

OptiX RTN 380 Radio Transmission System V100R009C10

Product Description

Issue 01
Date 2018-10-30



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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	V100R009C10
iManager U2000–T	V200R018C60

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

Symbol	Description
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 NOTICE	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.
 NOTE	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 .
<i>Italic</i>	Book titles are in <i>italics</i> .
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.

Updates in Issue 01 (2018-10-30) Based on Product Version V100R009C10

This issue is the first release for the product version V100R009C10.

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1 Product Introduction

About This Chapter

OptiX RTN 380 (RTN 380 for short) is a full-outdoor E-band microwave transmission equipment.

[1.1 Network Positioning](#)

The RTN 380 can provide large-capacity backhaul microwave links or aggregation links on a mobile communications network or a private network, or substitute for 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.

[1.2 Specifications](#)

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

[1.3 Site Configurations](#)

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

1.1 Network Positioning

The RTN 380 can provide large-capacity backhaul microwave links or aggregation links on a mobile communications network or a private network, or substitute for 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 RTN 380 has the following characteristics:

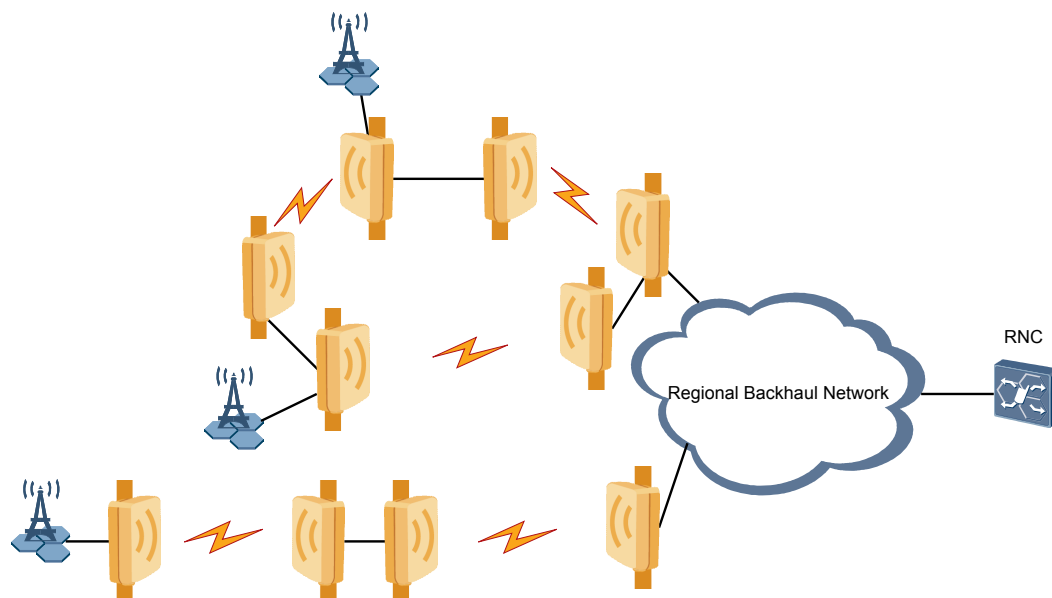
- The RTN 380 operates at 71-76 GHz or 81-86 GHz frequency bands. It features large capacity, low inter-site interference, and rich frequency spectrum resources, as compared with radio equipment that operates at 6-42 GHz frequency bands. Therefore, RTN 380s can form a backhaul network for base stations densely deployed in a city and provide large-capacity backhaul links for aggregation sites. In addition, the 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 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, RTN 380s are mainly used to:

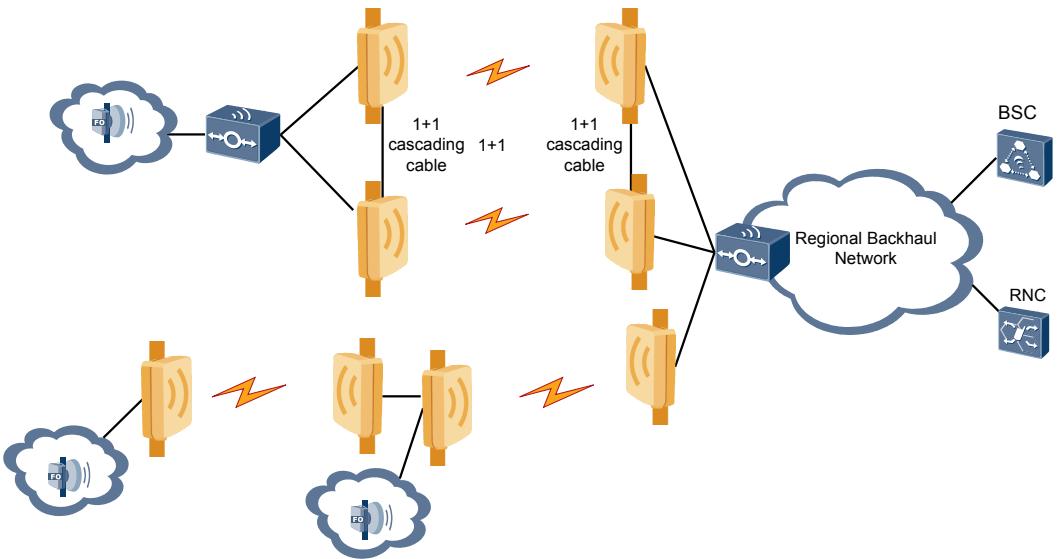
- Support protection such as PLA and 1+1 HSB. Provide large-capacity backhaul microwave links for 3G/LTE base stations especially those that are densely deployed in urban areas. See [Figure 1-1](#).
- Provide large-capacity aggregation links for 3G/LTE base stations and implement multi-direction aggregation 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](#).
- Work with the CSG to provide a microwave channel solution for transparent transmission on the IP RAN. See [Figure 1-4](#).
- Work with OptiX RTN 900 to implement the Super Dual Band solution through EPLA. This solution provides high-bandwidth, long-distance, and high-availability backhaul links. Super Dual Band Relay extends the E-band link transmission distance to three times the transmission distance of a single-hop E-band link. See [Figure 1-5](#).

Figure 1-1 Independently providing large-capacity backhaul links



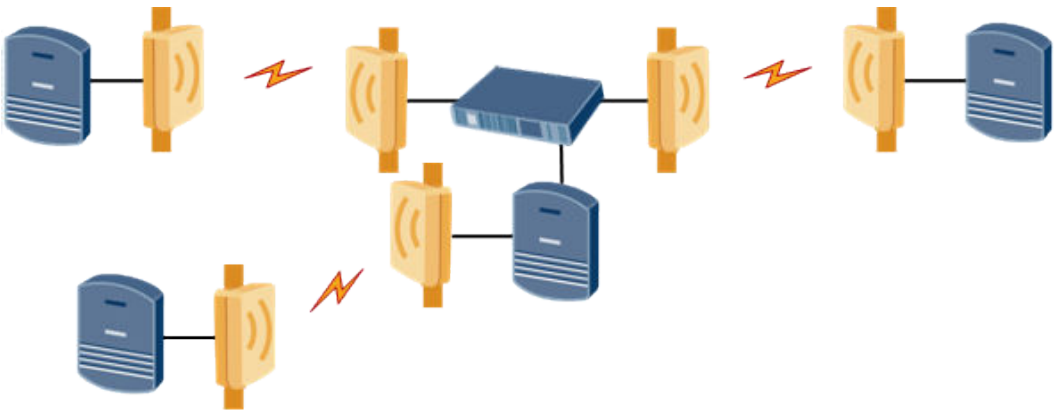
	RTN 380
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Figure 1-2 Providing aggregation backhaul links



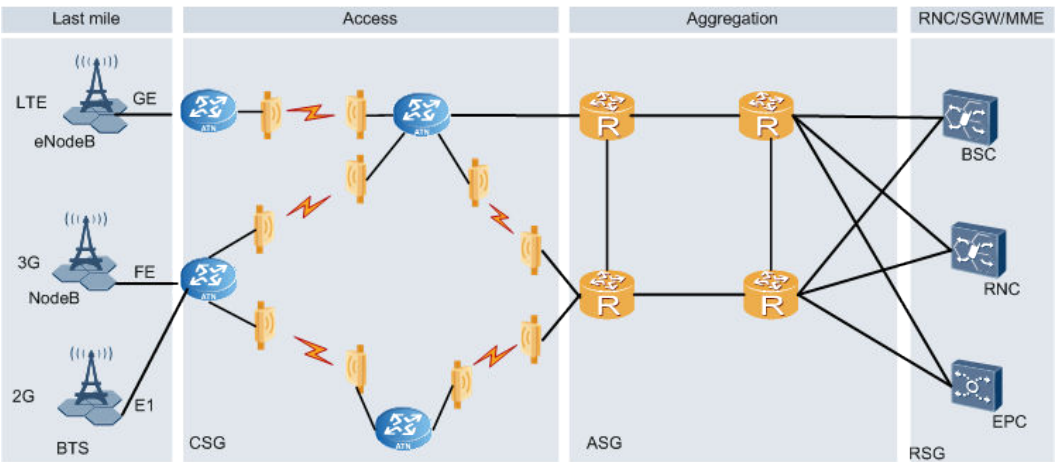
	RTN 380
	RTN 900 IDU
	Radio chains and/or radio sub-rings

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



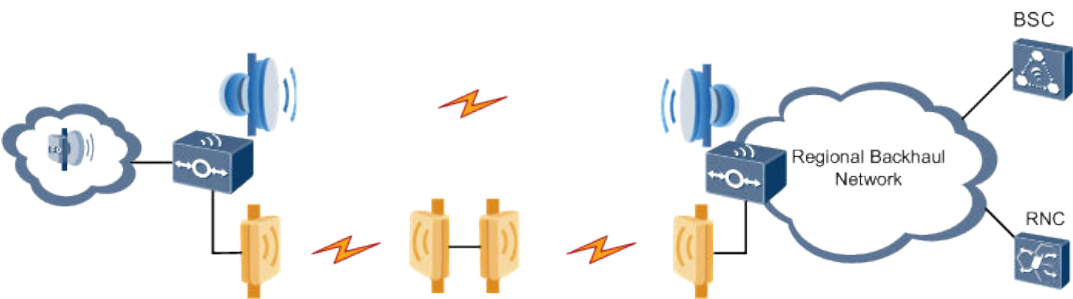
	RTN 380
	BBU
	RRU

Figure 1-4 RTN 380 working with the CSG



	RTN 380
	CSG

Figure 1-5 Super Dual Band solution



	RTN 380
	RTN 900 IDU
	ODU
	Radio chains and/or radio sub-rings

1.2 Specifications

RTN 380 specifications meet the high bandwidth requirements in E-Band microwave transmission. 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 and over PWE3 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 In the co-channel dual polarization (CCDP) configuration, RTN 380 supports the highest modulation 16QAM. 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.

Item	Specifications
Capacity	● Maximum air capacity: 3.2 Gbit/s ● Maximum air-interface service throughput: 4 Gbit/s ● Maximum switching capacity: 8 Gbit/s
RF configuration modes	● 1+0 mode ● 2+0 mode ● 1+1 HSB mode ● CCDP mode ● Multi-directional 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 HSB mode.
Channel configuration modes	● Adjacent channel alternate polarization (ACAP) ● Adjacent channel co-polarized (ACCP) ● Co-channel dual polarization (CCDP)
AMAC	Supported
ATPC	Supported
Super Dual Band	Supported
PLA	Supported
Service ports	● When Ethernet services are transmitted, 2 x FE/GE SFP ports and 2 x GE fixed electrical ports are supported, one of the electrical ports supporting Power over Ethernet. ● When CPRI services are transmitted, 1 x CPRI port is supported.
Service types	● Ethernet services – Native Ethernet services: E-Line service and E-LAN service – PW-carried Ethernet services: E-Line service, E-Aggr service, and E-LAN (VPLS) service (VPLS standing for virtual private LAN service) ● CPRI services
QoS/HQoS	Supported
MPLS Tunnel	Supported

Item	Specifications
PWE3	Supported
Clock features	- Supported clock sources: Microwave link clock and Synchronous Ethernet clock - IEEE 1588v2 time synchronization - ITU-T G.8275.1 time synchronization
Power supply modes	Power over Ethernet, which supports power supply through the AC PI, DC PI or other specified power supply equipment
Dimensions (H x W x D)/Weight	265 mm x 265 mm x 65 mm / 3.8 kg
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 0.3 m - Wide-beam antenna: available in diameters of 0.3 m x 0.077 m

Figure 1-6 Appearance of RTN 380



Figure 1-7 Ports



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

1.3 Site Configurations

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

1.3.1 1+0 Site Configuration

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

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

An RTN 380 is directly mounted on an antenna.

Figure 1-8 Typical 1+0 site configuration for transmitting Ethernet services

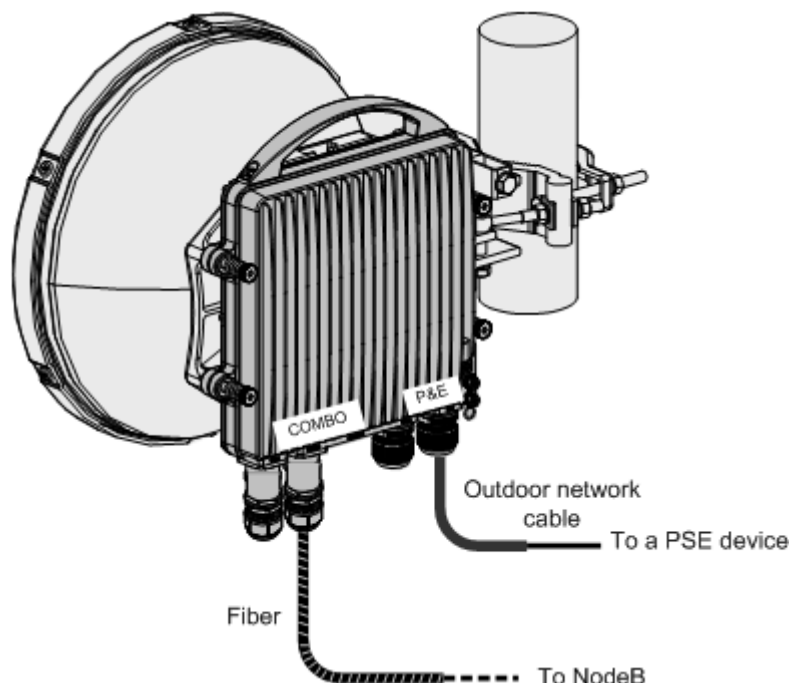
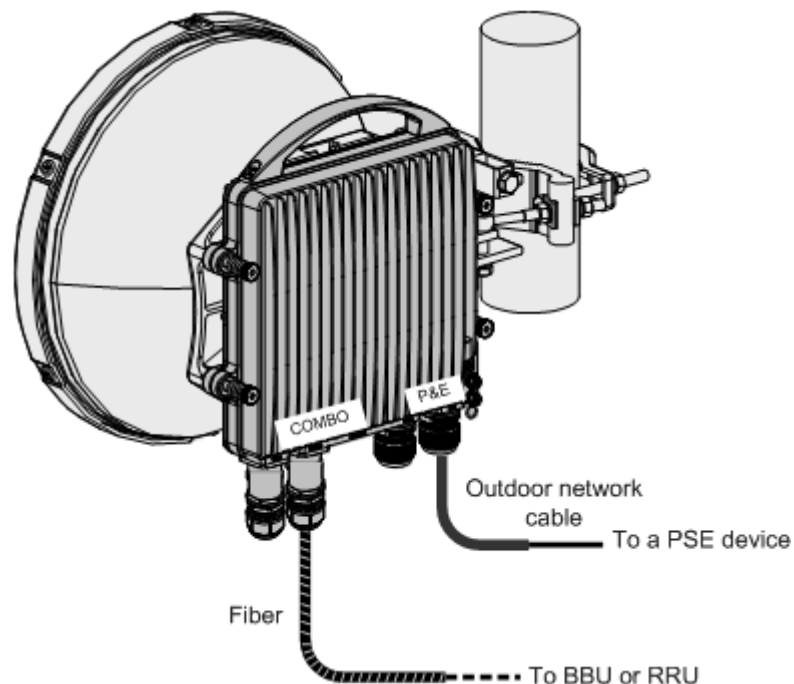


Figure 1-9 Typical 1+0 site configuration for transmitting CPRI services



1.3.2 2+0 Site Configuration

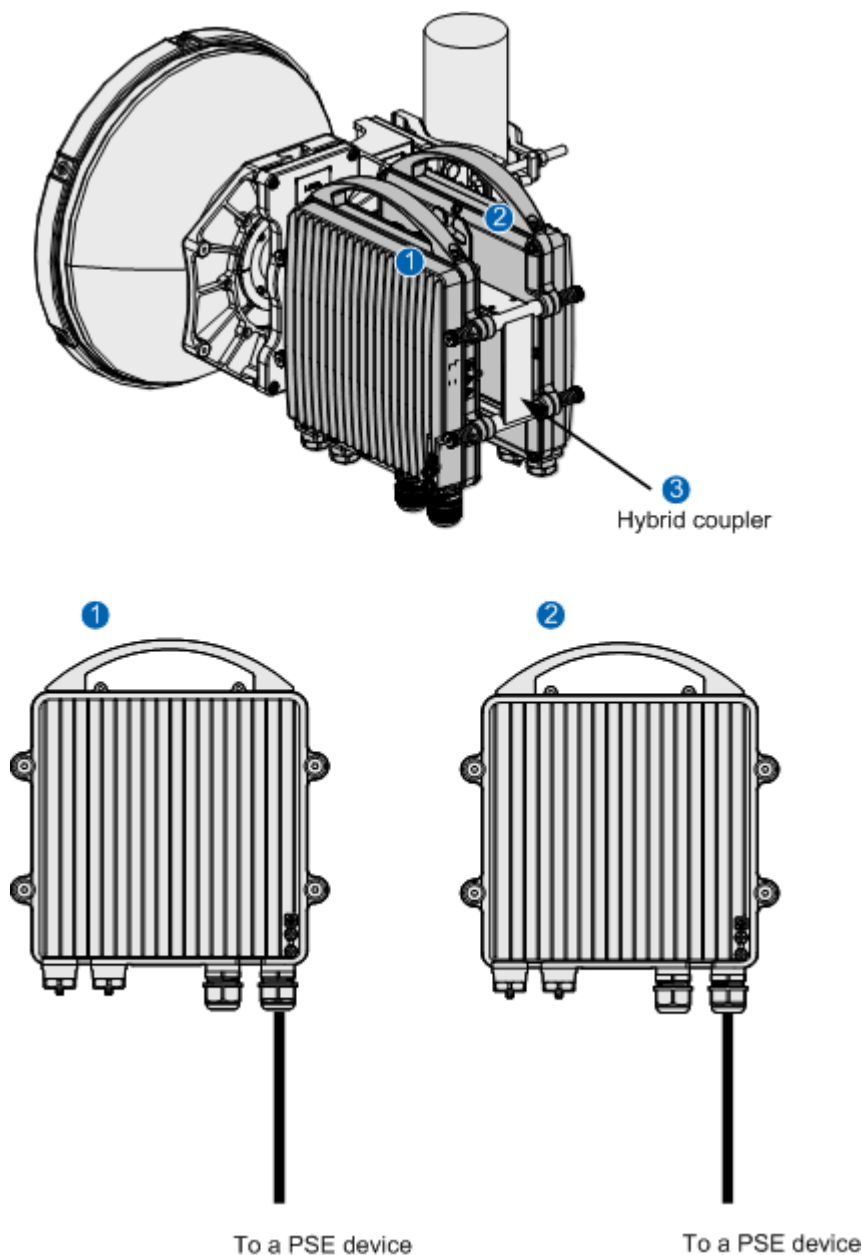
A 2+0 site provides two one-direction unprotected microwave links in the same RF direction.

At a 2+0 site, two RTN 380s are installed on a hybrid coupler, and the hybrid coupler is directly mounted on an antenna. Generally, the two RTN 380s are cascaded using gigabit Ethernet (GE) ports for physical link aggregation (PLA) configuration.

NOTE

At a 2+0 site, the hybrid coupler must be a balanced hybrid coupler.

Figure 1-10 Typical 2+0 site configuration for transmitting Ethernet services



NOTE

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

1.3.3 1+1 Site Configuration

A 1+1 site provides a microwave link protection system that comprises of one working microwave link and one protection microwave link in the same RF direction. The RTN 380 supports only 1+1 hot standby (HSB) protection configuration.

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

NOTE

At a 1+1 site, the hybrid coupler must be an unbalanced hybrid coupler.

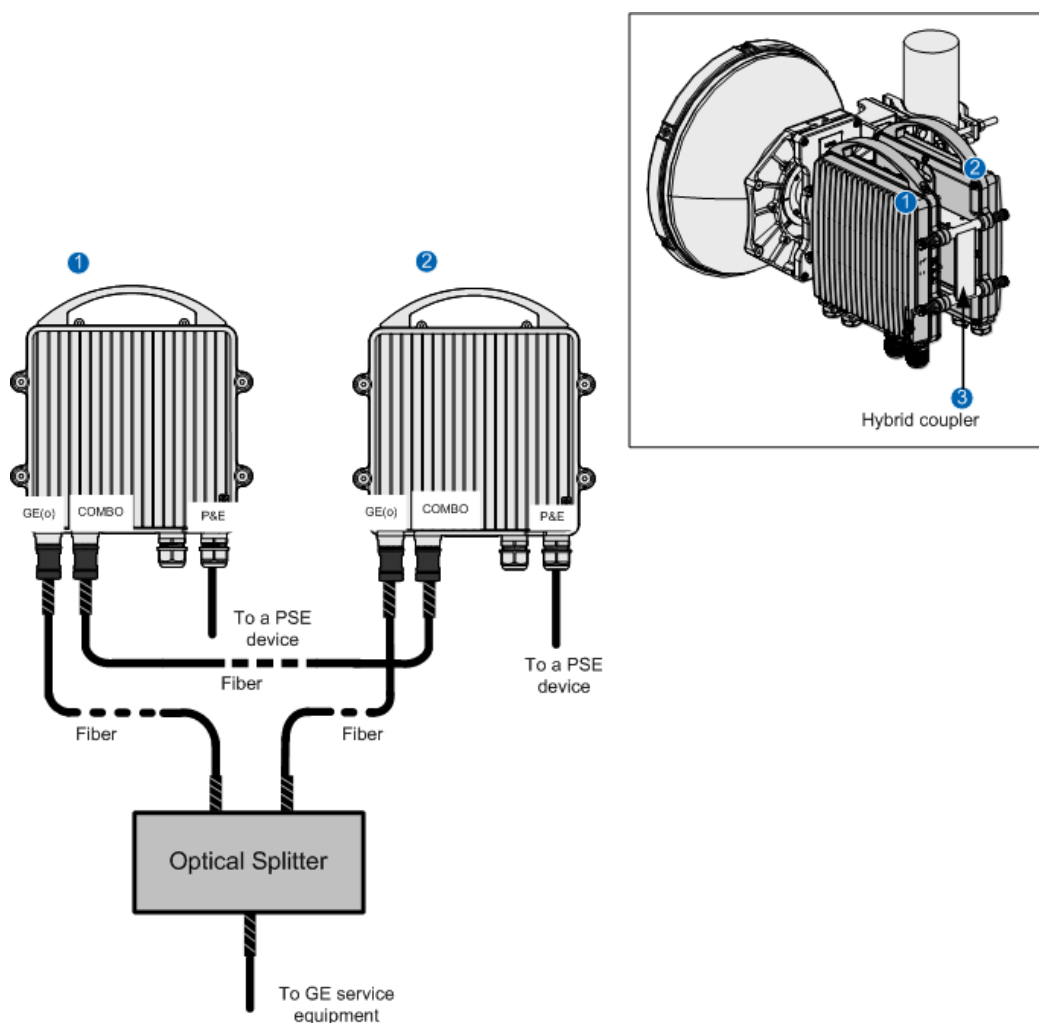
Two typical 1+1 site configurations are available:

- 1+1 site configuration using an optical splitter
- 1+1 site configuration using a LAG

1+1 Site Configuration Using an Optical Splitter

At a 1+1 site, an optical splitter can be used to split received GE optical signals into two channels, and transmit one channel to the working RTN 380 and the other channel to the protection RTN 380. The working and protection RTN 380s exchange 1+1 protection protocol packets over a 1+1 cascade cable. See [Figure 1-11](#).

Figure 1-11 Typical 1+1 site configuration using an optical splitter (only RTN 380s)

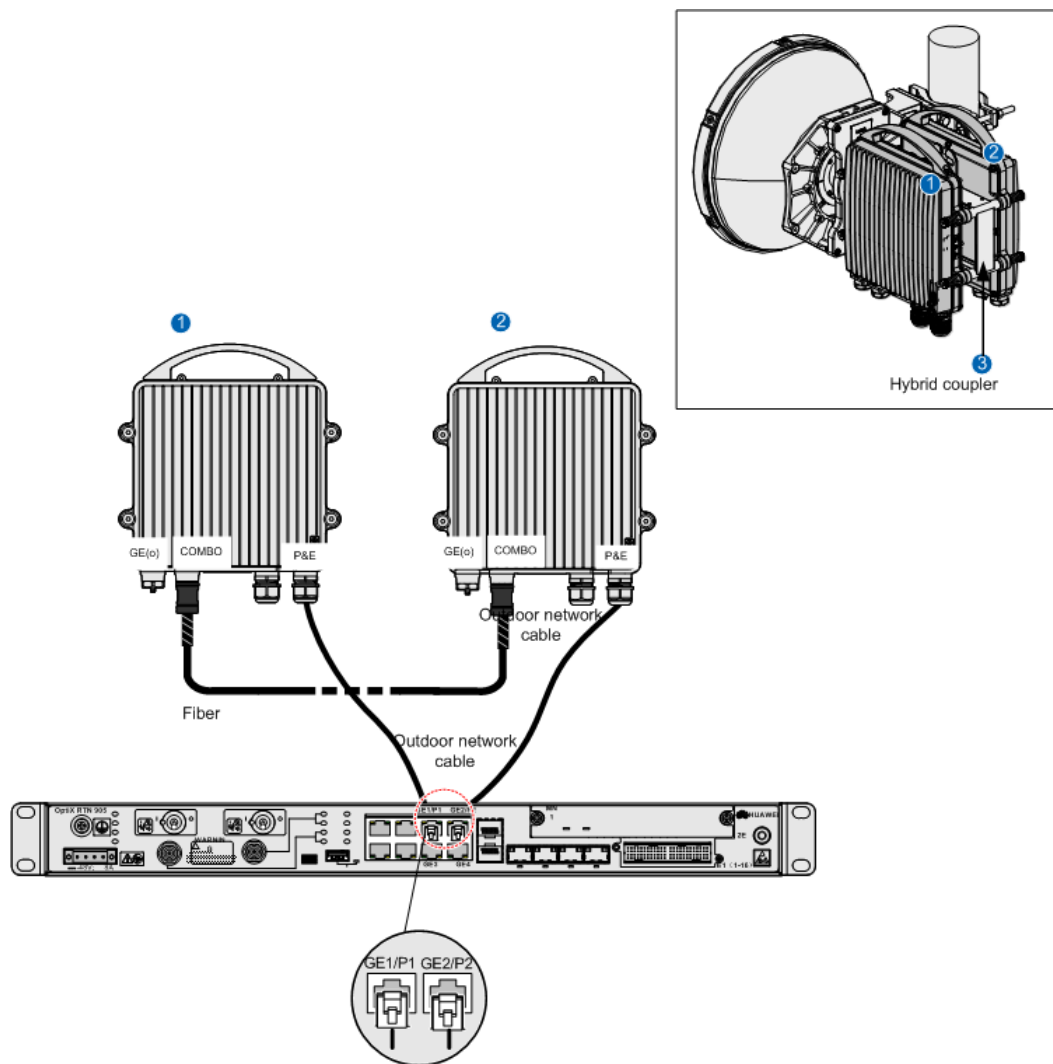


1+1 Site Configuration Using a LAG

Two RTN 380s can work with an RTN 900 or an LACP-supporting UNI-side device to implement 1+1 protection. The two RTN 380s exchange 1+1 protection protocol packets over

a 1+1 cascade cable. When working with an OptiX RTN 900 IDU, the RTN 380s can connect to the power-over-Ethernet ports of an RTN 900 IDU with outdoor network cables, which carry both power signals and Ethernet service signals. See [Figure 1-12](#).

Figure 1-12 Typical 1+1 site configuration using a LAG (RTN 380s working with an RTN 900 IDU)



NOTE

In 1+1 site configuration, two RTN 380s are cascaded through any Ethernet port.

1.3.4 CCDP Site Configuration

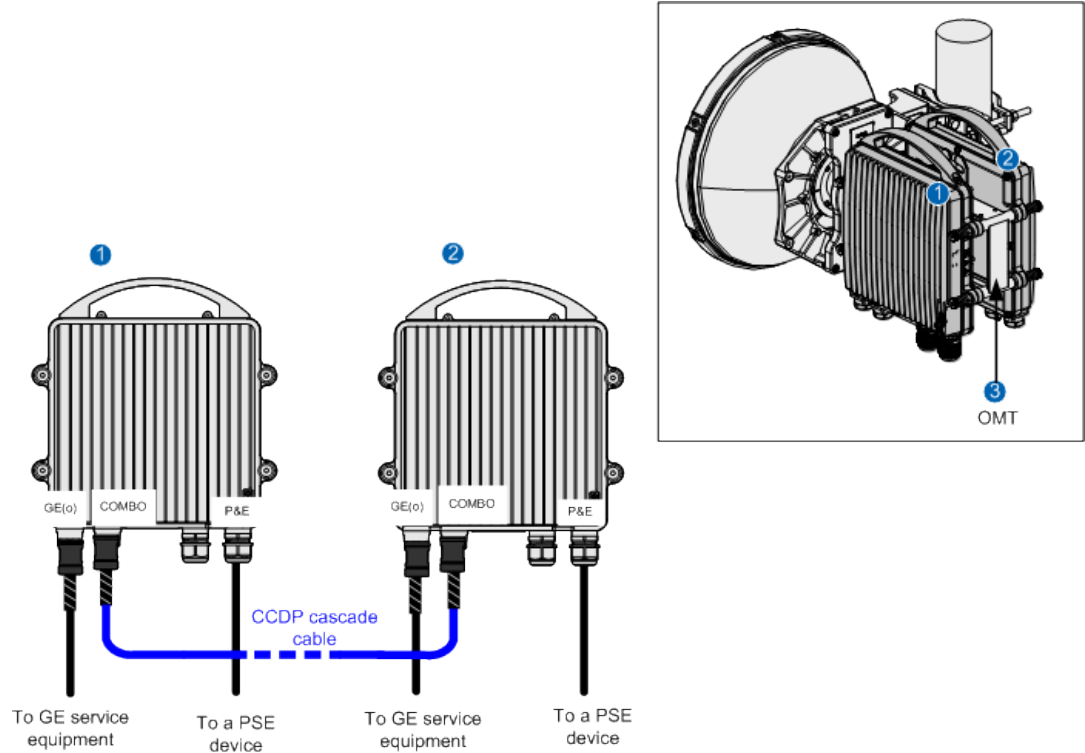
A co-channel dual polarization (CCDP) site configuration is a special 2+0 site configuration. A CCDP site configuration provides two microwave links operating at the same frequency in the vertical and horizontal directions.

To form a CCDP site configuration, two RTN 380s are mounted on an orthogonal mode transducer (OMT). The OMT can be directly mounted on an antenna. The two RTN 380s are cascaded through their COMBO ports or GE ports to transmit clock signals.

NOTE

Because the transmission distance of the RTN 380 is short, XPIC is not required to compensate the slight XPD deterioration.

Figure 1-13 Typical CCDP site configuration

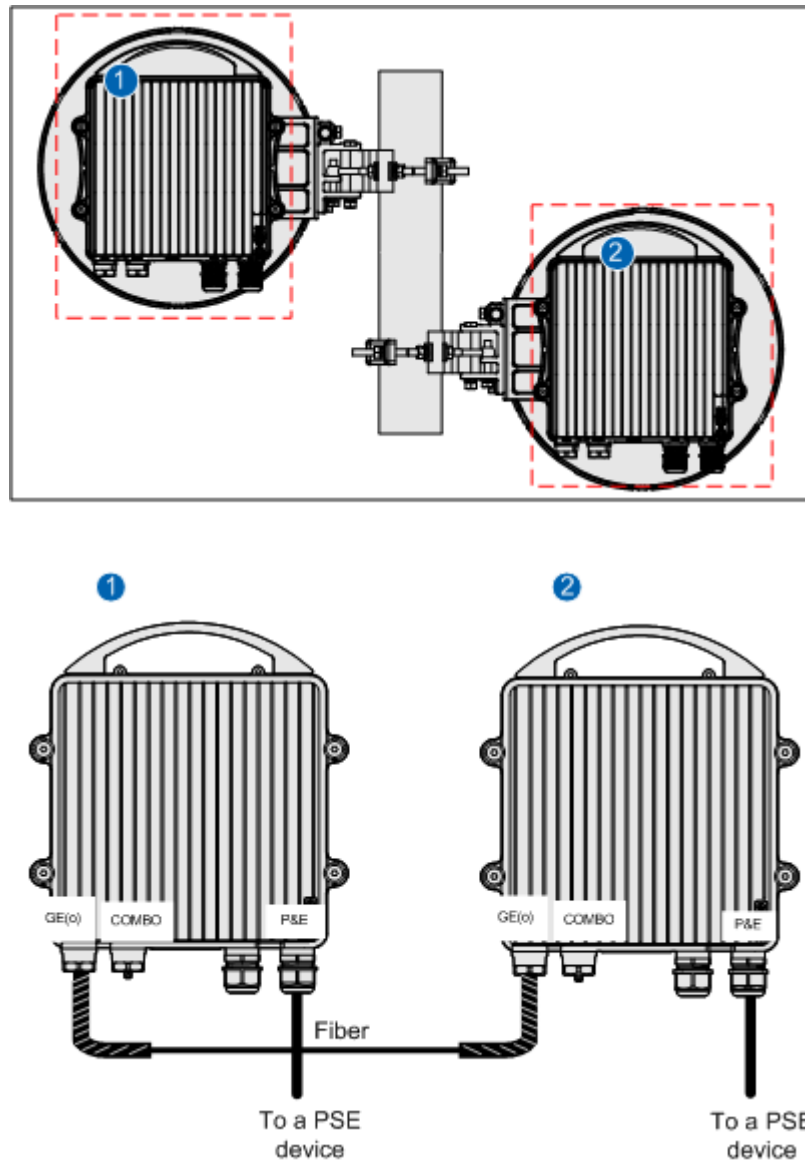


1.3.5 Multi-direction Site Configuration

A multi-direction site configuration provides microwave links in multiple RF directions.

To form a multi-direction site configuration, multiple RTN 380s are cascaded through their GE optical ports. Generally, two RTN 380s are cascaded to form a 2x(1+0) configuration, wherein the two RTN 380s are connected back-to-back. They independently perform Ethernet service switching and scheduling with their own built-in switching units.

Figure 1-14 2x(1+0) site configuration for transmitting Ethernet services

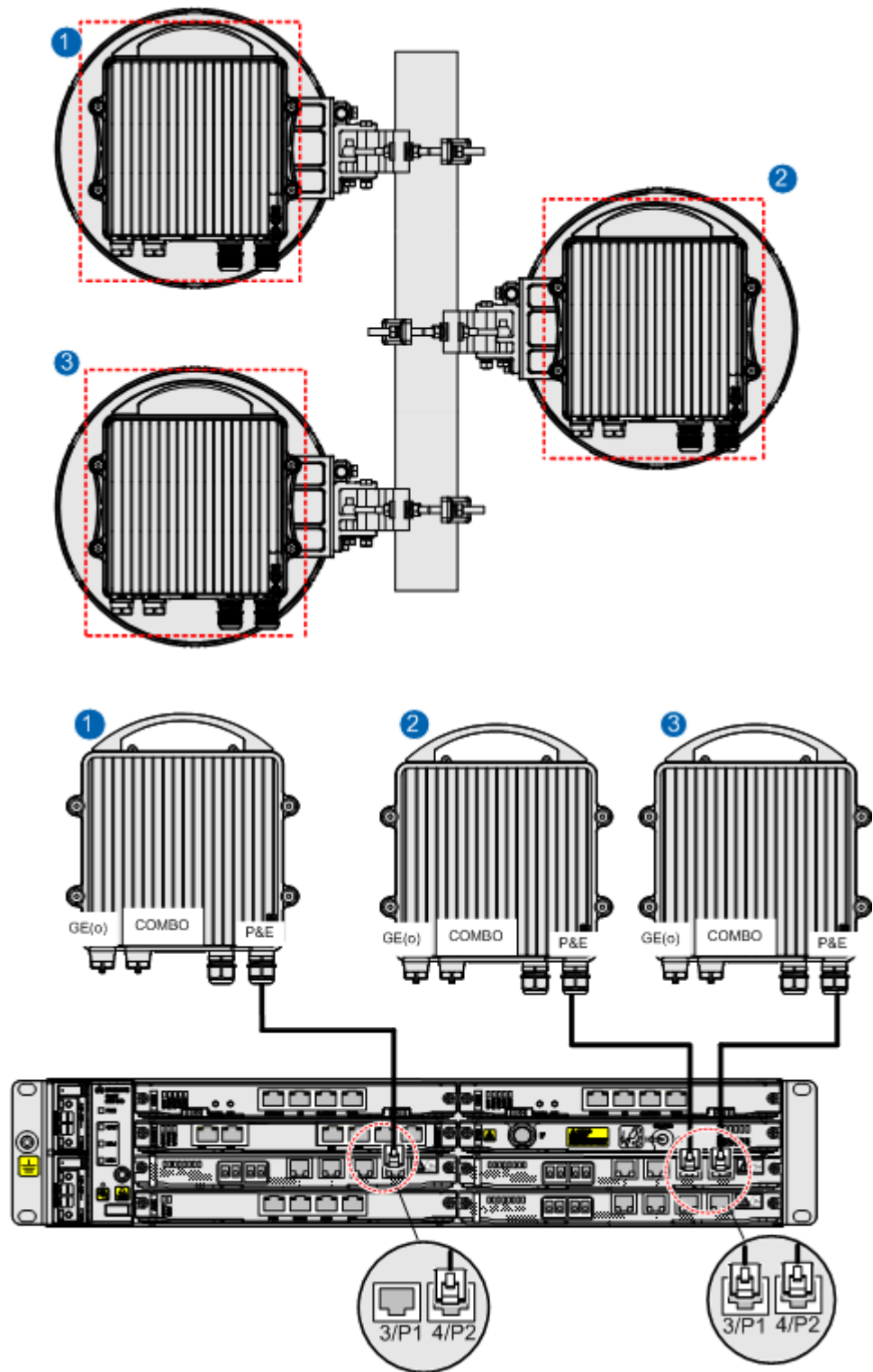


NOTE

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

Multiple RTN 380s work with an RTN 900 IDU to form a multi-direction configuration. An RTN 380 can connect to the Power-over-Ethernet port of an RTN 900 IDU using an outdoor network cable, which carries both power signals and Ethernet service signals.

Figure 1-15 Typical multi-direction site configuration (RTN 380s working with an RTN 900 IDU)



2 Functions and Features

About This Chapter

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

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.

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).

2.3 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).

2.4 Power over Ethernet

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

2.5 MPLS and PWE3 Functions

The RTN 380 supports Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3) functions, therefore to implement carrier-class transmission of packet services.

2.6 Ethernet Service Processing Capability

The RTN 380 can process native Ethernet services and PW-carried Ethernet services.

2.7 QoS

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

2.8 CPRI

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

2.9 Clock Features

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

2.10 Protection

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

2.11 Network Management

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

2.12 Rapid Deployment

Various technologies are used to simplify RTN 380 installation deployment.

2.13 Easy Maintenance

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

2.14 Security Management

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

2.15 Anti-Theft Function

Device authentication is the process wherein the U2000 checks and authenticates a device using a key to prevent any illegal device access.

2.16 Energy Saving

RTN 380 reduces the amount of energy consumed by using:

2.17 Environmental Protection

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.

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. Under all channel conditions, the service capacity varies according to the modulation scheme.

- When conditions for channel quality are favorable (for example, 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 (for example, 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.

With quality of service (QoS) technology, Ethernet 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. The services in different queues are transmitted to the microwave port after running the queue scheduling algorithm. When modulation scheme switching occurs, certain queues may be congested due to insufficient capacity at the air interface. As a result, certain services or all the services in these queues are discarded.

The AM technology used by the 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.
- When conditions for channel quality are unfavorable (for example, 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.

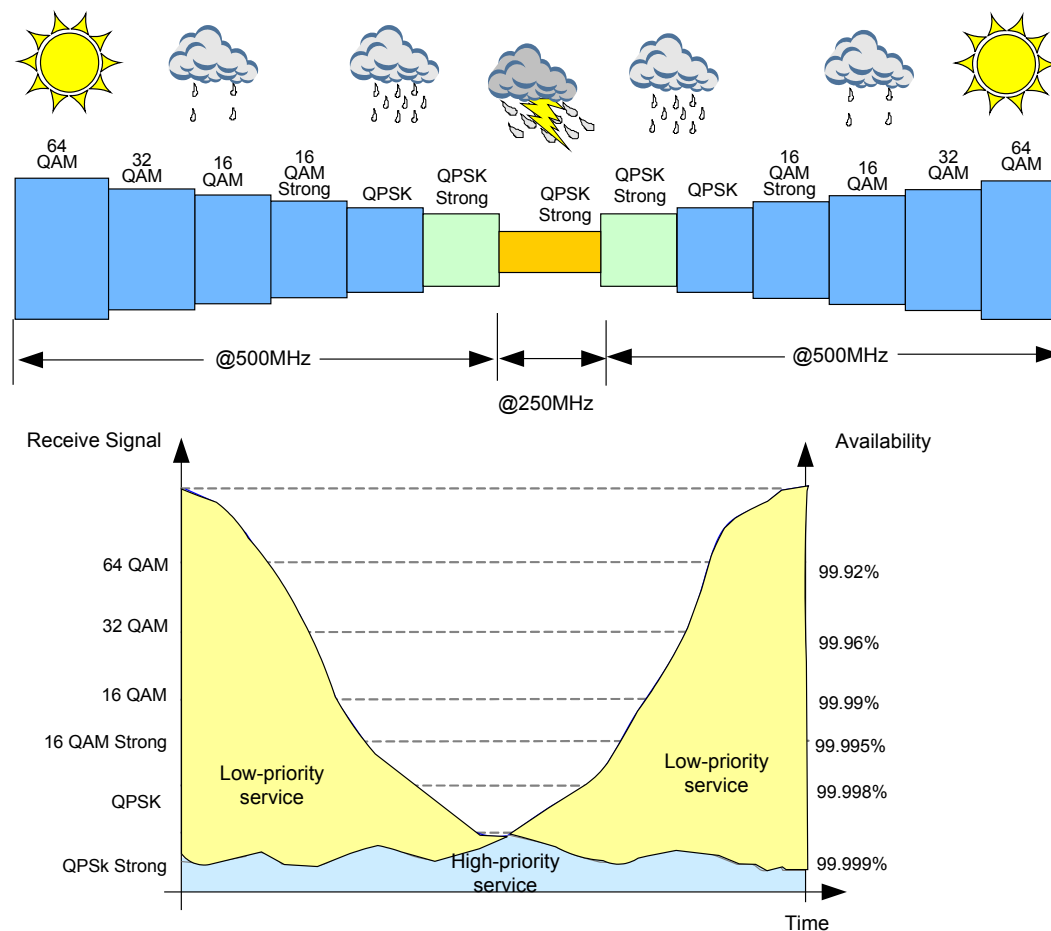
NOTE

RTN 380 supports only one-level AC downshifts from 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

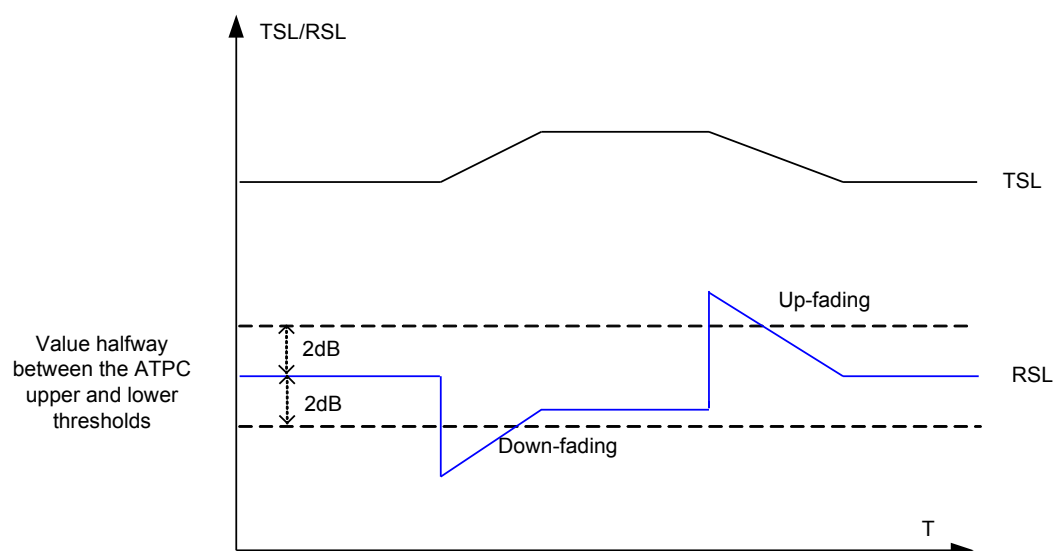


2.2 Automatic Transmit Power Control

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).

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



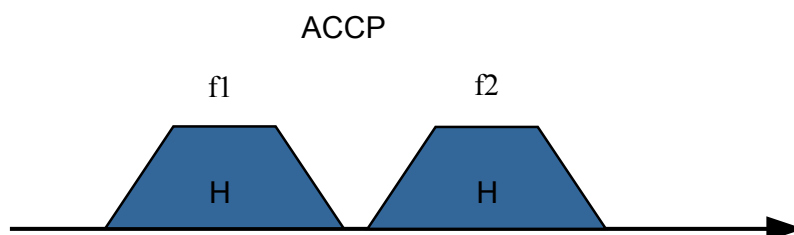
2.3 Channel Configuration

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 2-3](#).

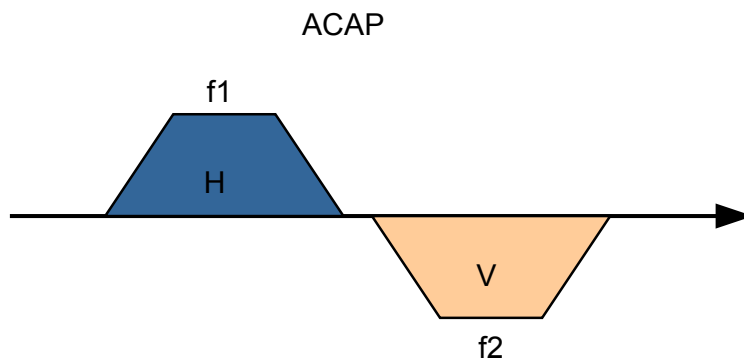
Figure 2-3 ACCP



ACAP

ACAP allows signals to be transmitted over the horizontally polarized electromagnetic wave and vertically polarized electromagnetic wave on two adjacent channels. See [Figure 2-4](#).

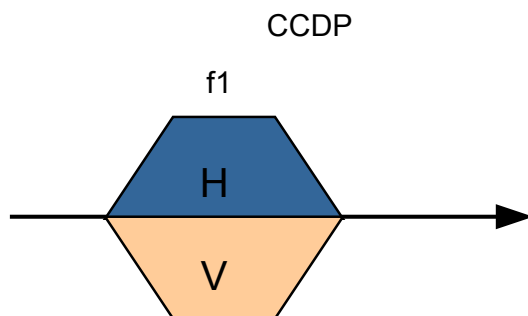
Figure 2-4 ACAP



CCDP

CCDP allows signals to be transmitted over the horizontally polarized electromagnetic wave and vertically polarized electromagnetic wave on the same channel. See [Figure 2-5](#).

Figure 2-5 CCDP



2.4 Power over Ethernet

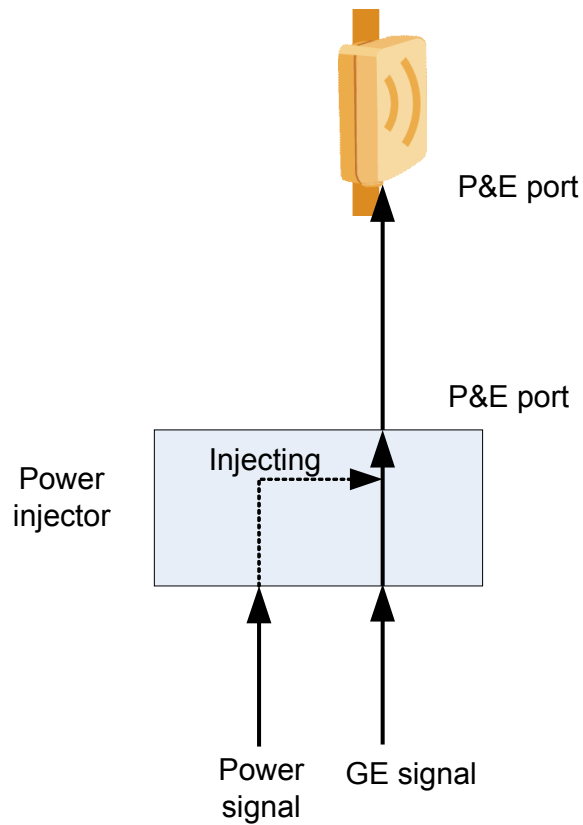
The RTN 380 provides a P&E port through which the RTN 380 supports power over Ethernet (P&E) as a powered device.

P&E Principles

In P&E mode, an outdoor network cable carries Ethernet service signals along with DC power signals. This eliminates the need for laying an extra power cable and therefore simplifies installation.

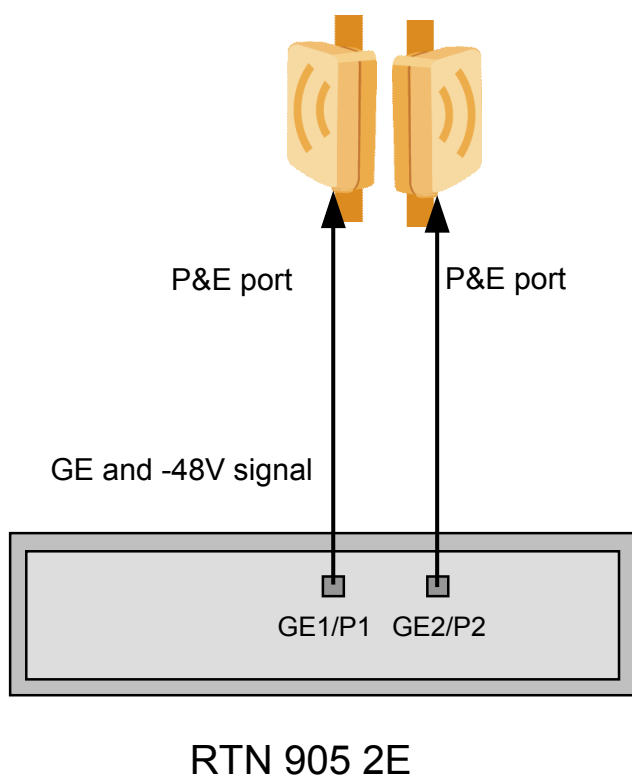
An RTN 380 can work with a power injector (PI) to implement P&E through its P&E port. See [Figure 2-6](#).

Figure 2-6 Working with a PI



An RTN 380 can also work with other power sourcing equipment, such as an RTN 900 IDU, to implement P&E through its P&E port. For example, when an OptiX RTN 905 2E IDU is used, it provides two P&E ports, as shown in [Figure 2-7](#).

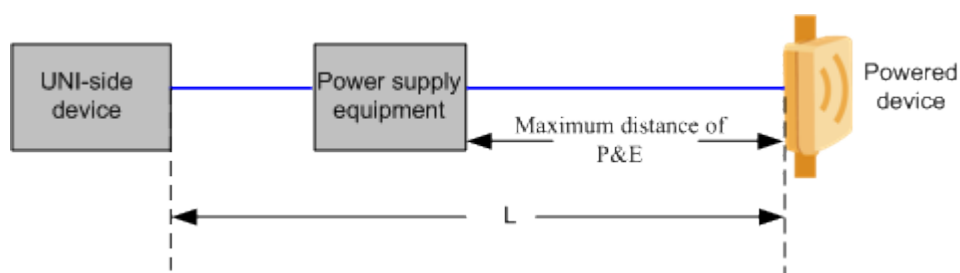
Figure 2-7 Working with an OptiX RTN 900



P&E Supply Distance

The P&E supply distance refers to the distance between the power sourcing equipment's P&E output port and a powered device. See [Figure 2-8](#).

Figure 2-8 P&E supply distance



Generally, the P&E supply distance depends on factors such as the powered device power consumption, power sourcing equipment type, and the supply mode (forceful or negotiable supply mode).

When an RTN power injector (PI) functions as the power sourcing equipment, it only couples the GE signals and power signals, without regenerating or enhancing these signals. Therefore, the length (L in [Figure 2-8](#)) of the network cable between the client-side device to the powered device must not extend 100 meters.

2.5 MPLS and PWE3 Functions

The RTN 380 supports Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3) functions, therefore to implement carrier-class transmission of packet services.

NOTE

The RTN 380 with SHUF3 boards do not support MPLS or PWE3 functions.

Table 2-1 MPLS and PWE3 functions

Function			Description
MPLS Tunnel	Setup mode		Static label switched paths (LSPs)
	Bearer mode		● Ethernet port ● Microwave port
	Protection scheme		1:1 MPLS tunnel APS
	OAM		● ITU-T Y.1710- and ITU-T Y.1711-compliant MPLS OAM ● ITU-T Y.1731-compliant MPLS-TP LSP OAM ● LSP ping and LSP traceroute
	Maximum number of tunnels		512
PWE3	ETH PWE3 services	Encapsulation mode	● Raw mode ● Tagged mode
		Service type	● E-Line ● E-Aggr ● E-LAN (VPLS)
	Setup mode		Static PWs
	Control word		Supported
	Maximum number of PWs		512
	Protection scheme		● 1:1 PW APS ● 1:1 PW FPS

Function		Description
	OAM	● ITU-T Y.1710- and ITU-T Y.1711-compliant PW OAM ● ITU-T Y.1731-compliant MPLS-TP PW OAM ● Virtual circuit connectivity verification (VCCV) ● PW ping and PW traceroute ● Intelligent service fault diagnosis
	MS-PW	Supported
	Configurable bandwidth	Supported

2.6 Ethernet Service Processing Capability

The RTN 380 can process native Ethernet services and PW-carried Ethernet services.

Table 2-2 Ethernet service processing capability

Item	Description
Service port	4xGE service ports ● 2xGE electrical ports, with one supporting power over Ethernet ● Two SFP ports, which support FE/GE/2.5GE SFP optical modules and FE/GE SFP electrical modules
Port attribute	● The GE electrical port supports 10M full-duplex, 100M full-duplex, 1000M full-duplex, and auto-negotiation modes. ● The GE optical port supports 1000M full-duplex and auto-negotiation modes. ● The FE optical port supports the 100M full-duplex mode.
Ethernet service type	● Native Ethernet services: E-Line service and E-LAN service ● PW-carried Ethernet services: E-Line service, E-Aggr service, and E-LAN (VPLS) service (VPLS standing for virtual private LAN service)
Range of maximum frame length	1518 bytes to 9600 bytes

Item	Description
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(Ethernet ports and microwave ports both support LLDP.)
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.8032v1/v2-compliant protection for Ethernet services on a single-ring or multi-ring network.
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/HQoS	Supported. For details, see 2.7 QoS .
Traffic control	Supports IEEE 802.3x-compliant traffic control.

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.
Microwave capacity reporting	This function is supported when RTN 380 is interconnected with ATN equipment. RTN 380 notifies ATN equipment of its air-interface capacity by sending ITU-T Y.1731 packets so that the ATN equipment can adjust traffic allocation on the entire network based on the air-interface capacity changes.
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

- E-Line services are Ethernet private line services. The RTN 380 supports a maximum of 512 E-Line services, including:
 - Port-, port+VLAN-, and port+QinQ-based native E-Line services
 - Port- and port+VLAN-based PW-carried E-Line services
- E-Aggr services are Ethernet aggregation services. The RTN 380 supports E-Aggr services from multiple UNIs to one PW or from multiple PWs to one UNI. The RTN 380 supports a maximum of 128 E-Aggr services.
- E-LAN services are Ethernet local area network (LAN) services.
 - IEEE 802.1d bridge-, IEEE 802.1q bridge-, and IEEE 802.1ad bridge-based native E-LAN services. The RTN 380 supports a maximum of eight E-LAN services.
 - PW-carried E-LAN services, that is, VPLSs based on virtual switch instances (VSIs). The RTN 380 supports a maximum of eight VSIs and 1024 logical ports.

 NOTE

The RTN 380 equipped with an SHUF3 board supports only one E-LAN services.

2.7 QoS

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

QoS provides different levels of service quality in certain aspects of services as required, such as bandwidth, delay, jitter, and packet loss ratio. This ensures that the request and response of a user or application reaches an expected quality level.

QoS Functions

Table 2-3 QoS functions

Function	Description
Simple traffic classification (DiffServ)	● Supports four DiffServ (DS) domains. ● 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.
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).
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 priority scheduling queues 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.

Function	Description
HQoS	● For QinQ NNIs, supports three levels of queue scheduling for QinQ priority queues, QinQ queues and egress ports, and supports three levels of rate limiting for QinQ queues, QinQ, and egress ports. ● For UNIs, supports four levels of queue scheduling for VUNI egress priority queues, V-UNI egress queues, V-UNI egress groups, and egress ports, and supports four levels of rate limiting for V-UNI egress queues, V-UNI egress, VUNI egress groups, and egress ports. ● For MPLS NNIs, supports three levels of queue scheduling for PWs, MPLS tunnels, and egress ports, and supports four levels of rate limiting for PW flow, PWs, MPLS tunnels, and egress ports.

Figure 2-9 Typical QoS application

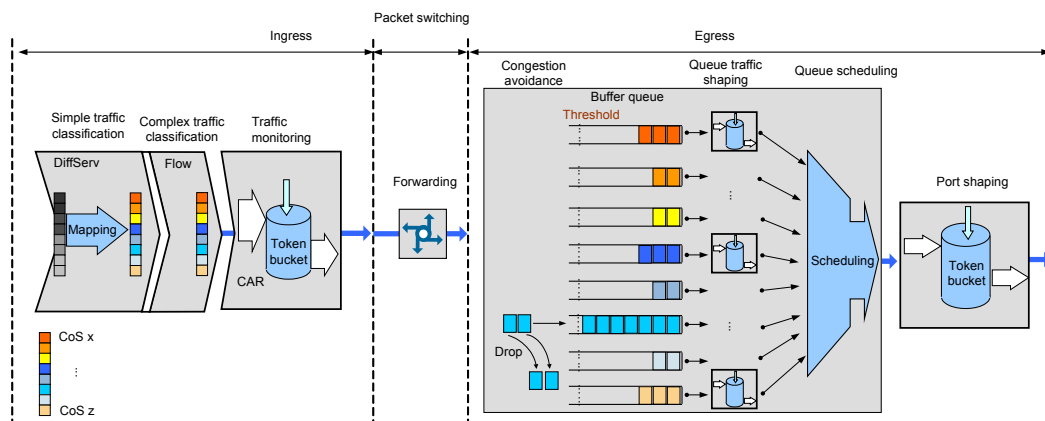
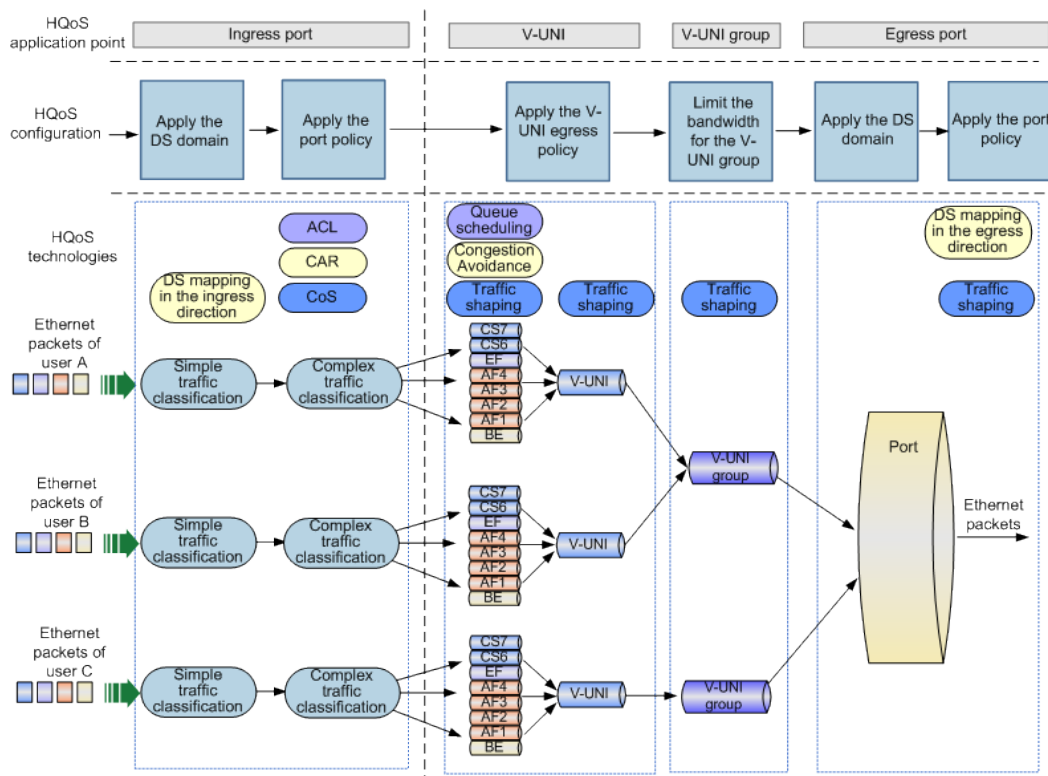


Figure 2-10 Typical HQoS application

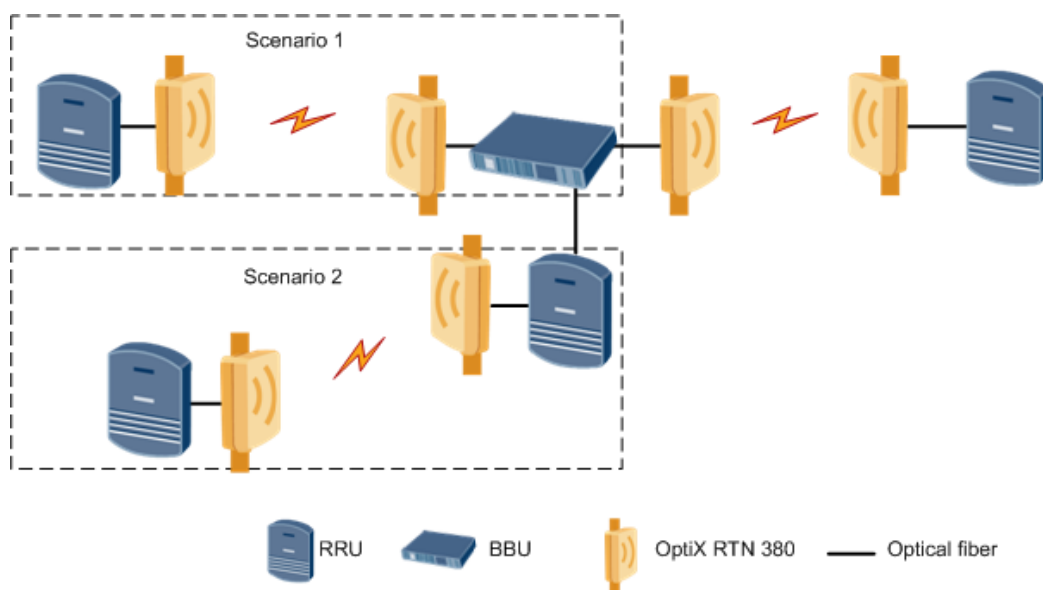


2.8 CPRI

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

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 2-11](#).

Figure 2-11 Replacement of optical fibers to transmit CPRI services between the BBU and remote RRUs



When 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.

2.9 Clock Features

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

Item	Description
IEEE 1588v2 time synchronization	Supports the following four modes: ● OC ● TC ● BC ● TC+BC
ITU-T G.8275.1	T-BC

2.10 Protection

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

Table 2-4 Protection schemes

Protected Object		Protection Scheme
Microwave link		● 1+1 hot standby (HSB), which provides NE-level protection ● Physical link aggregation (PLA), which provides microwave link-level protection and NE-level protection
Ethernet services		Link aggregation group (LAG) for Ethernet links and microwave links
Ethernet network		Ethernet ring protection switching (ERPS) for Ethernet links and microwave links
		MSTP protection for Ethernet links and microwave links
L2VPN	MPLS	MPLS tunnel 1:1 protection
	PW	PW 1:1 APS/FPS

2.11 Network Management

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

Network Management Modes

RTN 380 supports the following functions:

- Use the iManager U2000 Web LCT to manage one local NE or one remote NE on a per-NE basis.
- Use 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.
- Use the Simple Network Management Protocol (SNMP) to query and set multiple types of general information and service of NEs (That is, SNMP GET/SET are supported.)
- Use the web-based network management system to log in to and manage NEs. The PC can connect to an NE using network cables or through WLAN. On a browser (IE 9, Chrome, or Firefox), you can enter the IP address of an NE to open the NE management page. When a network cable is used to connect to an NE, you can also access and manage the corresponding remote NE.
- Monitor the running status of NEs in real time through the NCE-T and support microwave resource visualization and E2E service provisioning.

Network Management Information Exchange Solutions

Table 2-5 DCN information exchange schemes

Item		Specifications
DCC channel	Microwave port	Three Huawei-defined DCC bytes in microwave frames
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.
Network management system (NMS) port		One NMS port An Ethernet service electrical port can be configured as an NMS port.
Network management protocol	HWECC protocol	Supported
	IP protocol	Supported

Item		Specifications
	L2DCN protocol	Supported

2.12 Rapid Deployment

Various 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. Compact and light-weight, the device can be installed on a tower, achieving zero footprint installation.
- Supports power over Ethernet. RTN 380 can work with a power injector (PI), or other specified power sourcing equipment to receive service and power signals, facilitating deployment.
- Uses an alignment scope to facilitate antenna alignment, improving installation efficiency.
- 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 WLAN module.

2.13 Easy Maintenance

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

2.13.1 Contact-Free Maintenance

RTN 380 supports contact-free maintenance with its WLAN module.

NOTE

When SHUF3 boards are used, RTN 380 does not support the WLAN module.

The Web LCT can use WLAN to connect to a local RTN 380 with a WLAN module.

Figure 2-12 Contact-free maintenance

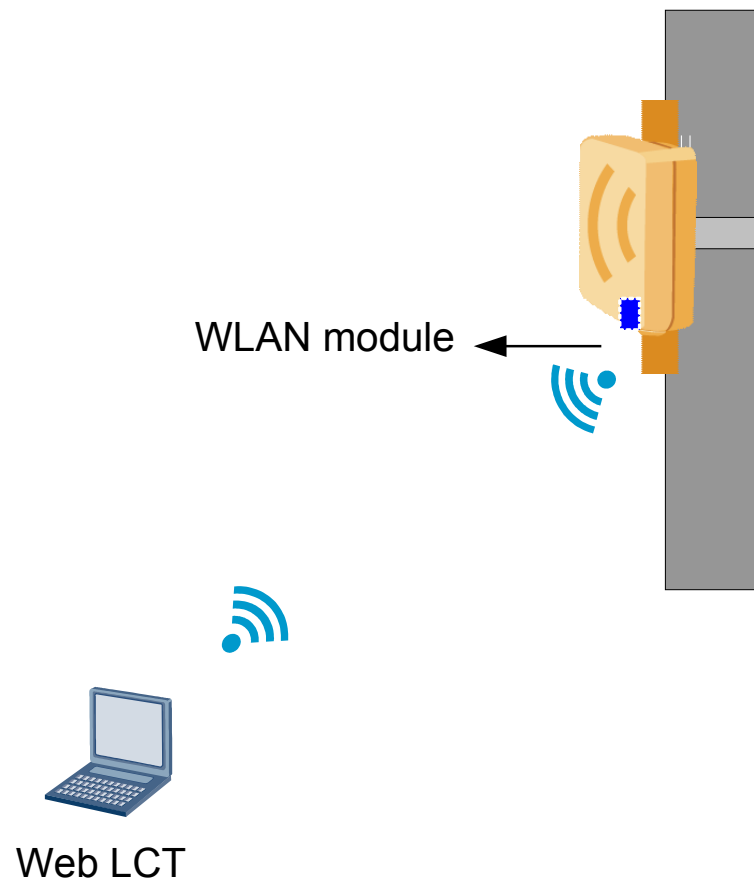
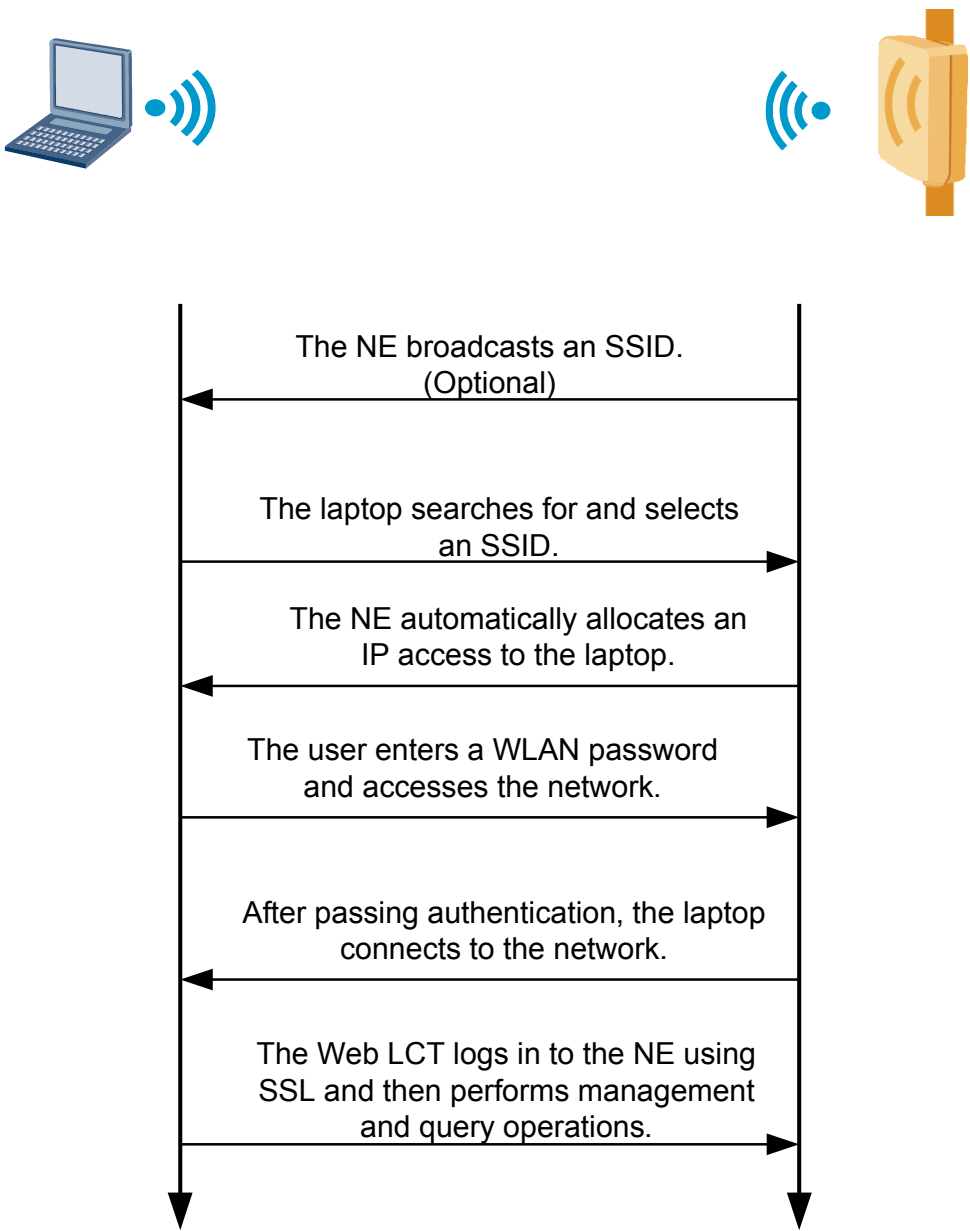


Figure 2-13 Access process through WLAN



After connecting to a local NE through WLAN, the 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.

2.13.2 Equipment-Level OAM

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

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

Table 2-6 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. ● Reports various 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. ● Allows users to observe and analyze Ethernet packets over a port through port mirroring. ● Captures headers of specified Ethernet packets. ● 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 Web LCT to the equipment using WLAN during equipment commissioning or maintenance. ● Supports query of site information on the U2000, such as the site type, power supply mode, and tower height, as well as exportation of such information.
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.

Function	Description
Packet service 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 ITU Y.1711-compliant MPLS OAM and LSP ping/traceroute. ● Supports ITU Y.1711-compliant PW OAM and PW ping/traceroute. ● Supports ITU Y.1731-compliant MPLS-TP LSP OAM and PW OAM. ● Supports IETF RFC 5357-compliant TWAMP Light. Supports serving as the reflector to respond to test packets from the initiator.
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.
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.

2.13.3 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 2-7 describes the packet OAM functions supported by RTN 380.

Table 2-7 Functions of the TP-Assist O&M system

OAM Stage	Subitem	Description
End-to-end service configuration	End-to-end packet service configuration	● Supports end-to-end configuration of Native E-Line/E-LAN services. ● Supports end-to-end configuration of MPLS tunnel and ETH PWE3.
	Automatic deployment of alarm management	● Automatically configures end-to-end ETH OAM during Native Ethernet service configuration and supports connectivity tests and alarm reporting ● Automatically configures end-to-end MPLS-TP OAM during MPLS tunnel service configuration and supports connectivity tests and alarm reporting. ● Automatically configures end-to-end ETH-OAM during ETH PWE3 service configuration and supports connectivity tests and alarm reporting.
Acceptance tests	Service connectivity tests	● Supports one-click connectivity test of Native E-Line and E-LAN services. ● Supports one-click connectivity test of the E-Line services carried by MPLS tunnels.

OAM Stage	Subitem	Description
	Service performance tests	● Supports one-click test on packet loss, delay, and delay variation of Native E-Line and E-LAN services. ● Supports one-click test on packet loss, delay, and delay variation of the E-Line services carried by MPLS tunnels. ● Simulates Ethernet meters to test packet loss, delay, and throughput. NOTE For a load-sharing LAG, an instrument-free throughput test measures only the single-link throughput, not the LAG-group throughput. ● Supports IP packet coloring and statistics collection.
Fault locating	Port IP ping	● Supports local ping at UNI ports. ● Supports remote ping at UNI ports.
	Port monitoring	● Reports alarms indicating Ethernet signal loss. ● Reports alarms indicating Ethernet port auto-negotiation failures (half-duplex alarm).
	Service loopback detecting	● Detects loopbacks in E-Line services. ● Automatically disables the service ports involved in a loop.

OAM Stage	Subitem	Description
	Intelligent fault diagnosis	● Checks the integrity of hardware, software, and configuration along a service path. ● Detects zero traffic and packet loss along a service path.
	Performance statistics	● Measures real-time and historical performance events for Ports, DS domains, flows, VLANs, UNI-side services, PWs, tunnel, and egress queues. ● Measures packet loss due to congestion for flows, PWs bandwidth, and egress queues.
	Performance monitoring	● Reports traffic threshold-crossing alarms by DS domain, VLAN, V-UNI, PW, and egress queue. ● Reports port bandwidth utilization threshold-crossing alarms. ● Reports packet loss threshold-crossing alarms for flows, PWs bandwidth, and egress queues. ● Reports zero-traffic alarms for ports, DS domains, flows, VLANs, UNI-side services, PWs, and egress queues.

2.14 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.
- 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 2-8 describes security functions provided by RTN 380.

Table 2-8 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.

Plane	Function	Description
	Operation log	Records non-query operations.
	Syslog management	Provides a standard solution to offline storage of logs, addressing insufficient storage space.
	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\1.1\1.2 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 a certificate file.

Plane	Function	Description
	WLAN connection control	● Supports access through a WLAN password and WLAN encryption. ● Supports the hiding of SSIDs. ● Supports the setting of WLAN access periods. ● Allows WLAN access control by a MAC address whitelist.
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.
	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.

2.15 Anti-Theft Function

Device authentication is the process wherein the U2000 checks and authenticates a device using a key to prevent any illegal device access.

A user can create its own public and private keys on the U2000, loads the public key to a device, and uses the private key for the NMS to authenticate the device. Once being loaded

with a public key, the device starts its anti-theft control function. The function stayed enabled until the NMS uses its private key to unlock the device.

Anti-Theft Mechanism

- When data communication network (DCN) is available, you can manage the device anti-theft function (that is, enable or disable the function) in an online manner by using the U2000.
- When DCN is unavailable, you can manage the device anti-theft function (for example, configure the warehouse-device anti-theft function) in an offline manner by using the web LCT.
- For the main devices, two anti-theft measures are available: disallowing any modification to the device configurations and restricting the air-interface bandwidth to 7 Mbit/s.
 - After being stolen, a main device can continue to function for 7 days (the duration can be specified to another value) and then its air-interface bandwidth will be restricted to 7 Mbit/s, with DCN communication still available.
 - After becoming unreachable to the U2000, a main device can continue to function for 7 days, and then its air-interface bandwidth will be restricted to 7 Mbit/s. Once its DCN communication recovers, its services automatically recover.

NOTE

- A device private key cannot be exported from the U2000, thereby ensuring the safety of the device anti-theft function.
- Before deploying the device anti-theft function, ensure that two sets of U2000 are deployed at two different places for mutual backup. If only one set of U2000 is deployed, all the devices will enter the "stolen" state once the U2000 fails, interrupting all the services on the network.

2.16 Energy Saving

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, 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.

2.17 Environmental Protection

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.

- 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.
- 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.

3 Product Structure

About This Chapter

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

3.1 System Architecture

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

3.2 Service Signal Processing Flow

This section describes how the function units of RTN 380 process one channel of P&E signals.

3.3 Ports

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

3.4 Indicators

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

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.

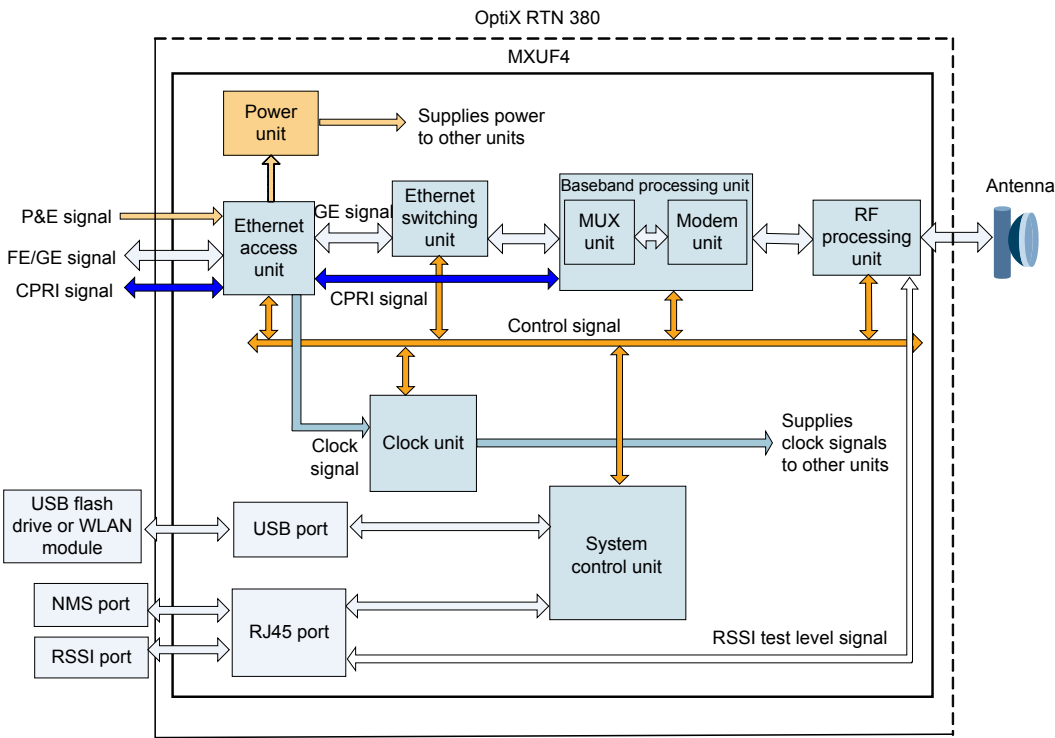
3.1 System Architecture

An OptiX RTN 380 has one logical 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



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.

Function Unit	Description
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.
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 WLAN 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	- Processes power over Ethernet 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 RTN 380 process one channel of P&E signals.

Figure 3-2 Signal processing flow

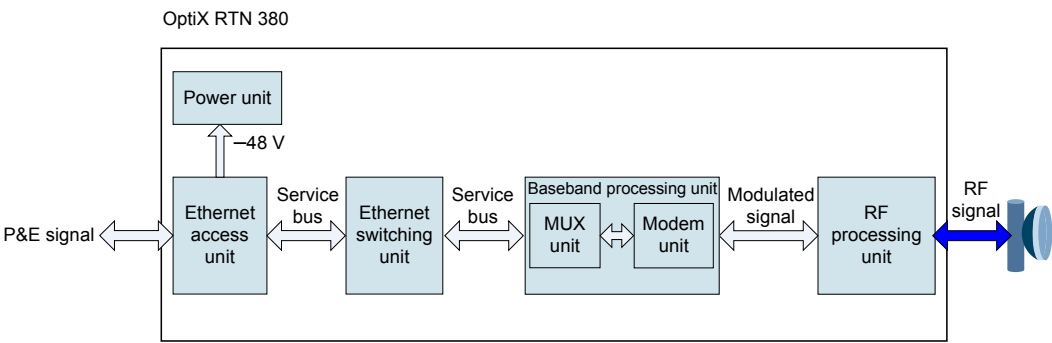


Table 3-1 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Ethernet access unit	● Receives/Transmits P&E signals. ● Splits the P&E 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.

Step	Function Unit	Processing Flow
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

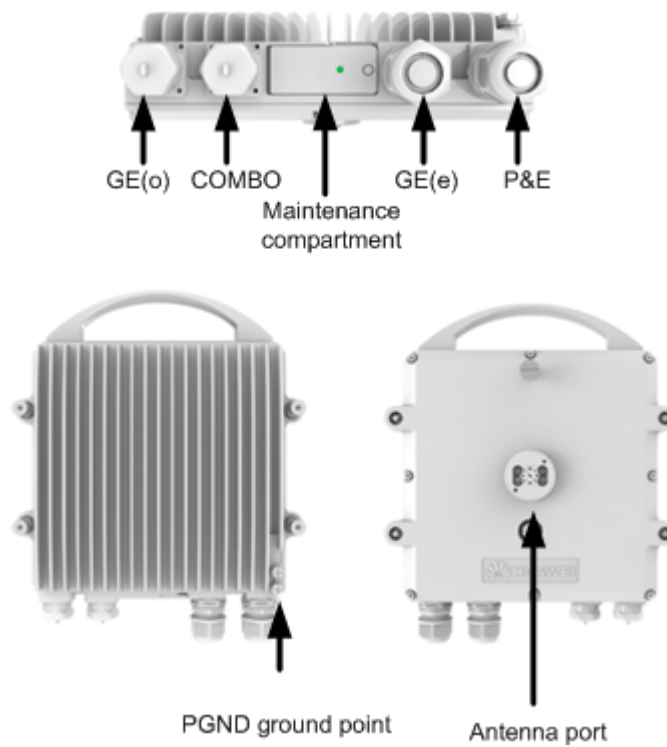
Step	Function Unit	Processing Flow
1	RF processing unit	● Isolates and filters RF signals. ● Performs down-conversion and power amplification. ● Transmits the modulated signals to the baseband processing unit.
2	Baseband processing unit	● Receives modulated signals from the RF processing unit. ● Performs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

Port Positions

Figure 3-3 Port positions



The maintenance compartment contains a USB port, RSSI port and an NMS port. See [Figure 3-4](#). When RTN 380 is running, the protective cover of the maintenance compartment must be closed.

Figure 3-4 Front view of the management ports

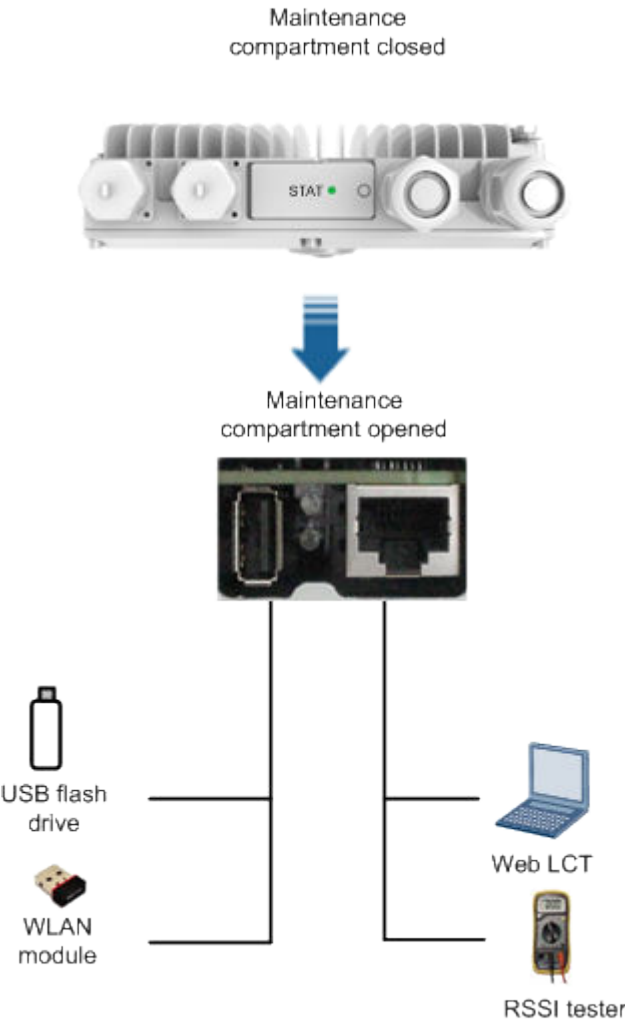


Table 3-3 Ports

No.	Physical Port	Logical Port	Description	Connector Type
1	GE(o)	1-MXUF4-4(GE(o))	GE/2.5 GE SFP port NOTE 2.5 GE optical ports are used in Super Dual Band solution. NOTE When GE electrical modules are used, waterproof sockets must be fitted. When the network cable length is greater than or equal to 2 m, lightning arresters must be provided for signals to protect devices.	SFP optical/ electrical module and SFP+ optical module
2	COMBO	1-MXUF4-3(COMB O)	Composite port that can function as any of the following ports through software setting: ● GE/2.5GE SFP port NOTE When GE electrical modules are used, waterproof sockets must be fitted. When the network cable length is greater than or equal to 2 m, lightning arresters must be provided for signals to protect devices. ● CPRI port NOTE When transmitting CPRI services, GE and P&E ports cannot receive/ transmit Ethernet services.	SFP module: ● GE service port: SFP optical/ electrical module and SFP + optical module ● CPRI port: See Table 3-5.
3	GE(e)	1-MXUF4-5(GE(e))	GE electrical port	RJ45 connector

No.	Physical Port	Logical Port	Description	Connector Type
4	P&E	1-MXUF4-2(P&E)	Power over Ethernet port, which can concurrently receive FE/GE electrical signals and power signals.	RJ45 connector
5	USB port	-	- You can insert a USB flash drive into the USB port to back up NE data, or update software. - You can also insert a WLAN module so that RTN 380 can connect to the Web LCT through a WLAN network.	USB connector
6	RSSI port	-	You can obtain the received signal level of RTN 380 by testing the voltage of the RSSI port using a multimeter.	RJ45 connector NOTE The RSSI port and NMS port share an RJ45 jack.
7	NMS port	-	The NMS port transmits network management signals.	
8	PGND ground point	-	-	M5 screw
9	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



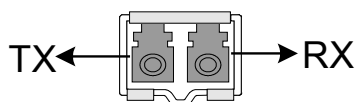
Unused ports must be capped.

GE(o) Port

A GE(o) port receives/transmits Ethernet services using an SFP/SFP+ module.

An SFP optical module provides one TX port and one RX port. For details, see [Figure 3-5](#), in which TX represents the transmit port and RX represents the receive port.

Figure 3-5 Ports of an SFP/SFP+ optical module



[Table 3-4](#) lists the types of SFP modules that the GE(o) port supports.

Table 3-4 SFP/SFP+ modules supported by the GE(o) 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
34060365	4.25 Gbit/s	850 nm, 0.3 km
34060517	6.144 Gbit/s	1310 nm, 2 km
34060528	6.144 Gbit/s	1310 nm, 10 km
34100099 NOTE The part number for waterproof sockets is 14990484, and the part number for lighting arresters is 19020323.	10/100/1000BASE-T(X)	-

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 port, it supports the same types of SFP 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

Part 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 power signals. It is connected to the PI or other specified power sourcing equipment.

GE(e) is a common Ethernet electrical port.

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

Figure 3-6 RJ45 connector front view

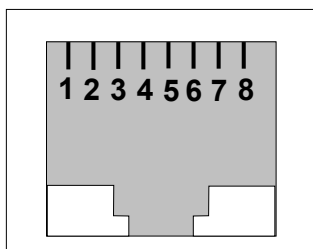


Table 3-6 Port pin assignments

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+/-48 V	Bidirectional data wire B (+)/ Power signal (-48 V)	BIDB+	Bidirectional data wire B (+)

Pin No.	P&E		GE(e)	
	Signal	Function	Signal	Function
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 (-)
6	BIDB-/48 V	Bidirectional data wire B (-)/ Power signal (-48 V)	BIDB-	Bidirectional data wire B (-)
7	BIDD+/48 V	Bidirectional data wire D (+)/ Power signal (-48 V)	BIDD+	Bidirectional data wire D (+)
8	BIDD-/48 V	Bidirectional data wire D (-)/ Power signal (-48 V)	BIDD-	Bidirectional data wire D (-)

USB Port

The USB port can either connect to a USB flash drive for upgrading software, or backing up data or to a WLAN module for enabling connection of the Web LCT to the equipment.

RSSI Port/NMS Port

[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 (-)
7	RSSI test level signal

Pin No.	Signal
8	Reserved

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.

Figure 3-7 Indicator positions

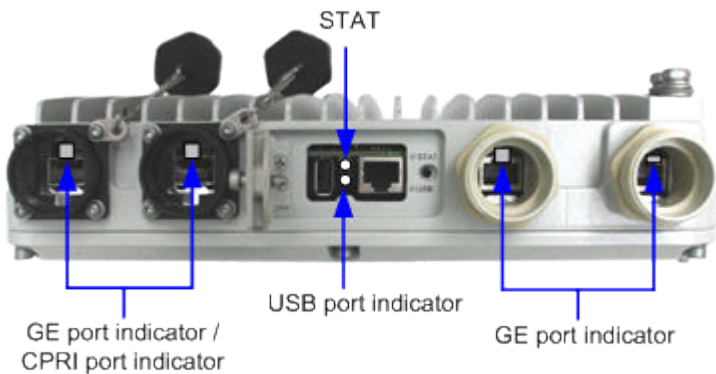


Table 3-8 Indicator status explanation

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

Indicator		Status	Meaning
		Steady red	The port is abnormal. The possible causes are as follows: ● The rate of the optical module is inconsistent with that of the NE. ● The optical power is abnormal.
		Blinking red	There are optical signals on the port. However, no service data is transmitted.
		Off	The port is not connected.
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	Blinking red	The equipment is working properly but services at the air interface are interrupted.

Indicator		Status	Meaning
		Steady green	● The microwave link is available. No expected receive power is set according to the network plan. ● The microwave link is available. The expected receive power is set according to the network plan. The difference between the actual receive power and the expected receive power is less than 3 dB.
		Blinks green	The microwave link is available. The difference between the actual receive power and the expected receive power is greater than 3 dB.
USB port indicator	WLAN module	Steady green	The WLAN module has been identified and is working properly.
		Steady red	The WLAN module is faulty.
		Blinks green	The WLAN link is normal.
		Off	● No WLAN module is connected to the USB port. ● The WLAN module connected to the USB port cannot be identified.

Indicator		Status	Meaning
	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.
		Blinking 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

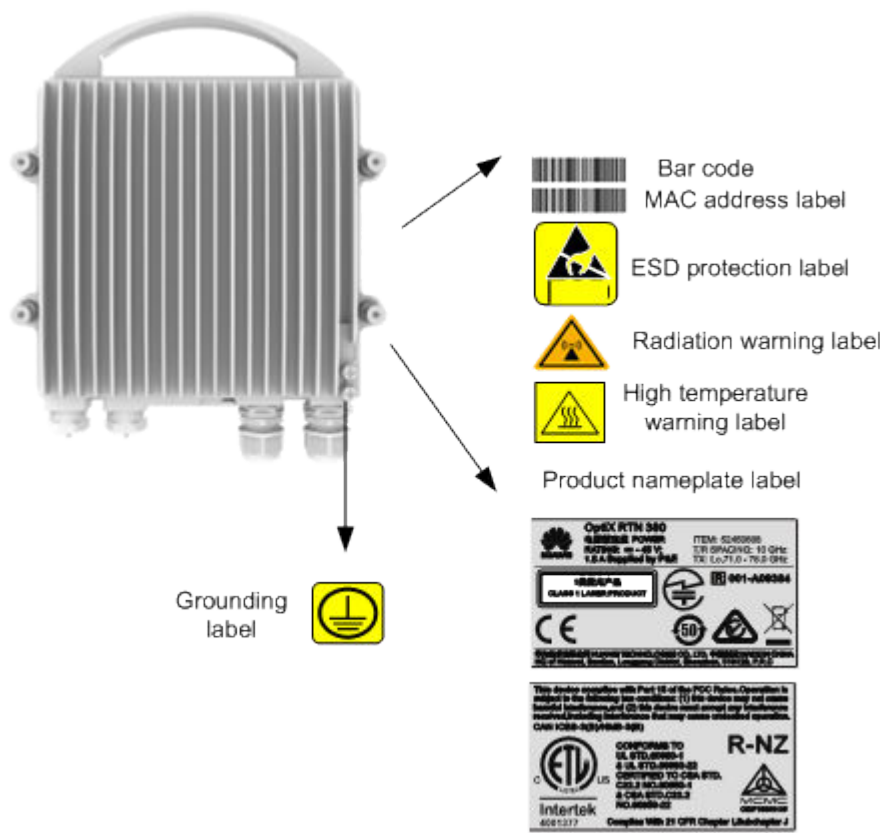
After you load data to an RTN 380 using a USB flash drive, the RTN 380 automatically resets. All the indicates are off during the reset. After the reset is complete, observe the system indicator to learn about the status of the RTN 380.

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.

Label Positions

Figure 3-8 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 3-9 Product nameplate label



Table 3-9 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

4 Networking and Applications

About This Chapter

RTN 380 supports various networks.

[4.1 Independent Networking](#)

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.

[4.2 Networking with the OptiX RTN 900](#)

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

[4.3 Networking with the ATN](#)

The RTN 380 can work with the ATN to implement the IP RAN-based mobile bearer solution that transmits services over microwave.

[4.4 Networking with LAN Switches](#)

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

[4.5 Supplementary Network for Optical Fibers](#)

Featuring high bandwidth and low interference between sites, 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.

4.1 Independent Networking

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.

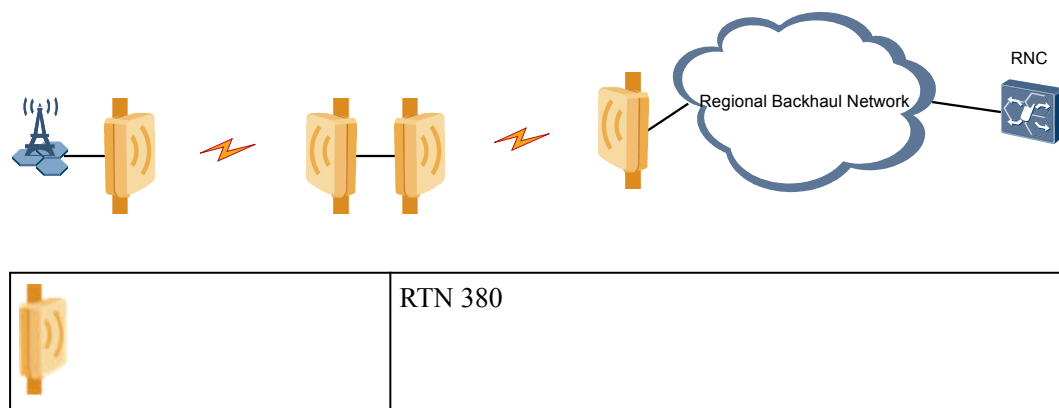
4.1.1 Chain Networks (Ethernet Services)

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. In this case, two RTN 380s must be installed at each site.
- Large-capacity microwave links use 2+0 configuration. In this case, two RTN 380s must be installed at each site. In 2+0 configuration mode, air interface LAG can be configured to provide Ethernet service protection.

Figure 4-1 Chain network solution



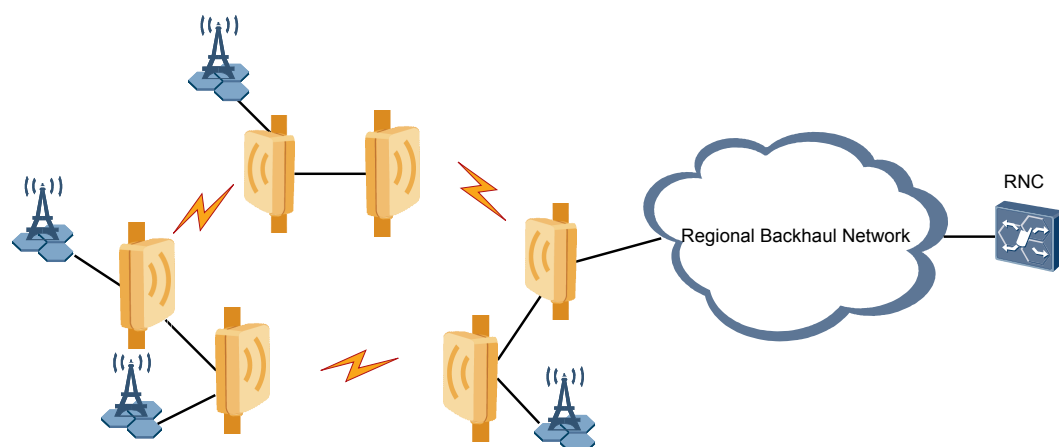
4.1.2 Ring Networks (Ethernet Services)

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 RTN 380s must be installed at one site.

Figure 4-2 Ring network solution



	RTN 380
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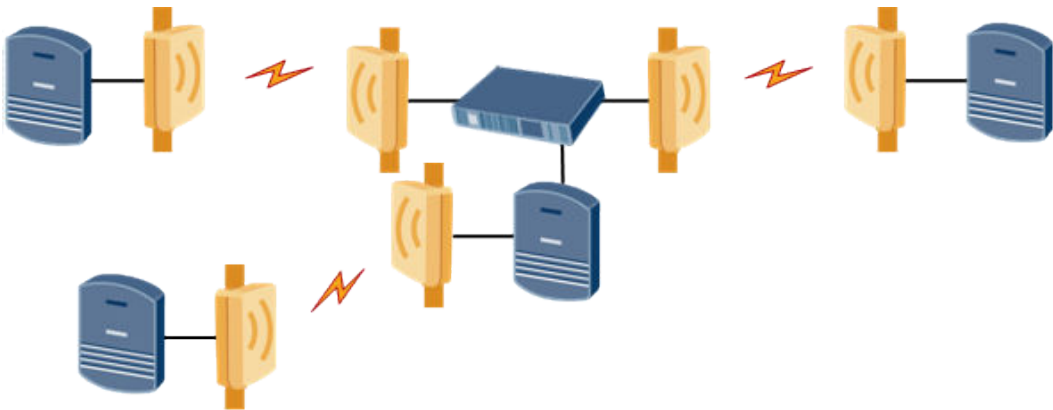
4.1.3 Point-to-Point Networking (CPRI Services)

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

As shown in [Figure 4-3](#), microwave links on a point-to-point network can:

- 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



	RTN 380
	BBU
	RRU

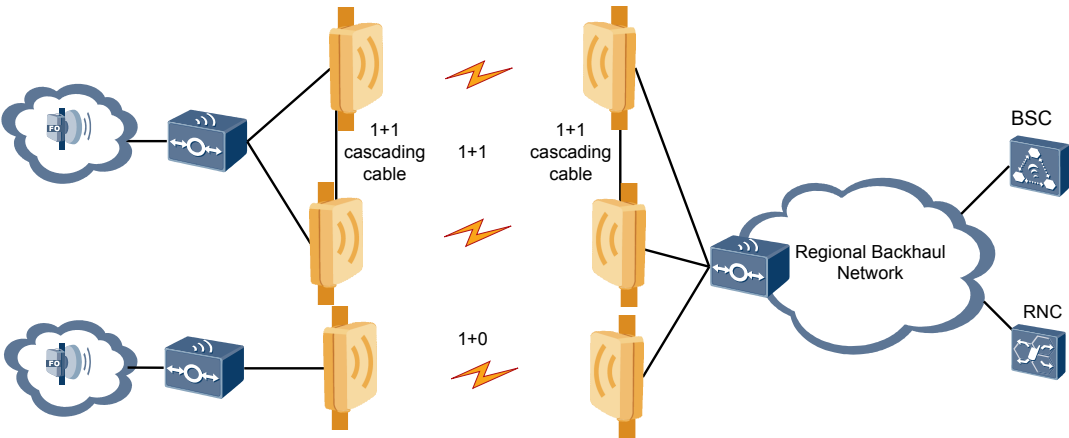
4.2 Networking with the OptiX RTN 900

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

[Figure 4-4](#) shows a network that combines RTN 380s and OptiX RTN 900s.

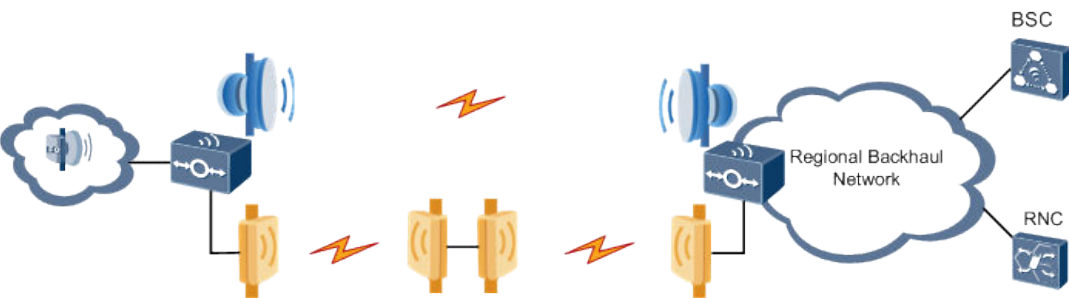
- For important links, RTN 380 can work with OptiX RTN 900 to provide 1+1 link protection.
- RTN 380 works with the IDU that supports the power over Ethernet function to receive/transmit power and Ethernet service signals through the P&E port.
- RTN 380 can work with OptiX RTN 900 to implement the Super Dual Band solution through EPLA. For 7- to 21-kilometer backhauling, Super Dual Band Relay can triple the E-band link transmission distance. This solution combines advantages of E-band and common frequency bands and provides high-bandwidth microwave links for macro base stations.

Figure 4-4 Hybrid network solution



	RTN 380
	RTN 900 IDU
	Radio chains and/or radio sub-rings

Figure 4-5 Super Dual Band solution



	RTN 380
	RTN 900 IDU
	Radio chains and/or radio sub-rings

Super Dual Band Relay adds E-band relay sites on an E-band link to extend its transmission distance for supporting 7- to 21-kilometer backhaul. Super Dual Band Relay has the following features:

- Supports a maximum of three E-band relay hops, which extends the SDB transmission distance extension by two times.
- Supports more than one E-band relay sites only if the E-band relay sites are of the same device type.

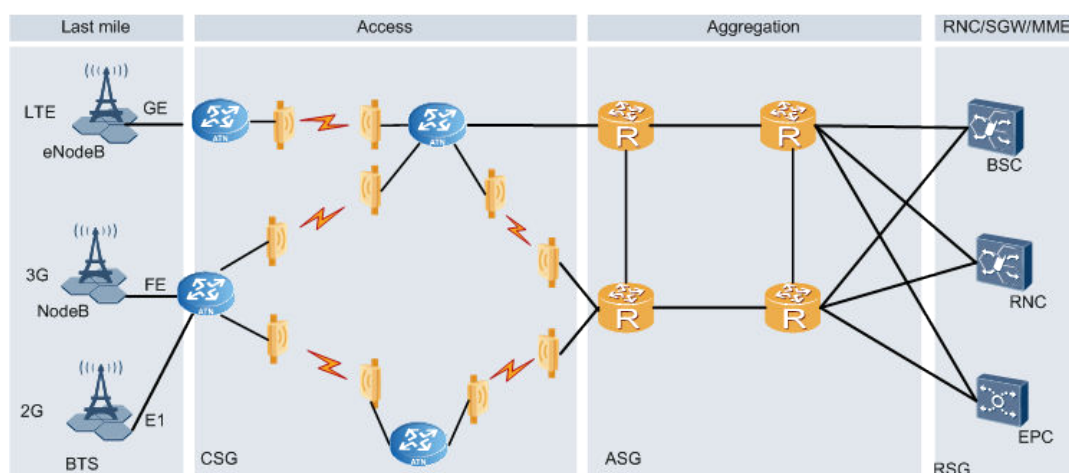
4.3 Networking with the ATN

The RTN 380 can work with the ATN to implement the IP RAN-based mobile bearer solution that transmits services over microwave.

In this solution:

- The ATN functions as the CSG, and the RTN 380 functions as the transparent microwave transmission channel for the CSG.
- The RTN 380 supports the automatically available DCN between the RTN 380 and ATN.

Figure 4-6 Networking with the ATN



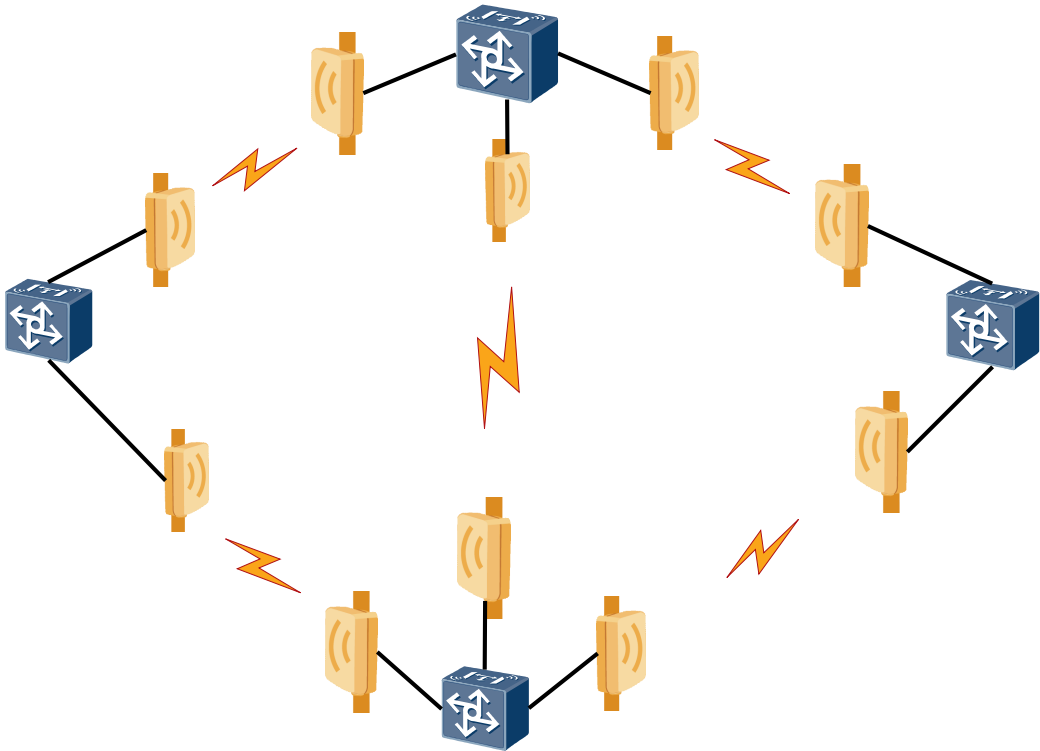
	RTN 380
	ATN

4.4 Networking with LAN Switches

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

As shown in [Figure 4-7](#), 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.

Figure 4-7 Networking with LAN switches



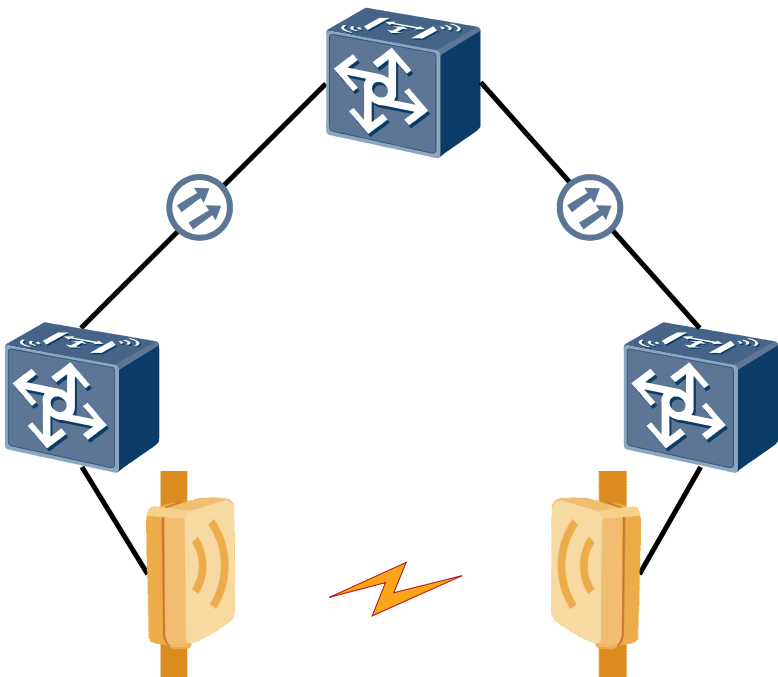
	RTN 380
	LAN switch

4.5 Supplementary Network for Optical Fibers

Featuring high bandwidth and low interference between sites, 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.

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 4-8](#).

Figure 4-8 Supplementary network



	RTN 380
	Packet transmission equipment

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.

5 Network Management System

About This Chapter

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

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.

5.2 Web LCT

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

5.3 U2000-T

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

5.4 Web-based NMS

A web-based NMS is a network maintenance terminal built in an NE.

5.1 Network Management Solutions

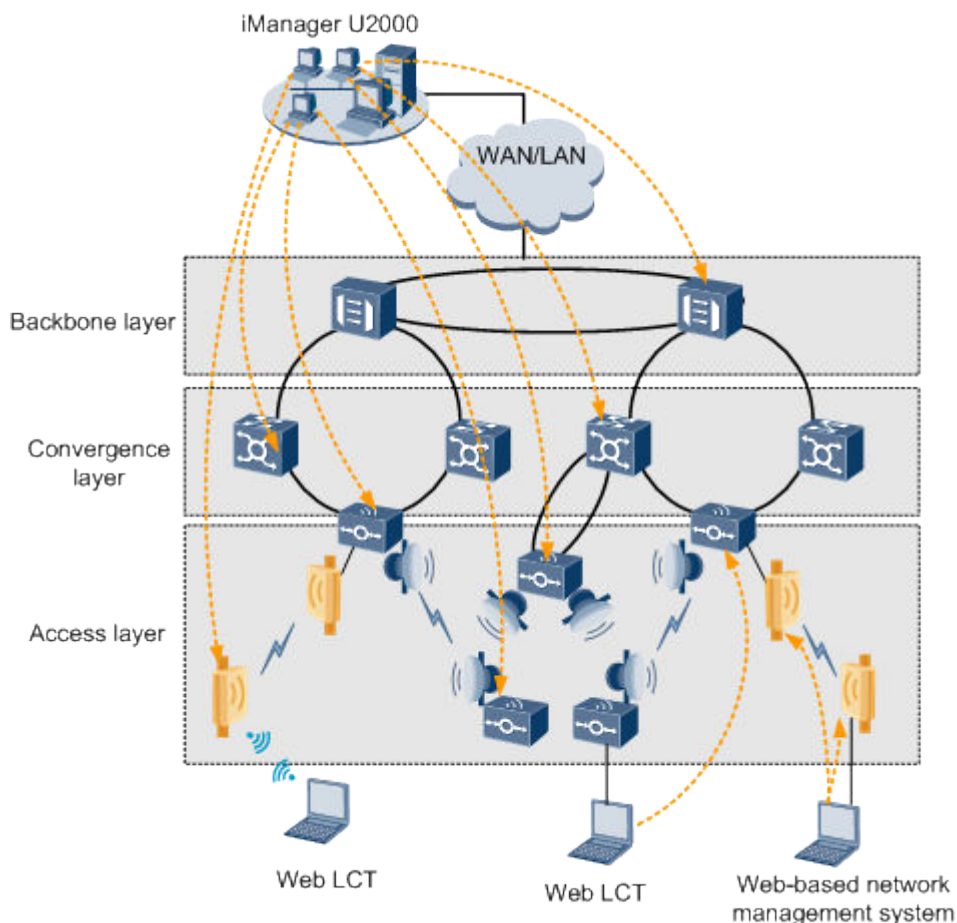
Huawei provides complete transport network management solutions that satisfy the telecommunications management network (TMN) requirements for various function domains and customer groups of telecommunications networks.

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-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.
- **Web-based network management system**

The web-based network management system allows you to manage local or remote NEs using a browser (IE 9, Chrome, or Firefox).

Figure 5-1 Network management solutions for transport networks



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

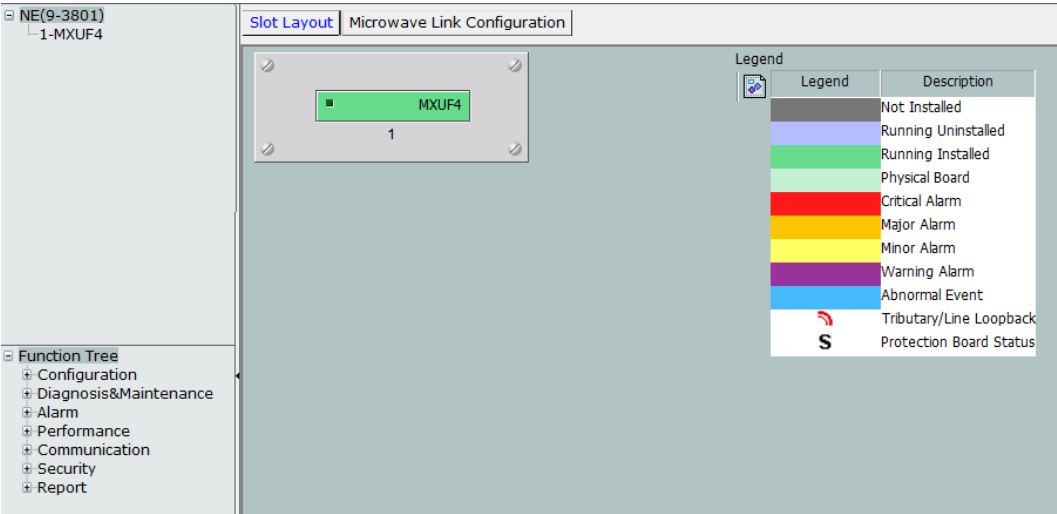
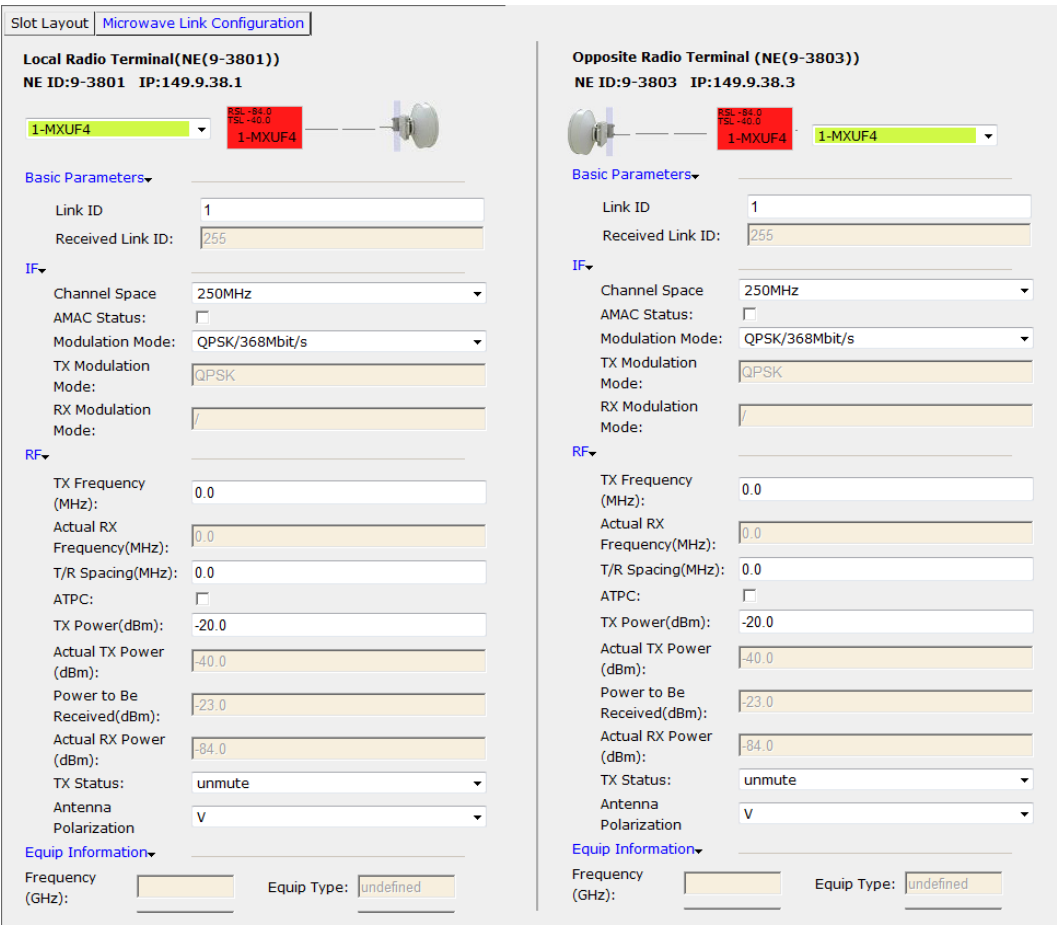


Figure 5-3 HOP management window



5.3 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 5-4](#).

The U2000-T manages network-level alarms, performance, inventory, and security, and end-to-end service configurations. See [Figure 5-5](#).

The U2000-T provides a built-in NE Explorer to manage all NEs on the topology. See [Figure 5-6](#).

Figure 5-4 Topology management interface of the U2000-T

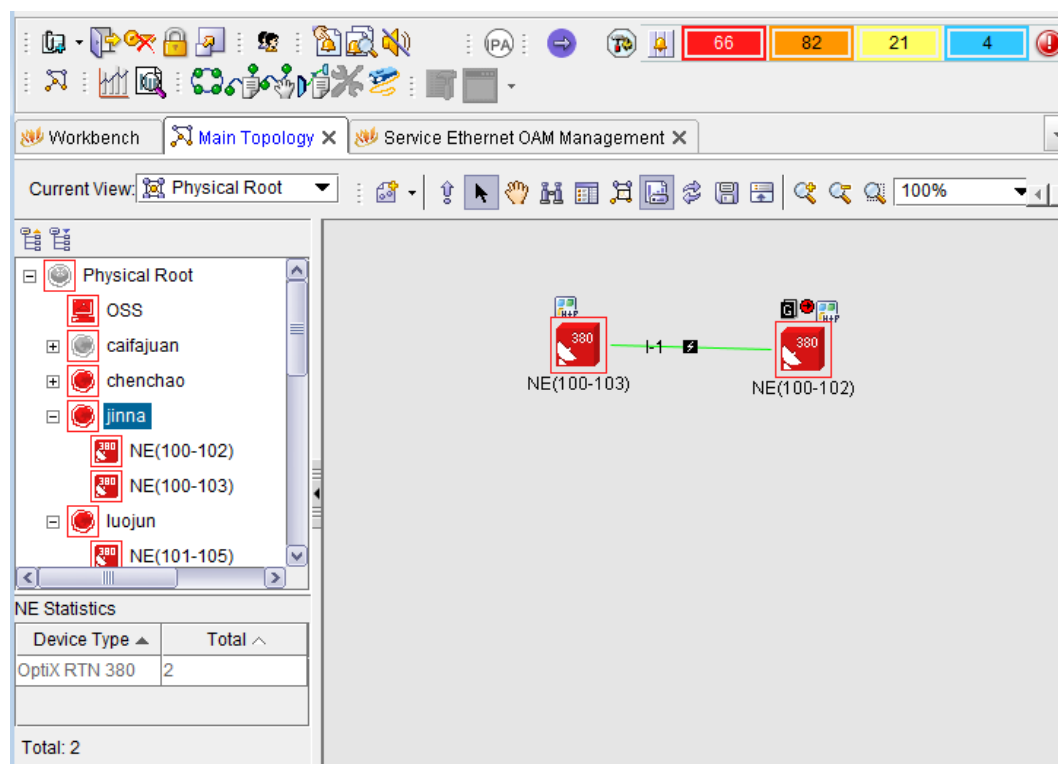


Figure 5-5 End-to-end service configuration interface of the U2000-T

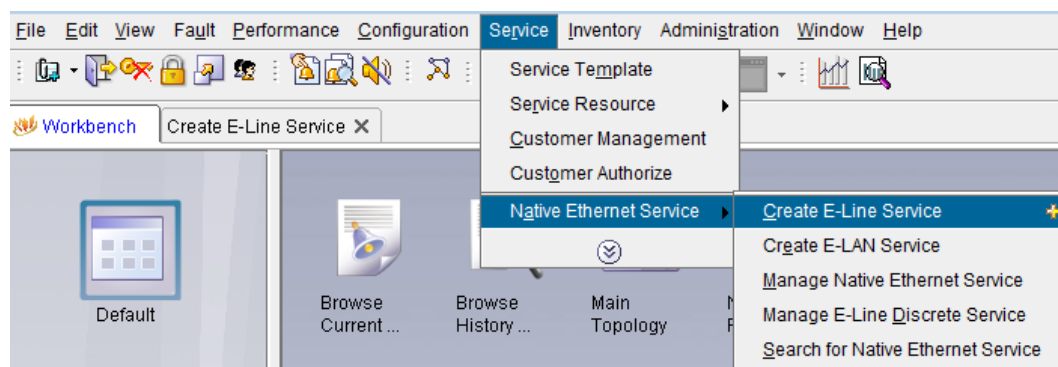
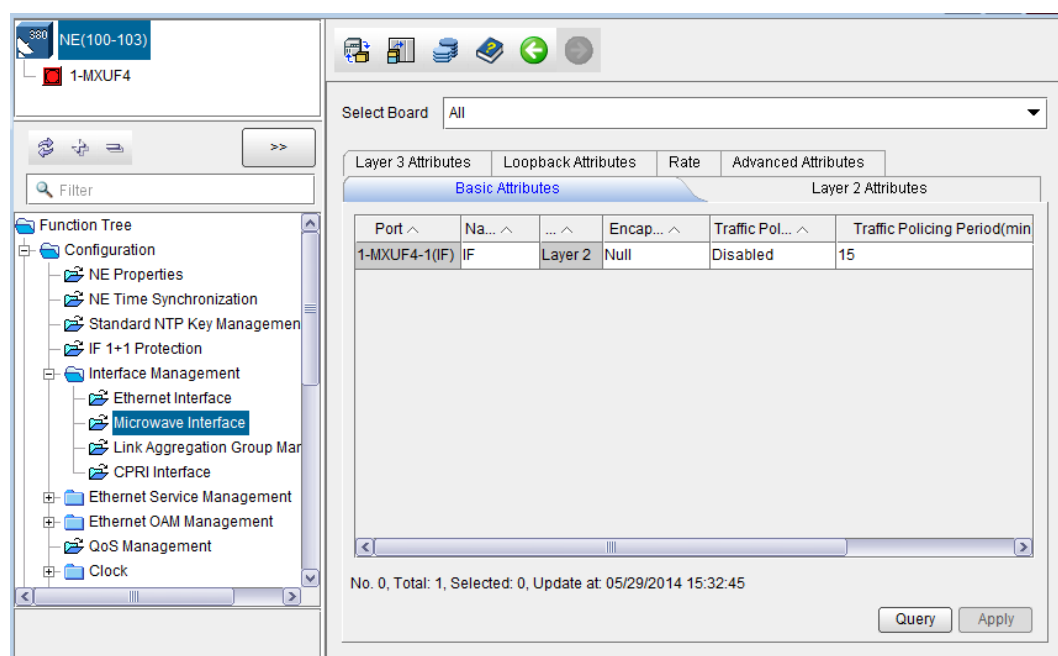


Figure 5-6 NE Explorer interface of the U2000-T



5.4 Web-based NMS

A web-based NMS is a network maintenance terminal built in an NE.

When WLAN or a network cable is used to connect a PC to an NE with a web-based NMS built in, you can access and manage the NE through IE9 or higher.

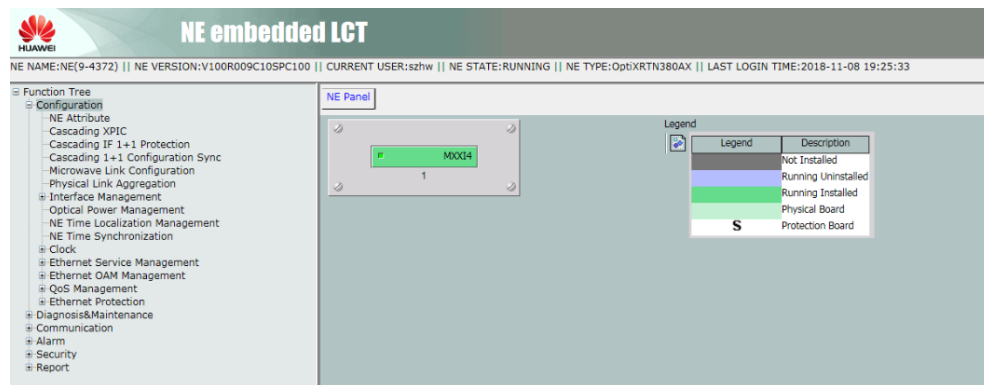
A PC connects to such an NE in either of the following two methods:

- Using a network cable
When a network cable is used, you can manage both the local and peer NEs.
- Using WLAN
When WLAN is used, you can manage only the local NE.

After a PC connects to such an NE, you can open the NE management page by entering the NE's IP address on a browser (IE9 or higher).

The web-based NMS provides NE management, alarm management, performance management, configuration management, communication management, and security management. **Figure 5-7** shows the management page.

Figure 5-7 Management page of the web-based NMS



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.

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 Service Capacities

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

Radio Working Modes for Transmitting Ethernet Services and service capacities

Table 6-1 Radio working modes and service capacities (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
	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

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
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.

Radio Working Modes for Transmitting CPRI Services and Service Capacities

Table 6-2 Radio working modes and service capacities (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

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

6.1.2 Frequency Bands

The 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 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

6.1.4 Distortion Sensitivity

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

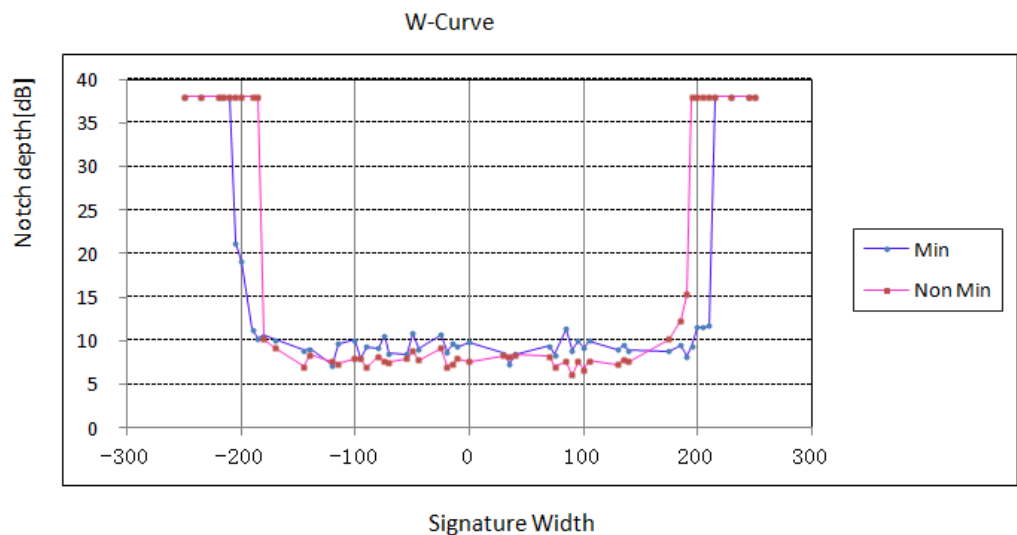
The notch depth of OptiX RTN 380 meets the requirements described in ETSI EN 302217-2-1.

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 6-1
500M/64QAM dispersion fading margin	33 dB

Figure 6-1 W-curve



6.1.5 Transceiver Performance

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

 NOTE

The maximum error between the actual transmit power of the RTN 380 and the preset transmit power on the NMS is ± 3 dB.

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

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

6.1.6 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.

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
MTBF (hour)	50.47×10^4
MTBF (year)	57.62
MTTR (hour)	1
Availability	99.99980%

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

Item	Performance		
	1+0 Configuration	2+0 Configuration	1+1 Configuration
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.

Optical Port Performance

The characteristics of optical ports comply with IEEE 802.3. [Table 6-12](#) and [Table 6-13](#) provide optical port performance.

Table 6-12 GE optical port performance

Item	Performance	
	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

Table 6-13 2.5 GE optical port performance

Item	Performance		
	Multi-Rate (Highest Rate: 4.25 Gbit/s)	Multi-Rate (Highest Rate: 6.144 Gbit/s)	Multi-Rate (Highest Rate: 6.144 Gbit/s)
Module BOM number	34060365	34060517	34060528
Nominal wavelength (nm)	850	1310	1310
Nominal bit rate (Mbit/s)	4.25 Gbit/s	6.144 Gbit/s	6.144 Gbit/s
Fiber type	Multimode	Single-mode	Single-mode
Transmission distance (km)	0.3	2	10
Operating wavelength (nm)	830 to 860	1261 to 1360	1261 to 1360
Mean launched power (dBm)	-9.0 to -1.5	-8.4 to 0.5	-8.4 to 0.5
Receiver minimum sensitivity (dBm)	-15.0	-13.8	-13.8
Minimum overload (dBm)	0	0.5	0.5
Minimum extinction ratio (dB)	3.0	3.5	3.5

FE Optical Port Performance

The characteristics of FE optical ports comply with IEEE 802.3. [Table 6-14](#) provides FE optical port performance.

Table 6-14 FE optical port performance

Item	Performance
	100BASE-LX (15 km)
Nominal bit rate (Mbit/s)	34060307
Nominal wavelength (nm)	1310
Maximum rate (Mbit/s)	155
Fiber type	Single-mode

Item	Performance
	100BASE-LX (15 km)
Transmission distance (km)	15
Operating wavelength (nm)	1274 to 1360
Mean launched power (dBm)	-15.0 to -8.0
Receiver minimum sensitivity (dBm)	-31.0
Minimum overload (dBm)	-8.0
Minimum extinction ratio (dB)	8.2

 NOTE

This module applies to SDH STM S-1.1/Fast Ethernet.

GE Electrical Port Performance

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

Table 6-15 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	RJ45 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 6-16](#) lists the main performance counters.

Table 6-16 CPRI port performance

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

Item	Performance
Dimensions (H x W x D)	265 mm x 265 mm x 65 mm
Weight	3.8 kg

Power Consumption

Item	Performance
Typical Power Consumption	39 W

Power Supply

Item		Specifications
P&E power supply	Power supply mode	Negotiable mode
	Voltage range	- 38.4 V to - 57.6 V
	Power supply distance	≤ 100 m

Electromagnetic Compatibility

- Passed CE, VCCI, IC and RCM authentication
- Compliant with ETSI EN 301 489-1
- Compliant with ETSI EN 301 489-4
- Compliant with CISPR 32/EN 55032
- Compliant with CISPR 24/EN 55024
- Compliant with VCCI V-3
- Compliant with ICES-003 Issue 6
- Compliant with AS/NZS CISPR 32
- Compliant with IEC 61000-6-1/EN 61000-6-1
- Compliant with IEC 61000-6-3/EN 61000-6-3

Lightning Protection

- Compliant with IEC/EN 61000-4-5
- Compliant with ITU-T K.21
- Compliant with ITU-T K.44

Safety

- Compliant with IEC 60825

- Compliant with IEC 60215
- Compliant with IEC 60950-1
- Compliant with IEC 60950-22

Environment

RTN 380 is used outdoors.

Table 6-17 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)
	Storage	Compliant with EN 300 019-1-1 (Class 1.2)
Air temperature	Operation	-33°C to +55°C
	Transportation and storage	-40°C to +70°C
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

7 Accessories

About This Chapter

This chapter describes all RTN 380 accessories.

7.1 Power Injector

A power injector (PI) uses DC or AC input power. It transmits both GE service signals and power signals to an RTN 380 through an Ethernet cable.

7.2 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 HSB.

7.3 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 Antennas

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

7.5 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.

7.6 WLAN Module

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

7.1 Power Injector

A power injector (PI) uses DC or AC input power. It transmits both GE service signals and power signals to an RTN 380 through an Ethernet cable.

The RTN 380 can work with several models of Huawei PIs. [Table 7-1](#) to [Table 7-2](#) lists the specifications of the PIs.

Table 7-1 Indoor PIs

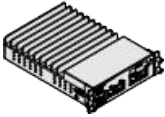
Model	OptiX RTN PI-DC A10	OptiX RTN PI-DC A11
Appearance		
Application scenario	Equipment room or outdoor cabinet	Equipment room or outdoor cabinet
Dimensions (H x W x D)	38.6 mm×145.6 mm×185 mm	36 mm x 145.6 mm x 84 mm
Weight	0.8 kg	0.5 kg
Power input	DC power: - 38.4 V to - 57.6 V	DC power: - 38.4 V to - 57.6 V
P&E port count and mode	One P&E port, force mode	One P&E port, PSE-PD mode (RTN 380 housing an MXUF4 board), Force mode (RTN 380 housing an SHUF3 board)
DC output port	Not supported	Not supported

Table 7-2 Outdoor PIs

Model	OptiX RTN PI-DC B10	OptiX RTN PI-DC B11	OptiX RTN PI-DC B20	OptiX RTN PI-AC B20	OptiX RTN PI-DC B21
Appearance					
Application scenario	Outdoor (A PI should not be installed at a high position on a tower.)	Outdoor (A PI should not be installed at a high position on a tower.)	Outdoor (A PI should not be installed at a high position on a tower.)	Outdoor (A PI should not be installed at a high position on a tower.)	Outdoor (A PI should not be installed at a high position on a tower.)

Model	OptiX RTN PI-DC B10	OptiX RTN PI-DC B11	OptiX RTN PI-DC B20	OptiX RTN PI-AC B20	OptiX RTN PI-DC B21
Dimensions (H x W x D)	226 mm×164 mm×43.6 mm	185 mm×115 mm×40 mm	250 mm x 180 mm x 52 mm	250 mm x 180 mm x 52 mm	250 mm x 154.5 mm x 35 mm
Weight	1.3 kg	0.97kg	3.0 kg	3.0 kg	1.8 kg
Power input	DC power: – 38.4 V to – 57.6 V	DC power: – 38.4 V to – 57.6 V	DC power: – 38.4 V to – 57.6 V	AC power: 90 V to 264 V, with the frequency ranging from 45 Hz to 65 Hz	DC power: – 38.4 V to – 57.6 V
P&E port count and mode	One P&E port, force mode	One P&E port, force mode	Two P&E ports, PSE- PD mode (RTN 380 housing an MXUF4 board),Force mode (RTN 380 housing an SHUF3 board)	Two P&E ports, PSE- PD mode (RTN 380 housing an MXUF4 board),Force mode (RTN 380 housing an SHUF3 board)	One P&E port, force mode
DC output port	Not supported	Not supported	One DC output port. Switching between DC output and P&E output is supported. (RTN 380 housing an MXUF4 board cannot support DC input.)	One DC output port. Switching between DC output and P&E output is supported. (RTN 380 housing an MXUF4 board cannot support DC input.)	Not supported

For details about each model of PI, see the corresponding product description and installation guide.

7.2 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 HSB.

7.2.1 Functions and Features

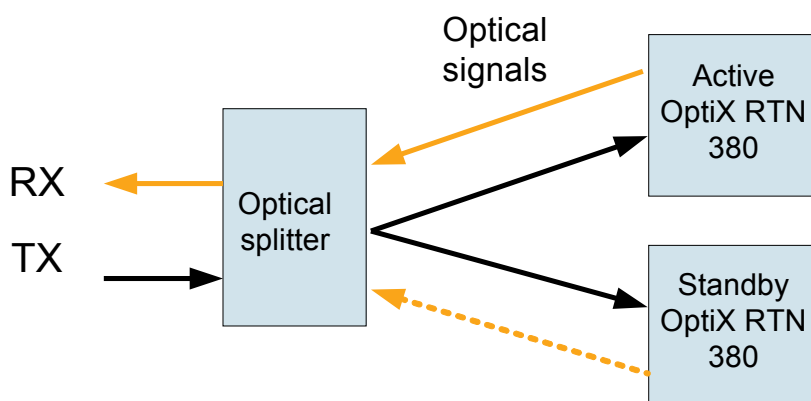
An optical splitter uses its optical splitting module to split optical signals.

Functions and Features

An optical splitter evenly splits one channel of GE optical signals into two channels.

Figure 7-1 shows the function diagram for an optical splitter.

Figure 7-1 Optical splitter function diagram



- 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 RTN 380s.
- In the receive direction, an optical splitter receives optical signals from the GE port of the active RTN 380. (The GE port of the standby RTN 380 does not transmit optical signals.)

Installation Modes

An optical splitter can be installed on:

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

7.2.2 Ports

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

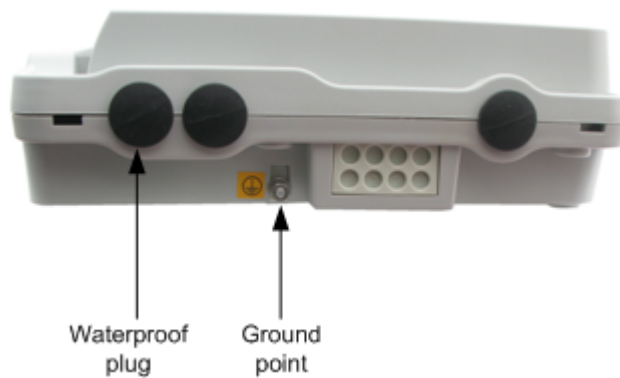
Appearance and Structure

An optical splitter has a protective cover, as shown in **Figure 7-2** and **Figure 7-3**.

Figure 7-2 Appearance of an optical splitter (front)



Figure 7-3 Appearance of an optical splitter (bottom)

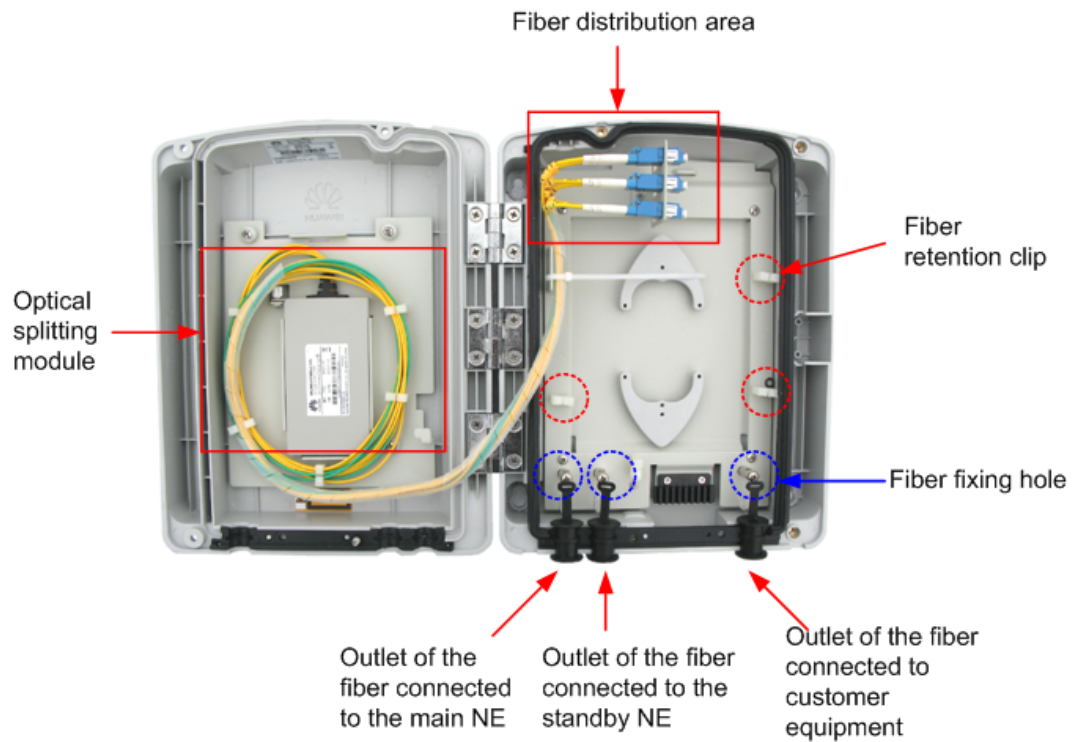


NOTE

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

Figure 7-4 shows the internal structure of an optical splitter.

Figure 7-4 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 7-5](#).

Figure 7-5 Fiber connection relationships



Table 7-3 Fiber connection relationships

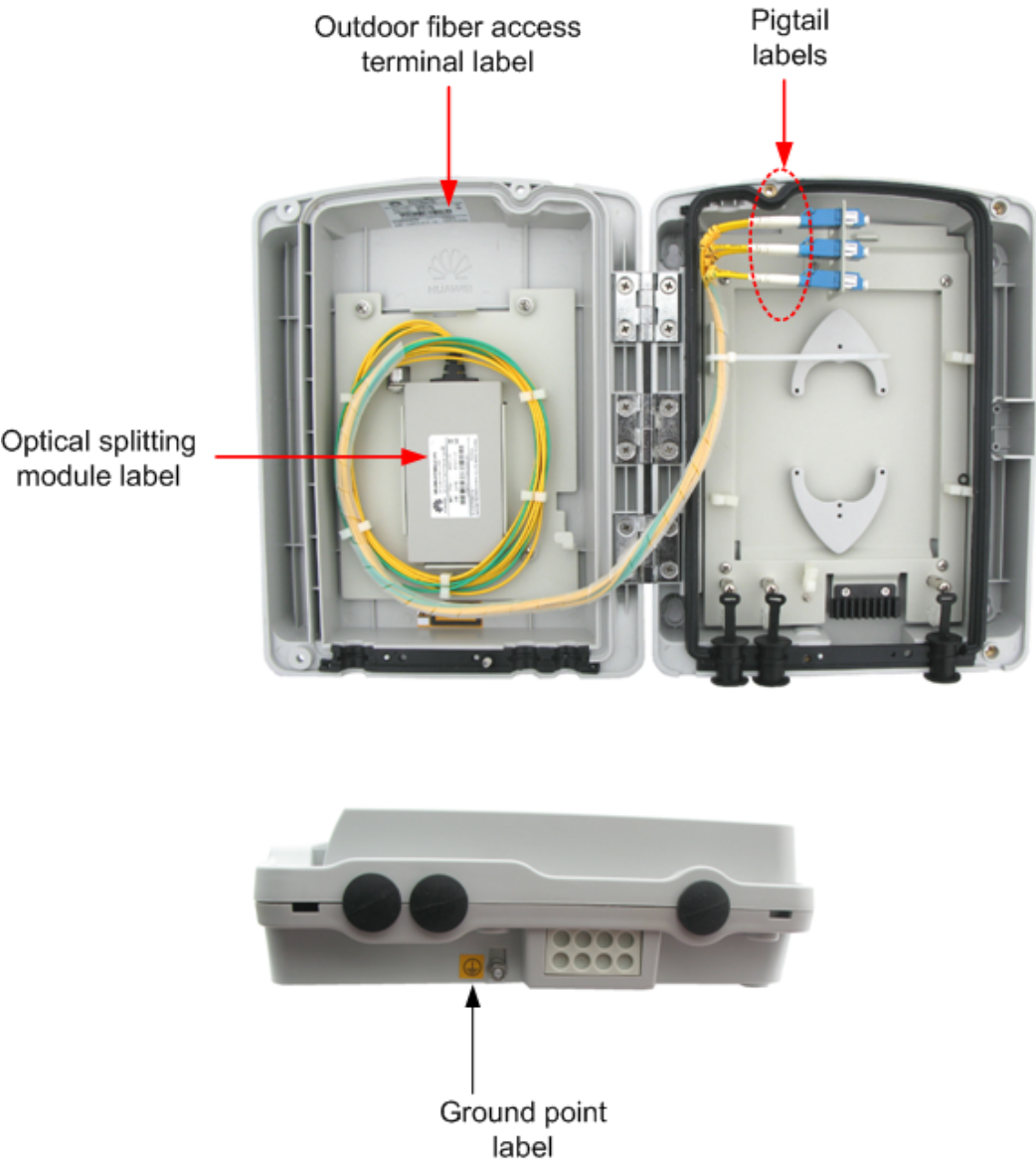
Fiber Number	Label	Connector Type	Description
101	M-Rx	LC/UPC	Connected to the GE receive port on the main RTN 380
201	M-Tx		Connected to the GE transmit port on the main RTN 380
102	S-Rx		Connected to the GE receive port on the standby RTN 380
202	S-Tx		Connected to the GE transmit port on the standby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

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.

7.2.3 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 7-6 Labels of an optical splitter



7.2.4 Technical Specifications

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

Table 7-4 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

Item	Specifications
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	$\leq 95\%$ (+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)

7.3 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.

7.3.1 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.

7.3.2 Functions and Features

Hybrid couplers combine and divide RF signals.

Hybrid couplers have the following functions and features:

- In the transmit direction, a hybrid coupler combines two RF signal routes from two 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 RTN 380s.

7.3.3 Ports

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

Figure 7-7 shows ports on a hybrid coupler.

Figure 7-7 Ports on a hybrid coupler

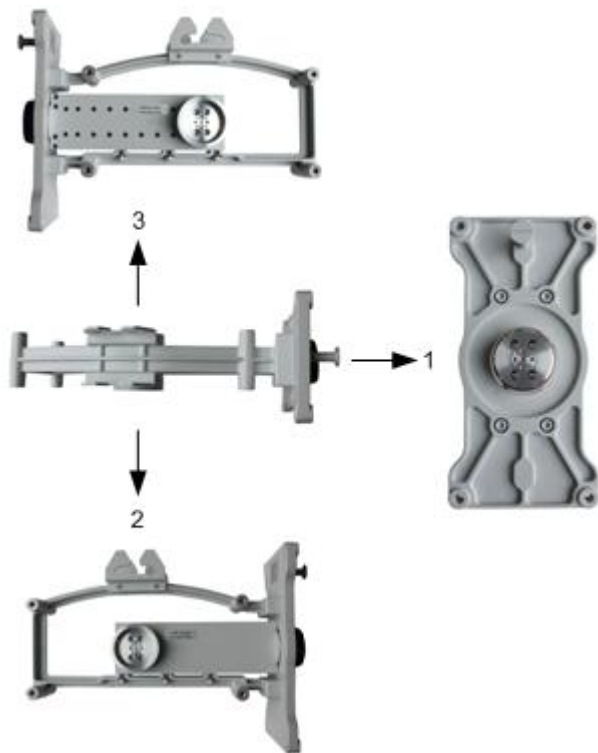


Table 7-5 describes the ports on a hybrid coupler.

Table 7-5 Description of ports on a hybrid coupler

N o.	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 RTN 380 of the extension tributary.	
3	Main tributary port	MAIN	Connects to the RTN 380 of the main tributary.	

7.3.4 Labels

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

Figure 7-8 shows the label of a hybrid coupler.

Figure 7-8 Label of a hybrid coupler



Table 7-6 describes information provided on a hybrid coupler label.

Table 7-6 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.
		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

Label Information	Content Example	Parameter	Parameter Description
		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 RTN 380	R: rectangular waveguide
		7: port code	C: Huawei port
Item code (ITEM)	52440759	-	Uniquely identifies the model of a hybrid coupler.
Description (DEP)	<u>71000-86000 MHz, 3dB</u> 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.
Bar code area		-	Indicates bar code of the hybrid coupler serial number.

7.3.5 Technical Specifications

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

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

Table 7-7 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)	● ≥ 25 (Balanced hybrid coupler) ● ≥ 27 (Unbalanced hybrid coupler) NOTE A 1+1 HSB configuration requires unbalanced hybrid couplers.
Standing wave ratio	≤ 1.4
Power capacity (W)	8
Dimensions (H x W x D)	$< 330 \text{ mm} \times 190 \text{ mm} \times 410 \text{ mm}$
Weight	$\leq 5 \text{ kg}$

7.4 Antennas

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

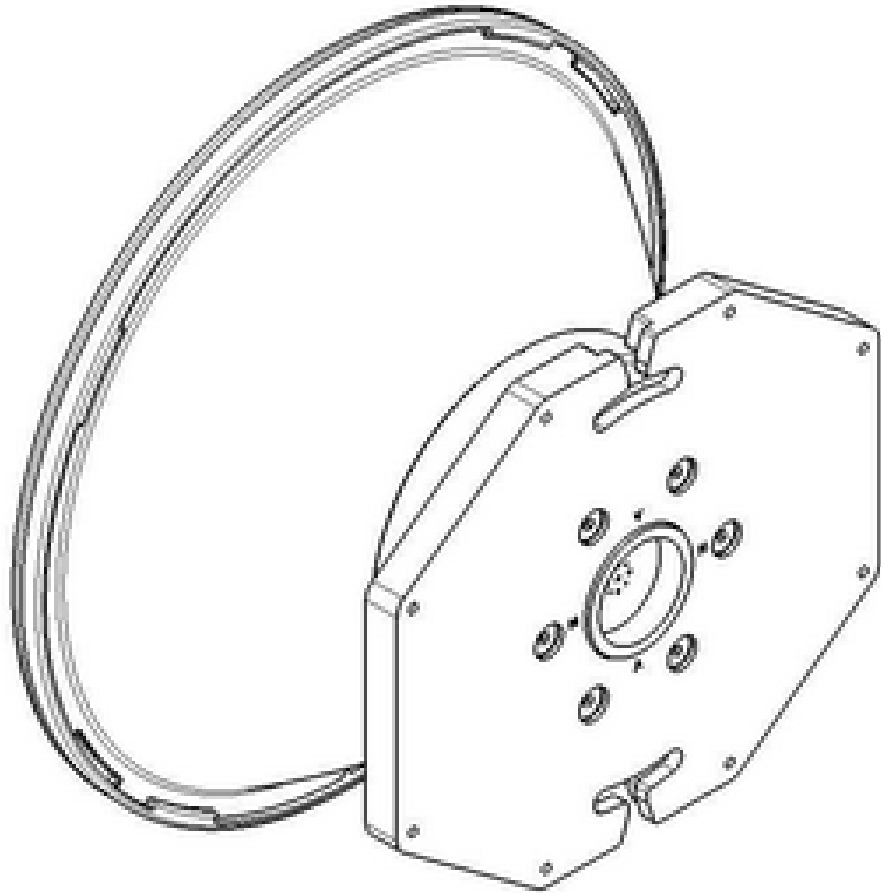
7.4.1 Types

RTN 380 supports dish antennas, flat antennas and wide-beam antennas.

Dish Antenna

Dish antennas are parabolic antennas. [Figure 7-9](#) shows the appearance of a dish antenna.

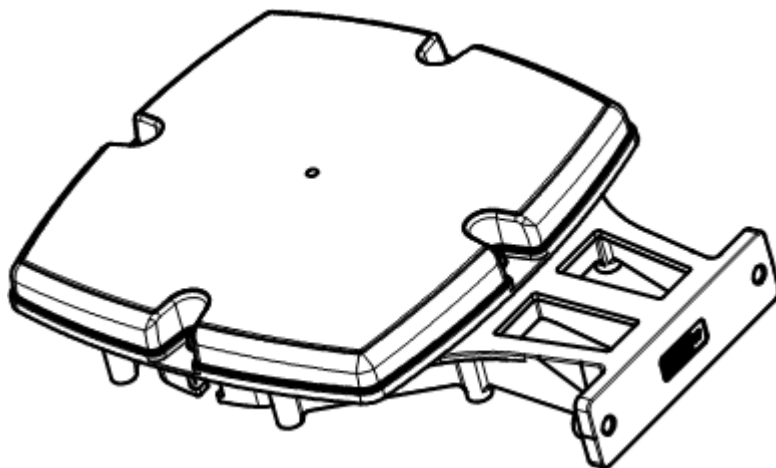
Figure 7-9 Appearance of a dish antenna



Flat Antenna

Flat antennas are small in size but offers high efficiency. [Figure 7-10](#) shows the appearance of a flat antenna.

Figure 7-10 Appearance of a flat antenna

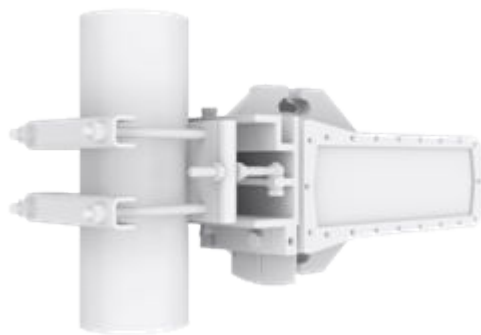


Wide-beam antennas

As network scale grows, the density of E-band microwave device deployment increases. Most E-band microwave devices are mounted on lamp posts. The traditional E-band parabolic antenna has a low anti-shake capability. Strong winds cause lamp posts to shake, which prevents the alignment of antennas. As a consequence, microwave link performance deteriorates, and services are interrupted.

Wide-beam antennas are usually used on pole-mounted sites, and have a high anti-shake capability, mitigating the impact of lamp post shaking on microwave links. **Figure 7-11** shows the appearance of a wide-beam antenna.

Figure 7-11 Appearance of a wide-beam antenna



Based on feed ports, wide-beam antennas are classified into two types: vertically polarized antennas and horizontally polarized antennas.

7.4.2 Functions and Features

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

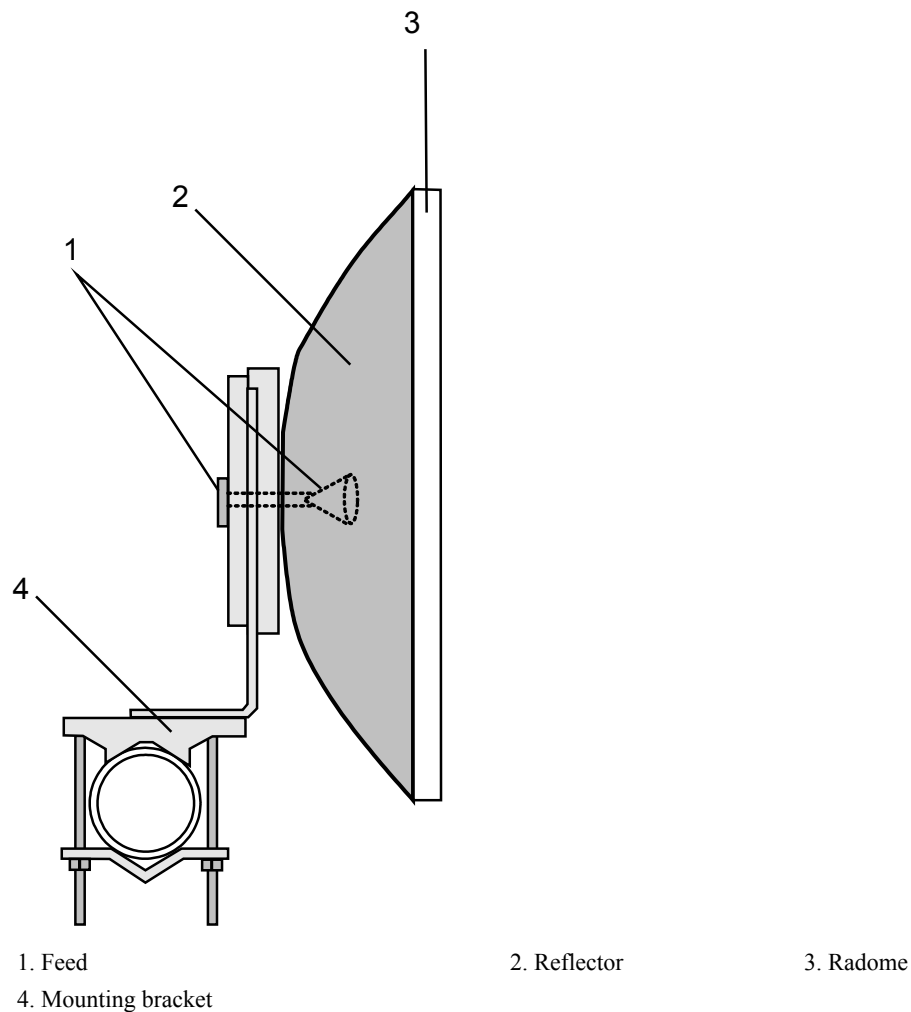
- In the transmit direction, antennas convert RF signals received from RTN 380s into directional electromagnetic waves and emit these waves into free space.
- In the receive direction, antennas receive electromagnetic waves from free space, convert these waves into RF signals, and transmit the RF signals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

7.4.3 Working Principles (Dish Antenna and Wide-Beam Antenna)

Similar to a dish antenna, a wide-beam antenna consists of a reflector, a feed, a radome, and a mounting bracket.

Figure 7-12 shows the structure of an antenna.

Figure 7-12 Antenna structure



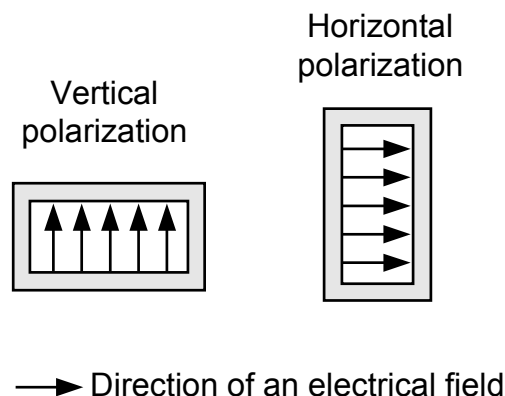
The functions of each component of an antenna are described as follows:

- Feeds

A feed receives RF signals from an 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 7-13** shows the polarization directions that rectangular waveguides support.

Figure 7-13 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 penetrating to the reflector.

- Mounting brackets

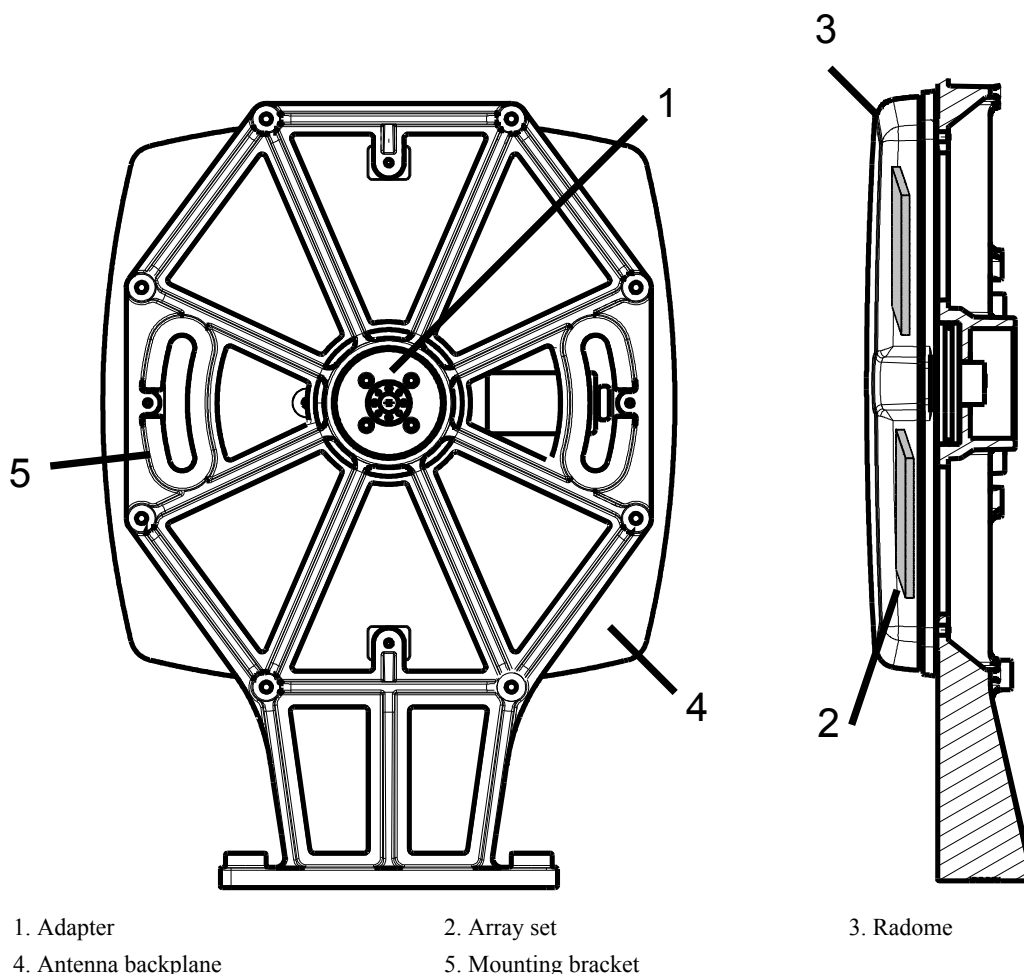
Mounting brackets are used to attach antennas onto poles and help achieve fine elevation and azimuth adjustments.

7.4.4 Working Principles (Flat Antenna)

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

Figure 7-14 shows the structure of a panel antenna.

Figure 7-14 Structure of a panel antenna



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
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.

7.4.5 Antenna Diameter

RTN 380 antennas of different types have different diameters.

Table 7-8 Antenna diameter

Type of Antenna	Antenna Diameter
Dish antenna	● 0.2 m ● 0.3 m ● 0.6 m
Wide-beam antenna	0.3 m x 0.077 m
Panel antenna	0.6 m NOTE The gain of a 0.6 m panel antenna is the same as that of a 0.3 m dish antenna.

7.4.6 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.

7.5 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).

- 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 is imported to RTN 380s.
- Security features:
 - The administrator accounts and passwords (encrypted) in the **RTN.CER** or **RTNEXTRA.CER** file are used to authenticate USB flash drives.
 - Other files in USB flash drives can be encrypted.

- The validity of files in USB flash drives can be verified.

Application Scenario

- 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, a USB flash drive is inserted into a faulty device. After authenticating the USB flash drive, the faulty device automatically backs up its data to the drive. After the faulty device is replaced, the drive holding the backup data is inserted into the new device, which automatically downloads the backup 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 an **RTN.CER/RTNEXTRA.CER** file and a **USBSEC.CFG** file (security policy file).

NOTE

- The **RTN.CER/RTNEXTRA.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.
- The **USBSEC.CFG** file stores the list of available files in the USB flash drive and the verification information and encryption parameters of each file. When the files in the USB flash drive are being loaded to an NE, the NE verifies and decrypts the files based on the **USBSEC.CFG** file. If a file is not in the file list in the **USBSEC.CFG** file or a file fails to be verified or decrypted, the file cannot be used by the NE.
- **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** or **RTNEXTRA.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 **USBSEC.CFG** file in the root directory, and verifies the integrity of files in the USB flash drive and decrypts the files based on the **USBSEC.CFG** file.
3. 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.
4. 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.
5. Checks the system parameter folder **sysdata**. If the folder contains data, the RTN 380 imports system parameters from the folder.
6. Checks the script folder **script**. If the folder contains data, the RTN 380 imports script data from the folder.
7. 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.
8. 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 7-9 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 7-9 Types of USB flash drives

No.	Manufacturer	Model	Capacity
1	Netac	U208	4 GB

7.6 WLAN Module

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

 NOTE

WLAN modules are not delivered with the equipment. They must be purchased separately.

Appearance

Figure 7-15 WLAN module



Specifications

Table 7-10 WLAN 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

Item	Specifications
WLAN encryption mode	WPA2-PSK
Setting of the service set identifier (SSID)	Supported
Setting whether to enable WLAN	Supported
Setting of WLAN passwords	Supported
Frequency hopping (FH)	Supported. The WLAN module can automatically select a good-quality channel or be manually set to work at a fixed channel.
Maximum transmission distance	● 30 m (laptop/mobile phone) ● 70 m (laptop + external WLAN 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 WLAN network adapter (such as Tenda W311U+) and there is no obstacle between the laptop and NE. It is recommended that an external WLAN 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 WLAN network adapter with better performance be used.

8 Cables

About This Chapter

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

8.1 Outdoor Network Cables

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

8.2 Outdoor Optical Fiber

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

8.3 RSSI Cables

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

8.4 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.

8.1 Outdoor Network Cables

Fitted with RJ45 connectors at both ends, outdoor network cables connect to 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 8-1 Network cable



Pin Assignments

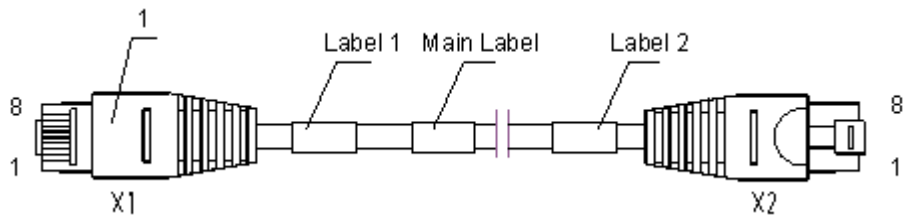


Table 8-1 Pin assignments for straight-through cables

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

Connector X1	Connector X2	Color	Relationship
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 through a P&E port, pin assignments for power signals output from the power sourcing equipment determines whether to use straight-through cables or crossover cables.
- A network cable transmits power signals and Ethernet signals simultaneously. Therefore, the impedance difference between cores of a network cable must be less than 5%; otherwise, Ethernet service packets may be lost.

8.2 Outdoor Optical Fiber

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

Fiber Diagram

Figure 8-2 Optical fiber (Single-mode)

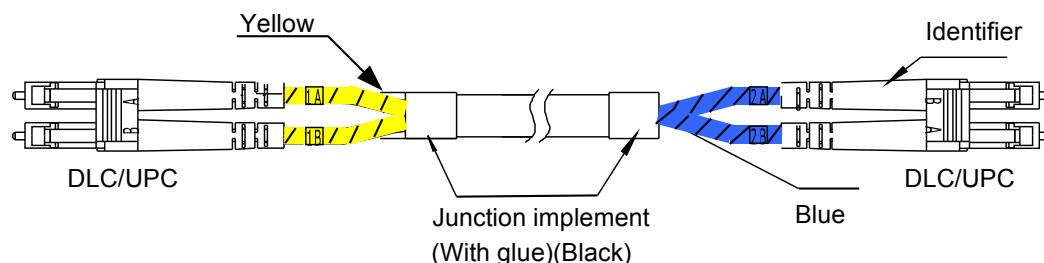
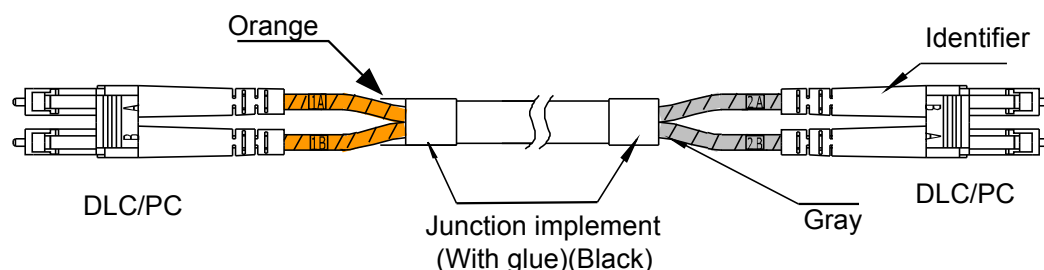


Figure 8-3 Optical fiber (Multi-mode)



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

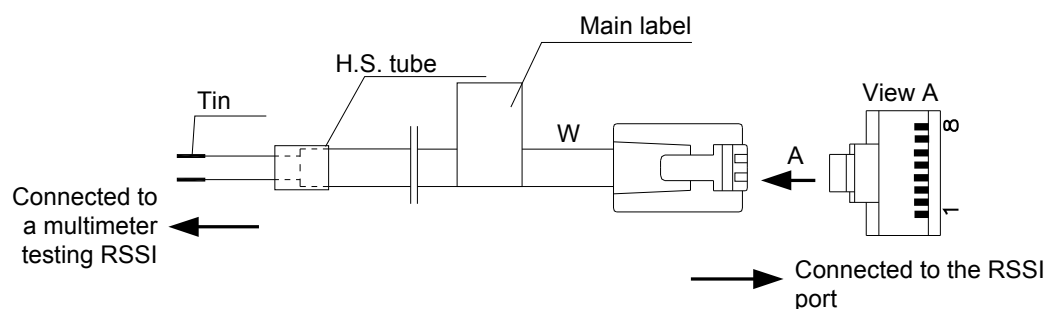
Optical fibers are available in 11 lengths, and the shortest one is 2 meters long. Optical fibers in the other 10 lengths ranging from 10 meters to 150 meters are used for transmitting GE/CPRI services. You can use optical fibers of appropriate lengths depending on the onsite requirements.

8.3 RSSI Cables

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

Cable Diagram

Figure 8-4 RSSI cable



Pin Assignments

An RSSI cable uses two cores to detect level signals.

Table 8-4 Pin assignments for RSSI cables

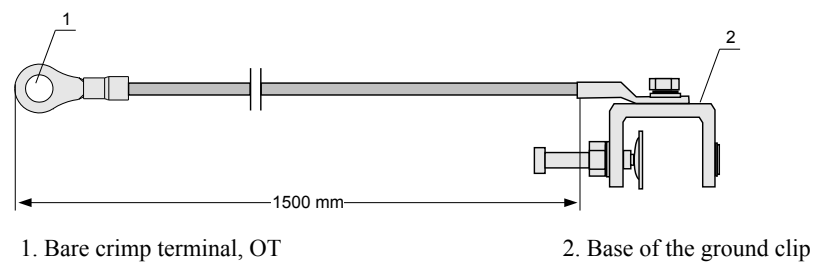
Pin	Signal
4	Ground signal
7	RSSI test level signal

8.4 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 8-5 RTN 380 PGND cable



A Appendix

[A.1 Port Loopbacks](#)

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

[A.2 Compliance Standards](#)

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
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

Standard	Description
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

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.664	Optical safety procedures and requirements for optical transport systems
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

Standard	Description
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 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
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.

NOTE

The functions of Fixed Service (FS) for this device are restricted to use and put into service due to the need for a spectrum license and/or the conditions attached to authorisation for the use of frequencies within all European Union countries (BE/BG/CZ/DK/DE/EE/IE/EL/ES/FR/HR/IT/CY/LV/LT/LU/HU/MT/NL/AT/PL/PT/RO/SI/SK/FI/SE/UK).

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

Standard	Description
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 300 019-1-1 (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
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

Standard	Description
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 RED Directive for digital systems operating in frequency bands where frequency co-ordination is applied

Standard	Description
ETSI EN 302 217-2	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 RED Directive
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 RED 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

Standard	Description
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

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

Standard	Description
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
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: Surge immunity test

Standard	Description
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
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

Standard	Description
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
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)

Standard	Description
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 radio 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
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.

Standard	Description
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
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