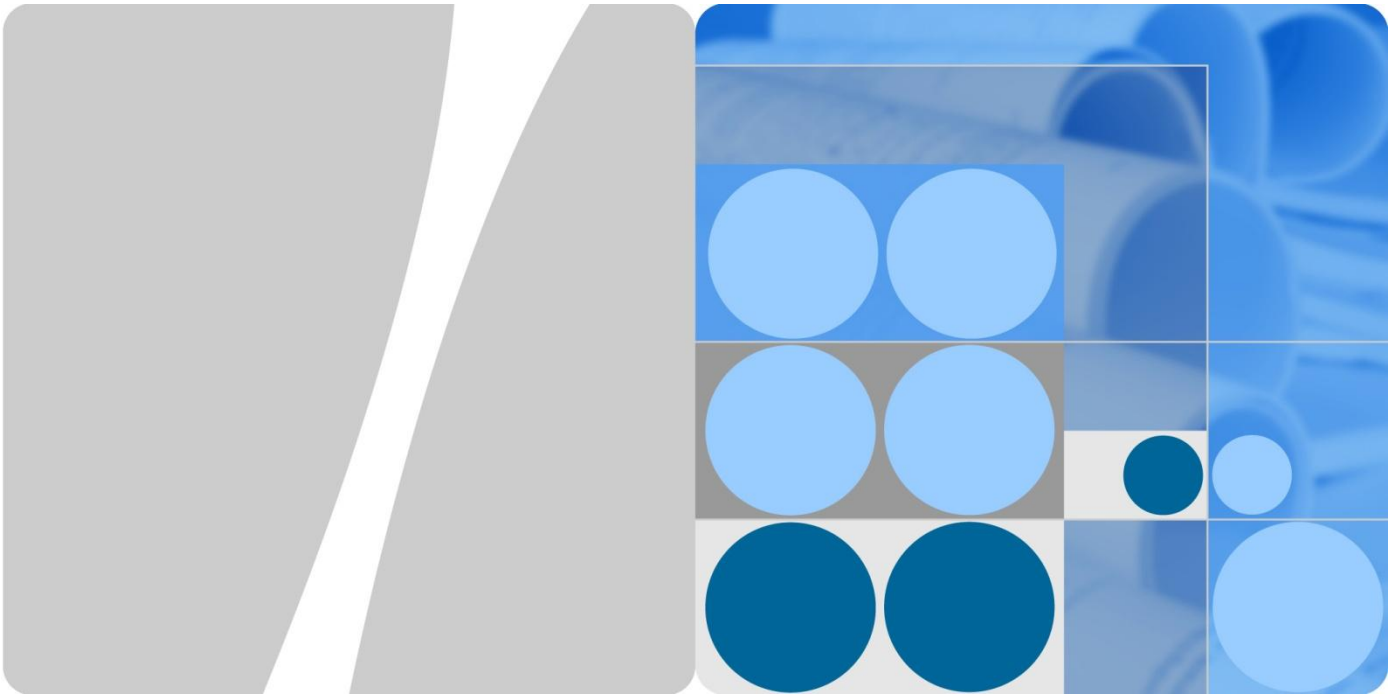

HUAWEI UGW9811 Unified Gateway

Product Description

Issue 01

Date 2014-03-01

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Contents

1 Product Orientation

1.1 Overview

This document describes HUAWEI UGW9811 V900R011.

The Huawei-proprietary UGW9811 (UGW9811) is a unified packet gateway that can be deployed in 2.5G General Packet Radio Service (GPRS) systems, 3G Universal Mobile Telecommunications Systems (UMTSs), or Evolved Packet Core (EPC) systems.

1.2 3GPP System Evolution

The mobile network has developed from the 2G global system for mobile communications (GSM), the 2.5G general packet radio service (GPRS), and the 3G universal mobile telecommunications system (UMTS) to the enhanced 3G (E3G) long term evolution (LTE). Mobile networks cover wide areas, achieve high-speed wireless data transmission, and allow access to the Internet.

- Brief Description of the Existing Network

  With the evolution of the radio technologies, existing networks have evolved from the 2G global system for mobile communications (GSM) to the 2.5G general packet radio service (GPRS) and lastly the 3G universal mobile telecommunications system (UMTS).

  This evolution has allowed mobile communications to achieve wide area coverage, high-speed radio data transmission, and integration with the Internet. The result is that the consumer can enjoy diversified services like voice, data, and video applications and "any time, any place" communication delivered in a personalized fashion.

  Currently, with the robust development of services and diversification of requirements, the 3G UMTS architecture is hindered by inherent limitations:

  - Insufficient support for packet switched domain (PS) network services. Generally, the 3G UMTS system is capable of supporting only non-real time services and depends on the circuit switched domain (CS) to bear voice services. This results in separate network operations for PS and CS, which hinders centralized network maintenance and management and increases OM expenditures.
  - Low efficiency in routing and forwarding data due to network overlayer. Therefore, network performance needs to be improved.

- Incapable of supporting multiple radio access systems. The development of service terminals in processing capabilities and radio access capabilities provides an impetus for the integration of multiple radio access technologies.

- Brief Description of the EPC Network

  To maintain a competitive edge in future networks, the 3rd Generation Partnership Project (3GPP) began to research the implications and long-term evolution of 3G technology—E3G technology. E3G refers to the enhanced 3G system, which has the following features:

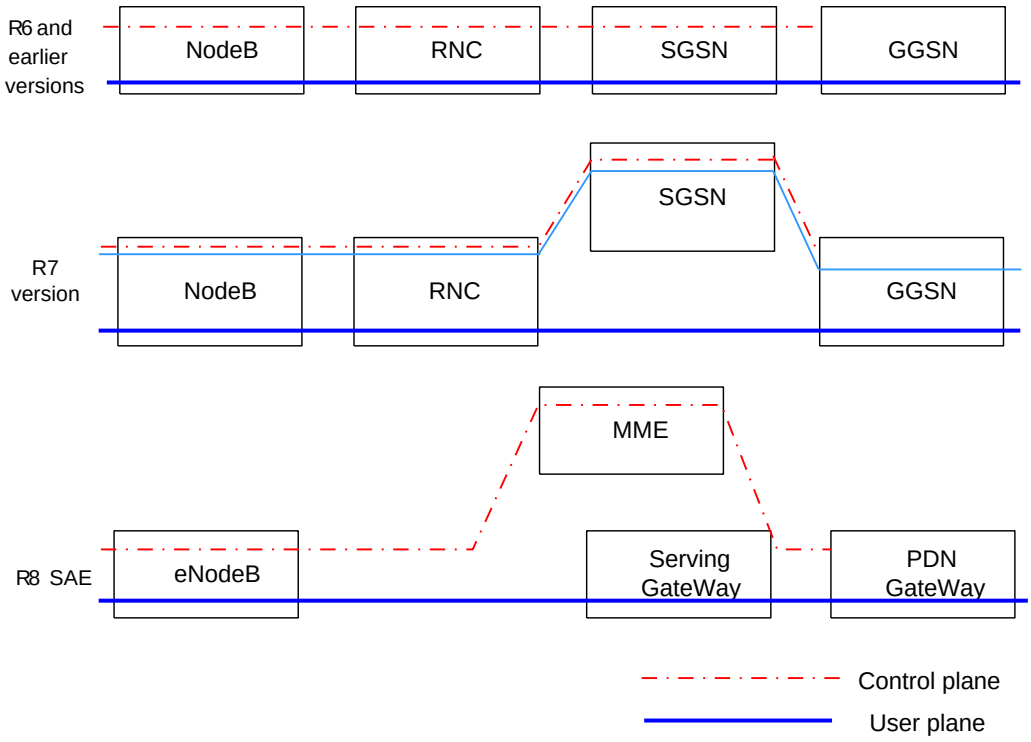
  - The technology for the air interface in E3G is LTE.
  - The core network evolution program of the LTE project is SAE, also known as the Evolved Packet Core (EPC).

  The 3GPP EPC project is working on a long-term program to explore key technologies in the next 10 years. According to the 3GPP evolution design, the EPC system provides the following features:

  - Overall packetization of the network architecture: The all-IP network contains only the PS. Voice services are jointly provided by the PS and the IP multimedia subsystem (IMS), enhancing the network efficiency and performance.
  - Delayered network architecture: The network architecture becomes simpler so that networks can be deployed more easily and data transmission delay is greatly reduced. The S-GW and P-GW may be implemented in one physical node, delayering the network.
  - Support for multiple access technologies: The EPC system supports interworking with the existing 3GPP system. In addition, it supports access of users in non-3GPP networks and provides roaming and handover between the 3GPP and non-3GPP networks for users.
  - High data transmission rate: The peak rate of the downlink traffic reaches 100 Mbit/s and the peak rate of the uplink traffic reaches 50 Mbit/s.
  - Fast deployment: Thanks to the simplified architecture, networks can be deployed rapidly to adapt to the requirements of the changing services.
  - Enhanced real-time services: The EPC system supports real-time services and reduces the setup time for service connections.

Figure 1-1 shows the evolution of the network architecture in the 3GPP standard.

Figure 1-1 Evolution of the network architecture in the 3GPP standard

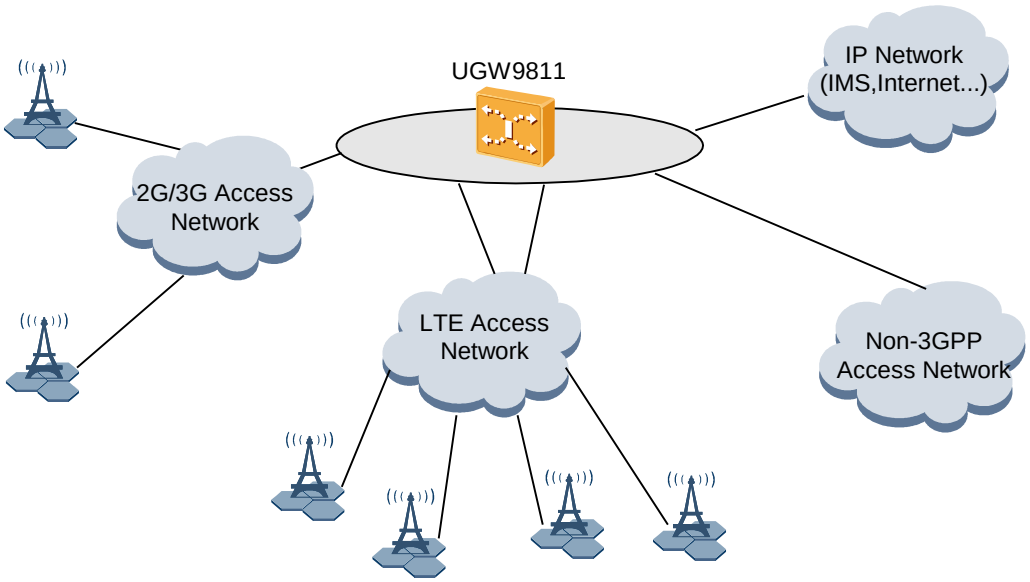


NodeB: 3G BTS
RNC: radio network controller
SGSN: serving GPRS support node
GGSN: gateway GPRS support node
eNodeB: evolved NodeB
MME: mobility management entity
Serving gateway: provided for implementing the service forwarding between the gateways
PDN gateway: packet data network gateway

The EPC network is designed for high-speed mobile packet data services. The network architecture is greatly simplified. Compared with the earlier versions, the architecture is optimized in the following ways:

- The LTE base stations are directly connected to the EPS core network. The previously independent base station controller (BSC) functions are integrated into the eNodeB.
- The PS domain is restructured as follows:
  - The signaling plane and forwarding plane of the serving GPRS support node (SGSN) are separated from each other. The signaling function of the SGSN is implemented by the mobility management entity (MME), and the forwarding function of the SGSN is implemented by the S-GW.
  - The functions of the GGSN are provided by the P-GW.
  - The S-GW and P-GW may be implemented in one physical node, delayering the network.
- The network converges with the non-3GPP networks such as CDMA2000 high rate packet data (HRPD) network, providing the interworking for various radio access technologies as shown in Figure 1-2.

Figure 1-2 Various types of radio accesses technologies implemented by the EPC system



1.3 Huawei EPC Solution

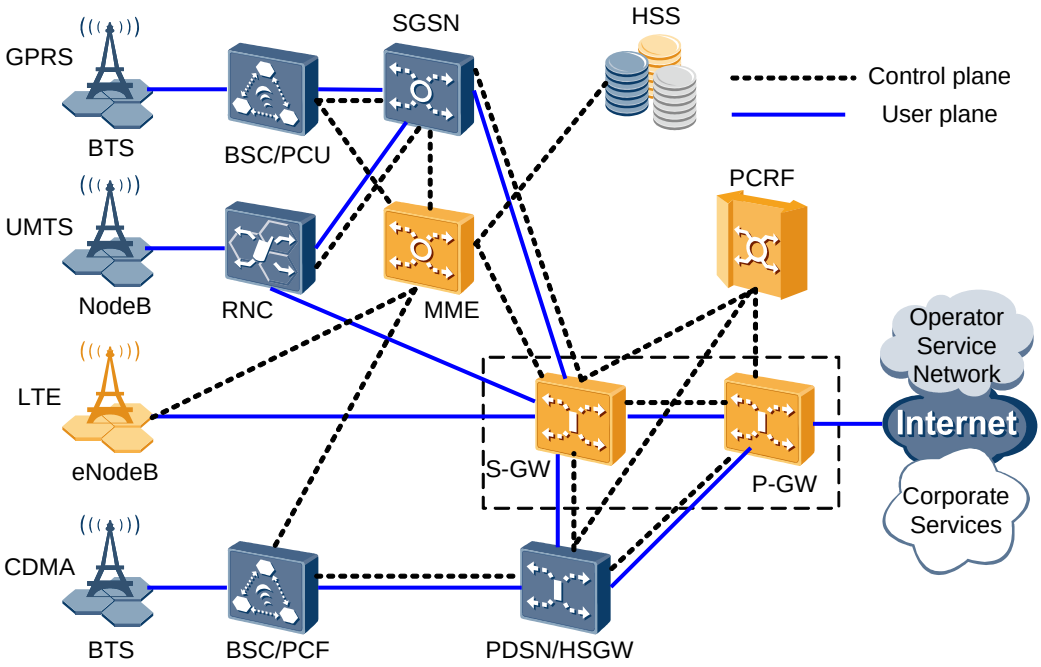
In response to the latest evolution of the network architecture, Huawei provides an EPC solution supporting different network elements (NEs) such as the MME, S-GW, P-GW, and policy and charging enforcement function (PCEF). This is in line with the developmental trends in multi-service and multi-access convergence.

The UGW9811 is deployed at the evolved packet core (EPC) and can provide the functionalities of the gateway GPRS support node (GGSN), serving gateway (S-GW), PDN gateway (P-GW), PCEF, or any combination of them. It is maintained as a single piece of equipment.

Application of the UGW9811 in Huawei EPC Solution

Figure 1-3 shows the network environment for application of the UGW9811 in a Huawei EPC solution.

Figure 1-3 Network environment for application of the UGW9811 in the Huawei EPC solution



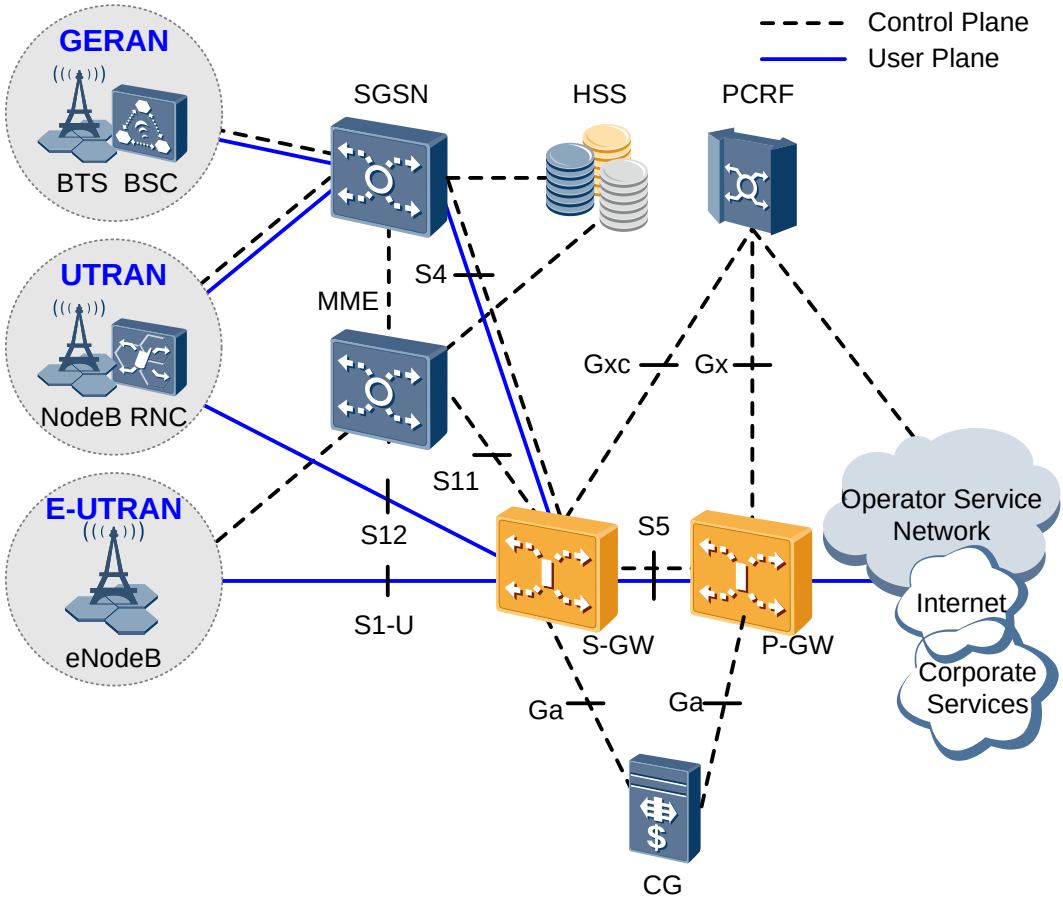
BTS: base transceiver station
NodeB: 3G BTS
SGSN: serving GPRS support node
eNodeB: evolved NodeB
S-GW: serving gateway
HSGW: HRPD serving gateway
PCRF: policy control and charging rules function
BSC: base station controller
RNC: radio network controller
HSS: home subscriber server
MME: mobility management entity
P-GW: PDN gateway
PDSN: packet data service node

Huawei EPC solution provides the following functions:

- Support the convergence of various 3GPP standard wireless networks (GERAN, UTRAN, or E-UTRAN)
- Support the EPC and compatibility with 2G/3G protocols and service functions
- Support the access of non-3GPP networks (CDMA2000 HRPD networks) with mobile IP technologies

Huawei EPC solution supports various network architectures described in 3GPP23.401 and 3GPP23.402. Figure 1-4 and Figure 1-5 show two typical types of network architectures. This document describes the supported interfaces and functions.

Figure 1-4 EPC network architecture for non-roaming 3GPP access



GERAN: GSM/EDGE radio access network

E-UTRAN: Evolved UMTS Terrestrial Radio Access Network

BSC: base station controller

RNC: radio network controller

SGSN: serving GPRS support node

HSS: home subscriber server

S-GW :serving gateway

PCRF: policy and charging rules function

UTRAN: UMTS Terrestrial Radio Access Network

BTS: base transceiver station

NodeB:3G BTS

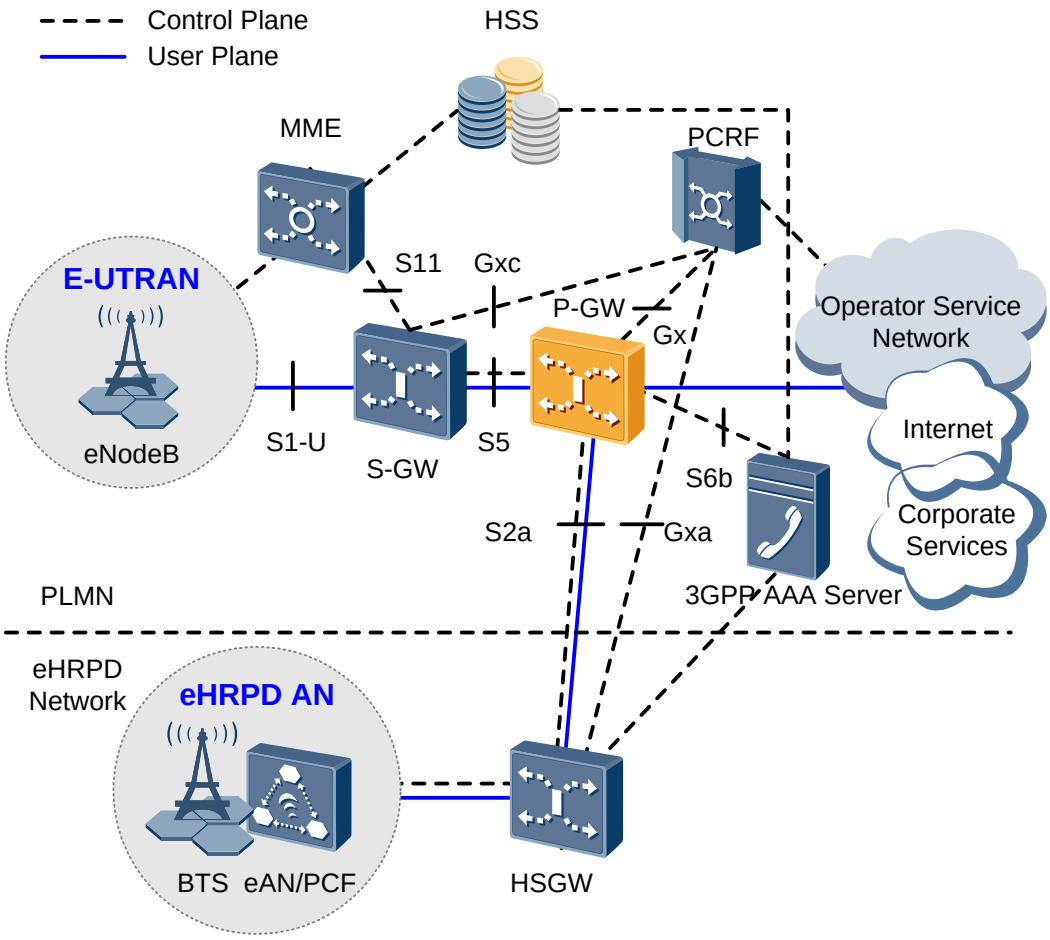
eNodeB: evolved NodeB

MME: mobility management entity

CG: charging gateway

P-GW: PDN gateway

Figure 1-5 EPC networking architecture for trusted non-3GPP access



eNodeB:evolved NodeB
HSS: home subscriber server
P-GW: PDN gateway
BTS: base transceiver station
PCF: packet control function
3GPP AAA Server :3GPP authentication, authorization and accounting server
MME: mobility managemententity
S-GW: Serving gateway
PCRF: policy and charging rules function
eAN: evolved access network
HSGW

The EPC network consists of the following:

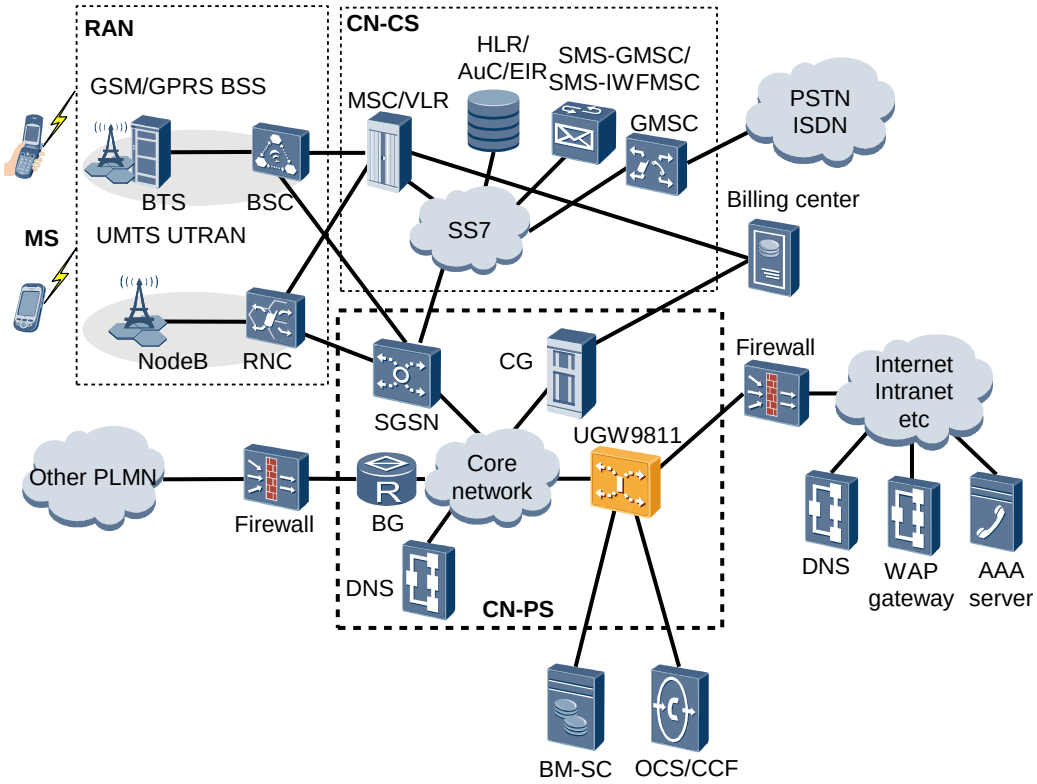
- User equipment (UE): a mobile user device, initiating and receiving calls over the air interface.
- E-UTRAN: implements all functions related to the radio access.
- EPC: core network that consists of the MME, S-GW, P-GW, and HSS and connecting to the external PDNs such as the Internet.

Application of the UGW9811 in the GPRS/UMTS Network

The UGW9811 supports multiple logical product forms and can meet carriers' various networking requirements at different stages and in different operation scenarios. The UGW9811 can serve as a GGSN in the GPRS/UMTS network.

Figure 1-6 shows the network environment for application of the UGW9811 in the GPRS/UMTS network.

Figure 1-6 Network environment for application of the UGW9811 in the GPRS/UMTS network

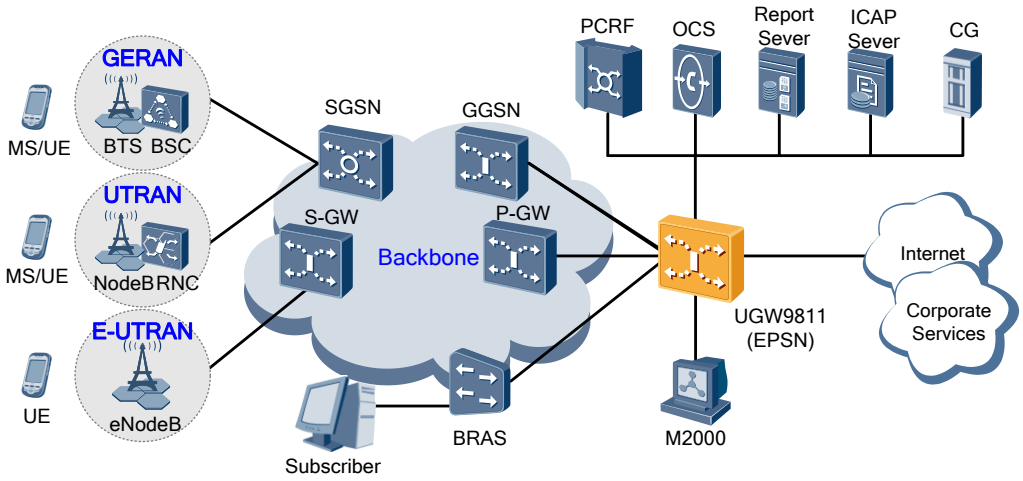


Application of the UGW9811 Functioning as an EPSN in GPRS/UMTS/EPC and Fixed Networks

When the UGW9811 serves as a GGSN/P-GW, it provides PCEF functions. In GPRS/UMTS/EPC networks, the UGW9811 can be deployed as an external PCEF support node (EPSN) between the GGSN/P-GW and PDN. In fixed networks, the UGW9811 can be deployed as an EPSN between the broadband remote access server (BRAS) and service networks/Internet.

Figure 1-7 shows the networking of the UGW9811 functioning as an EPSN in GPRS/UMTS/EPC and fixed networks.

Figure 1-7 Networking of the UGW9811 functioning as an EPSN in GPRS/UMTS/EPC and fixed networks



1.4 NE Introduction

E-UTRAN

The E-UTRAN implements all functions related to the radio access to the EPC network, including:

- Management and establishment of radio resources
- Header compression and user plane ciphering
- MME selection when no route to an MME can be determined from the information provided by the UE
- Uplink bearer level rate enforcement based on UE-aggregate maximum bit rate (AMBR) by means of uplink scheduling and maximum bit rate (MBR)
- Downlink bearer level rate enforcement based on UE-AMBR
- Uplink and downlink bearer level admission control
- Transport level packet marking in the uplink (for example, setting the DiffServ Code Point [DSCP] based on the QoS class identifier [QCI] of the associated EPS bearer)

MME

The MME is responsible for mobility management at the control plane, including management of the user contexts and mobile status and assignment of temporary identifiers. The functions of the MME include the following:

- Non-access stratum (NAS) signaling
- NAS signaling security
- Inter-CN node signaling for handover between 3GPP access networks (terminating S3)
- UE reachability in IDLE mode (including control and execution of paging retransmission)

- Tracking area list management
- P-GW or S-GW selection
- MME selection for handovers with MME change
- SGSN selection for handovers to 2G or 3GPP access networks
- Roaming (S6a towards home HSS)
- Authentication
- Bearer management functions including dedicated bearer establishment

S-GW

The S-GW is the anchor point at the user plane between different access networks. It can shield interfaces within the 3GPP network towards different access networks. The S-GW functions as the EPC gateway which terminates the interface towards the E-UTRAN.

The functions of the S-GW include the following:

- Local mobility anchor point for inter-eNodeB handover
- Assist the eNodeB reordering function during inter-eNodeB handover by sending one or more "end marker" packets to the source eNodeB immediately after switching the path
- ECM-IDLE mode downlink packet buffering and initiation of network triggered service request procedure
- Packet routing and forwarding
- Transport level packet marking in the uplink and downlink (DSCP)
- Perform accounting on user and QCI granularity for inter-operator fee charging

P-GW

The P-GW is the anchor point at the user plane between 3GPP access networks and non-3GPP access networks. The P-GW functions as the EPC gateway which terminates the SGi interface towards the PDN.

The functions of the P-GW include the following:

- Per-user based packet filtering (for example, Service Awareness [SA])
- UE IP address allocation
- Transport level packet marking in the uplink and downlink
- Uplink and downlink service charging (for example, based on service data flows [SDFs] defined by the PCRF or based on the SA defined by local policy)
- Uplink and downlink service level gating control
- Uplink and downlink service level rate enforcement (for example, by rate policing per SDF)
- Uplink and downlink rate enforcement based on APN-AMBR (for example, by rate policing per aggregate of traffic of all SDFs of the same UE-APN that are associated with Non-GBR)
- Downlink rate enforcement based on the accumulated MBRs of the aggregate of SDFs with the same GBR QCI (for example, by rate policing)
- DHCPv4 (server and client) functions
- IPv6 address allocation
- Uplink and downlink bearer binding

- Uplink bearer binding verification

SGSN

The EPC architecture supports both the Gn/Gp SGSN and the S4 SGSN.

The Gn/Gp SGSN inherits the SGSN functions of the 2G/3G network and supports the access of the existing GERAN/UTRAN to the GGSN. The S4 SGSN is the upgraded version of Gn/Gp SGSN, supporting the access of GERAN/UTRAN to the EPC as well as the switchover between the GERAN/UTRAN and E-UTRAN.

The SGSN is introduced to provide packet data services. The main function of the SGSN is to forward IP packets imported/exported by the UEs in the SGSN service area. The functions of the SGSN include the following:

- Routing and forwarding data packets from all mobile users in its own SGSN area
- Encryption and authentication
- Session management
- Mobility management
- Logical link management
- Charging data records (CDR) generation and export for collection of information about radio resource usage

GGSN

The GGSN is a functional entity that provides packet data services. It routes and encapsulates data packets between the GPRS/UMTS network and an external PDN. The GGSN provides the following functions:

- Interface to an external PDN

  The GGSN serves as a gateway for an MS to access the external PDN. For the external network, the GGSN serves as a router for all devices in the GPRS/UMTS network.
- GPRS/UMTS session management

  The GGSN sets up a connection between an MS and the external PDN.
- Data routing and forwarding

  The GGSN receives data from the MS and forwards the data to the external PDN. It also receives data from the external PDN and selects a transmission channel in the GPRS/UMTS network based on the destination address to forward the data to the SGSN.
- Charging for postpaid services

  The GGSN generates and outputs CDRs based on the usage of the external network by the subscribers.
- Call control and service switching functions for prepaid services

  For prepaid services, the GGSN serves as a service switching point (SSP) that connects a mobile network and an intelligent network.

HSS

The Home Subscriber Server (HSS) stores all subscriber data related to services provided by EPC networks.

CG

As a device in the EPC system, the CG collects and pre-processes CDRs generated by the GGSN, S-GW, P-GW,or EPSN. The CG also provides an interface to the billing center. When an EPC user accesses the Internet, several NEs generate CDRs. Each NE may generate several CDRs. The CG pre-processes the CDRs, and then sends them to the billing center. This helps reduce the work load of the billing center. If the CG is applied in the network, the GGSN, S-GW, P-GW ,or EPSN does not need to provide an interface to the billing center.

PCRF

A PCRF is a policy and charging control element.

In a non-roaming scenario, there is only a single PCRF in the Home Public Land Mobile Network (HPLMN) associated with one UE's IP-CAN session. The PCRF terminates the Rx interface and the Gx interface.

In a roaming scenario with local breakout of traffic, there may be two PCRFs associated with one UE's IP-CAN session:

- Home PCRF (H-PCRF) that resides within the HPLMN
- Visited PCRF (V-PCRF) that resides within the Visited Public Land Mobile Network (V-PLMN)

The functions of the H-PCRF include the following:

- Terminate the Rx interface for home network services
- Terminate the S9 interface for roaming with local breakout
- Associate the sessions established over multiple interfaces (S9 and Rx), for the same UE's IP-CAN session
- Terminate the Gx interface for home network services in the roaming scenario

The functions of the V-PCRF include the following:

- Terminate the Gx and S9 interfaces for roaming with local breakout
- Terminate the Rx interface for roaming with local breakout and visited carrier's application function (AF)

PCEF

The UGW9811 can be deployed as an EPSN or function as a GGSN/P-GW that provides the PCEF function.

- When a PCRF is deployed, the UGW9811 reports user plane events to the PCRF, detects service flows and implements gate actions, QoS control, and charging control policies as required by the PCRF.
- When no PCRF is deployed, the UGW9811 implements the configured gate actions, QoS control, and charging control policies for specific subscribers, APNs, or services.

AAA Server

The Authentication, Authorization, Accounting (AAA) server complies with the Remote Authentication Dial in User Service (RADIUS) protocol. The AAA server can also be deployed in other systems in addition to EPC networks.

DNS

There are two types of Domain Name Servers (DNSs) on the EPC network:

- DNS located between the P-GW and the PDN

  It is used to resolve the domain name of the PDN; equivalent to a common DNS on the Internet.
- DNS located on the EPC core network

  When the UE requests access to an external network for packet services, the MME requests the DNS to resolve the domain name according to the access point name (APN). After the IP address of the corresponding P-GW and S-GW are obtained, a transmission channel can be established between the UE and P-GW.

The DNS can also be deployed in other systems in addition to EPC networks.

BM-SC

The BM-SC implements the following functions:

- Distributes and controls eMBMS services.
- Performs access control and charging on subscribers who use broadcast services.
- Authenticates subscribers on the public land mobile network (PLMN), initiates eMBMS bearer requests, and schedules and delivers eMBMS services.

OCS

The online charging system (OCS) provides the service-specific credit control function (CCF). On the UGW9811, the OCS can identify prepaid users and rate, assign quotas, and deduct fees for prepaid users.

2 Key Benefits

2.1 Overview

This chapter describes key benefits of the following features provided by the UGW9811:

- Multiple service forms
- Support of GGSN9811-based smooth upgrade
- Carrier-class platform
- High reliability
- Security
- Large capacity
- Customized operation and maintenance system

2.2 Multiple Service Forms Meet Requirements in Different Scenarios

The UGW9811 has many logical forms and supports various types of access. This product can meet carriers' networking requirements at different phases and in different deployment scenarios.

- Multiple types of access: supports access in GPRS, UMTS, LTE, or CDMA2000HRPD mode.
- Multiple logical product forms: The UGW9811 supports any combination of the GGSN, S-GW, and/or P-GW. In operation and maintenance, the UGW9811 supports logical combinations of the GGSN, S-GW + P-GW, GGSN + S-GW + P-GW, and EPSN.

2.3 Support of GGSN9811-based Smooth Upgrade Saves CAPEX

The GGSN9811 V900R007 hardware platform can implement the UGW9811 functions after the software upgrade. This can better meet carriers' requirements for network evolution and service expansion.

2.4 Carrier-class Platform Enables More Flexible Services

The UGW9811 presents an ideal and flexible solution for wireless data communication to network carriers. In order to achieve this, it utilizes Huawei's Universal Switching Router (USR) hardware platform which boasts high reliability and high-level data throughput and a software platform that seamlessly integrates wireless telecommunication technologies and data communication technologies.

The USR is a carrier-class network switching device that is compliant with industry standards. Developed on the basis of Huawei Versatile Routing Platform (VRP), the software of the UGW9811 inherits the integrated routing technology, IP Quality of Service (QoS), Virtual Private Network (VPN), and security technology of the VRP and perfects the functions specific to applications in wireless telecommunication.

2.5 High Reliability Design Ensures the Normal Operation of Products

Reliability is crucial for both carriers and end users and the UGW9811 was designed with this need in mind. The design team focused on ensuring reliability in terms of hardware, software, networking and O&M to ensure optimal operations.

- Hardware reliability

  The UGW9811 supports hot plugging and hot backup of key boards, possesses a double-channel power supply system, and is protected from over-voltage and over-current.

  The DMPU subcards can work in load-sharing mode. Therefore, when one DMPU subcard is faulty, the other DMPU subcard takes over all services, and the system triggers a fault alarm. If the DMPU subcards are required but unavailable or if the DMPU subcards are overloaded, the system triggers an alarm.

- Software reliability

  The UGW9811 is capable of overload control, traffic control, resource check, system software backup, configuration files check and automatic fault detection. This ensures reliable running. The unique charging data record (CDR) cache function guarantees a reliable billing system. The hot patch technology helps to ensure the normal software running.

- Networking reliability

  The route backup and route load-sharing functions can prevent single point failures on networks, helping to build highly reliable networks. The Eth-trunk function can prevent the failure of a single port from affecting services.

- Operation and Maintenance Reliability

  SSL: The UGW9811 ensure data confidentiality for operation and maintenance.

  When the UGW9811 upgrade failed, it can rollback previous version automatically. In this way, the remote update failed service restore time can be reduce.

  The UGW9811 provides the patch rollback function to ensure the reliability of running patch.

2.6 Security Design Protects Customer Profits

One of the primary concerns of both carriers and end users is network security. Bearing this in mind, security requirements were taken into consideration in every aspect in the design of the UGW9811. The result is that multiple measures were adopted to ensure the protection of information which translates to satisfied customers and therefore profits to carriers.

To ensure security in the UGW9811 system the following measures are taken:

- Strict verification of operator identity
- Point-to-Point Protocol (PPP) security verification by the Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP) modes
- Packet filtering and access control list (ACL) mechanism to filter packets based on preset conditions
- Gi/SGi interface redirection function, which can offer defense against attacks that are based on protocol packets between mobile users in one UGW9811
- The SSL feature can be implemented on the UGW9811 when the UGW9811 communicates with the U2000 or local maintenance terminal (LMT) to enhance security through encryption. With this feature, the man-machine language (MML) channel, binary channel, and File Transfer Protocol (FTP) file transfer channel between the UGW9811 and the U2000 or LMT are encrypted
- The UGW9811 provides the digital signature function. The UGW9811 checks the integrity of the software or patch upgrade package by checking digital signature files.

3 Architecture

3.1 Hardware Architecture

3.1.1 Cabinet

The UGW9811 uses an N68E-22 cabinet. The design of the cabinet complies with the International Electro Commission 297 (IEC297) and Institute of Electrical and Electronics Engineers (IEEE) standards. A modular structure is used, facilitating capacity expansion and maintenance. In addition, electromagnetic compatibility was fully considered in the design of the cabinet and electromagnetic shielding interfaces are used.The UGW9811 consists of a UGW9811 subrack and a power distribution box. Figure 3-1 shows an N68E-22 cabinet.

Figure 3-1 N68E-22 cabinet

3.1.2 Subrack

A subrack is a mandatory device and houses UGW9811 boards, including the Switching Route Units (SRUs) /Main Processing Units (MPUs), Switching Fabric Units (SFUs), Service Processing Units (SPUs), Packet Enforcement Units (PEUs) and Line Processing Units (LPUs).

The UGW9811 supports PGP-16, PGP-X8, and PGP-X16 subracks.

PGP-16 Subrack

The design of the PGP-16 subrack complies with the IEC297 standard. Its dimensions (H × W × D) are 62.99 in × 17.40 in × 26.34 in (1600.00 mm × 442.00 mm × 669.00 mm).The subrack height is 36 U(1U=44.45mm=1.75inch).

Figure 3-2 shows the PGP-16 subrack and Figure 3-3 shows the components of the PGP-16 subrack.

Figure 3-2 PGP-16 subrack

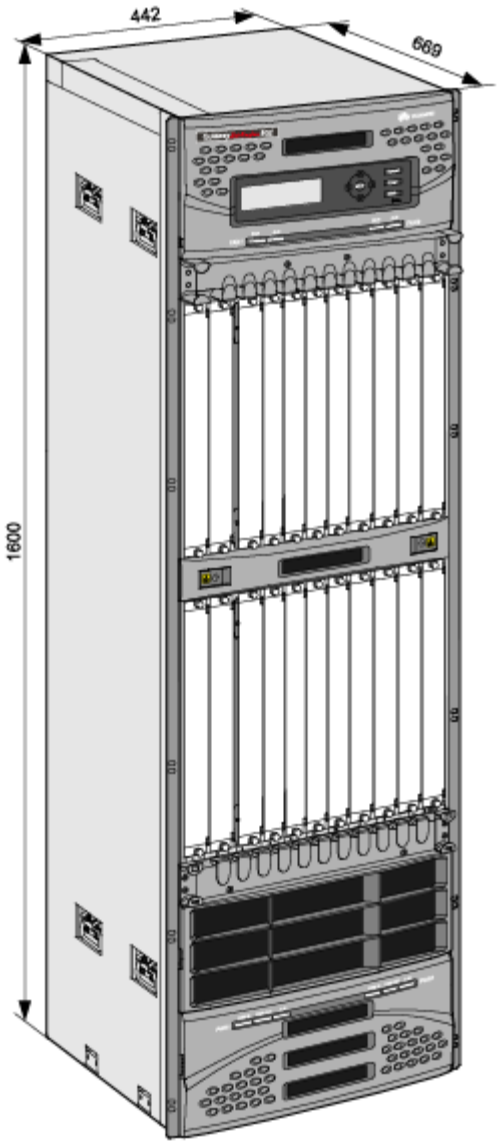
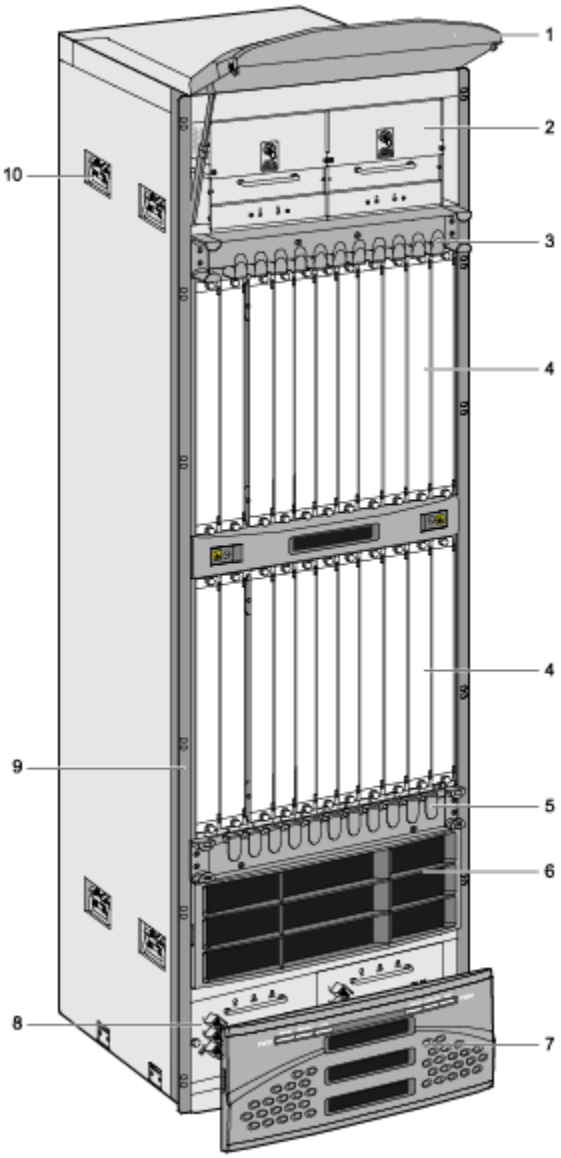


Figure 3-3 Components of the PGP-16 subrack



1. LCD	2. Fan module	3. Upper cable trough	4. Board cage	5. Lower cable trough
6. Air intake frame	7. Plastic panel of the power supply module	8. Power supply modules	9. Rack-mounting ear	10. Handle

Figure 3-4 shows the layout of components in the PGP-16 subrack and Figure 3-5 shows a typical layout of boards in the PGP-16 subrack

Figure 3-4 Hardware layout in the PGP-16 subrack

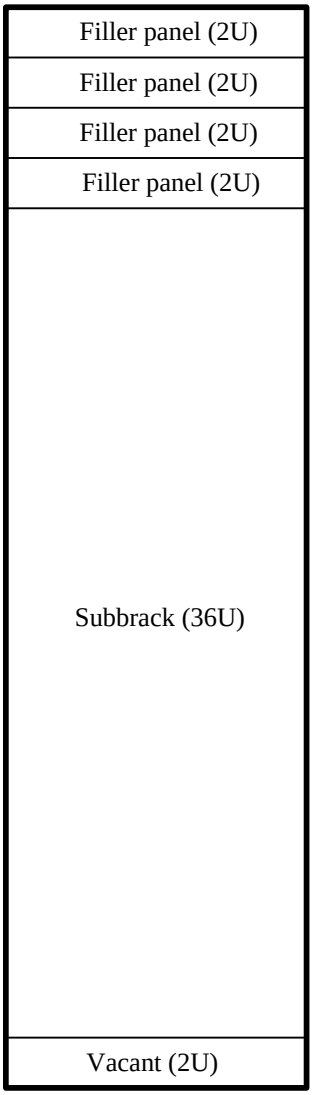
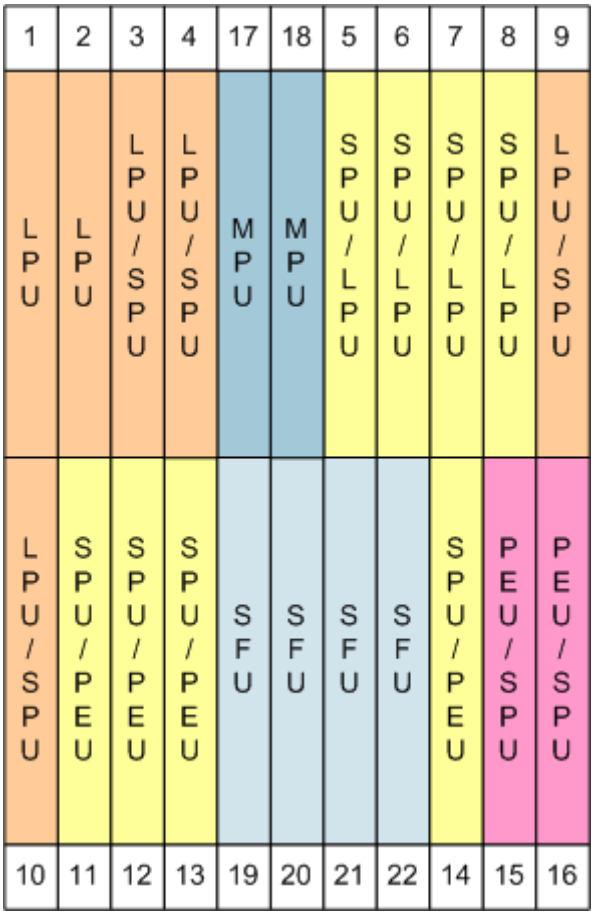


Figure 3-5 Layout of boards in the PGP-16 subrack



MPU: Main Processing Unit	SFU: Switching Fabric Unit	SPU: Service Processing Unit	PEU: Packet Enforcement Unit
LPU: Line Processing Unit	-	-	-

NOTE
In a PGP-16 subrack, SPUs are SPUds, SPUes, and SPUf1s.

PGP-X8 Subrack

The design of the PGP-X8 subrack complies with the IEC297 standard. Its dimensions (H × W × D) are 24.41 in × 17.40 in × 25.59 in (620.00 mm × 442.00 mm × 650.00 mm). The subrack height is 14 U(1U=44.45mm=1.75inch).

Figure 3-6 shows PGP-X8 subrack. Figure 3-7 shows the components of the PGP-X8 subrack.

Figure 3-6 PGP-X8 subrack

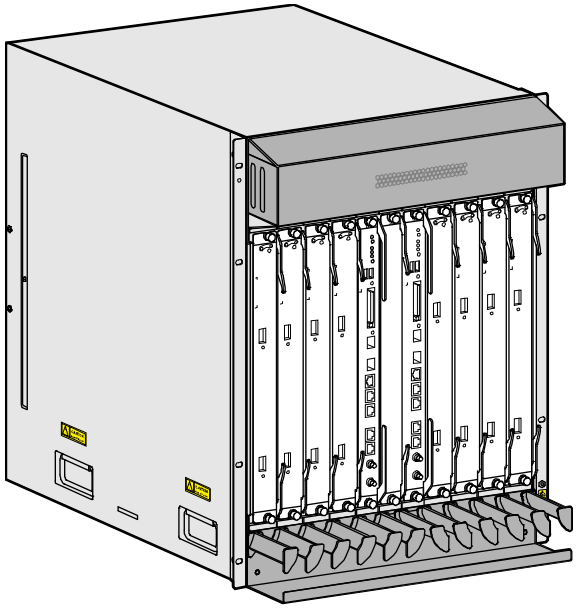
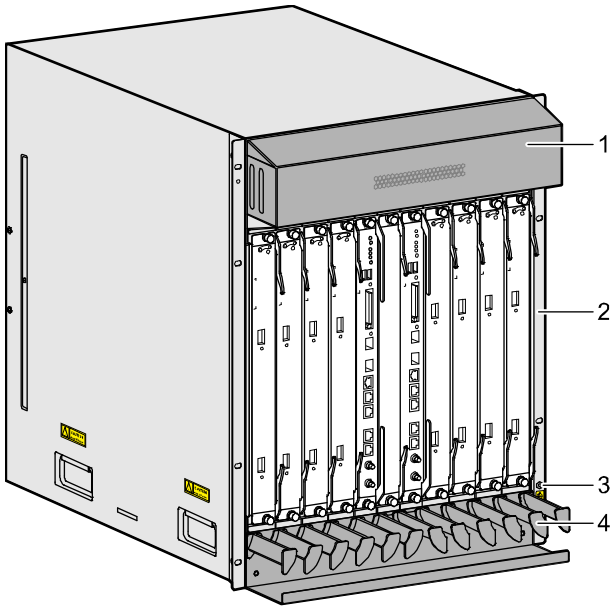


Figure 3-7 Components of the PGP-X8 subrack (face)



1 Air intake vent 2. Rack-mounting ear 3. ESD jack 4. Cable trough

Figure 3-8 shows the layout of components in the PGP-X8 subrack and Figure 3-9 shows a typical layout of boards of the PGP-X8 subrack

Figure 3-8 Hardware layout in the PGP-X8 subrack

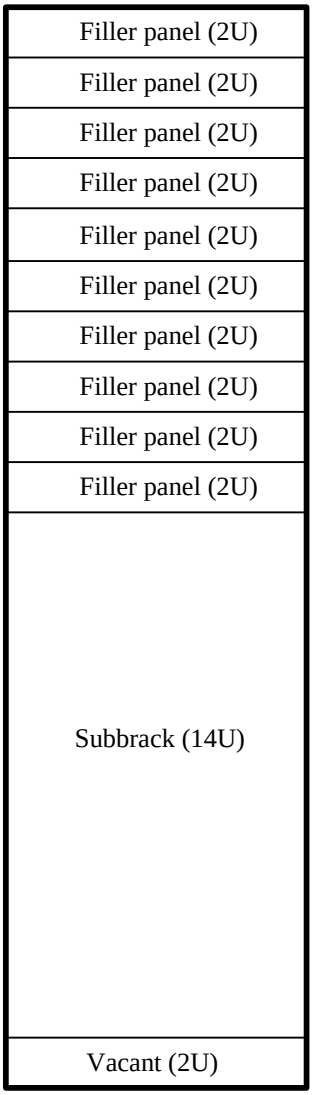
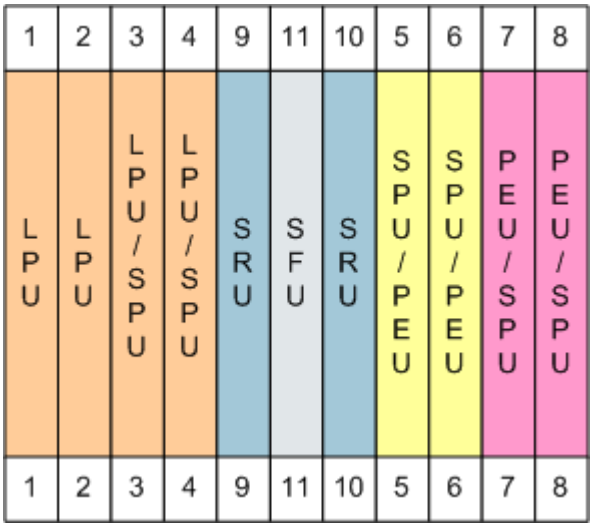


Figure 3-9 Layout of boards in the PGP-X8 subrack



SRU: Switching Route Unit	SFU: Switching Fabric Unit	SPU: Service Processing Unit	PEU: Packet Enforcement Unit
LPU: Line Processing Unit	-	-	-

PGP-X16 Subrack

The design of the PGP-X16 subrack complies with the IEC297 standard. Its dimensions (H × W × D) are 55.91 in × 17.40 in × 25.59 in (1420.00 mm × 442.00 mm × 650.00 mm). The subrack height is 32 U(1U=44.45mm=1.75inch).

Figure 3-10 shows the PGP-X16 subrack. Figure 3-11 shows the components of the PGP-X16 subrack.

Figure 3-10 PGP-X16 subrack

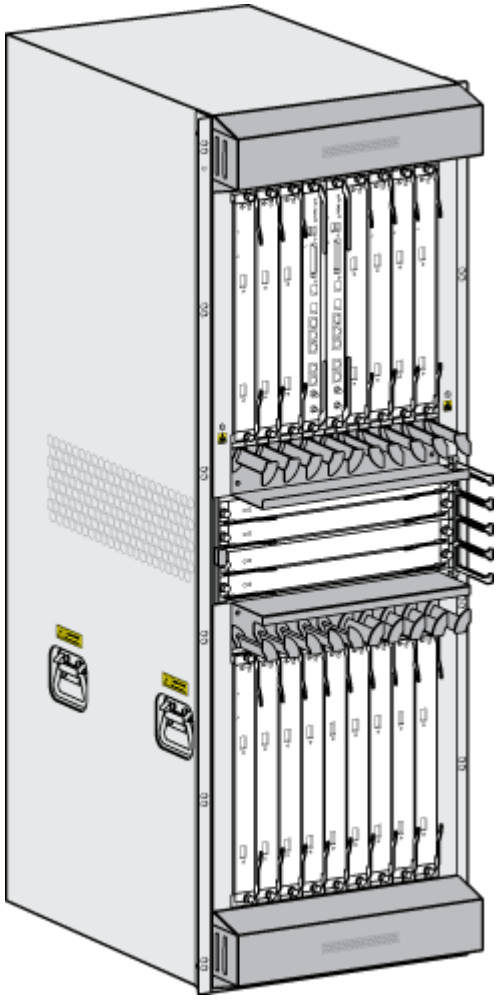
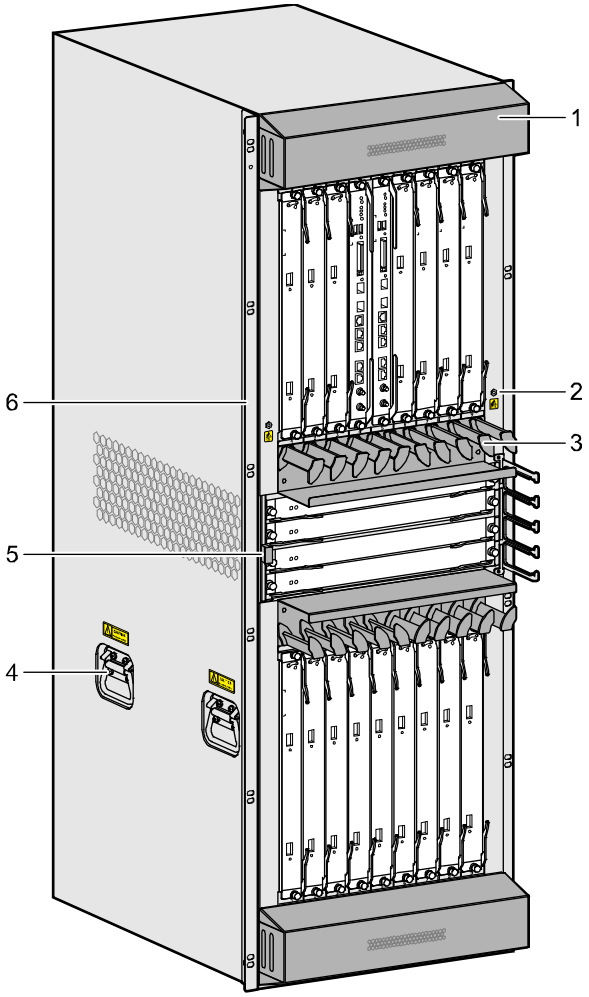


Figure 3-11 Components of the PGP-X16 subrack (face)



1 Air intake vent 2. ESD jack
3. Cable trough 4. Handle
5. SFU board cage 6. Rack-mounting ear

Figure 3-12 shows the layout of components in the PGP-X16 subrack and Figure 3-13 shows a typical layout of boards in the PGP-X16 subrack.

Figure 3-12 Hardware layout in the PGP-X16 subrack

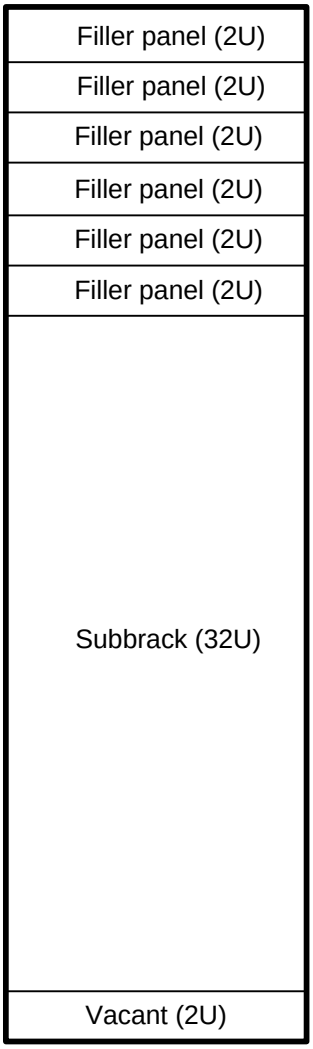
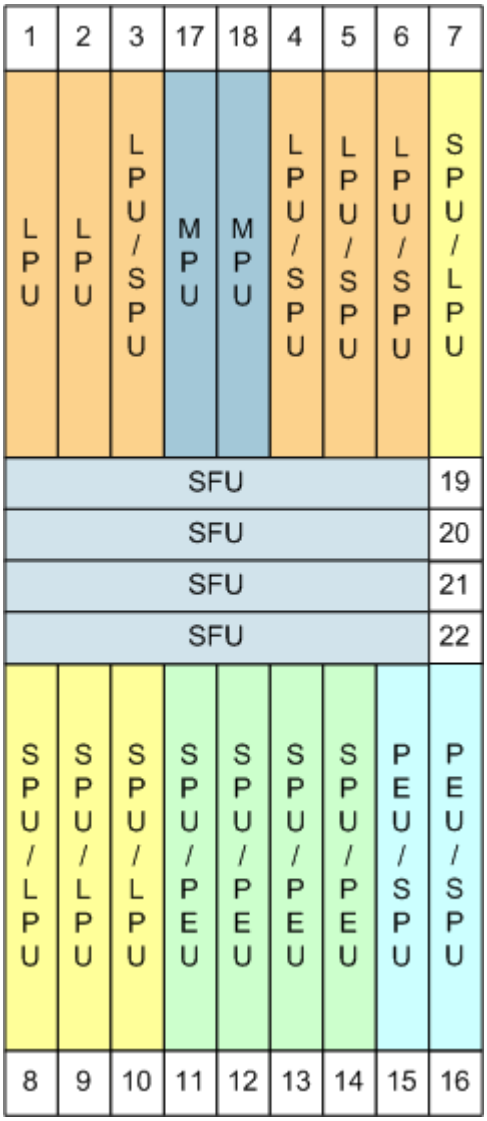


Figure 3-13 Layout of boards in the PGP-X16 subrack



MPU: Main Processing Unit	SFU: Switching Fabric Unit	SPU: Service Processing Unit	PEU: Packet Enforcement Unit
LPU: Line Processing Unit	-		

3.1.3 Boards

The UGW9811 consists of SRUs/MPUs, SFUs, SPUs, PEUs, and LPUs.

The SRU is the core circuit board for system management. The SFU performs the data exchange function. The SPU performs the service processing function. The PEU provides the internet protocol service quality management (IPSQM) function. The LPU provides physical interfaces that connect the UGW9811 to NEs or external networks.

SRU/MPU

The SRU/MPU, as the main control and switching unit of the UGW9811, is responsible for centralized control and management and data exchange. The SRU/MPUs work in 1+1 backup mode. The SRU/MPU is composed of the main control unit, switching unit, system clock unit, synchronous switching clock unit, and system maintenance unit. The SRU applies to a PGP-X8 subrack, and the MPU applies to PGP-16 and PGP-X16 subracks. The SRU in a PGP-X8 subrack integrates the function of an SFU.

SFU

The SFU supports expeditious data exchange.

SPU

The SPU performs service control, user packet forwarding, flow control, QoS, and content resolution functions. The SPUs work in load-sharing or N+1 or 1+1 backup mode. The operating mode is defined in the license file. In 1+1 backup mode, the SPUs guarantee service reliability.

An independent SPUf/SPUf1 can be deployed to provide the following functions:

- TCP optimization: uses a number of techniques, including TCP transparent proxy, skipping slow-start, fast retransmission and fast recovery, and TCP sender algorithm optimization, to improve the TCP transmission efficiency.
- Service-based routing (SBR): routes PDN-side service flows to external value-added service (VAS) servers based on SBR policies so that VAS services are provided.

PEU

The PEU provides the internet protocol service quality management (IPSQM) function. With this function, the PEU performs the traffic shaping function for the burst traffic destined to the eNodeBs, improving the bandwidth usage of the S1-U bearer link.

LPU

The LPU provides the following physical interfaces that connect the UGW9811 to external networks:

- FE (10/100 Mbit/s) interface
- GE (1000 Mbit/s) electrical interface
- GE (1000 Mbit/s) optical interface
- 10GE (10 Gbit/s) optical interface

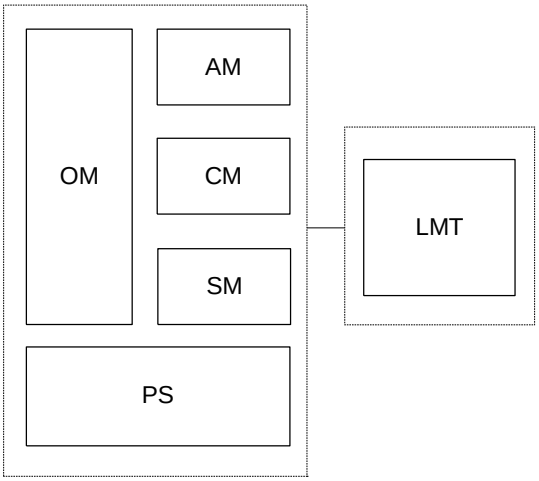
The LPU is composed of three modules: LPU module, switching network fabric adapter (FAD) module, and physical interface card (PIC) module.

These three modules work together to quickly process and forward service data. In addition, they maintain and manage link protocols and forwarding information base (FIB) tables.

3.2 Software Architecture

The logical structure of the UGW9811 consists of the access management (AM), service management (SM), charging management (CM), platform service (PS), operation and maintenance (OM), and local maintenance terminal (LMT) modules.

Figure 3-14 Logical structure of the UGW9811



- AM

  This is the principal module of the UGW9811 to support various access modes. It implements the role adaptation, access control, user authentication and authorization, address assignment, and bearer context management functions. It is also the interface of the UGW9811 directed to the access networks and other NEs (SGSN and MME) of the core network.

- SM

  This module obtains and controls policies for user data flows.

- CM

  This module processes charging protocols and manages CDRs. In addition, it works with the external charging gateway and the external charging system to provide multiple charging modes.

- PS

  This module distributes and processes signaling packets and data packets of the UGW9811. It works with other relevant modules to perform the charging and service control functions. In addition, it performs functions such as system support, OM, and routing.

- OM

  This module provides OM functions such as device management, data configuration management, and alarm management.

- LMT

  This module provides graphical user interfaces (GUIs).

4 Configurations

4.1 Overview

The UGW9811 supports four typical configurations: minimum configuration, 1+1 mode maximum configuration, load-sharing mode maximum configuration, and N+1 backup mode maximum configuration.

Configuring the UGW9811:

- The UGW9811 requires only one UGW9811 subrack. The cabinet that houses the UGW9811 subrack is called the UGW9811 service cabinet.
- Firewalls and Ethernet switches are optional devices in the UGW9811 service cabinet.

4.2 UGW9811 (PGP-16) Typical Configurations

Typical Minimum Configuration

In typical minimum configuration, the UGW9811 (PGP-16) supports 1,000,000 bearer contexts and 24 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-1 describes the UGW9811 (PGP-16) typical minimum configuration.

Table 4-1 UGW9811 (PGP-16) typical minimum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	2	
LPU	2	

1+1 Mode Maximum Configuration

In 1+1 mode maximum configuration, the UGW9811 (PGP-16) supports 5,000,000 bearer contexts and 120 Gbit/s throughput (with the packet length of 1024 bytes). Table 4-2 describes the UGW9811 (PGP-16) 1+1 mode maximum configuration.

Table 4-2 UGW9811 (PGP-16) 1+1 mode maximum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	10	
LPU	6	

Load-sharing Mode Maximum Configuration

In load-sharing mode maximum configuration, the UGW9811 (PGP-16) supports 10,000,000 bearer contexts and 240 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-3 describes the UGW9811 (PGP-16) load-sharing mode maximum configuration.

Table 4-3 UGW9811 (PGP-16) load-sharing mode maximum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	10	
LPU	6	

N+1 Backup Mode Maximum Configuration

In N+1 backup mode maximum configuration, the UGW9811 (PGP-16) supports 9,000,000 bearer contexts and 200 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-4 describes the UGW9811 (PGP-16) N+1 backup mode maximum configuration.

Table 4-4 UGW9811 (PGP-16) N+1 backup mode maximum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	10	
LPU	6	

4.3 UGW9811 (PGP-X8) Typical Configurations

Typical Minimum Configuration

In typical minimum configuration, the UGW9811 (PGP-X8) supports 4,000,000 bearer contexts and 60 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-5 describes the UGW9811 (PGP-X8) typical minimum configuration.

Table 4-5 UGW9811 (PGP-X8) typical minimum configuration

Board	Number	Remarks
SRU	2	This table lists only the basic board configuration.
SFU	1	
SPU	2	
LPU	2	

1+1 Mode Maximum Configuration

In 1+1 mode maximum configuration, the UGW9811 (PGP-X8) supports 12,000,000 bearer contexts and 180 Gbit/s throughput (with the packet length of 1024 bytes). Table 4-6 describes the UGW9811 (PGP-X8) 1+1 mode maximum configuration.

Table 4-6 UGW9811 (PGP-X8) 1+1 mode maximum configuration

Board	Number	Remarks
SRU	2	This table lists only the basic board configuration.
SFU	1	
SPU	6	
LPU	2	

Load-sharing Mode Maximum Configuration

In load-sharing mode maximum configuration, the UGW9811 (PGP-X8) supports 20,000,000 bearer contexts and 300 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-7 describes the UGW9811 (PGP-X8) load-sharing mode maximum configuration.

Table 4-7 UGW9811 (PGP-X8) load-sharing mode maximum configuration

Board	Number	Remarks
SRU	2	This table lists only the basic board

Board	Number	Remarks
SFU	1	configuration.
SPU	5	
LPU	3	

N+1 Backup Mode Maximum Configuration

In N+1 backup mode maximum configuration, the UGW9811 (PGP-X8) supports 16,000,000 bearer contexts and 240 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-8 describes the UGW9811 (PGP-X8) N+1 backup mode maximum configuration.

Table 4-8 UGW9811 (PGP-X8) N+1 backup mode maximum configuration

Board	Number	Remarks
SRU	2	This table lists only the basic board configuration.
SFU	1	
SPU	5	
LPU	3	

4.4 UGW9811 (PGP-X16) Typical Configurations

Typical Minimum Configuration

In typical minimum configuration, the UGW9811 (PGP-X16) supports 4,000,000 bearer contexts and 60 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-9 describes the UGW9811 (PGP-X16) typical minimum configuration.

Table 4-9 UGW9811 (PGP-X16) typical minimum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	2	
LPU	2	

1+1 Mode Maximum Configuration

In 1+1 mode maximum configuration, the UGW9811 (PGP-X16) supports 24,000,000 bearer contexts and 360 Gbit/s throughput (with the packet length of 1024 bytes). Table 4-10 describes the UGW9811 (PGP-X16) 1+1 mode maximum configuration.

Table 4-10 UGW9811 (PGP-X16) 1+1 mode maximum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	12	
LPU	4	

Load-sharing Mode Maximum Configuration

In load-sharing mode maximum configuration, the UGW9811 (PGP-X16) supports 40,000,000 bearer contexts and 600 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-11 describes the UGW9811 (PGP-X16) load-sharing mode maximum configuration.

Table 4-11 UGW9811 (PGP-X16) load-sharing mode maximum configuration

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	10	
LPU	6	

N+1 Backup Mode Maximum Configuration

In N+1 backup mode maximum configuration, the UGW9811 (PGP-X16) supports 36,000,000 bearer contexts and 540 Gbit/s throughput (with the packet length of 1024 bytes).

Table 4-12 describes the UGW9811 (PGP-X16) N+1 backup mode maximum configuration,.

Table 4-12 UGW9811 (PGP-X16) N+1 backup mode maximum configuration,

Board	Number	Remarks
MPU	2	This table lists only the basic board configuration.
SFU	4	
SPU	10	

Board	Number	Remarks
LPU	6	

5 Interfaces and Protocols

5.1 Overview

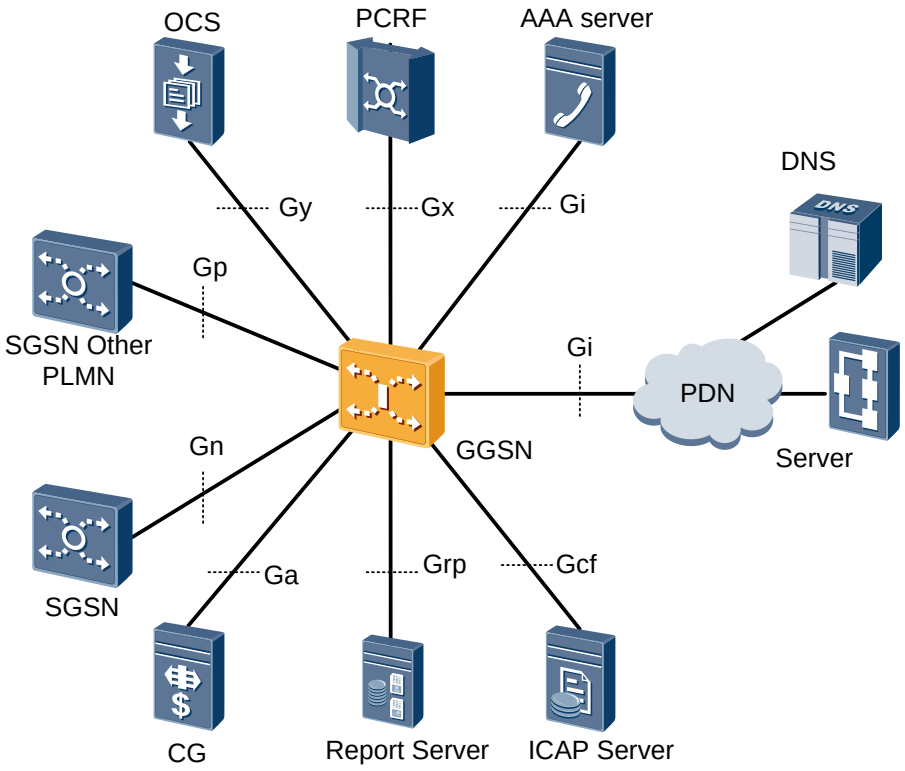
The UGW9811 is a gateway device deployed between the GRPS/UMTS/EPC system and external packet data networks (PDNs). The UGW9811 routes and encapsulates data packets between mobile networks and external PDNs. The UGW9811 complies with R99/R4/R5/R6/R7/R8//R9/R10 3GPP standards which can be applied in EPC or GPRS/UMTS systems.

5.2 Protocol Interfaces

The UGW9811 provides multiple interfaces that comply with standard protocols.

The interfaces provided by the UGW9811 on the GPRS/UMTS network are as follows, **Figure 5-1** shows the Interfaces when the UGW9811 serves as the GGSN.

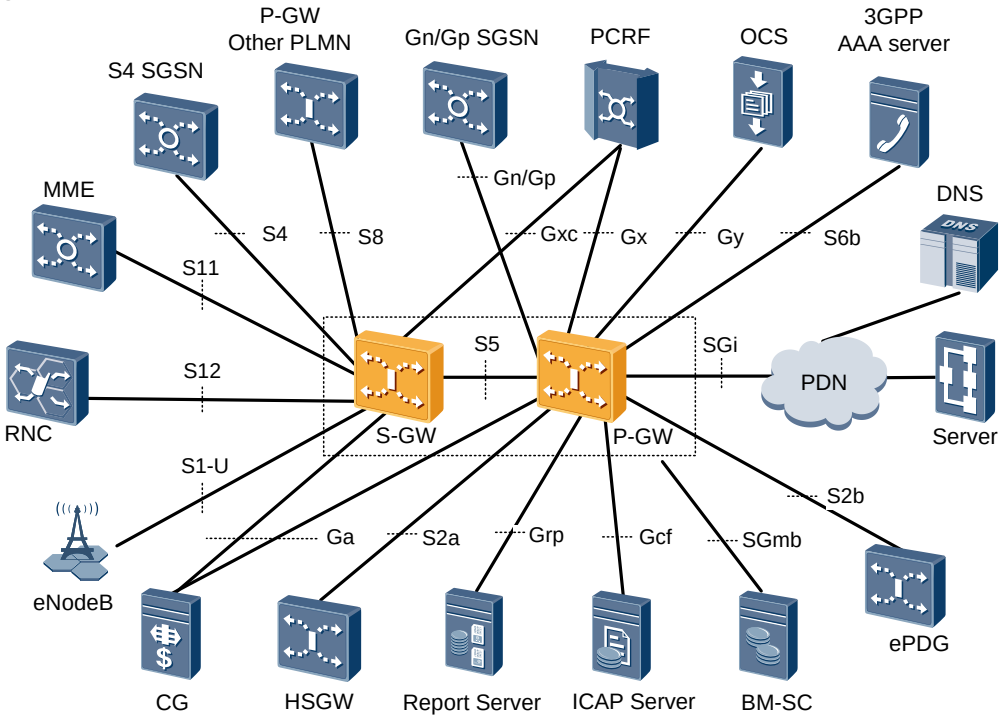
Figure 5-1 Interfaces when the UGW9811 serves as the GGSN



- Gn/Gp Interface: Gn/Gp Interface is an interface between the GGSN and the SGSN.The Gn interface is between the GPRS support nodes (GSNs) within the same public land mobile network (PLMN). The Gp interface is between the GSNs in different PLMNs.
- Gi Interface:Gi interface is an interface between the GGSN and the PDN. It can also serve as the interface connecting the GGSN and the AAA server, transmitting authentication and charging control messages.
- Ga Interface:Ga is an interface between the GGSN and the Charging Gateway Functionality (CGF). The Ga interface runs the GTP protocol. It runs the GTP protocol to send charging data records (CDRs) that are generated by a network element or functional entity to the CGF.
- Gy Interface:Gy is an interface between the GGSN and the online charging system/credit control function (OCS/CCF). It communicates based on the Diameter protocol and is used for online charging control. The UGW9811 interacts with the OCS through the Gy interface to realize credit control for content-based charging users and non-content-based charging users.
- Gx Interface:Gx is an interface between the GGSN and the policy charging rules function (PCRF). It communicates based on the Diameter protocol. The GGSN interacts with the PCRF through the Gx interface to realize policy and charging control (PCC) function.
- Grp Interface: Grp interface is a Huawei proprietary interface between the GGSN and report server. The EPSN uses the Grp interface to interwork with the report server to implement the mobile broadband (MBB) visibility function.
- Gcf Interface: Gcf interface is a Huawei proprietary interface between the GGSN and Internet Content Adaptation Protocol (ICAP) server. The EPSN uses the Gcf interface to interwork with the ICAP server to implement the uniform resource locator (URL) filtering function.

The interfaces provided by the UGW9811 on the EPC network are as follows, **Figure 5-2** shows the Interfaces when the UGW9811 serves as the S-GW or P-GW

Figure 5-2 Interfaces when the UGW9811 serves as the S-GW or P-GW

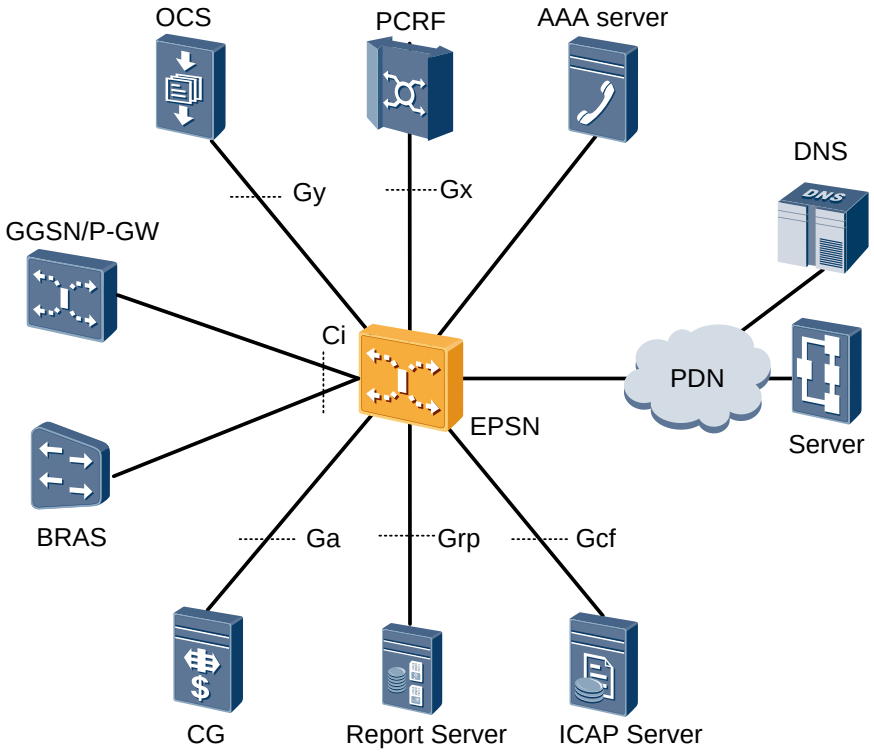


- S1-U Interface:S1-U interface is an interface in the user plane between the eNodeB and the S-GW. It is used to transmit the uplink and downlink user plane data between the eNodeB and the S-GW.
- S11 Interface: S11 interface is an interface in the control plane between the MME and the S-GW. It is mainly used to transmit messages for bearer establishment, update, and deletion between the MME and the S-GW.
- S12 Interface:S12 interface is an interface to the user plane between the RNC and the S-GW. It is used to transmit the downlink and uplink user plane data flows between the RNC and the S-GW when the direct tunnel solution is used on the UTRAN.
- S4 Interface:S4 interface is an interface in the signaling plane and the user plane between the S4 SGSN and S-GW. The signaling plane connects the S4 SGSN to the EPS network, transmitting messages for bearer establishment, update, and deletion. The user plane transmits the user plane downlink and uplink data flows between the S4 SGSN and the S-GW.
- S5/S8 Interface: S5/S8 Interface is an interface in the signaling plane and the user plane between the S-GW and the P-GW. S5 interface is used between the home S-GW and the home P-GW and the S8 interface is used between the S-GW on a visited network and the home P-GW.
- Ga Interface:Ga is an interface between the S-GW,or P-GW and the charging gateway functionality (CGF). The Ga interface runs the GTP protocol. It runs the GTP protocol to send charging data records (CDRs) that are generated by a network element or functional entity to the CGF.
- Gxc Interface: Gxc is an interface between the S-GW and the policy charging rules function (PCRF). It communicates based on the Diameter protocol. The S-GW interacts with the PCRF through the Gxc interface to realize policy and charging control (PCC) function.

- Gx Interface: Gx is an interface between the P-GW and the policy charging rules function (PCRF). It communicates based on the Diameter protocol.The P-GW interacts with the PCRF through the Gx interface to realize policy and charging control (PCC) function.
- Gy Interface:Gy is an interface between the P-GW and the online charging system/credit control function (OCS/CCF). It communicates based on the Diameter protocol and is used for online charging control. The UGW9811 interacts with the OCS through the Gy interface to realize credit control for content-based charging users and non-content-based charging users.
- Gn/Gp Interface: Gn/Gp Interface is an interface between the P-GW and the Gn/Gp SGSN.The Gn interface is between the GPRS support nodes (GSNs) within the same public land mobile network (PLMN). The Gp interface is between the GSNs in different PLMNs.
- S6b Interface:S6b interface is an interface between the P-GW and the 3GPP AAA server. It is used to obtain authentication parameters related to mobility, transmit mobility parameters, and provide static QoS information for the users switching from a non-3GPP network to the UE.
- SGi Interface:SGi interface is an interface between the P-GW and the PDN. It can also serve as the interface connecting the P-GW and the AAA server, transmitting authentication and charging control messages.
- S2a Interface:S2a interface is an interface between the P-GW (Gateway LMA) and the trusted non-3GPP IP access Mobile Access Gateway (MAG). The S2a interface enables the interworking between a trusted fixed network and an EPC network.
- S2b Interface: S2b interface is an interface between the P-GW and the Untrusted non-3GPP Access Epdg (evolved Packet Data Gateway).The S2b interface enables the interworking between a WLAN network and an EPC network.
- SGmb Interface: SGmb is an interface between the S-GW+P-GW and the broadcast/multicast service center (BM-SC). It communicates based on the Diameter protocol and is used to provide the control plane function of the evolved multimedia broadcast multicast Service.
- Grp Interface:Grp interface is a Huawei proprietary interface between the P-GW and report server. The EPSN uses the Grp interface to interwork with the report server to implement the mobile broadband (MBB) visibility function.
- Gcf Interface:Gcf interface is a Huawei proprietary interface between the P-GW and Internet Content Adaptation Protocol (ICAP) server. The EPSN uses the Gcf interface to interwork with the ICAP server to implement the uniform resource locator (URL) filtering function.

The interfaces provided when the UGW9811 serves as the EPSN as follows, Figure 5-3 shows the Interfaces when the UGW9811 serves as the EPSN.

Figure 5-3 Interfaces when the UGW9811 serves as the EPSN



- Ci Interface: Ci interface is a logical interface between the EPSN and network access server (NAS). The EPSN uses the Ci interface to interwork with the NAS to obtain subscriber information from RADIUS accounting messages.
- Ga Interface: Ga interfaceis is an interface between the EPSN and the Charging Gateway Functionality (CGF). The Ga interface runs the GTP protocol. It runs the GTP protocol to send charging data records (CDRs) that are generated by a network element or functional entity to the CGF.
- Gx Interface: Gx is an interface between the EPSN and policy charging rules function (PCRF). It communicates based on the Diameter protocol.The EPSN interacts with the PCRF through the Gx interface to realize policy and charging control (PCC) function
- Gy Interface: Gy is an interface between the EPSN and the online charging system/credit control function (OCS/CCF). It communicates based on the Diameter protocol and is used for online charging control. The UGW9811 interacts with the OCS through the Gy interface to realize credit control for content-based charging users and non-content-based charging users.
- Grp Interface: Grp interface is a Huawei proprietary interface between the EPSN and report server. The EPSN uses the Grp interface to interwork with the report server to implement the mobile broadband (MBB) visibility function
- Gcf Interface: Gcf interface is a Huawei proprietary interface between the EPSN and Internet Content Adaptation Protocol (ICAP) server. The EPSN uses the Gcf interface to interwork with the ICAP server to implement the uniform resource locator (URL) filtering function.

5.3 Physical Interfaces

Table 5-1 lists types and numbers of external physical interfaces provided by the UGW9811.

Table 5-1 Types and numbers of external physical interfaces provided by the UGW9811

Interface Type	Maximum Number of Interfaces (PGP-X16/PGP-16 Subrack)	Maximum Number of Interfaces (PGP-X8 Subrack)
GE (Gigabit Ethernet)	240	120
10GE (10 Gigabit Ethernet)	24	12

Table 5-2 lists protocols used on the UGW9811 interfaces.

Table 5-2 Protocols used on the UGW9811 interfaces

Logical Interface	Physical Interface	Application-Layer Protocol	Standards Compliance
Gn/Gp	GE 10GE	GTP-C GTP-U	3GPP TS 29.030 3GPP TS 29.060 3GPP TS 29.281
S2a	GE 10GE	PMIPv6	3GPP TS 23.402 3GPP TS 29.275
Gi/SGi	GE 10GE	RADIUS/DHCPv4/L2TP	3GPP TS 29.061
S6b	GE 10GE	Diameter	3GPP TS 23.402 3GPP TS 29.273
S4	GE 10GE	GTP-C GTP-U	3GPP TS 23.401 3GPP TS 29.274 3GPP TS 29.281
S11	GE 10GE	GTP-C	3GPP TS 23.401 3GPP TS 29.274
S12	GE 10GE	GTP-U	3GPP TS 23.401 3GPP TS 29.281
S1–U	GE 10GE	GTP-U	3GPP TS 23.401 3GPP TS 29.281 3GPP TS 36.414
S5/S8	GE 10GE	GTP-C GTP-U	3GPP TS 23.401 3GPP TS 29.274 3GPP TS 29.281

Logical Interface	Physical Interface	Application-Layer Protocol	Standards Compliance
Ga	GE 10GE	GTP'	3GPP TS 32.240 3GPP TS 32.251 3GPP TS 32.295 3GPP TS 32.298
Gy	GE 10GE	Diameter	3GPP TS 32.299
Gx/Gxc	GE 10GE	Diameter	3GPP TS 23.203 3GPP TS 29.212 3GPP TS 29.213

6 Operation and Maintenance

6.1 Overview

The UGW9811 provides user-friendly and simplified operation and maintenance approaches, including the LMT that integrates Graphic User Interface (GUI) and Command Line Interface (CLI), access to Huawei U2000 or operation and maintenance center (OMC), and comprehensive online help.

6.2 Benefits

Various Management Methods

The OM system of the UGW9811 allows you to customize a network management system based on the network structure, management requirements, and size of the operation. Based on a client/server distributed architecture, maintenance is available through the GUI client, centralized network maintenance interfaces, and CLI. The UGW9811 supports simultaneous multi-user access at local and remote ends.

User-Friendly GUI

The GUI helps to provide a user-friendly and convenient OM interface. Operations are simplified through the graphic network topology or device panel view.

Configuration Management

The configuration management function is performed by the command line interface (CLI) commands provided in the local maintenance terminal (LMT) of the UGW9811. By running the CLI commands, you can configure, modify, and query data. The UGW9811 receives, analyzes, and runs the CLI commands, and then returns the results to the LMT.

Message Tracing

The UGW9811 allows signaling message tracing, data packet tracing, interface message tracing, user message tracing, and message explanation

Operators can create interface and user tracing tasks to monitor the signaling of the interfaces and users of the system in real time. The stored messages including the information about

previous versions can be viewed online or offline. If a fault occurs in the UGW9811, you can quickly and accurately locate and clear the fault through the interface signaling tracing function.

Customizable Performance Measurement

The UGW9811 can display performance measurement data in the form of lists and graphics. It also supports background performance data collection. The centralized performance management system provides a comprehensive and direct operation environment. Operators can manage the performance of devices in the entire network. Operators can create, modify, and query performance measurement tasks and manage the results to learn the running status of the network and devices. The measurement results are for performance assessment and network optimization.

Remote Management

The UGW9811 supports various remote management functions, including online software patching, online commissioning, remote maintenance, and dynamic data setting.

Real-Time Fault Management

The UGW9811 can receive and display network device fault reports in real time. It provides real-time audio or visual alarms in the topology view, alarm panel, and alarm box. The UGW9811 provides detailed fault reports, and the fault management system with leveled filtering functions. This enables you to quickly determine fault causes. After determining fault causes, you can clear faults by following the instructions provided in the online help.

Comprehensive Online Help

The online help system for the UGW9811 provides useful information regarding the OM system and alarm handling. It allows you to quickly become familiar with the operation and maintenance of the UGW9811.

7 Technical Specification

7.1 Performance Specifications

7.1.1 Performance Specifications of the UGW9811 (PGP-16)

Table 7-1 Performance specifications of the UGW9811 (PGP-16) functioning as a GGSN/S-GW/P-GW

Item	Specification	
Maximum number of activated bearer contexts	SPUs in active/standby mode	5,000,000
	SPUs in load-sharing mode	10,000,000
	SPUs in N+1 backup mode	9,000,000
Maximum data throughput	SPUs in active/standby mode	120 Gbit/s
	SPUs in load-sharing mode	240 Gbit/s
	SPUs in N+1 backup mode	200 Gbit/s
Maximum number of APNs	3,000	
Maximum number of GRE tunnels	4,000	
Maximum number of L2TP tunnels	40,000	
Maximum number of eNodeBs	100,000	

7.1.2 Performance Specifications of the UGW9811 (PGP-X8)

Table 7-2 Performance specifications of the UGW9811 (PGP-X8) functioning as a GGSN/S-GW/P-GW

Item	Specification	
Maximum number of activated bearer contexts	SPUs in active/standby mode	12,000,000
	SPUs in load-sharing mode	20,000,000
	SPUs in N+1 backup mode	16,000,000
Maximum data throughput	SPUs in active/standby mode	180 Gbit/s
	SPUs in load-sharing mode	300 Gbit/s
	SPUs in N+1 backup mode	240 Gbit/s
Maximum number of APNs	3,000	
Maximum number of GRE tunnels	4,000	
Maximum number of L2TP tunnels	40,000	
Maximum number of eNodeBs	100,000	

7.1.3 Performance Specifications of the UGW9811 (PGP-X16)

Table 7-3 Performance specifications of the UGW9811 (PGP-X16) functioning as a GGSN/S-GW/P-GW

Item	Specification	
Maximum number of activated bearer contexts	SPUs in active/standby mode	24,000,000
	SPUs in load-sharing mode	40,000,000
	SPUs in N+1 backup mode	36,000,000
Maximum data throughput	SPUs in active/standby mode	360 Gbit/s
	SPUs in load-sharing mode	600 Gbit/s
	SPUs in N+1 backup mode	540 Gbit/s
Maximum number of APNs	3,000	
Maximum number of GRE	4,000	

Item	Specification
tunnels	
Maximum number of L2TP tunnels	40,000
Maximum number of eNodeBs	100,000

7.2 Entire-system Specifications

This section describes the entire-system specifications, such as the dimensions and power consumption.

Table 7-4 lists the entire-system specifications of the UGW9811 (PGP-16).

Table 7-4 Entire-system specifications of the UGW9811 (PGP-16)

Item	Specification
Cabinet	N68E-22
Cabinet dimensions (height × width × depth)	2,200 mm × 600 mm × 800 mm (86.61 in. × 23.62 in. × 31.50 in.)
Cabinet weight(include Power Distribution Box,in full configuration)	425 kg
Subrack dimensions (height × width × depth)	1,600 mm × 442 mm × 669 mm (62.99 in. × 17.40 in. × 26.34 in.) **NOTE** 1 U = 44.45 mm. The height is 36 U.
Subrack weight (in full configuration)	325 kg
Load-bearing capacity	> 600 kg/m ²
Power input(rated voltage)	-48V DC or -60V DC
Power input(voltage range)	-38.4V DC to -72V DC
Typical power consumption of a subrack(in full configuration)	5,600 W
Maximum power consumption of a subrack (in full configuration)	7,500 W

Table 7-5 lists the entire-system specifications of the UGW9811 (PGP-X8).

Table 7-5 Entire-system specifications of the UGW9811 (PGP-X8)

Item	Specification
Cabinet	N68E-22
Cabinet dimensions (height × width × depth)	2,200 mm × 600 mm × 800 mm (86.61 in. × 23.62 in. × 31.50 in.)
Cabinet weight(include Power Distribution Box,in full configuration)	300 kg
Subrack dimensions (height × width × depth)	620.00 mm × 442.00 mm × 650.00 mm (24.41 in. ×17.40 in. × 25.59 in.) **NOTE** 1 U = 44.45 mm. The height is 14 U.
Subrack weight (in full configuration)	143 kg
Load-bearing capacity	> 600 kg/m ²
Power input(rated voltage)	-48V DC or -60V DC
Power input(voltage range)	-38.4V DC to -72V DC
Typical power consumption of a subrack(in full configuration)	4,100 W
Maximum power consumption of a subrack (in full configuration)	6,600 W

Table 7-6 lists the entire-system specifications of the UGW9811 (PGP-X16).

Table 7-6 Entire-system specifications of the UGW9811 (PGP-X16)

Item	Specification
Cabinet	N68E-22
Cabinet dimensions (height × width × depth)	2,200 mm × 600 mm × 800 mm (86.61 in. × 23.62 in. × 31.50 in.)
Cabinet weight(include Power Distribution Box,in full configuration)	460 kg
Subrack dimensions	1420.00 mm × 442.00 mm × 650.00 mm (55.91 in. ×17.40 in.

Item	Specification
(height × width × depth)	× 25.59 in.) NOTE 1 U = 44.45 mm. The height is 32 U
Subrack weight (in full configuration)	290 kg
Load-bearing capacity	> 600 kg/m ²
Power input(rated voltage)	-48V DC or -60V DC
Power input(voltage range)	-38.4V DC to -72V DC
Typical power consumption of a subrack(in full configuration)	8,000 W
Maximum power consumption of a subrack (in full configuration)	12,900 W

7.3 Reliability Specifications

This section describes the reliability data for the device. The items listed include: mean time between failures (MTBF) or the mean time to repair (MTTR) among others.

Table 7-7 lists the reliability specifications of the UGW9811.

Table 7-7 Reliability specifications of the UGW9811

Item	Specification
Annual repair and return rate of boards	≤ 3%
Availability	≥ 99.999%
MTBF	PGP-16: ≥ 12.23y PGP-X8: ≥ 21.10y PGP-X16: ≥ 12.4y
MTTR	1 h
Annual mean failure time	5 min
Service interruption duration during a board switchover	1s
SPU Board restart time	3 min
System restart time	5 min
Start time from system power-on to	10 min

Item	Specification
service-ready	

7.4 Safety Specifications

This section describes the safety specifications with which the UGW9811 complies.

The UGW9811 meets the safety requirements and complies with the following standards:

- UL60950-1
- IEC 60950-1
- EN60950-1
- GB4943

7.5 EMC Specifications

This section describes the electromagnetic compatibility (EMC) specifications with which the UGW9811 complies.

The UGW9811 meets the EMC requirements and complies with the following standards:

- EN55022
- ETSI EN 300 386
- CISPR22
- IEC 61000-3-2
- IEC 61000-3-3
- IEC 61000-4-2
- IEC 61000-4-3
- IEC 61000-4-4
- IEC 61000-4-5
- IEC 61000-4-6
- IEC 61000-4-11
- IEC 61000-4-29

7.6 Environment Specifications

This section describes the environment specifications for the UGW9811. The environment specifications consist of the storage, transportation, and operating specifications.

The UGW9811 complies with the following standards:

- ETSI EN 300019

- IEC 60721
- IEC 60068-2-x

7.6.1 Storage Environment

This section describes the storage and environment requirements for the UGW9811, and consists of climatic, waterproofing, biological environment, air purity and mechanical stress requirements.

Climatic Requirements

Table 7-8 Climatic requirements for the storage environment

Item	Specification
Temperature	-40 ℃ to +70 ℃ (-40 ℉ to +158 ℉)
Temperature change rate	≤ 1 ℃(33.8 ℉)/min
Relative humidity	5% to 100%
Atmospheric pressure	70 kPa to 106 kPa
Solar radiation	≤ 1120 W/m ²
Heat radiation	≤ 600 W/m ²

Waterproofing Requirements

- The equipment should be stored indoors. The requirements for the equipment room are:
  - There should be no water on the floor and water should not leak into the package.
  - There should not be the presence of water which may damage the equipment.
- If the equipment must be stored outdoors, ensure that:
  - The packing box is intact.
  - Measures have been taken to waterproof the area so that no rain water can enter the packing box.
  - The ground is free of water and a water free atmosphere is provided for the packing box.
  - The packing box is not exposed to direct sunlight.

Biological Environment Requirements

- The equipment room should not be conducive for the growth of fungus or mildew.
- The equipment room should be rodent proof.

Air Purity Requirements

The air must be free from explosive, electro-conductive, magneto-conductive, or corrosive dust.

Table 7-9 lists requirements for physically active substances in the storage environment.

Table 7-9 Requirements for physically active substances in the storage environment

Physically Active Substance	Density
Suspended dust(diameter ≤ 75 μm)	≤ 5.00 mg/m ³
Precipitable dust(75 μm ≤ diameter ≤ 150 μm)	≤ 20.0 mg/m²•h
Sand(150 μm ≤ diameter ≤ 1000 μm)	≤ 300 mg/m ³

Table 7-10 lists requirements for chemically active substances in the storage environment.

Table 7-10 Requirements for chemically active substances in the storage environment

Chemically Active Substance	Density (mg/m³)
SO_2	≤ 0.30
H_2S	≤ 0.10
NO_2	≤ 0.50
NH_3	≤ 1.00
CI_2	≤ 0.10
HCI	≤ 0.10
HF	≤ 0.01
O_3	≤ 0.05

Mechanical Stress Requirements

Table 7-11 Requirements for mechanical stress in the storage environment

Item	Subitem	Specification		
Random vibration	Spectrum density of accelerated speed	-	0.02 m^2/s^3	-
	Frequency range	5Hz to 10Hz	10Hz to 50Hz	50 Hz to100 Hz
	dB/oct	+12	-	-12

7.6.2 Transportation Environment

This section describes the requirements for the transportation environment of the UGW9811. The requirements for the transportation environment consist of the climatic requirements,

waterproofing requirements, biological requirements, air purity requirements, and mechanical stress requirements.

Climatic Requirements

Table 7-12 Climatic requirements for equipment transportation

Item	Specification
Temperature	-40 ℃ to +70 ℃ (-40 ℉ to +158 ℉)
Temperature change rate	≤ 1 ℃(33.8 ℉)/min
Relative humidity	5% to 95%
Atmospheric pressure	70 kPa to 106 kPa
Solar radiation	≤ 1120 W/m ²
Heat radiation	≤ 600 W/m ²

Waterproofing Requirements

The waterproofing requirements for equipment transportation are:

- The packing box should be in intact.
- Waterproofing measures should be taken to prevent rainwater from leaking into the package.
- There is no water on the floor of the transportation vehicle.

Biological Environment Requirements

- The vehicle should not be conducive for the growth of fungus or mildew.
- The vehicle should not have rodent intrusion.

Air Purity Requirements

The air must be free from explosive, electro-conductive, magneto-conductive, or corrosive dust.

Table 7-13 lists requirements for physically active substances in the transportation environment.

Table 7-13 Requirements for physically active substances in the transportation environment

Physically Active Substance	Density
Suspended dust(diameter ≤ 75 μm)	N/A
Precipitable dust(75 μm ≤ diameter ≤ 150 μm)	≤ 3.0 mg/m²•h
Sand(μm ≤ diameter ≤ 1000 μm)	≤ 100 mg/m ³

Table 7-14 lists requirements for chemically active substances in the transportation environment.

Table 7-14 Requirements for chemically active substances in the transportation environment

Chemically Active Substance	Density (mg/m³)
SO_2	≤ 1.00
H_2S	≤ 0.50
NO_2	≤ 1.00
NH_3	≤ 3.00
HCI	≤ 0.50
HF	≤ 0.03
O_3	≤ 0.10

Mechanical Stress Requirements

Table 7-15 Requirements for mechanical stress in the transportation environment

Item	Subitem	Specification	
Random vibration	Spectrum density of accelerated speed	$1m^2/s^3$	–3dB/oct
	Frequency range	5Hz to 20Hz	20Hz to 200Hz
Collision	Impulse response spectrum I(sample weight >50kg)	$100m/s^2$,11ms,100 times each side	
	Impulse response spectrum II (sample weight≤50kg)	$180m/s^2$,6ms,100 times each side	

7.6.3 Operating Environment

This section describes the requirements for the operating environment of the UGW9811. The requirements for the operating environment consist of the climatic requirements, waterproofing requirements, biological requirements, air purity requirements, and mechanical stress requirements.

Climatic Requirements

Table 7-16 Requirements for temperature and humidity in the operating environment

Temperature		Relative Humidity	
Long term operation	Short term operation	Long term operation	Short term operation
5 ℃ to 40 ℃ (41 ℉ to 104 ℉)	-5 ℃ to +50 ℃ (23 ℉ to 122 ℉)	5% to 85%	5% to 90%

NOTE

- Before measuring temperature or humidity, make sure the device has no protection cards. The values are measured at 1.5 m above the floor and 0.4 m in front of the equipment, without protective panels in front of or behind the cabinet.
- Short term operation refers to continuous operation for no more than 48 hours or accumulated operation of no more than 15 days in a year.

Table 7-17 lists requirements for other climatic factors in the operating environment.

Table 7-17 Requirements for other climatic factors in the operating environment

Item	Specification
Altitude	≤ 3000 m (9842.4 ft)
Atmospheric pressure	70 kPa to 106 kPa
Temperature change rate	≤ 0.5 ℃(32.9 ℉)/min
Solar radiation	≤ 700 W/m ²
Heat radiation	≤ 600 W/m ²

Biological Environment Requirements

- The operating environment should not be conducive to the growth of fungus or mildew.
- The operating environment should be free from rodent intrusion.

Air Purity Requirements

The air must be free from explosive, electro-conductive, magneto-conductive, or corrosive dust.

Table 7-18 lists requirements for physically active substances in the operating environment.

Table 7-18 Requirements for physically active substances in the operating environment

Physically Active Substance	Density
Suspended dust(diameter ≤ 75 μm)	≤ 0.4 mg/m ³
Precipitable dust(75 μm ≤ diameter ≤ 150 μm)	≤ 15mg/m²•h
Sand(150 μm ≤ diameter ≤ 1000 μm)	≤ 300 mg/m ³

Table 7-19 lists requirements for chemically active substances in the operating environment.

Table 7-19 Requirements for chemically active substances in the operating environment

Chemically Active Substance	Density (mg/m³)
SO_2	≤ 0.30
H_2S	≤ 0.10
NO_2	≤ 0.50
NH_3	≤ 1.00
CI_2	≤ 0.10

Chemically Active Substance	Density (mg/m³)
HCI	≤ 0.10
HF	≤ 0.01
O_3	≤ 0.05

Mechanical Stress Requirements

Table 7-20 Requirements for mechanical stress in the operating environment

Item	Subitem	Specification	
Sinusoidal vibration	Speed	≤ 5 mm/s	N/A
	Acceleration speed	N/A	≤2 m/s^2
	Frequency range	5Hz to 62Hz	62Hz to 200Hz
Unsteady-state impact	Impulse response spectrum II	Half sine wave, 30 m/s^2, 11 ms, three times each side	
	Static payload	0 kPa	

NOTE

- Impact response spectrum: refers to the maximum acceleration response curve generated by the equipment under specified impact excitation. Static payload: refers to the capability of the equipment in package to bear the pressure from the top in a normal pile-on method.

A Acronyms and Abbreviations

Numerics	
3GPP	3rd Generation Partnership Project
A	
AAA	Authentication, Authorization and Accounting
AF	Application Function
AM	Access Manager
AMBR	Aggregate Maximum Bit Rate
ARP	Address Resolution Protocol
B	
BM-SC	Broadcast/Multicast Service Center
C	
CAR	Committed Access Rate
CM	Charging Manager
D	
DDoS	Distributed Denial of Service
DHCP	Dynamic Host Configuration Protocol
DSCP	DiffServ Code Point
E	
eMBMS	Evolved Multimedia Broadcast Multicast Service
eNodeB	Evolved NodeB

EPC	Evolved Packet Core
EPS	Evolved Packet System
EPSN	External PCEF Support Node
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
G	
GBR	Guaranteed Bit Rate
GERAN	GSM EDGE Radio Access Network
GTP	GPRS Tunneling Protocol
GW	Gateway
H	
HPLMN	Home Public Land Mobile Network
HSGW	HRPD Serving Gateway
HSS	Home Subscriber Server
I	
IMS	IP Multimedia Subsystem
L	
LAC	L2TP Access Concentrator
LTE	Long Term Evolution
M	
MAG	Mobile Access Gateway
MBMS	multimedia broadcast/multicast service
MBR	Maximum Bit Rate
MME	Mobility Management Entity
O	
OCS	Online Charging System
P	

PCC	Policy and Charging Control
PCEF	Policy and Charging Enforcement Function
PCRF	Policy and Charging Rules Function
PDSN	Packet Data Serving Node
PMIP	Proxy Mobile IP Protocol
Q	
QoS	Quality of Service
R	
RAI	Routing Area Identity