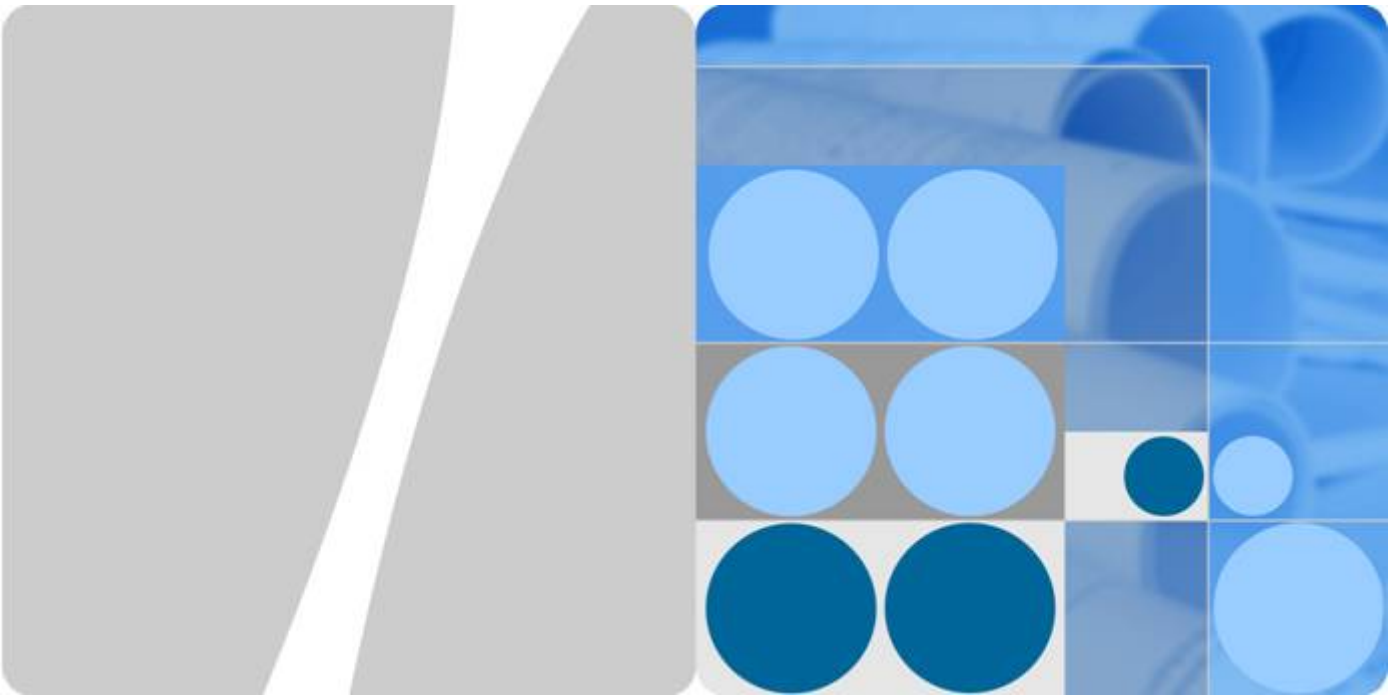

OptiX RTN 380 Radio Transmission System

V100R002C00

Product Description

Issue 02

Date 2014-06-30

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About This Document

Related Versions

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

Product Name	Version
OptiX RTN 380	V100R002C00
iManager U2000–T	V200R014C60

Intended Audience

This document is intended for:

- Network planning engineer
- Hardware installation engineer
- Installation and commissioning engineer
- Field maintenance engineer
- Data configuration engineer
- System maintenance engineer

Familiarity with the basic knowledge related to digital microwave communication technology will help you apply the information in this document.

Symbol Conventions

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

Symbol	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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Symbol	Description
	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

General Conventions

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

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

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 02 (2014-06-30)

This issue is the second release for the product version V100R002C00.

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Updates are as follows.

Update	Description
6 Technical Specifications	Added the "Technical Specifications" chapter.
Entire document	Fixed known defects.

Issue 01 (2014-05-30)

This issue is the first release for the product version V100R002C00.

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1 Product Introduction

About This Chapter

OptiX RTN 380 is a full-outdoor E-band microwave transmission equipment.

NOTE

RTN 380 is available in two models: RTN 380 using the system control board MXUF4 and RTN 380 using the system control board SHUF3. The first model is also called RTN 380 R2 and the latter one is also called RTN 380 R1. Unless otherwise specified, the RTN 380 in this document refers to the product using the system control board MXUF4.

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1.1 Network Positioning

The OptiX RTN 380 can provide large-capacity backhaul microwave links or aggregation links on a mobile communications network or a private network, or replace optical fibers to transmit CPRI signals between baseband units (BBUs) and remote radio units (RRUs) in a distributed base station system to achieve longer transmission of RRUs.

As E-band full outdoor radio equipment, the OptiX RTN 380 has the following characteristics:

- The OptiX RTN 380 operates at 71-76 GHz or 81-86 GHz frequency bands. It features large capacity, low inter-site interference, and rich frequency spectrum resources, as compared with radio equipment that operates at 6-42 GHz frequency bands. Therefore, OptiX RTN 380s can form a backhaul network for base stations densely deployed in a city and provide large-capacity backhaul links for aggregation sites. In addition, the OptiX RTN 380 can provide high-bandwidth microwave links for transmitting Ethernet services on a metro optical Ethernet in areas where optical fibers are difficult to lay out.
- As compact full outdoor radio equipment, the OptiX RTN 380 integrates all functions in a chassis and does not need an extra installation site. Therefore, it allows carriers to construct and operate networks at lower costs than traditional split radio equipment.

On a mobile communications network, OptiX RTN 380s are mainly used to:

- Provide large-capacity backhaul microwave links for 3G/LTE base stations especially those that are densely deployed in urban areas. See **Figure 1-1**.
- Provide large-capacity aggregation links for 3G/LTE base stations and implement multi-direction aggregation when working with OptiX RTN 900s. See **Figure 1-2**.
- Provide microwave links between BBUs and RRUs in a distributed base station system to transmit CPRI signals to achieve longer transmission of RRUs. See **Figure 1-3**.

Figure 1-1 Independently providing large-capacity backhaul links

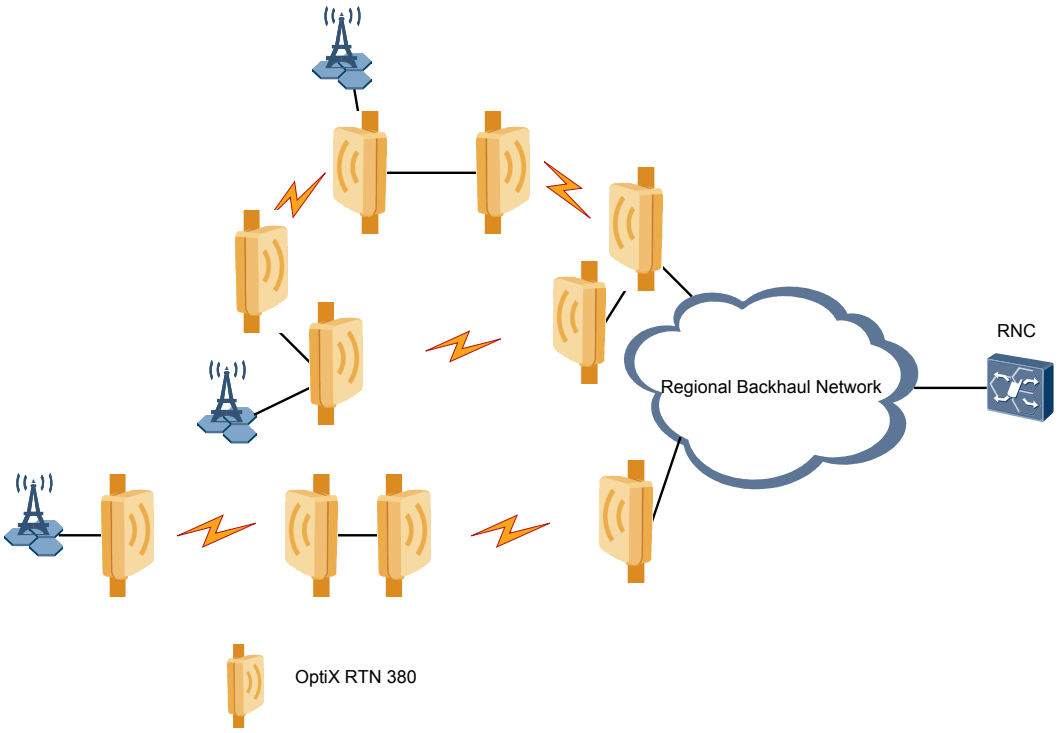

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Figure 1-2 Providing aggregation backhaul links

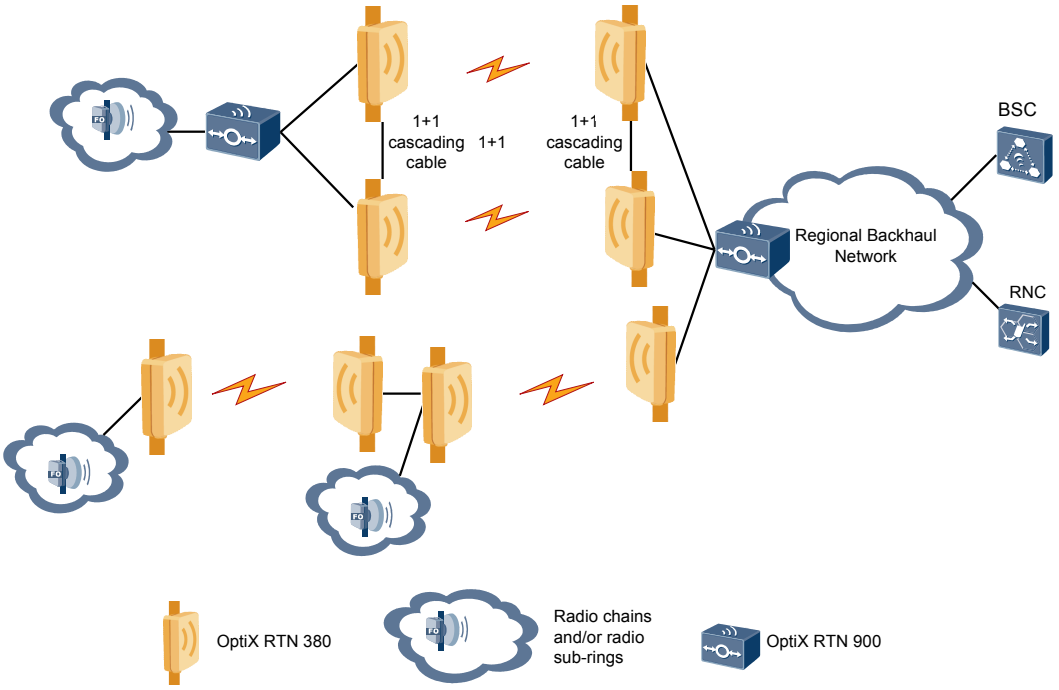
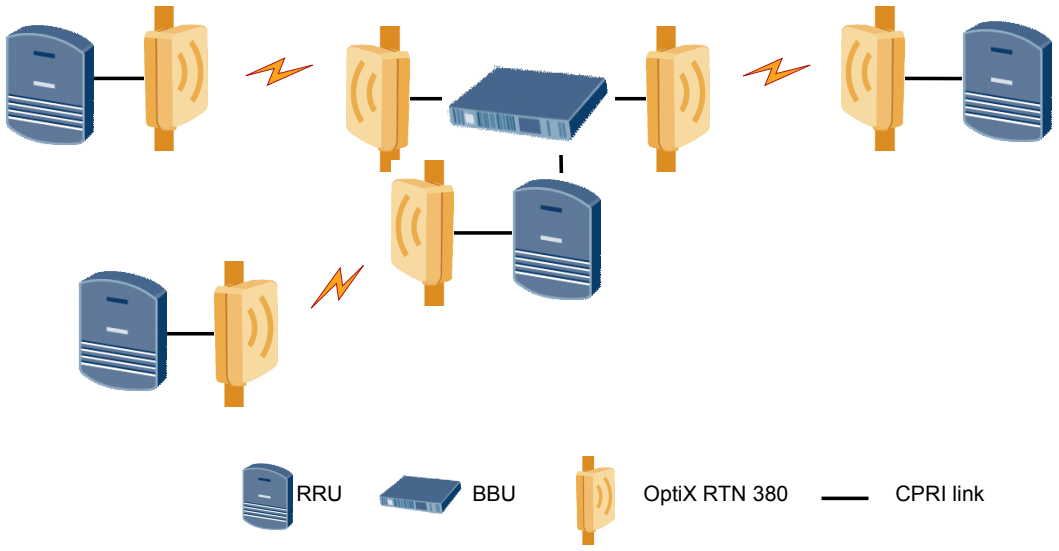


Figure 1-3 RTN 380 Longer transmission solution replacing optical fibers between BBUs and RRUs



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1.2 Specifications

OptiX RTN 380 specifications meet the high bandwidth requirements in E-Band microwave transmission. OptiX RTN 380 also has unique advantages in maintenance capabilities.

Table 1-1 lists the RTN 380 specifications.

Table 1-1 RTN 380 specifications

Item	Specifications
Microwave types	● IP microwave over Native Ethernet ● Microwave carrying common public radio interface (CPRI) services
Frequency bands	71-76 GHz and 81-86 GHz
Channel spacing	62.5 MHz, 125 MHz, 250 MHz, 500 MHz, and 750 MHz
Modulation schemes	QPSK Strong, QPSK, 16QAM Strong, 16QAM, 32QAM, and 64QAM **NOTE** The difference between strong modulation schemes and standard modulation schemes lies in encoding parameters. Strong modulation schemes have stronger FEC capabilities improving receiver sensitivity, but decreased air interface bandwidth.
RF configuration modes	● 1+0 mode ● 2+0 mode ● 1+1 mode **NOTE** ● In 1+1 or 2+0 mode, two OptiX RTN 380s are required for each site. ● When transparently transmitting CPRI services, RTN 380s cannot be configured in 1+1 mode.
Channel configuration modes	● Adjacent channel alternate polarization (ACAP) ● Adjacent channel co-polarized (ACCP) ● Co-channel dual polarization (CCDP)
AMAC	Supported
ATPC	Supported
Service ports	● When Ethernet services are transmitted, 2xFE/GE optical ports and 2xGE electrical ports are supported, one of the electrical ports supporting PoE. ● When CPRI services are transmitted, 1xCPRI port is supported.

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Item	Specifications
Service types	● Ethernet services – E-Line services: based on port, port+VLAN, port+QinQ – E-LAN services: based on 802.1d bridge, 802.1q bridge, and 802.1ad bridge A maximum of one E-LAN service is supported. ● CPRI services
Clock features	● Supported clock sources: – Microwave link clock – Synchronous Ethernet clock ● IEEE 1588v2 time synchronization
Power supply modes	PoE, which supports power supply through the PI, Dock, or other PSE equipment
Dimensions (H x W x D)	265 mm x 265 mm x 65 mm
Antennas	Dish antennas and flat antennas ● Dish antennas: available in diameters of 0.2 m, 0.3 m, and 0.6 m ● Flat antennas: available in models providing equivalent gain of dish antennas with diameters of 0.2 m and 0.3 m

Figure 1-4 Appearance of RTN 380

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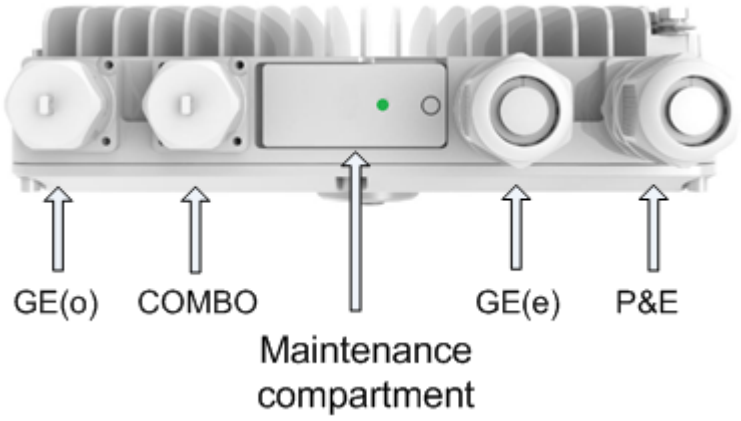
Figure 1-5 Ports



The maintenance compartment contains the NMS/RSSI port and USB port. The USB flash drive or Wi-Fi module is connected to the USB port.

1.3 Site Configurations

OptiX RTN 380s, which can be cascaded, are not only able to form 1+0 sites, but also 2+0 and 1+1 sites.

1.3.1 1+0 Sites

A 1+0 site provides a one-direction working microwave link.

In 1+0 mode, one single-polarized antenna is used.

An OptiX RTN 380 is directly mounted on an antenna.

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Figure 1-6 Typical configurations at a 1+0 site for transmitting Ethernet services (direct mounting)

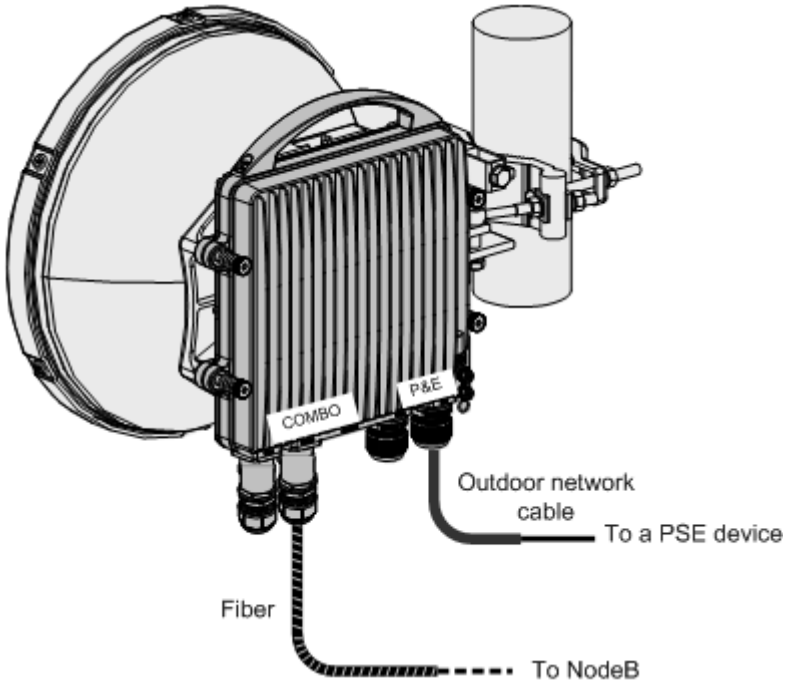
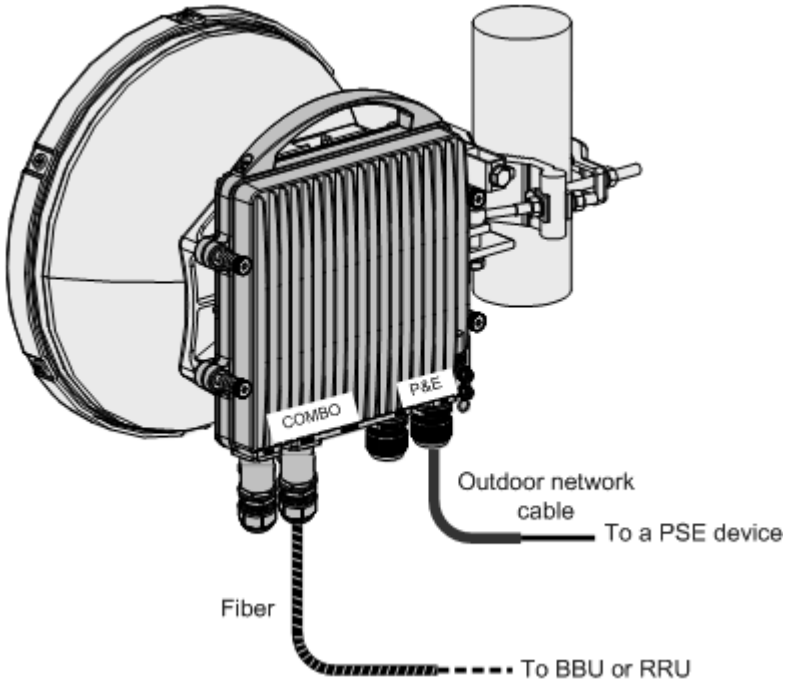


Figure 1-7 Typical configurations at a 1+0 site for transmitting CPRI services (direct mounting)



1.3.2 2+0 Sites

A 2+0 site provides two one-direction unprotected microwave links.

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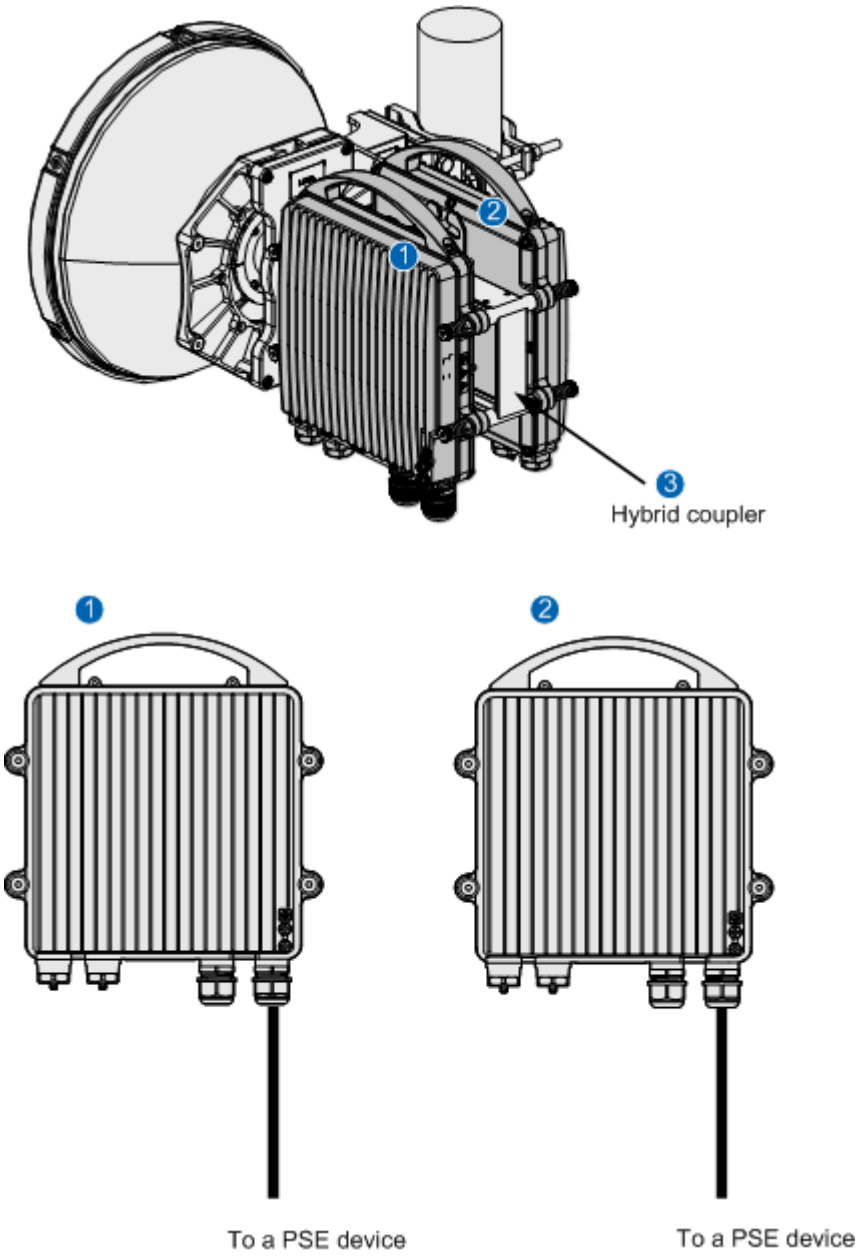
At a 2+0 site, two OptiX RTN 380s are installed on a hybrid coupler. The hybrid coupler is directly mounted on an antenna.

Figure 1-8 Typical configurations at a 2+0 site for transmitting Ethernet services (direct mounting)



NOTE

For CPRI services, two RTN 380s each receive/transmit one channel of CPRI services through the COMBO port.

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1.3.3 1+1 Sites

A 1+1 site provides a microwave link protection system that comprises one main microwave link and one standby microwave link in the same direction. The OptiX RTN 380 supports only 1+1 hot standby (HSB) protection for microwave links.

At a 1+1 site, two OptiX RTN 380s are installed on a hybrid coupler. The hybrid coupler is directly mounted on an antenna.

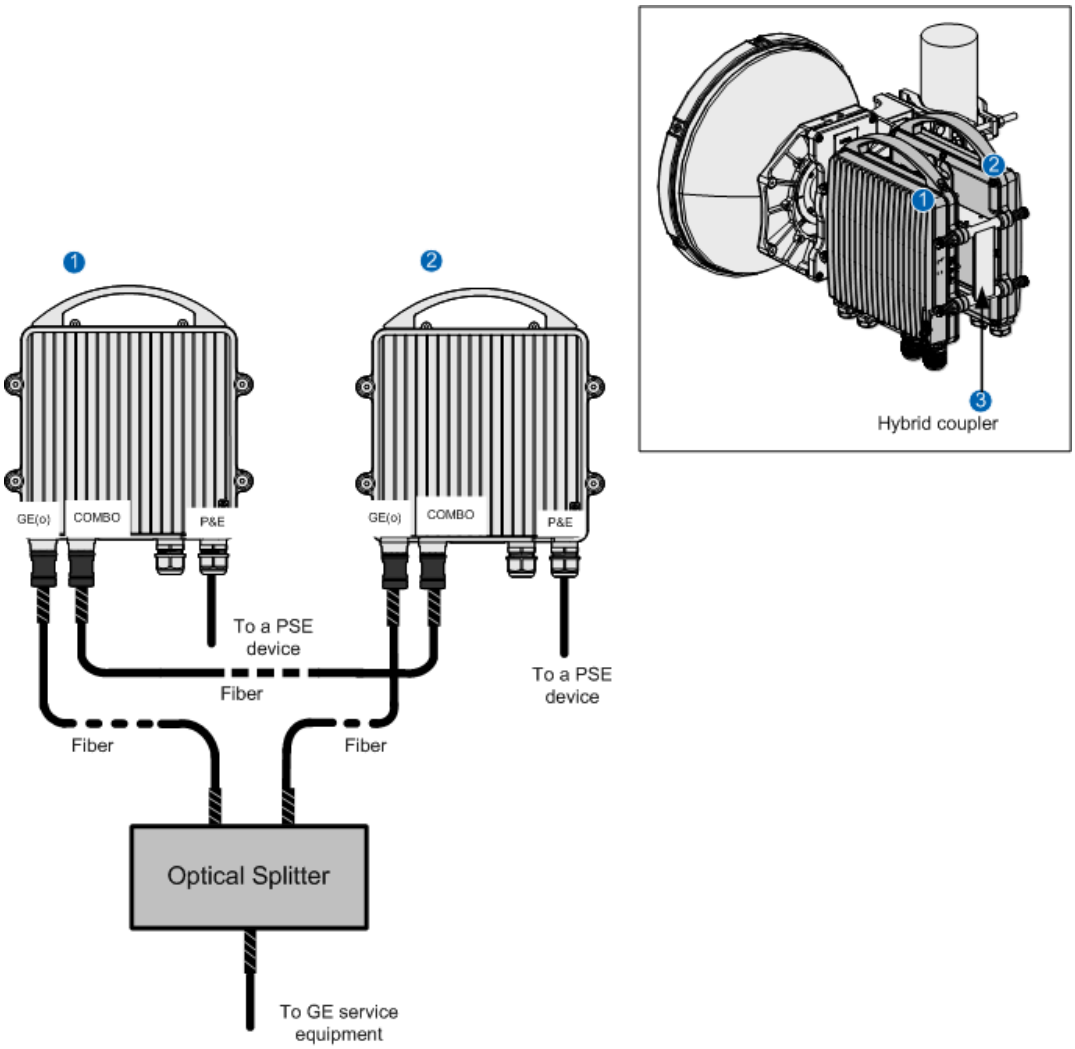
Two typical configurations are available for a 1+1 site.

- OptiX RTN 380s working with optical splitter
- OptiX RTN 380s working with an OptiX RTN 900 IDU

1+1 Site Consisting of OptiX RTN 380s and the optical splitter

An optical splitter is used to split one channel of optical signals into multiple channels. An optical splitter splits received GE optical signals into two channels, and transmits one channel to the main OptiX RTN 380 and the other channel to the standby OptiX RTN 380. The main and standby OptiX RTN 380s exchange 1+1 protection protocol packets using a 1+1 cascade cable. See **Figure 1-9**.

Figure 1-9 Typical configuration for a 1+1 site (only OptiX RTN 380s)



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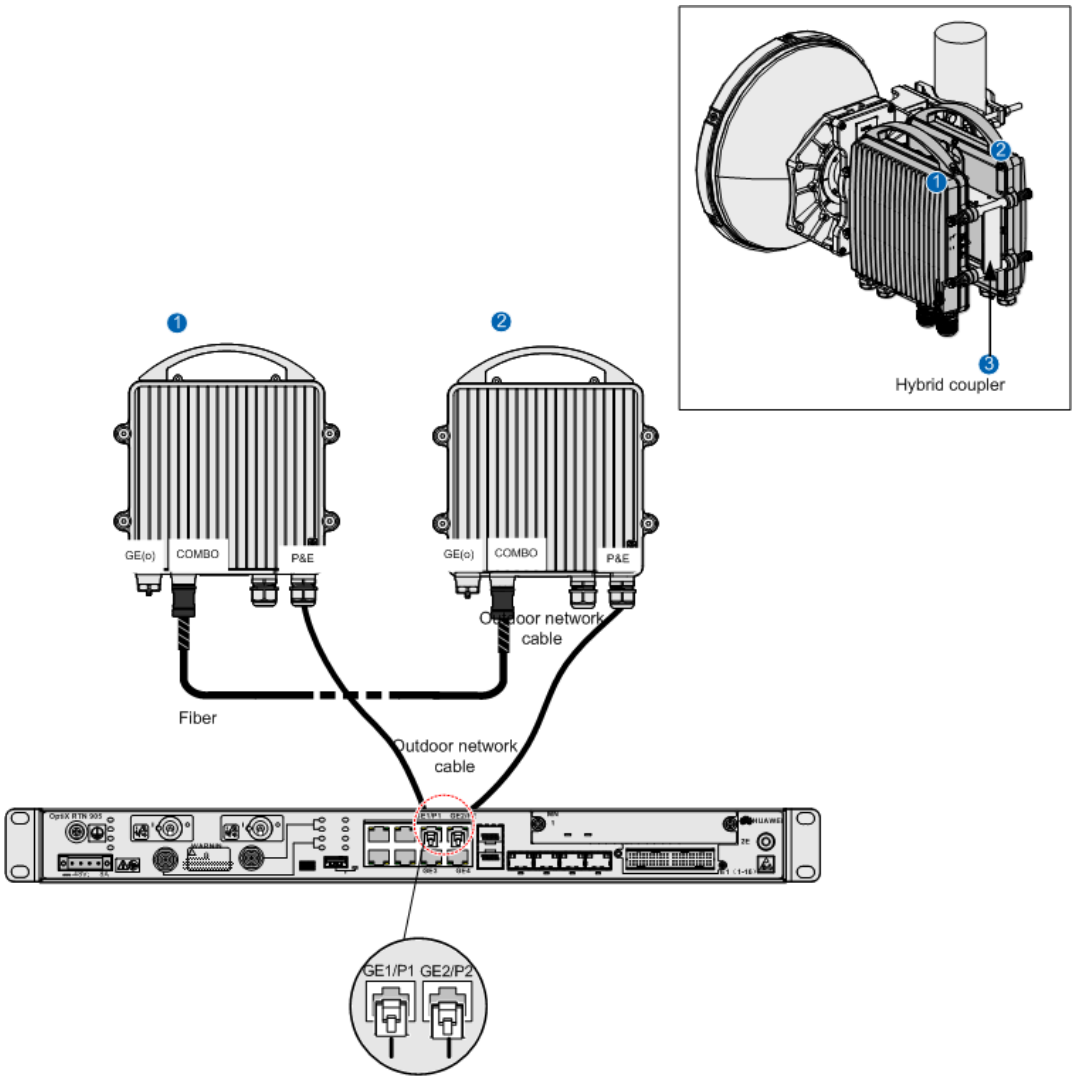
1+1 Site Consisting of OptiX RTN 380s and an OptiX RTN 900 IDU

Two OptiX RTN 380s can work with an OptiX RTN 900 IDU or an LACP-supporting UNI-side device to implement 1+1 protection. The main and standby OptiX RTN 380s exchange 1+1 protection protocol packets using a 1+1 cascade cable. When working with an OptiX RTN 900 IDU, the OptiX RTN 380s can connect to the power-over-Ethernet ports of an OptiX RTN 900 IDU using outdoor network cables, which carry both power signals and Ethernet service signals. See **Figure 1-10**.

Figure 1-10 Typical configuration for a 1+1 site (OptiX RTN 380s working with an OptiX RTN 900 IDU)



NOTE

In 1+1 protection configuration, active and standby RTN 380s are cascaded through any Ethernet port.

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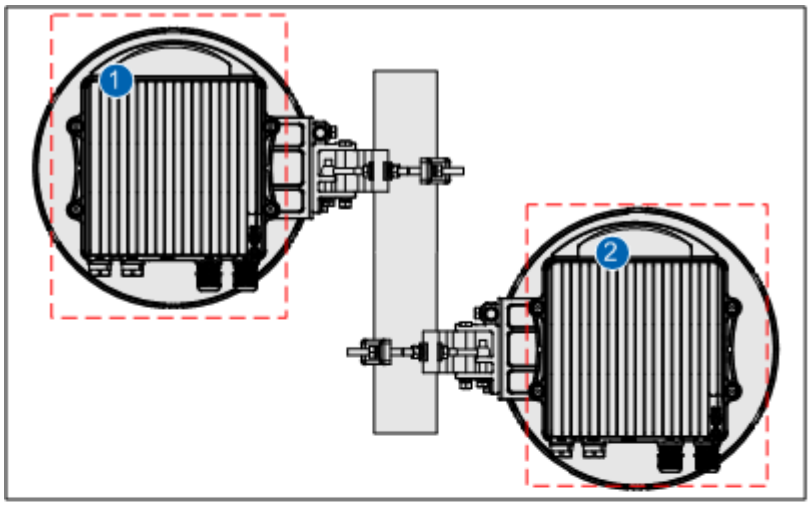
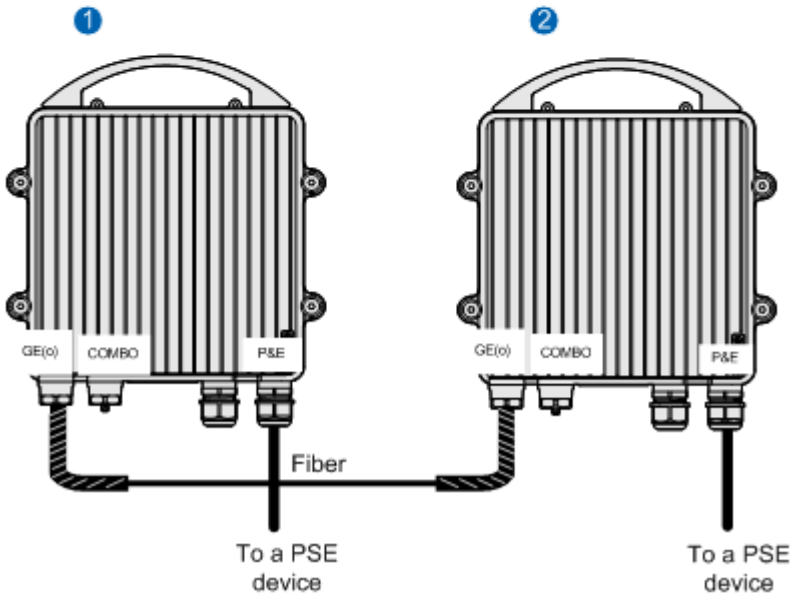
1.3.4 Multi-direction Sites

A multi-direction site provides multi-direction microwave links.

Multiple OptiX RTN 380s are cascaded using GE optical ports. Generally, multiple OptiX RTN 380s are cascaded for 2x(1+0) configuration. At a site with 2x(1+0) configuration, two OptiX RTN 380s are connected back-to-back. They can independently perform Ethernet service switching and scheduling with the help of built-in switching units.

Figure 1-11 Configurations at a 2x(1+0) site for transmitting Ethernet services





NOTE

For CPRI services, two RTN 380s each receive/transmit one channel of CPRI services through the COMBO port.

When multiple OptiX RTN 380s work with an OptiX RTN 900 IDU to form a multi-direction site, the maximum number of radio directions is equal to the number supported by the IDU.

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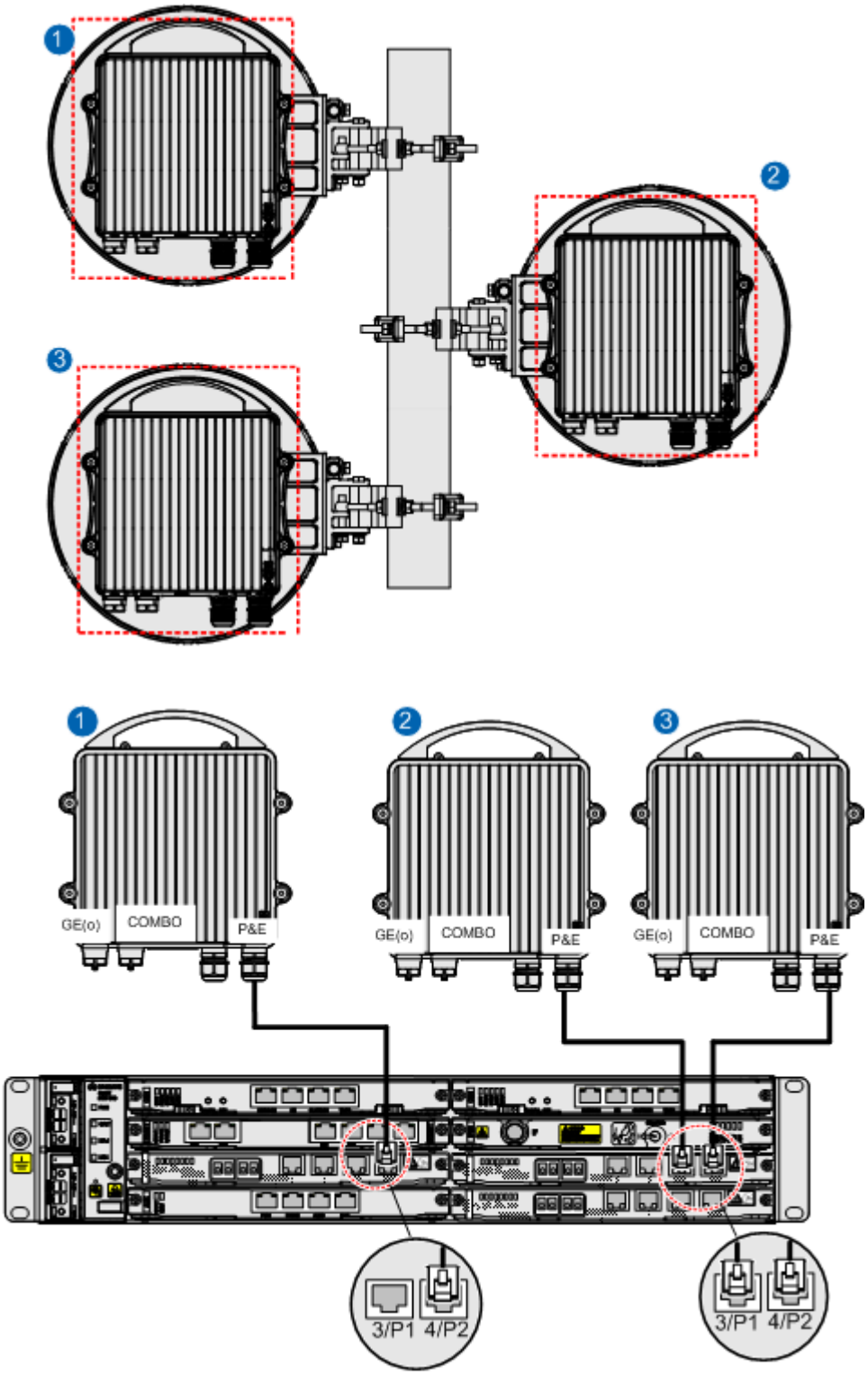
During installation, an OptiX RTN 380 can connect to the power-over-Ethernet port of an OptiX RTN 900 IDU using a outdoor network cable, which carries both power signals and Ethernet service signals.

Figure 1-12 Typical configurations at a multi-direction site (OptiX RTN 380s working with RTN 900)



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2 Functions and Features

About This Chapter

OptiX RTN 380 provides a variety of functions and features. It provides large-capacity high-quality microwave links for convergence sites on a mobile network or private network.

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OptiX RTN 380 supports multiple network management modes and provides comprehensive management information exchange solutions.

2.10 Rapid Deployment

A variety of technologies are used to simplify RTN 380 installation deployment..

2.11 Easy Maintenance

RTN 380 supports contact-free maintenance, powerful equipment-level OAM functions, and end-to-end TP-Assist.

2.12 Security Management

RTN 380 works with its network management system (NMS) to prevent unauthorized logins and operations, ensuring equipment management security.

2.13 Energy Saving

OptiX RTN 380 reduces the amount of energy consumed by using:

2.14 Environmental Protection

OptiX RTN 380 is designed to meet or exceed environmental protection requirements. The product complies with restriction of hazardous substances (RoHS) and waste from electrical and electronic equipment (WEEE) directives.

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2.1 AMAC

Adaptive modulation and adaptive channel space (AMAC) is a technology that automatically adjusts the working mode based on channel quality. AMAC includes the AM and AC functions.

AM

When AM technology is enabled and the same channel spacing is used, the radio service bandwidth varies according to the modulation scheme. The higher the modulation efficiency, the higher the bandwidth of the transmitted services. With quality of service (QoS) technology, packet services are groomed to queues with different priorities. Services in different queues are then transmitted to the microwave port after the queue-scheduling algorithm has been run. Under all channel conditions, the service capacity varies according to the modulation scheme.

- When conditions for channel quality are favorable good (such as on sunny days), the equipment uses a higher-order modulation scheme to transmit more user services. This improves transmission efficiency and spectrum utilization of the system.
- When conditions for channel quality are unfavorable (such as on stormy or foggy days), the equipment uses a lower-order modulation scheme to ensure that higher-priority services are transmitted first. If some lower-priority queues become congested due to a lack of available bandwidth, some or all interfaces in these queues are discarded. This method improves the anti-interference capabilities of a microwave link and ensures link availability for high-priority services.

The AM technology used by the OptiX RTN 380 has the following features:

- Uses QPSK Strong, QPSK, 16QAM Strong, 16QAM, 32QAM, 64QAM modulation schemes.
- Can configure both the lowest-order modulation scheme (also called reference scheme or modulation scheme of guaranteed AM capacity) and the highest-order modulation scheme (also called nominal scheme or modulation scheme of full AM capacity).
- Can switch modulation schemes without changing the transmit frequency, receive frequency, or channel spacing.
- Switches modulation schemes step-by-step.
- Features hitless shifting. When the modulation scheme is downshifted, low-priority services are discarded while high-priority services are not affected. Shifting is successful even when 100 dB/s channel fading occurs.

AC

AC is the enhancement of AM. If the lowest-order modulation scheme is set to QPSK Strong, the AM function downshifts the modulation scheme to QPSK Strong when channel quality deteriorates. Then, the AC function downshifts the channel spacing. The equipment uses the available bandwidth to transmit high-priority services, reducing the impact of channel quality deterioration on service signals.

- Channel spacing shifting is supported only when the modulation scheme downshifts to the lowest-order modulation scheme QPSK Strong.

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- When conditions for channel quality are unfavorable (such as on stormy or foggy days), the equipment downshifts the channel spacing, which reduces the impact of channel quality deterioration on service signals.
- AC features hitless shifting. When the channel spacing is downshifted, low-priority services are discarded while high-priority services are not affected. Shifting is successful even when 100 dB/s channel fading occurs.

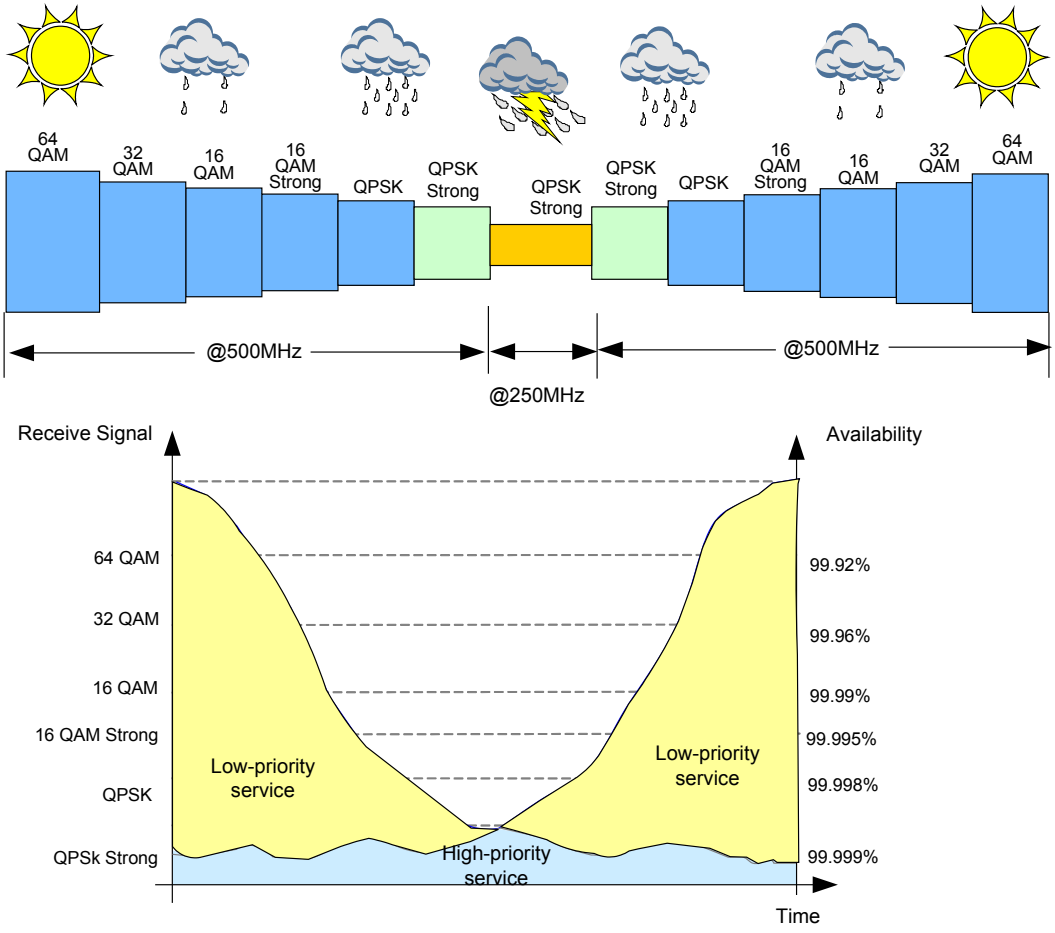
NOTE

OptiX RTN 380 supports only one-level AC downshifts form 500 MHz to 250 MHz or from 250 MHz to 125 MHz.

AMAC Diagram

Figure 2-1 shows the step-by-step shifting of the modulation scheme and channel spacing caused by weather changes and the impact of the shifting on service throughput and reliability.

Figure 2-1 AMAC diagram



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2.2 Automatic Transmit Power Control

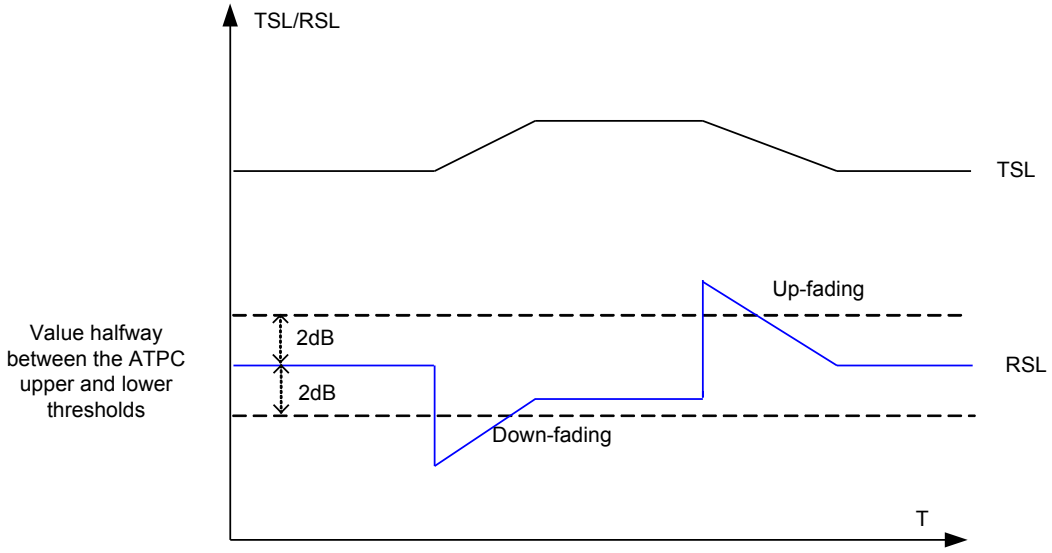
Automatic transmit power control (ATPC) is a method that uses received signal level (RSL) of the receiver to adjust transmit power within the ATPC control range. This feature reduces interference to neighboring systems and residual bit error rate (BER).

When ATPC is enabled:

- If the RSL is 2 dB or more than 2 dB less than the value halfway between the upper and lower ATPC thresholds, the receiver instructs the transmitter to increase transmit power so that the RSL does not deviate more than 2 dB from the halfway value.
- If the RSL is 2 dB or more than 2 dB greater than the value halfway between the upper and lower ATPC thresholds, the receiver instructs the transmitter to reduce transmit power so that the RSL does not deviate more than 2 dB from the halfway value.

Figure 2-2 shows the relationship between the RSL and the transmit signal level (TSL).

Figure 2-2 Relationship between the RSL and the TSL



2.3 Power over Ethernet

RTN 380 provides a P&E port through which it supports power over Ethernet (PoE) as a powered device (PD).

In PoE mode, a PoE cable carries Ethernet service signals along with DC power signals. PoE has the following advantages:

- Reduces the number of power cables and simplifies installation.
- Enables RTN 380 to share power supplies with small cell base stations.
- Enables RTN 380 to work with the power injector (PI) or other power sourcing equipment (PSE) such as an RTN 900 IDU or a Dock so that RTN 380 is connected to the network while being supplied with power.

An RTN 380 works with a power injector (PI), an OptiX RTN 900 IDU, or a Dock to implement power over Ethernet through its P&E port.

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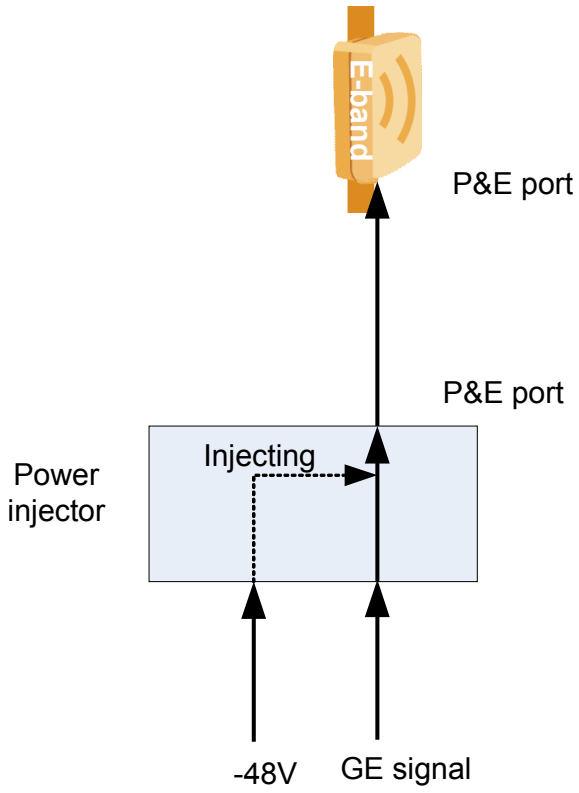
- One PI can power only one RTN 380. See **Figure 2-3**.

Figure 2-3 Working with a PI



- Working with other PSE equipment: For example, when an OptiX RTN 905 2E IDU is used, it provides two PoE ports so that it can supply power to up to two RTN 380s, as shown in **Figure 2-4**.

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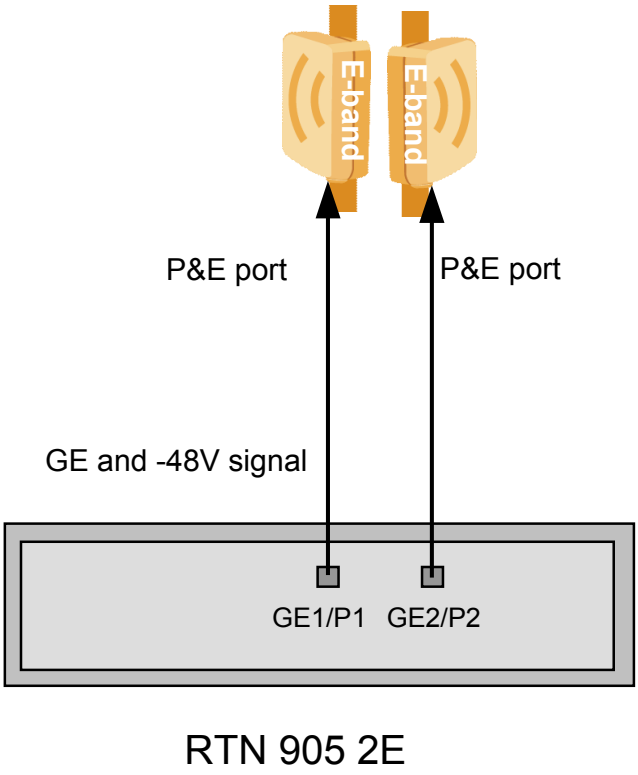
Figure 2-4 Working with an OptiX RTN 900



2.4 Ethernet Service Processing Capability

OptiX RTN 380 can process Native Ethernet services.

Table 2-1 Ethernet service processing capability

Item	Description
Service port	4xGE service ports ● 2xGE electrical ports, with one supporting PoE ● 2xFE/GE SFP optical ports
Port attribute	● The GE electrical port supports 10M full-duplex, 100M full-duplex, 1000M full-duplex, and auto-negotiation. ● The GE optical port supports 1000M full-duplex and auto-negotiation. ● The FE optical port supports 100M full-duplex and auto-negotiation.

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Item	Description
Ethernet service type	● Ethernet line (E-Line) service ● Ethernet local area network (E-LAN) service
Range of maximum frame length	1518 bytes to 9600 bytes
VLAN	● Adds, deletes, and swaps VLAN tags that comply with IEEE 802.1Q/P, and forwards packets based on VLAN tags. ● Processes packets based on the port tag attribute (Tag/Hybrid/Access). ● The VLAN ID ranges from 1 to 4094.
QinQ	● S-TAGs can be added, switched, or deleted. Packets can be forwarded based on S-VLAN IDs. ● An S-VLAN ID ranges from 1 to 4094.
MAC address	● The E-LAN service supports MAC address self-learning in two learning modes: SVL and IVL. ● Blacklist MAC addresses can be filtered. ● Static MAC address entries can be set. ● The capacity of the MAC address table is 16 k (including static and blacklist entries). ● The MAC address aging time is configurable.
LLDP	LLDP based on multicast addresses in nearest bridge mode
Spanning tree	Supports the MSTP protocol that adopts only the common and internal spanning tree (CIST). The MSTP protocol is equivalent to the RSTP protocol.
Link aggregation group (LAG)	LAGs consisting of Ethernet ports and of microwave and Ethernet ports
Ethernet ring protection switching (ERPS)	Supports ITU-T G.8032-compliant ring network protection for Ethernet services.
Link-state pass through (LPT)	Supports simplified LPT. When a microwave link fails, LPT automatically disables the Ethernet ports associated with the microwave link.
QoS	Supports QoS. For details, see **2.5 QoS**.
Traffic control	Supports IEEE 802.3x-compliant traffic control.

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Item	Description
ETH OAM	● Supports IEEE 802.1ag- and IEEE 802.3ah-compliant ETH OAM. ● Supports ITU-T Y.1731-compliant packet loss measurement, delay measurement, and delay variation measurement.
Ethernet performance monitoring	● Supports IETF RFC 2819-compliant remote network monitoring (RMON). ● Supports measurement of real-time and historical traffic and bandwidth utilization for ports.
Synchronous Ethernet	Supported.

NOTE

- OptiX RTN 380 supports a maximum of 64 E-Line services. The supported E-Line services fall into the following types:
  - Port-based E-Line services
  - Port+VLAN-based E-Line services
  - Port+QinQ-based E-Line services
- OptiX RTN 380 supports only one E-LAN service. The supported E-LAN services fall into the following types:
  - IEEE 802.1d bridge-based E-LAN services
  - IEEE 802.1q bridge-based E-LAN services
  - IEEE 802.1ad bridge-based E-LAN services

2.5 QoS

RTN 380 supports quality of service (QoS) functions, including traffic classification, traffic policing, congestion avoidance, queue scheduling, and traffic shaping.

QoS Processing Flow

QoS minimizes network delay and delay variations by properly allocating and monitoring network resources, thereby ensuring the quality of important services.

Figure 2-5 shows how RTN 380 performs QoS processing for Ethernet services.

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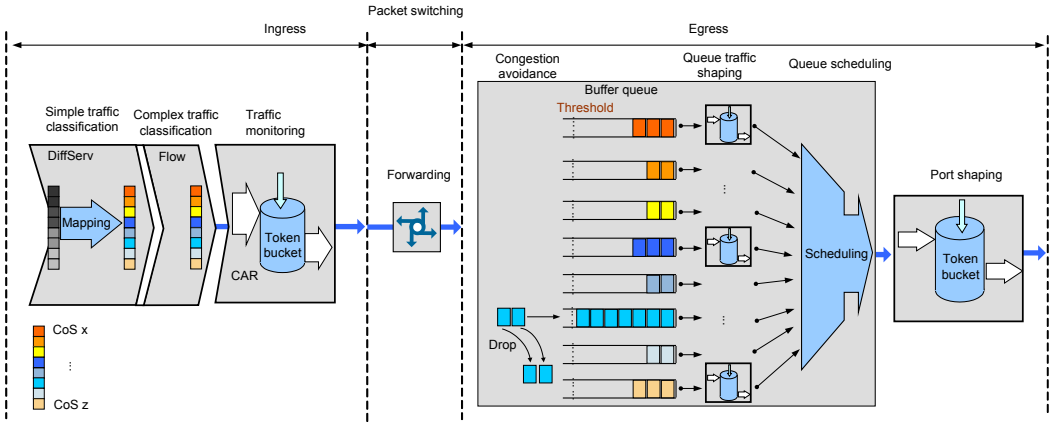
Figure 2-5 QoS processing



QoS Functions

Table 2-2 QoS functions

Function	Description
Simple traffic classification (DiffServ)	● Supports one DiffServ (DS) domain. ● Maps Ethernet services into different per-hop behaviors (PHBs) based on C-VLAN priorities, S-VLAN priorities, IP differentiated services code point (DSCP) values, or MPLS experimental bits (EXP) values. ● Supports enabling/disabling of DSCP demapping at egress ports.
Complex traffic classification	Supports traffic classification by MAC address, VLAN ID, VLAN priority, IP address, DSCP value, protocol type, port ID, or Internet Control Message Protocol (ICMP) type at ports.
ACL	Supports ACL based on complex traffic classification.
Traffic policing	Supports committed access rate (CAR) based on complex traffic classification at ports and supports the setting of the committed information rate (CIR), peak information rate (PIR), committed burst size (CBS), and peak burst size (PBS).

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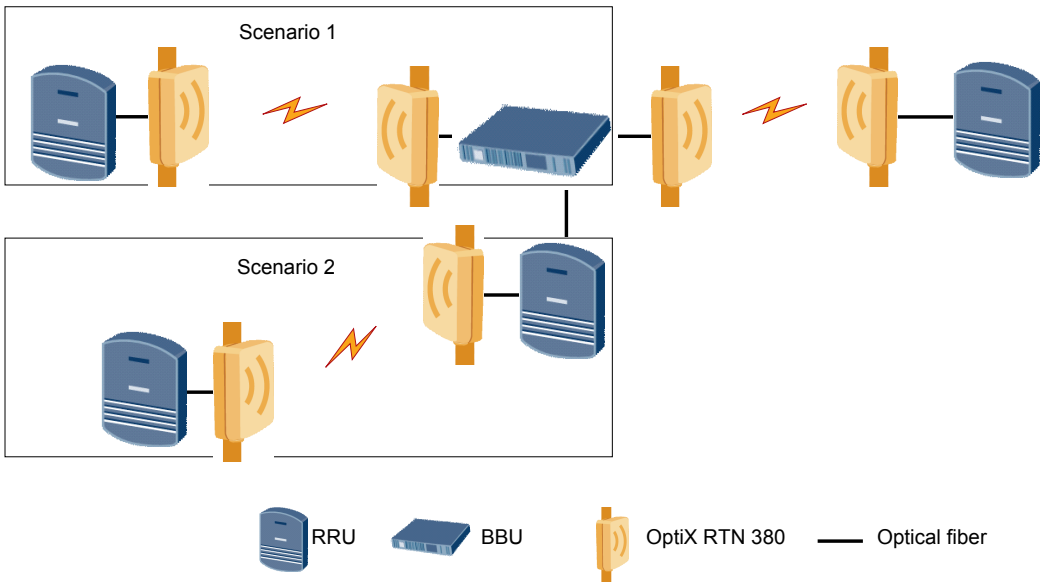
Function	Description
Congestion avoidance	● Supports tail drop at both microwave ports and Ethernet ports. ● Supports weighted random early detection (WRED) at both microwave ports and Ethernet ports.
Queue scheduling	● Supports eight levels of priority scheduling at both Ethernet ports and microwave ports. ● Flexibly sets the queue scheduling scheme for each Ethernet port and microwave port. The queue scheduling schemes include strict priority (SP), weighted round robin (WRR), and SP+WRR.
Traffic shaping	● Supports traffic shaping for egress queues and egress ports. ● Supports the setting of PIR in increments of 64 kbit/s and the setting of PBS.

2.6 CPRI

OptiX RTN 380 supports transparent transmission of common public radio interface (CPRI) services.

OptiX RTN 380 can substitute for optical fibers to transmit CPRI services between the baseband control unit (BBU) and remote radio units (RRUs) in a distributed base station system, as shown in **Figure 2-6**.

Figure 2-6 Replacement of optical fibers to transmit CPRI services between the BBU and remote RRUs



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When OptiX RTN 380 transmits CPRI services:

- The COMBO port functions as a CPRI port and transmits only CPRI services.
- In various radio working modes, the CPRI service transmission rate can be 1.25 Gbit/s or 2.5 Gbit/s.

  NOTE

  The accurate CPRI service transmission rate is 1.2288 Gbit/s or 2.4576 Gbit/s.

2.7 Clock Features

OptiX RTN 380's clock features meet clock transmission requirements of mobile communications networks and offer a wide selection of clock protection mechanisms.

Item	Description
Clock working mode	● Tracing ● Holdover ● Free-run
Clock source	● Microwave link clock ● Synchronous Ethernet clock
Synchronization Status Message (SSM) protocol or extended SSM protocol	Supported. SSM information can be transmitted in the following modes: ● Microwave link ● Synchronous Ethernet
IEEE 1588v2 time synchronization	Supports the following four modes: ● OC ● TC ● BC ● TC+BC

2.8 Protection

OptiX RTN 380 provides protection schemes for microwave links and Ethernet networks.

Table 2-3 Protection schemes

Protected Object	Protection Scheme
Microwave link	1+1 hot standby (HSB), which provides NE-level protection
Ethernet network	Link aggregation group (LAG) for Ethernet links and microwave links

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Protected Object	Protection Scheme
	Ethernet ring protection switching (ERPS) for Ethernet links and microwave links
	MSTP protection for Ethernet links and microwave links

2.9 Network Management

OptiX RTN 380 supports multiple network management modes and provides comprehensive management information exchange solutions.

Network Management Modes

OptiX RTN 380 supports the following functions:

- Uses the iManager U2000 Web LCT to manage one local NE or one remote NE on a per-NE basis.
- Uses the iManager U2000 to manage Huawei OptiX RTN NEs and Huawei optical transmission products in a centralized manner. The iManager U2000 is also able to manage transport networks in a unified manner.
- Uses the Simple Network Management Protocol (SNMP) to set and query specific NE configurations and to query NE alarms and performance.

Network Management Information Exchange Solutions

Table 2-4 DCN information exchange schemes

Item			Specifications
DCN channel	Data communications channel (DCC) bytes		Three Huawei-defined DCC bytes in microwave frames
	Network management system (NMS) port		One NMS port
	Inband DCN	Microwave link	All inband DCN channels are marked by one VLAN ID. The bandwidth of each inband DCN channel is configurable.
		Ethernet port	All inband DCN channels are marked by one VLAN ID. The bandwidth of each inband DCN channel is configurable. **NOTE** If Ethernet ports are used for 1+1 cascading, they also transmit inband DCN packets for network management.

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Item		Specifications
Network management protocol	HWECC protocol	Supported
	IP protocol	Supported
	L2DCN protocol	Supported

2.10 Rapid Deployment

A variety of technologies are used to simplify RTN 380 installation deployment..

For rapid deployment, design of RTN 380 considers the equipment form, plan, installation, and commissioning factors:

- RTN 380 is a full-outdoor device, which features in small footprint and light weight. It can be directly mounted to the rear side of antennas, requiring no additional space.
- Supports power over Ethernet. RTN 380 can work with a Dock, power injector (PI), or other power sourcing equipment (PSE) to receive service and power signals, facilitating deployment.
- Supports configuration-free deployment and commissioning using a USB flash drive.
- Provides built-in 802.1d bridge-based E-LAN services, facilitating Ethernet service configuration.
- Manages NEs on a per-NE basis without direction connections through a Wi-Fi module.

2.11 Easy Maintenance

RTN 380 supports contact-free maintenance, powerful equipment-level OAM functions, and end-to-end TP-Assist.

2.11.1 Contact-Free Maintenance

RTN 380 supports contact-free maintenance with its Wi-Fi module.

The Mobile LCT or Web LCT can use Wi-Fi to connect to a local RTN 380 with a Wi-Fi module.

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Figure 2-7 Contact-free maintenance

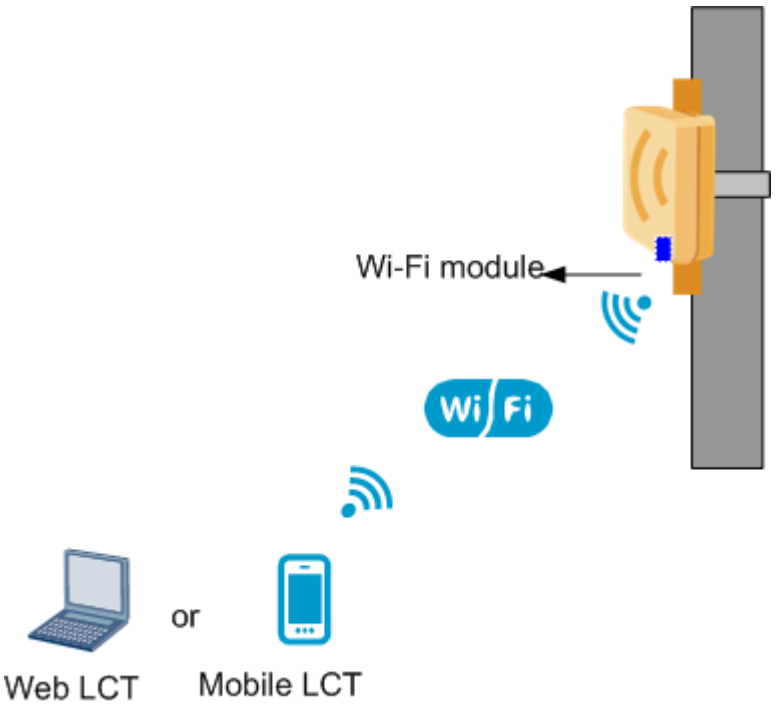

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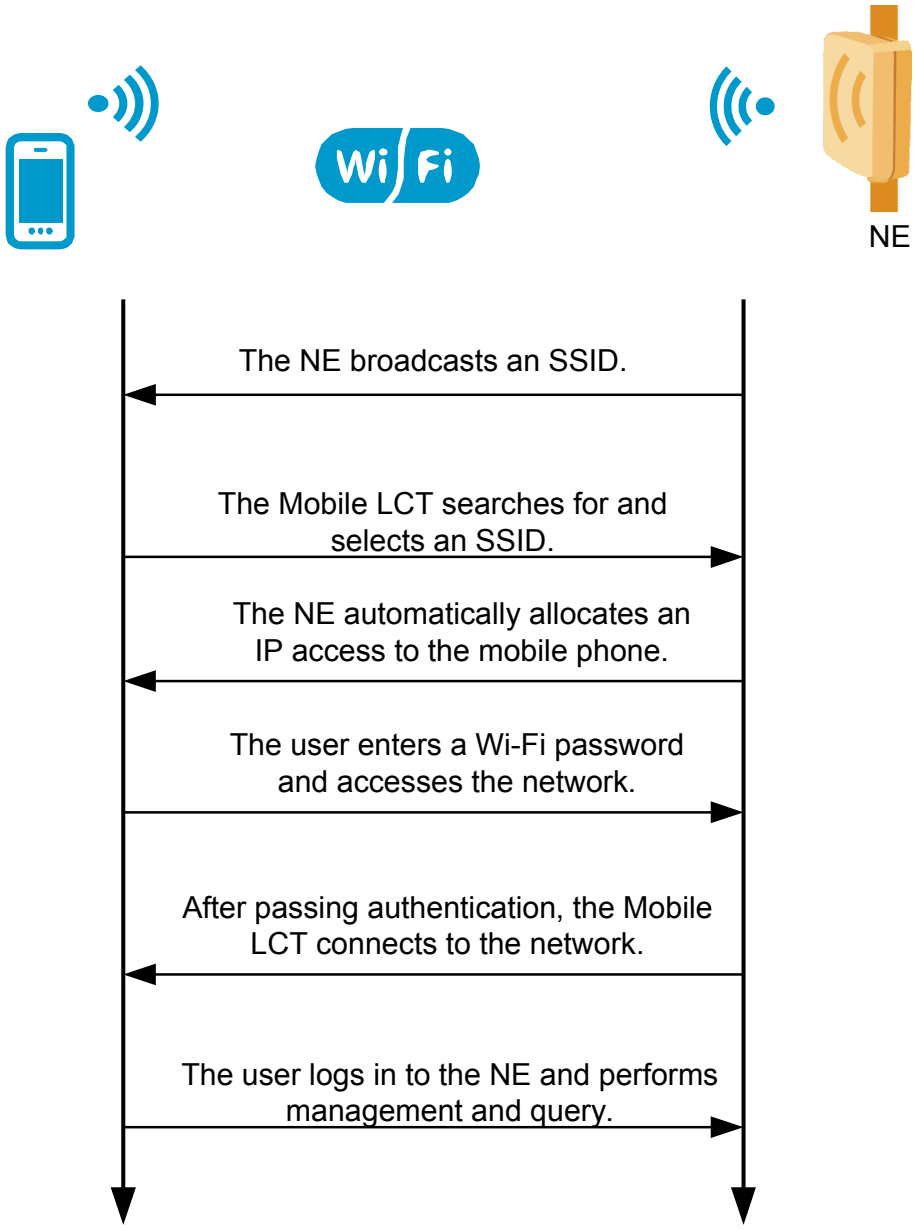
Figure 2-8 Access process through Wi-Fi



After connecting to a local NE through Wi-Fi, the Mobile LCT or Web LCT can be used to configure the NE, and query NE alarms, and the Web LCT can also be used to query performance and logs, facilitating commissioning and maintenance.

2.11.2 Equipment-Level OAM

RTN 380 provides a variety of operation, administration and maintenance (OAM) functions that effectively reduce equipment maintenance costs.

Table 2-5 describes the OAM functions supported by RTN 380.

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Table 2-5 Equipment-level OAM functions

Function	Description
Management and monitoring	● Supports unified management of microwave transmission networks and optical transmission networks, and end-to-end service creation and management using the iManager U2000-T. ● Supports creation, configuration, and operation management of an RTN 380 using the iManager U2000-M. ● Reports a variety of alarms and performance events. ● Supports RMON performance events. ● Measures real-time and historical traffic and bandwidth utilization for ports. ● Measures congestion-caused packet loss information by traffic class and egress queue for ports. ● Queries equipment temperatures. ● Monitors key radio transmission performance indicators, such as the microwave transmit power, receive power, signal-to-noise ratio (SNR), and air-interface bit error rate (BER), and displays them graphically. ● Supports frequency scanning to help identify co-channel interference and adjacent-channel interference. ● Collects one-click fault diagnosis information. ● Supports the connection of the Mobile LCT or Web LCT to the equipment using Wi-Fi during equipment commissioning or maintenance.
Diagnosis tests	● Supports pseudo random binary sequence (PRBS) tests at microwave ports. ● Supports PRBS tests at CPRI ports. ● Simulates Ethernet meters to test the packet loss ratio, delay, and throughput. ● Supports various loopback functions at service ports and microwave ports.
ETH OAM	● Supports IEEE 802.1ag- and IEEE 802.3ah-compliant ETH OAM. ● Supports ITU-T Y.1731-compliant packet loss measurement, delay measurement, and delay variation measurement. ● Supports loopback tests for Ethernet services.
Database management	● Backs up and restores NE databases remotely using the iManager U2000-T. ● Backs up and restores NE data using USB flash drives. ● Backs up and restores databases of peer NEs on microwave links.

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Function	Description
Software management	● Supports remote loading of NE software and data using the iManager U2000-T and provides a complete NE upgrade solution, allowing rapid upgrades of the entire network. ● Upgrades NE software using USB flash drives. ● Supports the not-stop forwarding (NSF) function, which prevents Ethernet services from being interrupted by warm NE software resets. ● Supports hot patches so that you can upgrade software without interrupting services. ● Supports software version rollback so that original system services are restored in case of software upgrade failures.

2.11.3 Packet OAM (TP-Assist)

In compliance with the network-centered, service-centered, and intelligent packet network O&M trend, Huawei promotes a brand new O&M system based on the TP-Assist solution. The O&M system covers the entire O&M process from network planning to fault diagnosis.

Table 2-6 describes the packet OAM functions supported by RTN 380.

Table 2-6 Functions of the TP-Assist O&M system

Function	Description	Purpose
Professional planning service and planning tools	Experienced planning expert teams provide professional planning service. Planning tool UniSTAR Designer, embedded with the common network HLD/LLD design templates and device/board/interface capacity parameter templates, is used. This tool is applicable to various network planning scenarios including new network construction, network expansion, network migration, and service adjustment.	Improves planning efficiency. Improves planning accuracy.
End-to-end service deployment	Deploys Native Ethernet (E-Line and E-LAN) services and hybrid services in an end-to-end manner. Deploys services across microwave and optical fibers in an end-to-end manner. Deploys ERPS rings in an end-to-end manner.	Quick service configuration Improves configuration accuracy.

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Function		Description	Purpose
Automatic deployment of alarm management with service deployment		Deploying ETH-OAM or MPLS-TP OAM when deploying Ethernet services and MPLS tunnels in an end-to-end manner.	Avoids extra OAM deployment operations. Allows the NE to automatically report alarms when a service fault occurs.
One-click service connectivity test		Supports one-click service connectivity test for Ethernet services and MPLS tunnels that are deployed in an end-to-end manner.	Quick commissioning Lowers project acceptance costs.
One-click service performance test		Supports one-click packet loss, delay, and delay jitter tests for Ethernet services and MPLS tunnels that are deployed in an end-to-end manner.	
Automatic tests with no need for any instrument		Simulating the Smartbits function, supports delay, throughput, short-term packet loss ratio, and long-term packet loss ratio tests for VLAN-based E-Line services.	
Performance monitoring and measurement	Network-level performance monitoring and measurement system	The PMS embedded in the U2000 supports unified monitoring and measurement of any measurement object and performance indicator in the network. It supports 24-hour service status pre-warning and monitoring, and provides equipment performance threshold-crossing alarms and network performance threshold-crossing alarms.	Optimized monitoring points, rich service monitoring methods Visualized monitoring; network-level and service-centered monitoring
	360-degree traffic statistics and monitoring based on service paths	Allows all-service-layer (port, MPLS tunnel, PW, and VLAN) traffic statistics and monitoring in a service view. Supports QoS packet loss detection.	
Visualized O&M	Queries and display of service paths based on VLANs	For E-Line services, allows users to find the service working path and protection path views based VLANs. For E-LAN services, allows users to find the VLAN domain views based on VLANs.	Service visualization
	Queries and display of service paths based on MAC addresses	For E-LAN services, allows users to find the actual MAC address forwarding path views based on MAC addresses.	

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Function		Description	Purpose
	Display of L2 protocol status information based on service paths	Illustrates the running status of the spanning tree protocol and ERPS protocol of each NE in the service view.	
Intelligent fault diagnosis		Performs automatic fault diagnosis for Ethernet services by layer (service/PW/tunnel/port) and by level (connectivity/performance/configuration). Quickly outputs fault diagnosis reports on a one-click operation GUI.	Intelligent fault diagnosis Cross-product fault diagnosis
IP ping		Responds to IP ping packets sent from client equipment and then quickly narrows down the fault location to the client equipment or the transport network. Support near-end or far-end IP ping responding. Supports initiating an IP ping test to the near-end or far-end.	
Network-level E-LAN service loop detection		Quickly detects an E-LAN loop (if any) in the service view. Automatically shuts down a looped service. Displays the loopback path.	

2.12 Security Management

RTN 380 works with its network management system (NMS) to prevent unauthorized logins and operations, ensuring equipment management security.

Overview of Hardware Security

RTN 380 uses the following hardware security measures:

- Microwave ports: The forward error correction (FEC) encoding mode is adopted and the adaptive time-domain equalizer for baseband signals is used. This enables the microwave ports to withstand strong interference. An interceptor cannot restore the content in a data frame if coding details and service configurations are not obtained.
- Modular design: Control units are separated from service units, and service units are separated from each other. In this manner, a fault on any unit can be isolated, minimizing the impact of the fault on other units in the system.
- CPU flow control: The data flow sent to the CPU for processing is classified and controlled to prevent CPU resources from being exhausted by a large number of packets. This ensures that the CPU operates properly under attacks.

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- Management port control: The protective cover for the maintenance compartment is kept closed when the management port is not being used, preventing unauthorized access.

Overview of Software Security

RTN 380 processes two types of data: O&M data and service data. The two types of data are transmitted over independent paths and do not affect each other. This enables services running on an RTN 380 to be processed on two planes:

- Management plane

  The management plane provides access to the required equipment and management functions, such as managing accounts and passwords, communication protocols, and alarm reporting. Security features on the management plane implement secure access, integrated security management, and all-round security audits.

- Data plane

  The data plane processes the service data flow entering the equipment and forwards service packets according to the forwarding table. Security features on the data plane ensure confidentiality and integration of user data by preventing malicious theft, modification, and removal of user service packets. These features ensure reliable data forwarding by protecting forwarding entries against malicious attacks and falsification.

Table 2-7 describes security functions provided by RTN 380.

Table 2-7 Security functions

Plane	Function	Description
Management plane	Account and password management	Manages and stores maintenance accounts and passwords.
	Local authentication and authorization	Authenticates and authorizes accounts.
	RADIUS authentication and authorization	Authenticates and authorizes remote accounts in a centralized manner to reduce maintenance costs.
	Security log	Records events related to account management.
	Operation log	Records non-query operations.
	Syslog management	Provides a standard solution to offline storage of logs, addressing insufficient storage space.

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Plane	Function	Description
	TCP/IP attack defense	Provides defense against TCP/IP attacks, such as error IP packet attacks, Internet Control Message Protocol (ICMP) ping and Jolt attacks, and DoS attacks.
	Access control list	Provides access control lists based on IP addresses and port IDs.
	SSL/TLS encryption communication (SSL is the abbreviated form of Secure Sockets Layer, and TLS is the abbreviated form of Transport Layer Security.)	Uses the SSL3.0 and TLS1.0 protocols to establish an encryption channel based on a security certificate.
	Secure File Transfer Protocol (SFTP)	Provides SFTP services.
	Open Shortest Path First (OSPF)	Uses the OSPFv2 protocol for standard MD5 authentication.
	Network Time Protocol (NTP)	Uses the NTPv3 protocol for MD5 authentication and permission control.
	Simple Network Management Protocol (SNMP)	Uses the SNMPv3 protocol for authentication and data encryption.
	USB flash drive connection control	Supports connection of only authorized USB flash drives based on an certificate file.
	Wi-Fi connection control	Supports Wi-Fi connection with correct passwords.
Data plane	Flow control	Controls traffic at ports. Broadcast packets are suppressed. Unknown unicast packets and multicast packets are discarded. QoS is used to control service traffic.
	Discarding of incorrect packets	Discards incorrect packets, such as an Ethernet packet shorter than 64 bytes.

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Plane	Function	Description
	Loop prevention	Detects self-loops at service ports and blocks self-looped ports.
	Access control of Layer 2 services	Filters static MAC addresses in the static MAC address table, provides a blacklist, enables and disables the MAC address learning function, and filters packets based on traffic classification.
	Service separation	Includes Layer 2 logical separation, split horizon, and physical path separation.

2.13 Energy Saving

OptiX RTN 380 reduces the amount of energy consumed by using:

- Streamlined design with minimum components
- High-efficiency power modules
- Low-power components
- Energy conservation mode

  In this mode, OptiX RTN 380 can shut down some clocks or decrease the internal sampling frequency (only at the 250 MHz channel bandwidth currently) to decrease the module power consumption.

  NOTE

  During a switch to the energy conservation mode, services may be interrupted and the service delay increases.

2.14 Environmental Protection

OptiX RTN 380 is designed to meet or exceed environmental protection requirements. The product complies with restriction of hazardous substances (RoHS) and waste from electrical and electronic equipment (WEEE) directives.

- OptiX RTN 380 complies with compulsory packing restrictions that limit the size of the package containing the equipment and accessories to three times that of the equipment dimensions.
- The product is designed for easy unpacking. In addition, all hazardous substances contained in the package can decompose quickly.

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- Every plastic component that weighs over 25 g is labeled according to the standards of ISO 11469 and ISO 1043-1 to ISO 1043-4. All components and packages of the equipment are provided with standard labels for recycling.
- Plugs and connectors are easy to find and can be operated using standard tools.
- All the accompanying materials (such as labels) are easy to remove. Certain types of identifying information (such as silkscreens) are printed on the chassis.

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3 Product Structure

About This Chapter

This chapter describes the system architecture, service signal processing flow, external ports, and indicator status.

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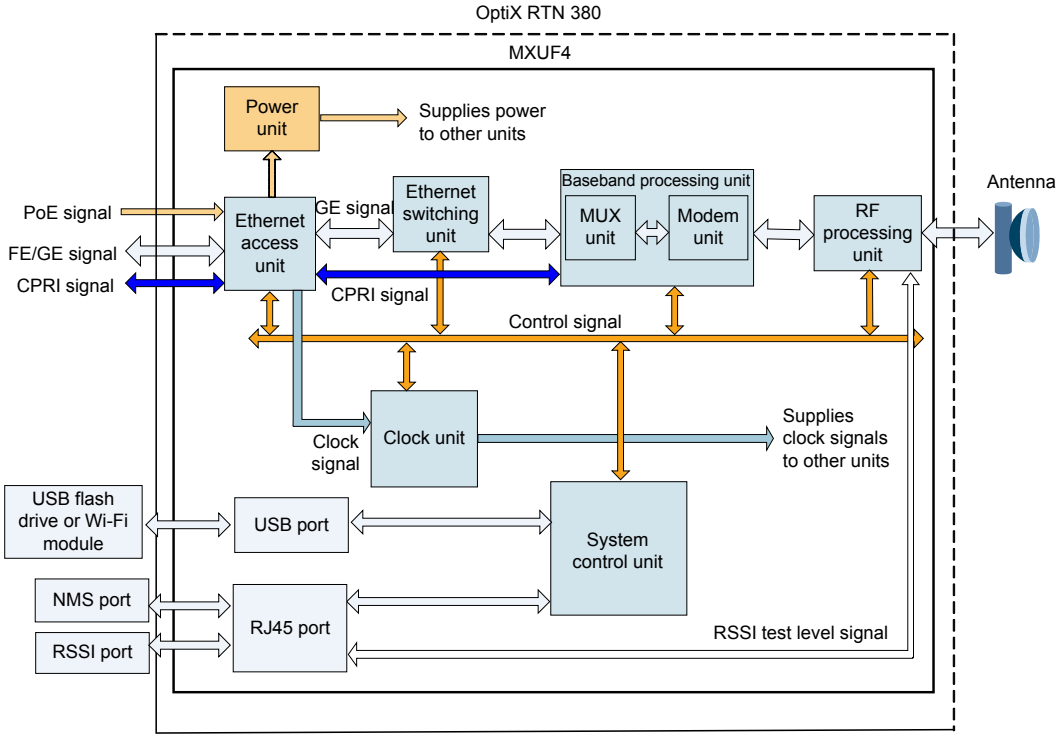
3.1 System Architecture

An OptiX RTN 380 has one physical board, which is displayed as MXUF4 on the network management system (NMS) and occupies logical slot 1.

The MXUF4 board is physically divided into multiple function units based on logical functions.

Block Diagram

Figure 3-1 Block diagram



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Function Units

Function Unit	Description
Service interface unit	For Ethernet service transmission: ● Receives/Transmits Ethernet service signals. ● Converts serial Ethernet signals into parallel Ethernet signals. ● Performs frame delimitation, preamble stripping, and cyclic redundancy check (CRC). ● Transmits power signals to the power unit. For common public radio interface (CPRI) service transmission: ● Receives/Transmits CPRI service signals through the CPRI port. ● Converts serial CPRI signals into parallel CPRI signals.
Ethernet switching unit	● Processes VLAN tags in Ethernet service signals. ● Performs quality of service (QoS) processing for Ethernet frames. ● Grooms services and performs protocol processing.
Baseband processing unit	● The MUX unit maps/demaps service signals to/from microwave frame signals. ● The MUX unit extracts overhead bytes from microwave frames and transmits the overhead bytes to the system control unit. ● The modem unit modulates and demodulates digital signals. ● The modem unit performs forward error correction (FEC). ● The modem unit performs conversion between analog and digital signals.
RF processing unit	● Performs frequency conversion and power amplification and sends RF signals to antennas in the transmit direction. ● Separates, filters, down converts, amplifies, and converts RF signals into baseband analog signals in the receive direction.

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Function Unit	Description
System control unit	● Controls and manages the running status of other units, and collects alarms and performance events through the control bus. ● Processes network management messages. ● Processes data from a USB flash drive. ● Processes Wi-Fi access signals.
Clock unit	● Extracts clock signals and provides them to other units. ● Receives and processes IEEE 1588v2 protocol messages for time synchronization.
Power unit	● Receives PoE power signals. ● Performs DC power conversion and supplies power to other units.

3.2 Service Signal Processing Flow

This section describes how the function units of OptiX RTN 380 process one channel of PoE signals.

Figure 3-2 Signal processing flow

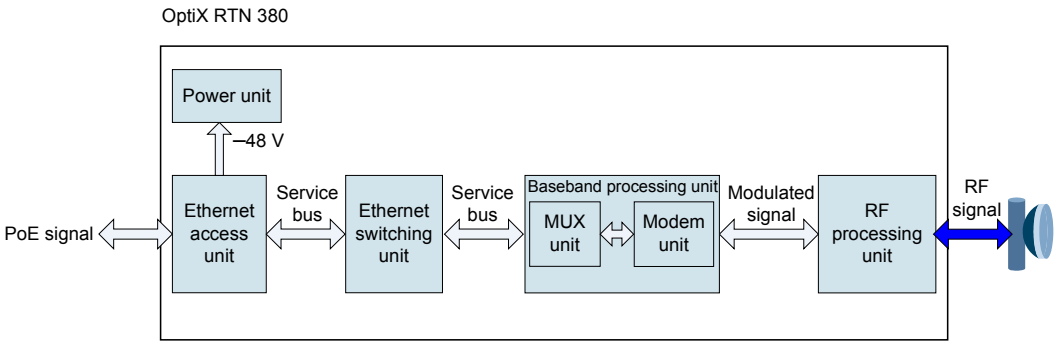

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Table 3-1 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Ethernet access unit	● Receives/Transmits PoE signals. ● Splits the PoE signals into Ethernet service signals and -48 V power signals. ● Transmits power signals to the power unit. ● Extracts Ethernet frames from Ethernet service signals.
2	Ethernet switching unit	● Performs Layer 2 protocol processing and quality of service (QoS) processing for the Ethernet frames. ● Transmits processed FE/GE service signals to the baseband processing unit.
3	Baseband processing unit	● Receives FE/GE service signals from the Ethernet switching unit. ● Turns FE/GE service signals and microwave frame overheads into microwave frames. ● Performs forward error correction (FEC) coding. ● Selects a proper modulation scheme based on the current channel quality. ● Performs modulation and digital/analog conversion. ● Transmits modulated signals to the RF processing unit.
4	RF processing unit	● Performs up-conversion and power amplification to convert the modulated signals into RF signals. ● Transmits the RF signals to the antenna through a flexible waveguide.

Table 3-2 Signal processing in the receive direction

Step	Function Unit	Processing Flow
1	RF processing unit	● Isolates and filters RF signals. ● Performs down-conversion and power amplification. ● Transmits the modulated signals to the baseband processing unit.

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Step	Function Unit	Processing Flow
2	Baseband processing unit	● Receives modulated signals from the RF processing unit. ● Performs analog/digital conversion. ● Demodulates signals. ● Performs FEC decoding. ● Extracts overhead signals and Ethernet frames from microwave frames. ● Transmits the Ethernet frames to the Ethernet switching unit.
3	Ethernet switching unit	● Receives Ethernet frames from the baseband processing unit. ● Processes the Ethernet frames based on service configurations and Layer 2 protocols. ● Transmits the Ethernet frames to the Ethernet access unit.
4	Ethernet access unit	Performs parallel/serial conversion and transmits the Ethernet signals.

3.3 Ports

RTN 380 has four service ports, one antenna port, and one maintenance compartment.

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Port Positions

Figure 3-3 Port positions

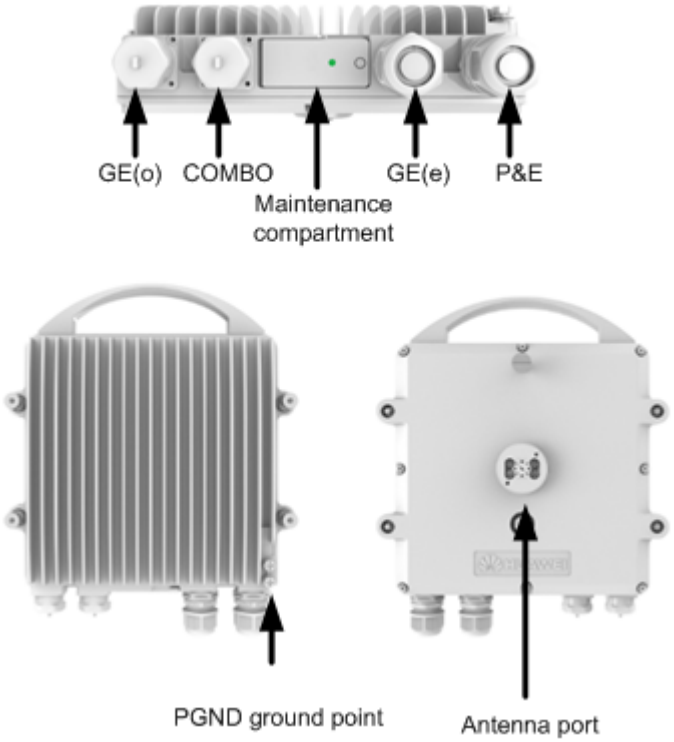

Table 3-3 Ports

No.	Port	Description	Connector Type
1	GE(o)	GE optical port	Small form-factor pluggable (SFP) optical module: supports 100BASE-LX, 1000BASE-SX, and 1000BASE-LX.
2	COMBO	Composite port that can function as any of the following ports through software setting: ● GE optical port ● CPRI port **NOTE** When transmitting CPRI services, GE and P&E ports cannot receive/transmit Ethernet services.	SFP module: ● GE optical port: supports 100BASE-LX, 1000base-LX and 1000base-SX. ● CPRI port: See **Table 3-5**.
3	GE(e)	GE electrical port	RJ45 connector

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No.	Port	Description	Connector Type
4	P&E	Power over Ethernet port, which can concurrently receive FE/GE electrical signals and -48 V power signals.	RJ45 connector
5	Management ports	● USB port – You can insert a USB flash drive into the USB port to import initial configuration data, back up NE data, or update software. – You can also insert a Wi-Fi module so that RTN 380 can connect to the Mobile LCT or Web LCT through a Wi-Fi network. ● The RSSI port and NMS port share an RJ45 jack. – RSSI port: You can obtain the received signal level of RTN 380 by testing the voltage of the RSSI port using a multimeter. – NMS port: The NMS port transmits network management signals.	USB port: USB connector RSSI port/NMS port: RJ45 connector
6	PGND ground point	-	M5 screw
7	Antenna port	● An antenna port connects to an antenna, or a hybrid coupler. ● RTN 380 can adapt its polarization direction to the hybrid coupler or antenna.	153IEC-R740, which can be connected to a UG387/U-R740

NOTE

Unused ports must be capped.

GE(o) Optical Port

A GE optical port receives/transmits Ethernet services using an SFP optical module.

An SFP optical module provides one TX port and one RX port. For details, see **Figure 3-4**, in which TX represents the transmit port and RX represents the receive port.

Figure 3-4 Ports of an SFP optical module

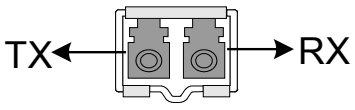

Table 3-4 lists the types of SFP optical modules that the GE optical port supports.

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Table 3-4 SFP optical modules supported by the GE optical port

Part Number	Module Type	Wavelength and Transmission Distance
34060321	1000BASE-SX	850 nm, 0.5 km
34060290	1000BASE-LX	1310 nm, 10 km
34060307	100Base-LX	1310 nm, 15 km

COMBO Port

A COMBO port is a versatile composite port and can be configured as a GE service port or CPRI port.

- If a COMBO port is configured as a GE optical port, it supports the same types of SFP optical modules as the GE optical port.
- If the COMBO port is configured as a CPRI port, RTN 380 and the interconnected BBU/RRU must use the same type of SFP optical module. **Table 3-5** lists the supported SFP optical module types.

Table 3-5 Types of SFP optical modules

BOM Number	Rate	Wavelength and Transmission Distance
34060286/34060321	1.2288 Gbit/s	850 nm, 0.5 km
34060290		1310 nm, 10 km
34060365	2.4576 Gbit/s	850 nm, 0.3 km
34060327		1310 nm, 2 km
34060336		1310 nm, 15 km

P&E Port and GE(e) Port

P&E is a power over Ethernet port, which is used to transmit FE/GE electrical signals and -48 V power signals. It is connected to the PI or other PSE equipment.

GE(e) is a common Ethernet electrical port.

The P&E port and GE(e) port both use the RJ45 connector.

Figure 3-5 RJ45 connector front view

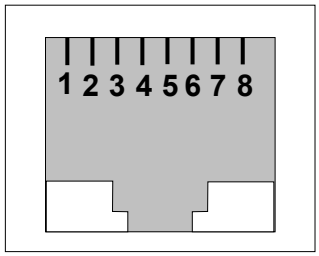

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Table 3-6 Port pin assignments

Pin No.	P&E		GE(e)	
	Signal	Function	Signal	Function
1	BIDA+/BGND	Bidirectional data wire A (+)/ Power ground	BIDA+	Bidirectional data wire A (+)
2	BIDA-/BGND	Bidirectional data wire A (-)/ Power ground	BIDA-	Bidirectional data wire A (-)
3	BIDB+/-48V	Bidirectional data wire B (+)/ Power signal (-48 V)	BIDB+	Bidirectional data wire B (+)
6	BIDB-/-48V	Bidirectional data wire B (-)/ Power signal (-48 V)	BIDB-	Bidirectional data wire B (-)
4	BIDC+/BGND	Bidirectional data wire C (+)/ Power ground	BIDC+	Bidirectional data wire C (+)
5	BIDC-/BGND	Bidirectional data wire C (-)/ Power ground	BIDC-	Bidirectional data wire C (-)
7	BIDD+/-48V	Bidirectional data wire D (+)/ Power signal (-48 V)	BIDD+	Bidirectional data wire D (+)
8	BIDD-/-48V	Bidirectional data wire D (-)/ Power signal (-48 V)	BIDD-	Bidirectional data wire D (-)

Management Ports

Management ports are located in the maintenance compartment. When RTN 380 is running, the protective cover of the maintenance compartment must be closed. See **Figure 3-6**.

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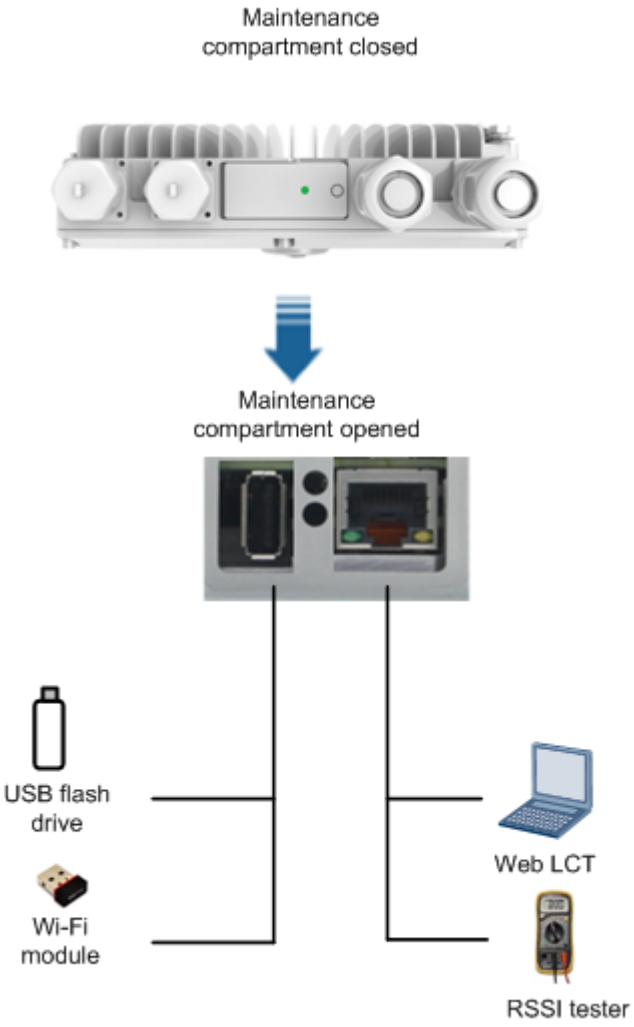
Figure 3-6 Front view of the management ports



The USB port can either connect to a USB flash drive for importing configurations, upgrading software, or backing up data or to a Wi-Fi module for enabling connection of the Mobile LCT to the equipment.

Table 3-7 provides the pin assignments for the RJ45 connector of the RSSI port/NMS port.

Table 3-7 Pin assignments for the RJ45 connector of the RSSI port/NMS port

Pin No.	Signal
1	Signal output (+)
2	Signal output (-)
3	Signal input (+)
4	Ground
5	Reserved
6	Signal input (-)

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Pin No.	Signal
7	RSSI test level signal
8	Reserved

The RJ45 connector has two indicators that indicate the NMS port connection status. **Table 3-8** describes what the indicator statuses mean.

Table 3-8 Indicator status explanation

Indicator	Status	Meaning
LINK (yellow)	On	The NMS port connection is normal.
	Off	The NMS port connection is interrupted.
ACT (green)	On or blinks	The NMS port is receiving or transmitting data.
	Off	The NMS port is not receiving or transmitting data.

3.4 Indicators

An RTN 380 has service port indicators, one USB port indicator, and one system indicator.

The indicators are located inside ports, and indicate the operating status of equipment during the installation, commissioning, and maintenance processes.

Table 3-9 Indicator status explanation

Indicator	Status	Meaning
GE optical port indicator	Steady green	The GE optical port is connected correctly, but is not receiving or transmitting data.
	Blinks green	The GE optical port is receiving or transmitting data.
	Off	The GE optical port is not connected or is incorrectly connected.

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Indicator		Status	Meaning
GE electrical port indicator	Link	Steady green	The GE electrical port is connected correctly, but is not receiving or transmitting data.
		Off	The GE electrical port is not connected.
	ACT	Steady yellow	The GE electrical port is receiving or transmitting data.
		Off	The GE electrical port is not receiving or transmitting data.
Indicator that indicates system operating status and link status (STAT)	Operating status	Steady green	The equipment is working properly and services at the air interface are normal.
		Steady red	The hardware is faulty (for example, the equipment fails to start, or a HARD_BAD alarm is reported).
		Off	The equipment is not powered on.
	Link status	Blinks red	The equipment is working properly but services at the air interface are interrupted.
USB port indicator	Wi-Fi module	Steady green	The Wi-Fi module has been identified and is working properly.
		Steady red	The Wi-Fi module is faulty.

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Indicator		Status	Meaning
		Off	● No Wi-Fi module is connected to the USB port. ● The Wi-Fi module connected to the USB port cannot be identified.
	USB flash drive	Steady green	Backing up or restoring data is complete.
		Blinks green	Data is being backed up or restored.
		Steady red	● The USB flash drive is faulty. ● Backing up or restoring data fails.
		Blinks red	The hardware is faulty and fails to initialize the USB flash drive.
		Off	● No USB flash drive is connected to the USB port. ● The USB flash drive connected to the USB port cannot be identified.

NOTE

After you load data to an RTN 380 using a USB flash drive, the RTN 380 automatically resets. All the indicates are off during the reset. After the reset is complete, observe the system indicator to learn about the status of the RTN 380.

3.5 Labels

Product nameplate labels, qualification card labels, electrostatic discharge (ESD) protection labels, radiation warning labels, grounding labels, high temperature warning labels, and other types of labels are affixed in their respective positions on the chassis. Adhere to any warnings or instructions on the labels when performing various tasks to avoid any personal injury or damage to equipment.

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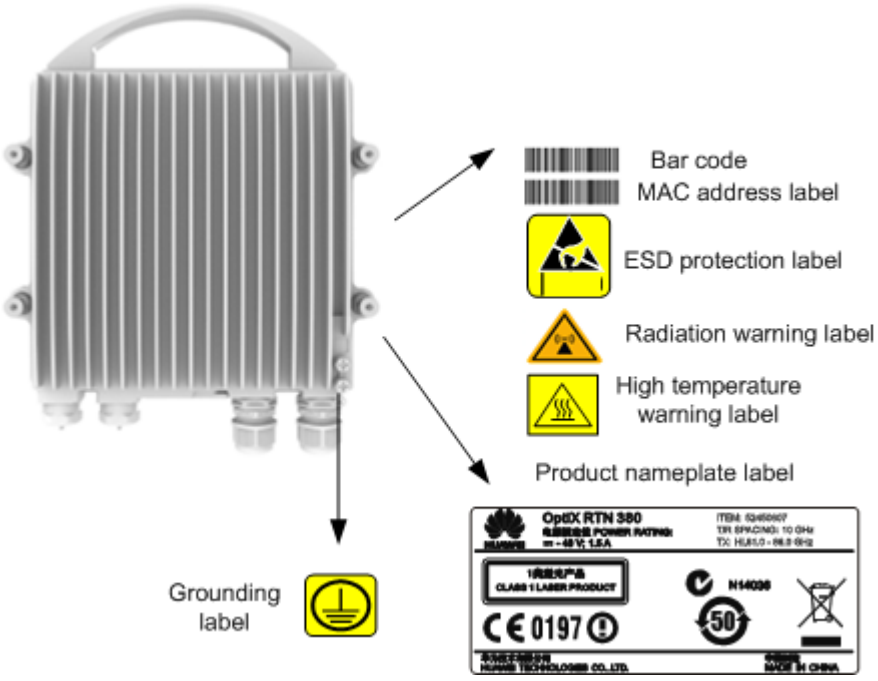
Label Positions

Figure 3-7 Label positions



NOTE

High temperature warning label: Indicates that the equipment surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. Wear protective gloves to handle the equipment.

Product Nameplate Label

Figure 3-8 Product nameplate label

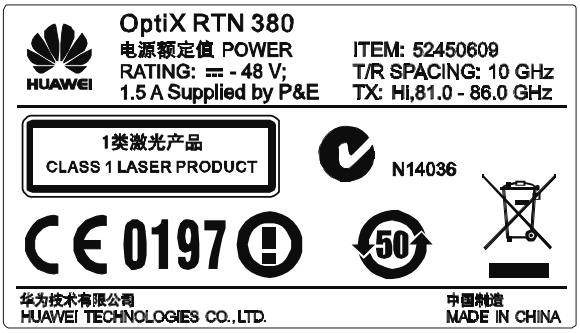


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Table 3-10 Label description

Label	Description
OptiX RTN 380	Product name
ITEM: 52450609	Product type
-48V; 1.5A	Rated power
Supplied by P&E	Power over Ethernet
T/R SPACING	T/R spacing (GHz)
Tx: Hi,81.0–86.0GHz	TX high/low site ● Hi: TX high site ● Lo: TX low site TX frequency range ● Transmit frequency range of the TX high site: 81.0 GHz-86.0 GHz ● Transmit frequency range of the TX low site: 71.0 GHz-76.0 GHz

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4 Networking and Applications

About This Chapter

OptiX RTN 380 supports various networks.

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4.1 Independent Networking

OptiX RTN 380s can independently form a ring or chain backhaul network for aggregation sites, or provide point-to-point microwave links transmitting common public radio interface (CPRI) services.

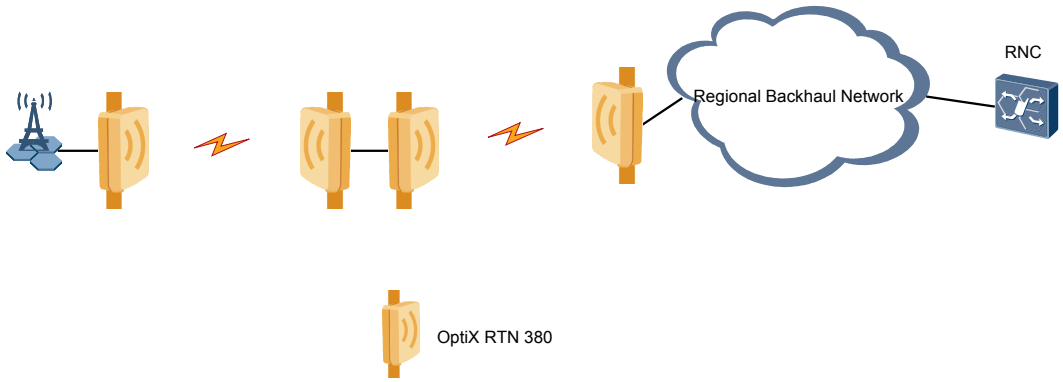
4.1.1 Chain Networks (Ethernet Services)

OptiX RTN 380 supports point-to-point networks. Chain, tree, or star networks can be built by cascading NEs.

Figure 4-1 shows a chain network solution. In this solution:

- Medium-/Small-capacity microwave links use 1+0 configuration.
- 1+1 configuration can be used for links requiring higher reliability.
- Large-capacity microwave links use 2+0 configuration. In this case, two OptiX RTN 380s must be installed at one site. In 2+0 configuration mode, air interface LAG can be configured to provide Ethernet service protection.

Figure 4-1 Chain network solution



4.1.2 Ring Networks (Ethernet Services)

OptiX RTN 380 supports ring networks and provides protection for ring networks. In addition, ring networks and chain networks can be combined to form ring-with-chain networks.

Figure 4-2 shows a ring network solution. In this solution:

- Ethernet ring protection switching (ERPS) can be configured to protect Ethernet services on the ring network.
- Two OptiX RTN 380s must be installed at one site.

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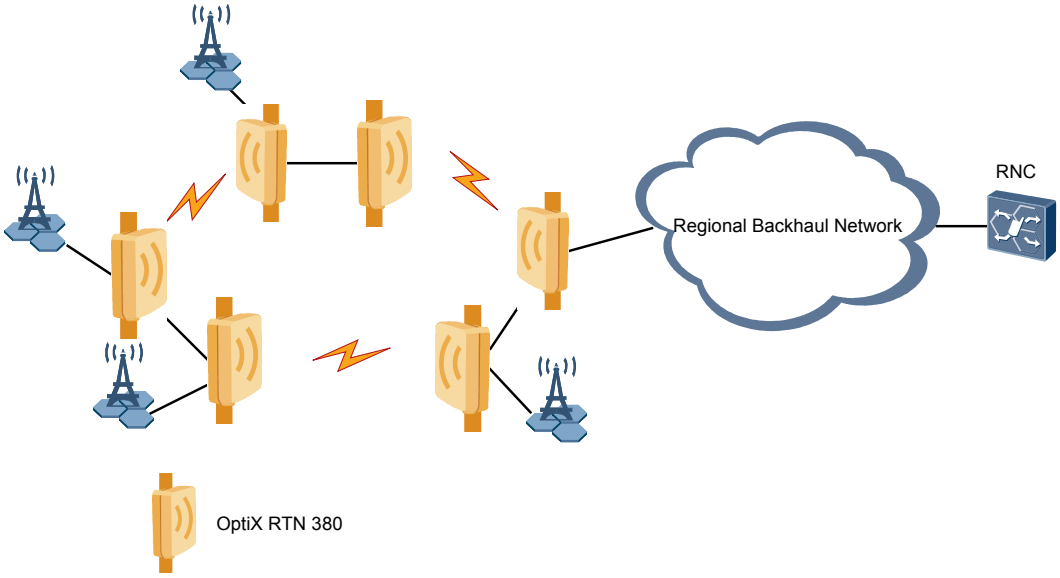
Figure 4-2 Ring network solution



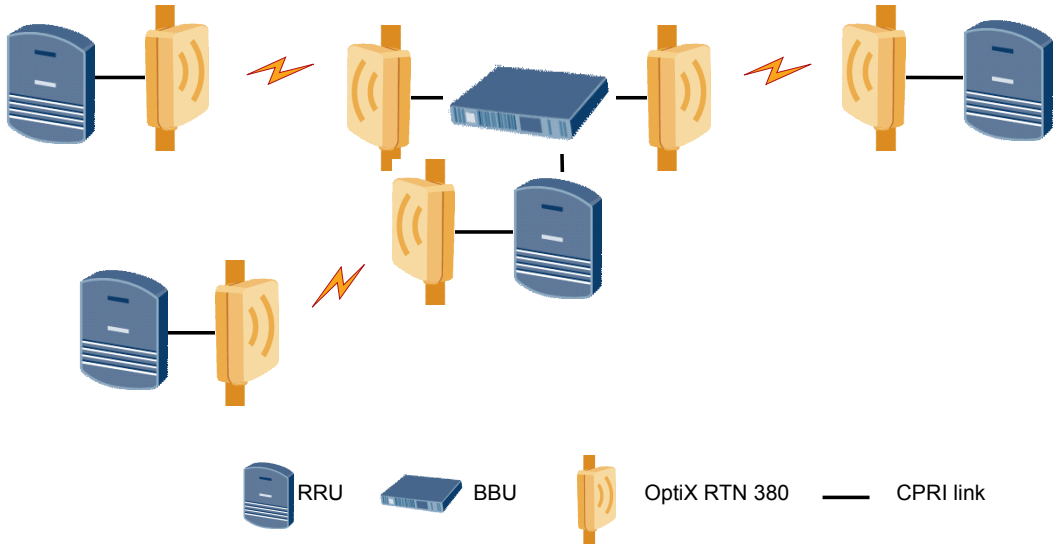
4.1.3 Point-to-Point Networking (CPRI Services)

When transmitting common public radio interface (CPRI) services, OptiX RTN 380s support only point-to-point networking.

As shown in **Figure 4-3**, microwave links on a point-to-point network can:

- OptiX RTN 380s can transmit CPRI services between a BBU and an RRU, as well as between two RRUs.
- A maximum of two E-band microwave link hops are supported between a BBU and an RRU.

Figure 4-3 Point-to-point networking for CPRI services



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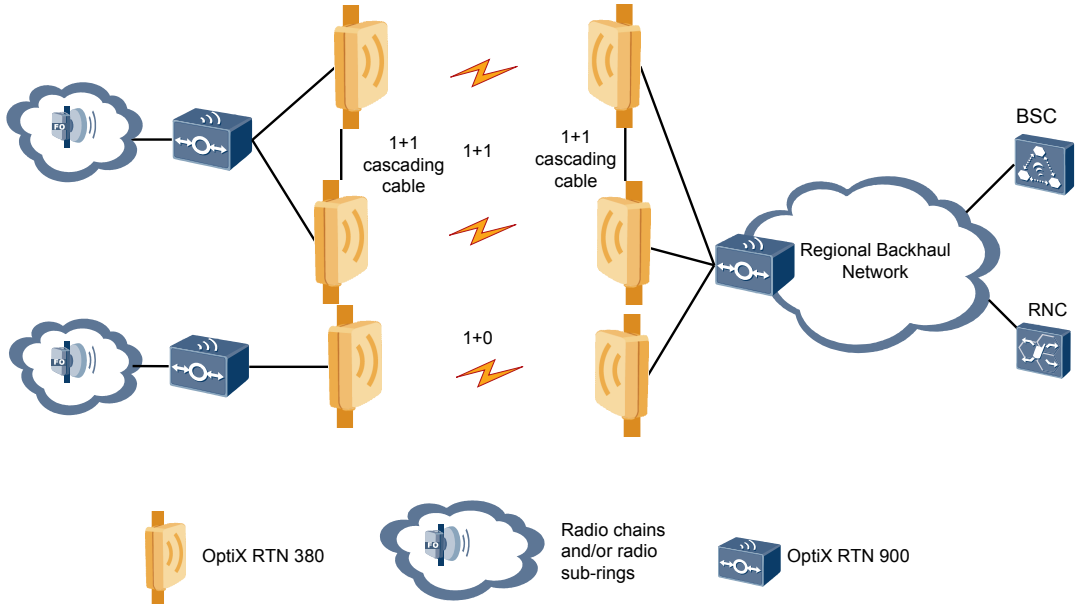
4.2 Networking with the OptiX RTN 900

OptiX RTN 380 can work with OptiX RTN 900, which increases the service convergence capabilities of nodal NEs.

Figure 4-4 shows a network that combines OptiX RTN 380s and OptiX RTN 900s.

- OptiX RTN 380 can work with OptiX RTN 900 to provide high-bandwidth microwave backhaul links and increase the service convergence capabilities of nodal NEs.
- For important links, OptiX RTN 380 can work with OptiX RTN 900 to provide 1+1 link protection.
- RTN 380 works with the IDU that supports the PoE function to receive/transmit power and Ethernet service signals through the P&E port.

Figure 4-4 Hybrid network solution



4.3 Networking with LAN Switches

OptiX RTN 380 can work with LAN switches to comprise full-meshed and other complex networks.

As shown in **Figure 4-5**, RTN 380s work with LAN switches to form a network. The spanning tree protocol can be enabled on these devices to prevent loops and protect services.

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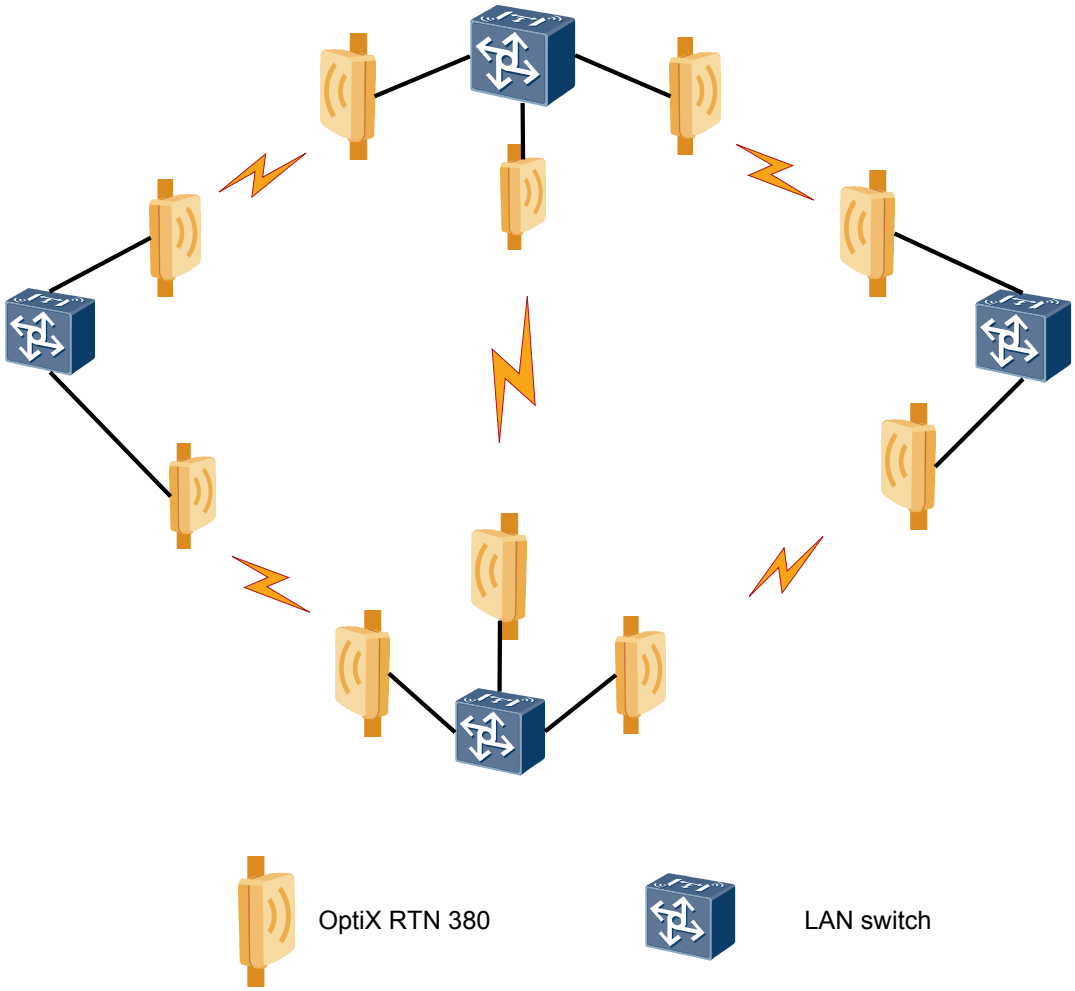
Figure 4-5 Networking with LAN switches



4.4 Supplementary Network for Optical Fibers

OptiX RTN 380 can provide high-bandwidth microwave links for transmitting Ethernet services on a metro optical Ethernet in areas where optical fibers are difficult to lay out.

Featuring high bandwidth and low interference between sites, RTN 380 applies to supplementary networks.

RTN 380 can provide high-bandwidth microwave links for transmitting Ethernet services on a metro optical Ethernet in areas where optical fibers are difficult to lay out, as shown in **Figure 4-6**.

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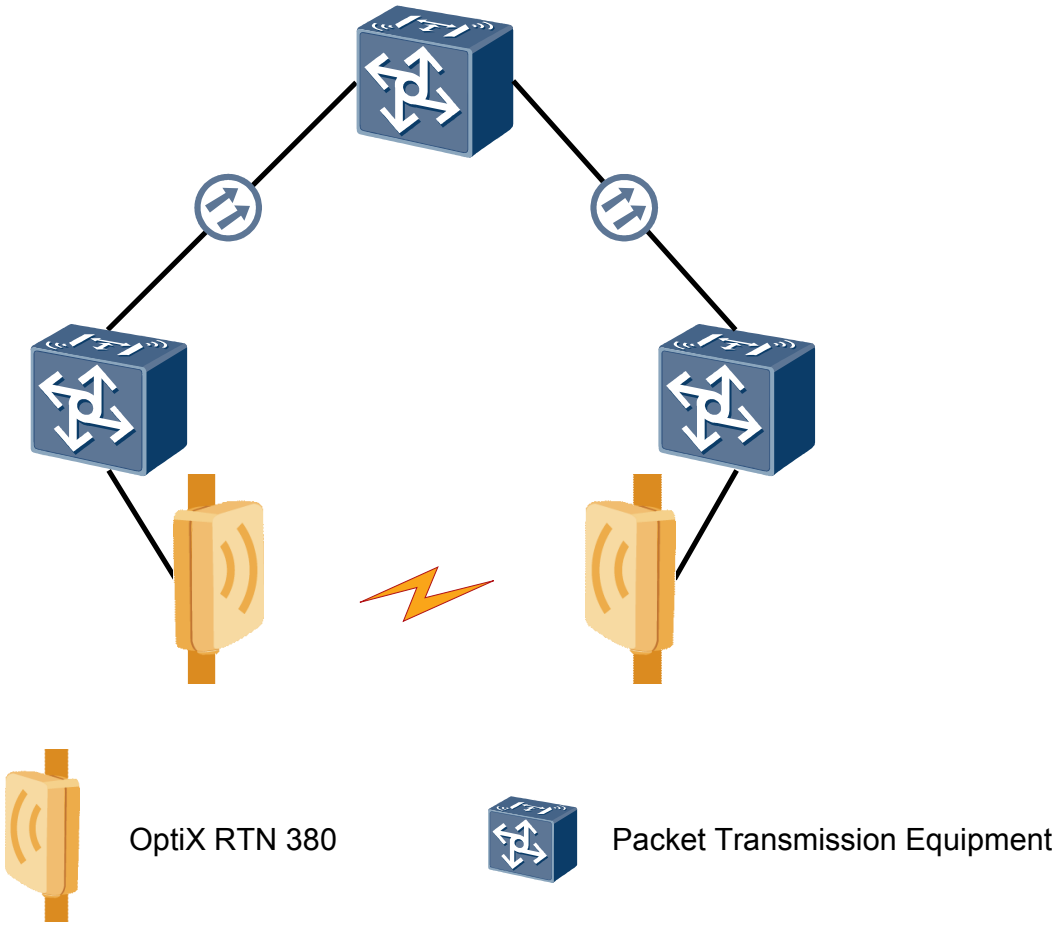
Figure 4-6 Supplementary network



RTN 380 can form a chain network or a ring network with optical transmission equipment to function as a supplement to optical fiber transmission. In the second scenario, RTN 380 forms an ERPS network with the optical transmission equipment to protect services.

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5 Network Management System

About This Chapter

This chapter describes network management solutions and the network management system (NMS) software used in these solutions.

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5.1 Network Management Solutions

Huawei provides complete transport network management solutions that satisfy the telecommunications management network (TMN) requirements for various function domains and customer groups of telecommunications networks.

The following network management solutions are available:

- **iManager U2000 Web LCT local maintenance terminal**

  The Web LCT, a web-based local maintenance terminal, manages local and remote NEs on a per-NE/hop basis.

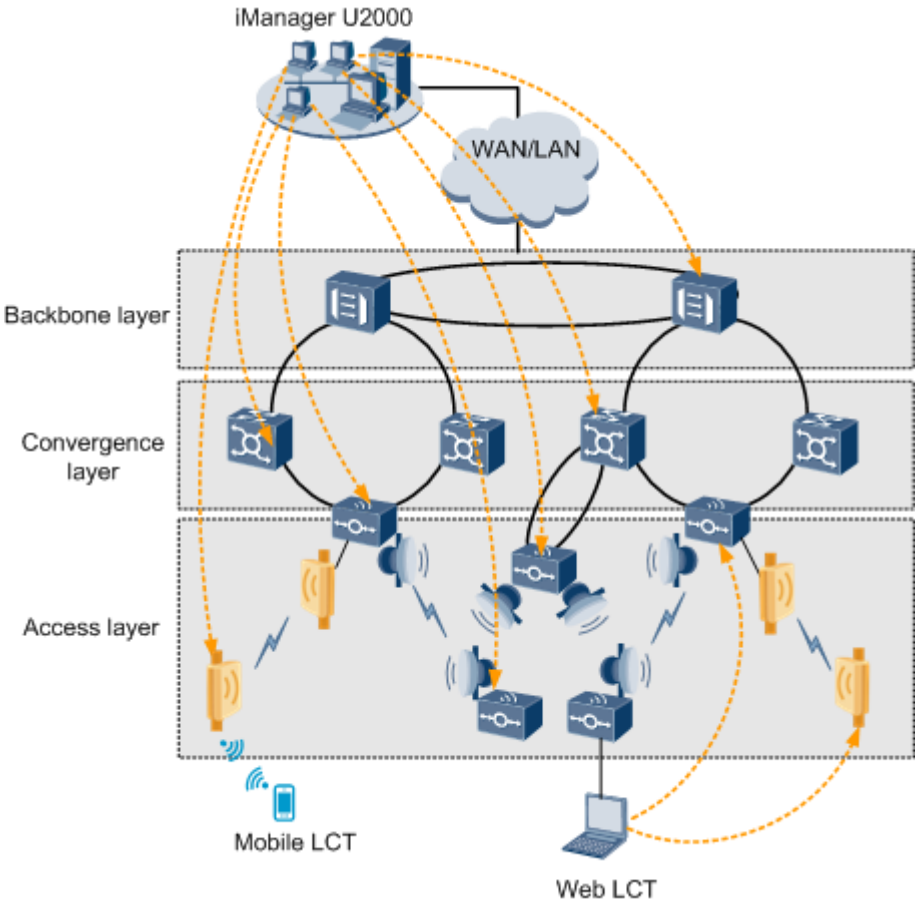
- **iManager U2000 Mobile LCT local maintenance terminal**

  The Mobile LCT, a local maintenance terminal running on a smartphone, manages local and remote NEs on a per-NE/hop basis through Wi-Fi.

- **iManager U2000-T unified network management system**

  The iManager U2000-T, a network-level management system, manages Huawei RTN, PTN, MSTP, and WDM products on transport networks in a unified manner.

Figure 5-1 Network management solutions for transport networks



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5.2 Web LCT

The Web LCT is a local maintenance terminal running on a PC.

The Web LCT provides the following management functions at the NE layer: NE management, alarm management, performance management, configuration management, communication management, and security management.

The Web LCT also provides hop management, which displays the information about the two ends of a microwave link hop graphically and enables a microwave link hop to be managed easily.

Figure 5-2 NE management window

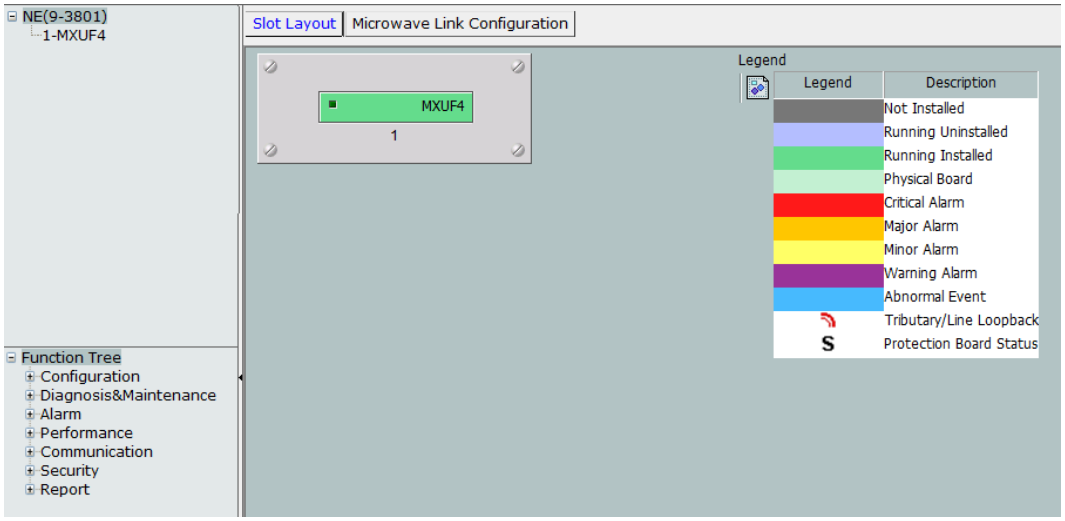

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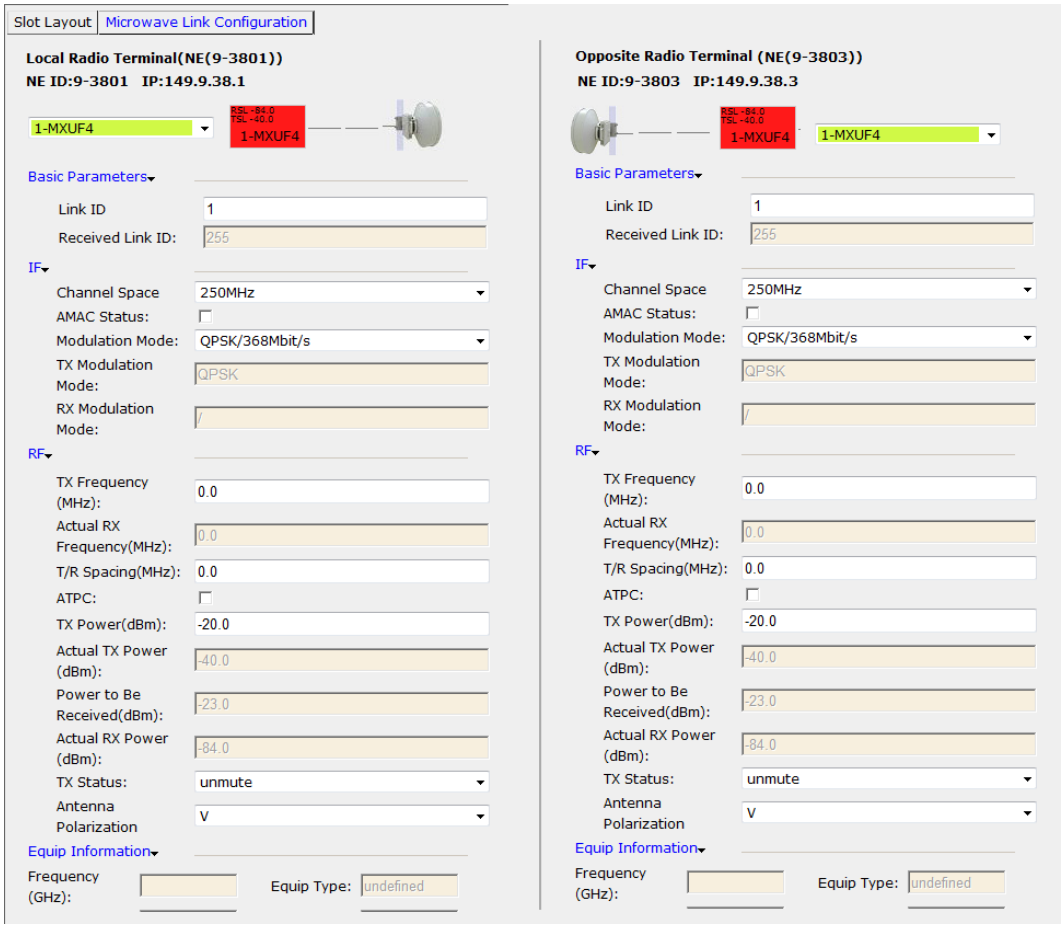
Figure 5-3 HOP management window



5.3 Mobile LCT

The Mobile LCT is a local maintenance terminal running on a smartphone.

The Mobile LCT manages an NE after connecting to the NE using Wi-Fi. **Figure 5-4** shows a typical application scenario.

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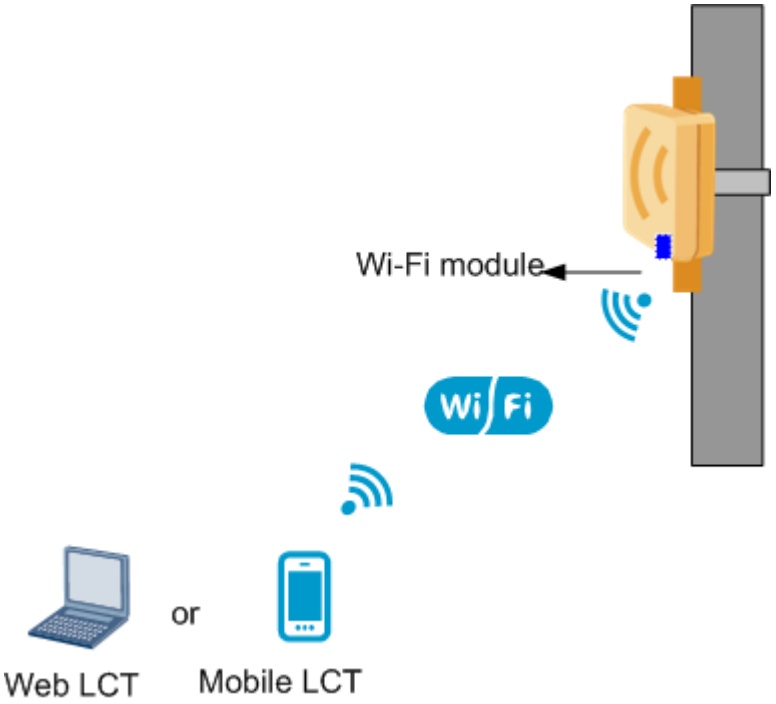
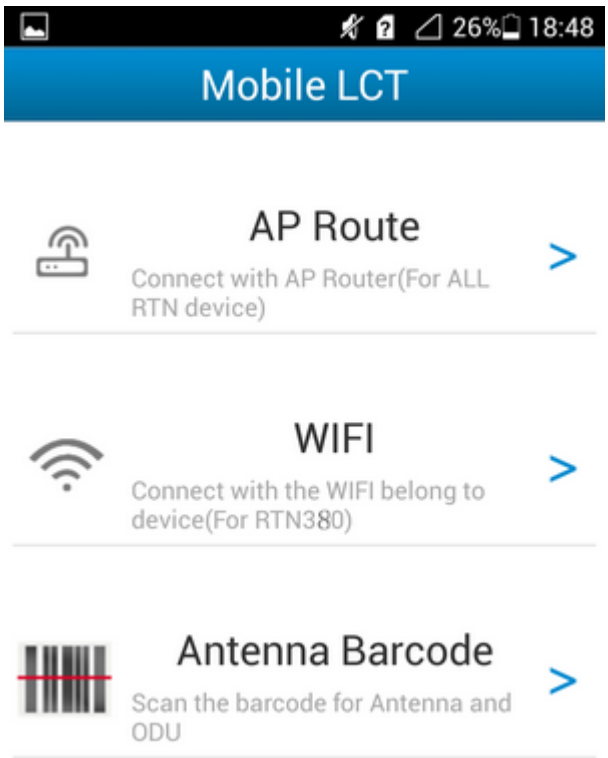
Figure 5-4 Mobile LCT application scenario



The Mobile LCT can create NEs by searching NEs, configure NE attributes, microwave links, and DCN, and query alarms.

Figure 5-5 Workbench of the Mobile LCT



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5.4 U2000-T

The iManager U2000-T is a network-level management system (NMS) that manages Huawei fixed-line network products in a unified manner.

The U2000-T provides topology management, which displays NE positions and connections between NEs. See **Figure 5-6**.

The U2000-T manages network-level alarms, performance, inventory, and security, and end-to-end service configurations. See **Figure 5-7**.

The U2000-T provides a built-in NE Explorer to manage all NEs on the topology. See **Figure 5-8**.

Figure 5-6 Topology management interface of the U2000-T

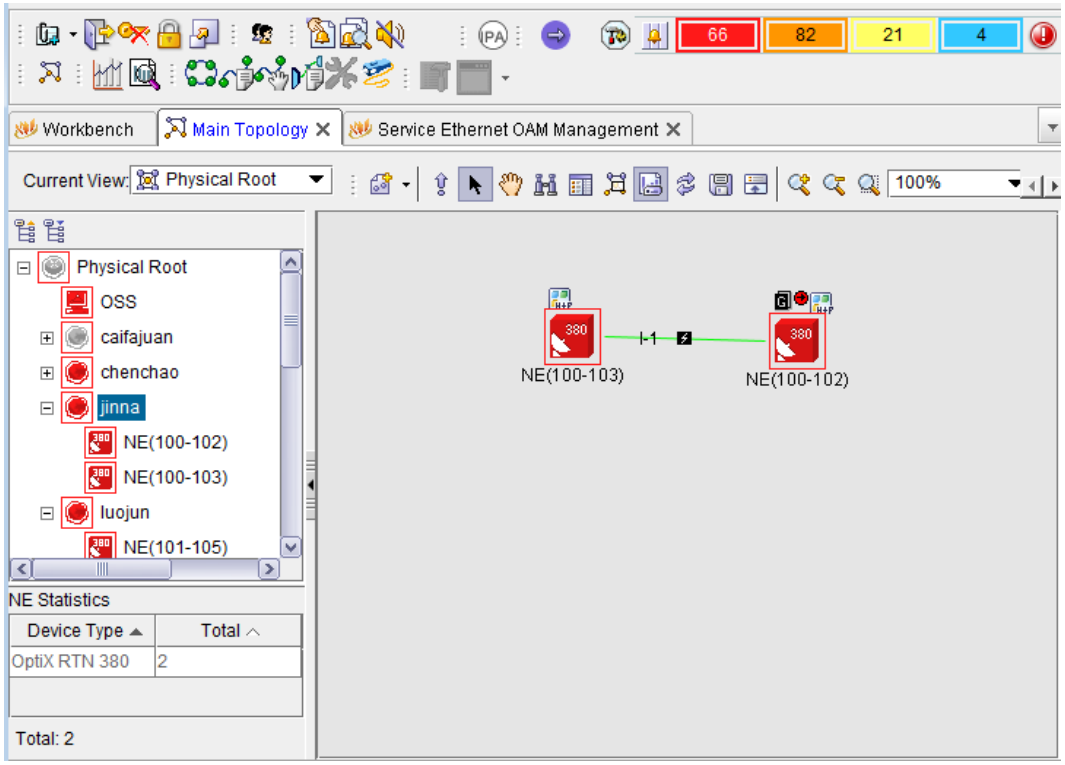

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Figure 5-7 End-to-end service configuration interface of the U2000-T

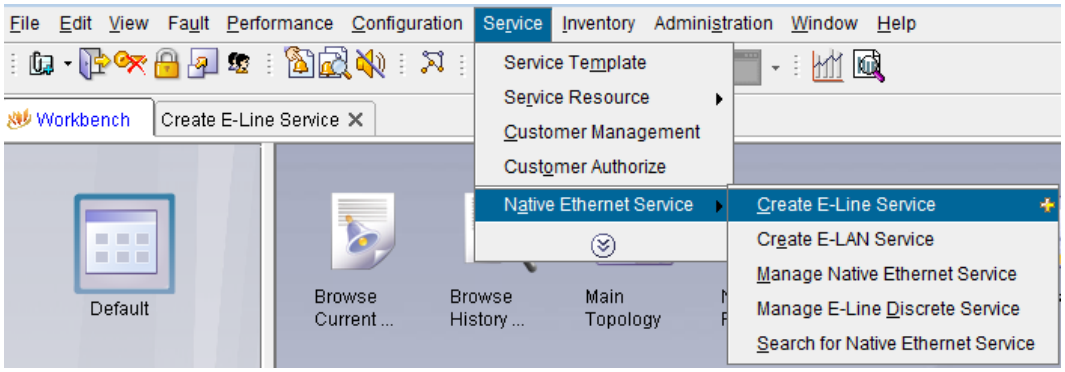
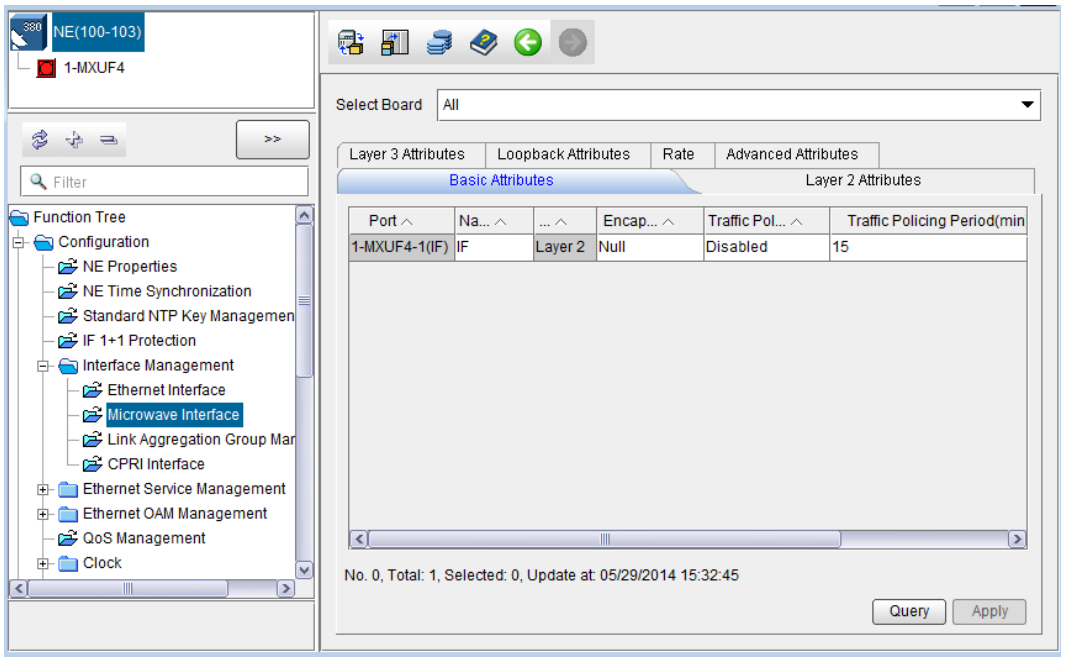


Figure 5-8 NE Explorer interface of the U2000-T



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6 Technical Specifications

About This Chapter

This chapter describes the technical specifications of OptiX RTN 380.

6.1 RF Performance
This chapter describes the radio frequency (RF) performance and various technical specifications related to microwave.

6.2 Predicted Reliability
Predicted reliability includes predicted equipment reliability and predicted link reliability. Reliability is measured by mean time between failures (MTBF). Reliability prediction complies with the Bellcore TR-332 standard.

6.3 Ethernet Port Performance
Ethernet port performance complies with IEEE 802.3.

6.4 CPRI Port Performance
CPRI port performance complies with CPRI 6.0.

6.5 Integrated System Performance
Integrated system performance includes the dimensions, weight, power consumption, and power supply.

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6.1 RF Performance

This chapter describes the radio frequency (RF) performance and various technical specifications related to microwave.

6.1.1 Radio Working Mode and Air Interface Capacity

This section lists the radio working modes supported by the OptiX RTN 380.

Radio Working Modes for Transmitting Ethernet Services and Air Interface Capacity

Table 6-1 Radio working modes and air interface capacity (transmitting Ethernet services)

Channel Spacing (MHz)	Modulation Scheme	Native Ethernet Throughput (Mbit/s)			
		Frame Header Compression Disabled	L2 Frame Header Compression Enabled	L2+L3 Frame Header Compression (IPv4) Enabled	L2+L3 Frame Header Compression (IPv6) Enabled
62.5	QPSK Strong	47 to 58	47 to 76	47 to 98	47 to 132
	QPSK	88 to 109	88 to 143	89 to 185	89 to 249
	16QAM Strong	127 to 157	127 to 205	127 to 266	128 to 358
	16QAM	179 to 220	179 to 288	179 to 374	180 to 504
	32QAM	223 to 276	224 to 360	224 to 467	225 to 630
	64QAM	269 to 332	269 to 434	270 to 562	271 to 758
125	QPSK Strong	97 to 119	97 to 156	97 to 202	97 to 273
	QPSK	181 to 223	181 to 292	182 to 379	182 to 511
	16QAM Strong	260 to 321	260 to 420	261 to 544	261 to 733
	16QAM	365 to 451	366 to 589	366 to 764	367 to 1029
	32QAM	456 to 562	457 to 736	458 to 953	459 to 1285
	64QAM	549 to 678	550 to 886	551 to 1148	553 to 1548
250	QPSK Strong	206 to 254	206 to 332	206 to 430	207 to 580
	QPSK	364 to 449	365 to 588	365 to 762	366 to 1026
	16QAM Strong	523 to 645	524 to 843	525 to 1093	526 to 1473
	16QAM	734 to 906	736 to 1184	737 to 1535	739 to 2068

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Channel Spacing (MHz)	Modulation Scheme	Native Ethernet Throughput (Mbit/s)			
		Frame Header Compression Disabled	L2 Frame Header Compression Enabled	L2+L3 Frame Header Compression (IPv4) Enabled	L2+L3 Frame Header Compression (IPv6) Enabled
	32QAM	918 to 1132	919 to 1480	921 to 1918	923 to 2585
	64QAM	1104 to 1362	1106 to 1781	1108 to 2308	1111 to 3110
500	QPSK Strong	416 to 513	416 to 670	417 to 869	418 to 1171
	QPSK	734 to 905	735 to 1184	736 to 1534	738 to 2068
	16QAM Strong	1053 to 1298	1054 to 1698	1056 to 2200	1059 to 2965
	16QAM	1478 to 1822	1480 to 2383	1482 to 2700	1486 to 3300
	32QAM	1844 to 2275	1847 to 2520	1850 to 2700	1855 to 3539
	64QAM	2221 to 2520	2225 to 2829	2228 to 3249	2234 to 4000
750	QPSK Strong	605 to 746	606 to 975	607 to 1264	608 to 1703
	QPSK	1068 to 1317	1070 to 1723	1071 to 2232	1074 to 3008
	16QAM Strong	1531 to 1889	1534 to 2470	1536 to 2700	1540 to 3300
	16QAM	2149 to 2520	2153 to 2738	2156 to 3144	2162 to 4000
	32QAM	2520 to 3003	2520 to 3417	2691 to 3925	2698 to 4000
	64QAM	2520 to 3616	2520 to 4000	2700 to 4000	3249 to 4000

NOTE

The throughput specifications in the preceding table are based on the following conditions:

- Frame header compression disabled: C-tagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
- L2 frame header compression enabled: C-tagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
- L2+L3 frame header compression (IPv4) enabled: C-tagged Ethernet frames with a length ranging from 70 bytes to 9600 bytes
- L2+L3 frame header compression (IPv6) enabled: C-tagged Ethernet frames with a length ranging from 90 bytes to 9600 bytes

NOTE

In 16QAM Strong mode, the spectrum mask complies with ETSI EN 302 217-2-2 Class 3.

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Radio Working Modes for Transmitting CPRI Services and Air Interface Capacity

Table 6-2 Radio working modes (transmitting CPRI services)

Channel Spacing (MHz)	Modulation Scheme	Capacity
500	16QAM	One channel of 1.25 Gbit/s CPRI services
500	64QAM	One channel of 2.5 Gbit/s CPRI services
750	16QAM Strong	One channel of 1.25 Gbit/s CPRI services
750	16QAM	One channel of 2.5 Gbit/s CPRI services
750	32QAM	One channel of 2.5 Gbit/s CPRI services

6.1.2 Frequency Bands

The OptiX RTN 380 supports the 71–76 GHz and 81–86 GHz frequency bands.

Table 6-3 Frequency information

Frequency Band (GHz)	T/R Spacing (GHz)	Transmit Frequency of the TX Low Site (GHz)		Transmit Frequency of the TX High Site (GHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
71–76/81–86	10	71.0	76.0	81.0	86.0

6.1.3 Channel Configuration

The OptiX RTN 380 supports three channel configuration modes: adjacent channel co-polarized (ACCP), adjacent channel alternate polarization (ACAP), and co-channel dual polarization (CCDP).

ACCP

ACCP allows signals to be transmitted over the electromagnetic waves in the same polarization direction on two adjacent channels. See **Figure 6-1**.

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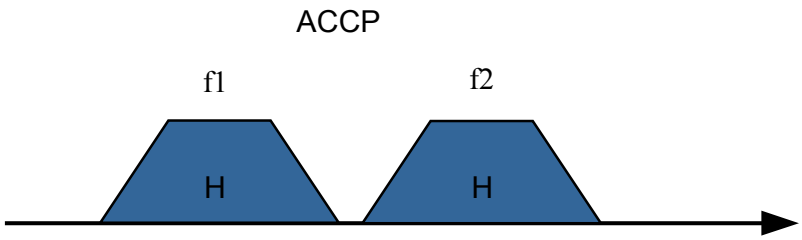
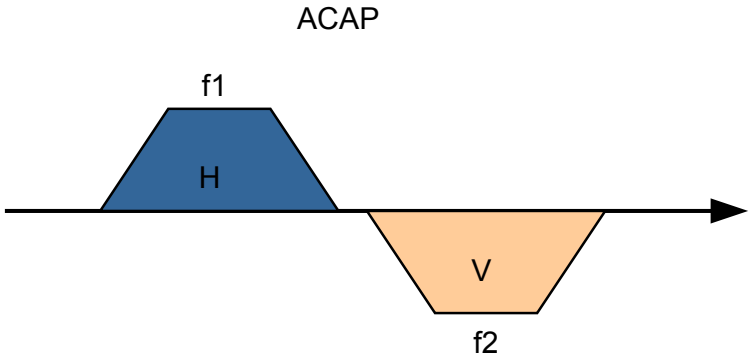
Figure 6-1 ACCP



ACAP

ACAP allows signals to be transmitted over the horizontally polarized electromagnetic wave and vertically polarized electromagnetic wave on two adjacent channels. See **Figure 6-2**.

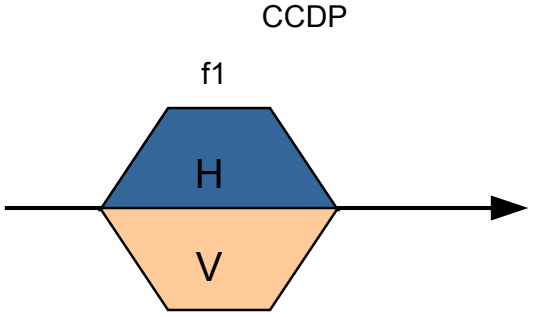
Figure 6-2 ACAP



CCDP

CCDP allows signals to be transmitted over the horizontally polarized electromagnetic wave and vertically polarized electromagnetic wave on the same channel. See **Figure 6-3**.

Figure 6-3 CCDP



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6.1.4 Receiver Sensitivity

Receiver sensitivity shows the anti-fading capability of the radio equipment.

Table 6-4 Typical receiver sensitivity values

Item	Performance				
	62.5 MHz Channel Spacing	125 MHz Channel Spacing	250 MHz Channel Spacing	500 MHz Channel Spacing	750 MHz Channel Spacing
RSL@ BER=10^{-6}(unit: dBm)					
QPSK Strong	-82.0	-79.5	-77.0	-74.0	-72.5
QPSK	-79.5	-77.0	-74.0	-71.0	-70.0
16QAM Strong	-74.5	-72.0	-69.0	-66.0	-65.0
16QAM	-71.5	-69.0	-66.0	-63.0	-62.0
32QAM	-67.5	-65.5	-62.5	-59.5	-58.0
64QAM	-65.5	-63.0	-60.0	-57.5	-55.5

6.1.5 Distortion Sensitivity

The distortion sensitivity reflects the anti-multipath fading capability of OptiX RTN 380.

The notch depth of OptiX RTN 380 meets the requirements described in ETSI EN 302217-2-1.

Table 6-5 describes the anti-multipath fading capability of OptiX RTN 380 in 500M/64QAM microwave working modes.

Table 6-5 Anti-multipath fading capability

Item	Performance
500M/64QAM W-curve	See **Figure 6-4**
500M/64QAM dispersion fading margin	33 dB

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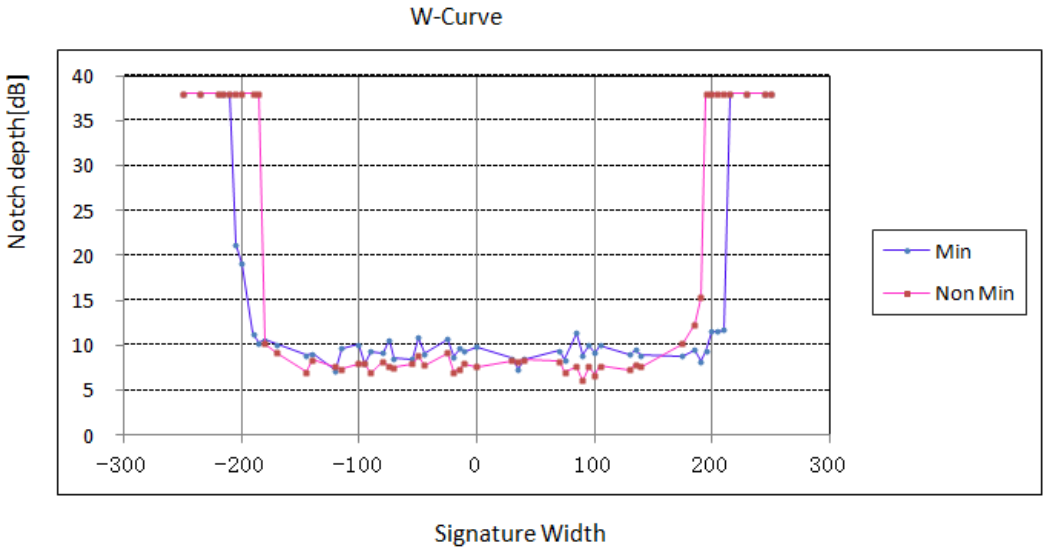
Figure 6-4 W-curve



6.1.6 Transceiver Performance

Transceiver performance data includes the maximum/minimum transmit power, maximum receive power, and frequency stability.

Maximum Transmit Power

Table 6-6 Maximum transmit power

Modulation Scheme	Maximum Transmit Power (dBm)
QPSK Strong	19
QPSK	
16QAM Strong	17
16QAM	15
32QAM	14
64QAM	12

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Minimum Transmit Power

Table 6-7 Minimum transmit power

Modulation Scheme	Minimum Transmit Power (dBm)
QPSK Strong to 64QAM	-2

Maximum Receive Power

Table 6-8 Maximum receive power

Modulation Scheme	Maximum Receive Power (dBm)
QPSK Strong to 64QAM	-23

Frequency Stability

Frequency stability: ±5 ppm

6.1.7 Baseband Signal Processing Performance of the Modem

The baseband signal processing performance of the modem indicates the FEC coding scheme and the performance of the baseband time domain adaptive equalizer.

Table 6-9 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	Low-density parity check code (LDPC) encoding **NOTE** Strong modulation supports LDPC coding. Strong indicate FEC coding strength. Strong FEC improves receiver sensitivity by increasing error-correcting codes.
Adaptive time-domain equalizer for baseband signals	Supported.

6.2 Predicted Reliability

Predicted reliability includes predicted equipment reliability and predicted link reliability. Reliability is measured by mean time between failures (MTBF). Reliability prediction complies with the Bellcore TR-332 standard.

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6.2.1 Predicted Equipment Reliability

The equipment reliability shows the reliability of a single piece of equipment.

Table 6-10 Predicted equipment reliability

Item	Performance		
	1+0 Configuration	2+0 Configuration	1+1 Configuration
MTBF (hour)	50.47×10^4	25.24×10^4	179.17×10^4
MTBF (year)	57.62	28.81	204.53
MTTR (hour)	1	2	0.3
Availability	99.99980%	99.99960%	99.99994%

6.2.2 Predicted Link Reliability

The link reliability shows the reliability of a microwave link hop and shows the reliability of all components involved.

Table 6-11 Predicted equipment reliability for a single hop of link

Item	Performance		
	1+0 configuration	2+0 configuration	1+1 configuration
MTBF (hour)	25.24×10^4	12.62×10^4	89.59×10^4
MTBF (year)	28.81	14.40	102.27
Availability	99.99960%	99.99920%	99.99989%

6.3 Ethernet Port Performance

Ethernet port performance complies with IEEE 802.3.

GE Optical Port Performance

The characteristics of GE optical ports comply with IEEE 802.3. **Table 6-12** provides GE optical port performance.

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Table 6-12 GE optical port performance

Item	Performance	
Classification code	**1000BASE-SX (0.55 km)**	**1000BASE-LX (10 km)**
Module BOM number	34060321	34060290
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	1000
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.55	10
Operating wavelength (nm)	830 to 860	1274 to 1360
Mean launched power (dBm)	-10.0 to -2.5	-9.5 to -3.0
Receiver minimum sensitivity (dBm)	-17.0	-20.0
Minimum overload (dBm)	0	-3.0
Minimum extinction ratio (dB)	9.0	9.0

FE Optical Port Performance

The characteristics of FE optical ports comply with IEEE 802.3. **Table 6-13** provides FE optical port performance.

Table 6-13 FE optical port performance

Item	Performance
Classification code	**100BASE-LX (15 km)**
Module BOM number	34060307 **NOTE** This module applies to SDH STM S-1.1/Fast Ethernet.
Nominal wavelength (nm)	1310
Maximum rate (Mbit/s)	155
Fiber type	Single-mode
Transmission distance (km)	15
Operating wavelength (nm)	1274 to 1360
Mean launched power (dBm)	-15.0 to -8.0

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Item	Performance
Classification code	**100BASE-LX (15 km)**
Receiver minimum sensitivity (dBm)	-31.0
Minimum overload (dBm)	-8.0
Minimum extinction ratio (dB)	8.2

GE Electrical Port Performance

The characteristics of GE electrical ports comply with IEEE 802.3. The following table provides GE electrical port performance.

Table 6-14 GE electrical port performance

Item	Performance
Nominal bit rate (Mbit/s)	10(10BASE-T) 100(100BASE-TX) 1000(1000BASE-T)
Code pattern	Manchester encoding signal (10BASE-T) MLT-3 encoding signal (100BASE-TX) 4D-PAM5 encoding signal (1000BASE-T)
Port type	P&E port

6.4 CPRI Port Performance

CPRI port performance complies with CPRI 6.0.

CPRI Port Performance

RTN 380 uses SFP optical modules to provide CPRI ports. Different SFP optical modules provide CPRI ports of different performance. **Table 6-15** lists the main performance counters.

Table 6-15 CPRI port performance

Item	Performance					
Port rate	**1.2288 Gbit/s**			**2.4576 Gbit/s**		
Module BOM number	34060286	34060321	34060290	34060365	34060327	34060336

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Item	Performance					
Port rate	**1.2288 Gbit/s**			**2.4576 Gbit/s**		
Transmission distance (km)	0.55	0.55	10	0.3	2.0	15.0
Nominal wavelength (nm)	850	850	1310	850	1310	1310
Maximum rate	2.125 Gbit/s	1.25 Gbit/s	1.25 Gbit/s	4.25 Gbit/s	2.67 Gbit/s	2.67 Gbit/s
Fiber type	Multimode	Multimode	Single-mode	Multimode	Single-mode	Single-mode
Operating wavelength (nm)	830-860	830-860	1274-1360	830-860	1274-1360	1274-1360
Mean launched power (dBm)	-9.5 to -2.5	-10.0 to -2.5	-9.5 to -3.0	-9.0 to -1.5	-9.5 to -3.0	-5.0 to 0
Minimum receiver sensitivity (dBm)	-17.0	-17.0	-20.0	-15.0	-18.0	-21.0
Minimum overload (dBm)	0	0	-3.0	0	-3.0	0
Minimum extinction ratio (dB)	9.0	9.0	9.0	3.0	9.0	8.2

6.5 Integrated System Performance

Integrated system performance includes the dimensions, weight, power consumption, and power supply.

Mechanical performance and power consumption

Item	Performance
Dimensions (H x W x D)	265 mm x 265 mm x 65 mm

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Item	Performance
Weight	3.8 kg
Typical Power Consumption	39 W
Power Supply	● Support power over Ethernet. ● The power input voltage ranges from –38.4 V to –57.6 V.

Electromagnetic Compatibility

- Passed CE authentication.
- Compliant with ETSI EN 301 489-1.
- Compliant with ETSI EN 301 489-4.
- Compliant with ETSI EN 300 385.
- Compliant with EN 55022 class B

Lightning Protection

- Compliant with ITU-T K.27.
- Compliant with ITU-T K.41.
- Compliant with ETSI EN 300 253.

Safety

- Passed CE authentication.
- Compliant with IEC 60825.
- Compliant with IEC 60215.
- Compliant with IEC 60950-1
- Compliant with IEC 60950-22
- Compliant with K.20.
- Compliant with K.21.
- Compliant with EN 41003

Environment

OptiX RTN 380 is used outdoors.

Table 6-16 Environment performance

Item		Performance
Major reference standards	Operation	Compliant with EN 300 019-1-4 (Class 4.1)
	Transportation	Compliant with EN 300 019-1-2 (Class 2.3)

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Item		Performance
	Storage	Compliant with EN 300 019-1-1 (Class 1.2)
Air temperature	Operation	-33ºC to +55ºC
	Transportation and storage	-40ºC to +70ºC
Protection class		IP65
Relative humidity		5% to 100%
Earthquake resistant design		Compliant with ETSI 300 019-2-4
Mechanical stress test		Compliant with ETSI EN 300 019-2-1

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7 Accessories

About This Chapter

RTN 380 describes all the accessories.

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7.1 Power Injector

A power injector (PI) transmits GE signals together with -48 V power signals to an RTN 380 through a network cable.

NOTE

Huawei provides various types of PIs with similar functions and working principles. PIs will be detailed latter by taking OptiX RTN PI-DC A11 as an example.

Table 7-1 Differences between PIs

Type	OptiX RTN PI-DC A10	OptiX RTN PI-DC B10	OptiX RTN PI-DC A11
Appearance			
Application scenario	Indoor equipment room and outdoor cabinet	Outdoor (not on a tower)	Indoor equipment room and outdoor cabinet
Dimensions/Weight	38.6 mm x 145.6 mm x 185 mm/0.8 kg	43.6 mm x 164 mm x 226 mm/1.3 kg	36.0 mm x 145.6 mm x 84 mm/0.5 kg
Input power supply	–38.4 V to –57.6 V	–38.4 V to –57.6 V	–38.4 V to –57.6 V
Number of P&E ports/Mode	One/Forced power mode	One/Forced power mode	One/Standard PSE or forced power mode

7.1.1 Appearance, Functions, and Features

A power injector (PI) transmits GE electrical signals, -48 V power signals, and network management signals to an RTN 380 through a P&E cable.

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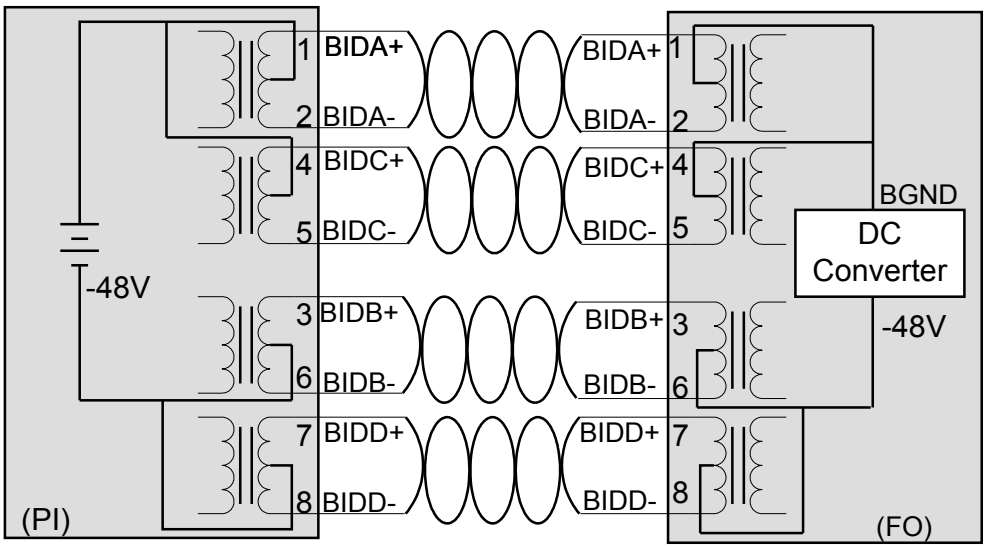
Appearance

Figure 7-1 Appearance

Features and Functions

- Switches between the standard PSE power mode or forced power mode through a dual in-line package (DIP) switch.
- Receives/Transmits a channel of electrical GE service signals.
- Receives a channel of -48 V DC power signals.
- Couples -48 V power signals to eight pins of the GE electrical port and transmits them to an RTN 380 through a P&E cable. See **Figure 7-2**.

Figure 7-2 -48 V power signal coupling



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There is no interference between DC power signals and Ethernet service signals, which can be transmitted over the same twisted pair.

Installation Modes

An indoor PI can be installed:

- In a 300 mm deep European Telecommunications Standards Institute (ETSI) cabinet
- In a 600 mm deep ETSI cabinet
- In a 450 mm deep 19-inch cabinet
- In a 600 mm deep 19-inch cabinet
- In a 19-inch open rack
- In an outdoor cabinet for wireless equipment
- On an indoor wall

7.1.2 Ports and Indicators

A power injector (PI) has one GE service port, one network management system (NMS) port, one P&E port, one power input port, indicators, and labels on its front panel.

Ports

Figure 7-3 and Figure 7-4 show the ports on a PI.

Figure 7-3 Ports on the front panel of a PI

Figure 7-4 Port on the rear side of a PI

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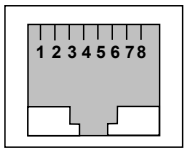
Table 7-2 Ports on a PI

Port	Description	Connector Type	Required Cable
RTN (+)	BGND	2-pin terminal block	**8.5 PI Power Cables**
NEG (-)	-48 V		
GE	GE electrical port	RJ45	Ordinary network cable
NMS	NMS port (reserved)		
MGMT	NMS port (reserved)	RJ45	**8.2 Outdoor Network Cables**
P&E	Ethernet service and -48 V power port		
Power Output Mode	Power output mode switch: ● If the DIP switch is on the PSE-PD side, the standard PSE power mode, which applies to standard PoE equipment such as RTN 380 is used. ● If the DIP switch is on the FORCE side, the forced power mode is used.RTN 380 does not use the forced power mode. **NOTE** The switch should be set to the planned value before the PI is powered on. After the PI is powered on, the mode cannot be changed.	DIP switch	-

The GE service port, NMS port, and P&E port use RJ45 connectors. **Figure 7-5** shows the front view of an RJ45 connector.

Figure 7-5 Front view of an RJ45 connector



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The GE electrical port is compatible with an FE electrical port and supports the MDI, MDI-X, and auto-MDI/MDI-X modes. **Table 7-3** and **Table 7-4** provide the pin assignments for an RJ45 port in different modes.

Table 7-3 Pin assignments for an RJ45 connector in MDI mode (Ethernet service signals)

Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
1	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)
2	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)
3	RX+	Receiving data (+)	BIDB+	Bidirectional data wire B (+)
4	Reserved	-	BIDC+	Bidirectional data wire C (+)
5	Reserved	-	BIDC-	Bidirectional data wire C (-)
6	RX-	Receiving data (-)	BIDB-	Bidirectional data wire B (-)
7	Reserved	-	BIDD+	Bidirectional data wire D (+)
8	Reserved	-	BIDD-	Bidirectional data wire D (-)

Table 7-4 Pin assignments for an RJ45 connector in MDI-X mode (Ethernet service signals)

Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
1	RX+	Receiving data (+)	BIDB+	Bidirectional data wire B (+)
2	RX-	Receiving data (-)	BIDB-	Bidirectional data wire B (-)
3	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)
4	Reserved	-	BIDD+	Bidirectional data wire D (+)
5	Reserved	-	BIDD-	Bidirectional data wire D (-)

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Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
6	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)
7	Reserved	-	BIDC+	Bidirectional data wire C (+)
8	Reserved	-	BIDC-	Bidirectional data wire C (-)

The P&E port couples Ethernet service signals and power signals and transmits them. Whether the port uses MDI or MDI-X mode to transmit Ethernet service signals does not affect the pin assignments for the power signals.

Table 7-5 Pin assignments for an RJ45 connector (power signals)

Pin	Signal
1	BGND
2	BGND
3	Power signal (-48 V)
4	BGND
5	BGND
6	Power signal (-48 V)
7	Power signal (-48 V)
8	Power signal (-48 V)

The NMS and MGMT ports transmit network management signals. **Table 7-6** lists their pin assignments.

Table 7-6 Pin assignments for the NMS and MGMT ports

Pin	Signal	Function
1	TX+	Transmitting data (+)
2	TX-	Transmitting data (-)
3	RX+	Receiving data (+)
4	Reserved	-

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Pin	Signal	Function
5	Reserved	-
6	RX-	Receiving data (-)
7	Reserved	-
8	Reserved	-

Indicators

Table 7-7 Indicator status explanation

Indicator	Status	Meaning
DC IN	Steady green	Power is supplied.
	Off	Power is not supplied.
P&E OUT	Steady green	P&E is being output normally.
	Blinks green	In PSE-PD mode, the equipment is in handshake status.
	Off	P&E is not being output.

7.1.3 PI Labels

This section lists the labels that are attached to a power injector (PI). Adhere to any warnings or instructions on the labels when performing various tasks to avoid any personal injury or damage to equipment.

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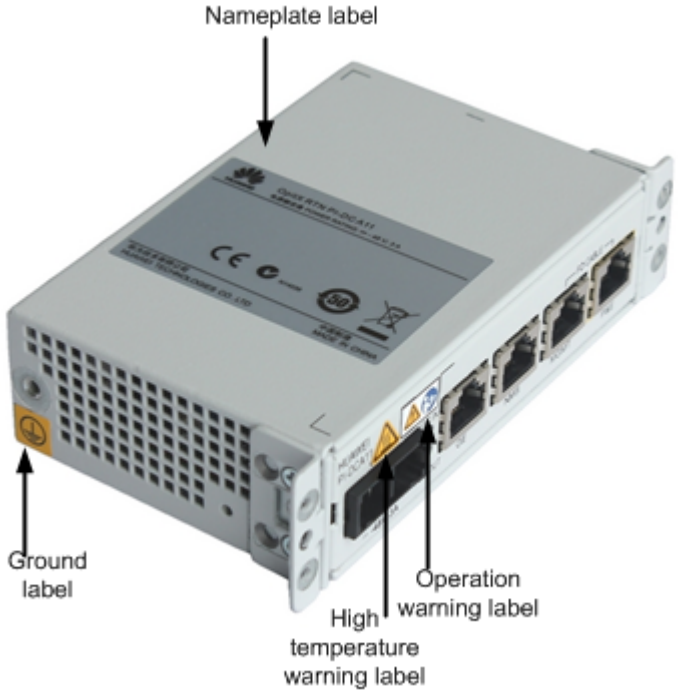
Figure 7-6 Label positions on an indoor PI



NOTE

- High temperature warning label: Indicates that the equipment surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. Wear protective gloves to handle the equipment.
- Operation warning label: Instructs you to check the connection of a P&E cable to a port.

Table 7-8 Product nameplate label description

Example of the Label Content	Parameter	Parameter Description
OptiX RTN PI – DC A 11 1 2 3 4 5	1: Product name	-
	2: Power supply mode	DC: direct current
	3: Application environment	● A: indoor ● B: outdoor
	4: Number of channels	1: one power-over-Ethernet channel
	5: Version number	-

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Example of the Label Content	Parameter	Parameter Description
电源额定值 POWER RATING : ⎓ -48V; 2.6A	-	PI power supply rated value

7.1.4 Technical Specifications

The technical specifications of power injectors (PIs) include electromagnetic compatibility, anti-interference capability, safety, and environmental standards.

Power Supply

Item	Specifications
Input voltage range	-38.4 V to -57.6 V
Number of PoE outputs	One
PoE mode	Standard PSE power mode and forced power mode

Dimensions and Weight

Item	Specifications
Dimensions (H x W x D)	36 mm x 145.6 mm x 84 mm
Weight	0.5 kg

Electromagnetic Compatibility

- Passed CE authentication
- Compliant with ETSI EN 301 489-1
- Compliant with ETSI EN 301 489-4
- Compliant with ETSI EN 300 386

Safety

- Passed CE authentication
- Compliant with EN60950-22
- Compliant with IEC60950-22
- Compliant with IEC60950-1
- Compliant with EN60950-1

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Environment

Table 7-9 Environment performance

Item		Specifications
Major reference standards	Operating	Compliant with EN 300 019-1-4 class 4.1
	Transportation	Compliant with ETSI EN 300 019-1-2 class 2.3
	Storage	Compliant with ETSI EN 300 019-1-1 class 1.2
Operating temperature		-33ºC to +55ºC
Relative humidity		5% to 100%
Earthquake resistant design		Compliant with GR3108 Zone 4 and ETSI 300 019-2-4/YD5083

7.2 Dock

Dock is a type of outdoor power sourcing equipment (PSE) with the built-in Layer 2 switching function. It often provides power to both RTN 380 and Huawei small cell base stations.

NOTE

Huawei provides various types of Docks with similar functions and working principles. The following details Docks by taking Dock V318R001C00 working with Huawei small cell base stations as an example.

7.2.1 Appearance, Functions, and Features

A Dock switches Ethernet services between equipment and provides power to other equipment. It transmits DC power signals which are converted from AC power signals together with Ethernet signals.

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Appearance

Features and Functions

- Power supply functions
  - Receives 220 V AC power and converts it to -57 V DC power.
  - Outputs -57 V DC power signals coupled with Ethernet service signals through the LAN0, LAN1, and WAN ports, implementing power over Ethernet (PoE).
  - Supports the standard PSE power mode and forced power mode (PSE stands for power sourcing equipment). By default, a Dock uses the standard PSE power mode.
- Ethernet service functions
  - Provides one FE/GE optical port (OPT). The port supports 100M full-duplex (FE optical module), 1000M full-duplex (GE optical module), and autonegotiation. The port works in autonegotiation mode by default.
  - Provides three PoE ports including LAN0, LAN1, and WAN. These ports support 100M full-duplex, 1000M full-duplex, and autonegotiation. These ports work in autonegotiation mode by default.
  - Switches Ethernet service packets among four Ethernet ports based on the IEEE 802.1ad bridge.
- Clock functions
  - Supports synchronous Ethernet clocks.
  - Supports the configuration of clock sources. By default, a Dock traces synchronous Ethernet clocks of optical ports or WAN ports. Optical ports have a higher priority than the WAN ports.
- Supports configuration management, security management, and system management.

For more details, see related documents of Huawei Atomcell.

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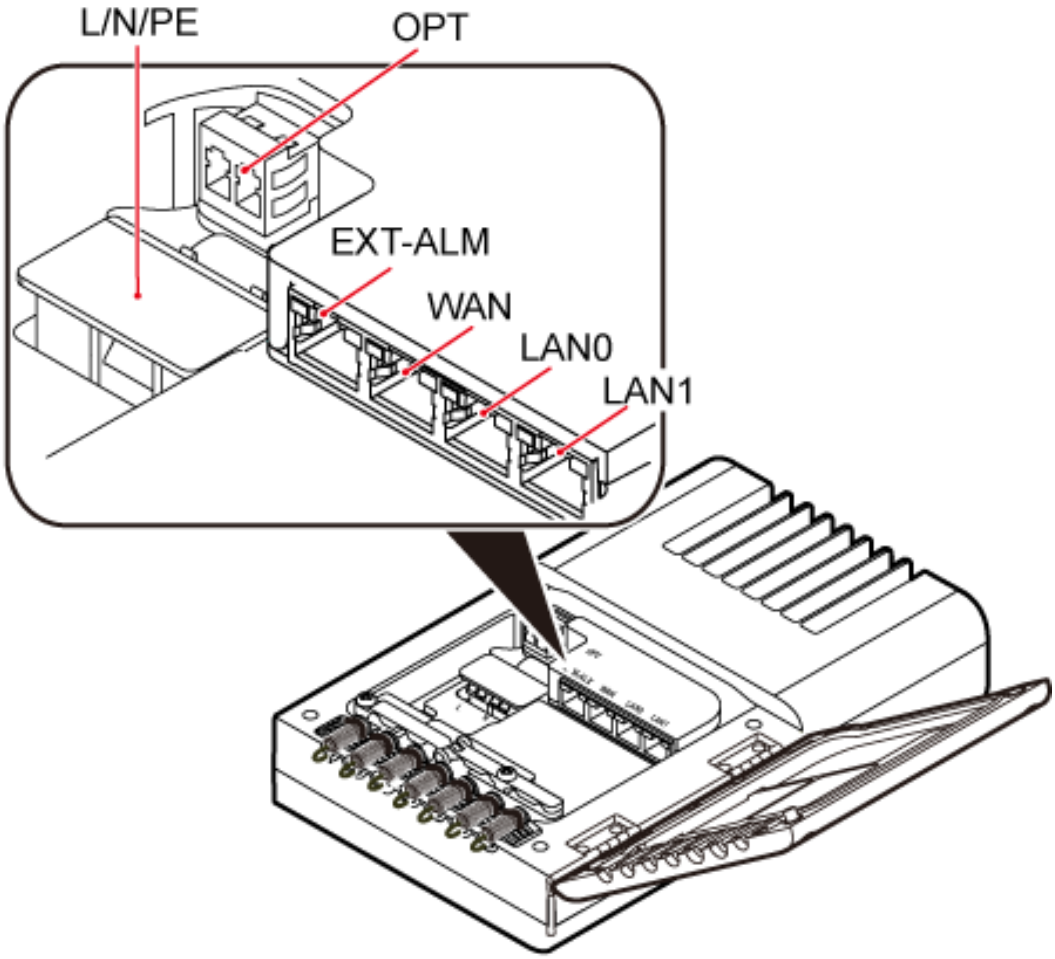
7.2.2 Ports and Indicators

Ports are inside a Dock, and indicators are outside a Dock.

Ports



The following describes ports of a Dock.

Table 7-10 Ports

Port	Description
OPT	FE/GE optical port that connects to external transmission equipment
L/N/PE	Port that connects to external power equipment through a live wire, neutral wire, or PE cable

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Port	Description
EXT-ALM	Environment monitoring port that provides four-line dry contacts to connect external devices and monitor alarms
WAN	PoE port that connects to external transmission equipment
LAN0	PoE port that connects to a small cell base station
LAN1	PoE port that connects to commissioning equipment or lower-level cascade equipment

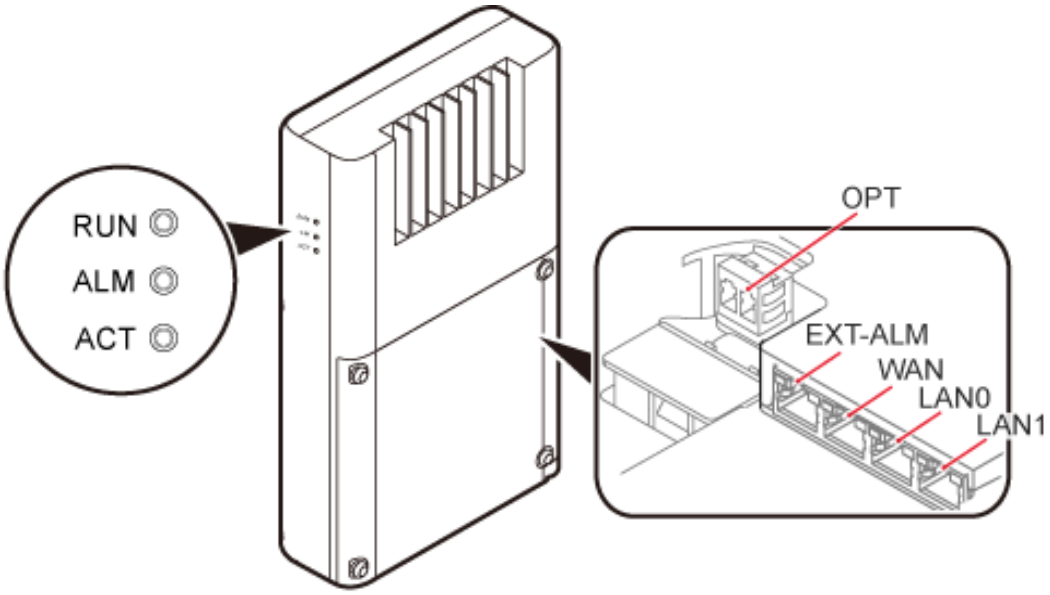
NOTE

WAN and LAN1 ports can provide power to standard PoE equipment.

Indicators

A Dock has three external indicators RUN, ALM, and ACT to indicate the equipment running status. Each internal RJ45 connector has two indicators for indicating the connection status and data transmission status. The connector of the OPT port has one indicator for indicating both the connection status and data transmission status.

Figure 7-7 Indicators of a Dock



The following table describes indicators of a Dock.

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Table 7-11 External indicators

Indicator	Meaning	Status	Description
RUN	Running status	Steady green	Power supply is available, but the Dock is faulty or has just been powered on.
		Off	No power supply is available, or the Dock is faulty.
		Blinks green (on for 1s and off for 1s)	The Dock is running properly.
		Blinks green (on for 0.125s and off for 0.125s)	Software is being loaded to the Dock, or the Dock is not started.
ALM	Alarm status	Steady red	An alarm is generated, and the Dock must be replaced. Or, the Dock has just been powered on.
		Blinks red	An alarm is generated. The alarm is caused by a fault on the Dock.
		Off	No alarm
ACT	Service status	Steady green	The Dock is receiving or transmitting data.
		Off	The Dock is not receiving or transmitting data, or has just been powered on.

Table 7-12 Internal indicators

Indicator	Meaning	Status	Description
EXTALM/WAN/ LAN0/LAN1	Green indicator: connection status	Steady green	The port is connected correctly.

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Indicator	Meaning	Status	Description
		Off	No connection is set up on the port.
	Orange indicator: data transmission	Blinks orange	The port is receiving or transmitting data.
		Off	The port is not receiving or transmitting data.
OPT	Optical port status	Steady green	The port connection status is normal, and the port is not receiving or transmitting data.
		Blinks green	The port is receiving or transmitting data.
		Off	No connection is set up on the port.

7.2.3 Technical Specifications

The technical specifications of Docks include dimensions and weight, power supplies, and power consumption.

Dimensions and Weight

Item	Specifications
Dimensions (H x W x D)	52 mm x 160 mm x 250 mm
Weight	2.8 kg

Power Supply

Item	Specifications
Input voltage range	90 V AC to 290 V AC, frequency being 45 Hz to 65 Hz
Output PoE voltage	-57 V DC
Number of PoE outputs	Three

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Item	Specifications
Output power of PoE ports	● Output power of the LAN0 port: 150 W ● Total output power of WAN and LAN1 ports: 60 W

Power Consumption

Power consumption ≤ 35 W

7.3 Optical Splitter

An optical splitter is used to split one channel of optical signals into multiple channels. It has an outdoor fiber access terminal for housing its main module, the optical splitting module. By working with an optical splitter, OptiX RTN 380 can implement 1+1 hot standby (HSB).

7.3.1 Functions and Features

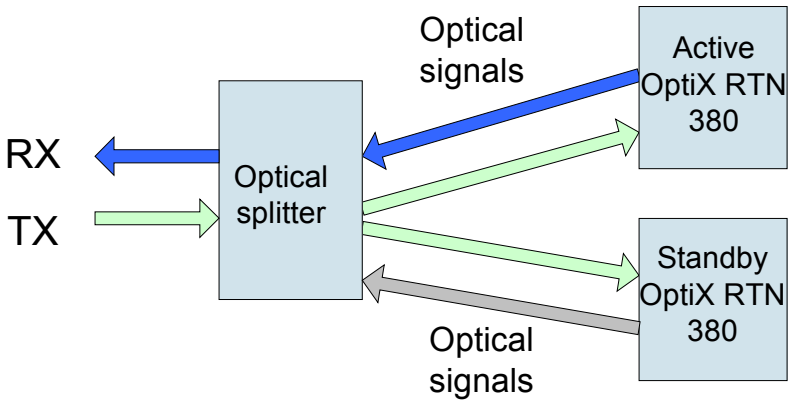
An optical splitter uses its optical splitting module to split optical signals.

Functions and Features

- In the transmit direction, an optical splitter evenly splits one channel of GE optical signals into two channels and sends them to the active and standby OptiX RTN 380s in a 1+1 hot standby (HSB) protection group.
- In the receive direction, an optical splitter receives optical signals from the GE port of the active OptiX RTN 380 in a 1+1 HSB protection group. (The GE port of the standby OptiX RTN 380 does not transmit optical signals.)

Figure 7-8 shows the function diagram for an optical splitter.

Figure 7-8 Optical splitter function diagram



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Installation Mode

An optical splitter can be installed on:

- An outdoor wall
- A pole with a diameter ranging from 30 mm to 120 mm
- A tower

7.3.2 Ports

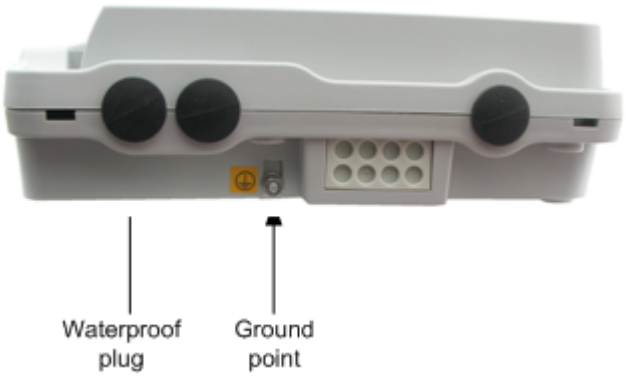
The ports of an optical splitter are located in the fiber distribution area of the outdoor fiber access terminal.

Appearance and Structure

An optical splitter has a protective cover, as shown in **Figure 7-9**–**Figure 7-10**.

Figure 7-9 Appearance of an optical splitter (front)

Figure 7-10 Appearance of an optical splitter (bottom)



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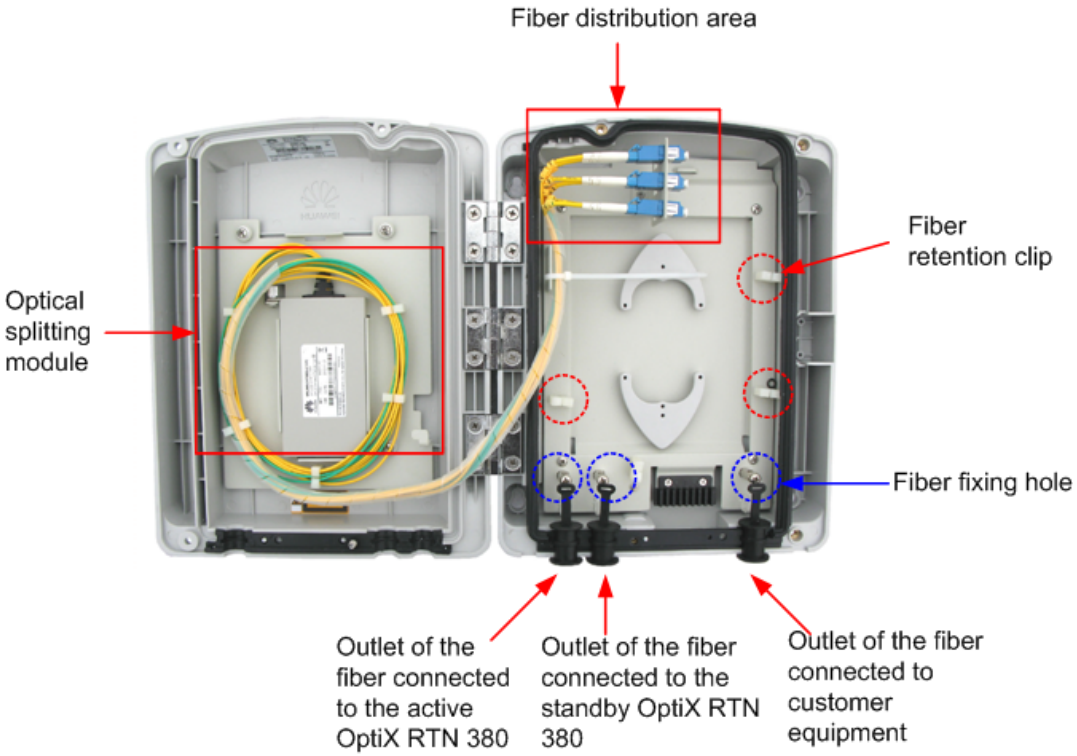
NOTE

Normally, an optical splitter does not need to be grounded when working with OptiX RTN 380.

The main components of an optical splitter are the optical splitting module, outdoor fiber access terminal, and fiber adapters, as shown in **Figure 7-11**.

Figure 7-11 Internal structure of an optical splitter



Ports

The three ports in the fiber distribution area connect the optical splitting module and equipment. The number and label on each fiber indicate the connection relationship. For details, see **Figure 7-12**.

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Figure 7-12 Fiber connection relationships

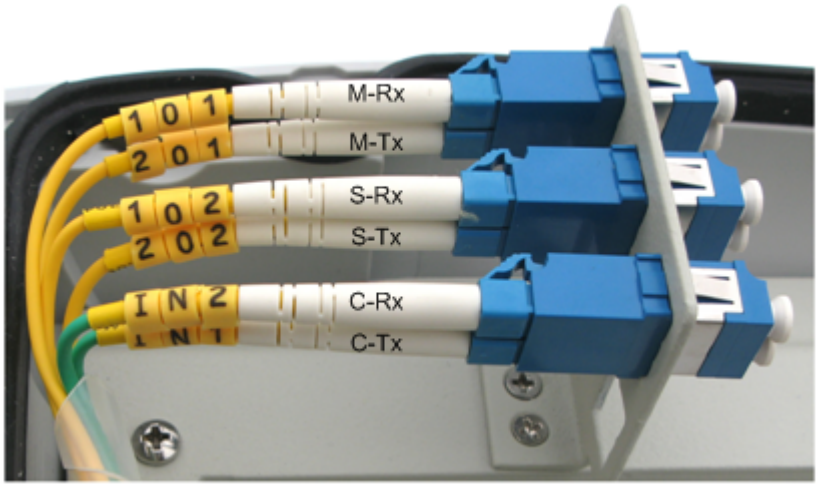

Table 7-13 Fiber connection relationships

Fiber Number	Label	Connector Type	Description
101	M-Rx	LC/UPC	Connected to the GE receive port on the main OptiX RTN 380
201	M-Tx		Connected to the GE transmit port on the main OptiX RTN 380
102	S-Rx		Connected to the GE receive port on the standby OptiX RTN 380
202	S-Tx		Connected to the GE transmit port on the standby OptiX RTN 380
IN2	C-Rx		Connected to the GE receive port on customer equipment
IN1	C-Tx		Connected to the GE transmit port on customer equipment

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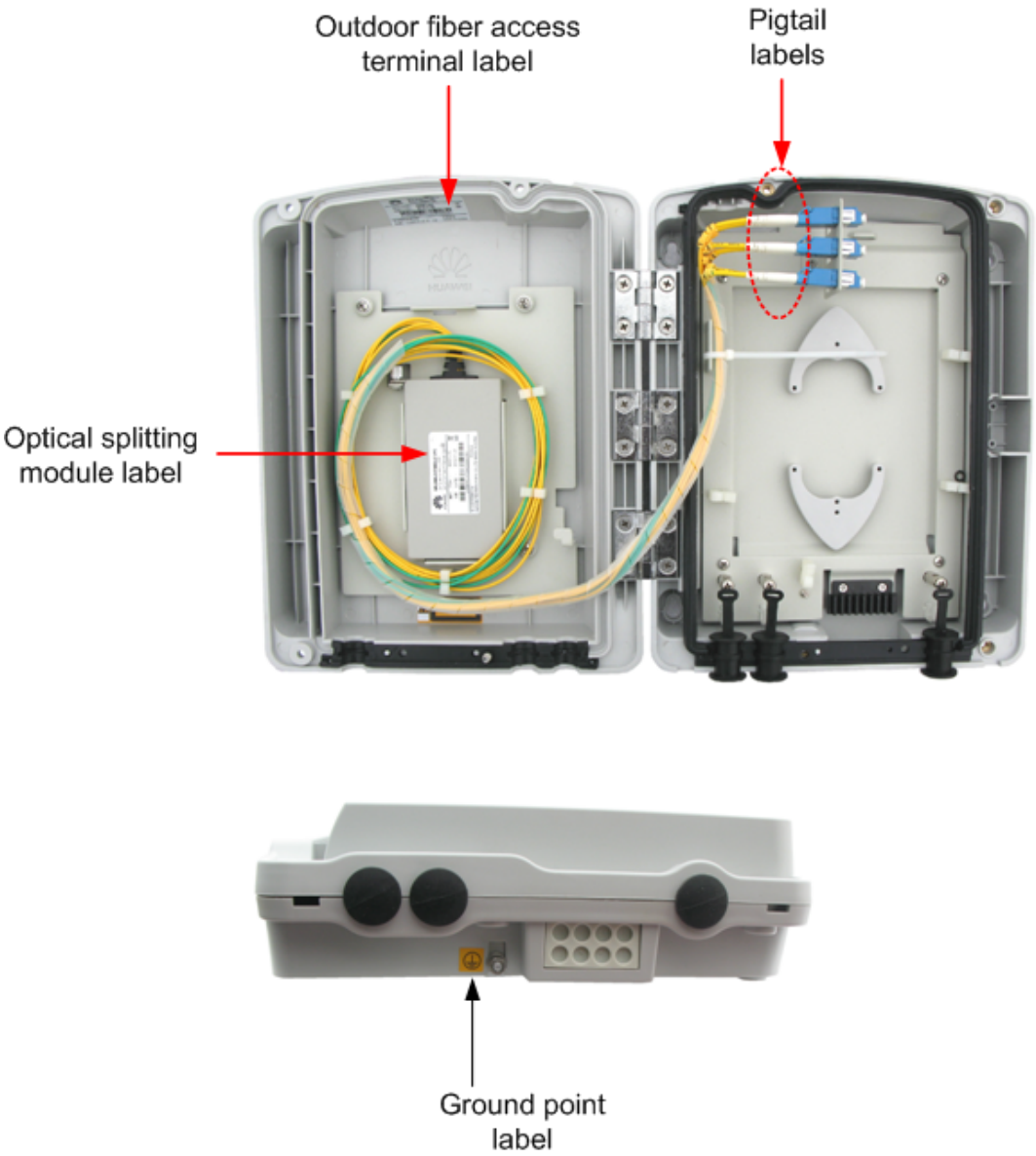
The fiber adapters for connecting pigtails in the fiber distribution area provide the anti-misinsertion function. Install pigtails based on the labels attached to them.

7.3.3 Labels

There are three labels on the fiber access terminal of an optical splitter: fiber access terminal label, optical splitting module label, and ground point label.

Figure 7-13 Labels of an optical splitter



7.3.4 Technical Specifications

This section describes the technical specifications of an optical splitter, including environment and performance specifications.

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Table 7-14 Technical specifications

Item	Specifications
Fiber type	Single-mode
Operating wavelength	1310 nm/1490 nm/1550 nm
Working bandwidth	1310±40 nm/1490±10 nm/1550±40 nm
Split ratio	Equal splitting
Insertion loss	≤ 3.8 dB
Operating temperature	-40°C to +65°C
Storage temperature	-40°C to +70°C
Working humidity	≤ 95% (+40°C)
Atmospheric pressure	70-106 kPa
Protection class	IP55
Dimensions (H x W x D)	296 mm x 238 mm x 70 mm
Weight	3.6 kg (including the fiber access terminal)

7.4 Hybrid Coupler

A hybrid coupler (RF signal combiner/divider) is used for installing two OptiX RTN 380s on an antenna. The hybrid couplers in this document refer to those that can work with OptiX RTN 380s.

7.4.1 Types

Hybrid couplers are available as balanced and unbalanced hybrid couplers.

Balanced and unbalanced hybrid couplers are described as follows:

- A balanced hybrid coupler splits one RF signal into two almost equivalent RF branch signals.
- A unbalanced hybrid coupler splits one RF signal into two RF signals with different power levels.The signal power on the standby path is about 6 dB lower than the signal power on the main path.

NOTE

The same attenuation also exists in the transmit direction as that in the receive direction.

7.4.2 Functions and Features

Hybrid couplers combine and divide RF signals.

Hybrid couplers have the following functions and features:

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- In the transmit direction, a hybrid coupler combines two RF signal routes from two OptiX RTN 380s into one and transmits the signals to an antenna.
- In the receive direction, the hybrid coupler divides the RF signals received from the antenna into two outputs and transmits the signals to OptiX RTN 380s.

7.4.3 Ports

A hybrid coupler has one antenna port, one main tributary port, and one extension tributary port.

Figure 7-14 shows ports on a hybrid coupler.

Figure 7-14 Ports on a hybrid coupler

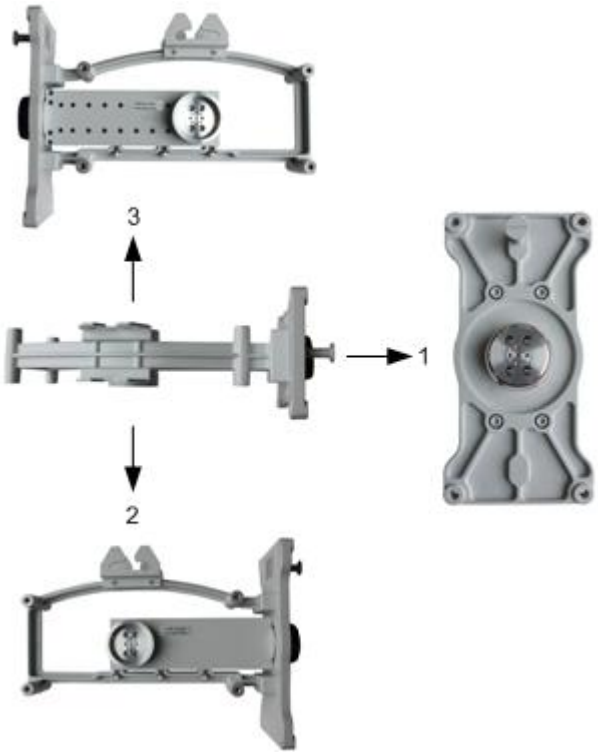

Table 7-15 describes the ports on a hybrid coupler.

Table 7-15 Description of ports on a hybrid coupler

No.	Port	Mark	Function	Port Type
1	Antenna port	-	Connects to an antenna.	153IEC-R740, which can be connected to a UG387/U-R740.
2	Extension tributary port	STANDBY	Connects to the OptiX RTN 380 of the extension tributary.	

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No.	Port	Mark	Function	Port Type
3	Main tributary port	MAIN	Connects to the OptiX RTN 380 of the extension tributary.	

7.4.4 Labels

Labels are attached to a hybrid coupler and its packaging to provide basic information of the device.

Figure 7-15 shows the label of a hybrid coupler.

Figure 7-15 Label of a hybrid coupler

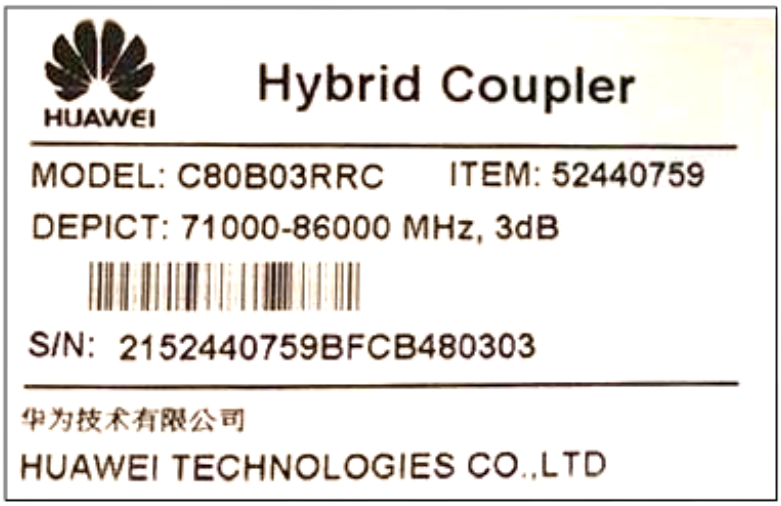

Table 7-16 describes information provided on a hybrid coupler label.

Table 7-16 Information provided on a hybrid coupler label

Label Information	Content Example	Parameter	Parameter Description
Name	Hybrid Coupler	-	Indicates that the component is a hybrid coupler.
Model (MODEL)	C 80 B 03 R R C ① ② ③ ④ ⑤ ⑥ ⑦	1: component type	C indicates the hybrid coupler.

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Label Information	Content Example	Parameter	Parameter Description
		2: frequency band	Indicates the operating frequency of the hybrid coupler in GHz. For example, 80 indicates that the hybrid coupler operates at 80 GHz.
		3: tributary features	B: balanced U: unbalanced
		4: coupling	03 indicates that the coupling of the tributary is 3 dB. 06 indicates that the coupling of the tributary is 6 dB.
		5: waveguide type of port connected to antenna	R: rectangular waveguide
		6: waveguide type of ports connected to OptiX RTN 380	R: rectangular waveguide
		7: port type	C: Huawei port
Item code (ITEM)	**52440759**	-	Uniquely identifies the model of a hybrid coupler.
Description (DEP)	**71000-86000 MHz, 3dB** ① ②	1: operating frequency range	Indicates the operating frequency range of the hybrid coupler in MHz.
		2: coupling	Indicates coupling (dB) of the main and extension tributaries.
Serial number (S/N)	**2152440759BFCB480303**	-	Identifies a hybrid coupler uniquely.

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Label Information	Content Example	Parameter	Parameter Description
Bar code area		-	Indicates bar code of the hybrid coupler serial number.

7.4.5 Technical Specifications

The technical specifications of hybrid couplers include electrical and mechanical specifications.

Table 7-17 lists the technical specifications of hybrid couplers.

Table 7-17 Technical specifications of hybrid couplers

Item	Specifications
Attenuation of the main tributary (dB)	≤ 6.0 (Balanced hybrid coupler) ≤ 4.0 (Unbalanced hybrid coupler)
Attenuation of the extension tributary (dB)	≤ 6.0 (Balanced hybrid coupler) ≤ 9.0 (Unbalanced hybrid coupler)
Flatness of the main tributary (dB)	≤ 1.0
Flatness of the extension tributary (dB)	≤ 1.0
Isolation between the main tributary and the tributary path (dB)	≥ 20
Standing wave ratio	≤ 1.4
Power capacity (W)	8
Dimensions (H x W x D)	< 330 mm x 190 mm x 410 mm
Weight	≤ 5 kg

7.5 Antennas

Radio equipment uses antennas to emit and receive electromagnetic waves. OptiX RTN 380 supports parabolic antennas and flat antennas. Parabolic antennas are also called dish antennas.

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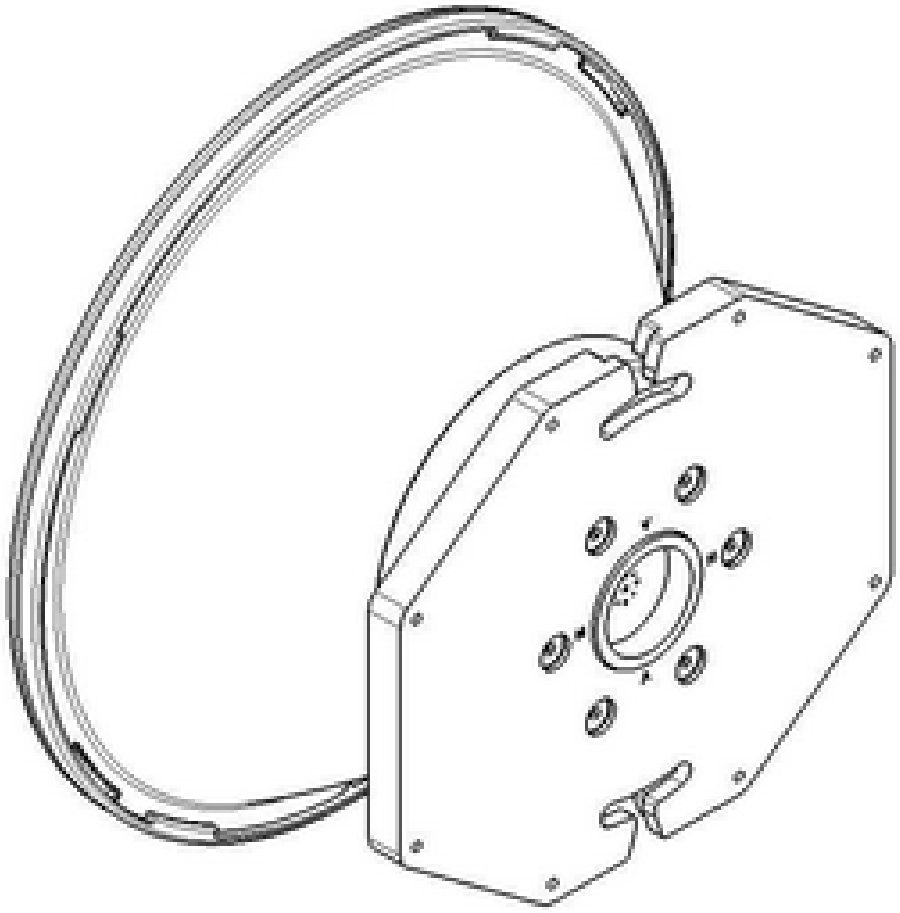
7.5.1 Types

OptiX RTN 380 supports dish antennas and flat antennas.

Dish Antenna

Dish antennas are parabolic antennas. **Figure 7-16** shows the appearance of a dish antenna.

Figure 7-16 Appearance of a dish antenna



Flat Antenna

Flat antennas are small in size but offers high efficiency. **Figure 7-17** shows the appearance of a flat antenna.

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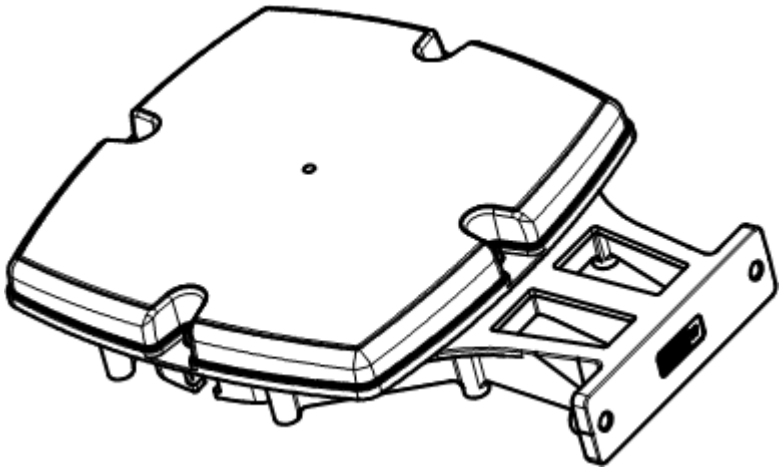
Figure 7-17 Appearance of a flat antenna



7.5.2 Functions and Features

Antennas perform conversion between RF signals received from OptiX RTN 380s and electromagnetic waves radiated in free space.

- In the transmit direction, antennas convert RF signals received from OptiX RTN 380s into directional electromagnetic waves and emit these waves into free space.
- In the receive direction, antennas receive electromagnetic waves from free space, convert these waves into RF signals, and transmit the RF signals to OptiX RTN 380s.

7.5.3 Working Principles (Dish Antenna)

An antenna consists of a reflector, a feed, a radome, and a mounting bracket.

Figure 7-18 shows the structure of an antenna.

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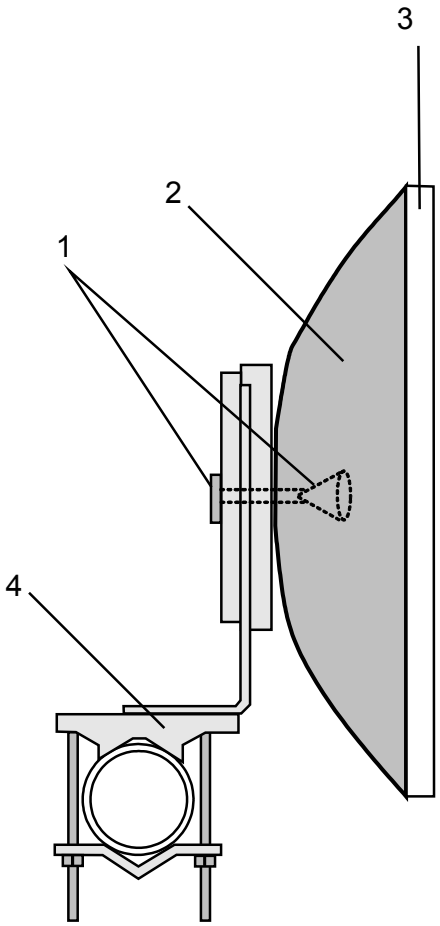
Figure 7-18 Antenna structure



1. Feed 2. Reflector 3. Radome
4. Mounting bracket

The functions of each component of an antenna are described as follows:

- Feeds

  A feed receives RF signals from an OptiX RTN 380 at its input port and transmits those signals to its output port through its waveguide. Located at the focal spot of the reflector, the output port of the feed is equivalent to a double reflector antenna and emits electromagnetic waves towards the reflector.

  You can rotate the feed to change the polarization direction of an antenna. Here, polarization direction refers to the polarization direction of emitted electromagnetic waves or the direction of an electrical field. **Figure 7-19** shows the polarization directions that rectangular waveguides support.

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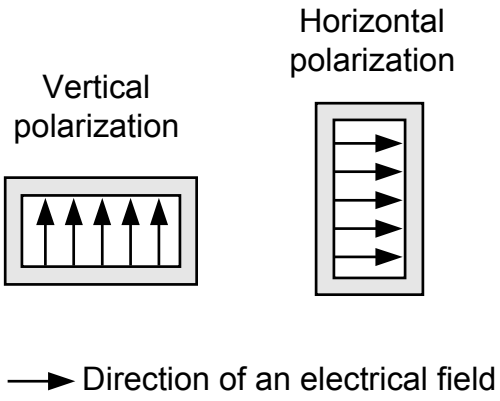
Figure 7-19 Polarization directions that rectangular waveguides support



- Reflectors

  Generally taking the form of rotatable paraboloids, antenna reflectors reflect electromagnetic waves and increase directive gain.

  - In the transmit direction, reflectors reflect the electromagnetic waves emitted from feeds so the reflected electromagnetic waves are directional.
  - In the receive direction, reflectors focus the electromagnetic waves from free space to feeds' output ports.
- Radomes

  Radomes protect antennas from being damaged by wind, rain, snow, or ice. Radomes do not prevent electromagnetic waves from penetrate to the reflector.
- Mounting brackets

  Mounting brackets are used to attach antennas onto poles and help achieve fine elevation and azimuth adjustments.

7.5.4 Working Principles (Flat Antenna)

A flat antenna consists of the radome, array set, antenna backplane, adapter, and mounting bracket.

Figure 7-20 shows the structure of a panel antenna.

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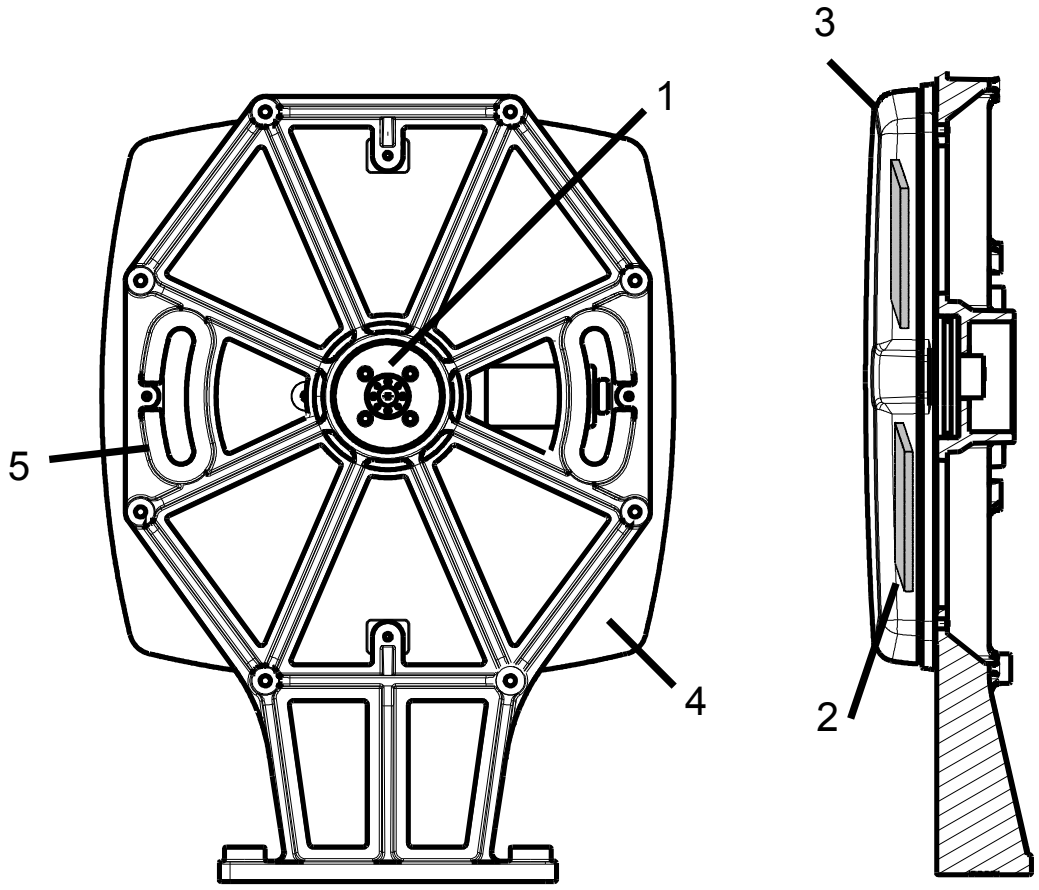
Figure 7-20 Structure of a panel antenna



1. Adapter
2. Array set
3. Radome
4. Antenna backplane
5. Mounting bracket

The functions of each component of the antenna are described as follows:

- Adapter

  The adapter is used to connect the antenna to the antenna port on OptiX RTN 380.

- Array set

  The array set contains four radiation arrays and a power distributor.

  Radiation array: A metal plate is cut out with arranged slots, each of which is a slot antenna unit. The radiation array concentrates the electromagnetic waves absorbed by slot antenna units and transmits the waves to the power distributor.

  Power distributor: In the transmit direction, it distributes the power from OptiX RTN 380 to the four radiation arrays. In the receive direction, it combines the signals from the four radiation arrays into one and sends the signal to OptiX RTN 380.

- Radome

  Radome: It prevents the antenna against the wind, rain, ice, and snow. Electromagnetic waves can be radiated through the radome.

- Antenna backplane

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Antenna components are fixed onto the antenna backplane.

- Mounting bracket

  The mounting bracket is used for securing the antenna onto the pole and for adjusting the azimuth and elevation angles slightly.

7.5.5 Antenna Diameters

OptiX RTN 380 supports dish antennas available in three diameters: 0.2 m, 0.3 m and 0.6 m. OptiX RTN 380 supports two flat antennas that provide equivalent gain of dish antennas with diameters of 0.2 m and 0.3 m.

7.5.6 Technical Specifications

The technical specifications of antennas include electrical and mechanical specifications. The electrical specifications of antennas include the antenna gain, half-power beamwidth, standing wave ratio, and front-to-back ratio. The mechanical specifications of antennas include the dimensions, weight, anti-wind capability, and anti-snow/ice capability.

Huawei provides complete antenna portfolios. For information about antenna specifications, contact Huawei.

7.6 USB Flash Drives

Configuring, replacing, and upgrading RTN 380s is simple with USB flash drives, which store NE data and new software to be installed and are also used to back up configuration data.

Functions and Features

USB flash drives prepared for RTN 380s store NE software and configuration data (including databases, system parameters, and scripts).

- Equipment software and scripts stored in USB flash drives are installed on RTN 380s for deployment and commissioning. With this system, users do not need to configure data onsite.
- Software, patch packages, NE databases, and system parameters are backed up to USB flash drives. This avoids the need to reconfigure data when replacing a RTN 380.
- Software of target versions stored in USB flash drives are imported to RTN 380s.

Application Scenario

- For deployment and commissioning of an RTN 380, scripts, and software are stored on a USB flash drive. After the USB flash drive is plugged in and functioning, the RTN 380 downloads software, and scripts in sequence.
- For an upgrade or downgrade of an RTN 380, only the software of the target version is stored on a USB flash drive. After the USB flash drive is plugged in and functioning, the RTN 380 compares the versions of the running software and the software stored on the USB flash drive. If the versions are not the same, the RTN 380 automatically downloads the software from the USB flash drive for an upgrade or downgrade.
- During RTN 380 replacement, an empty USB flash drive is inserted into a faulty device, which automatically backs up its data to the drive. After the faulty device is replaced, the

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drive holding the backup data is inserted into the new device, which automatically downloads the backed up NE data, software, and system parameters and restores the NE data.

Data uploading

A USB flash drive contains the following folders:

NOTE

The USB flash drive partition format is FAT32.

- The root directory stores a **RTN.CER** file.

  NOTE

  The **RTN.CER** file, which stores administrator-level account and password information (with password information encrypted), is used for authenticating the USB flash drive. The file is generated by a system administrator at the network management center (NMC) using a dedicated tool.

- pkg: stores the NE software.

NOTICE

Data is saved in the \pkg folder only when the NE software is upgraded. Otherwise, keep the folder empty.

- patch: stores the patch software.
- sysdata: stores system parameters.
- script: stores scripts.
- db: stores NE databases.
- license: stores a license.
- devicetype: stores device type parameters.

When a USB flash drive is connected to an RTN 380, the RTN 380 checks the folders on the USB flash drive in the following order:

1. Checks for the **RTN.CER** file in the root directory. If the file exists, the USB flash drive is authenticated. Otherwise, the USB flash drive fails to be identified.
2. Checks the NE software folder **pkg**. If the NE software version is different from that of the local RTN 380, the RTN 380 upgrades its software.
3. Checks the patch software folder **patch**. If the patch software version is different from that of the local RTN 380, the RTN 380 loads the patch software from the folder.
4. Checks the system parameter folder **sysdata**. If the folder contains data, the RTN 380 imports system parameters from the folder.
5. Checks the script folder **script**. If the folder contains data, the RTN 380 imports script data from the folder.
6. Checks the database folder **db**. If the folder contains data and the device type under **\Devicetype** is the same as the NE device type, the RTN 380 loads the database from the folder.

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7. If any of the preceding folders contains no data or does not exist, the RTN 380 checks the next folder. If the RTN 380 finds none of the preceding folders, it exports its data to the USB flash drive.

Ensure that USB flash drives have only the preceding folders, as extra folders may lead to malfunctions.

NOTE

A device reads data from a USB flash drive at different rates in different scenarios. The user can check whether the device is reading data from a USB flash drive by observing the USB port or USB flash drive indicator.

Types of USB Flash Drives

Table 7-18 lists the types of USB flash drives supported by RTN 380. Not all USB flash drives are supported by RTN 380. If a USB flash drive of another model or capacity is required, confirm with the local Huawei office that the USB flash drive is supported by RTN 380.

Table 7-18 Types of USB flash drives

No.	Manufacturer	Model	Capacity
1	Netac	U208	4 GB

7.7 Wi-Fi Module

A Wi-Fi module for an RTN 380 enables the Mobile LCT or Web LCT to connect to the RTN 380 using Wi-Fi, implementing contact-free configuration and maintenance.

Appearance

Figure 7-21 Wi-Fi module

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Specifications

Table 7-19 Wi-Fi module specifications

Item	Specifications
Port	USB2.0 high-speed connector
Dimensions (H x W x D)	20 mm x 14 mm x 6 mm
Wireless mode	Compatible with IEEE 802.11b/g/n
Maximum wireless rate	● IEEE 802.11n: 150 Mbit/s ● IEEE 802.11g: 54 Mbit/s ● IEEE 802.11b: 11 Mbit/s
Frequency range	2.4 GHz to 2.4835 GHz
Wireless transmit power	Maximum power: 20 dBm ● IEEE 802.11b: 18±1 dBm ● IEEE 802.11g: 15±1 dBm ● IEEE 802.11n: 12±1 dBm
Receiver sensitivity	● 130 Mbit/s: -68 dBm@10% PER ● 108 Mbit/s: -68 dBm@10% PER ● 54 Mbit/s: -68 dBm@10% PER ● 11 Mbit/s: -85 dBm@8% PER ● 6 Mbit/s: -88 dBm@10% PER ● 1 Mbit/s: -90 dBm@8% PER
Wi-Fi encryption mode	WPA2-PSK
Setting of the service set identifier (SSID)	Supported
Setting whether to enable Wi-Fi	Supported
Setting of Wi-Fi passwords	Supported

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Item	Specifications
Maximum transmission distance	● 30 m (laptop/mobile phone) ● 70 m (laptop + external Wi-Fi network adapter) **NOTE** 30 m is obtained based on tests in which a laptop (such as Lenovo Thinkpad X230) or mobile phone (such as Huawei 8815) is used and there is no obstacle between the laptop/mobile phone and NE. The actual transmission distance may vary according to performance of the laptop or mobile phone used. 70 m is obtained based on tests in which a laptop works with an external Wi-Fi network adapter (such as Tenda W311U+) and there is no obstacle between the laptop and NE. It is recommended that an external Wi-Fi network adapter with 18 dBm transmit power, -86 dBm receiver sensitivity, and an antenna of more than 4.2 dBi gain be used or an external Wi-Fi network adapter with better performance be used.

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8 Cables

About This Chapter

This chapter describes the purpose, physical appearance, and connections of various cables used with OptiX RTN 380s.

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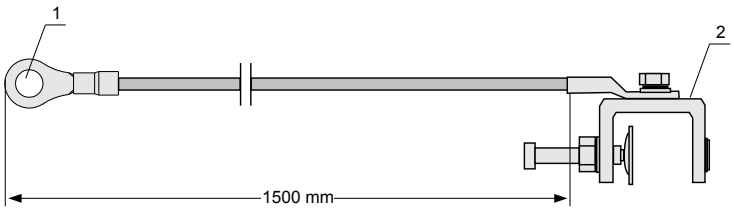
8.1 RTN 380 PGND Cables

PGND cables are connected to ground screws and outdoor ground points (such as ground points on towers) so that RTN 380 is connected to the outdoor ground grid.

Cable Diagram

Figure 8-1 OptiX RTN 380 PGND cable



1. Bare crimp terminal, OT
2. Base of the ground clip

8.2 Outdoor Network Cables

Fitted with RJ45 connectors at both ends, outdoor network cables connect Ethernet ports.

The GE electrical ports of PIs support the medium dependent interface (MDI), MDI crossover (MDI-X), and auto-MDI/MDI-X modes. Straight-through cables and crossover cables can be used to connect the NMS ports and GE electrical ports to MDIs or MDI-Xs. Straight-through cables are recommended if network cables are made onsite.

Cable Diagram

Figure 8-2 Network cable

Pin Assignments

Table 8-1 Pin assignments for straight-through cables

Connector X1	Connector X2	Color	Relationship
X1.1	X2.1	White/Orange	Twisted pair

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Connector X1	Connector X2	Color	Relationship
X1.2	X2.2	Orange	
X1.3	X2.3	White/Green	Twisted pair
X1.6	X2.6	Green	
X1.4	X2.4	Blue	Twisted pair
X1.5	X2.5	White/Blue	
X1.7	X2.7	White/Brown	Twisted pair
X1.8	X2.8	Brown	
Braided shield			

Table 8-2 Pin assignments for crossover cables

Connector X1	Connector X2	Color	Relationship
X1.1	X2.3	White/Green	Twisted pair
X1.2	X2.6	Green	
X1.3	X2.1	White/Orange	Twisted pair
X1.6	X2.2	Orange	
X1.4	X2.4	Blue	Twisted pair
X1.5	X2.5	White/Blue	
X1.7	X2.7	White/Brown	Twisted pair
X1.8	X2.8	Brown	
Braided shield			

NOTE

- Straight-through cables are used between MDIs and MDI-Xs, and crossover cables are used between MDIs or between MDI-Xs. The only difference between straight-through cables and crossover cables is with regard to their pin assignments.
- Either straight-through cables or crossover cables can be used to connect RTN 380 to common Ethernet equipment since Ethernet electrical ports support the MDI, MDI-X, and auto-MDI/MDI-X modes. If RTN 380 connects to power sourcing equipment (PSE) through a P&E port, pin assignments for power signals output from the PSE determines whether to use straight-through cables or crossover cables.

8.3 Outdoor Optical Fiber

Outdoor optical fibers are used for transmitting optical signals, and they fit outdoor scenarios.

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Fiber Diagram

Figure 8-3 Optical fiber (Single-mode)

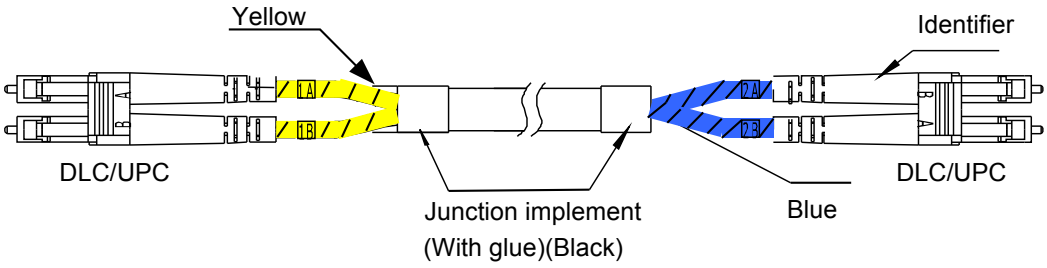
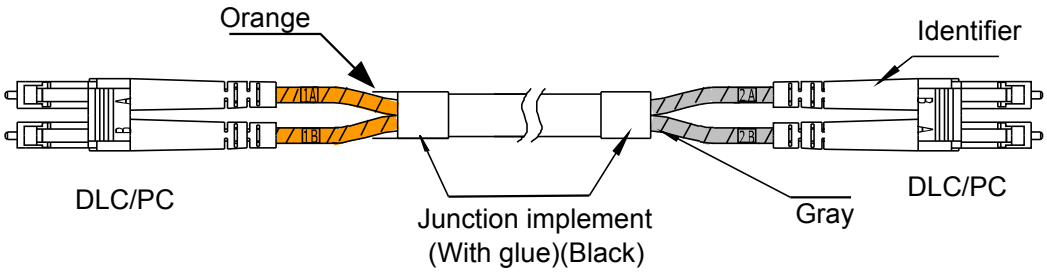


Figure 8-4 Optical fiber (Multi-mode)



NOTE

- Fiber connectors must be fit into outdoor protective tubes.
- Optical fibers already have correct receive/transmit connections at both ends.

Technical Specifications

Table 8-3 Technical specifications of optical fibers

Connector Type	Fiber Parameter
DLC/UPC	Single-mode, GYFJH 2B1.3 (low smoke and zero halogen), 7.0 mm, 2-core, 0.03 m/0.34 m, 2 mm, outdoor protected branch cable
DLC/PC	Multi-mode, GYFJH 2A1a (low smoke zero halogen), 7.0 mm, 2-core, 0.03 m/0.34 m, 2 mm, outdoor protected branch cable

Optical fibers are available in 11 lengths, and the shortest one is 2 meters long. Optical fibers in the other 10 lengths ranging from 10 meters to 150 meters are used for transmitting GE/CPRI services. You can use optical fibers of appropriate lengths depending on the onsite requirements.

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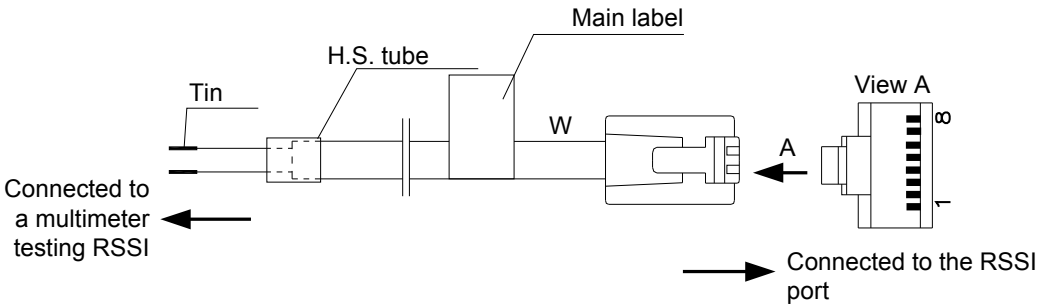
8.4 RSSI Cables

Received signal strength indicator (RSSI) cables connect RSSI ports of RTN 380s to multimeters.

Cable Diagram

Figure 8-5 RSSI cable



Pin Assignments

An RSSI cable uses two cores to detect level signals.

Table 8-4 Pin assignments for RSSI cables

Pin	Signal
4	Ground signal
7	RSSI test level signal

8.5 PI Power Cables

PI power cables connect PIs to power supply devices and supply them with -48 V power.

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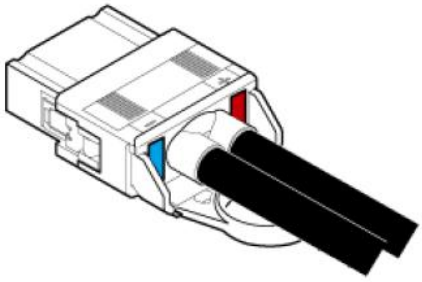
Cable Diagram

Figure 8-6 PI power cable



Cable Parameters

Table 8-5 Cable parameters

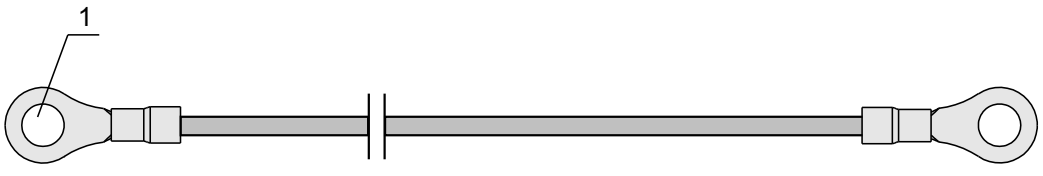
Cable	Cable Parameter	Terminal Parameter
Indoor-PI power cable	Power cable, 600 V, UL3386, 1.5 mm^2, 16 AWG, blue/ black, XLPE	Common connector, 2-pin, single row, 5.08 mm (pitch)

8.6 PI PGND Cables

Power injector (PI) PGND cables connect the ground points on the left of indoor PIs to external equipment's ground points (for example, cabinets' ground columns), so indoor PIs and external equipment share the same ground.

Cable Diagram

Figure 8-7 PI PGND cable



1. Bare crimp terminal, OT

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A Appendix

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A.1 Port Loopbacks

The loopback capabilities of ports on RTN 380 differ based on the port type.

Table A-1 Port loopbacks

Port Type	Loopback Capability
Microwave port	● Inloops at the IF port ● Inloops at the composite port ● Outloops at the composite port
GE port	● Inloops at the MAC layer ● Inloops at the PHY layer
CPRI port	● Inloops ● Outloops

A.2 Compliance Standards

A.2.1 ITU-R Standards

OptiX RTN 380 complies with the ITU-R standards designed for radio equipment.

Table A-2 ITU-R standard

Standard	Description
ITU-R F.1093	Effects of multipath propagation on the design and operation of line-of-sight digital fixed wireless systems
ITU-R F.1094	Maximum allowable error performance and availability degradations to digital fixed wireless systems arising from radio interference from emissions and radiations from other sources
ITU-R F.1102	Characteristics of fixed wireless systems operating in frequency bands above about 17 GHz
ITU-R F.1191	Bandwidths and unwanted emissions of digital fixed service systems
ITU-R F.1565	Performance degradation due to interference from other services sharing the same frequency bands on a co-primary basis with real digital fixed wireless systems used in the international and national portions of a 27 500 km hypothetical reference path at or above the primary rate

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Standard	Description
ITU-R F.1605	Error performance and availability estimation for synchronous digital hierarchy terrestrial fixed wireless systems
ITU-R F.1668	Error performance objectives for real digital fixed wireless links used in 27 500 km hypothetical reference paths and connections
ITU-R F.1703	Availability objectives for real digital fixed wireless links used in 27 500 km hypothetical reference paths and connections
ITU-R F.592	Vocabulary of terms for the fixed service
ITU-R F.746	Radio-frequency arrangements for fixed service systems
ITU-R F.752	Diversity techniques for point-to-point fixed wireless systems
ITU-R F.758	Considerations in the development of criteria for sharing between the terrestrial fixed service and other services
ITU-R SM.329	Unwanted emissions in the spurious domain
ITU-R P.525	Calculation of free-space attenuation
ITU-R P.530	Propagation data and prediction methods required for the design of terrestrial line-of-sight systems
ITU-R P.676	Attenuation by atmospheric gases
ITU-R P.837	Characteristics of precipitation for propagation modelling
ITU-R P.838	Specific attenuation model for rain for use in prediction methods
ITU-R P.836	Information on water vapour density
ITU-R F.5B313	Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands
ITU-R F.2107	characteristics and applications of fixed wireless systems operating in frequency ranges between 57 GHz and 134 GHz
ITU-R SM.328	Spectra and bandwidth of emissions
ITU-R SM.1045	Frequency tolerance of transmitters
ITU-R SM.1539-1	Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329
ITU-R SM.1541	Unwanted emissions in the out-of-band domain
ITU-R F.1519	Guidance on frequency arrangements based on frequency blocks for systems in the fixed service

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A.2.2 ITU-T Standards

OptiX RTN 380 complies with the ITU-T standards.

Table A-3 ITU-T standard

Standard	Description
ITU-T G.8011	Ethernet over Transport - Ethernet services framework
ITU-T G.8011.1	Ethernet private line service
ITU-T G.8011.2	Ethernet virtual private line service
ITU-T G.8261	Timing and synchronization aspects in packet networks
ITU-T G.8262	Timing characteristics of synchronous ethernet equipment slave clock (EEC)
ITU-T G.8264	Timing distribution through packet networks
ITU-T G.8032	Ethernet ring protection switching
ITU-T G.8012	Ethernet UNI and Ethernet over transport NNI
ITU-T Y.1730	Requirements for OAM functions in Ethernet based networks and Ethernet services
ITU-T Y.1731	OAM functions and mechanisms for Ethernet based networks
ITU-T G.8010	Architecture of Ethernet layer networks
ITU-T G.8021	Characteristics of Ethernet transport network equipment functional blocks
ITU-T Y.1291	An architectural framework for support of quality of service (QoS) in packet networks
ITU-T G.8040	GFP frame mapping into Plesiochronous Digital Hierarchy (PDH)
ITU-T K.20	Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents
ITU-T K.21	Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents
ITU-T K.27	Bonding configurations and earthing inside a telecommunication building

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Standard	Description
ITU-T K.41	Resistibility of internal interfaces of telecommunication centres to surge overvoltages

A.2.3 ETSI Standards

OptiX RTN 380 complies with the ETSI standards designed for radio equipment.

Table A-4 ETSI standard

Standard	Description
ETSI EN 300 385	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment
ETSI EN 300 386	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements
ETSI EN 301 489-1	Electromagnetic compatibility and Radio spectrum Matters(ERM); Electromagnetic Compatibility(EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-4	Electromagnetic compatibility and Radio spectrum Matters(ERM); Electromagnetic Compatibility(EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services
ETSI EN 301 390	Fixed Radio Systems; Point-to-point and Multipoint Systems; Spurious emissions and receiver immunity limits at equipment/ antenna port of Digital Fixed Radio Systems
ETSI TR 102 457	Transmission and Multiplexing (TM); Study on the electromagnetic radiated field in fixed radio systems for environmental issuesStudy on the electromagnetic radiated field in fixed radio systems for environmental issues
ETSI EN 300 132-2	Environmental Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)
ETSI EN 300 019-1-1 (Class 1.2)	Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage Class 1.2
ETSI EN 300 019-1-2 (Class 2.3)	Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation Class 2.3

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Standard	Description
ETSI EN 300 019-1-3 (Indoor Unit Class 3.2)	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations
ETSI EN 300 019-1-4 (Outdoor Unit Class 4.1)	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations
ETSI EN 300 019-2-1	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-1: Specification of environmental tests; Storage
ETSI EN 300 019-2-2	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-2: Specification of environmental tests; Transportation
ETSI EN 300 019-2-4	Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-4: Specification of environmental tests; Stationary use at non-weatherprotected locations
ETSI TR 102 489	Thermal Management Guidance for equipment and its deployment
ETSI EN 301 126-1	Fixed Radio Systems; Conformance testing; Part 1: Point-to-point equipment - Definitions, general requirements and test procedures
ETSI EN 301 126-3-1	Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures
ETSI EN 302 217-1	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics
ETSI EN 302 217-2-1	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied
ETSI EN 302 217-2-2	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for digital systems operating in frequency bands where frequency co-ordination is applied
ETSI EN 302 217-3	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Equipment operating in frequency bands where both frequency coordinated or uncoordinated deployment might be applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

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Standard	Description
ETSI EN 302 217-4-1	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-1: System-dependent requirements for antennas
ETSI EN 302 217-4-2	Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Antennas; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
ETSI TR 102 565	Fixed Radio Systems (FRS); Point-to-point systems; Requirements and bit rates of PtP Fixed Radio Systems with packet data interfaces, effects of flexible system parameters, use of mixed interfaces and implications on IP/ATM networks Req.s and bit rates of systems wit packet data interfaces applying RIC-rates not covered by PDH/SDH.
ETSI EN 300 253	Environmental Engineering (EE); Earthing and bonding of telecommunication equipment in telecommunication centres
ETSI EN 300 119	Environmental Engineering (EE); European telecommunication standard for equipment practice;
ETSI ES 201 468 Ver. 1.3.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Additional ElectroMagnetic Compatibility (EMC) requirements and resistibility requirements for telecommunications equipment for enhanced availability of service in specific applications
ETSI TR 103 820	Fixed Radio Systems; Energy efficiency metrics and test procedures for Point-to-point fixed radio systems
ETSI TR 103 053	Access, Terminals, Transmission and Multiplexing (ATTM)Fixed Radio Systems; Parameters affecting the Signal-to-Noise Ratio (SNR) and the Receiver Signal Level (RSL) threshold in point-to-point receivers; Theory and practice

A.2.4 CEPT Standards

OptiX RTN 380 complies with the CEPT standards.

Table A-5 CEPT Standards

Standard	Description
ERC/REC 74-01	Unwanted Emissions in the Spurious Domain
ECC/REC/(05)07	Radio frequency channel arrangements for Fixed Service Systems operating in the bands 71 - 76 GHz and 81 - 86 GHz
ECC/REC/(02)05	Unwanted emissions

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A.2.5 IEC Standards

OptiX RTN 380 complies with the IEC standards related to the waveguide.

Table A-6 IEC standards

Standard	Description
IEC 60154-1	Flanges for waveguides. Part 1: General requirements
IEC 60154-2	Flanges for waveguides. Part 2: Relevant specifications for flanges for ordinary rectangular waveguides
IEC 60154-3	Flanges for waveguides. Part 3: Relevant specifications for flanges for flat rectangular waveguides
IEC 60154-4	Flanges for waveguides. Part 4: Relevant specifications for flanges for circular waveguides
IEC 60154-6	Flanges for waveguides. Part 6: Relevant specifications for flanges for medium flat rectangular waveguides
IEC 60154-7	Flanges for waveguides - Part 7: Relevant specifications for flanges for square waveguides
IEC 60153-1	Hollow metallic waveguides. Part 1: General requirements and measuring methods
IEC 60153-2	Hollow metallic waveguides. Part 2: Relevant specifications for ordinary rectangular waveguides
IEC 60153-3	Hollow metallic waveguides. Part 3: Relevant specifications for flat rectangular waveguides
IEC 60153-4	Hollow metallic waveguides. Part 4: Relevant specifications for circular waveguides
IEC 60153-6	Hollow metallic waveguides. Part 6: Relevant specifications for medium flat rectangular waveguides
IEC 60153-7	Hollow metallic waveguides. Part 7: Relevant specifications for square waveguides
IEC 60215	Safety requirements for radio transmitting equipment
IEC 60529	Degrees of protection provided by enclosures
IEC 60825	Safety of laser products
IEC 60950-1	Information technology equipment – Safety – Part 1 General requirements
IEC 60950-22	Information technology equipment – Safety – Part 22 Equipment installed outdoors
IEC 60657	Non-ionizing radiation hazards in the frequency range from 10 MHz to 300 000 MHz

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Standard	Description
IEC 60297	Dimensions of mechanical structures of the 482.6 mm (19 in) series
IEC 60529	Degrees of protection provided by enclosures
IEC 721-3-4 Classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5 (Outdoor Unit)	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weather protected locations. Classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5
IEC 61000-4-2	Electromagnetic compatibility (EMC) Part 2: Testing and measurement techniques Section 2: Electrostatic discharge immunity test Basic EMC Publication
IEC 61000-4-3	Electromagnetic compatibility; Part 3: Testing and measurement techniques Section 3 radio frequency electromagnetic fields; immunity test.
IEC 61000-4-4	Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 4: Electrical fast transient/burst immunity test Basic EMC publication
IEC 61000-4-5	Electromagnetic compatibility (EMC) Part 5: Testing and measurement techniques Section 5: Sruge immunity test
IEC 61000-4-6	Electromagnetic compatibility: Part 6: Testing and measurement techniques: Section 6 conducted disturbances induced by radio-frequency fields; immunity test
IEC 61000-4-29	Electromagnetic compatibility: Part 29: Testing and measurement techniques –Voltage dips,short interruptions and voltage variations on DC input power port immunity tests

A.2.6 IETF Standards

OptiX RTN 380 complies with IETF standards.

Table A-7 IETF standards

Standard	Description
RFC 791	Internet Protocol
RFC 2819	Remote Network Monitoring Management Information Base
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1662	PPP in HDLC-like Framing
RFC 2615	PPP over SONET/SDH

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Standard	Description
draft-ietf-l2vpn-oam-req-frmk-05	L2VPN OAM requirements and framework
draft-ietf-l2vpn-signaling-08	Provisioning, autodiscovery, and signaling in L2VPNs
RFC 4664	Framework for layer 2 virtual private networks (L2VPNs)
RFC 3289	Management information base for the differentiated services architecture
RFC 3644	Policy quality of service (QoS) Information model
RFC 3670	Information model for describing network device QoS datapath mechanisms
RFC 2212	Specification of guaranteed quality of service
RFC 2474	Definition of the Differentiated Services Field(DS Field) in the IPv4 and IPv6 Headers
RFC 2475	An architecture for differentiated services
RFC 2597	Assured forwarding PHB group
RFC 3140	Per hop behavior identification codes
RFC 3246	An expedited forwarding PHB (Per-hop behavior)
STD 0062	An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks

A.2.7 IEEE Standards

OptiX RTN 380 complies with the IEEE standards designed for Ethernet networks.

Table A-8 IEEE standards

Standard	Description
IEEE 802.1D	Media Access Control (MAC) Bridges
IEEE 802.3	Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications
IEEE 802.1Q	Virtual Bridged Local Area Networks
IEEE 802.1ag	Virtual Bridged Local Area Networks — Amendment 5: Connectivity Fault Management
IEEE 802.3ah	Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks

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Standard	Description
IEEE 802.3x	Supplements to Carrier Sense Multiple Access With Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
IEEE 1588v2	IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems

A.2.8 Other Standards

This section describes other standards with which OptiX RTN 380 complies.

Table A-9 Other standards

Standard	Description
EN 50289	Communication cables - Specifications for test methods
EN 50392	Generic standard to demonstrate the compliance of electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0 Hz - 300 GHz)
EN 62311	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)
EN 50383	Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunications system (110 MHz - 40 GHz)
EN 50385	Product standard to demonstrate the compliances of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to ratio frequency electromagnetic fields(110MHz-40GHz)-General public
EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (IEC/CISPR 22:1997, modified + A1:2000); German version EN 55022:1998 + Corrigendum:2001 + A1:2000
EN 55024	Information technology equipment - Immunity characteristics - Limits and methods of measurement
EN 41003	Particular safety requirements for equipment to be connected to telecommunication networks;
EN 60215	safty requirements for radio transmitting equipment
EN 60825-1	Safety of laser products

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Standard	Description
EN 60825-2	Safty of laser products part 2:safty of optical fibre communication systems
EN 60950-1	Information technology equipment — Safety — Part 1 General requirements
EN 60950-22	Information technology equipment — Safety — Part 22 Equipment installed outdoors
EN 60529	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989 + A1:1999); German version EN 60529:1991 + A1:2000
EN 61000-3-2	Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current< 16 A per phase)
EN 61000-3-3	Electromagnetic compatibility(EMC) —Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < – 16 A per phase and not subject toconditional connection
EN 61000-4-2	CENELEC. EMC Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test
EN 61000-4-3	CENELEC. EMC Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.
EN 61000-4-4	CENELEC. EMC Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test.
EN 61000-4-5	CENELEC. EMC Part 4: Testing and measurement techniques - Section 5: Surge Immunity test.
EN 61000-4-6	CENELEC. EMC Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances induced by radio frequency field.
AF-PHY-0086.001	AF-PHY-0086.001 Inverse Multiplexing for ATM Specification Version 1.1
AF-TM-0121.000	Traffic Management Specification
MEF2	Requirements and Framework for Ethernet Service Protection in Metro Ethernet Networks
MEF4	Metro Ethernet network architecture framework - Part 1: generic framework
MEF10	Ethernet services attributes phase 1
MEF9	Abstract Test Suite for Ethernet Services at the UNI
MEF14	Abstract Test Suite for Traffic Management Phase 1

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Standard	Description
CISPR 22(2010)	limits and methods of measurement of radio disturbance characteristics of information
CISPR 24(2010)	Information Technology Equipment -Immunity characteristics -Limits and methods measurement
CPRI	Common Public Radio Interface: A common standard of the key internal interface between the REC and the RE of the wireless base station

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B Glossary

Numerics

3G See **3rd Generation.**

3rd Generation (3G) The third generation of digital wireless technology, as defined by the International Telecommunications Union (ITU). Third generation technology is expected to deliver data transmission speeds between 144 kbit/s and 2 Mbit/s, compared to the 9.6 kbit/s to 19.2 kbit/s offered by second generation technology.

A

ABR See **area border router.**

ACAP See **adjacent channel alternate polarization.**

ACL See **access control list.**

AF See **assured forwarding.**

AIS alarm indication signal

AM See **adaptive modulation.**

ARP See **Address Resolution Protocol.**

ASBR See **autonomous system boundary router.**

ATPC See **automatic transmit power control.**

Address Resolution Protocol (ARP) An Internet Protocol used to map IP addresses to MAC addresses. The ARP protocol enables hosts and routers to determine link layer addresses through ARP requests and responses. The address resolution is a process by which the host converts the target IP address into a target MAC address before transmitting a frame. The basic function of ARP is to use the target equipment's IP address to query its MAC address.

access control list (ACL) A list of entities, together with their access rights, which are authorized to access a resource.

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adaptive modulation (AM)	A technology that is used to automatically adjust the modulation mode according to the channel quality. When the channel quality is favorable, the equipment uses a high-efficiency modulation mode to improve the transmission efficiency and the spectrum utilization of the system. When the channel quality is degraded, the equipment uses the low-efficiency modulation mode to improve the anti-interference capability of the link that carries high-priority services.
adjacent channel alternate polarization (ACAP)	A channel configuration method, which uses two adjacent channels (a horizontal polarization wave and a vertical polarization wave) to transmit two signals.
air interface	The interface between the cellular phone set or wireless modem (usually portable or mobile) and the active base station.
alarm suppression	A method to suppress alarms for the alarm management purpose. Alarms that are suppressed are no longer reported from NEs.
area border router (ABR)	A router that can belong to more than two areas of which one area must be a backbone area.
assured forwarding (AF)	One of the four per-hop behaviors (PHB) defined by the Diff-Serv workgroup of IETF. It is suitable for certain key data services that require assured bandwidth and short delay. For traffic within the bandwidth limit, AF assures quality in forwarding. For traffic that exceeds the bandwidth limit, AF degrades the service class and continues to forward the traffic instead of discarding the packets.
automatic transmit power control (ATPC)	A method of adjusting the transmit power based on fading of the transmit signal detected at the receiver
autonomous system boundary router (ASBR)	A router that exchanges routing information with other ASs.

B

BE	See **best effort.**
BIOS	See **basic input/output system.**
backup	A periodic operation performed on data stored in a database for the purposes of recovering the data if an error occurs. The backup also refers to the data synchronization between active and standby boards.
baseband	A form of modulation in which the information is applied directly onto the physical transmission medium.
basic input/output system (BIOS)	Firmware stored on the computer motherboard that contains basic input/output control programs, power-on self test (POST) programs, bootstraps, and system setting information. The BIOS provides hardware setting and control functions for the computer.
best effort (BE)	A traditional IP packet transport service. In this service, the diagrams are forwarded following the sequence of the time they reach. All diagrams share the bandwidth of the network and routers. The amount of resource that a diagram can use depends of the time it reaches. BE service does not ensure any improvement in delay time, jitter, packet loss ratio, and high reliability.

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blacklist A method of filtering packets based on their source IP addresses. Compared with ACL, the match condition for the black list is much simpler. Therefore, the black list can filter packets at a higher speed and can effectively screen the packet sent from the specific IP address.

bridge A device that connects two or more networks and forwards packets among them. Bridges operate at the physical network level. Bridges differ from repeaters because bridges store and forward complete packets, while repeaters forward all electrical signals. Bridges differ from routers because bridges use physical addresses, while routers use IP addresses.

broadcast A means of delivering information to all members in a network. The broadcast range is determined by the broadcast address.

burst A process of forming data into a block of the proper size, uninterruptedly sending the block in a fast operation, waiting for a long time, and preparing for the next fast sending.

C

CC See **continuity check.**

CCDP See **co-channel dual polarization.**

CSES consecutive severely errored second

CSMA/CD See **carrier sense multiple access with collision detection.**

carrier sense multiple access with collision detection (CSMA/CD) Carrier sense multiple access with collision detection (CSMA/CD) is a computer networking access method in which:

- A carrier sensing scheme is used.
- A transmitting data station that detects another signal while transmitting a frame, stops transmitting that frame, transmits a jam signal, and then waits for a random time interval before trying to send that frame again.

chain network One type of network that all network nodes are connected one after one to be in series.

channel spacing The center-to-center difference in frequencies or wavelengths between adjacent channels in a WDM device.

co-channel dual polarization (CCDP) A channel configuration method, which uses a horizontal polarization wave and a vertical polarization wave to transmit two signals. The Co-Channel Dual Polarization has twice the transmission capacity of the single polarization.

congestion management A flow control measure to solve the problem of network resource competition. When the network congestion occurs, it places packets into the queue for buffer and determines the packet forwarding order.

continuity check (CC) An Ethernet connectivity fault management (CFM) method used to detect the connectivity between MEPs by having each MEP periodically transmit a Continuity Check Message (CCM).

D

DCC See **data communications channel.**

DCN See **data communication network.**

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DD	database description
DM	See **delay measurement.**
DRDB	dynamic random database
DSCP	differentiated services code point
data communication network (DCN)	A communication network used in a TMN or between TMNs to support the data communication function.
data communications channel (DCC)	The data channel that uses the D1-D12 bytes in the overhead of an STM-N signal to transmit information on the operation, management, maintenance, and provisioning (OAM&P) between NEs. The DCC channel composed of bytes D1-D3 is referred to as the 192 kbit/s DCC-R channel. The other DCC channel composed of bytes D4-D12 is referred to as the 576 kbit/s DCC-M channel.
delay measurement (DM)	The time elapsed since the start of transmission of the first bit of the frame by a source node until the reception of the last bit of the loopbacked frame by the same source node, when the loopback is performed at the frame's destination node.
dual-polarized antenna	An antenna intended to simultaneously radiate or receive two independent radio waves orthogonally polarized.

E

E-LAN	See **Ethernet local area network.**
E-Line	See **Ethernet line.**
E1	An European standard for high-speed data transmission at 2.048 Mbit/s. It provides thirty-two 64 kbit/s channels. A time division multiplexing frame is divided in to 32 timeslots numbered from 0 to 31. Timeslot 0 is reserved for frame synchronization, and timeslot 16 is reserved for signaling transmission. The rest 30 timeslots are use as speech channels. Each timeslot sends or receives an 8-bit data per second. Each frame sends or receives 256-bit data per second. 8000 frames will be sent or received per second. Therefore the line data rate is 2.048 Mbit/s.
ECC	See **embedded control channel.**
EF	See **expedited forwarding.**
EMC	See **electromagnetic compatibility.**
ERPS	Ethernet ring protection switching
ES	errored second
ESD	electrostatic discharge
ETS	European Telecommunication Standards
ETSI	See **European Telecommunications Standards Institute.**
Ethernet line (E-Line)	A type of Ethernet service that is based on a point-to-point EVC (Ethernet virtual connection).
Ethernet local area network (E-LAN)	A type of Ethernet service that is based on a multipoint-to-multipoint EVC (Ethernet virtual connection).

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European Telecommunications Standards Institute (ETSI)	A standards-setting body in Europe. Also the standards body responsible for GSM.
electromagnetic compatibility (EMC)	A condition which prevails when telecommunications equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment.
embedded control channel (ECC)	A logical channel that uses a data communications channel (DCC) as its physical layer to enable the transmission of operation, administration, and maintenance (OAM) information between NEs.
expedited forwarding (EF)	The highest order QoS in the Diff-Serv network. EF PHB is suitable for services that demand low packet loss ratio, short delay, and broad bandwidth. In all the cases, EF traffic can guarantee a transmission rate equal to or faster than the set rate. The DSCP value of EF PHB is "101110".
extended ID	The number of the subnet to which an NE belongs, used to identify different network segments in a wide area network (WAN). Together, the ID and extended ID form the physical ID of the NE.
extended NE ID	The serial number of a subnetwork where an NE resides, which is usually used to distinguish different network segments. An extended ID and an ID form the physical ID of an NE.

F

FEC	See **forward error correction.**
FIFO	See **first in first out.**
FPGA	See **field programmable gate array.**
FTP	File Transfer Protocol
field programmable gate array (FPGA)	A semi-customized circuit that is used in the Application Specific Integrated Circuit (ASIC) field and developed based on programmable components. FPGA remedies many of the deficiencies of customized circuits, and allows the use of many more gate arrays.
first in first out (FIFO)	A stack management method in which data that is stored first in a queue is also read and invoked first.
flooding	A type of incident, such as insertion of a large volume of data, that results in denial of service.
forward error correction (FEC)	A bit error correction technology that adds correction information to the payload at the transmit end. Based on the correction information, the bit errors generated during transmission can be corrected at the receive end.

G

GNE	See **gateway network element.**
gateway	A device that connects two network segments using different protocols. It is used to translate the data in the two network segments.

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gateway network element (GNE)	An NE that serves as a gateway for other NEs to communicate with a network management system.

H

HSDPA	See **High Speed Downlink Packet Access.**
HUAWEI Electronic Document Explorer (HedEx)	The software used to view, search for, and upgrade electronic documentation of Huawei products. HedEx, pronounced as [hediks], has two editions, HedEx Lite and HedEx Server.
HedEx	See **HUAWEI Electronic Document Explorer.**
High Speed Downlink Packet Access (HSDPA)	A modulating-demodulating algorithm put forward in 3GPP R5 to meet the requirement for asymmetric uplink and downlink transmission of data services. It enables the maximum downlink data service rate to reach 14.4 Mbit/s without changing the WCDMA network topology.

I

ICMP	See **Internet Control Message Protocol.**
IDU	See **indoor unit.**
IEEE	See **Institute of Electrical and Electronics Engineers.**
IP	Internet Protocol
IP address	A 32-bit (4-byte) binary number that uniquely identifies a host connected to the Internet. An IP address is expressed in dotted decimal notation, consisting of the decimal values of its 4 bytes, separated with periods; for example, 127.0.0.1. The first three bytes of the IP address identify the network to which the host is connected, and the last byte identifies the host itself.
IPv4	See **Internet Protocol version 4.**
IPv6	See **Internet Protocol version 6.**
ISO	International Organization for Standardization
ITU	See **International Telecommunication Union.**
Institute of Electrical and Electronics Engineers (IEEE)	A professional association of electrical and electronics engineers based in the United States, but with membership from numerous other countries. The IEEE focuses on electrical, electronics, and computer engineering, and produces many important technology standards.
International Telecommunication Union (ITU)	A United Nations agency, one of the most important and influential recommendation bodies, responsible for recommending standards for telecommunication (ITU-T) and radio networks (ITU-R).
Internet Control Message Protocol (ICMP)	A network layer protocol that provides message control and error reporting between a host server and an Internet gateway.

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Internet Protocol version 4 (IPv4)	The current version of the Internet Protocol (IP). IPv4 utilizes a 32bit address which is assigned to hosts. An address belongs to one of five classes (A, B, C, D, or E) and is written as 4 octets separated by periods and may range from 0.0.0.0 through to 255.255.255.255. Each IPv4 address consists of a network number, an optional subnetwork number, and a host number. The network and subnetwork numbers together are used for routing, and the host number is used to address an individual host within the network or subnetwork.
Internet Protocol version 6 (IPv6)	An update version of IPv4, which is designed by the Internet Engineering Task Force (IETF) and is also called IP Next Generation (IPng). It is a new version of the Internet Protocol. The difference between IPv6 and IPv4 is that an IPv4 address has 32 bits while an IPv6 address has 128 bits.
indoor unit (IDU)	The indoor unit of the split-structured radio equipment. It implements accessing, multiplexing/demultiplexing, and intermediate frequency (IF) processing for services.

J

jitter	The measure of short waveform variations caused by vibration, voltage fluctuations, and control system instability.

L

L2VPN	Layer 2 virtual private network
LACP	See **Link Aggregation Control Protocol.**
LAG	See **link aggregation group.**
LAN	See **local area network.**
LB	See **loopback.**
LBM	See **loopback message.**
LBR	See **loopback reply.**
LCT	local craft terminal
LM	See **loss measurement.**
LOS	See **loss of signal.**
LSA	link-state advertisement
LSDB	link state database
LT	linktrace
LTM	See **linktrace message.**
LTR	See **linktrace reply.**
Layer 2 switching	A data forwarding method. In a LAN, a network bridge or 802.3 Ethernet switch transmits and distributes packet data based on the MAC address. Since the MAC address is at the second layer of the OSI model, this data forwarding method is called Layer 2 switching.

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Link Aggregation Control Protocol (LACP)	A dynamic link aggregation protocol that improves the transmission speed and reliability. The two ends of the link send LACP packets to inform each other of their parameters and form a logical aggregation link. After the aggregation link is formed, LACP maintains the link status in real time and dynamically adjusts the ports on the aggregation link upon detecting the failure of a physical port.
link aggregation group (LAG)	An aggregation that allows one or more links to be aggregated together to form a link aggregation group so that a MAC client can treat the link aggregation group as if it were a single link.
linktrace message (LTM)	The message sent by the initiator MEP of 802.1ag MAC Trace to the destination MEP. LTM includes the Time to Live (TTL) and the MAC address of the destination MEP2.
linktrace reply (LTR)	For 802.1ag MAC Trace, the destination MEP replies with a response message to the source MEP after the destination MEP receives the LTM, and the response message is called LTR. LTR also includes the TTL that equals the result of the TTL of LTM minus 1.
local area network (LAN)	A network formed by the computers and workstations within the coverage of a few square kilometers or within a single building, featuring high speed and low error rate. Current LANs are generally based on switched Ethernet or Wi-Fi technology and run at 1,000 Mbit/s (that is, 1 Gbit/s).
loopback (LB)	A troubleshooting technique that returns a transmitted signal to its source so that the signal or message can be analyzed for errors. The loopback can be a inloop or outloop.
loopback message (LBM)	The loopback packet sent by the node that supports 802.2ag MAC Ping to the destination node. LBM message carries its own sending time.
loopback reply (LBR)	A response message involved in the 802.2ag MAC Ping function, with which the destination MEP replies to the source MEP after the destination MEP receives the LBM. The LBR carries the sending time of LBM, the receiving time of LBM and the sending time of LBR.
loss measurement (LM)	A method used to collect counter values applicable for ingress and egress service frames where the counters maintain a count of transmitted and received data frames between a pair of MEPs.
loss of signal (LOS)	No transitions occurring in the received signal.

M

MA	maintenance association
MAC	See **Media Access Control.**
MAC address	A link layer address or physical address. It is six bytes long.
MD	See **maintenance domain.**
MDI	medium dependent interface
ME	maintenance entity
MEP	maintenance end point
MIB	See **management information base.**
MIP	maintenance intermediate point

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MP	maintenance point
MPLS	See **Multiprotocol Label Switching.**
MSTP	See **Multiple Spanning Tree Protocol.**
MTBF	See **mean time between failures.**
MTTR	See **mean time to repair.**
MTU	See **maximum transmission unit.**
Media Access Control (MAC)	A protocol at the media access control sublayer. The protocol is at the lower part of the data link layer in the OSI model and is mainly responsible for controlling and connecting the physical media at the physical layer. When transmitting data, the MAC protocol checks whether to be able to transmit data. If the data can be transmitted, certain control information is added to the data, and then the data and the control information are transmitted in a specified format to the physical layer. When receiving data, the MAC protocol checks whether the information is correct and whether the data is transmitted correctly. If the information is correct and the data is transmitted correctly, the control information is removed from the data and then the data is transmitted to the LLC layer.
Multiple Spanning Tree Protocol (MSTP)	A protocol that can be used in a loop network. Using an algorithm, the MSTP blocks redundant paths so that the loop network can be trimmed as a tree network. In this case, the proliferation and endless cycling of packets is avoided in the loop network. The protocol that introduces the mapping between VLANs and multiple spanning trees. This solves the problem that data cannot be normally forwarded in a VLAN because in STP/RSTP, only one spanning tree corresponds to all the VLANs.
Multiprotocol Label Switching (MPLS)	A technology that uses short tags of fixed length to encapsulate packets in different link layers, and provides connection-oriented switching for the network layer on the basis of IP routing and control protocols.
maintenance domain (MD)	The network or the part of the network for which connectivity is managed by connectivity fault management (CFM). The devices in a maintenance domain are managed by a single Internet service provider (ISP).
management information base (MIB)	A type of database used for managing the devices in a communications network. It comprises a collection of objects in a (virtual) database used to manage entities (such as routers and switches) in a network.
maximum transmission unit (MTU)	The largest packet of data that can be transmitted on a network. MTU size varies, depending on the network—576 bytes on X.25 networks, for example, 1500 bytes on Ethernet, and 17,914 bytes on 16 Mbit/s token ring. Responsibility for determining the size of the MTU lies with the link layer of the network. When packets are transmitted across networks, the path MTU, or PMTU, represents the smallest packet size (the one that all networks can transmit without breaking up the packet) among the networks involved.
mean time between failures (MTBF)	The average time between consecutive failures of a piece of equipment. It is a measure of the reliability of the system.
mean time to repair (MTTR)	The average time that a device will take to recover from a failure.
microwave	The portion of the electromagnetic spectrum with much longer wavelengths than infrared radiation, typically above about 1 mm.

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multicast	A process of transmitting data packets from one source to many destinations. The destination address of the multicast packet uses Class D address, that is, the IP address ranges from 224.0.0.0 to 239.255.255.255. Each multicast address represents a multicast group rather than a host.

N

NAS	network access server
NE	network element
NE Explorer	The main operation interface of the NMS, which is used to manage the telecommunication equipment. In the NE Explorer, a user can query, manage, and maintain NEs, boards, and ports.
NTP	Network Time Protocol
network segment	Part of a network on which all message traffic is common to all nodes; that is, a message broadcast from one node on the segment is received by all other nodes on the segment.
network storm	A phenomenon that occurs during data communication. To be specific, mass broadcast packets are transmitted in a short time; the network is congested; transmission quality and availability of the network decrease rapidly. The network storm is caused by network connection or configuration problems.

O

OAM	See **operation, administration and maintenance.**
ODF	optical distribution frame
ODU	See **outdoor unit.**
OSPF	See **Open Shortest Path First.**
Open Shortest Path First (OSPF)	A link-state, hierarchical interior gateway protocol (IGP) for network routing that uses cost as its routing metric. A link state database is constructed of the network topology, which is identical on all routers in the area.
operation, administration and maintenance (OAM)	A set of network management functions that cover fault detection, notification, location, and repair.
outdoor unit (ODU)	The outdoor unit of the split-structured radio equipment. It implements frequency conversion and amplification for radio frequency (RF) signals.

P

P2P	See **point-to-point service.**
PBS	See **peak burst size.**
PDU	protocol data unit
PHB	See **per-hop behavior.**
PLL	See **phase-locked loop.**
PPP	Point-to-Point Protocol

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PPPoE	Point-to-Point Protocol over Ethernet
PRBS	See **pseudo random binary sequence.**
PSN	See **packet switched network.**
PTP	Precision Time Protocol
packet loss	The discarding of data packets in a network when a device is overloaded and cannot accept any incoming data at a given moment.
packet switched network (PSN)	A telecommunications network that works in packet switching mode.
peak burst size (PBS)	A parameter that defines the capacity of token bucket P, that is, the maximum burst IP packet size when the information is transferred at the peak information rate.
per-hop behavior (PHB)	IETF Diff-Serv workgroup defines forwarding behaviors of network nodes as per-hop behaviors (PHB), such as, traffic scheduling and policing. A device in the network should select the proper PHB behaviors, based on the value of DSCP. At present, the IETF defines four types of PHB. They are class selector (CS), expedited forwarding (EF), assured forwarding (AF), and best-effort (BE).
phase-locked loop (PLL)	A circuit that consists essentially of a phase detector that compares the frequency of a voltage-controlled oscillator with that of an incoming carrier signal or reference-frequency generator. The output of the phase detector, after passing through a loop filter, is fed back to the voltage-controlled oscillator to keep it exactly in phase with the incoming or reference frequency.
physical layer	Layer 1 in the Open System Interconnection (OSI) architecture; the layer that provides services to transmit bits or groups of bits over a transmission link between open systems and which entails electrical, mechanical and handshaking.
point-to-point service (P2P)	A service between two terminal users. In P2P services, senders and recipients are terminal users.
polarization	A kind of electromagnetic wave, the direction of whose electric field vector is fixed or rotates regularly. Specifically, if the electric field vector of the electromagnetic wave is perpendicular to the plane of horizon, this electromagnetic wave is called vertically polarized wave; if the electric field vector of the electromagnetic wave is parallel to the plane of horizon, this electromagnetic wave is called horizontal polarized wave; if the tip of the electric field vector, at a fixed point in space, describes a circle, this electromagnetic wave is called circularly polarized wave.
policy	A set of rules that are applied when the conditions for triggering an event are met.
pseudo random binary sequence (PRBS)	A sequence that is random in the sense that the value of each element is independent of the values of any of the other elements, similar to a real random sequence.

Q

QPSK	See **quadrature phase shift keying.**
QoS	See **quality of service.**

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quadrature phase shift keying (QPSK)	A modulation method of data transmission through the conversion or modulation and the phase determination of the reference signals (carrier). It is also called the fourth period or 4-phase PSK or 4-PSK. QPSK uses four dots in the star diagram. The four dots are evenly distributed on a circle. On these phases, each QPSK character can perform two-bit coding and display the codes in Gray code on graph with the minimum BER.
quality of service (QoS)	A commonly-used performance indicator of a telecommunication system or channel. Depending on the specific system and service, it may relate to jitter, delay, packet loss ratio, bit error ratio, and signal-to-noise ratio. It functions to measure the quality of the transmission system and the effectiveness of the services, as well as the capability of a service provider to meet the demands of users.

R

RADIUS	See **Remote Authentication Dial In User Service.**
RADIUS authentication	An authentication mode in which the BRAS sends the user name and the password to the RADIUS server by using the RADIUS protocol. The RADIUS server authenticates the user, and then returns the result to the BRAS.
RDI	remote defect indication
RED	See **random early detection.**
RF	See **radio frequency.**
RFC	See **Request For Comments.**
RMON	remote network monitoring
RNC	See **radio network controller.**
RSL	See **received signal level.**
RSSI	See **received signal strength indicator.**
RTN	radio transmission node
Remote Authentication Dial In User Service (RADIUS)	A security service that authenticates and authorizes dial-up users and is a centralized access control mechanism. RADIUS uses the User Datagram Protocol (UDP) as its transmission protocol to ensure real-time quality. RADIUS also supports the retransmission and multi-server mechanisms to ensure good reliability.
Request For Comments (RFC)	A document in which a standard, a protocol, or other information pertaining to the operation of the Internet is published. The RFC is actually issued, under the control of the IAB, after discussion and serves as the standard. RFCs can be obtained from sources such as InterNIC.
radio frequency (RF)	A type of electric current in the wireless network using AC antennas to create an electromagnetic field. It is the abbreviation of high-frequency AC electromagnetic wave. The AC with the frequency lower than 1 kHz is called low-frequency current. The AC with frequency higher than 10 kHz is called high-frequency current. RF can be classified into such high-frequency current.
radio network controller (RNC)	A device in a radio network subsystem that is in charge of controlling the usage and integrity of radio resources.

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random early detection (RED)	A packet loss algorithm used in congestion avoidance. It discards the packet according to the specified higher limit and lower limit of a queue so that global TCP synchronization resulting from traditional tail drop can be prevented.
received signal level (RSL)	The signal level at a receiver input terminal.
received signal strength indicator (RSSI)	The received wide band power, including thermal noise and noise generated in the receiver, within the bandwidth defined by the receiver pulse shaping filter, for TDD within a specified timeslot. The reference point for the measurement shall be the antenna
receiver sensitivity	The minimum acceptable value of mean received power at point Rn (a reference point at an input to a receiver optical connector) to achieve a 1x10-12 BER when the FEC is enabled.
route	The path that network traffic takes from its source to its destination. Routes can change dynamically.
routing table	A mapping table that stores the relationship between the original address, destination address, SMS protocol type, and account. The SMSC delivers an SMS message to the designated account according to the information in the routing table.

S

SD	See **signal degrade.**
SF	See **signal fail.**
SFP	small form-factor pluggable
SNMP	See **Simple Network Management Protocol.**
SNR	See **signal-to-noise ratio.**
SPF	shortest path first
SSL	See **Secure Sockets Layer.**
SSM	See **Synchronization Status Message.**
Secure Sockets Layer (SSL)	A security protocol that works at a socket level. This layer exists between the TCP layer and the application layer to encrypt/decode data and authenticate concerned entities.
Simple Network Management Protocol (SNMP)	A network management protocol of TCP/IP. It enables remote users to view and modify the management information of a network element. This protocol ensures the transmission of management information between any two points. The polling mechanism is adopted to provide basic function sets. According to SNMP, agents, which can be hardware as well as software, can monitor the activities of various devices on the network and report these activities to the network console workstation. Control information about each device is maintained by a management information block.
Synchronization Status Message (SSM)	A message that carries the quality levels of timing signals on a synchronous timing link. SSM messages provide upstream clock information to nodes on an SDH network or synchronization network.
service flow	An MAC-layer-based unidirectional transmission service. It is used to transmit data packets, and is characterized by a set of QoS parameters, such as latency, jitter, and throughput.

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shaping	A process of delaying packets within a traffic stream to cause it to conform to specific defined traffic profile.
signal degrade (SD)	A signal indicating that associated data has degraded in the sense that a degraded defect condition is active.
signal fail (SF)	A signal indicating that associated data has failed in the sense that a near-end defect condition (non-degrade defect) is active.
signal-to-noise ratio (SNR)	The ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time. SNR is expressed as 10 times the logarithm of the power ratio and is usually expressed in dB.
single-polarized antenna	An antenna intended to radiate or receive radio waves with only one specified polarization.
subnet mask	The technique used by the IP protocol to determine which network segment packets are destined for. The subnet mask is a binary pattern that is stored in the device and is matched with the IP address.

T

TCP/IP	Transmission Control Protocol/Internet Protocol
TD-SCDMA	See **Time Division-Synchronous Code Division Multiple Access.**
Time Division-Synchronous Code Division Multiple Access (TD-SCDMA)	A 3G mobile communications standard found in UMTS mobile telecommunications networks in China as an alternative to W-CDMA. TD-SCDMA integrates technologies of CDMA, TDMA, and FDMA, and makes use of technologies including intelligent antenna, joint detection, low chip rate (LCR), and adaptive power control. With the flexibility of service processing, a TD-SCDMA network can connect to other networks through the RNC.
tail drop	A congestion management mechanism, in which packets arrive later are discarded when the queue is full. This policy of discarding packets may result in network-wide synchronization due to the TCP slow startup mechanism.
tolerance	Permissible degree of variation from a pre-set standard.
traffic classification	A function that enables you to classify traffic into different classes with different priorities according to some criteria. Each class of traffic has a specified QoS in the entire network. In this way, different traffic packets can be treated differently.
traffic shaping	A way of controlling the network traffic from a computer to optimize or guarantee the performance and minimize the delay. It actively adjusts the output speed of traffic in the scenario that the traffic matches network resources provided by the lower layer devices, avoiding packet loss and congestion.

U

UAS	unavailable second
UAT	See **unavailable time event.**
UDP	See **User Datagram Protocol.**
UNI	See **user-to-network interface.**

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User Datagram Protocol (UDP)	A TCP/IP standard protocol that allows an application program on one device to send a datagram to an application program on another. UDP uses IP to deliver datagrams. UDP provides application programs with the unreliable connectionless packet delivery service. That is, UDP messages may be lost, duplicated, delayed, or delivered out of order. The destination device does not actively confirm whether the correct data packet is received.
unavailable time event (UAT)	An event that is reported when the monitored object generates 10 consecutive severely errored seconds.
unicast	The process of sending data from a source to a single recipient.
user-to-network interface (UNI)	The interface between user equipment and private or public network equipment (for example, ATM switches).

V

VB	virtual bridge
VLAN	virtual local area network
VM	virtual memory

W

WEEE	waste electrical and electronic equipment
WRED	See **weighted random early detection.**
WRR	weighted round robin
WTR	See **wait to restore.**
Web LCT	The local maintenance terminal of a transport network, which is located at the NE management layer of the transport network.
wait to restore (WTR)	The number of minutes to wait before services are switched back to the working line.
weighted random early detection (WRED)	A packet loss algorithm used for congestion avoidance. It can prevent the global TCP synchronization caused by traditional tail-drop. WRED is favorable for the high-priority packet when calculating the packet loss ratio.
window	General method for speech preprocessing, like Haming window.

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