OptiX RTN 950A Radio Transmission System V100R019C00

IDU Hardware Description

Issue 01

Date 2019-08-30

HUAWEI TECHNOLOGIES CO., LTD.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: https://www.huawei.com

Email: support@huawei.com

About This Document

Related Versions

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

Product Name	Version
OptiX RTN 950A	V100R019C00
NCE	V100R019C00

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EFP8, EMS6, and SLF1CSHO boards.

Intended Audience

This document is intended for:

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

Before reading this document, you are supposed to be familiar with the following:

- Basics of digital microwave communication
- Basics of the OptiX RTN 950A

Symbol Conventions

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

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could 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	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

General Conventions

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

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

GUI Conventions

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

Convention	Description
Boldface	Buttons, menus, parameters, tabs, window, and dialog titles are in **boldface**. For example, click **OK**.

Convention	Description
>	Multi-level menus are in **boldface** and separated by the ">" signs. For example, choose **File** > **Create** > **Folder**.

Updates in Issue 01 (2019-08-30) Based on Product Version V100R019C00

This document is the first release for the V100R019C00 product version.

Contents

1 Introduction

The OptiX RTN 950A is a product in the OptiX RTN 900 radio transmission system series.

1.1 Network Application

The OptiX RTN 900 is a new generation TDM/Hybrid/Packet/Routing integrated microwave transmission system developed by Huawei. It provides a seamless microwave transmission solution for mobile communication network or private networks.

OptiX RTN 900 Product Family

The OptiX RTN 900 series provide various service interfaces and can be installed easily and configured flexibly. The OptiX RTN 900 series provide a solution that can integrate TDM microwave, Hybrid microwave, Packet microwave, and Routing microwave technologies according to the networking scheme for the sites, achieving smooth upgrade from TDM microwave to Hybrid microwave, from Hybrid microwave to Packet microwave, and from Packet microwave to Routing microwave. This solution meets the transmission requirements of 2G, 3G, and LTE services while also allowing for future network evolution and convergence.

There are some types of OptiX RTN 900 Packet microwave products: OptiX RTN 910A, OptiX RTN 905, OptiX RTN 905 s, OptiX RTN 910, OptiX RTN 950, OptiX RTN 950A, and OptiX RTN 980. Users can choose the product best suited for their site.

NOTE

The OptiX RTN 910 does not provide V100R006C10 or later versions.

The OptiX RTN 905 1C is not supported in V100R011C00 or later. The OptiX RTN 905 1A/2A are not supported in V100R019C00 or later.

Table 1-1 OptiX RTN 900 product family

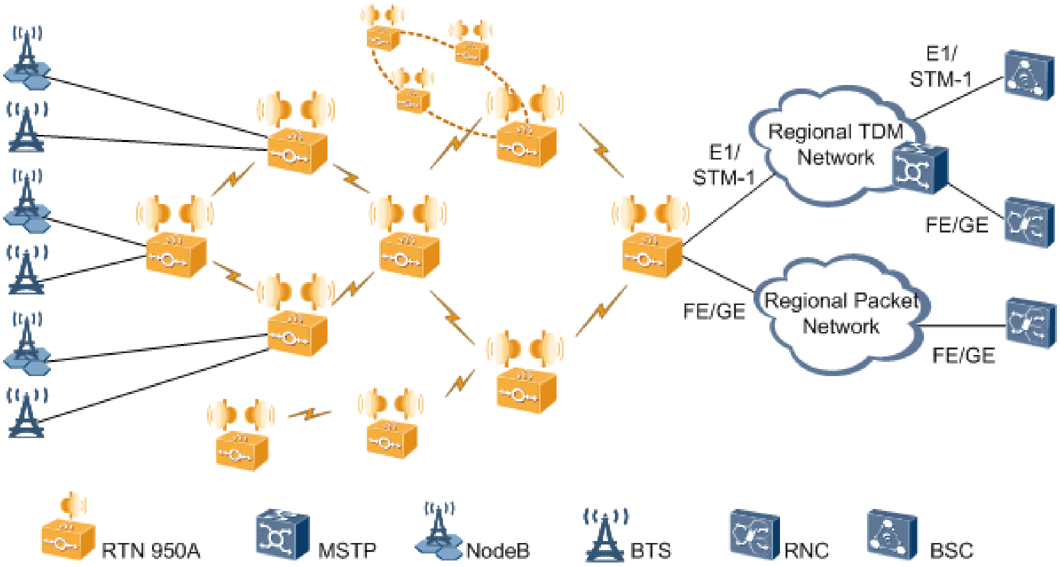
Product Name	IDU Appearance	Characteristic
OptiX RTN 905		● 1 U high IDU ● Integrated chassis (1A/2A/1C/1E/2E/2F) ● One or two microwave links
OptiX RTN 905 s		● 1 U high IDU ● Integrated chassis ● One microwave links
OptiX RTN 910		● 1 U high IDU ● Boards pluggable ● Integrated service ports on system control, switching, and timing boards ● One or two IF boards
OptiX RTN 910A		● 1 U high IDU ● Unpluggable system control, switching, and timing board (CSHR), and two pluggable boards in expansion slots ● IF ports, power input/output ports, and ports that can receive/transmit multiple types of services on a system control, switching, and timing board. ● A maximum of two IF boards, which are inserted in expansion slots
OptiX RTN 950		● 2 U high IDU ● Boards pluggable ● 1+1 protection for system control, switching, and timing boards ● A maximum of six IF boards
OptiX RTN 950A		● 2 U high IDU ● Boards pluggable ● Integrated service ports on system control, switching, and timing boards ● A maximum of six IF boards
OptiX RTN 980		● 5 U high IDU ● Boards pluggable ● 1+1 protection for system control, switching, and timing boards ● Integrated service ports on system control, switching, and timing boards ● A maximum of fourteen IF boards

OptiX RTN 950A

The OptiX RTN 950A provides a generic platform for TDM/Hybrid/Packet/Routing microwave transmission, meeting the backhaul requirements of various wireless networks.

- The OptiX RTN 950A can provide the Hybrid/Packet microwave transmission solution for 2G/3G mobile backhaul networks. In this solution, the OptiX RTN 950A is deployed at the access and convergence layers and provides ring protection and multi-directional convergence functions. **Figure 1-1** shows the Hybrid/Packet microwave transmission solution provided by the OptiX RTN 950A.

Figure 1-1 Microwave transmission solution provided by the OptiX RTN 950A



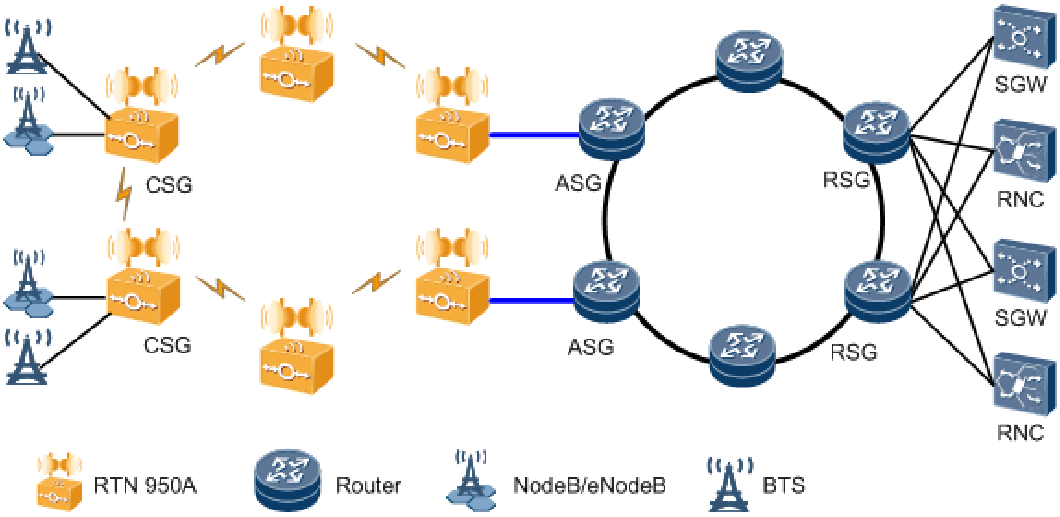
NOTE

The OptiX RTN 950A supports a wide range of interfaces and service bearer technologies, and is therefore compatible with various backhaul networks. Specifically, packet services can be backhauled through TDM networks, and TDM services can be backhauled through packet networks.

- The OptiX RTN 950A can provide the route microwave solution for LTE bearer networks. In this solution, the OptiX RTN 950A functions as a CSG and works with routers that function as ASGs and RSGs to provide end-to-end L3VPN services. The routers can be Huawei CX600s or other routers. **Figure 1-2** shows the route microwave transmission solution provided by the OptiX RTN 950A.

  The route microwave transmission solution can be used in end-to-end Layer 3 networking. When deployed for backhauling services from a multitude of eNodeBs, the solution simplifies VLAN planning, reduces broadcast traffic, and does not require much configuration modification on the transmission network when the wireless side changes.

Figure 1-2 Routing microwave transmission solution provided by the OptiX RTN 950A



NOTE

The OptiX RTN 950A supports the routing microwave transmission solution only when its SCC board is SLF2CSHO or CSHOF.

1.2 Components

The OptiX RTN 950A adopts a split structure. The system consists of the IDU 950A and the ODU. Each ODU is connected to the IDU 950A through an IF cable.

IDU 950A

The IDU 950A is the indoor unit for an OptiX RTN 950A system. It receives and multiplexes services, performs service processing and IF processing, and provides the system control and communications function.

Table 1-2 lists the basic features of the IDU 950A.

Table 1-2 Features of the IDU 950A

Item	Description
Chassis height	2 U
Pluggable	Supported
The maximum number of radio directions	12

Item	Description
RF configuration mode	● N+0 non-protection configuration ● Nx(1+0) non-protection configuration ● 1+1 protection configuration ● N+1 protection configuration ● XPIC configuration ● 2CA configuration ● 4x4 MIMO configuration
Service interface type	● Native E1 interface ● Smart E1 interface ● T1 interface ● STM-1 optical/electrical interface ● FE optical/electrical interface ● GE optical/electrical interface ● 2.5GE optical interface ● 10GE optical interface

Figure 1-3 Appearance of the IDU 950A

ODU

The ODU is the outdoor unit for the OptiX RTN 900. It converts frequencies and amplifies signals.

The OptiX RTN 900 product series can use the RTN 600 ODU and RTN XMC ODU, covering the entire frequency band from 6 GHz to 42 GHz.

NOTE

Table 1-3 lists the highest modulation schemes supported by the ODU in different frequency bands. For the maximum modulation scheme supported by the ODU in different channel spacings, see IF Running Modes and Microwave Work Modes in the *Product Description*.

Table 1-3 RTN XMC ODUs that the OptiX RTN 950A supports

ODU type	Description		
	Frequency band	Highest-order Modulation	Channel spacing
XMC-2	6/7/8/10/10.5/11/13/15/18/23/26/28/32/38/42 GHz	2048QAM (13/15/18/23/38 GHz, 7/8 GHz XMC-2E) 1024QAM (6/10/10.5/11/26/28/32/42 GHz) 256QAM (7/8 GHz Normal)	7/14/28/40/50/56 MHz **NOTE** The 10.5 GHz frequency band does not support 40/50/56 MHz channel spacing.
XMC-2H	6/7/8/11 GHz	2048QAM	7/14/28/40/56 MHz
XMC-3	7/8/11/13/15/18/23/26/28/32/38 GHz	4096QAM (7/8/11/13/15/18/23/26 GHz) 2048QAM (28/32/38 GHz)	3.5/7/14/28/40/56 MHz (7/8/11/13/15/18/23/26/28/38 GHz) 3.5/7/14/28/40/56/112 MHz (32 GHz)
XMC-3W	7/8/13/18/15/23 GHz	4096QAM	3.5/7/14/28/40/56 MHz
XMC-3H	15/18/23/28/38 GHz	8192QAM	3.5/7/14/28/40/56/112 MHz
XMC-5D	13/15/18 GHz	4096QAM (13/15 GHz) 2048QAM (18 GHz)	7/14/28/40/56/112 MHz **NOTE** Olny the 18 GHz frequency band supports 112 MHz channel spacing.

Table 1-4 RTN 600 ODUs that the OptiX RTN 950A supports

Item	Description	
	High-Power ODU	Standard Power ODU
ODU type	HP, HPA	SP, SPA
Frequency band	6/7/8/10/10.5/11/13/15/18/23/26/28/32/38 GHz (HP) 6/7/8/11/13/15/18/23 GHz (HPA)	7/8/11/13/15/18/23/26/38 GHz (SP ODU) 6/7/8/11/13/15/18/23 GHz (SPA ODU)
Highest-order Modulation	256QAM	256QAM

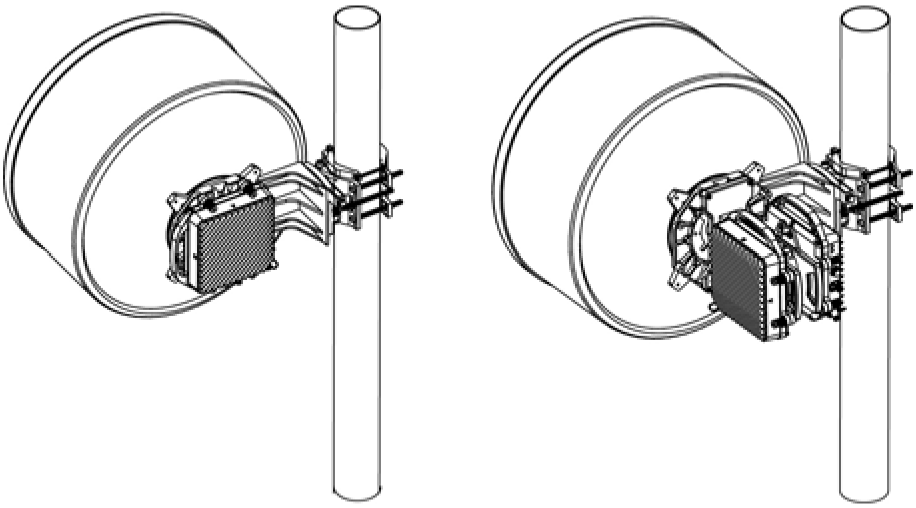
Item	Description	
	High-Power ODU	Standard Power ODU
Channel spacing	7/14/28/40/56 MHz (6/7/8/10/11/13/15/18/23/26/28/32/38 GHz) 7/14/28 MHz (10.5 GHz)	3.5/7/14/28 MHz

There are two methods for mounting the ODU and the antenna: direct mounting and separate mounting.

- The direct mounting method is generally adopted when a small- or medium-diameter and single-polarized antenna is used. In this situation, if one ODU is configured for one antenna, the ODU is directly mounted at the back of the antenna. If two ODUs are configured for one antenna, an RF signal combiner/splitter (hence referred to as a hybrid coupler) must be mounted to connect the ODUs to the antenna. **Figure 1-4** illustrates the direct mounting method.

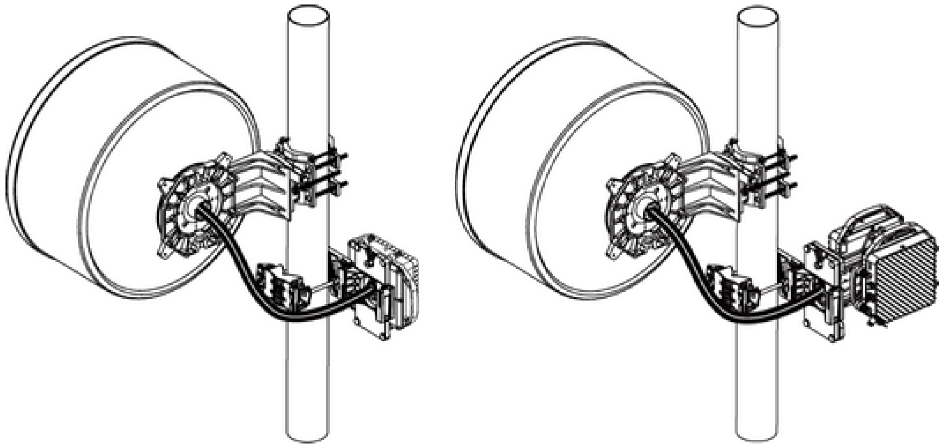
  The direct mounting method can also be adopted when a small- or medium-diameter and dual-polarized antenna is used. Two ODUs are mounted onto an antenna using an orthomode transducer (OMT). The method for installing an OMT is similar to that for installing a hybrid coupler.

  Figure 1-4 Direct mounting



- The separate mounting method is adopted when a large- or medium-diameter and single- or dual-polarized antenna is used. **Figure 1-5** shows the separate mounting method. In this situation, a hybrid coupler can be mounted (two ODUs share one feed boom).

Figure 1-5 Separate mounting



NOTE

The OptiX RTN 950A provides an antenna solution that covers the entire frequency band, and supports single-polarized antennas and dual-polarized antennas with diameters of 0.3 m to 3.7 m along with the corresponding feeder system. In addition, the OptiX RTN 950A provides dual-band antennas with a diameter of 0.3 m to 0.6 m, which are developed for SDB.

2 Chassis

The IDU of the OptiX RTN 950A is a 2U chassis. It can be deployed in a variety of scenarios and on several different types of racks, cabinets, and surfaces.

2.1 Chassis Structure
The dimensions (H x W x D) of the IDU 950A chassis are 88 mm x 442 mm x 220 mm. The IDU 950A chassis has an air-cooled four-layered structure.

2.2 Installation Methods
The IDU 950A can be deployed in a variety of scenarios and on several different types of racks, cabinets, and surfaces.

2.3 Air Duct
An IDU 950A chassis supports air cooling, with air inlet on the left side and air outlet on the right side.

2.4 IDU Labels
Product nameplate labels, qualification card labels, ESD protection labels, grounding labels, laser safety class labels, high temperature warning labels, and operation warning labels, and other types of labels are attached to their respective positions on the IDU chassis or boards. Adhere to the warnings and instructions on the labels when performing various types of tasks, thereby avoiding bodily injuries or damage to the IDU.

2.1 Chassis Structure

The dimensions (H x W x D) of the IDU 950A chassis are 88 mm x 442 mm x 220 mm. The IDU 950A chassis has an air-cooled four-layered structure.

Figure 2-1 shows the chassis structure of the IDU 950A.

Figure 2-1 Structure of the IDU 950A chassis

Figure 2-2 Slots of the IDU 950A

<table>
<tr><td rowspan="4">Slot 11 (FAN)</td><td colspan="2">Slot 7 (CSHO)</td></tr>
<tr><td>Slot 5 (EXT)</td><td>Slot 6 (EXT)</td></tr>
<tr><td>Slot 3 (EXT)</td><td>Slot 4 (EXT)</td></tr>
<tr><td>Slot 1 (EXT)</td><td>Slot 2 (EXT)</td></tr>
</table>

2.2 Installation Methods

The IDU 950A can be deployed in a variety of scenarios and on several different types of racks, cabinets, and surfaces.

The IDU 950A can be installed:

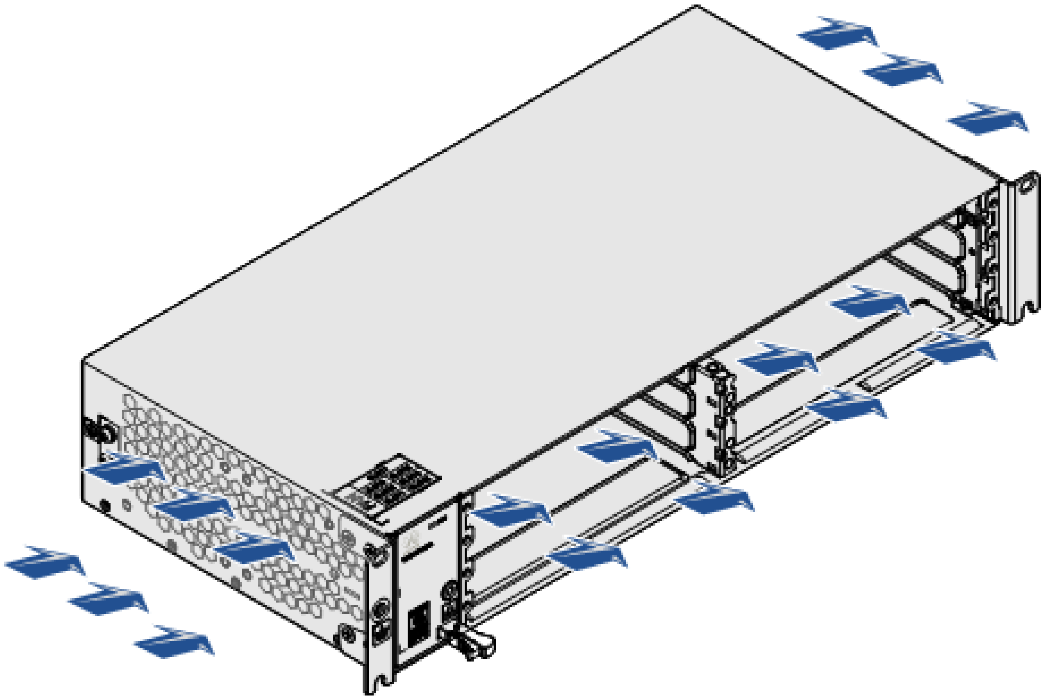
- In a 300 mm-deep European Telecommunications Standards Institute (ETSI) cabinet
- In a 600 mm-deep ETSI cabinet
- In a 450 mm-deep 19-inch cabinet
- In a 600 mm-deep 19-inch cabinet
- In a 19-inch open rack
- In a wireless-equipment outdoor cabinet
- On a wall
- On a table

2.3 Air Duct

An IDU 950A chassis supports air cooling, with air inlet on the left side and air outlet on the right side.

Figure 2-3 shows the air duct in an IDU 950A chassis.

Figure 2-3 Air duct in an IDU 950A chassis



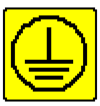
2.4 IDU Labels

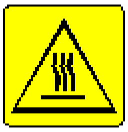
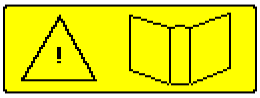
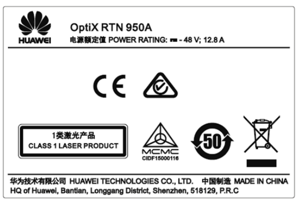
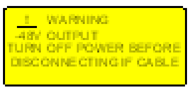
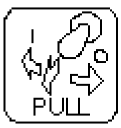
Product nameplate labels, qualification card labels, ESD protection labels, grounding labels, laser safety class labels, high temperature warning labels, and operation warning labels, and other types of labels are attached to their respective positions on the IDU chassis or boards. Adhere to the warnings and instructions on the labels when performing various types of tasks, thereby avoiding bodily injuries or damage to the IDU.

Label Description

Table 2-1 provides the description of the labels on the IDU chassis and boards. Actual labels may vary depending on the configurations of the chassis and boards.

Table 2-1 Description of the IDU labels

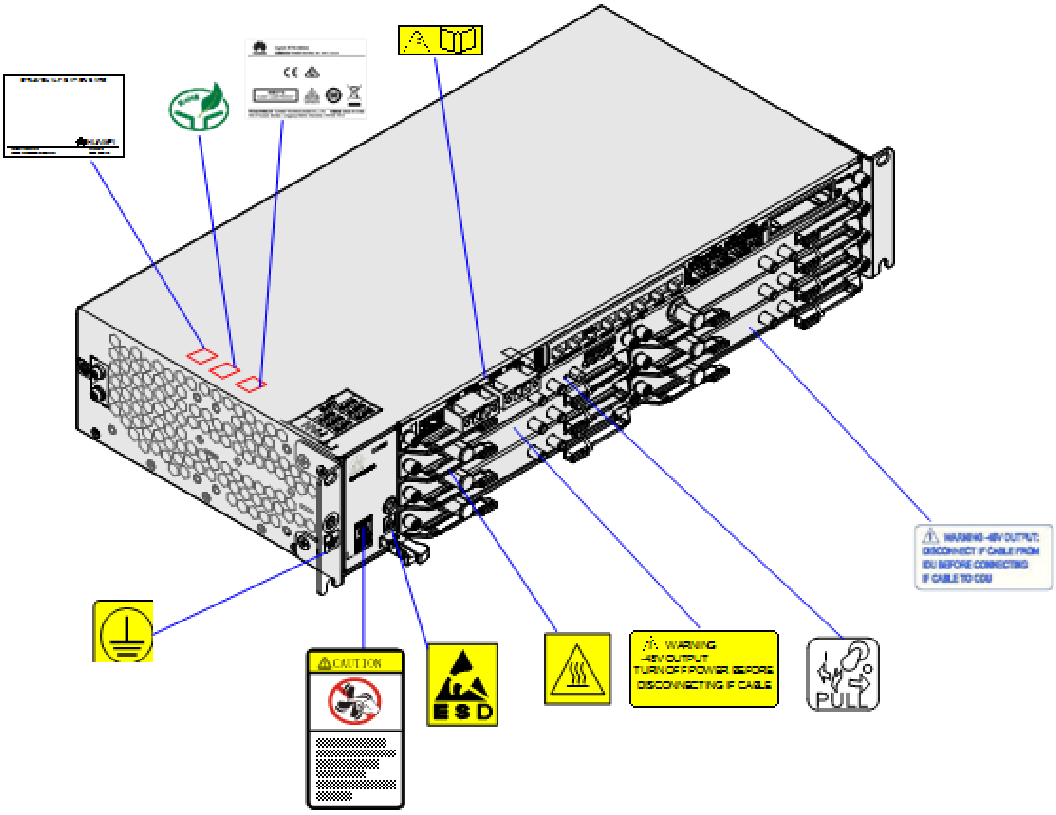
Label	Label Name	Description
	ESD protection label	Indicates that the equipment is sensitive to static electricity.
	Grounding label	Indicates the grounding position of the IDU chassis.

Label	Label Name	Description
	Fan warning label	Warns you not to touch fan leaves when the fan is rotating.
	High temperature warning label	Indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. In such a case, wear protective gloves to handle the board.
	Power caution label	Instructs you to read related instructions before performing any power-related tasks.
	Qualification card label	Indicates that the equipment has been quality checked.
	RoHS label	Indicates that the equipment complies with the related requirements specified in the RoHS directive.
	Product nameplate label	Indicates the product name and certification.
	Operation warning label	Instruct you to turn off the ODU power switch before removing an IF cable.
	Operation guidance label	Instructs you to slightly pull the switch lever outwards before setting the switch to the "I" or "O" position.
	Operation warning label	Instructs you to disconnect the IF cable from the IDU before connecting the IF cable to the ODU.

Label Position

Figure 2-4 shows the positions of the labels on the IDU 950A chassis.

Figure 2-4 Positions of the IDU 950A labels



3 Boards

The IDU 950A supports the following types of boards: system control, switching, and timing boards, IF boards, Ethernet boards, SDH boards, PDH boards, power supply boards, and fan boards.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EFP8, EMS6, and SLF1CSHO boards.

The ISU2 is a universal IF board that supports the Integrated IP microwave mode and SDH radio mode at the same time. The ISU2 uses the DC-I power distribution mode.

3.10 ISX2

The ISX2 is a universal XPIC IF board and provides the XPIC function for signals transmitted/received in Integrated IP microwave mode and SDH radio mode. The ISX2 uses the DC-I power distribution mode.

3.11 IFU2

The IFU2 is a universal IF board that supports the Integrated IP microwave mode. The IFU2 uses the DC-I power distribution mode.

3.12 EG4/EG4P

EG4/EG4P boards are 4xGE interface boards, which provide flexible combinations of port types to meet a wide variety of service requirements. One EG4/EG4P board provides a maximum of four ports, two always being RJ45 electrical ports and the other two being small form-factor pluggable (SFP) ports or RJ45 electrical ports. On an EG4P board, the two fixed RJ45 electrical ports provide the RTN 300 full-outdoor radio equipment series with power and service signals simultaneously.

3.13 EX1

EX1 boards are 1x10GE processing boards. This board can be used only with the CSHOF board.

3.14 EM6

EM6 boards are 6-port Ethernet interface boards. The interface types can be flexibly combined based on service requirements. An EM6 board provides two fixed RJ45 FE electrical ports and the other four ports can be SFP ports or RJ45 electrical ports.

3.15 EM6D

EM6D is a 6-port Ethernet processing board that supports the Super Dual Band feature. It provides two 10GE ports, two 2.5GE ports, and two GE ports.

3.16 EMS6

The EMS6 is an FE/GE EoSDH processing board providing the L2 switching function. It provides four FE electrical ports and two GE ports using small form-factor pluggable (SFP) optical/electrical modules.

3.17 EFP8

The EFP8 is an 8-port FE EoPDH processing board. The EFP board is connected to the packet plane through its bridging GE port.

3.18 SL1DA

The SL1DA is a 2xSTM-1 optical interface board. The SL1DA can also provide STM-1 electrical ports by using SFP electrical modules.

3.19 ML1/MD1

The ML1 is a 16xSmart E1 service processing board. The MD1 is a 32xSmart E1 service processing board.

3.20 CQ1

CQ1 boards are 4-port channelized STM-1 processing boards.

3.21 MN1

MN1 boards are multiple-protocol null-port circuit emulation extended boards.

3.22 SP3S/SP3D

The SP3S is a 16xE1 75-ohm/120-ohm tributary board. The SP3D is a 32xE1 75-ohm/120-ohm tributary board. The SP3SA VER.C and SP3DA VER.C can be used as a 16xT1 100-

ohm tributary board and a 32xT1 100-ohm tributary board respectively. In the board names, A indicates the feature code and VER.C indicates the board version.

3.23 AUX
The AUX is an auxiliary management interface board of the OptiX RTN 950A.

3.24 FAN
The FAN is a fan board that dissipates heat generated in the chassis through air cooling.

3.25 TCU6
The TDM connecting unit (TCU6) is a 6xE1 port conversion board. The TCU6 implements conversion between DB44 ports and RJ45 ports.

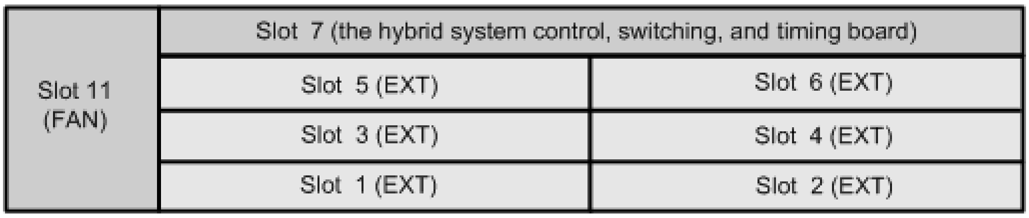
3.1 Board List

The IDU 950A provides various functions with different boards inserted.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EFP8, EMS6, and SLF1CSHO boards.

Figure 3-1 IDU slot layout



NOTE

"EXT" represents an extended slot, which can house any type of IF board or interface board.

Table 3-1 List of the IDU boards

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
CSHO	Hybrid system control, switching, and timing board	Slot 7	-	● Provides full time-division cross-connections of VC-12/VC-3/VC-4 services equivalent up to 32x32 VC-4s. ● Provides a 10 Gbit/s packet switching capability. ● The new SLF2CSHO board supports L3VPN functions (SLF2 is the functional version). ● Performs system communication and control. ● Supports anti-Theft function. ● Provides two -48 V DC power input ports. ● Supports the clock processing function, providing one external clock input/output port and two external time input/output ports. The first external time port uses the same physical connector as the external clock port. ● Uses SFP modules to provide two STM-1 optical/ electrical ports. When CSHO boards work with MN1 boards, these ports can be configured as channelized STM-1 ports, which support CES E1s and ML-PPP E1s. ● Provides sixteen TDM E1/T1 ports. SupportsE1 ports support 75-ohm/120-ohm adaptive impedance. T1 ports support 100-ohm impedance. The mode of a TDM E1/T1 port can be configured through software. Only SLF2CSHO boards support T1 ports. When CSHO boards work with MN1 boards, these TDM E1 ports can be configured as Smart E1 ports, which support CES E1s, ML-PPP E1s, and fractional E1s. ● Provides six GE ports, of which four can only be RJ45 GE electrical ports and the other two can be GE/FE optical ports or GE electrical ports equipped with SFP modules. The GE electrical ports are compatible with the FE electrical ports. ● Provides one Ethernet NM port, one NM serial port, and one NM cascade port. ● Provides one Huawei outdoor cabinet monitoring port, which uses the same physical connector as the second external time port. ● Provides a USB port that allows data to be backed up using a USB flash drive. **NOTE** A CSHO board can house a WLAN module only when using the SLF2 functional version.

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
CSHOF	Hybrid system control, switching, and timing board	Slot 7	-	● Provides full time-division cross-connections of VC-12/VC-3/VC-4 services equivalent up to 32x32 VC-4s. ● Provides a 90 Gbit/s packet switching capability. ● Performs system communication and control. ● Supports anti-Theft function. ● Provides two -48 V DC power input ports. ● Supports Super Dual Band. ● Supports the clock processing function, providing one external clock input/output port and one external time input/output ports. The external time port uses the same physical connector as the external clock port. ● Provides six Ethernet service ports, of which two can be 10GE/2.5GE/GE optical ports equipped with SFP+/SFP modules, two can be RJ45 GE electrical ports, and the other two can be GE/FE optical ports or GE electrical ports equipped with SFP modules or RJ45 GE electrical ports. The GE3 and GE4 fixed electrical ports share the same physical channel with the GE3 and GE4 optical ports. Every channel can implement only one function at a time. ● Uses SFP modules to provide two STM-1 optical/electrical ports. STM-1-1 and STM-1-2 share the same physical ports with the GE3 and GE4 optical ports. Every port can implement only one function at a time. But when the two ports are STM-1 ports, the GE3/GE4 RJ45 GE electrical ports can be used. ● Provides sixteen TDM E1 ports. E1 ports support 75-ohm/120-ohm adaptive impedance. ● Supports CES. ● Provides one Ethernet NM port, one NM serial port, and one NM cascade port. ● Provides one Huawei outdoor cabinet monitoring port, which uses the same physical connector as the external time port and external clock port. ● Provides a USB port that allows data to be backed up using a USB flash drive. And the port supports housing a WLAN module.

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
ISU2	Universal IF board	Slot 1 to Slot 6	CSHO/ CSHOF	● Provides one IF port. ● Supports modulation schemes from QPSK to 256QAM. ● Supports integrated IP microwave and SDH microwave using the Native E1+Ethernet, Native STM-1+Ethernet, or SDH service mode. ● Supports the AM function. ● Supports air-interface bandwidth acceleration (Ethernet frame header compression). ● Supports the PLA function. ● Supports the EPLA function when working with CSHOF.
ISX2	Universal XPIC IF board	Slot 1 to Slot 6	CSHO	● Provides one IF port. ● Supports modulation schemes from QPSK to 256QAM. ● Supports integrated IP microwave and SDH microwave using the Native E1+Ethernet, Native STM-1+Ethernet, or SDH service mode. ● Supports the XPIC function. ● Supports the AM function. ● Supports the AM booster function. ● Supports air-interface bandwidth acceleration (Ethernet frame header compression). ● Supports the PLA function. ● Supports the EPLA function on OptiX RTN 950A.

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
ISV3	Versatile IF board	Slot 1 to Slot 6	CSHO/ CSHOF	● Provides one IF port. ● Supports multiple IF running modes: – IS3: The highest-order modulation mode is 2048QAM. When working in IS3 mode, ISV3 boards can interconnect with each other or with RTN 905 s. **NOTE** When working at a channel spacing 3.5 MHz, ISV3 boards can interconnect only with ISV3 boards. – IS2: The highest-order modulation mode is 256QAM. When working in IS2 mode, ISV3 boards can interconnect with ISU2/ISX2 boards. ● Supports integrated IP microwave and SDH microwave using the Native E1+Ethernet, Native STM-1+Ethernet, or SDH service mode. ● Supports the XPIC function. ● Supports the AM function. ● Supports air-interface bandwidth acceleration (Ethernet frame header compression) and enhanced Ethernet frame compression (payload compression). ● Supports AES256-based encryption at air interfaces. ● Supports the PLA function. ● Supports the EPLA/EPLA+ function on OptiX RTN 950A. ● Supports anti-Theft function.

<table>
<tr><th>Board Acronym</th><th>Board Name</th><th>Valid Slot</th><th>Required System Control Board</th><th>Description</th></tr>
<tr><td>ISM6</td><td>Two-channel versatile IF board</td><td>Slot 1 to Slot 6</td><td>CSHO/ CSHOF</td><td>
Provides two IF ports. The two IF ports can be used together or independently.
Supports multiple IF running modes:
IS6-PLUS: The highest-order modulation mode is 4096QAM. The maximum channel spacing is 112 MHz (in this case, the highest-order modulation mode is 2048QAM).
IS6: The highest-order modulation mode is 4096QAM. The maximum channel spacing is 112 MHz (in this case, the highest-order modulation mode is 2048QAM).
IS3: The highest-order modulation mode is 2048QAM. When working in IS3 mode, ISM6 boards can interconnect with ISV3 boards or RTN 905 s.
IS2: The highest-order modulation mode is 256QAM. When working in IS2 mode, ISM6 boards can interconnect with ISU2/ISX2 boards.

Supports integrated IP microwave and SDH microwave using the Native E1+Ethernet, Native STM-1+Ethernet, or SDH service mode.
Supports 1+1 protection for two intra- or inter-board IF channels.
Supports XPIC for two intra-board IF channels.
Supports use of two boards to provide 1+1 protection for XPIC groups.
Supports intra-board PLA.
Supports EPLA/EPLA+.
Supports AM.
Supports air-interface bandwidth acceleration (Ethernet frame header compression).
Supports MIMO.
Supports anti-Theft function.
</td></tr>
</table>

<table>
<tr><th>Board Acronym</th><th>Board Name</th><th>Valid Slot</th><th>Required System Control Board</th><th>Description</th></tr>
<tr><td>ISM8</td><td>Dual-channel versatile IF board</td><td>Slot 1 to Slot 6</td><td>SLF2CSHO/ CSHOF</td><td>

Provides two IF ports. The two IF ports can be used together or independently.
Supports multiple IF running modes:

IS8: The highest-order modulation mode is 8192QAM. The maximum channel spacing is 112 MHz (in this case, the highest-order modulation mode is 4096QAM).
IS6: The highest-order modulation mode is 4096QAM. The maximum channel spacing is 112 MHz (in this case, the highest-order modulation mode is 2048QAM).
IS3: The highest-order modulation mode is 2048QAM. When working in IS3 mode, ISM6 boards can interconnect with ISV3 boards or RTN 905 s.

Supports integrated IP microwave and SDH microwave using the Native E1+Ethernet, Native STM-1+Ethernet, or SDH service mode.
Supports 1+1 protection for two intra- or inter-board IF channels.
Supports XPIC for two intra-board or inter-board IF channels.
Supports use of two boards to provide 1+1 protection for XPIC groups.
Supports intra-board PLA.
Supports EPLA.
Supports AM.
Supports CA.
Supports MIMO.
Supports air-interface bandwidth acceleration (Ethernet frame header compression).
Supports AES256-based encryption at air interfaces.
</td></tr>
<tr><td>IFU2</td><td>Universal IF board</td><td>Slot 1 to Slot 6</td><td>CSHO</td><td>

Provides one IF port.
Supports modulation schemes from QPSK to 256QAM.
Supports integrated IP microwave using the Native E1+Ethernet service mode.
Supports the AM function.
Supports the EPLA function on OptiX RTN 950A.
</td></tr>
</table>

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
SL1DA	2xSTM-1 interface board	Slot 1 to Slot 6	CSHO/ CSHOF	● Uses SFP modules to provide two STM-1 optical/ electrical ports. ● Support K-byte transparent transmission.
CQ1	4-port channelized STM-1 interface board	Slot 1 to Slot 6	CSHO/ CSHOF	● Uses the SFP optical modules to provide four channelized STM-1 optical/electrical ports. ● Supports CES E1 and ML-PPP E1 processing for E1s in STM-1 frames. ● Transmits overhead bytes over CES E1s.
EM6D	2x10GE /GE +4xGE Ethernet Service Processing Board with Super Dual Band Feature	Slot 1/3/5	SLF2CSHO	● Uses SFP+/SFP optical modules to provide two GE, 2.5GE, or 10GE optical ports. The 2.5GE optical port can only be used to connect to the private port of Huawei OptiX RTN equipment. ● Provides two GE electrical ports. ● Supports Super Dual Band. ● Complies with IEEE 1588v2 and ITU-T G.8275.1.
EM6	4-port RJ45/SFP + 2-port RJ45 Fast Ethernet /Gigabit Ethernet interface board	slot 1 to slot 6	CSHO/ CSHOF	● Provides four GE ports and two FE electrical ports, of which the GE ports can be RJ45 GE electrical ports or SFP GE optical ports. The GE electrical ports are compatible with the FE electrical ports. ● Supports synchronous Ethernet. ● Supports the IEEE 1588v2 and ITU-T G.8275.1.
EG4	2-port RJ45/SFP + 2-port RJ45 Gigabit Ethernet interface board	Slot 1 to Slot 6	CSHO/ CSHOF	● Provides four GE ports, of which two can be RJ45 GE electrical ports or SFP GE optical ports and the other two can only be RJ45 GE electrical ports. The GE electrical ports are compatible with the FE electrical ports. ● Supports synchronous Ethernet. ● Supports the IEEE 1588v2 and ITU-T G.8275.1. ● Supports anti-Theft function.

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
EG4P	2-port RJ45/SFP + 2-port RJ45 Gigabit Ethernet interface board, providing the power supply function	Slot 1 to Slot 6	CSHO/ CSHOF	● Provides four GE ports, of which two can be RJ45 GE electrical ports or SFP GE optical ports and the other two can only be RJ45 GE electrical ports supporting the power over Ethernet function. The GE electrical ports are compatible with the FE electrical ports. ● Supports synchronous Ethernet. ● Supports the IEEE 1588v2 and ITU-T G.8275.1. ● Supports anti-Theft function.
EX1	1x10GE interface board	Slot 1/2	CSHOF	● Uses XFP modules to provide one 10GE port. ● Supports synchronous Ethernet. ● Supports IEEE 1588v2 and ITU-T G.8275.1.
EFP8	8-port RJ45 FE EoPDH processing board with the switching function	Slot 1 to Slot 6	CSHO	● Provides eight FE electrical ports. ● Bridges to the packet plane through one internal GE port. ● Processes EoPDH services. ● Supports transparently transmitted services and L2 switched services. ● Supports synchronous Ethernet.
EMS6	4-port RJ45 and 2-port SFP FE/GE EoSDH processing board, providing the switching function	Slot 1 to Slot 6	CSHO	● Provides four FE electrical ports. ● Uses SFP modules to provide two GE optical ports or GE electrical ports. The GE electrical ports are compatible with the FE electrical ports. ● Bridges to the packet plane through one internal GE port. ● Processes EoSDH services. ● Supports transparently transmitted Ethernet services and L2 switched services. ● Supports synchronous Ethernet.
ML1	16xE1 (Smart) tributary board	Slot 1 to Slot 6	CSHO	● Provides sixteen 75-ohm or 120-ohm Smart E1 ports. ● Supports CES E1, ATM/IMA E1, ML-PPP E1, and Fractional E1 functions.

Board Acronym	Board Name	Valid Slot	Required System Control Board	Description
MD1	32xE1 (Smart) tributary board	Slot 1 to Slot 6	CSHO	• Provides thirty-two 75-ohm or 120-ohm Smart E1 ports. • Supports CES E1, ATM/IMA E1, ML-PPP E1, and Fractional E1 functions.
MN1	Multi-protocol processing board	Slot 1	CSHO/ CSHOF	• Provides multi-protocol function extension, and supports the CES and ML-PPP functions. • After MN1 boards are configured, STM-1 ports on CSHO boards can be configured as channelized STM-1 ports, and E1 ports can be configured as Smart E1 ports. E1 channels over channelized STM-1 ports support the CES E1 and ML-PPP functions. Smart E1 ports support CES E1, ML-PPP E1, and fractional E1 functions. • After MN1 boards are configured, STM-1 ports on CSHOF boards can be configured as channelized STM-1 ports. E1 channels over channelized STM-1 ports support the CES E1 function. Channelized emulation can be directly implemented on E1 ports through MP1 boards of system control boards and does not require MN1 boards. • Has no port on its front panel.
SP3S	16xE1 tributary board	Slot 1 to Slot 6	CSHO/ CSHOF	Provides sixteen 75-ohm or 120-ohm TDM E1 ports or 100-ohm TDM T1 ports whose modes can be configured through software.
SP3D	32xE1 tributary board	Slot 1 to Slot 6	CSHO/ CSHOF	Provides thirty-two 75-ohm or 120-ohm TDM E1 ports or 100-ohm TDM T1 ports whose modes can be configured through software.
AUX	Auxiliary interface board	Slot 1 to Slot 6	CSHO/ CSHOF	Provides one orderwire port, one asynchronous data port, one synchronous data port, and four-input and two-output external alarm ports.
TCU6	6xE1 connector conversion board	Slot 1 to Slot 6	CSHO	Provides one DB44 connector and six RJ45 connectors. When used with an E1 tributary board and an Anea 96-to-DB44 transit cable, it converts E1s 1 to 6 on the Anea 96 connector into RJ45 connectors.
FAN	Fan board	Slot 11	CSHO/ CSHOF	Air-cools the IDU.

3.2 Board Appearance

The dimensions (H x W x D) of the board in the extended slot of the IDU 950A chassis are 19.82 mm x 193.80 mm x 225.80 mm. The dimensions (H x W x D) of the system control, switching, and timing board in the IDU 950A chassis are 22.36 mm x 388.40 mm x 269.73 mm.

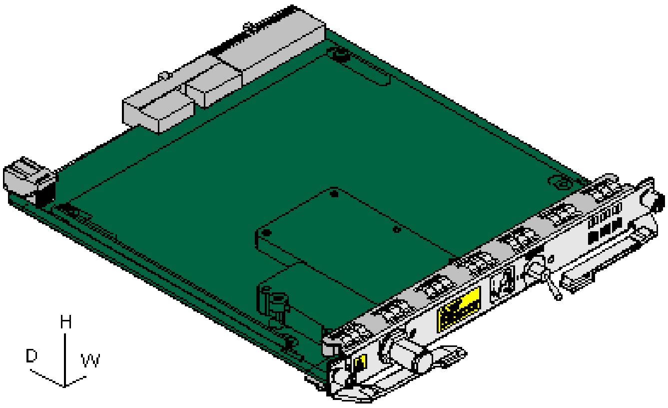
NOTE

The depth of the board refers to the distance between the front panel and the end of the PCB.

Board Appearance

Figure 3-2 shows the appearance of an ISV3 board in an IDU 950A chassis.

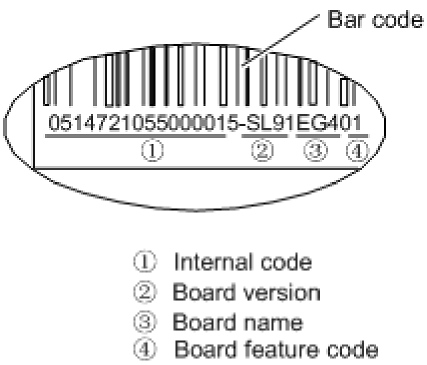
Figure 3-2 Appearance of an ISV3 board



Bar Code

The front panel of a board has two ejector levers and two captive screws. The ejector levers help you remove or insert a board. The captive screws fasten a board to the chassis. A board bar code (as shown in **Figure 3-3**) is attached to one of the ejector levers.

Figure 3-3 Bar code



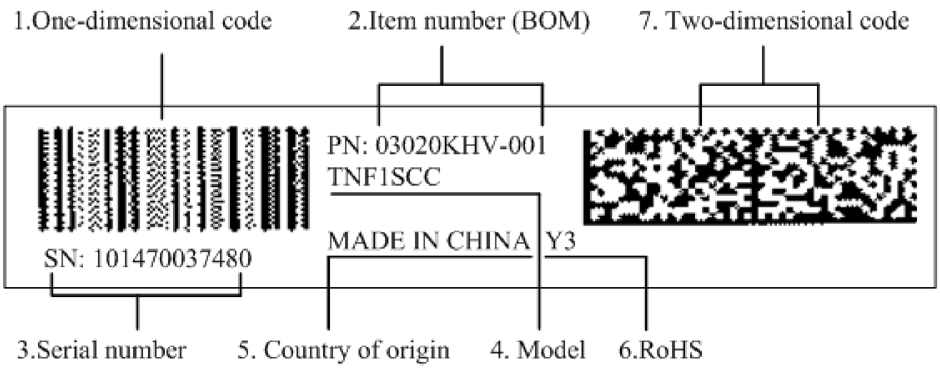
NOTE

The bar codes of some boards contain board feature codes, which further classify boards. For example, the feature codes of some boards using SFP modules (such as EG4) indicate the type of SFP module being used, and the feature codes of some other boards providing E1 ports (such as SP3S) indicate the impedance of E1 ports.

Two-dimensional Barcode Label of a Board

Figure 3-4 shows a two-dimensional bar code, and Table 3-2 provides the description of the bar code.

Figure 3-4 Board's two-dimensional bar code



NOTE

The bar code in the figure is only an example and it may differ in practice.

Table 3-2 Description of the two-dimensional bar code of a board

No.	Item	Description
1	One-dimensional code	A one-dimensional code contains the serial number of an item, compliant with ISO/IEC 15417 Code 128, and provided for barcode scanning. One-dimensional codes are retained for business continuity.
2	Item number (BOM)	An item number indicates the ID of an item. Huawei's item number is a string of 8 to 17 characters, including letters, digits, and special characters such as "-" and "=". An item number is also known as a part number (PN). The item number of a board is a string of 8 or 12 characters.

No.	Item	Description
3	Serial number	Serial number (SN) is the exclusive identifier of an item. The SN can help after-sales personnel identify the maintenance period. The value is a string of 12, 16, or 20 characters containing digits and letters. The value is a string of 12, 16, or 20 characters containing digits and letters.
4	Model	The value consists of digits and letters. For a board, this field contains information about the version, name, and board feature codes. **NOTE** Only the bar codes of some boards contain board feature codes, which further classify boards. For example, the feature codes of some boards using SFP modules (such as EG4) indicate the type of SFP module being used, and the feature codes of some other boards providing E1 ports (such as ML1) indicate the impedance of E1 ports.
5	Country of origin	Indicates the country where the item is manufactured.
6	RoHS	An environmental friendliness flag code identifies the environmental protection information.
7	Two-dimensional code	A two-dimensional code normally contains the serial number, item number, and manufacturer identifier. Some two-dimensional codes do not contain manufacturer identifier due to length limitations. Two-dimensional codes comply with the ISO16022 - Data Matrix standard and are provided for barcode scanning as an upgrade of the one-dimensional code. Manufacturer identifier: Manufacturer information that Huawei applies for from the Electronic Data Interchange Forum for Companies with Interests in Computing and Electronics (EDIFICE). The manufacturer identifier of Huawei is LEHWT.

3.2.1 Photos of System Control, Switching, and Timing Boards

This section provides photos of system control, switching, and timing boards.

Figure 3-5 CSHO board

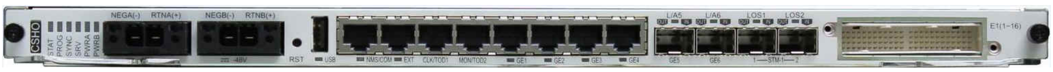


Figure 3-6 CSHOF board

3.2.2 Photos of IF Boards

This section provides photos of IF boards.

Figure 3-7 ISU2 board

Figure 3-8 ISX2 board

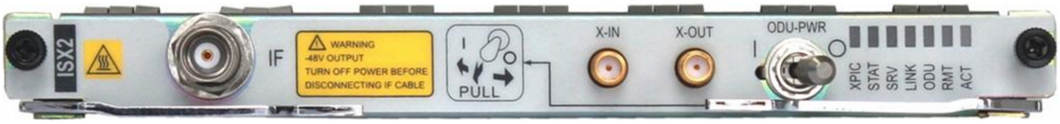


Figure 3-9 ISV3 board

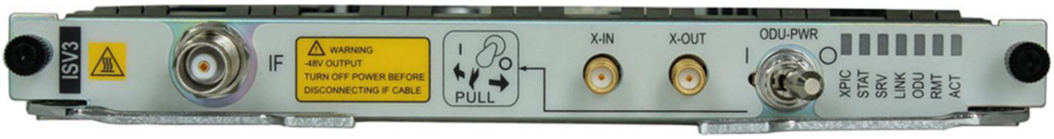


Figure 3-10 IFU2 board

Figure 3-11 ISM6 board

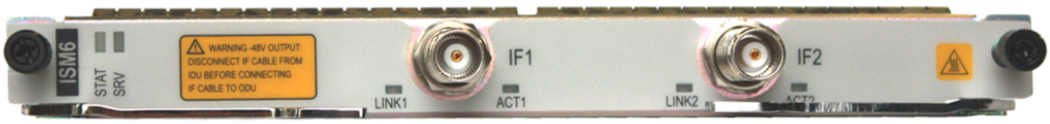


Figure 3-12 ISM8 board

3.2.3 Photos of Service Boards

This section provides photos of some service boards.

Figure 3-13 CQ1 board

Figure 3-14 EM6 board

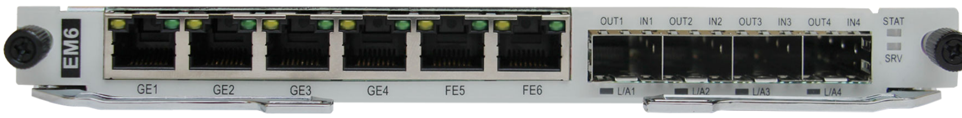


Figure 3-15 EG4 board

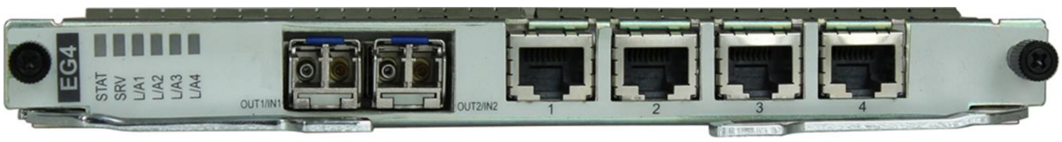


Figure 3-16 EG4P board

Figure 3-17 EM6D board

Figure 3-18 EFP8 board

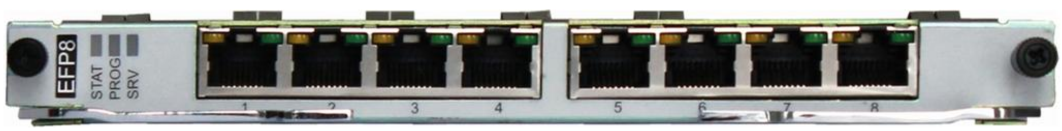


Figure 3-19 EMS6 board

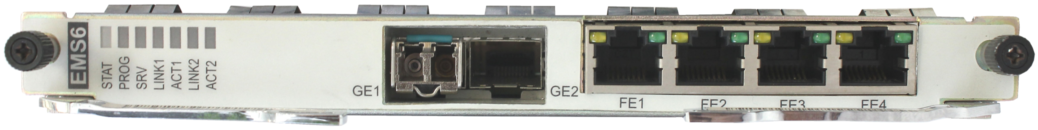


Figure 3-20 ML1 board

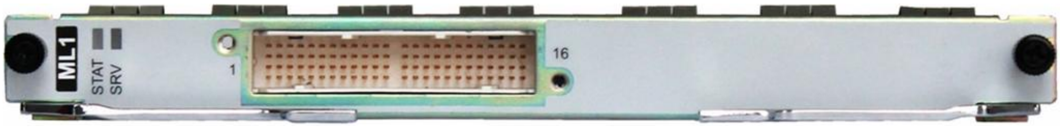
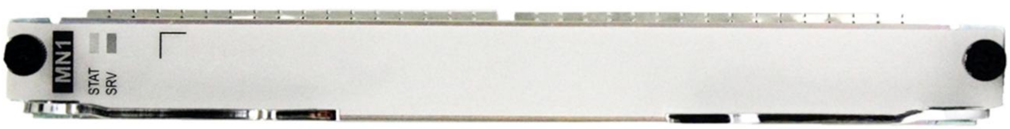


Figure 3-21 SP3S board

Figure 3-22 SP3D board

Figure 3-23 MN1 board



3.3 Function Differences Between Boards of the Same Type

3.3.1 Differences Between Universal IF Boards

Universal IF boards of different models have different features.

NOTE

Y indicates that a board supports a function, and N indicates that a board does not support a function.

Table 3-3 Differences between universal IF boards

Item			Specifications					
			IFU2	ISU2	ISX2	ISV3	ISM6	ISM8
Microwave types	Integrated IP microwave	Native E1 + Ethernet	Y	Y	Y	Y	Y	Y
		Native STM-1 + Ethernet	N	Y	Y	Y	Y	Y
	SDH microwave	STM-1	N	Y	Y	Y	Y	Y
		2 x STM-1	N	Y	Y	Y	Y	Y
Ethernet frame header compression			N	Y	Y	Y	Y	Y
Payload compression			N	N	N	Y	N	Y
MIMO			N	N	N	N	Y	Y
112 MHz channel spacing			N	N	N	N	Y	Y
1 Gbit/s backplane bus bandwidth			Y	Y	Y	Y	Y	Y
2.5 Gbit/s backplane bus bandwidth			N	N	N	N	Y	Y
2 x 2.5 Gbit/s backplane bus bandwidth			N	N	N	N	N	Y
XPIC			N	N	Y	Y	Y	Y[e]
K byte pass-through			N	Y	Y	Y	Y	Y
AES-based encryption at air interfaces			N	N	N	Y	N	Y
PLA			N	Y	Y	Y	Y	Y
EPLA			Y	Y	Y	Y	Y	Y
EPLA+			N	N	N	Y[c]	Y	N
Anti-theft function			N	N	N	Y	Y	N
CA			N	N	N	N	N	Y
Highest-order modulation scheme		256QAM	Y	Y	Y	Y	Y	Y
		2048QAM	N	N	N	Y[a]	Y[a]	Y
		4096QAM	N	N	N	N	Y[b]	Y

Item		Specifications					
		IFU2	ISU2	ISX2	ISV3	ISM6	ISM8
	8192QAM	N	N	N	N	N	Y[d]

NOTE

a: In IS3 mode, 2048QAM is supported only when AM is enabled.

b: 4096QAM is supported only in IS6 mode.

c: EPLA+ is available only when ISV3 boards work with ISM6 boards.

d: 8192QAM is supported only in IS8 mode.

e: Intra-board XPIC is supported but inter-board XPIC is not.

3.3.2 Differences Between Packet Ethernet Boards

Different types of packet Ethernet boards provide different functions and features.

NOTE

- "Y" indicates that the corresponding board supports the specific function, and "N" indicates that the corresponding board does not support the specific function.

Table 3-4 Differences between packet Ethernet boards

Item		Specifications				
		EG4	EG4P	EM6	EM6D	EX1[c]
Port specifications	Number of unpluggable FE electrical ports	-	-	2	-	-
	Number of unpluggable GE electrical ports	2[a]		-[b]	2	-
	Number of GE SFP ports	2		4[b]	4	-
	Number of 10GE Ethernet ports	-		-	2	1

Item	Specifications				
	EG4	EG4P	EM6	EM6D	EX1[c]
Backplane bus bandwidth	● 2x2.5 Gbit/s for slot 1/2 and 2.5 Gbit/s for slots 3 - 6 (working with the CSHOF) ● 2.5 Gbit/s (working with other system control boards)		● 2x2.5 Gbit/s for slot 1/2 and 2.5 Gbit/s for slots 3 - 6 (working with the CSHO) ● 2.5 Gbit/s (working with other system control boards)	2.5 Gbit/s	10 Gbit/s
IEEE 1588v2	Y		Y	Y	Y[d]
ITU-T G.8275.1 time synchronization	Y		Y	Y	Y[d]
IEEE 1588 ACR	Y		Y	Y	Y[d]
Device authentication	Y		Y	Y	Y[e]
Power over Ethernet	N	Y	N	N	N

NOTE

- a: In addition, two unpluggable GE ports are available, sharing service channels with the two SFP ports. The two types of ports cannot work at the same time, and only one type of ports can work at a time.
- b: Four fixed GE electrical ports are supported, which share the same service channel with four SFP ports. Only one type of port is valid at a time.
- c: EX1 boards must work with CSHOF boards.
- d: The specific function is supported only when the corresponding port works in LAN mode.
- e: Device authentication is supported only when the EX1 board used with the CSHOF board.

3.3.3 Differences Between System Control, Switching, and Timing Boards

Different system control, switching, and timing boards provide different functions and features.

NOTE

- This section describes the differences in the major functions and features of the system control, switching, and timing boards supported by the OptiX RTN 950A. For details, see the *Functions and Features* of the corresponding boards and the corresponding features in the *Feature Description*.
- "Y" indicates that the corresponding board supports the specific function, and "N" indicates that the corresponding board does not support the specific function.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EFP8, EMS6, and SLF1CSHO boards.

Table 3-5 Comparison between the major functions of the system control boards

Item	Functions and Features	IDU		
		SLF1CSHO	SLF2CSHO	CSHOF
Hardware Features	10GE/2.5GE/GE optical port	N	N	Y
	USB port	Y	Y	Y
	Pluggable CF card	N	N	N
Microwave Types	Hybrid microwave	Y	Y	Y
	Packet microwave	Y	Y	Y
	Routing microwave	N	Y	Y
Microwave Features	SDB	N	Y	Y
	MIMO	N	Y	Y
	CA	N	N	Y
	N+1 protection	Y	Y	Y
	Enhanced N+1 protection	N	N	N
	PLA	Y	Y	Y
	EPLA	Y	Y	Y
	EPLA+	Y	Y	N
	AES-based encryption at air interfaces	Y	Y	Y
	Ethernet frame header compression	Y	Y	Y
	Enhanced Ethernet frame compression	Y	Y	Y
Ethernet features	VLAN	Y	Y	Y
	QinQ	Y	Y	Y

Item	Functions and Features	IDU		
		SLF1CSHO	SLF2CSHO	CSHOF
based on the packet plane	Layer 2 switching	Y	Y	Y
	ERPS	Y	Y	Y
	SEP	Y	Y	Y
	RSTP	Y	Y	N
	LPT	Y	Y	N
	HQoS	Y	Y	Y
	ETH-OAM	Y	Y	Y
	Bandwidth notification	Y	Y	Y
MPLS	MPLS OAM	Y	Y	N
	MPLS-TP OAM	Y	Y	Y
PWE3		Y	Y	Y
L3VPN	Ntive IP	N	Y	N
	HVPN	N	Y	Y
Clock Features	IEEE 1588v2	Y	Y	Y
	G.8275.1	Y	Y	Y
	CES ACR	Y	Y	Y
	IEEE 1588 ACR	Y	Y	Y
	ITU-T G.8265.1 clock synchronization	N	Y	N
Maintenanc e Features	IP packet coloring and statistics collection	Y	Y	N
	TWAMP Light	Y	Y	Y

3.4 CSHO

CSHO boards are system control, switching, and timing board.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports SLF1CSHO boards.

3.4.1 Version Description

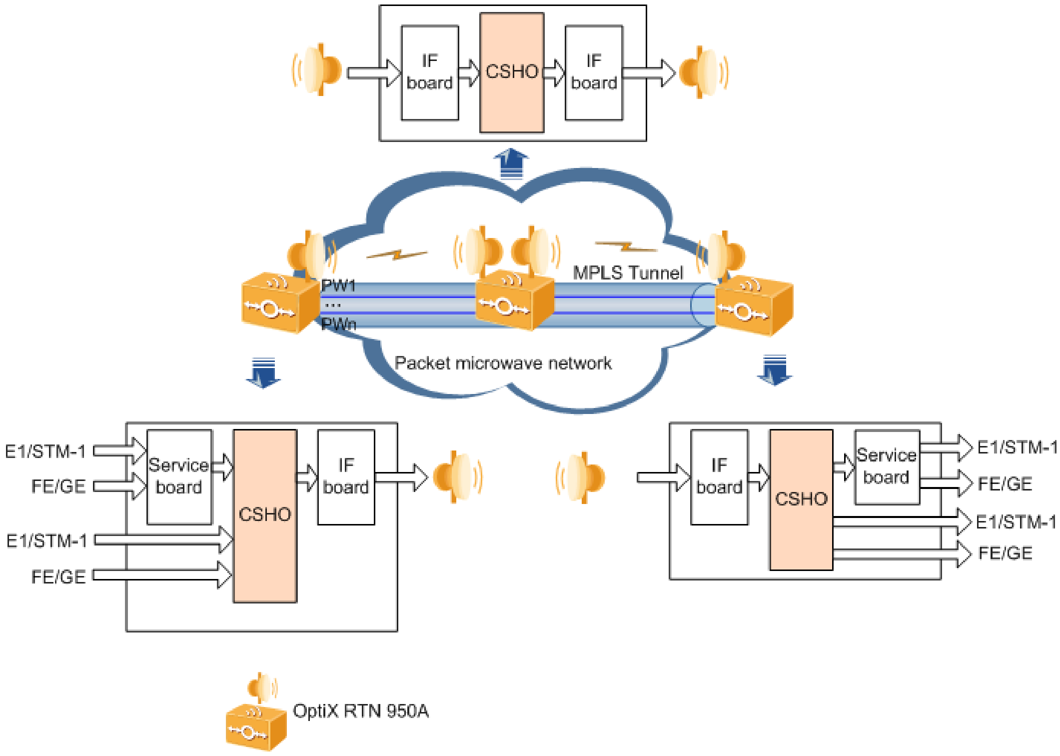
The CSHO boards have two functional versions: SLF1 and SLF2.

SLF2 supports L3VPN functions, the E1 interface can be configured as a T1 interface and WLAN modules, whereas SLF1 does not.

3.4.2 Application

CSHO boards function as system control, switching, and timing boards of RTN 950A. They converge and groom various services through GE/STM-1/E1 service ports and TDM/hybrid/packet microwave ports. The E1 interface supports the T1 function. The E1 service is used as an example to describe the application scenario. For the T1 service, the application scenario is similar.

Figure 3-24 Application scenario of CSHO boards



NOTE

- In the preceding figure, IF boards must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet or native STM-1+Ethernet mode.
- Service boards shown in the preceding figure can be native E1 interface boards, smart E1 interface boards, STM-1 interface boards, channelized STM-1 interface boards, or Ethernet interface boards.
- Ethernet ports on CSHO boards can carry MPLS tunnels, which allow CSHO boards to transmit Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3) services traversing microwave networks and regional backhaul networks in end-to-end mode.

3.4.3 Functions and Features

CSHO boards provide 10 Gbit/s packet switching capacity, full time-division cross-connection, system control and communication, and clock processing functions. In addition, CSHO boards provide GE, STM-1, E1/T1, auxiliary, and management ports.

Table 3-6 lists the functions and features that CSHO boards support.

Table 3-6 Functions and features that CSHO boards support

Function and Feature		Description
Basic functions	Switching capacity	Provides a 10 Gbit/s packet switching capacity.
	Cross-connect capacity	Supports full time-division cross-connections at the VC-12, VC-3, or VC-4 level, which are equivalent to 32x32 VC-4s.
	System control and communication	Manages, monitors, and controls the running status of the IDU, and works as a communication service unit between the network management system (NMS) and boards, allowing the NMS to control and manage the NE.
Clock	Clock source	Provides the system clock and frame headers of service signals and overhead signals for the other units by tracing any of the following clock sources: ● External clock ● SDH line clock ● PDH tributary clock ● Microwave link clock ● Synchronous Ethernet clock
	Clock protection	● Protection based on clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Time synchronization	● Supports IEEE 1588v2 time synchronization. ● Supports ITU-T G.8275.1 time synchronization. ● Supports use of the AE 905S module as the clock source for time synchronization.
	IEEE 1588 ACR	Supported
	External clock port	1
	External time port	2
Data communication network (DCN)	Outband DCN	Supports a maximum of 15 data communications channels (DCCs).
	Inband DCN	Supported, with the DCN bandwidth being configurable

Function and Feature		Description
Network management protocols	Huawei Embedded Control Channel (Huawei embedded control channel (HWECC)) protocol	Supported
	IP protocol	Supported
	L2 DCN	Supported (An L2 DCN can be large in scale.)
	Simple Network Management Protocol (SNMP)	Provides the SNMP Get and Set functions for managing devices.
Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3)		Supported. For details, see **Table 3-7**.
QoS		Supported. For details, see **Table 3-8**.
Hierarchy VPN functions		Supported by the SLF2 version. The NE can function only as cell site gateway (CSG). For details, see **Table 3-9**.
Native IP		Supported. For details, see **Table 3-10**.
EBGP Option A		Supported.
NE virtualization		Supported. An NE housing CSHO can function as the master NE in an NE virtualization application.
Ethernet service		Supported. For details **Table 3-11**.
Synchronous digital hierarchy (SDH) service		Supported. For details **Table 3-12**.
E1 service		Supported. For details **Table 3-13**.
T1 service		Supported only on SLF2CSHO and only with B8SZ/AMI coding. For details **Table 3-13**.
Anti-Theft function		Supported.
Power input ports		Two -48 V power ports
Auxiliary ports and	NMS port	1
	NMS serial port	1

Function and Feature		Description
management ports	NE cascade port	1
	Outdoor cabinet monitoring port	1 (with port specifications in compliance with RS-485)
	USB port	1 ● Connects to a USB flash drive, which can be used to back up and restore databases. ● Houses a WLAN module to implement wireless NMS access. **NOTE** A CSHO board can house a WLAN module only when using the SLF2 functional version.
Operation and maintenance (O&M)	Warm reset and cold reset	Supported
	In-service field programmable gate array (FPGA) loading	Supported
	Queries of board manufacturing information	Supported
	Board power consumption query	Supported
	Board temperature monitoring	Supported
	Board voltage monitoring	Supported
	Monitoring of indicators on the other boards	Supported

Table 3-7 lists the static MPLS/PWE3 functions that the packet switching unit of a CSHO board provides by working with its Ethernet service interface unit or a service board. The CSHO board does not support ATM PWE3 services. The CSHO board supports TDM PWE3 services when the CSHO board works with MN1 board.

Table 3-7 MPLS/PWE3 functions

<table>
<tr><th colspan="3">Function and Feature</th><th>Description</th></tr>
<tr><td rowspan="5">MPLS tunnel</td><td colspan="2">Setup mode</td><td>Static LSPs</td></tr>
<tr><td colspan="2">Bearer mode</td><td>● Ethernet port
● IP microwave port
● ML-PPP link (CSHO)</td></tr>
<tr><td colspan="2">VLAN subinterface</td><td>Supported</td></tr>
<tr><td colspan="2">Protection</td><td>1:1 MPLS tunnel APS</td></tr>
<tr><td colspan="2">OAM</td><td>● MPLS OAM that complies with ITU-T Y.1710 and ITU-T Y.1711 (CSHO)
● MPLS-TP LSP OAM that complies with ITU-T Y.1731
● LSP ping and LSP traceroute functions (CSHO)</td></tr>
<tr><td rowspan="8">PWE3</td><td rowspan="3">TDM PWE3</td><td>Emulation mode</td><td>● SAToP
● CESoPSN</td></tr>
<tr><td>Packet loading time</td><td>125 µs to 5000 µs</td></tr>
<tr><td>Jitter compensation buffering time</td><td>● 375 µs to 16000 µs (for TDM PWE3 services carried on Smart E1 boards)
● 875 µs to 16000 µs (for TDM PWE3 services carried on channelized STM-1 boards)</td></tr>
<tr><td rowspan="4">ATM PWE3 (CSHO)</td><td>Mapping mode</td><td>● 1-to-1 ATM VCC mapping
● N-to-1 ATM VCC mapping
● 1-to-1 ATM VPC mapping
● N-to-1 ATM VPC mapping</td></tr>
<tr><td>Maximum number of concatenated cells</td><td>31</td></tr>
<tr><td>Cell concatenation wait time</td><td>100 µs to 50000 µs</td></tr>
<tr><td>Transparently transmitted ATM service</td><td>Supported</td></tr>
<tr><td>ETH PWE3</td><td>Encapsulation mode</td><td>● Raw mode
● Tagged mode</td></tr>
</table>

Function and Feature			Description
		Service type	- E-Line - E-Aggr (CSHO) - E-LAN (VPLS)
	Setup mode		Static PWs
	Control Word		supported
	Number of PWs		Supports a maximum of 1024 PWs.
	Protection		- 1:1 PW APS - 1:1 PW FPS (CSHO)
	OAM		- PW OAM that complies with ITU-T Y. 1710 and ITU-T Y.1711 (CSHO) - MPLS-TP PW OAM that complies with ITU-T Y.1731 - VCCV - PW ping and PW traceroute functions (CSHO) - ITU-T Y.1731-compliant packet loss measurement, delay measurement, and delay variation measurement (CSHO) - One-click PWE3 service fault diagnosis (CSHO)
	MS-PW (CSHO)		Supported
	Configurable bandwidth		Supported

Table 3-8 lists the quality of service (QoS) that the packet switching unit of a CSHO board provides by working with its Ethernet service interface unit or a service board.

Table 3-8 QoS functions

Function and Feature	Description
DiffServ	Supports simple traffic classification by specifying per-hop behaviors (PHBs) based on packets-carried QoS information (including C-VLAN priority, S-VLAN priority, DSCP value, and MPLS EXP value).
Ethernet complex traffic classification	Supports port traffic classification by MAC address, VLAN ID, VLAN priority, IP address, DSCP, protocol type, port number, or ICMP type.
Committed access rate (CAR)	Provides the CAR processing for traffic flows at ports.

Function and Feature	Description
Queue scheduling policies	Supports the following queue scheduling policies: ● SP ● WRR ● SP+WRR
Congestion avoidance	Discards packets in tail drop mode or weighted random early detection (WRED) mode.
Traffic shaping	Supports shaping for a specified port, priority queue, or service flow, and allows the peak information rate (PIR) and committed information rate (CIR) to be modified in 64 kbit/s steps.
HQoS	Supports multilevel QoS scheduling based on ports, virtual user-network interfaces (V-UNIs), V-UNI groups, tunnels, PWs, and QinQ links.

Table 3-9 lists L3VPN functions that the SLF2CSHO supports.

Table 3-9 Hierarchy VPN functions

Function		Description
IGP and private network routing protocol	IS-IS protocol	Single-area and single-process IS-IS
	OSPF protocol	Single-area OSPF
Tunnel	Creation mode	● RSVP-TE tunnel ● LDP LSP (only for carrying L3VPN services)
	Protection	● TE tunnel hot standby ● TE tunnel rerouting ● IGP fast convergence
L2VPN service (CSHO)	Service type	TDM PWE3 (CES) ETH PWE3 (VLL)
	Creation mode	LDP PW
	Protection	PW redundancy
L3VPN service	Service forwarding	VPN routing and forwarding (VRF), using public network labels and private network labels
	Private-network route advertisement	BGP protocol (MP-iBGP), and EBGP protocol **NOTE** The RTN 950A support EBGP protocol only when the SCC board is CSHO.

Function		Description
	Local private network routing protocol	Applicable only to direct routes and static routes
	VPN FRR	Supported
OAM	LSP Ping/ Traceroute	Supported
	RFC 2544	Supported
	L3VPN Ping/ Traceroute	Supported
	L3VPN network quality analysis (NQA)	This product can function as a server only to respond to UDP jitter tests initiated by CX600. **NOTE** The RTN 950A support L3VPN NQA only when the SCC board is CSHO.
	IP FPM	Supported **NOTE** The RTN 950A support IP FPM only when the SCC board is CSHO.
DHCP Relay		Supported
VLANIF		Supported **NOTE** The RTN 950A support VLANIF only when the SCC board is CSHO.

Table 3-10 Native IP functions

Function		Description
Public routing protocols	Intermediate System to Intermediate System (IS-IS)	Multi-process IS-IS and multi-AS IS-IS are supported.
	Open Shortest Path First (OSPF)	Multi-area OSPF is supported.
Tunnels	Setup mode	Native IP
	Protection schemes	IGP fast convergence

Function		Description
L3VPN service	Route advertisement mode between MCEs and PEs	EBGP Option A
	Import mode of local VPN routes	Direct routes and static routes
	VPN FRR	Supported
OAM	RFC 2544	Supported
	L3VPN NQA	An RTN device can function as a server and respond to UDP jitter test requests initiated by a CX600.
	IP FPM	Supported
DHCP Relay		Supported
VLANIF		Supported

Table 3-11 lists the functions and features that the Ethernet service interface unit of a CSHO board provides by working with the packet switching unit.

Table 3-11 Ethernet service functions

Function and Feature		Description
Basic functions		Receives/Transmits FE/GE service signals and works with the packet switching unit to process the received FE/GE service signals.
Port specifications	Fixed GE electrical port	Four 10/100/1000BASE-T(X) ports
	GE small form-factor pluggable (SFP) port	Provides two ports by using SFP modules of any of the following types: ● Dual-fiber bidirectional FE/GE optical module ● Single-fiber bidirectional FE/GE optical module ● 10/100/1000BASE-T(X) GE electrical module

Function and Feature		Description
Port attributes	Working mode	● Supports 10M/100M/1000M half-duplex, full-duplex, and auto-negotiation for electrical GE1 ports. ● Supports 10M/100M/1000M full-duplex and auto-negotiation for electrical GE2, GE3, and GE4 ports. ● Supports 1000M full-duplex and auto-negotiation for GE optical ports. ● Supports 100M full-duplex for FE optical ports.
	TAG attributes	● Supports setting and query of the TAG attributes of an Ethernet port. ● TAG attributes: tag aware, access, and hybrid
	Jumbo frame	Supports a maximum frame length of 9600 bytes.
	Traffic control	Supports port-based traffic control that complies with IEEE 802.3x.
Services	E-Line services	● Port-based E-line services ● VLAN-based E-line services ● E-Line services carried by QinQ links ● E-Line services carried by pseudo wires (PWs)
	E-LAN services	● E-LAN services based on IEEE 802.1d bridges ● E-LAN services based on IEEE 802.1q bridges ● E-LAN services based on IEEE 802.1ad bridges ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
Link aggregation group (LAG)	Inter-board LAG	Supported
	Intra-board LAG	Supported
Smart Ethernet Protection (SEP)		Supported
Ethernet ring protection switching (ERPS)		Supports the ERPS function that complies with ITU-T G.8032v1.
Spanning tree protocol		Supports MSTP that runs only Common and Internal Spanning Tree (CIST) instances. The MSTP protocol provides functions equivalent to those of the Rapid Spanning Tree Protocol (RSTP) protocol.
Link-state pass through (LPT)		Supported
Link Layer Discovery Protocol (LLDP)		Supported

Function and Feature		Description
ETH OAM	Ethernet service OAM	● Supports ETH OAM functions that comply with IEEE 802.1ag. ● Supports packet loss, delay, and delay variation measurement functions that comply with ITU-T Y.1731.
	Ethernet port OAM	Supports ETH OAM functions that comply with IEEE 802.3ah.
Remote network monitoring (RMON)		Supported
Clock	Clock source	Synchronous Ethernet (not supported by SFP electrical modules)
	Clock protection	● Protection based on clock source priorities ● Protection implemented by running the SSM protocol ● Protection implemented by running the extended SSM protocol
	Time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization. Supports use of the AE 905S module as the clock source for time synchronization. **NOTE** SFP electrical modules do not support time synchronization.
	IEEE 1588 ACR	Supported
DCN	Inband DCN	Each FE/GE port provides one inband DCN channel.
OAM	Loopback	● Supports inloops at the PHY layer of Ethernet ports. ● Supports inloops at the MAC layer of Ethernet ports.
	Warm reset	Supported
	SFP module information query	Supported

Table 3-12 lists the SDH service functions that CSHO boards support. When working with MN1 boards, SDH ports on CSHO boards can implement CES and ML-PPP functions. For details, see **3.21.3 Functions and Features**.

Table 3-12 SDH service functions

Function and Feature		Description
Basic functions		Receives/Transmits two channels of STM-1 optical/ electrical signals.
Optical port specifications		● Supports SFP electrical and optical modules. ● Uses SFP optical modules to provide Ie-1, S-1.1, L-1.1, and L-1.2 electrical ports that comply with ITU-T G.957. ● Uses SFP electrical modules to provide 75-ohm STM-1 electrical ports that comply with ITU-T G. 703.
Protection	Linear multiplex section protection (LMSP)	Supported
	Subnetwork connection protection (SNCP)	Supported
Clock	Clock source	Provides one SDH line clock signal over each line port.
	Clock protection	● Protection based on clock source priorities ● Protection implemented by running the SSM protocol ● Protection implemented by running the extended SSM protocol
Data communication network (DCN)	Outband DCN	Each SDH line port provides one DCC channel consisting of three DCC bytes, nine DCC bytes, or 12 DCC bytes.
O&M	Loopback	● Supports outloops at optical (electrical) ports. ● Supports inloops at optical (electrical) ports. ● Supports outloops on VC-4 paths. ● Supports inloops on VC-4 paths.
	Setting of the on/off state for a laser	Supported
	Automatic laser shutdown (ALS)[a]	Supported

Function and Feature		Description
	Detection and query of SFP optical module information	Supported
	Warm reset and cold reset	Supported

NOTE

a: The ALS function is implemented as follows:

1. When an optical module detects an R_LOS alarm at a receive port and the alarm persists for 500 ms, the laser at the transmit port is automatically shut down.
2. The laser begins to launch intermittent laser pulses. It emits light for 2 seconds and shuts down for 60 seconds.
3. After the R_LOS alarm is cleared, the laser becomes normal and continuously emits light.

Table 3-13 lists the PDH service functions that CSHO boards support. When working with MN1 boards, PDH ports on CSHO boards can implement CES and ML-PPP functions. For details, see **3.21.3 Functions and Features**.

Table 3-13 PDH service functions

Function and Feature		Description
Basic functions		Receives/Transmits E1/T1 signals.
Port specifications	75-ohm or 120-ohm E1 port or 100-ohm T1 port	16
Clock	Clock source	Extracts the first and the fifth E1s/T1s as the tributary clock sources.
	Clock protection	Protection based on clock source priorities
	E1 retiming	Supported
O&M	Loopback	Supports inloops and outloops at E1/T1 tributary ports.
	Warm reset and cold reset	Supported
	Pseudo random binary sequence (PRBS) test at E1/T1 ports	Supported

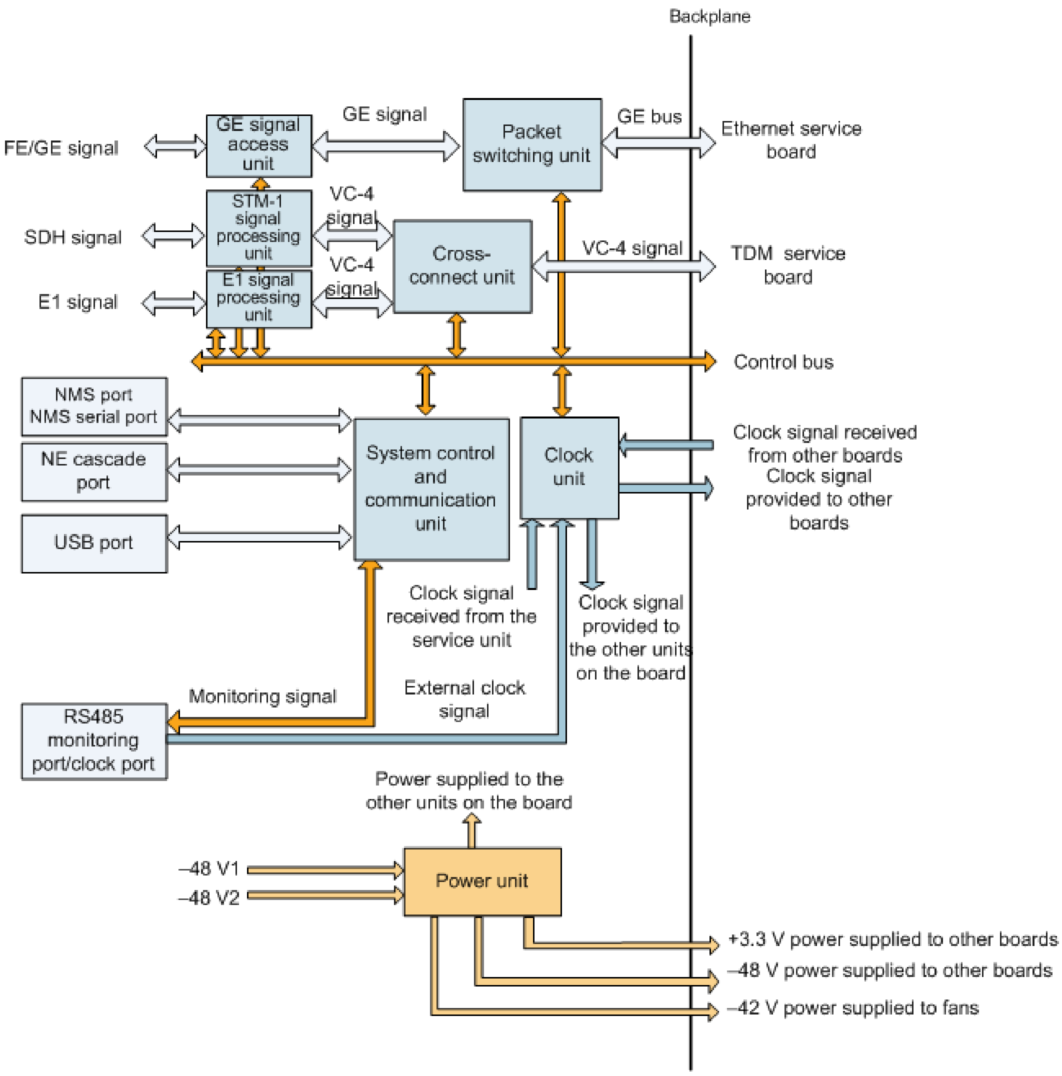
3.4.4 Working Principle

A CSHO board consists of the system control and communication unit, packet switching unit, cross-connect unit, clock unit, and service unit.

The E1 interface supports the T1 function. The E1 service is used as an example to describe the working principle. For the T1 service, the working principle is similar.

Function Block Diagram

Figure 3-25 Function block diagram



System Control and Communication Unit

The system control and communication unit comprises the CPU unit and logic control unit. It provides the following functions:

- The CPU unit controls and manages the other units on the board and collects alarms and performance events using the control bus.
- The CPU unit controls and manages the other boards in the IDU and collects alarms and performance events using the control bus.

- The CPU unit controls and manages the ODU by transmitting ODU control signals to the SMODEM unit in the IF board over the control bus in the backplane.
- The CPU unit enables the packet switching unit using the control bus to groom Ethernet service packets.
- The CPU unit processes Ethernet protocol packets from the packet switching unit using the control bus.
- The CPU unit processes network management messages over data communications channels (DCCs) by working with the logic control unit.
- The CPU unit communicates with the network management system (NMS) using the NMS port and NE cascade port.
- The CPU unit reads outdoor cabinet monitoring signals using the control bus to monitor and manage an outdoor cabinet.
- The logic control unit decodes address read/write signals from the CPU unit and implements field programmable gate array (FPGA) loading.
- The logic control unit cross-connects overheads between the auxiliary interface unit, the CPU unit, and other boards. This helps to achieve the following purposes:
  - Adding or dropping DCC information processed by the CPU unit
  - Adding or dropping orderwire and asynchronous data services
  - Exchanging orderwire bytes, DCC bytes, and K bytes between different lines

Packet Switching Unit

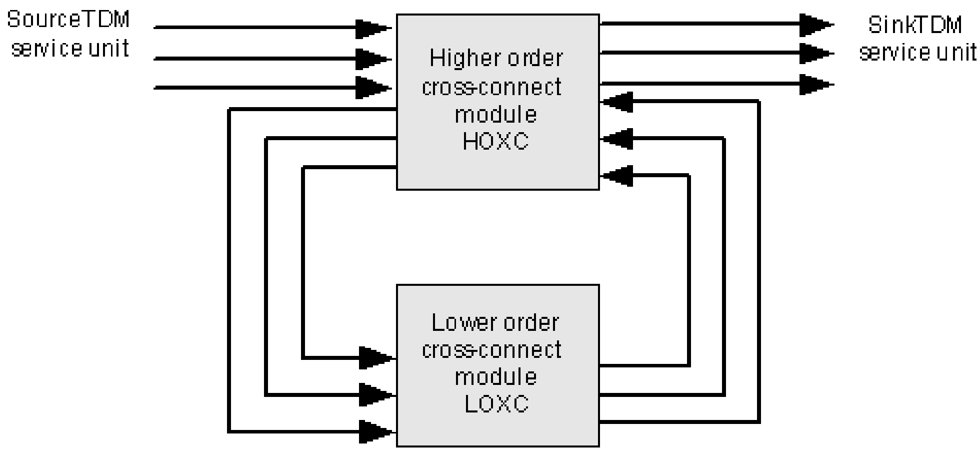
The packet switching unit grooms services and processes protocol messages. The services groomed by the packet switching unit includes native Ethernet services, and Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3) packets carried over Ethernet.

- After receiving Ethernet services from the Ethernet interface unit on the same board or an Ethernet board, the packet switching unit grooms the Ethernet services based on the configurations that are delivered by the system control and communication unit.
- After receiving protocol packets from the Ethernet interface unit on the same board or an Ethernet board, the packet switching unit transmits the protocol packets to the system control and communication unit for processing. After processing the protocol packets, the system control and communication unit sends them back to the packet switching unit. The packet switching unit transmits the protocol packets to the Ethernet interface unit or the Ethernet board.

Cross-Connect Unit

The cross-connect unit grooms services over the entire system using the higher order cross-connect module and the lower order cross-connect module. **Figure 3-26** shows the functional block diagram of the cross-connect unit.

Figure 3-26 Functional block diagram of the cross-connect unit



The source TDM service unit transmits VC-4 signals to the higher order cross-connect module over VC-4 buses. If the VC-4 signals carry only VC-4 services, the higher order cross-connect module processes the VC-4 signals and then transmits the signals to the sink TDM service unit. If the VC-4 signals include VC-12 or VC-3 services, the higher order cross-connect module grooms the VC-12 or VC-3 services to the lower order cross-connect module. The lower order cross-connect module processes the VC-12 or VC-3 services and then transmits the services back to the higher order cross-connect module. The higher order cross-connect module processes the services and then transmits the services to the sink TDM service unit.

Ethernet Signal Access Unit

The Ethernet signal access unit receives/transmits FE/GE signals, and works with the Layer 2 switching unit to provide Layer 2 switching functions. In addition, the Ethernet signal access unit receives IEEE 1588v2 messages (not supported by SFP electrical modules), adds timestamps to them, and sends them to the clock unit.

- In the receive direction, after restructuring, decoding, and performing serial/parallel conversion for electrical signals, the Ethernet signal access unit performs frame delimitation and preamble processing, extracts Ethernet frames, and performs cyclic redundancy check (CRC) and Ethernet performance measurement. If optical signals are received, the Ethernet signal access unit performs O/E conversion before performing the preceding operations.
- In the transmit direction, after performing frame delimitation, preamble addition, CRC code computation, and Ethernet performance measurement, the Ethernet signal access unit performs serial/parallel conversion for signals, encodes the signals, and transmits the signals to the Ethernet port. In the case of an optical port, after performing the preceding operations, the Ethernet signal access unit needs to perform E/O conversion for signals and then transmit them through the optical port.

E1 Signal Processing Unit

The E1 signal processing unit allows access of, codes/decodes, and maps/demaps E1 electrical signals and processes clock overheads. Signal processing on this unit is the same as that on the SP3S/SP3D. For details, see **3.22.4 Working Principle and Signal Flow**.

STM-1 Signal Processing Unit

The STM-1 signal processing unit allows access of STM-1 signals, extracts clock signals, restores data, scrambles/descrambles data, and processes overheads and pointers. Signal processing on the STM-1 signal processing unit is the same as that on the SL1D. For details, see **3.18.4 Working Principle and Signal Flow**.

Clock Unit

The clock unit selects a clock source from the external clock sources or the service clock sources sent from the service ports based on their clock priorities. After locking the clock source with the phase-locked loop, the clock unit provides a system clock and the service- and overhead-signal frame headers to other units on the same and other boards.

The clock unit receives IEEE 1588v2 messages from the Ethernet signal access unit on the same board or from an Ethernet service board and processes the messages to implement clock/time synchronization.

Power Supply Unit

The power supply unit performs the following functions:

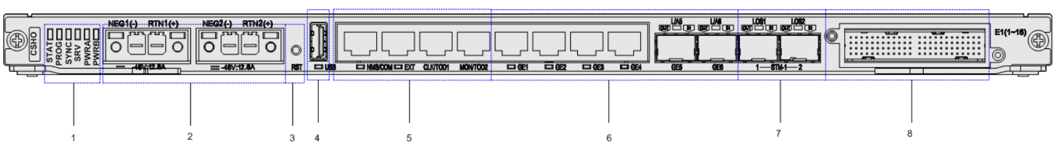
- Combines and then converts the two -48 V power inputs into the power supply required by the chips of the other units on the local board.
- Combines the two -48 V power inputs to provide -48 V power supply or combines and converts the two -48 V power inputs into the +3.3 V power supply required by boards in extended slots.
- Combines and then converts the two -48 V power inputs into the -42 V power supply required by the fan.

3.4.5 Front Panel

A CSHO board has indicators, buttons, service ports, card fasteners, clock ports, auxiliary ports, and management ports on its front panel.

Front Panel Diagram

Figure 3-27 Front panel of a CSHO board



1. Indicators	2. Power input ports	3. Button
4. USB port	5. Clock, auxiliary, and management ports	6. GE ports
7. STM-1 ports	8. E1/T1 port	-

Indicators

Table 3-14 Status explanation for indicators on a CSHO board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, the board is not created, or there is no power supplied to the board.
PROG	Blinks on (green) and off at 100 ms intervals	Software is being loaded to the board during the board power-on or reset process.
	Blinks on (green) and off at 300 ms intervals	The board software is in BIOS boot state during the board power-on or reset process.
	On (green)	• The upper layer software is being initialized during the board power-on or reset process. • The software is running properly during the board running process.
	Blinks on (red) and off at 100 ms intervals	The BOOTROM self-check fails during the board power-on or reset process.
	On (red)	• The memory self-check fails or loading upper layer software fails during the board power-on or reset process. • The logic file or upper layer software is lost during the board running process. • The pluggable storage card is faulty.
SYNC	On (green)	The clock is working properly.
	On (red)	The synchronization sources are lost.
SRV	On (green)	The system is working properly.
	On (red)	A critical or major alarm is generated in the system.
	On (yellow)	A minor or remote alarm is generated in the system.
PWRA	On (green)	There is an input from the first -48 V power port.

Indicator		State	Meaning
		Off	There is no input from the first -48 V power port.
PWRB		On (green)	There is an input from the second -48 V power port.
		Off	There is no input from the second -48 V power port.
USB	USB flash drive	Blinks (red)	The USB flash drive is online but faulty, or the NE does not support the USB flash drive.
		Blinks on (yellow) and off at 300 ms intervals	Data is being backed up to or recovered from the USB flash drive.
		On (red)	Backing up data to or recovering data from the USB flash drive failed.
		On (green)	• A USB flash drive is online. • Data backup or recovery is complete.
		Off	The USB flash drive is offline or the NE cannot identify the USB flash drive.
	WLAN module **NOTE** A CSHO board can house a WLAN module only when using the SLF2 functional version.	Steady green	The WLAN module has been identified and is working properly.
		Steady red	The WLAN module is faulty.
		Off	• No WLAN module is connected to the USB port. • The WLAN module connected to the USB port cannot be identified.
GE1-GE4		On (green)	The port is properly connected.
		Blinks (yellow)	The port is receiving or transmitting data.
		Off	The port is not connected or is incorrectly connected.
L/A5-L/A6		On (green)	The port is properly connected and is not transmitting or receiving data.

Indicator	State	Meaning
	On (red)	An optical power alarm is reported (applicable only to optical ports).
	Blinks (yellow)	The port is receiving or transmitting data.
	Off	The port is not connected or is incorrectly connected.
LOS1-LOS2	On (red)	The SDH optical port reports an R_LOS alarm.
	Off	The SDH optical port is free of R_LOS alarms.
NMS/COM and EXT	on (green)	The connection is normal.
	on or blinks (yellow)	The port is receiving or transmitting data.
	off	The port is not receiving or transmitting data.

Power Supply Ports

Table 3-15 Power Supply Ports

Port	Port Description	Connector Type	Corresponding Cable
NEGA(-)/ NEGB(-)	-48 V power input port	2 mm HM power connector (2x2 pins)	**5.1 Power Cable**
RTNA(+)/ RTNB(+)	BGND power input port		

USB Port

Table 3-16 USB port

Port	Description	Connector Type
USB	Universal Serial Bus (USB) port. ● Connects to a USB flash drive, which can be used to back up and restore databases. ● Houses a WLAN module to implement wireless NMS access. **NOTE** A CSHO board can house a WLAN module only when using the SLF2 functional version.	Type-A USB female

Clock, Auxiliary, and Management Ports

Table 3-17 Clock, auxiliary, and management ports

Port	Description	Connector Type
NMS/COM	NMS port or NMS serial port	RJ45
EXT	NE cascade port	
CLK/TOD1	External clock port (2048 kbit/s or 2048 kHz), external time port 1, or wayside E1 port	
MON/TOD2	Outdoor cabinet monitoring port or external time port 2	

NOTE

- The external clock port, external time port 1share one physical port. This port can also transparently transmit DCC bytes, orderwire overhead bytes, and synchronous/asynchronous data overhead bytes. However, this port can implement only one of the preceding functions at a time.
- The external time port 2 and outdoor cabinet monitoring port share one physical port. However, this port can implement only one of the preceding functions at a time.

Auxiliary ports and management ports use RJ45 connectors. The pin assignments for the ports, however, are different. **Figure 3-28** shows the front view of the RJ45 connector.

Figure 3-28 Front view of the RJ45 connector

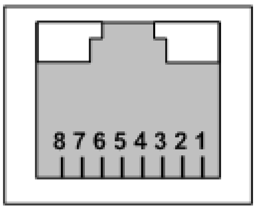


Table 3-18 Pin assignments for the NMS/COM port

Port	Pin	Signal
NMS/COM	1	Transmitting data (+)
	2	Transmitting data (-)
	3	Receiving data (+)
	4	Grounding end of the NM serial port
	5	Receive end of the NM serial port
	6	Receiving data (-)
	7	Not defined
	8	Transmit end of the NM serial port

Table 3-19 Pin assignments for the EXT port

Port	Pin	Signal
EXT	1	Transmitting data (+)
	2	Transmitting data (-)
	3	Receiving data (+)
	6	Receiving data (-)
	4, 5, 7, 8	Not defined

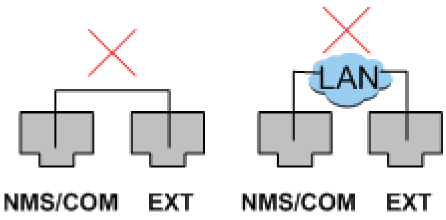
NOTE

The EXT port supports the auto-MDI/MDI-X modes; that is, the EXT port can transmit data through pins 3 and 6 and receive data through pins 1 and 2.

The ports NMS/COM and EXT are equivalent to two ports on a hub. Therefore, no external Ethernet link should be configured between the two ports. Otherwise, an Ethernet loop will be formed and cause a broadcast storm on the network. The DCN communication will be affected.

Figure 3-29 shows two common incorrect connections.

Figure 3-29 Incorrect connections between NMS/COM and EXT



The external clock port (2048 kbit/s or 2048 kHz), external time port 1, and wayside E1 port share the port CLK/TOD1. Table 3-20 lists the pin assignments for the port CLK/TOD1. This port can work in only one mode at a time.

Table 3-20 Pin assignments for CLK/TOD1

Pin	Working Mode				
	External Clock	External Time Input (1PPS + Time Information)	External Time Output (1PPS + Time Information)	External Time Input (DCLS)	External Time Output (DCLS)
1	Signal input (-)	Not defined	Not defined	Not defined	Not defined
2	Signal input (+)	Not defined	Not defined	Not defined	Not defined
3	Not defined	1PPS signal input (-) (RS-422 level)	1PPS signal output (-) (RS-422 level)	DCLS time signal input (-) (RS-422 level)	DCLS time signal output (-) (RS-422 level)
4	Signal output (-)	Ground end	Ground end	Ground end	Ground end
5	Signal output (+)	Ground end	Ground end	Ground end	Ground end
6	Not defined	1PPS signal input (+) (RS-422 level)	1PPS signal output (+) (RS-422 level)	DCLS time signal input (+) (RS-422 level)	DCLS time signal output (+) (RS-422 level)

Pin	Working Mode				
	External Clock	External Time Input (1PPS + Time Information)	External Time Output (1PPS + Time Information)	External Time Input (DCLS)	External Time Output (DCLS)
7	Not defined	Time information input (-) (RS-422 level)	Time information output (-) (RS-422 level)	Not defined	Not defined
8	Not defined	Time information input (+) (RS-422 level)	Time information output (+) (RS-422 level)	Not defined	Not defined

NOTE

The pin assignment when the CLK/TOD1 port functions as a wayside E1 service port is the same as that when the CLK/TOD1 port functions as a clock port.

The external time port 2 and outdoor cabinet monitoring port share the port MON/TOD2. **Table 3-21** lists the pin assignments for the port MON/TOD2.

Table 3-21 Pin assignments for MON/TOD2

Pin	Working Mode				
	External Time Input (1PPS + Time Information)	External Time Output (1PPS + Time Information)	External Time Input (DCLS)	External Time Output (DCLS)	Outdoor Cabinet Monitoring Port
1	Not defined	Not defined	Not defined	Not defined	Reserved
2	Not defined	Not defined	Not defined	Not defined	Reserved

Pin	Working Mode				
	External Time Input (1PPS + Time Information)	**External Time Output (1PPS + Time Information)**	**External Time Input (DCLS)**	**External Time Output (DCLS)**	**Outdoor Cabinet Monitoring Port**
3	1PPS signal input (-) (RS-422 level)	1PPS signal output (-) (RS-422 level)	DCLS time signal input (-) (RS-422 level)	DCLS time signal output (-) (RS-422 level)	Outdoor cabinet monitoring signal input (-) (RS-422 level)
4	Ground end	Ground end	Ground end	Ground end	Reserved
5	Ground end	Ground end	Ground end	Ground end	Ground end
6	1PPS signal input (+) (RS-422 level)	1PPS signal output (+) (RS-422 level)	DCLS time signal input (+) (RS-422 level)	DCLS time signal output (+) (RS-422 level)	Outdoor cabinet monitoring signal input (+) (RS-422 level)
7	Time information input (-) (RS-422 level)	Time information output (-) (RS-422 level)	Not defined	Not defined	Outdoor cabinet monitoring signal output (-) (RS-422 level)
8	Time information input (+) (RS-422 level)	Time information output (+) (RS-422 level)	Not defined	Not defined	Outdoor cabinet monitoring signal output (+) (RS-422 level)

Service Ports

Table 3-22 Service ports

Port	Description	Connector Type	Required Cable
GE1-GE4	FE/GE port (unpluggable electrical port)	RJ45	**5.10 Network Cable**
GE5-GE6	FE/GE port (SFP module)	RJ45 SFP electrical module or LC SFP optical module AE 905S module	● SFP optical module: **5.6 Fiber Jumper** ● SFP electrical module: **5.10 Network Cable**
STM-1(1)-STM-1(2)	STM-1 port	● LC (with an SFP optical module) ● SAA straight female (with an SFP electrical module)	● SFP optical module: **5.6 Fiber Jumper** ● SFP electrical module: **5.7 STM-1 Cable**
E1 (1-16)	First to sixteenth E1/T1 signals, which can be configured using software **NOTE** SLF2CSHO supports T1 signals.	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

NOTE

- Only twisted pair cables can be used on T1 interfaces, which is the same as on 120-ohm E1 interfaces. The definition of cable connector pins on the two types of interfaces is also the same.
- On SLF2CSHO, a T1 port can connect to a cable of up to 200 meters long.

The GE electrical ports (RJ45 ports) support the medium dependent interface (MDI), medium dependent interface crossover (MDI-X), and auto-MDI/MDI-X modes. **Table 3-23** and **Table 3-24** list the pin assignments for an RJ45 port in different modes.

Table 3-23 Pin assignments for an RJ45 port in MDI mode

Pin	1000BASE-T	
	Signal	Function
1	BIDA+	Bidirectional data wire A (+)
2	BIDA-	Bidirectional data wire A (-)
3	BIDB+	Bidirectional data wire B (+)
4	BIDC+	Bidirectional data wire C (+)

Pin	1000BASE-T	
	Signal	Function
5	BIDC-	Bidirectional data wire C (-)
6	BIDB-	Bidirectional data wire B (-)
7	BIDD+	Bidirectional data wire D (+)
8	BIDD-	Bidirectional data wire D (-)

Table 3-24 Pin assignments for an RJ45 port in MDI-X mode

Pin	1000BASE-T	
	Signal	Function
1	BIDB+	Bidirectional data wire B (+)
2	BIDB-	Bidirectional data wire B (-)
3	BIDA+	Bidirectional data wire A (+)
4	BIDD+	Bidirectional data wire D (+)
5	BIDD-	Bidirectional data wire D (-)
6	BIDA-	Bidirectional data wire A (-)
7	BIDC+	Bidirectional data wire C (+)
8	BIDC-	Bidirectional data wire C (-)

The E1 port uses an Anea 96 connector. **Figure 3-30** shows the front view of an Anea 96 connector, and **Table 3-25** lists the pin assignments for an Anea 96 connector.

Figure 3-30 Front view of an Anea 96 connector

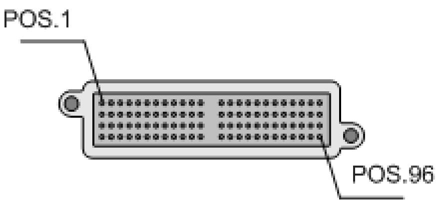


Table 3-25 Pin assignments for an Anea 96 connector

Pin	Signal	Pin	Signal
1	The first received E1 differential signal (+)	25	The first transmitted E1 differential signal (+)
2	The first received E1 differential signal (-)	26	The first transmitted E1 differential signal (-)
3	The second received E1 differential signal (+)	27	The second transmitted E1 differential signal (+)
4	The second received E1 differential signal (-)	28	The second transmitted E1 differential signal (-)
5	The third received E1 differential signal (+)	29	The third transmitted E1 differential signal (+)
6	The third received E1 differential signal (-)	30	The third transmitted E1 differential signal (-)
7	The fourth received E1 differential signal (+)	31	The fourth transmitted E1 differential signal (+)
8	The fourth received E1 differential signal (-)	32	The fourth transmitted E1 differential signal (-)
9	The fifth received E1 differential signal (+)	33	The fifth transmitted E1 differential signal (+)
10	The fifth received E1 differential signal (-)	34	The fifth transmitted E1 differential signal (-)
11	The sixth received E1 differential signal (+)	35	The sixth transmitted E1 differential signal (+)
12	The sixth received E1 differential signal (-)	36	The sixth transmitted E1 differential signal (-)
13	The seventh received E1 differential signal (+)	37	The seventh transmitted E1 differential signal (+)
14	The seventh received E1 differential signal (-)	38	The seventh transmitted E1 differential signal (-)
15	The eighth received E1 differential signal (+)	39	The eighth transmitted E1 differential signal (+)
16	The eighth received E1 differential signal (-)	40	The eighth transmitted E1 differential signal (-)
17	The ninth received E1 differential signal (+)	41	The ninth transmitted E1 differential signal (+)
18	The ninth received E1 differential signal (-)	42	The ninth transmitted E1 differential signal (-)

Pin	Signal	Pin	Signal
19	The tenth received E1 differential signal (+)	43	The tenth transmitted E1 differential signal (+)
20	The tenth received E1 differential signal (-)	44	The tenth transmitted E1 differential signal (-)
21	The eleventh received E1 differential signal (+)	45	The eleventh transmitted E1 differential signal (+)
22	The eleventh received E1 differential signal (-)	46	The eleventh transmitted E1 differential signal (-)
23	The twelfth received E1 differential signal (+)	47	The twelfth transmitted E1 differential signal (+)
24	The twelfth received E1 differential signal (-)	48	The twelfth transmitted E1 differential signal (-)
49	The thirteenth received E1 differential signal (+)	73	The thirteenth transmitted E1 differential signal (+)
50	The thirteenth received E1 differential signal (-)	74	The thirteenth transmitted E1 differential signal (-)
51	The fourteenth received E1 differential signal (+)	75	The fourteenth transmitted E1 differential signal (+)
52	The fourteenth received E1 differential signal (-)	76	The fourteenth transmitted E1 differential signal (-)
53	The fifteenth received E1 differential signal (+)	77	The fifteenth transmitted E1 differential signal (+)
54	The fifteenth received E1 differential signal (-)	78	The fifteenth transmitted E1 differential signal (-)
55	The sixteenth received E1 differential signal (+)	79	The sixteenth transmitted E1 differential signal (+)
56	The sixteenth received E1 differential signal (-)	80	The sixteenth transmitted E1 differential signal (-)

NOTE
Pin signals can also be T1 signals. The definition of T1 pin signals is the same as that of E1 pin signals.

Button

Table 3-26 Button

Button	Name	Description
RST	Board warm reset button	The button allows you to perform a warm reset on the board.

3.4.6 Valid Slots

A CSHO board is inserted in slot 7 of an IDU chassis. Slot 7 occupies the space of two ordinary slots. For the network management system (NMS) to manage functional units on a CSHO board, the functional units are mapped into specific logical boards and allocated logical slots on the NMS.

Figure 3-31 Slot for a CSHO board in an IDU chassis

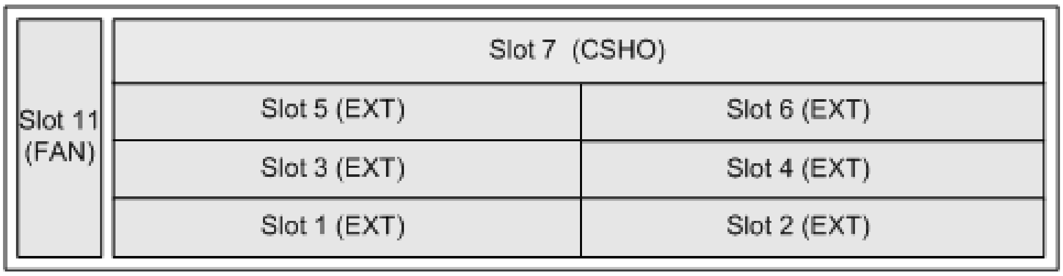
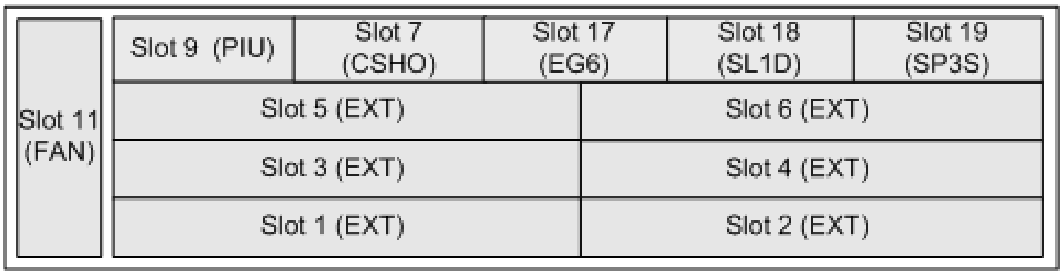
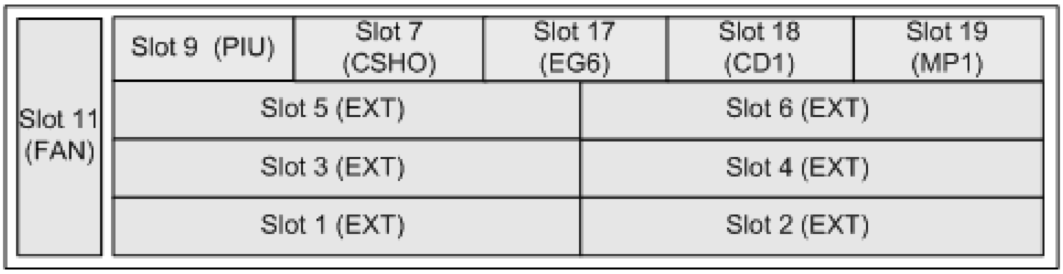


Figure 3-32 Logical slots for a CSHO board



When a CSHO board works with an MN1 board, the boards in logical slots 18 and 19 for the CSHO board must be CD1 and MP1 respectively, as shown in **Figure 3-33**.

Figure 3-33 Logical slots for a CSHO board (working with an MN1 board)



3.4.7 Types of SFP Modules

The GE and STM-1 ports on a CSHO board support multiple types of small form-factor pluggable (SFP) modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-27 Types of SFP modules that the GE/FE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Two-fiber bidirectional GE module	34060286	1000Base-SX	850 nm, 0.5 km
	34060473	1000Base-LX	1310 nm, 10 km
	34060298	1000BASE-VX	1310 nm, 40 km
	34060513		1550 nm, 40 km
	34060360	1000BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional GE module	34060475	1000BASE-BX-D	Transmit: 1490 nm; receive: 1310 nm 10 km
	34060470	1000BASE-BX-U	Transmit: 1310 nm; receive: 1490 nm 10 km
	34060540	1000BASE-BX-D	Transmit: 1490 nm; receive: 1310 nm 40 km
	34060539	1000BASE-BX-U	Transmit: 1310 nm; receive: 1490 nm 40 km
Two-fiber bidirectional FE module	34060287	100BASE-FX	1310 nm, 2 km
	34060276	100BASE-LX	1310 nm, 15 km
	34060281	100BASE-VX	1310 nm, 40 km
	34060282	100BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional FE module	34060364	100BASE-BX-D	Transmit: 1550 nm; receive: 1310 nm 15 km
	34060363	100BASE-BX-U	Transmit: 1310 nm; receive: 1550 nm 15 km

Category	Part Number	Type	Wavelength and Transmission Distance
	34060329	100BASE-BX-D	Transmit: 1550 nm; receive: 1310 nm 40 km
	34060328	100BASE-BX-U	Transmit: 1310 nm; receive: 1550 nm 40 km
Electrical module	34100052	10/100/1000BASE-T(X)	100 m

Table 3-28 SDH SFP module types

Category	Part Number	Module Type
Optical module	34060287	Ie-1
	34060276	S-1.1
	34060281	L-1.1
	34060282	L-1.2
Electrical module	34100104	STM-1e

NOTE

For the specifications for each type of SFP module, see **3.4.8 Technical Specifications**.

3.4.8 Technical Specifications

This section describes board specifications, including the packet switching capacity, cross-connection capacity, performance of Ethernet ports, STM-1 ports, clocks, and wayside service ports, mechanical behaviors, and power consumption.

Packet Switching Capacity

A CSHO board supports a 10 Gbit/s packet switching capacity.

Cross-Connection Capacity

A CSHO board supports full time-division cross-connections at the VC-12, VC-3, or VC-4 level, which are equivalent to 32x32 VC-4s.

Ethernet Port Specifications

Ethernet port specifications comply with IEEE 802.3. The following tables list the specifications of GE optical ports and GE electrical ports.

Table 3-29 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

Table 3-30 GE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Nominal bit rate (Mbit/s)	1000	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	10	10	40	40
Operating wavelength (nm)	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500
Average optical output power (dBm)	-9 to -3	-9 to -3	-3 to +3	-3 to +3
Receiver sensitivity (dBm)	-19.5	-19.5	-23	-23

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Overload (dBm)	-3	-3	-3	-3
Extinction ratio (dB)	6	6	6	6

Table 3-31 FE optical interface specifications (two-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1310	1310	1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Multi-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Average optical output power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-30	-28	-34	-34
Overload (dBm)	-14	-8	-10	-10
Extinction ratio (dB)	10	8.2	10	10.5

Table 3-32 FE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	15	15	40	40

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Operating wavelength (nm)	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580
Average optical output power (dBm)	-15 to -8	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-32	-32	-32	-32
Overload (dBm)	-8	-8	-10	-10
Extinction ratio (dB)	8.5	8.5	10	10

Table 3-33 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

STM-1 Optical Interface Performance

The performance of the STM-1 optical interface is compliant with ITU-T G.957/G.825. The following table provides the typical performance of the interface.

Table 3-34 STM-1 optical interface performance (two-fiber bidirectional)

Item	Performance			
Nominal bit rate (kbit/s)	155520			
Classification code	Ie-1	S-1.1	L-1.1	L-1.2
Fiber type	Multi-mode fiber	Single-mode fiber	Single-mode fiber	Single-mode fiber
Transmission distance (km)	2	15	40	80

Item	Performance			
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Mean launched power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver minimum sensitivity (dBm)	-30	-28	-34	-34
Minimum overload (dBm)	-14	-8	-10	-10
Minimum extinction ratio (dB)	10	8.2	10	10

NOTE

The OptiX RTN 950A uses SFP optical modules for providing optical interfaces. You can use different types of SFP optical modules to provide optical interfaces with different classification codes and transmission distances.

E1 Interface Performance

Table 3-35 E1 interface performance

Item	Performance	
Nominal bit rate (kbit/s)	2048	
Code pattern	HDB3	
Impedance (ohm)	75	120
Wire pair in each transmission direction	One coaxial wire pair	One symmetrical wire pair

T1 Interface Performance

Table 3-36 T1 interface performance

Item	Performance
Nominal bit rate (kbit/s)	1544
Code pattern	B8ZS and AMI
Impedance (ohm)	100
Wire pair in each transmission direction	One symmetrical wire pair

Clock Timing and Synchronization Performance

Clock timing and synchronization performance complies with related ITU-T Recommendations.

Table 3-37 Clock timing and synchronization performance

Item	Performance
External synchronization source	2048 kbit/s (compliant with ITU-T G.703 §9), or 2048 kHz (compliant with ITU-T G.703 §13)
Frequency accuracy	Compliant with ITU-T G.813
Pull-in and pull-out ranges	
Noise generation	
Noise tolerance	
Noise transfer	
Transient response and holdover performance	

Mechanical Behaviors, Power Specifications and Power Consumption

Table 3-38 Mechanical behaviors, power specifications and power consumption

Item	Performance
Dimensions (H x W x D)	22.36 mm x 388.40 mm x 269.73 mm
Weight	1.1 kg
Input voltage	Two -48 V (-38.4 V to -57.6 V) DC inputs
Fuse capacity	20.0 A
Typical power consumption	< 32.0 W

3.5 CSHOF

The CSHOF is the Hybrid/Packet system control, switching, and timing board. It provides 90 Gbit/s packet switching, full time-division cross-connection, system control and communication, and clock processing functions. It also provides two 10GE ports, four GE ports, auxiliary ports, and management ports.

3.5.1 Description

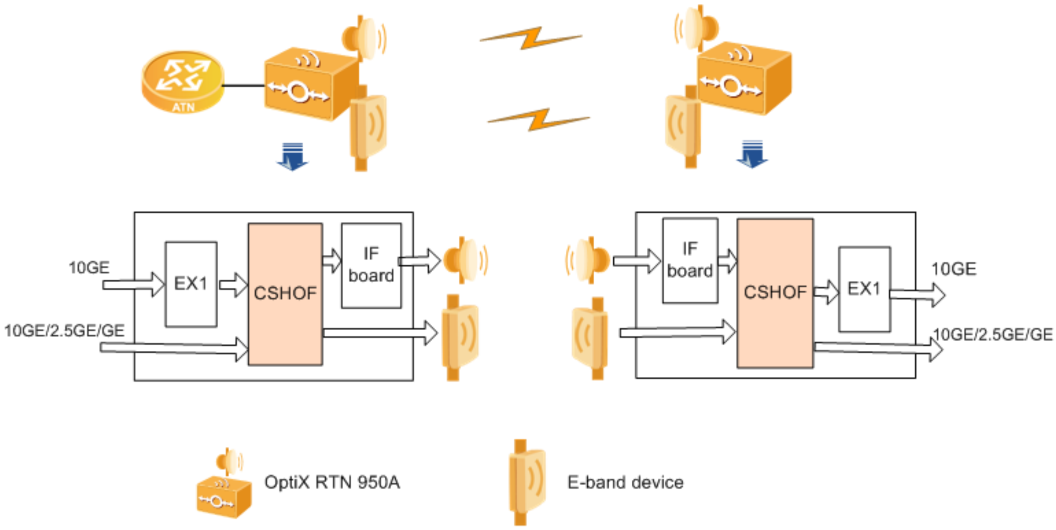
The functional version of the CSHOF is SLF2.

3.5.2 Application

The CSHOF is a new-generation Hybrid/Packet system control, switching, and timing board. It provides two 10GE ports, four GE ports, and two GE/STM-1 ports for scheduling and transmission of multiple services. It supports the Super Dual Band solution.

Application of CSHOF Boards in the SDB Microwave Network

Figure 3-34 Application scenario of CSHOF boards

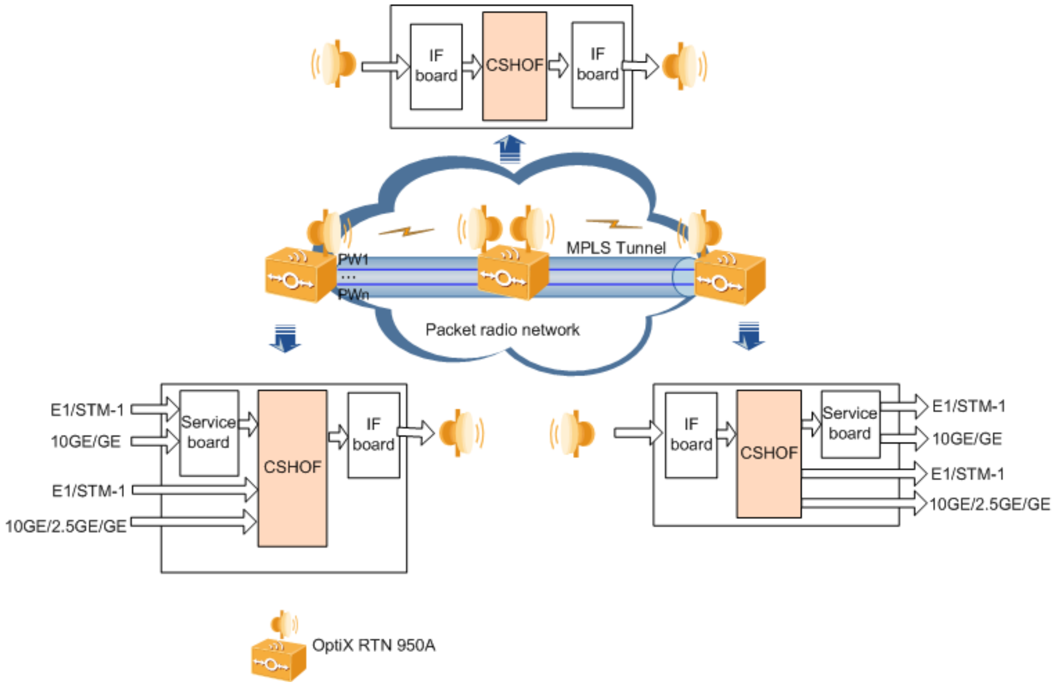


NOTE

- In the preceding figure, IF boards must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet or native STM-1+Ethernet mode.

Application of CSHOF Boards in the Packet Microwave Network

Figure 3-35 Application scenario of CSHOF boards



NOTE

- In the preceding figure, IF boards must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet or native STM-1+Ethernet mode.
- Service boards shown in the preceding figure can be native E1 interface boards, STM-1 interface boards, channelized STM-1 interface boards, or Ethernet interface boards.
- Ethernet ports on CSHOF boards can carry MPLS tunnels, which allow CSHOF boards to transmit Multiprotocol Label Switching (MPLS) and pseudo wire emulation edge-to-edge (PWE3) services traversing microwave networks and regional backhaul networks in end-to-end mode.

3.5.3 Functions and Features

The CSHOF is the Hybrid/Packet system control, switching, and timing board. It provides 90 Gbit/s packet switching, full time-division cross-connection, system control and communication, and clock processing functions. It also provides two 10GE ports, four GE ports, two STM-1 ports, 16 E1 ports, auxiliary ports, and management ports.

Table 3-39 lists the functions and features that CSHOF boards support.

Table 3-39 Functions and Features that CSHOF boards support

Function and Feature		Description
Basic functions	Switching capability	Provides 90 Gbit/s packet switching.

Function and Feature		Description
	Cross-connect capability	Provides full time-division VC-12/VC-3/VC-4 cross-connections (equivalent to 32 x 32 VC-4 cross-connections).
	System control and communication	Manages, monitors, and controls the running status of the IDU, and works as a communication service unit between the NMS and boards, allowing the NMS to control and manage the NE.
Clock	Clock source	Traces the clock source to provide the frame headers of system clocks, service signals, and overhead signals for each unit. The types of clock sources that can be traced are as follows: ● External clock ● SDH line clock ● PDH tributary clock ● Microwave link clock ● Synchronous Ethernet clock
	Clock protection	● Protection based on clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Time synchronization	● Supports IEEE 1588v2 time synchronization. ● Supports ITU-T G.8257.1 time synchronization.
	IEEE 1588 ACR	Supported
	External clock port	1
	External time port	1
DCN	Outband DCN	Supports a maximum of 15 data communications channels (DCCs).
	Inband DCN	Supported, with the DCN bandwidth being configurable
Network management protocols	Huawei Embedded Control Channel (HWECC) protocol	Supported

Function and Feature		Description
	IP protocol	Supported
	L2 DCN	Supported
	Simple Network Management Protocol (SNMP)	Provides the SNMP Get and Set functions to manage devices (excluding L3VPN service configurations).
QoS		Supported.
		For details, see **Table 3-41**.
Hierarchy VPN functions		Supported. The NE can function only as cell site gateway (CSG). For details, see **Table 3-42**.
MPLS/PWE3		Supported. For details, see **Table 3-40**.
Super Dual Band		Supported
PLA/EPLA		Supported
Synchronous digital hierarchy (SDH) service		Supported
E1 service		Supported
Anti-theft		Supported
Power input port		Supported
Ethernet service		Supported
		For details, see **Table 3-43**.
Auxiliary ports and management ports	NMS port	1
	NM serial port	1
	NE cascade port	1
	Outdoor cabinet monitoring port	1 (with port specifications in compliance with RS-485)
	Type-A USB port	1 ● Connects to a USB flash drive, which can be used to back up and restore databases. ● Houses a WLAN module to implement wireless NMS access.
OM	Warm reset and cold reset	Supported

Function and Feature		Description
	In-service FPGA loading	Supported
	Board manufacturer information query	Supported
	Board power consumption query	Supported
	Board temperature monitoring	Supported
	Board voltage monitoring	Supported
	Monitoring of indicators on the other boards	Supported
	Hot swapping	Supported

Table 3-40 lists the static MPLS/PWE3 functions that the packet switching unit of a CSHOF board provides by working with its Ethernet service interface unit or a service board. The CSHOF board does not support ATM PWE3 services. The E1 service interface unit on the CSHOF board supports TDM PWE3 services. The STM-1 service interface unit on the CSHOF board supports TDM PWE3 services when the CSHOF board works with MN1 board.

Table 3-40 MPLS/PWE3 functions

Function and Feature			Description
MPLS tunnel	Setup mode		Static LSPs
	Bearer mode		● Ethernet port ● IP microwave port
	VLAN subinterface		Supported
	Protection		1:1 MPLS tunnel APS
	OAM		MPLS-TP LSP OAM that complies with ITU-T Y.1731
PWE3	TDM PWE3	Emulation mode	● SAToP ● CESoPSN

Function and Feature			Description
		Packet loading time	125 µs to 5000 µs
		Jitter compensation buffering time	875 µs to 16000 µs (for TDM PWE3 services carried on channelized STM-1 boards)
	ETH PWE3	Encapsulation mode	• Raw mode • Tagged mode
		Service type	• E-Line • E-LAN (VPLS)
	Setup mode		Static PWs
	Control Word		supported
	Number of PWs		Supports a maximum of 1024 PWs.
	Protection		1:1 PW APS
	OAM		• MPLS-TP PW OAM that complies with ITU-T Y.1731 • VCCV

Table 3-41 lists the quality of service (QoS) that the packet switching unit of a CSHOF board provides by working with a service board.

Table 3-41 QoS functions

Function and Feature	Description
DiffServ	Supports simple traffic classification by specifying per-hop behaviors (PHBs) based on the QoS information (including C-VLAN priority, S-VLAN priority, DSCP value, and MPLS EXP value) carried in packets.
Complex traffic classification	Supports port traffic classification based on the MAC address, VLAN ID, VLAN priority, IP address, DSCP, protocol type, port number, or ICMP type.
Committed access rate (CAR)	Supported
Queue scheduling policies	Supports the following queue scheduling policies: • SP • WRR • SP+WRR

Function and Feature	Description
Congestion avoidance	Drops packets in tail drop mode or weighted random early detection (WRED) mode.
Traffic shaping	Supported
HQoS	Supports multi-level QoS scheduling based on ports, virtual user-network interfaces (V-UNIs), V-UNI groups, and QinQ links.

Table 3-42 lists L3VPN functions that the CSHOF supports.

Table 3-42 Hierarchy VPN functions

<table>
<tr><th colspan="2">Function</th><th>Description</th></tr>
<tr><td rowspan="2">IGP and private network routing protocol</td><td>IS-IS protocol</td><td>Single-area and single-process IS-IS</td></tr>
<tr><td>OSPF protocol</td><td>Single-area OSPF</td></tr>
<tr><td rowspan="2">Tunnel</td><td>Creation mode</td><td>● RSVP-TE tunnel
● LDP LSP (only for carrying L3VPN services)</td></tr>
<tr><td>Protection</td><td>● TE tunnel hot standby
● TE tunnel rerouting
● IGP fast convergence</td></tr>
<tr><td rowspan="4">L3VPN service</td><td>Service forwarding</td><td>VPN routing and forwarding (VRF), using public network labels and private network labels</td></tr>
<tr><td>Private-network route advertisement</td><td>BGP protocol (MP-iBGP)</td></tr>
<tr><td>Local private network routing protocol</td><td>Applicable only to direct routes and static routes</td></tr>
<tr><td>VPN FRR</td><td>Supported</td></tr>
<tr><td rowspan="3">OAM</td><td>LSP Ping/ Traceroute</td><td>Supported</td></tr>
<tr><td>RFC 2544</td><td>Supported</td></tr>
<tr><td>L3VPN Ping/ Traceroute</td><td>Supported</td></tr>
<tr><td colspan="2">DHCP Relay</td><td>Supported</td></tr>
</table>

Table 3-43 lists Ethernet service functions that the CSHOF supports.

Table 3-43 Ethernet service functions

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td colspan="2">Basic functions</td><td>Receives 10GE/GE service signals and works with the packet switching unit to process the received service signals.</td></tr>
<tr><td rowspan="2">Port specifications</td><td>10GE port: SFP +/SFP optical module</td><td>2
NOTE
This port is downward compatible with 2.5GE and GE.
Supports GE electrical modules and FE optical modules.</td></tr>
<tr><td>GE port</td><td>Four fixed electrical ports, two optical ports shared by STM-1 and GE fixed electrical ports</td></tr>
<tr><td rowspan="4">Port attributes</td><td>Working mode</td><td>● 10GE optical ports support the 10G full-duplex and LAN modes.
● 2.5GE optical ports support the 2500M full-duplex mode.
● GE optical ports support the 1000M full-duplex and auto-negotiation modes.
● GE1–GE4 electrical ports support the 10M/100M/1000M full-duplex and auto-negotiation modes.
● FE optical ports support the 100M full-duplex mode.</td></tr>
<tr><td>Tag attributes</td><td>● Supports setting and query of the TAG attributes of an Ethernet port.
● Tag attributes include Tag Aware, Access, and Hybrid.</td></tr>
<tr><td>Jumbo frame</td><td>Supports a maximum frame length of 9600 bytes.</td></tr>
<tr><td>Traffic control</td><td>Supports port-based traffic control that complies with IEEE 802.3x.</td></tr>
<tr><td rowspan="2">Services</td><td>E-line services</td><td>● Port-based E-Line services
● VLAN-based E-Line services
● E-Line services carried by QinQ links
● E-Line services carried by pseudo wires (PWs)</td></tr>
<tr><td>E-LAN service</td><td>● E-LAN services based on IEEE 802.1d bridges
● E-LAN services based on IEEE 802.1q bridges
● E-LAN services based on IEEE 802.1ad bridges
● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)</td></tr>
</table>

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td rowspan="2">Link aggregation group (LAG)</td><td>Inter-board LAG</td><td>Supported</td></tr>
<tr><td>Intra-board LAG</td><td>Supported</td></tr>
<tr><td colspan="2">Ethernet ring protection switching (ERPS)</td><td>Supports the ERPS function that complies with ITU-T G.8032v1/v2.</td></tr>
<tr><td colspan="2">Smart Ethernet Protection (SEP)</td><td>Supported</td></tr>
<tr><td colspan="2">Link Layer Discovery Protocol (LLDP)</td><td>Supported</td></tr>
<tr><td>ETH OAM</td><td>Ethernet service OAM</td><td>● Supports ETH OAM functions that comply with IEEE 802.1ag.
● Supports ETH OAM functions that comply with IEEE 802.3ah.
● Supports packet loss, delay, and delay variation measurement functions that comply with ITU-T Y. 1731.</td></tr>
<tr><td colspan="2">Remote network monitoring (RMON)</td><td>Supported</td></tr>
<tr><td rowspan="4">Clock</td><td>Clock source</td><td>Synchronous Ethernet
NOTE
Synchronous Ethernet is not supported by electrical modules.</td></tr>
<tr><td>Clock protection</td><td>● Protection based on clock source priorities
● Protection implemented by running the SSM protocol
● Protection implemented by running the extended SSM protocol</td></tr>
<tr><td>Time synchronization
NOTE
Time synchronization is not supported by electrical modules.</td><td>● Supports IEEE 1588v2 time synchronization.
● Supports ITU-T G.8257.1 time synchronization.</td></tr>
<tr><td>IEEE 1588 ACR</td><td>Supported</td></tr>
<tr><td>DCN</td><td>Inband DCN</td><td>Each Ethernet port provides one inband DCN channel.</td></tr>
<tr><td rowspan="2">OAM</td><td>Loopback</td><td>● Supports inloops at the PHY layer of Ethernet ports.
● Supports inloops at the MAC layer of Ethernet ports.</td></tr>
<tr><td>Warm reset</td><td>Supported</td></tr>
</table>

Function and Feature		Description
	SFP module information query	Supported

Table 3-44 lists SDH service functions that the CSHOF supports.

Table 3-44 SDH service functions

Function and Feature		Description
Basic functions		Receives/Transmits two channels of STM-1 optical/ electrical signals.
Optical port specifications		● Supports SFP electrical and optical modules. ● Uses SFP optical modules to provide Ie-1, S-1.1, L-1.1, and L-1.2 electrical ports that comply with ITU-T G.957. ● Uses SFP electrical modules to provide 75-ohm STM-1 electrical ports that comply with ITU-T G. 703.
Protection	Linear multiplex section protection (LMSP)	Supported
	Subnetwork connection protection (SNCP)	Supported
Clock	Clock source	Provides one SDH line clock signal over each line port.
	Clock protection	● Protection based on clock source priorities ● Protection implemented by running the SSM protocol ● Protection implemented by running the extended SSM protocol
Data communication network (DCN)	Outband DCN	Each SDH line port provides one DCC channel consisting of three DCC bytes, nine DCC bytes, or 12 DCC bytes.
O&M	Loopback	● Supports outloops at optical (electrical) ports. ● Supports inloops at optical (electrical) ports. ● Supports outloops on VC-4 paths. ● Supports inloops on VC-4 paths.

Function and Feature		Description
	Setting of the on/off state for a laser	Supported
	Automatic laser shutdown (ALS)[a]	Supported
	Detection and query of SFP optical module information	Supported
	Warm reset and cold reset	Supported

NOTE

a: The ALS function is implemented as follows:

1. When an optical module detects an R_LOS alarm at a receive port and the alarm persists for 500 ms, the laser at the transmit port is automatically shut down.
2. The laser begins to launch intermittent laser pulses. It emits light for 2 seconds and shuts down for 60 seconds.
3. After the R_LOS alarm is cleared, the laser becomes normal and continuously emits light.

Table 3-45 lists the functions and features that CSHOF boards support. PDH ports on CSHOF boards can implement CES function. For details, see **3.19.3 Functions and Features**.

Table 3-45 PDH service functions

Function and Feature		Description
Basic functions		Receives/transmits E1 signals.
Port specifications	75-ohm or 120-ohm E1 port	16
Clock	Clock source	Extracts the first and fifth E1 signals as the tributary clock source.
	Clock protection	Protection based on clock source priorities
	E1 retiming	Supported
OM	Loopback	Supports inloops and outloops at E1/T1 tributary ports.
	Warm reset and cold reset	Supported

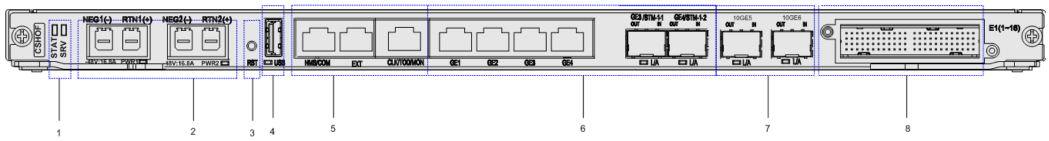
Function and Feature		Description
	Pseudo random binary sequence (PRBS) test at E1/T1 ports	Supported

3.5.4 Front Panel

A CSHOF board has indicators, buttons, power ports, service ports, card fasteners, clock ports, auxiliary ports, and management ports on its front panel.

Front Panel Diagram

Figure 3-36 Front panel of a CSHOF board



1. Indicators	2. Power input ports	3. Button
4. USB port	5. Clock, auxiliary, and management ports	6. GE/STM-1 ports
7. 10GE ports	8. E1 ports	-

Indicators

Table 3-46 Status explanation for indicators on a CSHOF board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, the board is not created, or there is no power supplied to the board.
SRV	On (green)	The system is working properly.
	On (red)	A critical or major alarm occurs in the system.
	On (yellow)	A minor or remote alarm occurs in the system.

Indicator	State	Meaning
PWR1	On (green)	There is input from the first －48 V power port.
	Off	There is no input from the first －48 V power port.
PWR2	On (green)	There is input from the second －48 V power port.
	Off	There is no input from the second －48 V power port.
USB(USB flash drive)	Blinks (red)	The USB flash drive is online but faulty, or the NE does not support the USB flash drive.
	Blinks on (yellow) and off at 300 ms intervals	Data is being backed up to or recovered from the USB flash drive.
	On (red)	Backing up data to or recovering data from the USB flash drive failed.
	On (green)	● A USB flash drive is online. ● Data backup or recovery is complete.
	Off	The USB flash drive is offline or the NE cannot identify the USB flash drive.
USB(WLAN module)	On (green)	The WLAN module has been identified and is working properly.
	On (red)	The WLAN module is faulty.
	Off	● No WLAN module is connected to the USB port. ● The WLAN module connected to the USB port cannot be identified.
GE1–GE4 (electrical port)	On (green)	The port is connected properly.
	Blinks (yellow)	The port is receiving or transmitting data.
	Off	The port is not connected or is incorrectly connected.
L/A	On (green)	The Ethernet port is properly connected and is not receiving or transmitting data.
	On (red)	The Ethernet port reports an optical power alarm (applicable only to optical ports). The STM-1 port reports an R_LOS alarm.
	Blinks (yellow)	The Ethernet port is receiving or transmitting data.

Indicator	State	Meaning
	Off	The Ethernet port is not connected or is incorrectly connected. The STM-1 port does not report an R_LOS alarm.

Power Supply Ports

Table 3-47 Power supply ports

Port	Port Description	Connector Type	Corresponding Cable
NEG1(-)/ NEG2(-)	－48 V power input port.	2 mm HM power connector (2x2 pins)	**5.1 Power Cable**
RTN1(+)/ RTN2(+)	BGND power input port		

USB Port

Table 3-48 USB port

Port	Description	Connector Type
USB	USB port. ● Connects to a USB flash drive, which can be used to back up and restore databases. ● Houses a WLAN module to implement wireless NMS access.	Type-A USB female

Clock, Auxiliary, and Management Ports

Table 3-49 Clock, auxiliary, and management ports

Port	Description	Connector Type
NMS/COM	NMS port/NMS serial port	RJ45
EXT	NE cascade port	

Port	Description	Connector Type
CLK/TOD/MON	External clock port (2048 kbit/s or 2048 kHz), external time port 1, or outdoor cabinet monitoring port	

NOTE

- External clock port, external time port and the outdoor cabinet monitoring port are combined into one physical port on CSHOF board.
- This port can implement only one function at a time.

Auxiliary ports and management ports use RJ45 connectors. The pin assignments for the ports, however, are different. **Figure 3-37** shows the front view of the RJ45 connector.

Figure 3-37 Front view of the RJ45 connector

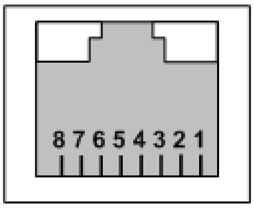


Table 3-50 Pin assignments of the NMS/COM port

Port	Pin	Signal
NMS/COM	1	Transmitting data (+)
	2	Transmitting data (-)
	3	Receiving data (+)
	4	Ground end of the NMS serial port
	5	Receive end of the NMS serial port
	6	Receiving data (-)
	7	Not defined
	8	Transmit end of the NMS serial port

Table 3-51 Pin assignments for the EXT port

Port	Pin	Signal
EXT	1	Transmitting data (+)
	2	Transmitting data (-)

Port	Pin	Signal
	3	Receiving data (+)
	6	Receiving data (-)
	4, 5, 7, 8	Not defined

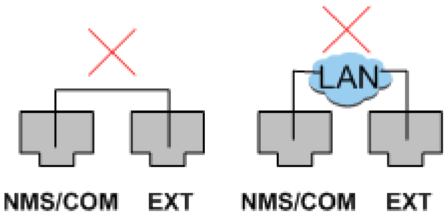
NOTE

The EXT port supports the MDI and auto-MDI-X modes. That is, the EXT port can transmit data through pins 3 and 6 and receive data through pins 1 and 2.

The NMS and EXT ports are equivalent to two ports on a hub. Therefore, no external Ethernet link can be configured between the two ports. Otherwise, an Ethernet loop will be formed, causing a broadcast storm and affecting the DCN communication.

Figure 3-38 shows two common error connections.

Figure 3-38 Incorrect connections between NMS/COM and EXT



The clock port (CLK), high-precision time port (TOD1), and outdoor cabinet monitoring port (MON) share the same RJ45 connector. **Table 3-52** lists the pin assignments for the CLK/TOD/MON port. This port can work in only one mode at a time.

Table 3-52 Pin assignments for the CLK/TOD/MON port

Pin	Working Mode					
	External clock	**External Time Input (1PPS +Time Information)**	**External Time Output (1PPS +Time Information)**	**External Time Input (DCLS)**	**External Time Output (DCLS)**	**Outdoor Cabinet Monitoring Port**
1	Signal input (-)	Not defined	Not defined	Not defined	Not defined	Reserved
2	Signal input (+)	Not defined	Not defined	Not defined	Not defined	Reserved
3	Not defined	1PPS signal input (-) (RS-422 level)	1PPS signal output (-) (RS422 level)	DCLS time signal input (-) (RS422 level)	DCLS time signal output (-) (RS422 level)	Outdoor cabinet monitoring signal input (-) (RS422 level)
4	Signal output (-)	Ground end	Ground end	Ground end	Ground end	Reserved
5	Signal output (+)	Ground end	Ground end	Ground end	Ground end	Ground end

Pin	Working Mode					
	External clock	**External Time Input (1PPS +Time Information)**	**External Time Output (1PPS +Time Information)**	**External Time Input (DCLS)**	**External Time Output (DCLS)**	**Outdoor Cabinet Monitoring Port**
6	Not defined	1PPS signal output (+) (RS-422 level)	1PPS signal output (+) (RS-422 level)	DCLS time signal input (+) (RS-422 level)	DCLS time signal input (+) (RS-422 level)	Outdoor cabinet monitoring signal output (+) (RS-422 level)
7	Not defined	Time information output (-) (RS-422 level)	Time information output (-) (RS-422 level)	Not defined	Not defined	Outdoor cabinet monitoring signal input (-) (RS-422 level)

Pin	Working Mode					
	External clock	External Time Input (1PPS +Time Information)	External Time Output (1PPS +Time Information)	External Time Input (DCLS)	External Time Output (DCLS)	Outdoor Cabinet Monitoring Port
8	Not defined	Time information input (+) (RS-422 level)	Time information output (+) (RS-422 level)	Not defined	Not defined	Outdoor cabinet monitoring signal input (+) (RS-422 level)

Service Ports

Table 3-53 Service ports

Port	Description	Connector Type	Corresponding Cable
GE1-GE4*	FE/GE port (fixed electrical port)	RJ45	**5.10 Network Cable**
GE5–GE6	10GE port (SFP/SFP+ module)	RJ45 SFP electrical module/LC SFP/SFP+ optical module AE 905S module	• SFP/SFP+ optical module: **5.6 Fiber Jumper** • SFP electrical module: **5.10 Network Cable**

Port	Description	Connector Type	Corresponding Cable
STM-1-1-STM-1-2*	STM-1 port GE port	● SFP optical module: LC ● SFP electrical module: SAA straight female	● SFP optical module: **5.6 Fiber Jumper** ● SFP electrical module: **5.7 STM-1 Cable**
E1 (1-16)	First to sixteenth E1/T1 signals	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

NOTE
*: Two optical GE ports (GE3 and GE4) and two STM-1 ports share physical ports, and one port can be GE Port or STM-1 port. Two GE optical ports (GE3 and GE4) and two GE electrical ports (GE3 and GE4) share physical channels. When using the GE3/GE4 electrical ports, the GE3/GE4 optical ports only can be STM-1 ports.

The GE electrical ports (RJ45 ports) support the MDI, MDI-X, and auto-MDI/MDI-X modes. **Table 3-54** and **Table 3-55** list the pin assignments for an RJ45 port in different modes.

Table 3-54 Pin assignments for an RJ45 port in MDI mode

Pin	1000BASE-T	
	Signal	Function
1	BIDA+	Bidirectional data wire A (+)
2	BIDA-	Bidirectional data wire A (-)
3	BIDB+	Bidirectional data wire B (+)
4	BIDC+	Bidirectional data wire C (+)
5	BIDC-	Bidirectional data wire C (-)
6	BIDB-	Bidirectional data wire B (-)
7	BIDD+	Bidirectional data wire D (+)
8	BIDD-	Bidirectional data wire D (-)

Table 3-55 Pin assignments for an RJ45 port in MDI-X mode

Pin	1000BASE-T	
	Signal	Function
1	BIDB+	Bidirectional data wire B (+)

Pin	1000BASE-T	
	Signal	Function
2	BIDB-	Bidirectional data wire B (-)
3	BIDA+	Bidirectional data wire A (+)
4	BIDD+	Bidirectional data wire D (+)
5	BIDD-	Bidirectional data wire D (-)
6	BIDA-	Bidirectional data wire A (-)
7	BIDC+	Bidirectional data wire C (+)
8	BIDC-	Bidirectional data wire C (-)

The E1 port uses an Anea 96 connector. For the pin assignments for an Anea 96 connector, see **Figure 3-39** and **Table 3-56**.

Figure 3-39 Front view of an Anea 96 connector

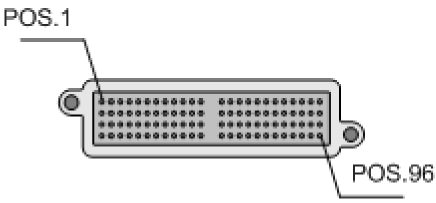


Table 3-56 Pin assignments for an Anea 96 connector

Pin	Signal	Pin	Signal
1	The first received E1 differential signal (+)	25	The first transmitted E1 differential signal (+)
2	The first received E1 differential signal (-)	26	The first transmitted E1 differential signal (-)
3	The second received E1 differential signal (+)	27	The second transmitted E1 differential signal (+)
4	The second received E1 differential signal (-)	28	The second transmitted E1 differential signal (-)
5	The third received E1 differential signal (+)	29	The third transmitted E1 differential signal (+)
6	The third received E1 differential signal (-)	30	The third transmitted E1 differential signal (-)

Pin	Signal	Pin	Signal
7	The fourth received E1 differential signal (+)	31	The fourth transmitted E1 differential signal (+)
8	The fourth received E1 differential signal (-)	32	The fourth transmitted E1 differential signal (-)
9	The fifth received E1 differential signal (+)	33	The fifth transmitted E1 differential signal (+)
10	The fifth received E1 differential signal (-)	34	The fifth transmitted E1 differential signal (-)
11	The sixth received E1 differential signal (+)	35	The sixth transmitted E1 differential signal (+)
12	The sixth received E1 differential signal (-)	36	The sixth transmitted E1 differential signal (-)
13	The seventh received E1 differential signal (+)	37	The seventh transmitted E1 differential signal (+)
14	The seventh received E1 differential signal (-)	38	The seventh transmitted E1 differential signal (-)
15	The eighth received E1 differential signal (+)	39	The eighth transmitted E1 differential signal (+)
16	The eighth received E1 differential signal (-)	40	The eighth transmitted E1 differential signal (-)
17	The ninth received E1 differential signal (+)	41	The ninth transmitted E1 differential signal (+)
18	The ninth received E1 differential signal (-)	42	The ninth received E1 differential signal (-)
19	The tenth received E1 differential signal (+)	43	The tenth transmitted E1 differential signal (+)
20	The tenth received E1 differential signal (-)	44	The tenth received E1 differential signal (-)
21	The eleventh received E1 differential signal (+)	45	The eleventh transmitted E1 differential signal (+)
22	The eleventh received E1 differential signal (+)	46	The eleventh transmitted E1 differential signal (-)
23	The twelfth received E1 differential signal (+)	47	The twelfth transmitted E1 differential signal (+)
24	The twelfth received E1 differential signal (+)	48	The twelfth transmitted E1 differential signal (-)
49	The thirteenth received E1 differential signal (+)	73	The thirteenth transmitted E1 differential signal (+)

Pin	Signal	Pin	Signal
50	The thirteenth received E1 differential signal (-)	74	The thirteenth transmitted E1 differential signal (-)
51	The fourteenth received E1 differential signal (+)	75	The fourteenth transmitted E1 differential signal (+)
52	The fourteenth received E1 differential signal (-)	76	The fourteenth transmitted E1 differential signal (-)
53	The fifteenth received E1 differential signal (+)	77	The fifteenth transmitted E1 differential signal (+)
54	The fifteenth transmitted E1 differential signal (-)	78	The fifteenth transmitted E1 differential signal (-)
55	The sixteenth received E1 differential signal (+)	79	The sixteenth transmitted E1 differential signal (+)
56	The sixteenth transmitted E1 differential signal (-)	80	The sixteenth transmitted E1 differential signal (-)

Button

Table 3-57 Button

Button	Name	Description
RST	Board warm reset button	The button allows you to warm reset the board. When the RST button is pressed and released, the board is warm reset.

3.5.5 Valid Slots

The CSHOF board is a dual-slot board. The board is inserted in slot 7 of an IDU chassis. For the NMS to manage functional units on a CSHOF board, the functional units are mapped into specific logical boards and allocated logical slots on the NMS.

Figure 3-40 Slot for a CSHOF board in an IDU chassis

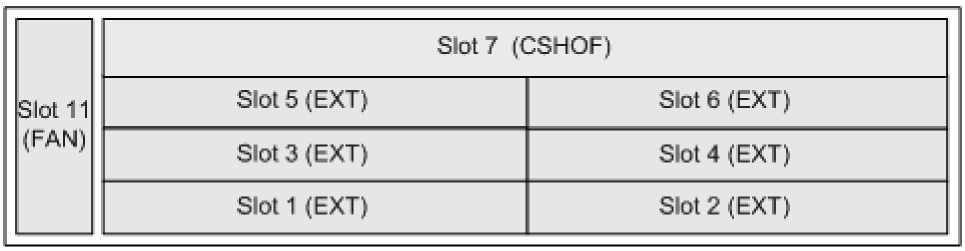
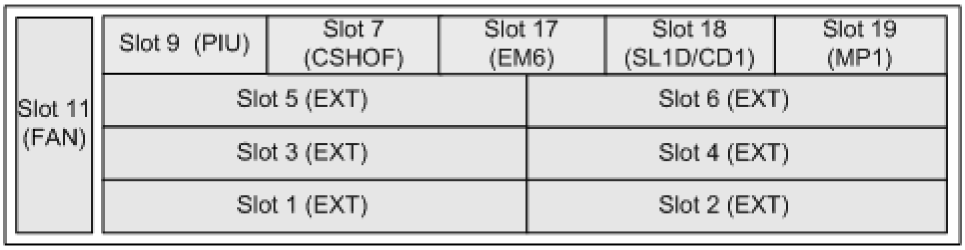


Figure 3-41 Logical slots for a CSHOF board on the NMS



3.5.6 Types of SFP+/SFP Modules

The 10GE/2.5GE/GE, FE, and STM-1 ports on a CSHOF board support multiple types of SFP +/SFP modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

NOTE

The CSHOF board must be used with Huawei's optical modules (**Table 3-58** to **Table 3-63**). If non-Huawei optical modules are used, their reliability is not guaranteed.

Table 3-58 Types of SFP modules that GE optical ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060286	1000Base-SX	850 nm, 0.5 km
	34060473	1000BASE-LX	1310 nm, 10 km
	34060298	1000BASE-VX	1310 nm, 40 km
	34060513	1000BASE-VX	1550 nm, 40 km
	34060360	1000BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional GE module	34060475	1000BASE-BX-D	Transmit wavelength: 1490 nm/receive wavelength: 1310 nm 10 km
	34060470	1000BASE-BX-U	Transmit wavelength: 1310 nm/receive wavelength: 1490 nm 10 km

Category	Part Number	Type	Wavelength and Transmission Distance
	34060540	1000BASE-BX-D	Transmit wavelength: 1490 nm/receive wavelength: 1310 nm 40 km
	34060539	1000BASE-BX-U	Transmit wavelength: 1310 nm/receive wavelength: 1490 nm 40 km

Table 3-59 Types of SFP+ modules that 2.5GE optical ports support

Category	Part Number	Wavelength and Transmission Distance
Dual-fiber bidirectional 2.5GE module	34060365	850 nm, 0.3 km
	34060517	1310 nm, 2 km
	34060528	1310 nm, 10 km

Table 3-60 Types of SFP+ modules that 10GE optical ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional 10GE module	34060618	10GBase-SR	850 nm, 0.1 km
	34060600	10GBase-SR	850 nm, 0.3 km
	34060684	10GBase-LC	1550 nm, 40km
Dual-fiber bidirectional 10GE module	34060713-001	10GBase-SR	1310 nm, 1.4 km
	34060599-002	10GBase-LR	1310 nm, 10 km

Table 3-61 Types of SFP modules that FE optical ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060287	100BASE-FX	1310 nm, 2 km
	34060276	100BASE-LX	1310 nm, 15 km
	34060281	100BASE-VX	1310 nm, 40 km
	34060282	100BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional GE module	34060364	100BASE-BX-D	Transmit wavelength: 1550 nm/receive wavelength: 1310 nm 15 km
	34060363	100BASE-BX-U	Transmit wavelength: 1310 nm/receive wavelength: 1550 nm 15 km
	34060329	100BASE-BX-D	Transmit wavelength: 1550 nm/receive wavelength: 1310 nm 40 km
	34060328	100BASE-BX-U	Transmit wavelength: 1310 nm/receive wavelength: 1550 nm 40 km

Table 3-62 Type of the SFP modules that the STM-1 optical ports support

Part Number	Type
34060287	Ie-1
34060276	S-1.1
34060281	L-1.1
34060282	L-1.2
34100104	STM-1e

Table 3-63 Type of the SFP modules that the GE electrical ports support

Part Number	Type
34100052	10/100/1000BASE-T(X)

3.5.7 Technical Specifications

This section describes board specifications, including the packet switching capacity, cross-connection capacity, Ethernet port specifications, clock performance, wayside service port specifications, mechanical behaviors, and power consumption.

Packet Switching Capacity

A CSHOF board provides a 90 Gbit/s packet switching capability.

Cross-Connect Capacity

A CSHOF board provides full time-division VC-12/VC-3/VC-4 cross-connections (equivalent to 32 x 32 VC-4 cross-connections).

Ethernet Port Specifications

Ethernet port specifications comply with IEEE 802.3.

Table 3-64 GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.5	10
Operating wavelength (nm)	770 to 860	1270 to 1355
Average optical output power (dBm)	-9 to -3	-9 to -3
Receiver sensitivity (dBm)	-17	-20
Overload (dBm)	0	-3
Extinction ratio (dB)	9.5	9.5

Table 3-65 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

Table 3-66 GE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Nominal bit rate (Mbit/s)	1000	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	10	10	40	40
Operating wavelength (nm)	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500
Average optical output power (dBm)	-9 to -3	-9 to -3	-3 to +3	-3 to +3
Receiver sensitivity (dBm)	-19.5	-19.5	-23	-23
Overload (dBm)	-3	-3	-3	-3
Extinction ratio (dB)	6	6	6	6

Table 3-67 2.5GE optical interface specifications (two-fiber bidirectional)

Item	Specifications		
BOM code	**34060365**	**34060517**	**34060528**
Nominal wavelength (nm)	850	1310	1310
Fiber type	Multi-mode	Single-mode	Single-mode
Transmission distance (km)	0.3	2	10
Operating wavelength (nm)	770 to 860	1261 to 1360	1261 to 1360
Average optical output power (dBm)	-9 to -1.5	-8.4 to 0.5	-8.4 to 0.5
Receiver sensitivity (dBm)	-15	-13.8	-13.8
Overload (dBm)	0	0.5	0.5
Extinction ratio (dB)	3	3.5	3.5

Table 3-68 10GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications				
Classification code	**10GBase-SR (0.1 km)**	**10GBase-SR (0.3 km)**	**10GBase-SR (1.4 km)**	**10GBase-LR (10 km)**	**10GBase-LC (40 km)**
Nominal wavelength (nm)	850	850	1310	1310	1550
Fiber type	Multi-mode	Multi-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	0.1	0.3	1.4	10	40

Item	Specifications				
Classification code	**10GBase-SR (0.1 km)**	**10GBase-SR (0.3 km)**	**10GBase-SR (1.4 km)**	**10GBase-LR (10 km)**	**10GBase-LC (40 km)**
Operating wavelength (nm)	770 to 860	770 to 860	1261 to 1360	1261 to 1360	1480 to 1580
Average optical output power (dBm)	-5 to -1	-7.3 to -1	-8.2 to 0.5	-8.2 to 0.5	-4.7 to 4.0
Receiver sensitivity (dBm)	-11.1	-11.1	-10.3	-14.4	-14.1
Overload (dBm)	-1	-1	0.5	0.5	0.5
Extinction ratio (dB)	3	3	3.5	3.5	3.5

FE Optical Interface Specifications

The characteristics of FE optical interfaces comply with IEEE 802.3.

Table 3-69 FE optical interface specifications (two-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1310	1310	1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Multi-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Average optical output power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-30	-28	-34	-34
Overload (dBm)	-14	-8	-10	-10

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Extinction ratio (dB)	10	8.2	10	10.5

Table 3-70 FE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	15	15	40	40
Operating wavelength (nm)	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580
Average optical output power (dBm)	-15 to -8	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-32	-32	-32	-32
Overload (dBm)	-8	-8	-10	-10
Extinction ratio (dB)	8.5	8.5	10	10

NOTE

The OptiX RTN 950A uses SFP modules to provide FE optical interfaces. Users can use different types of SFP modules to provide FE optical interfaces with different classification codes and transmission distances.

STM-1 Optical Port Specifications

STM-1 optical port specifications comply with ITU-T G.957/G.825.

Table 3-71 STM-1 optical interface performance (two-fiber bidirectional)

Item	Performance
Nominal bit rate (kbit/s)	155520

Item	Performance			
Classification code	Ie-1	S-1.1	L-1.1	L-1.2
Fiber type	Multi-mode fiber	Single-mode fiber	Single-mode fiber	Single-mode fiber
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Mean launched power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver minimum sensitivity (dBm)	-30	-28	-34	-34
Minimum overload (dBm)	-14	-8	-10	-10
Minimum extinction ratio (dB)	10	8.2	10	10

GE Electrical Interface Specifications

The characteristics of GE electrical interfaces comply with IEEE 802.3.

Table 3-72 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

STM-1 Electrical Port Specifications

STM-1 electrical port specifications comply with ITU-T G.703.

Table 3-73 STM-1 electrical port specifications

Item	Specifications
Nominal bit rate (kbit/s)	155520
Code pattern	CMI
Wire pair in each transmission direction	One coaxial wire pair
Impedance (ohm)	75

NOTE

The OptiX RTN 950A uses SFP electrical modules for providing electrical ports.

E1 Interface Performance

Table 3-74 E1 interface performance

Item	Performance	
Nominal bit rate (kbit/s)	2048	
Code pattern	HDB3	
Impedance (ohm)	75	120
Wire pair in each transmission direction	One coaxial wire pair	One symmetrical wire pair

Clock Timing and Synchronization Performance

Clock timing and synchronization performance meets related ITU-T Recommendations.

Table 3-75 Clock timing and synchronization performance

Item	Performance
External synchronization source	2048 kbit/s (compliant with ITU-T G.703 §9), or 2048 kHz (compliant with ITU-T G.703 §13)
Frequency accuracy	Compliant with ITU-T G.813
Pull-in and pull-out ranges	
Noise generation	
Noise tolerance	
Noise transfer	

Item	Performance
Transient response and holdover performance	

Mechanical Behaviors and Power Consumption

Table 3-76 Mechanical behaviors and power consumption

Item	Specifications
Dimensions (H x W x D)	22.36 mm x 388.40 mm x 269.73 mm
Weight	1.08 kg
Typical power consumption	46 W
Maximum power consumption	57 W

3.6 ISM8

ISM8 is a dual-channel IF board that provides two IF ports and one 10GE cascading port.

3.6.1 Version Description

The functional version of the ISM8 is SL91.

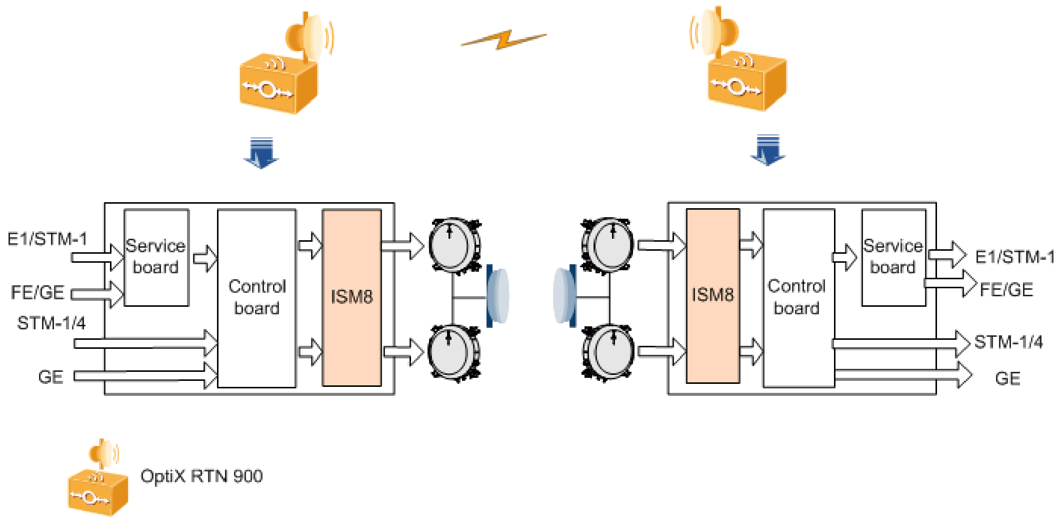
3.6.2 Application

The ISM8 board provides two IF ports. The two IF ports can be used to implement intra-board/inter-board XPIC, 1+1 HSB/FD/SD, or PLA/EPLA functions in one microwave direction, or provide microwave links in different directions.

Scenario Where Two IF Ports Are Applied in the Same Microwave Direction

ISM8 boards support XPIC/PLA/EPLA/EPLA+ between intra-board ports as well as 1+1 HSB/FD/SD between intra-ports.

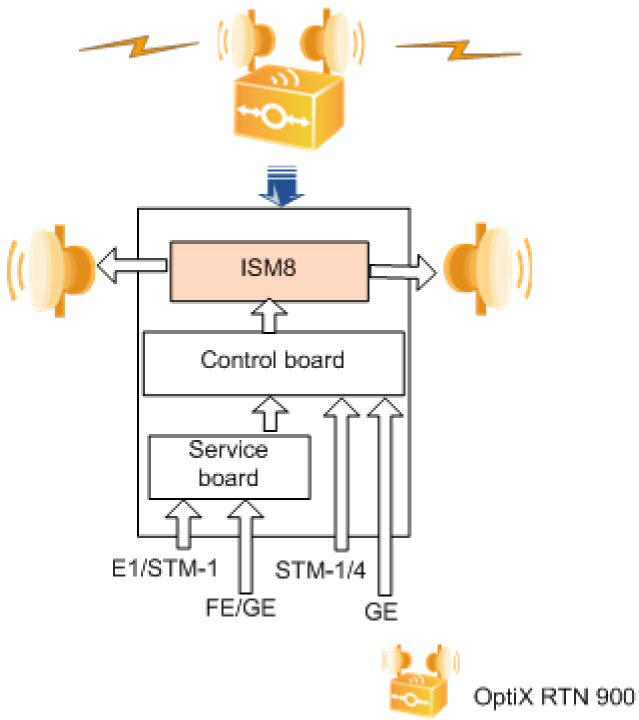
Figure 3-42 Scenario where two IF ports are applied in the same microwave direction



Scenario Where Two IF Ports Are Applied in Different Microwave Directions

An ISM8 board can transmit packets in two microwave directions through its two IF ports. The two IF ports can work in different modes at the same time.

Figure 3-43 Scenario where two IF ports are applied in different microwave directions



3.6.3 Functions and Features

The ISM8 IF board receives and transmits two IF signals, provides the management channel to the ODU, and supplies the required -48 V power to the ODU.

The ISM8 IF board needs to work with packet switching units to provide Ethernet and packet services.

Table 3-77 Functions and features that ISM8 boards support

Function and Feature	Description
Basic functions	• Receives and transmits 2xIF signals. • Provides management channels to ODUs. • Supplies -48 V power to ODUs.
Radio types	• Integrated IP microwave • SDH radio **NOTE** Integrated IP microwave is compatible with Hybrid radio and Packet radio.
Service types in Integrated IP microwave mode	• Native E1 + Ethernet • Native STM-1 + Ethernet **NOTE** One STM-1 service is equivalent to 63 E1 services. The total number of E1 and STM-1 services accessed on each board is less than or equal to 126 (the number of E1 services).
Service types in SDH radio mode	• STM-1 • 2xSTM-1 **NOTE** If one IF port provides 2 x STM-1 microwave, the other IF port can only provide integrated IP microwave (the number of E1/STM-1 services is 0).

Function and Feature	Description
Running modes	● IS8 mode, which is the default mode. In this mode, the modulation schemes QPSK-8192QAM and the extended modulation schemes QPSK Strong and 16QAM Strong are supported. The 8192QAM modulation scheme is supported only when the channel spacing is 28/40/56 MHz. When the channel spacing is 112 MHz, modulation schemes QPSK Strong-4096QAM are supported. ● IS6 mode, which is the default mode. In this mode, the modulation schemes QPSK-4096QAM and the two extended modulation schemes QPSK Strong and and 16QAM Strong are supported. The 112 MHz channel spacing is supported, and in this channel spacing, the modulation schemes QPSK-2048QAM and the two extended modulation schemes QPSK Strong and 16QAM Strong are supported. ● IS3 mode. In this mode, the modulation schemes QPSK-2048QAM and the four extended modulation schemes QPSK Strong, 16QAM Strong, and 512QAM Light, and 1024QAM Light are supported. ISM8 boards can interconnect only with ISV3 boards or the RTN 905 1E/2E. **NOTE** Compared with QPSK/16QAM, QPSK Strong/16QAM Strong has stronger FEC capability, and therefore has better receiver sensitivity. It has, however, less air interface bandwidth. Compared with 512QAM/ 1024QAM, 512QAM Light/1024QAM Light has weaker FEC capability, and therefore has worse receiver sensitivity. It has, however, higher air interface bandwidth.

Function and Feature	Description
Modulation schemes	● IS8 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/1024QAM/2048QAM/4096QAM/8192QAM ● IS6 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/1024QAM/2048QAM/4096QAM ● IS3 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/512QAM Light/1024QAM/1024QAM Light/2048QAM **NOTE** ● In IS8 mode, the channel spacing is 28/40/56 MHz, and 8192QAM is supported only when AM is enabled. ● In IS6 mode, 4096QAM is supported only when AM is enabled. ● In IS3 mode, 2048QAM is supported only when AM is enabled. ● The highest-order modulation scheme that can be used by an IF port is determined based on factors such as the ODU frequency band, XPIC, and channel spacing. For details, see **3.6.7 Technical Specifications**.
112 MHz channel spacing	Supported (only in IS6/IS8 mode).
Backplane bus bandwidth	● Working with the SLF2CSHO: 1 Gbit/s with EPLA enabled and 2.5 Gbit/s with EPLA disabled for slots 4/6, and 2.5 Gbit/s for other slots ● Working with the CSHOF: 2x2.5 Gbit/s for slots 1/2 and 2.5 Gbit/s for slots 3 to 6
MIMO	Supported.
Predistortion	Supported.
Automatic transmit power control (ATPC)	Supported.
Adaptive modulation (AM)	Supported only in Integrated IP microwave mode.
E1 priorities	Supported only if native TDM services transmitted over Integrated IP microwave are E1 services.
AES256-based encryption at air interfaces	Supported.

Function and Feature		Description
Compression of Ethernet frame headers		Supported.
XPIC		Intra-board and inter-board XPIC are supported.
CA		Supported.
Anti-theft function		Not Supported.
Microwave working modes		For details, see **3.6.7 Technical Specifications**.
Link protection	1+1 HSB/FD/SD protection (HSB stands for hot standby, FD stands for frequency diversity, and SD stands for space diversity.)	Supported. **NOTE** 1+1 HSB/FD/SD protection is supported between intra-board or inter-board ports.
	N+1 protection	Supported.
	Link aggregation groups (LAGs) at air interfaces	Supported.
	Physical link aggregation (PLA/EPLA)	Supported. **NOTE** ● Inter-board PLA is not supported.
TDM service protection		Subnetwork connection protection (SNCP)
K byte pass-through		Supported
Ethernet service functions		See **Table 3-78**
Multiprotocol Label Switching (MPLS) functions		Refer to the description of MPLS/PWE3 functions provided in the sections about system control, switching, and timing boards.
PWE3 functions		
Clock	Physical layer synchronization	Air interface clock
	Physical-layer clock protection	● Protection implemented by providing clock sources with different priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol

Function and Feature		Description
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.
	Packet frequency synchronization	Supports IEEE 1588 ACR
Data communication network (DCN)	Inband DCN	Supports inband DCN. DCN bandwidth is configurable.
	Outband DCN	● Supports one data communications channel (DCC) that is composed of three DCC bytes for each channel in Integrated IP microwave mode. ● Supports one DCC that is composed of D1-D3 bytes, D4-D12 bytes, or D1-D12 bytes for each channel in SDH radio mode.
Operation and management	Loopback	● Supports inloops and outloops at IF ports. ● Supports inloops and outloops at composite (COMP) ports.
	Cold and warm resetting	Supported
	In-service field programmable gate array (FPGA) loading	Supported
	Pseudo random binary sequence (PRBS) test at IF ports	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Temperature monitoring	Supported
	Voltage monitoring	Supported

Table 3-78 Ethernet features of the ISM8 IF board

Function and Feature		Description
Ethernet services	Native Ethernet services	● E-Line services – Port-based E-line services. – VLAN-based E-line services. – E-Line services carried by QinQ links. ● E-LAN services – E-LAN services based on IEEE 802.1d bridges. – E-LAN services based on IEEE 802.1q bridges. – E-LAN services based on IEEE 802.1ad bridges.
	PWE3 Ethernet services	● E-Line services carried by PWs. ● E-Aggr services carried by PWs. ● E-LAN (VPLS) services carried by PWs
Smart Ethernet protection (SEP)		Supported.
Ethernet ring protection switching (ERPS)		Supported (complies with ITU-T G.8032 v1/v2).
Operation, administration, and management (OAM)		● Supports ETH OAM functions that comply with IEEE 802.1ag and IEEE 802.3ah. ● Supports frame loss measurement, frame delay measurement, and delay variation measurement functions that comply with ITU-T Y.1731.
Quality of service (QoS)		Refer to the description of QoS functions provided in the sections about system control, switching, and timing boards.
Remote network monitoring (RMON)		Supported.

3.6.4 Working Principle and Signal Flow

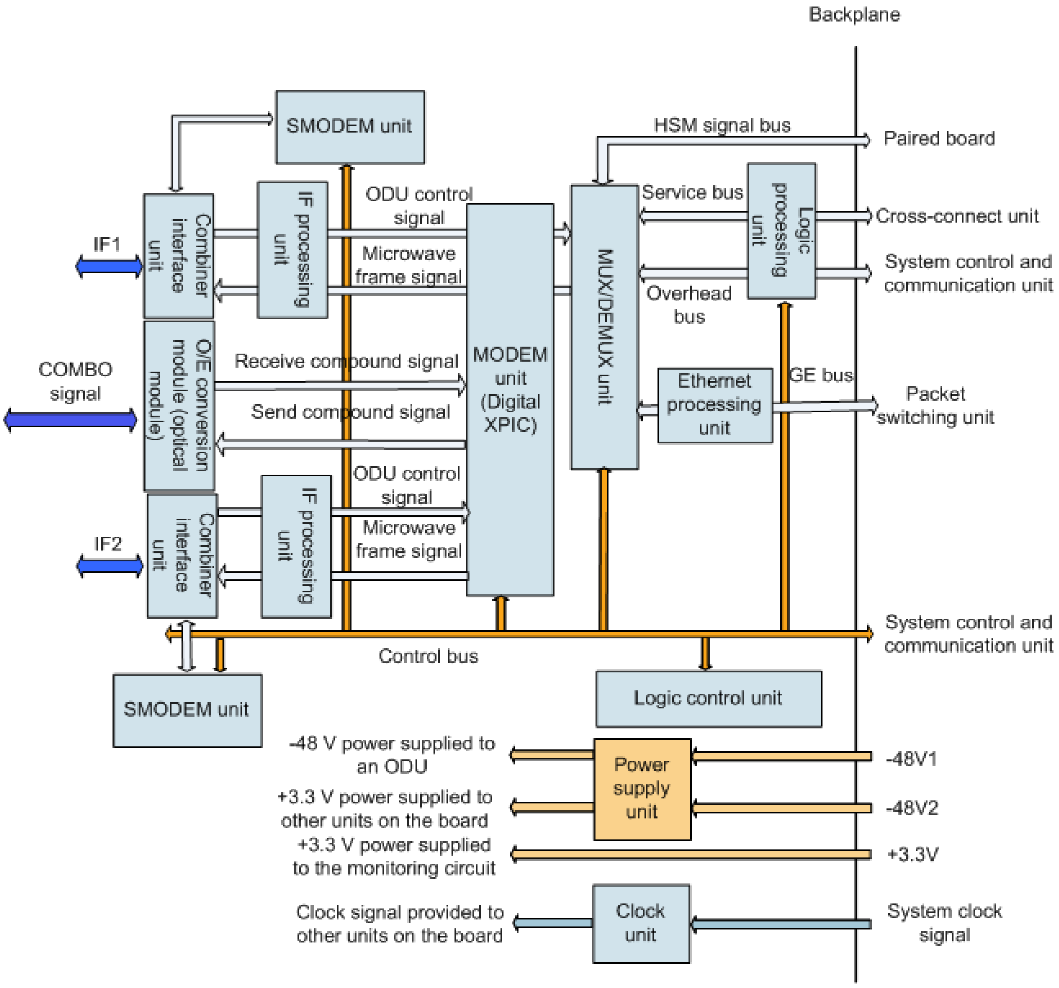
This section describes how the function units of an ISM8 board process Integrated IP microwave IF signals.

NOTE

Although integrated IP microwave signals and SDH microwave signals have different microwave frame structures and service types, the ISM8 process them in the same manner.

Function Block Diagram

Figure 3-44 ISM8 board's function block diagram



Signal Processing Flow in the Receive Direction

Table 3-79 Signal processing in the Receive direction

Step	Function Unit	Processing Flow
1	Combiner interface unit	Separates ODU control signals from microwave service signals.
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits ODU control signals to the system control and communication unit.
3	IF processing unit	Filters signals, performs analog/digital conversion, and transmits the converted signals to the modem unit.

Step	Function Unit	Processing Flow
4	Modem unit	● If XPIC is disabled, performs digital demodulation. ● If XPIC is enabled, performs XPIC operations for IF signals. ● Performs time-domain adaptive equalization. ● Performs forward error correction (FEC) decoding and generates alarms, if any.
5	MUX/DEMUX unit	● Detects microwave frame headers and generates alarms and performance events, if any. ● Verifies parity bits in microwave frames and generates alarms and performance events, if any. ● Checks link IDs in microwave frames and generates alarms and performance events, if any. ● Detects changes in both ATPC messages and response messages, and reports the changes to the system control and communication unit over the control bus. ● Extracts orderwire bytes, auxiliary channel bytes (including F1 and serial bytes), and DCC bytes from microwave frames, and transmits the bytes to the logic processing unit. ● Maps E1 service signals to specific positions in VC-4s and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Demaps VC-4s from STM-1 service signals and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Extracts Ethernet signals from the microwave service signals, and transmits the Ethernet signals to the Ethernet processing unit.
6	Ethernet processing unit	● Processes GE signals received from the MUX/DEMUX unit. ● Sends the processed signals to the packet switching unit.
7	Logic processing unit	● Processes clock signals. ● Transmits overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.
8	O/E conversion module (optical module)	● Receives compound signals. ● Sends processed signals to the modem unit.

NOTE

In inter-boards 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

ISM8 Signal Processing Flow in the Transmit Direction

Table 3-80 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signals from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals that are sent by the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Adds overheads to the VC-4 signals from the logic processing unit to construct STM-1 signals (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Sets overheads for microwave frames. ● Combines Ethernet signals, E1/STM-1 service signals, and microwave frame overheads into microwave frames.
4	Modem unit	● Performs FEC coding. ● Performs digital modulation.
5	IF processing unit	● Performs digital/analog conversion. ● Performs digital modulation. ● Filters signals. ● Amplifies signals.
6	SMODEM unit	Modulates ODU control signals from the system control and communication unit.
7	Combiner interface unit	Combines ODU control signals, microwave service signals, and -48 V power signals, and then sends the combined signals through an IF cable.

Step	Function Unit	Processing Flow
8	O/E conversion module (optical module)	● Processes compound signals. ● Sends processed signals to the cascading cable through the cascading port.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies the power to an ODU. Performs soft-start and filtering operations for the -48 V power received from the power supply bus on the backplane, and supplies -48 V power to an ODU after performing DC-DC conversion.
- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies a +3.3 V power to other units on the ISM6 board.

Clock Unit

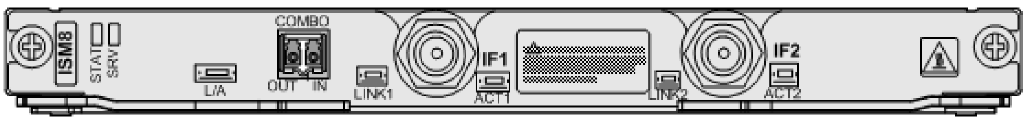
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.6.5 Front Panel

An ISM8 board has indicators, IF ports, 10GE ports, and labels on its front panel.

Front panel diagram

Figure 3-45 Front panel of an ISM8 board



Indicators

Table 3-81 Description of the indicators on an ISM8 board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm is reported.
	Steady yellow	A minor or remote alarm is reported.
L/A	On (green)	The port is connected correctly and is not receiving or transmitting data.
	Blinking on (red) for 300 ms and off for 300 ms repeatedly	Port COMBO port has received too strong power (applicable only to optical ports).
	Blinking on (red) for 300 ms and off for 700 ms repeatedly	Port COMBO port has received too weak power (applicable only to optical ports).
	Blinking (yellow)	The COMBO port is receiving or transmitting data.
	Off	The COMBO port is not connected or is incorrectly connected.
LINK1	On (green)	The first microwave link is normal.
	On (red)	The first microwave link is faulty.
	Off	● The ODU connected to port IF1 is not powered on. ● No ODU logic board is configured for port IF1.

Indicator	State	Meaning
ACT1	On (green)	● In a 1+1 protected system, the first microwave link works as the main one. ● In an unprotected system, the first microwave link has been activated.
	Off	● In a 1+1 protected system, the first microwave link works as the standby one. ● In an unprotected system, no ODU logic board is configured for port IF1.
LINK2	On (green)	The second microwave link is normal.
	On (red)	The second microwave link is faulty.
	Off	● The ODU connected to port IF2 is not powered on. ● ODU logic board is configured for port IF2.
ACT2	On (green)	● In a 1+1 protected system, the second microwave link works as the main one. ● In an unprotected system, the second microwave link has been activated.
	Off	● In a 1+1 protected system, the second microwave link works as the standby one. ● In an unprotected system, no ODU logic board is configured for port IF2.

Port

Table 3-82 IF port description

Port	Description	Connector Type	Corresponding Cable
IF1[a]	IF port	TNC	**IF jumper**
IF2	IF port	TNC	**IF jumper**

NOTE

a: Only the IF1 port can be used to supply power to the XMC-5D ODU.

Table 3-83 Description of service ports

Port	Description	Connector Type
COMBO	10GE port	SFP+ optical module

NOTE

When the COMBO port is used for CA cascading, only the following optical module type is supported: 34060713-001 OSX1D4N01 Optical Transceiver,SFP+,1310nm,9.8G,-8.2dBm to +0.5dBm,-10.3dBm,LC,SM,1.4km.

Table 3-84 Types of SFP+ modules that 10GE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060713-001	10GBase-SR	1310 nm, 1.4 km

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

The operation warning label instructs you to connect an IF cable to the ODU before connecting it to the IDU.

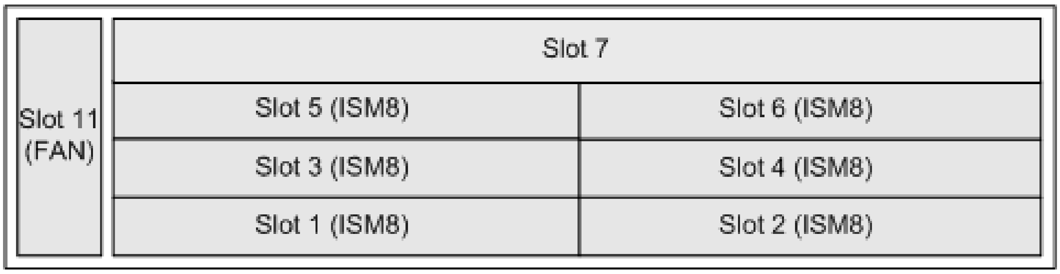
3.6.6 Valid Slots

The ISM8 board can be inserted in slot 1 to 6. The logical slots of the ISM8 on the NMS should be the same as the physical slots.

NOTE

For the maximum number of boards supported by the OptiX RTN 950A, see Number of radio directions in *Product Description*.

Figure 3-46 Slots for the ISM8 in the chassis



An ODU does not occupy a physical slot but has a logical slot on the NMS.

- ODU connecting to the IF1 port: Its logical slot ID is equal to the logical slot ID of the connected IF board plus 20.
- ODU connecting to the IF2 port: Its logical slot ID is equal to the logical slot ID of the connected IF board plus 40.

Figure 3-47 Logical slot number of the ISM8 on the NMS

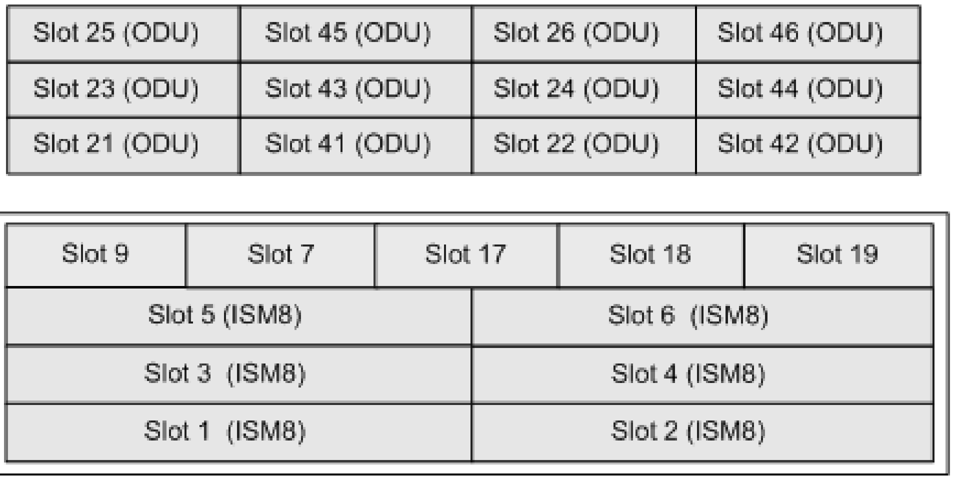


Table 3-85 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 3 and 5 > Slots 1 and 2

3.6.7 Technical Specifications

This topic describes the ISM8 board specifications, including microwave work modes, IF performance, Ethernet service port performance, modem performance, board mechanical behavior and board power consumption.

3.6.7.1 Microwave Work Modes (ISM8 Board)

This section describes the microwave work modes of the ISM8 board.

3.6.7.1.1 Microwave Work Modes (IS8 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS8 running mode.

SDH microwave work mode

Table 3-86 SDH microwave work mode (IS8 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	16QAM	112
NOTE In IS8 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP microwave work mode (IS8 mode, E1+Ethernet)

Table 3-87 Integrated IP microwave work mode (7/8 GHz, IS8 mode, E1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	4	8 to 10	9 to 15	9 to 19	9 to 26
7	QPSK	5	10 to 12	10 to 17	10 to 23	11 to 31
7	16QAM Strong	8	17 to 22	18 to 30	18 to 39	18 to 53
7	16QAM	10	20 to 26	21 to 35	21 to 46	22 to 63
7	32QAM	12	26 to 33	27 to 45	27 to 58	28 to 79
7	64QAM	15	33 to 42	34 to 56	34 to 74	35 to 100
7	128QAM	18	39 to 50	40 to 67	41 to 88	41 to 119
7	256QAM	20	45 to 57	46 to 76	46 to 100	47 to 136

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	512QAM	22	50 to 63	51 to 84	51 to 111	52 to 150
7	1024QAM	25	54 to 68	55 to 91	55 to 119	56 to 161
14(13.75)	QPSK Strong	8	18 to 23	18 to 31	19 to 40	19 to 55
14(13.75)	QPSK	10	21 to 27	22 to 36	22 to 47	22 to 64
14(13.75)	16QAM Strong	16	37 to 47	38 to 62	38 to 82	39 to 111
14(13.75)	16QAM	19	43 to 55	44 to 73	44 to 96	45 to 130
14(13.75)	32QAM	25	54 to 69	55 to 92	56 to 120	57 to 163
14(13.75)	64QAM	31	69 to 87	70 to 116	71 to 152	72 to 206
14(13.75)	128QAM	37	82 to 103	83 to 138	84 to 180	85 to 244
14(13.75)	256QAM	43	93 to 118	95 to 157	96 to 206	97 to 279
14(13.75)	512QAM	47	103 to 131	105 to 174	106 to 227	108 to 308
14(13.75)	1024QAM	50	113 to 143	114 to 190	116 to 248	117 to 336
14(13.75)	2048QAM	55	123 to 156	125 to 207	126 to 271	128 to 367
28(27.5)	QPSK Strong	17	37 to 47	38 to 63	38 to 82	39 to 111
28(27.5)	QPSK	20	43 to 55	44 to 73	45 to 96	45 to 130
28(27.5)	16QAM Strong	35	75 to 96	77 to 127	78 to 166	79 to 226
28(27.5)	16QAM	41	88 to 112	90 to 149	91 to 195	92 to 264
28(27.5)	32QAM	52	111 to 141	113 to 187	114 to 244	116 to 331
28(27.5)	64QAM	65	140 to 177	142 to 235	143 to 307	146 to 416
28(27.5)	128QAM	75	166 to 210	168 to 278	170 to 364	172 to 493
28(27.5)	256QAM	75	189 to 239	191 to 317	193 to 414	196 to 561
28(27.5)	512QAM	75	212 to 268	214 to 355	217 to 464	220 to 629
28(27.5)	1024QAM	75	229 to 290	231 to 383	234 to 501	237 to 678
28(27.5)	2048QAM	75	254 to 322	257 to 426	260 to 556	264 to 754

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28(27.5)	4096QAM	75	268 to 340	272 to 450	274 to 588	279 to 796
28(27.5)	8192QAM	75	284 to 360	287 to 476	290 to 622	295 to 842
40	QPSK Strong	24	53 to 67	54 to 90	55 to 118	56 to 159
40	QPSK	28	62 to 79	63 to 105	64 to 138	65 to 187
40	16QAM Strong	48	108 to 137	110 to 182	111 to 238	113 to 323
40	16QAM	56	127 to 161	128 to 213	130 to 278	132 to 377
40	32QAM	72	159 to 201	161 to 267	163 to 348	165 to 472
40	64QAM	75	200 to 254	203 to 336	205 to 439	208 to 594
40	128QAM	75	237 to 300	240 to 397	242 to 519	246 to 703
40	256QAM	75	270 to 342	273 to 453	276 to 591	281 to 801
40	512QAM	75	302 to 383	306 to 507	309 to 662	314 to 897
40	1024QAM	75	327 to 414	330 to 546	333 to 714	339 to 967
40	2048QAM	75	365 to 463	369 to 611	373 to 799	379 to 1082
40	4096QAM	75	383 to 485	387 to 641	391 to 838	398 to 1135
40	8192QAM	75	405 to 513	410 to 678	414 to 886	421 to 1201
56(55)	QPSK Strong	35	76 to 96	77 to 128	78 to 167	79 to 226
56(55)	QPSK	41	89 to 112	90 to 149	91 to 195	92 to 265
56(55)	16QAM Strong	71	154 to 195	156 to 258	157 to 337	160 to 457
56(55)	16QAM	75	179 to 227	182 to 301	184 to 394	187 to 533
56(55)	32QAM	75	225 to 285	228 to 377	230 to 493	234 to 668
56(55)	64QAM	75	283 to 359	287 to 475	290 to 620	294 to 840
56(55)	128QAM	75	335 to 425	339 to 562	343 to 734	348 to 994
56(55)	256QAM	75	382 to 485	387 to 640	391 to 837	397 to 1134
56(55)	512QAM	75	427 to 542	432 to 716	437 to 935	444 to 1267

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56(55)	1024QAM	75	463 to 587	468 to 775	473 to 1012	480 to 1371
56(55)	2048QAM	75	505 to 640	511 to 846	516 to 1106	525 to 1498
56(55)	4096QAM	75	551 to 698	557 to 923	563 to 1206	572 to 1633
56(55)	8192QAM	75	583 to 739	590 to 976	595 to 1275	605 to 1727

Table 3-88 Integrated IP microwave work mode (11 GHz to 38 GHz, IS8 mode, E1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	4	8 to 10	9 to 15	9 to 19	9 to 26
7	QPSK	5	10 to 13	11 to 18	11 to 24	11 to 33
7	16QAM Strong	8	18 to 23	18 to 31	19 to 40	19 to 55
7	16QAM	10	20 to 26	21 to 35	21 to 46	22 to 62
7	32QAM	12	26 to 33	27 to 44	27 to 58	27 to 79
7	64QAM	15	34 to 43	35 to 58	35 to 76	36 to 102
7	128QAM	18	40 to 51	41 to 68	41 to 89	42 to 121
7	256QAM	20	47 to 59	48 to 79	48 to 103	49 to 140
7	512QAM	22	53 to 67	54 to 89	54 to 116	55 to 158
7	1024QAM	25	57 to 73	58 to 97	59 to 127	60 to 172
7	2048QAM	28	63 to 80	64 to 106	65 to 139	66 to 188
14(13.75)	QPSK Strong	8	18 to 23	18 to 31	19 to 40	19 to 55
14(13.75)	QPSK	10	21 to 27	22 to 37	22 to 48	23 to 65
14(13.75)	16QAM Strong	16	37 to 47	38 to 63	38 to 83	39 to 112
14(13.75)	16QAM	19	44 to 55	45 to 74	45 to 97	46 to 131

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14(13.75)	32QAM	25	55 to 70	56 to 93	57 to 122	58 to 165
14(13.75)	64QAM	31	68 to 87	69 to 115	70 to 151	71 to 204
14(13.75)	128QAM	37	83 to 106	85 to 140	85 to 183	87 to 249
14(13.75)	256QAM	43	96 to 122	98 to 162	99 to 212	100 to 287
14(13.75)	512QAM	47	108 to 137	110 to 182	111 to 238	113 to 322
14(13.75)	1024QAM	50	118 to 149	120 to 198	121 to 259	123 to 351
14(13.75)	2048QAM	55	129 to 164	131 to 217	132 to 284	135 to 385
28(27.5)	QPSK Strong	17	38 to 48	39 to 64	39 to 84	40 to 114
28(27.5)	QPSK	20	43 to 55	44 to 74	45 to 96	46 to 131
28(27.5)	16QAM Strong	35	78 to 99	80 to 132	80 to 173	82 to 234
28(27.5)	16QAM	41	89 to 113	90 to 150	91 to 196	93 to 265
28(27.5)	32QAM	52	114 to 145	116 to 193	117 to 252	119 to 341
28(27.5)	64QAM	65	146 to 185	148 to 245	149 to 320	152 to 434
28(27.5)	128QAM	75	172 to 218	174 to 289	176 to 377	179 to 511
28(27.5)	256QAM	75	199 to 253	202 to 335	204 to 437	207 to 592
28(27.5)	512QAM	75	223 to 283	226 to 374	228 to 489	232 to 662
28(27.5)	1024QAM	75	244 to 309	246 to 407	249 to 532	253 to 721
28(27.5)	2048QAM	75	272 to 345	275 to 456	278 to 596	283 to 807
28(27.5)	4096QAM	75	290 to 367	293 to 486	296 to 635	301 to 860
28(27.5)	8192QAM	75	307 to 390	311 to 515	314 to 673	319 to 912
40	QPSK Strong	24	54 to 69	55 to 92	56 to 120	57 to 163
40	QPSK	28	63 to 80	64 to 106	65 to 139	66 to 188
40	16QAM Strong	48	111 to 141	113 to 187	114 to 244	116 to 331
40	16QAM	56	128 to 162	130 to 215	131 to 281	133 to 381
40	32QAM	72	161 to 204	163 to 270	164 to 353	167 to 478

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	64QAM	75	202 to 256	205 to 339	207 to 443	210 to 601
40	128QAM	75	245 to 311	248 to 411	251 to 538	255 to 728
40	256QAM	75	284 to 360	288 to 476	291 to 623	295 to 843
40	512QAM	75	317 to 402	321 to 531	324 to 694	329 to 940
40	1024QAM	75	346 to 439	350 to 579	353 to 757	359 to 1026
40	2048QAM	75	390 to 494	394 to 653	398 to 853	405 to 1155
40	4096QAM	75	410 to 519	414 to 686	419 to 897	425 to 1214
40	8192QAM	75	434 to 551	440 to 728	444 to 951	451 to 1288
56(55)	QPSK Strong	35	77 to 98	78 to 130	79 to 170	80 to 230
56(55)	QPSK	41	89 to 112	90 to 149	91 to 195	92 to 265
56(55)	16QAM Strong	71	158 to 200	160 to 266	162 to 347	165 to 470
56(55)	16QAM	75	180 to 228	182 to 302	184 to 394	187 to 534
56(55)	32QAM	75	225 to 285	228 to 378	230 to 494	234 to 669
56(55)	64QAM	75	287 to 364	291 to 482	294 to 630	299 to 853
56(55)	128QAM	75	341 to 432	345 to 571	348 to 746	354 to 1011
56(55)	256QAM	75	394 to 500	399 to 660	403 to 863	409 to 1169
56(55)	512QAM	75	449 to 569	454 to 752	459 to 983	466 to 1331
56(55)	1024QAM	75	491 to 623	496 to 822	501 to 1074	510 to 1455
56(55)	2048QAM	75	537 to 681	543 to 899	549 to 1175	558 to 1592
56(55)	4096QAM	75	583 to 739	589 to 977	596 to 1276	606 to 1729
56(55)	8192QAM	75	624 to 791	631 to 1045	638 to 1366	648 to 1850
112	QPSK Strong	70	153 to 194	155 to 257	157 to 336	159 to 455
112	QPSK	75	180 to 228	182 to 302	184 to 395	187 to 535
112	16QAM Strong	75	313 to 397	317 to 524	320 to 685	325 to 928
112	16QAM	75	361 to 457	365 to 604	369 to 790	375 to 1070

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	32QAM	75	452 to 572	457 to 756	461 to 988	469 to 1339
112	64QAM	75	575 to 729	582 to 963	588 to 1259	597 to 1705
112	128QAM	75	677 to 858	685 to 1134	692 to 1482	703 to 2007
112	256QAM	75	780 to 988	788 to 1305	796 to 1705	809 to 2310
112	512QAM	75	891 to 1129	901 to 1491	910 to 1949	925 to 2500
112	1024QAM	75	956 to 1212	966 to 1599	976 to 2090	992 to 2500
112	2048QAM	75	1049 to 1329	1061 to 1756	1071 to 2294	1089 to 2500
112	4096QAM	75	1123 to 1423	1136 to 1879	1147 to 2456	1166 to 2500

Table 3-89 Integrated IP microwave work mode (7/8 GHz, IS8 mode, E1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	9 to 11	9 to 19	9 to 12
7	QPSK	4	10 to 12	10 to 13	10 to 23	11 to 31
7	16QAM Strong	8	17 to 22	18 to 23	18 to 39	18 to 53
7	16QAM	9	20 to 26	21 to 27	21 to 46	22 to 63
7	32QAM	11	26 to 33	26 to 34	27 to 58	27 to 79
7	64QAM	15	33 to 42	34 to 43	34 to 74	35 to 100
7	128QAM	17	39 to 50	40 to 51	41 to 87	41 to 119
7	256QAM	20	45 to 57	45 to 58	46 to 100	47 to 135
7	512QAM	22	50 to 63	50 to 64	51 to 110	52 to 150

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	QPSK Strong	8	18 to 23	19 to 31	19 to 40	19 to 55
14 (13.75)	QPSK	9	21 to 27	22 to 36	22 to 47	22 to 64
14 (13.75)	16QAM Strong	16	37 to 47	38 to 63	38 to 82	39 to 111
14 (13.75)	16QAM	19	43 to 55	44 to 73	44 to 95	45 to 129
14 (13.75)	32QAM	24	55 to 69	56 to 92	56 to 121	57 to 164
14 (13.75)	64QAM	30	69 to 87	70 to 116	71 to 151	72 to 205
14 (13.75)	128QAM	36	81 to 103	83 to 137	84 to 179	85 to 243
14 (13.75)	256QAM	41	93 to 118	95 to 157	96 to 206	97 to 278
14 (13.75)	512QAM	46	103 to 131	105 to 173	106 to 227	107 to 307
14 (13.75)	1024QAM	50	113 to 143	114 to 189	115 to 247	117 to 335
28 (27.5)	QPSK Strong	17	37 to 47	38 to 63	38 to 82	39 to 111
28 (27.5)	QPSK	20	43 to 55	44 to 73	45 to 96	45 to 130
28 (27.5)	16QAM Strong	35	75 to 96	77 to 127	77 to 166	79 to 225
28 (27.5)	16QAM	41	88 to 112	90 to 149	91 to 195	92 to 264
28 (27.5)	32QAM	52	111 to 141	113 to 186	114 to 244	116 to 330
28 (27.5)	64QAM	65	140 to 177	142 to 235	143 to 307	146 to 416
28 (27.5)	128QAM	75	166 to 210	168 to 278	170 to 364	172 to 493
28 (27.5)	256QAM	75	189 to 239	191 to 317	193 to 414	196 to 561
28 (27.5)	512QAM	75	212 to 268	214 to 355	216 to 464	220 to 628
28 (27.5)	1024QAM	75	229 to 290	231 to 383	233 to 500	237 to 678
28 (27.5)	2048QAM	75	254 to 322	257 to 425	259 to 556	264 to 753
28 (27.5)	4096QAM	75	268 to 340	271 to 449	274 to 587	279 to 795
40	QPSK Strong	24	53 to 67	54 to 90	55 to 117	55 to 159
40	QPSK	28	62 to 79	63 to 105	64 to 137	65 to 186
40	16QAM Strong	48	108 to 137	110 to 182	111 to 238	113 to 322

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	16QAM	56	126 to 160	128 to 212	130 to 278	132 to 376
40	32QAM	72	159 to 201	161 to 267	163 to 348	165 to 472
40	64QAM	75	200 to 253	202 to 335	204 to 438	208 to 594
40	128QAM	75	237 to 300	240 to 397	242 to 518	246 to 702
40	256QAM	75	270 to 342	273 to 452	276 to 591	280 to 801
40	512QAM	75	302 to 382	305 to 506	309 to 661	314 to 895
40	1024QAM	75	326 to 414	330 to 546	333 to 714	339 to 967
40	2048QAM	75	365 to 462	369 to 611	373 to 799	379 to 1082
40	4096QAM	75	383 to 485	387 to 641	391 to 838	398 to 1135
56 (55)	QPSK Strong	35	76 to 96	77 to 128	78 to 167	79 to 226
56 (55)	QPSK	41	89 to 112	90 to 149	91 to 195	92 to 264
56 (55)	16QAM Strong	71	153 to 194	156 to 258	157 to 337	160 to 456
56 (55)	16QAM	75	179 to 227	182 to 301	184 to 393	187 to 533
56 (55)	32QAM	75	225 to 285	227 to 377	230 to 492	233 to 667
56 (55)	64QAM	75	283 to 359	287 to 474	289 to 620	294 to 840
56 (55)	128QAM	75	335 to 424	339 to 561	342 to 733	348 to 993
56 (55)	256QAM	75	382 to 484	387 to 640	391 to 837	397 to 1134
56 (55)	512QAM	75	427 to 541	432 to 715	436 to 935	444 to 1266
56 (55)	1024QAM	75	463 to 587	468 to 774	472 to 1012	480 to 1371
56 (55)	2048QAM	75	505 to 640	511 to 846	516 to 1106	525 to 1498
56 (55)	4096QAM	75	551 to 698	557 to 922	563 to 1205	572 to 1633

Table 3-90 Integrated IP microwave work mode (11 GHz to 38 GHz, IS8 mode, E1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	9 to 15	9 to 19	9 to 26
7	QPSK	4	10 to 13	11 to 18	11 to 24	11 to 32
7	16QAM Strong	8	18 to 22	18 to 31	19 to 40	19 to 54
7	16QAM	9	20 to 26	21 to 35	21 to 46	22 to 62
7	32QAM	11	26 to 33	27 to 44	27 to 58	27 to 78
7	64QAM	15	34 to 43	35 to 58	35 to 75	36 to 102
7	128QAM	17	40 to 51	41 to 68	41 to 89	42 to 120
7	256QAM	20	47 to 59	48 to 79	48 to 103	49 to 140
7	512QAM	22	51 to 65	53 to 87	53 to 114	54 to 155
7	1024QAM	25	56 to 71	57 to 95	58 to 124	59 to 168
14 (13.75)	QPSK Strong	8	18 to 23	18 to 31	19 to 40	19 to 55
14 (13.75)	QPSK	9	21 to 27	22 to 37	22 to 48	23 to 65
14 (13.75)	16QAM Strong	16	37 to 47	38 to 63	38 to 82	39 to 112
14 (13.75)	16QAM	19	43 to 55	44 to 74	45 to 97	46 to 131
14 (13.75)	32QAM	24	55 to 70	56 to 93	56 to 121	57 to 164
14 (13.75)	64QAM	30	68 to 87	70 to 115	70 to 151	71 to 205
14 (13.75)	128QAM	36	83 to 105	84 to 140	85 to 183	86 to 247
14 (13.75)	256QAM	41	96 to 122	98 to 162	99 to 212	100 to 287
14 (13.75)	512QAM	46	108 to 137	110 to 182	111 to 238	113 to 323
14 (13.75)	1024QAM	50	116 to 147	118 to 195	119 to 255	121 to 345
14 (13.75)	2048QAM	75	127 to 161	129 to 214	130 to 279	132 to 378
28 (27.5)	QPSK Strong	17	38 to 48	39 to 64	39 to 84	40 to 114
28 (27.5)	QPSK	20	43 to 55	44 to 74	45 to 96	45 to 131

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	16QAM Strong	35	78 to 99	79 to 132	80 to 172	81 to 233
28 (27.5)	16QAM	41	89 to 112	90 to 149	91 to 195	93 to 265
28 (27.5)	32QAM	52	114 to 145	116 to 192	117 to 251	119 to 341
28 (27.5)	64QAM	65	146 to 184	148 to 244	149 to 319	151 to 433
28 (27.5)	128QAM	75	171 to 217	174 to 288	175 to 376	178 to 510
28 (27.5)	256QAM	75	199 to 253	202 to 335	204 to 437	207 to 592
28 (27.5)	512QAM	75	223 to 283	226 to 374	228 to 489	232 to 662
28 (27.5)	1024QAM	75	243 to 309	246 to 407	248 to 532	253 to 721
28 (27.5)	2048QAM	75	272 to 344	275 to 456	278 to 595	282 to 806
28 (27.5)	4096QAM	75	289 to 367	293 to 485	296 to 634	301 to 858
40	QPSK Strong	24	54 to 69	55 to 92	56 to 120	57 to 163
40	QPSK	28	63 to 80	64 to 106	65 to 139	66 to 188
40	16QAM Strong	48	111 to 141	113 to 187	114 to 244	116 to 331
40	16QAM	56	128 to 162	130 to 215	131 to 281	133 to 381
40	32QAM	72	160 to 203	163 to 269	164 to 352	167 to 477
40	64QAM	75	202 to 256	205 to 339	207 to 443	210 to 600
40	128QAM	75	245 to 310	248 to 411	250 to 537	254 to 727
40	256QAM	75	284 to 360	287 to 476	290 to 622	295 to 842
40	512QAM	75	317 to 401	320 to 530	324 to 693	329 to 939
40	1024QAM	75	346 to 438	350 to 579	353 to 756	359 to 1024
40	2048QAM	75	389 to 493	394 to 652	398 to 852	404 to 1155
40	4096QAM	75	409 to 519	414 to 686	418 to 896	425 to 1214
56 (55)	QPSK Strong	35	77 to 97	78 to 130	79 to 169	80 to 229
56 (55)	QPSK	41	89 to 112	90 to 149	91 to 195	92 to 265

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM Strong	71	158 to 200	160 to 265	162 to 347	164 to 470
56 (55)	16QAM	75	179 to 227	182 to 301	184 to 394	187 to 533
56 (55)	32QAM	75	225 to 285	228 to 378	230 to 494	234 to 669
56 (55)	64QAM	75	287 to 364	291 to 481	293 to 629	298 to 852
56 (55)	128QAM	75	340 to 431	344 to 570	348 to 745	353 to 1009
56 (55)	256QAM	75	394 to 499	398 to 660	402 to 862	409 to 1167
56 (55)	512QAM	75	449 to 569	454 to 752	459 to 982	466 to 1330
56 (55)	1024QAM	75	491 to 623	496 to 822	501 to 1074	510 to 1455
56 (55)	2048QAM	75	537 to 680	543 to 899	549 to 1175	558 to 1591
56 (55)	4096QAM	75	583 to 739	590 to 976	596 to 1275	605 to 1728
112	QPSK Strong	70	153 to 194	155 to 257	157 to 336	159 to 455
112	QPSK	75	180 to 228	182 to 302	184 to 395	187 to 535
112	16QAM Strong	75	313 to 396	317 to 524	320 to 685	325 to 928
112	16QAM	75	361 to 457	365 to 604	369 to 790	375 to 1070
112	32QAM	75	451 to 572	457 to 756	461 to 988	469 to 1338
112	64QAM	75	575 to 729	582 to 963	588 to 1258	597 to 1705
112	128QAM	75	677 to 858	685 to 1134	692 to 1481	703 to 2006
112	256QAM	75	780 to 988	788 to 1305	796 to 1705	809 to 2310
112	512QAM	75	891 to 1129	901 to 1491	910 to 1949	925 to 2500
112	1024QAM	75	956 to 1211	966 to 1599	976 to 2089	992 to 2500
112	2048QAM	75	1049 to 1329	1061 to 1756	1071 to 2294	1089 to 2500
112	4096QAM	75	1123 to 1423	1135 to 1879	1147 to 2455	1165 to 2500

Integrated IP microwave work mode (IS8 mode, STM-1+Ethernet)

Table 3-91 Integrated IP microwave work mode (7/8 GHz, IS8 mode, STM-1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28(27.5)	128QAM	1	166 to 210	168 to 278	170 to 364	172 to 493
28(27.5)	256QAM	1	189 to 239	191 to 317	193 to 414	196 to 561
28(27.5)	512QAM	1	212 to 268	214 to 355	217 to 464	220 to 629
28(27.5)	1024QAM	1	229 to 290	231 to 383	234 to 501	237 to 678
28(27.5)	2048QAM	1	254 to 322	257 to 426	260 to 556	264 to 754
28(27.5)	4096QAM	1	268 to 340	272 to 450	274 to 588	279 to 796
28(27.5)	8192QAM	1	284 to 360	287 to 476	290 to 622	295 to 842
40	64QAM	1	200 to 254	203 to 336	205 to 439	208 to 594
40	128QAM	1	237 to 300	240 to 397	242 to 519	246 to 703
40	256QAM	1	270 to 342	273 to 453	276 to 591	281 to 801
40	512QAM	1	302 to 383	306 to 507	309 to 662	314 to 897
40	1024QAM	1	327 to 414	330 to 546	333 to 714	339 to 967
40	2048QAM	1	365 to 463	369 to 611	373 to 799	379 to 1082
40	4096QAM	1	383 to 485	387 to 641	391 to 838	398 to 1135
40	8192QAM	1	405 to 513	410 to 678	414 to 886	421 to 1201
56(55)	16QAM	1	179 to 227	182 to 301	184 to 394	187 to 533
56(55)	32QAM	1	225 to 285	228 to 377	230 to 493	234 to 668
56(55)	64QAM	1	283 to 359	287 to 475	290 to 620	294 to 840
56(55)	128QAM	1	335 to 425	339 to 562	343 to 734	348 to 994
56(55)	256QAM	1	382 to 485	387 to 640	391 to 837	397 to 1134
56(55)	512QAM	1	427 to 542	432 to 716	437 to 935	444 to 1267
56(55)	1024QAM	1	463 to 587	468 to 775	473 to 1012	480 to 1371

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56(55)	2048QAM	1	505 to 640	511 to 846	516 to 1106	525 to 1498
56(55)	4096QAM	1	551 to 698	557 to 923	563 to 1206	572 to 1633
56(55)	8192QAM	1	583 to 739	590 to 976	595 to 1275	605 to 1727

Table 3-92 Integrated IP microwave work mode (11 GHz to 38 GHz, IS8 mode, STM-1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28(27.5)	128QAM	1	172 to 218	174 to 289	176 to 377	179 to 511
28(27.5)	256QAM	1	199 to 253	202 to 335	204 to 437	207 to 592
28(27.5)	512QAM	1	223 to 283	226 to 374	228 to 489	232 to 662
28(27.5)	1024QAM	1	244 to 309	246 to 407	249 to 532	253 to 721
28(27.5)	2048QAM	1	272 to 345	275 to 456	278 to 596	283 to 807
28(27.5)	4096QAM	1	290 to 367	293 to 486	296 to 635	301 to 860
28(27.5)	8192QAM	1	307 to 390	311 to 515	314 to 673	319 to 912
40	64QAM	1	202 to 256	205 to 339	207 to 443	210 to 601
40	128QAM	1	245 to 311	248 to 411	251 to 538	255 to 728
40	256QAM	1	284 to 360	288 to 476	291 to 623	295 to 843
40	512QAM	1	317 to 402	321 to 531	324 to 694	329 to 940
40	1024QAM	1	346 to 439	350 to 579	353 to 757	359 to 1026
40	2048QAM	1	390 to 494	394 to 653	398 to 853	405 to 1155
40	4096QAM	1	410 to 519	414 to 686	419 to 897	425 to 1214
40	8192QAM	1	434 to 551	440 to 728	444 to 951	451 to 1288
56(55)	16QAM	1	180 to 228	182 to 302	184 to 394	187 to 534

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56(55)	32QAM	1	225 to 285	228 to 378	230 to 494	234 to 669
56(55)	64QAM	1	287 to 364	291 to 482	294 to 630	299 to 853
56(55)	128QAM	1	341 to 432	345 to 571	348 to 746	354 to 1011
56(55)	256QAM	1	394 to 500	399 to 660	403 to 863	409 to 1169
56(55)	512QAM	1	449 to 569	454 to 752	459 to 983	466 to 1331
56(55)	1024QAM	1	491 to 623	496 to 822	501 to 1074	510 to 1455
56(55)	2048QAM	1	537 to 681	543 to 899	549 to 1175	558 to 1592
56(55)	4096QAM	1	583 to 739	589 to 977	596 to 1276	606 to 1729
56(55)	8192QAM	1	624 to 791	631 to 1045	638 to 1366	648 to 1850
112	QPSK	1	180 to 228	182 to 302	184 to 395	187 to 535
112	16QAM Strong	1	313 to 397	317 to 524	320 to 685	325 to 928
112	16QAM	1	361 to 457	365 to 604	369 to 790	375 to 1070
112	32QAM	1	452 to 572	457 to 756	461 to 988	469 to 1339
112	64QAM	1	575 to 729	582 to 963	588 to 1259	597 to 1705
112	128QAM	1	677 to 858	685 to 1134	692 to 1482	703 to 2007
112	256QAM	1	780 to 988	788 to 1305	796 to 1705	809 to 2310
112	512QAM	1	891 to 1129	901 to 1491	910 to 1949	925 to 2500
112	1024QAM	1	956 to 1212	966 to 1599	976 to 2090	992 to 2500
112	2048QAM	1	1049 to 1329	1061 to 1756	1071 to 2294	1089 to 2500
112	4096QAM	1	1123 to 1423	1136 to 1879	1147 to 2456	1166 to 2500

Table 3-93 Integrated IP microwave work mode (7/8 GHz, IS8 mode, STM-1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	166 to 210	168 to 278	170 to 364	172 to 493
28 (27.5)	256QAM	1	189 to 239	191 to 317	193 to 414	196 to 561
28 (27.5)	512QAM	1	212 to 268	214 to 355	216 to 464	220 to 628
28 (27.5)	1024QAM	1	229 to 290	231 to 383	233 to 500	237 to 678
28 (27.5)	2048QAM	1	254 to 322	257 to 425	259 to 556	264 to 753
28 (27.5)	4096QAM	1	268 to 340	271 to 449	274 to 587	279 to 795
40	64QAM	1	200 to 253	202 to 335	204 to 438	208 to 594
40	128QAM	1	237 to 300	240 to 397	242 to 518	246 to 702
40	256QAM	1	270 to 342	273 to 452	276 to 591	280 to 801
40	512QAM	1	302 to 382	305 to 506	309 to 661	314 to 895
40	1024QAM	1	326 to 414	330 to 546	333 to 714	339 to 967
40	2048QAM	1	365 to 462	369 to 611	373 to 799	379 to 1082
40	4096QAM	1	383 to 485	387 to 641	391 to 838	398 to 1135
56 (55)	16QAM	1	179 to 227	182 to 301	184 to 393	187 to 533
56 (55)	32QAM	1	225 to 285	227 to 377	230 to 492	233 to 667
56 (55)	64QAM	1	283 to 359	287 to 474	289 to 620	294 to 840
56 (55)	128QAM	1	335 to 424	339 to 561	342 to 733	348 to 993
56 (55)	256QAM	1	382 to 484	387 to 640	391 to 837	397 to 1134
56 (55)	512QAM	1	427 to 541	432 to 715	436 to 935	444 to 1266
56 (55)	1024QAM	1	463 to 587	468 to 774	472 to 1012	480 to 1371
56 (55)	2048QAM	1	505 to 640	511 to 846	516 to 1106	525 to 1498
56 (55)	4096QAM	1	551 to 698	557 to 922	563 to 1205	572 to 1633

Table 3-94 Integrated IP microwave work mode (11 GHz to 38 GHz, IS8 mode, STM-1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28(27.5)	128QAM	1	171 to 217	174 to 288	175 to 376	178 to 510
28(27.5)	256QAM	1	199 to 253	202 to 335	204 to 437	207 to 592
28(27.5)	512QAM	1	223 to 283	226 to 374	228 to 489	232 to 662
28(27.5)	1024QAM	1	243 to 309	246 to 407	248 to 532	253 to 721
28(27.5)	2048QAM	1	272 to 344	275 to 456	278 to 595	282 to 806
28(27.5)	4096QAM	1	289 to 367	293 to 485	296 to 634	301 to 858
40	64QAM	1	202 to 256	205 to 339	207 to 443	210 to 600
40	128QAM	1	245 to 310	248 to 411	250 to 537	254 to 727
40	256QAM	1	284 to 360	287 to 476	290 to 622	295 to 842
40	512QAM	1	317 to 401	320 to 530	324 to 693	329 to 939
40	1024QAM	1	346 to 438	350 to 579	353 to 756	359 to 1024
40	2048QAM	1	389 to 493	394 to 652	398 to 852	404 to 1155
40	4096QAM	1	409 to 519	414 to 686	418 to 896	425 to 1214
56(55)	16QAM	1	179 to 227	182 to 301	184 to 394	187 to 533
56(55)	32QAM	1	225 to 285	228 to 378	230 to 494	234 to 669
56(55)	64QAM	1	287 to 364	291 to 481	293 to 629	298 to 852
56(55)	128QAM	1	340 to 431	344 to 570	348 to 745	353 to 1009
56(55)	256QAM	1	394 to 499	398 to 660	402 to 862	409 to 1167
56(55)	512QAM	1	449 to 569	454 to 752	459 to 982	466 to 1330
56(55)	1024QAM	1	491 to 623	496 to 822	501 to 1074	510 to 1455
56(55)	2048QAM	1	537 to 680	543 to 899	549 to 1175	558 to 1591
56(55)	4096QAM	1	583 to 739	590 to 976	596 to 1275	605 to 1728
112	QPSK	1	180 to 228	182 to 302	184 to 395	187 to 535
112	16QAM Strong	1	313 to 396	317 to 524	320 to 685	325 to 928
112	16QAM	1	361 to 457	365 to 604	369 to 790	375 to 1070

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	32QAM	1	451 to 572	457 to 756	461 to 988	469 to 1338
112	64QAM	1	575 to 729	582 to 963	588 to 1258	597 to 1705
112	128QAM	1	677 to 858	685 to 1134	692 to 1481	703 to 2006
112	256QAM	1	780 to 988	788 to 1305	796 to 1705	809 to 2310
112	512QAM	1	891 to 1129	901 to 1491	910 to 1949	925 to 2500
112	1024QAM	1	956 to 1211	966 to 1599	976 to 2089	992 to 2500
112	2048QAM	1	1049 to 1329	1061 to 1756	1071 to 2294	1089 to 2500
112	4096QAM	1	1123 to 1423	1135 to 1879	1147 to 2455	1165 to 2500

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

Integrated IP microwave work mode (IS8-mode, 4x4 MIMO)

Table 3-95 Integrated IP microwave work mode (IS8 mode, E1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	QPSK Strong	17	35 to 45	36 to 59	36 to 78	37 to 105
28 (27.5)	QPSK	20	41 to 53	42 to 70	42 to 91	43 to 123
28 (27.5)	16QAM Strong	35	72 to 92	73 to 121	74 to 158	75 to 214
28 (27.5)	16QAM	41	85 to 107	85 to 142	86 to 185	88 to 251
28 (27.5)	32QAM	52	106 to 134	107 to 178	108 to 232	110 to 314
28 (27.5)	64QAM	65	133 to 169	135 to 223	136 to 292	138 to 396
28 (27.5)	128QAM	75	158 to 200	160 to 264	161 to 345	164 to 468
28 (27.5)	256QAM	75	177 to 224	179 to 296	181 to 387	184 to 524
28 (27.5)	512QAM	75	198 to 251	200 to 332	202 to 434	206 to 587
28 (27.5)	1024QAM	75	225 to 285	227 to 377	230 to 492	233 to 667
28 (27.5)	2048QAM	75	253 to 320	255 to 423	258 to 552	262 to 748
28 (27.5)	4096QAM	75	267 to 338	270 to 447	272 to 584	277 to 790
56 (55)	QPSK Strong	35	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	41	86 to 109	87 to 144	88 to 188	89 to 255
56 (55)	16QAM Strong	71	149 to 188	150 to 249	152 to 325	154 to 441
56 (55)	16QAM	75	174 to 220	176 to 291	177 to 380	180 to 515
56 (55)	32QAM	75	217 to 276	220 to 364	222 to 476	226 to 644
56 (55)	64QAM	75	273 to 346	276 to 457	278 to 597	283 to 808
56 (55)	128QAM	75	322 to 409	326 to 539	329 to 705	334 to 955
56 (55)	256QAM	75	361 to 457	365 to 604	368 to 789	374 to 1069

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	512QAM	75	404 to 512	408 to 676	412 to 883	419 to 1196
56 (55)	1024QAM	75	458 to 581	463 to 767	468 to 1002	475 to 1357
56 (55)	2048QAM	75	514 to 652	520 to 860	525 to 1124	533 to 1523
56 (55)	4096QAM	75	543 to 688	549 to 908	554 to 1187	563 to 1607

Table 3-96 Integrated IP microwave work mode (IS8 mode, STM-1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	158 to 200	160 to 264	161 to 345	164 to 468
28 (27.5)	256QAM	1	177 to 224	179 to 296	181 to 387	184 to 524
28 (27.5)	512QAM	1	198 to 251	200 to 332	202 to 434	206 to 587
28 (27.5)	1024QAM	1	225 to 285	227 to 377	230 to 492	233 to 667
28 (27.5)	2048QAM	1	253 to 320	255 to 423	258 to 552	262 to 748
28 (27.5)	4096QAM	1	267 to 338	270 to 447	272 to 584	277 to 790
56 (55)	16QAM Strong	1	149 to 188	150 to 249	152 to 325	154 to 441
56 (55)	16QAM	1	174 to 220	176 to 291	177 to 380	180 to 515
56 (55)	32QAM	1	217 to 276	220 to 364	222 to 476	226 to 644
56 (55)	64QAM	1	273 to 346	276 to 457	278 to 597	283 to 808
56 (55)	128QAM	1	322 to 409	326 to 539	329 to 705	334 to 955
56 (55)	256QAM	1	361 to 457	365 to 604	368 to 789	374 to 1069

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	512QAM	1	404 to 512	408 to 676	412 to 883	419 to 1196
56 (55)	1024QAM	1	458 to 581	463 to 767	468 to 1002	475 to 1357
56 (55)	2048QAM	1	514 to 652	520 to 860	525 to 1124	533 to 1523
56 (55)	4096QAM	1	543 to 688	549 to 908	554 to 1187	563 to 1607

Integrated IP microwave work mode (IS8-mode, CA)

Table 3-97 Integrated IP microwave work mode (IS8 mode, E1 + Ethernet, CA, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
			Without Compression
14 (13.75)	QPSKSTRONG	8	18 to 23
14 (13.75)	QPSK	9	22 to 28
14 (13.75)	16QAMSTRONG	16	38 to 48
14 (13.75)	16QAM	19	44 to 56
14 (13.75)	32QAM	24	55 to 70
14 (13.75)	64QAM	30	69 to 87
14 (13.75)	128QAM	36	84 to 106
14 (13.75)	256QAM	41	97 to 123
14 (13.75)	512QAM	46	109 to 138
14 (13.75)	1024QAM	50	118 to 150
14 (13.75)	2048QAM	75	130 to 165
28 (27.5)	QPSKSTRONG	17	38 to 49
28 (27.5)	QPSK	20	44 to 56
28 (27.5)	16QAMSTRONG	35	79 to 100

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
			Without Compression
28 (27.5)	16QAM	41	89 to 113
28 (27.5)	32QAM	52	115 to 146
28 (27.5)	64QAM	65	146 to 186
28 (27.5)	128QAM	75	172 to 219
28 (27.5)	256QAM	75	200 to 253
28 (27.5)	512QAM	75	224 to 283
28 (27.5)	1024QAM	75	243 to 309
28 (27.5)	2048QAM	75	272 to 345
40	QPSKSTRONG	24	55 to 70
40	QPSK	28	63 to 80
40	16QAMSTRONG	48	112 to 141
40	16QAM	56	129 to 163
40	32QAM	72	161 to 204
40	64QAM	75	203 to 257
40	128QAM	75	246 to 312
40	256QAM	75	285 to 361
40	512QAM	75	317 to 402
40	1024QAM	75	346 to 439
40	2048QAM	75	390 to 494
56 (55)	QPSKSTRONG	35	77 to 98
56 (55)	QPSK	41	89 to 113
56 (55)	16QAMSTRONG	71	159 to 201
56 (55)	16QAM	75	180 to 228
56 (55)	32QAM	75	226 to 286
56 (55)	64QAM	75	288 to 365
56 (55)	128QAM	75	341 to 433
56 (55)	256QAM	75	395 to 500

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
			Without Compression
56 (55)	512QAM	75	450 to 570
56 (55)	1024QAM	75	491 to 622
56 (55)	2048QAM	75	538 to 681

Table 3-98 Integrated IP microwave work mode (IS8 mode, STM-1 + Ethernet, CA, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
			Without Compression
28 (27.5)	128QAM	1	172 to 219
28 (27.5)	256QAM	1	200 to 253
28 (27.5)	512QAM	1	224 to 283
28 (27.5)	1024QAM	1	243 to 309
28 (27.5)	2048QAM	1	272 to 345
40	64QAM	1	203 to 257
40	128QAM	1	246 to 312
40	256QAM	1	285 to 361
40	512QAM	1	317 to 402
40	1024QAM	1	346 to 439
40	2048QAM	1	390 to 494
56 (55)	16QAM	1	180 to 228
56 (55)	32QAM	1	226 to 286
56 (55)	64QAM	1	288 to 365
56 (55)	128QAM	1	341 to 433
56 (55)	256QAM	1	395 to 500
56 (55)	512QAM	1	450 to 570

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
			Without Compression
56 (55)	1024QAM	1	491 to 622
56 (55)	2048QAM	1	538 to 681

3.6.7.1.2 Microwave Work Modes (IS6 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS6 running mode.

NOTE

For ISM6 board, only the SL91ISM6 VER.C can work with the XMC-5D ODU.

SDH microwave work mode

Table 3-99 SDH microwave work mode (IS6 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	16QAM	112
NOTE In IS6 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP microwave work mode (IS6 mode, E1+Ethernet)

Table 3-100 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	4	8 to 10	8 to 12	8 to 19	8 to 25
7	QPSK	5	10 to 13	10 to 16	10 to 25	10 to 32

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	16QAM Strong	8	17 to 21	17 to 26	17 to 41	18 to 53
7	16QAM	10	20 to 26	20 to 32	21 to 49	21 to 63
7	32QAM	12	25 to 32	25 to 39	26 to 61	26 to 78
7	64QAM	15	32 to 40	32 to 50	33 to 77	33 to 98
7	128QAM	18	37 to 47	38 to 58	38 to 90	39 to 116
7	256QAM	20	43 to 54	43 to 66	43 to 102	44 to 131
7	512QAM	22	47 to 60	47 to 73	48 to 113	49 to 145
7	1024QAM	25	51 to 65	52 to 80	52 to 123	53 to 158
14 (13.75)	QPSK Strong	8	17 to 21	17 to 26	17 to 41	18 to 53
14 (13.75)	QPSK	10	20 to 26	21 to 32	21 to 49	21 to 64
14 (13.75)	16QAM Strong	16	35 to 44	35 to 54	36 to 84	36 to 108
14 (13.75)	16QAM	19	41 to 52	42 to 64	42 to 99	43 to 127
14 (13.75)	32QAM	25	52 to 66	52 to 80	53 to 124	54 to 159
14 (13.75)	64QAM	31	65 to 83	66 to 101	66 to 156	68 to 200
14 (13.75)	128QAM	37	77 to 98	78 to 120	79 to 185	80 to 237
14 (13.75)	256QAM	43	89 to 113	90 to 138	91 to 214	93 to 274
14 (13.75)	512QAM	47	99 to 125	99 to 153	101 to 236	103 to 303
14 (13.75)	1024QAM	50	104 to 132	105 to 162	106 to 250	109 to 321
14 (13.75)	2048QAM	55	115 to 146	116 to 179	118 to 276	120 to 354
28 (27.5)	QPSK Strong	17	36 to 46	36 to 56	37 to 86	37 to 111
28 (27.5)	QPSK	20	42 to 54	42 to 66	43 to 101	44 to 130
28 (27.5)	16QAM Strong	35	73 to 93	74 to 114	75 to 175	76 to 225
28 (27.5)	16QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
28 (27.5)	32QAM	52	109 to 139	110 to 170	112 to 262	114 to 337
28 (27.5)	64QAM	65	135 to 172	136 to 210	138 to 324	141 to 416

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	75	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	75	185 to 234	186 to 287	189 to 443	192 to 568
28 (27.5)	512QAM	75	207 to 262	208 to 320	211 to 494	215 to 635
28 (27.5)	1024QAM	75	219 to 277	220 to 339	223 to 523	228 to 672
28 (27.5)	2048QAM	75	242 to 306	244 to 374	247 to 578	251 to 742
28 (27.5)	4096QAM	75	258 to 327	260 to 400	263 to 617	268 to 792
56 (55)	QPSK Strong	35	73 to 93	74 to 114	75 to 176	76 to 226
56 (55)	QPSK	41	86 to 109	87 to 133	88 to 206	89 to 264
56 (55)	16QAM Strong	71	148 to 188	149 to 230	151 to 355	154 to 456
56 (55)	16QAM	75	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	75	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	75	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	75	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	75	373 to 473	376 to 578	381 to 891	388 to 1145
56 (55)	512QAM	75	417 to 528	420 to 645	425 to 996	433 to 1278
56 (55)	1024QAM	75	450 to 571	454 to 698	460 to 1076	468 to 1382
56 (55)	2048QAM	75	502 to 636	506 to 777	512 to 1199	522 to 1539
56 (55)	4096QAM	75	535 to 678	540 to 829	546 to 1280	557 to 1643
40	QPSK Strong	24	49 to 63	50 to 77	51 to 119	51 to 153
40	QPSK	28	58 to 74	58 to 90	59 to 139	60 to 179
40	16QAM Strong	48	100 to 127	101 to 156	102 to 240	104 to 309
40	16QAM	56	117 to 149	118 to 182	120 to 281	122 to 360
40	32QAM	72	150 to 190	151 to 232	153 to 359	156 to 460
40	64QAM	75	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	75	219 to 277	221 to 339	223 to 524	228 to 672

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	256QAM	75	253 to 320	255 to 392	258 to 605	263 to 776
40	512QAM	75	282 to 358	285 to 438	288 to 675	294 to 867
40	1024QAM	75	304 to 386	307 to 472	311 to 728	317 to 934
40	2048QAM	75	330 to 418	332 to 511	337 to 788	343 to 1012
40	4096QAM	75	344 to 436	347 to 533	351 to 823	358 to 1056
112	QPSK Strong	70	148 to 188	149 to 229	151 to 354	154 to 455
112	QPSK	75	173 to 219	174 to 268	177 to 414	180 to 531
112	16QAM Strong	75	298 to 377	300 to 461	304 to 712	310 to 914
112	16QAM	75	348 to 441	351 to 539	355 to 831	362 to 1067
112	32QAM	75	435 to 551	439 to 674	444 to 1040	453 to 1336
112	64QAM	75	548 to 694	552 to 848	559 to 1309	570 to 1680
112	128QAM	75	647 to 820	653 to 1003	661 to 1547	673 to 1987
112	256QAM	75	747 to 947	753 to 1158	763 to 1786	777 to 2293
112	512QAM	75	835 to 1058	841 to 1293	852 to 1995	868 to 2415
112	1024QAM	75	909 to 1143	918 to 1509	921 to 1607	N/A
112	2048QAM	75	965 to 1214	975 to 1603	978 to 1607	N/A

Table 3-101 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	8 to 12	8 to 19	8 to 24
7	QPSK	4	10 to 12	10 to 15	10 to 24	10 to 31
7	16QAM Strong	8	16 to 21	17 to 26	17 to 40	17 to 51

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	16QAM	9	20 to 25	20 to 31	20 to 48	20 to 61
7	32QAM	11	24 to 31	25 to 38	25 to 59	25 to 76
7	64QAM	15	31 to 39	31 to 48	32 to 74	32 to 96
7	128QAM	17	36 to 46	37 to 56	37 to 87	38 to 112
7	256QAM	20	42 to 53	42 to 65	43 to 101	44 to 130
7	512QAM	22	47 to 60	47 to 73	48 to 113	49 to 145
14 (13.75)	QPSK Strong	8	16 to 21	16 to 26	17 to 40	17 to 51
14 (13.75)	QPSK	9	20 to 25	20 to 31	20 to 48	21 to 62
14 (13.75)	16QAM Strong	16	34 to 43	34 to 53	35 to 82	35 to 105
14 (13.75)	16QAM	19	40 to 51	40 to 62	41 to 96	42 to 124
14 (13.75)	32QAM	24	50 to 64	51 to 78	51 to 120	52 to 155
14 (13.75)	64QAM	30	63 to 80	64 to 98	64 to 152	66 to 195
14 (13.75)	128QAM	36	75 to 95	75 to 116	76 to 179	78 to 231
14 (13.75)	256QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
14 (13.75)	512QAM	46	96 to 121	96 to 148	98 to 229	100 to 294
14 (13.75)	1024QAM	50	104 to 132	105 to 162	106 to 250	109 to 321
28 (27.5)	QPSK Strong	17	36 to 46	36 to 56	37 to 86	37 to 111
28 (27.5)	QPSK	20	42 to 54	42 to 66	43 to 101	44 to 130
28 (27.5)	16QAM Strong	35	73 to 93	74 to 114	75 to 175	76 to 225
28 (27.5)	16QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
28 (27.5)	32QAM	52	109 to 139	110 to 170	112 to 262	114 to 337
28 (27.5)	64QAM	65	135 to 172	136 to 210	138 to 324	141 to 416
28 (27.5)	128QAM	75	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	75	184 to 233	185 to 284	187 to 439	191 to 564
28 (27.5)	512QAM	75	198 to 251	200 to 307	202 to 474	206 to 609

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	1024QAM	75	216 to 274	218 to 335	221 to 517	225 to 664
28 (27.5)	2048QAM	75	227 to 287	228 to 351	231 to 542	236 to 696
56 (55)	QPSK Strong	35	73 to 93	74 to 114	75 to 176	76 to 226
56 (55)	QPSK	41	86 to 109	87 to 133	88 to 206	89 to 264
56 (55)	16QAM Strong	71	148 to 188	149 to 230	151 to 355	154 to 456
56 (55)	16QAM	75	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	75	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	75	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	75	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	75	369 to 467	372 to 571	376 to 882	384 to 1132
56 (55)	512QAM	75	400 to 507	403 to 619	408 to 956	416 to 1227
56 (55)	1024QAM	75	436 to 552	439 to 675	445 to 1041	453 to 1337
56 (55)	2048QAM	75	456 to 578	460 to 707	466 to 1091	475 to 1401
40	QPSK Strong	24	49 to 63	50 to 77	51 to 119	51 to 153
40	QPSK	28	58 to 74	58 to 90	59 to 139	60 to 179
40	16QAM Strong	48	100 to 127	101 to 156	102 to 240	104 to 309
40	16QAM	56	117 to 149	118 to 182	120 to 281	122 to 360
40	32QAM	72	150 to 190	151 to 232	153 to 359	156 to 460
40	64QAM	75	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	75	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	75	251 to 318	253 to 389	256 to 600	261 to 770
40	512QAM	75	271 to 344	273 to 420	277 to 648	282 to 832
40	1024QAM	75	295 to 374	298 to 458	302 to 706	307 to 907
40	2048QAM	75	326 to 413	328 to 505	333 to 779	339 to 1000
112	QPSK Strong	70	147 to 188	149 to 229	150 to 354	152 to 455

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	QPSK	75	172 to 219	174 to 268	175 to 414	178 to 531
112	16QAM Strong	75	297 to 377	300 to 461	302 to 712	306 to 914
112	16QAM	75	347 to 441	351 to 539	352 to 831	357 to 1067
112	32QAM	75	434 to 551	439 to 674	441 to 1040	447 to 1336
112	64QAM	75	546 to 694	552 to 848	554 to 1309	562 to 1680
112	128QAM	75	646 to 820	653 to 1003	656 to 1547	665 to 1987
112	256QAM	75	745 to 947	753 to 1158	757 to 1786	768 to 2293
112	512QAM	75	832 to 1058	841 to 1293	845 to 1995	857 to 2415
112	1024QAM	75	910 to 1144	919 to 1510	918 to 1452	N/A

Integrated IP microwave work mode (IS6-mode, STM-1+Ethernet)

Table 3-102 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	1	185 to 234	186 to 287	189 to 443	192 to 568
28 (27.5)	512QAM	1	207 to 262	208 to 320	211 to 494	215 to 635
28 (27.5)	1024QAM	1	219 to 277	220 to 339	223 to 523	228 to 672
28 (27.5)	2048QAM	1	242 to 306	244 to 374	247 to 578	251 to 742
28 (27.5)	4096QAM	1	258 to 327	260 to 400	263 to 617	268 to 792
56 (55)	16QAM	1	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	1	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	1	273 to 346	275 to 423	279 to 653	284 to 838

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	128QAM	1	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	1	373 to 473	376 to 578	381 to 891	388 to 1145
56 (55)	512QAM	1	417 to 528	420 to 645	425 to 996	433 to 1278
56 (55)	1024QAM	1	450 to 571	454 to 698	460 to 1076	468 to 1382
56 (55)	2048QAM	1	502 to 636	506 to 777	512 to 1199	522 to 1539
56 (55)	4096QAM	1	535 to 678	540 to 829	546 to 1280	557 to 1643
40	64QAM	1	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	1	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	1	253 to 320	255 to 392	258 to 605	263 to 776
40	512QAM	1	282 to 358	285 to 438	288 to 675	294 to 867
40	1024QAM	1	304 to 386	307 to 472	311 to 728	317 to 934
40	2048QAM	1	330 to 418	332 to 511	337 to 788	343 to 1012
40	4096QAM	1	344 to 436	347 to 533	351 to 823	358 to 1056
112	QPSK	1	173 to 219	174 to 268	177 to 414	180 to 531
112	16QAM Strong	1	298 to 377	300 to 461	304 to 712	310 to 914
112	16QAM	1	348 to 441	351 to 539	355 to 831	362 to 1067
112	32QAM	1	435 to 551	439 to 674	444 to 1040	453 to 1336
112	64QAM	1	548 to 694	552 to 848	559 to 1309	570 to 1680
112	128QAM	1	647 to 820	653 to 1003	661 to 1547	673 to 1987
112	256QAM	1	747 to 947	753 to 1158	763 to 1786	777 to 2293
112	512QAM	1	835 to 1058	841 to 1293	852 to 1995	868 to 2415
112	1024QAM	1	909 to 1143	918 to 1509	921 to 1607	TBD
112	2048QAM	1	965 to 1214	975 to 1603	978 to 1607	TBD

Table 3-103 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	1	184 to 233	185 to 284	187 to 439	191 to 564
28 (27.5)	512QAM	1	198 to 251	200 to 307	202 to 474	206 to 609
28 (27.5)	1024QAM	1	216 to 274	218 to 335	221 to 517	225 to 664
28 (27.5)	2048QAM	1	227 to 287	228 to 351	231 to 542	236 to 696
56 (55)	16QAM	1	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	1	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	1	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	1	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	1	369 to 467	372 to 571	376 to 882	384 to 1132
56 (55)	512QAM	1	400 to 507	403 to 619	408 to 956	416 to 1227
56 (55)	1024QAM	1	436 to 552	439 to 675	445 to 1041	453 to 1337
56 (55)	2048QAM	1	456 to 578	460 to 707	466 to 1091	475 to 1401
40	64QAM	1	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	1	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	1	251 to 318	253 to 389	256 to 600	261 to 770
40	512QAM	1	271 to 344	273 to 420	277 to 648	282 to 832
40	1024QAM	1	295 to 374	298 to 458	302 to 706	307 to 907
40	2048QAM	1	326 to 413	328 to 505	333 to 779	339 to 1000
112	QPSK	1	172 to 219	174 to 268	175 to 414	178 to 531
112	16QAM Strong	1	297 to 377	300 to 461	302 to 712	306 to 914
112	16QAM	1	347 to 441	351 to 539	352 to 831	357 to 1067
112	32QAM	1	434 to 551	439 to 674	441 to 1040	447 to 1336
112	64QAM	1	546 to 694	552 to 848	554 to 1309	562 to 1680
112	128QAM	1	646 to 820	653 to 1003	656 to 1547	665 to 1987

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	256QAM	1	745 to 947	753 to 1158	757 to 1786	768 to 2293
112	512QAM	1	832 to 1058	841 to 1293	845 to 1995	857 to 2415
112	1024QAM	1	910 to 1144	919 to 1510	918 to 1452	TBD

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

Integrated IP microwave work mode (IS6-mode, 4x4 MIMO)

Table 3-104 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	QPSK Strong	16	33 to 42	34 to 56	34 to 73	34 to 99
28 (27.5)	QPSK	18	39 to 49	39 to 65	40 to 86	40 to 116
28 (27.5)	16QAM Strong	32	68 to 86	69 to 114	69 to 149	70 to 202
28 (27.5)	16QAM	38	79 to 101	80 to 133	81 to 174	82 to 236
28 (27.5)	32QAM	48	100 to 126	101 to 167	102 to 218	103 to 296
28 (27.5)	64QAM	60	125 to 159	126 to 210	128 to 274	130 to 371

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	71	148 to 188	150 to 248	151 to 324	154 to 439
28 (27.5)	256QAM	75	171 to 217	173 to 286	174 to 374	177 to 506
28 (27.5)	512QAM	75	194 to 246	196 to 324	198 to 424	201 to 574
28 (27.5)	1024QAM	75	217 to 275	219 to 363	221 to 474	225 to 642
28 (27.5)	1024QAM Light	75	220 to 279	223 to 369	225 to 482	229 to 653
40	QPSK Strong	22	46 to 58	46 to 76	46 to 100	47 to 135
40	QPSK	25	53 to 68	54 to 89	54 to 117	55 to 159
40	16QAM Strong	44	92 to 117	93 to 155	94 to 203	96 to 274
40	16QAM	52	108 to 137	109 to 181	110 to 237	112 to 321
40	32QAM	65	135 to 172	137 to 227	138 to 297	141 to 402
40	64QAM	75	171 to 217	173 to 286	174 to 374	177 to 506
40	128QAM	75	202 to 256	204 to 338	206 to 442	210 to 599
40	256QAM	75	233 to 296	236 to 391	238 to 511	242 to 692
40	512QAM	75	265 to 336	268 to 443	270 to 579	275 to 784
40	1024QAM	75	296 to 375	299 to 495	302 to 648	307 to 877
40	1024QAM Light	75	301 to 382	305 to 504	308 to 659	313 to 893
56 (55)	QPSK Strong	33	69 to 87	69 to 115	70 to 151	71 to 204
56 (55)	QPSK	38	80 to 102	81 to 135	82 to 176	83 to 239
56 (55)	16QAM Strong	67	139 to 176	141 to 233	142 to 305	144 to 413
56 (55)	16QAM	75	163 to 206	164 to 272	166 to 356	169 to 482
56 (55)	32QAM	75	204 to 258	206 to 341	208 to 446	211 to 604
56 (55)	64QAM	75	257 to 325	259 to 429	262 to 561	266 to 760
56 (55)	128QAM	75	304 to 385	307 to 508	310 to 664	315 to 899
56 (55)	256QAM	75	351 to 444	354 to 587	358 to 767	364 to 1040
56 (55)	512QAM	75	398 to 504	402 to 665	406 to 869	412 to 1178
56 (55)	1024QAM	75	445 to 563	449 to 744	454 to 972	461 to 1320

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	1024QAM Light	75	452 to 573	457 to 757	462 to 989	469 to 1341

Table 3-105 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	148 to 188	150 to 248	151 to 324	154 to 439
28 (27.5)	256QAM	1	171 to 217	173 to 286	174 to 374	177 to 506
28 (27.5)	512QAM	1	194 to 246	196 to 324	198 to 424	201 to 574
28 (27.5)	1024QAM	1	217 to 275	219 to 363	221 to 474	225 to 642
28 (27.5)	1024QAM Light	1	220 to 279	223 to 369	225 to 482	229 to 653
40	64QAM	1	171 to 217	173 to 286	174 to 374	177 to 506
40	128QAM	1	202 to 256	204 to 338	206 to 442	210 to 599
40	256QAM	1	233 to 296	236 to 391	238 to 511	242 to 692
40	512QAM	1	265 to 336	268 to 443	270 to 579	275 to 784
40	1024QAM	1	296 to 375	299 to 495	302 to 648	307 to 877
40	1024QAM Light	1	301 to 382	305 to 504	308 to 659	313 to 893
56 (55)	16QAM	1	163 to 206	164 to 272	166 to 356	169 to 482
56 (55)	32QAM	1	204 to 258	206 to 341	208 to 446	211 to 604
56 (55)	64QAM	1	257 to 325	259 to 429	262 to 561	266 to 760
56 (55)	128QAM	1	304 to 385	307 to 508	310 to 664	315 to 899
56 (55)	256QAM	1	351 to 444	354 to 587	358 to 767	364 to 1040
56 (55)	512QAM	1	398 to 504	402 to 665	406 to 869	412 to 1178
56 (55)	1024QAM	1	445 to 563	449 to 744	454 to 972	461 to 1320
56 (55)	1024QAM Light	1	452 to 573	457 to 757	462 to 989	469 to 1341

3.6.7.1.3 Microwave Work Modes (IS3 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS3 running mode.

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

When being used in North America, ISV3 boards support the FCC 10/20/30/40/50 MHz channel spacing. For details, see the *User Guide for North America*.

2048QAM is used only when AM is enabled.

NOTE

For ISM6 board, only the SL91ISM6 VER.C can work with the XMC-5D ODU.

SDH Microwave Work Mode

Table 3-106 SDH microwave work modes (IS3 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
NOTE In IS3 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP Microwave Work Mode (IS3 mode, E1+Ethernet)

NOTE

After AES-based encryption at air interfaces is enabled, overheads occupy additional air-interface bandwidth (< 300 kbit/s). As a result, the maximum number of E1 services decreases by one in the following modulation schemes:

- XPIC disabled: 7 MHz/QPSK Strong, 7 MHz/16QAM, 14 MHz/QPSK, and 14 MHz/16QAM
- XPIC enabled: 14 MHz/QPSK Strong

Table 3-107 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 9	4 to 13
3.5	16QAM	4	9 to 11	9 to 14	9 to 19	9 to 27
7	QPSK Strong	4	8 to 10	8 to 14	8 to 18	8 to 24
7	QPSK	5	10 to 13	10 to 17	10 to 22	10 to 31
7	16QAM Strong	8	17 to 22	17 to 29	17 to 37	18 to 51
7	16QAM	10	20 to 26	21 to 34	21 to 45	21 to 61
7	32QAM	12	25 to 32	25 to 42	26 to 55	26 to 75
7	64QAM	15	32 to 40	32 to 54	33 to 70	33 to 95
7	128QAM	18	37 to 48	38 to 63	38 to 82	39 to 112
7	256QAM	20	42 to 53	43 to 71	43 to 92	44 to 125
7	512QAM	21	45 to 57	45 to 75	46 to 98	46 to 133
7	512QAM Light	22	48 to 61	48 to 80	49 to 105	50 to 142
7	1024QAM	23	51 to 65	52 to 86	52 to 112	53 to 152
14 (13.75)	QPSK Strong	8	17 to 22	17 to 29	17 to 38	18 to 51
14 (13.75)	QPSK	10	21 to 26	21 to 35	21 to 45	21 to 62
14 (13.75)	16QAM Strong	16	35 to 45	35 to 59	36 to 77	36 to 105
14 (13.75)	16QAM	20	41 to 53	42 to 69	42 to 91	43 to 123
14 (13.75)	32QAM	24	52 to 66	52 to 87	53 to 114	54 to 154
14 (13.75)	64QAM	31	65 to 83	66 to 109	67 to 143	68 to 194
14 (13.75)	128QAM	37	77 to 98	78 to 129	79 to 169	80 to 229
14 (13.75)	256QAM	42	88 to 112	89 to 148	90 to 193	92 to 262
14 (13.75)	512QAM	44	94 to 119	95 to 157	96 to 205	97 to 278
14 (13.75)	512QAM Light	46	100 to 127	101 to 168	102 to 219	104 to 297

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	1024QAM	48	104 to 131	105 to 174	106 to 227	107 to 307
14 (13.75)	1024QAM Light	50	109 to 138	110 to 182	111 to 238	113 to 323
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 255
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	75 63	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	75 63	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	75 63	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	75 63	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	75 63	228 to 289	230 to 382	233 to 499	237 to 676
28 (27.5)	2048QAM	75 63	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	75 63	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	75 63	423 to 536	427 to 708	432 to 925	439 to 1000
56 (55)	1024QAM	75 63	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	75 63	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	75 63	502 to 636	507 to 839	512 to 999	520 to 1000
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	75 63	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	75 63	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	75 63	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	75 63	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	75 63	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-108 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	8 to 13	8 to 17	8 to 24
7	QPSK	4	10 to 12	10 to 17	10 to 22	10 to 30
7	16QAM Strong	6	16 to 21	17 to 28	17 to 36	17 to 49
7	16QAM	9	20 to 25	20 to 33	20 to 44	20 to 59
7	32QAM	11	24 to 31	25 to 41	25 to 54	25 to 73
7	64QAM	14	31 to 39	31 to 52	32 to 68	32 to 92
7	128QAM	17	36 to 46	37 to 61	37 to 80	38 to 108

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	QPSK Strong	8	16 to 21	17 to 28	17 to 36	17 to 49
14 (13.75)	QPSK	9	20 to 25	20 to 34	20 to 44	21 to 60
14 (13.75)	16QAM Strong	16	34 to 43	34 to 57	35 to 75	35 to 101
14 (13.75)	16QAM	19	40 to 51	41 to 67	41 to 88	42 to 120
14 (13.75)	32QAM	24	50 to 64	51 to 84	51 to 110	52 to 149
14 (13.75)	64QAM	30	63 to 80	64 to 106	65 to 139	66 to 188
14 (13.75)	128QAM	36	75 to 95	76 to 126	77 to 164	78 to 223
14 (13.75)	256QAM	40	85 to 107	86 to 142	86 to 185	88 to 251
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 254
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	75 63	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	75 63	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	75 63	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	75 63	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	75 63	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	75 63	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	75 63	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	75 63	454 to 575	459 to 759	463 to 992	471 to 1000
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	75 63	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	75 63	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	75 63	293 to 372	296 to 491	299 to 641	304 to 869

Integrated IP microwave work mode (IS3 mode, STM-1+Ethernet)

Table 3-109 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	1	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	1	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	1	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	1	228 to 289	230 to 382	233 to 499	237 to 676

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	2048QAM	1	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	1	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	1	423 to 536	427 to 708	432 to 925	439 to 1000
56 (55)	1024QAM	1	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	1	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	1	502 to 636	507 to 839	512 to 999	520 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	1	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	1	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	1	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	1	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	1	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-110 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	1	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	1	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	1	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	1	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	1	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	1	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	1	454 to 575	459 to 759	463 to 992	471 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	1	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	1	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	1	293 to 372	296 to 491	299 to 641	304 to 869

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.6.7.2 Receiver Sensitivity (ISM8 Board)

This section describes the receiver sensitivity of the ISM8 board.

3.6.7.2.1 Receiver Sensitivity (IS8 Running Mode)

The OptiX RTN 950A running in IS8 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS8 mode)

Table 3-111 Typical receiver sensitivity in SDH microwave mode (IS8 mode)

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/128QAM	56 MHz/128QAM	112 MHz/16QAM
RSL@ BER=10^{-6} (dBm)			
@7 GHz	-72.5	-69.5	N/A
@8 GHz	-72.5	-69.5	N/A
@7&8 GHz (XMC-3W ODU)	-71.5	-68.5	N/A
@11 GHz	-72	-69	N/A
@13 GHz	-72	-69	N/A

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/128QAM	56 MHz/128QAM	112 MHz/16QAM
@13 GHz (XMC-3W ODU)	-71.5	-68	N/A
@15 GHz	-72	-69	N/A
@15 GHz (XMC-3W ODU)	-71.5	-68	N/A
@18 GHz	-71.5	-68.5	N/A
@18 GHz (XMC-3W ODU)	-71	-67.5	N/A
@23 GHz	-71.5	-68.5	N/A
@23 GHz (XMC-3W ODU)	-71	-67.5	N/A
@26 GHz	-71	-68	-76
@28 GHz	-70.5	-67.5	N/A
@32 GHz	-70	-67	-74.5
@38 GHz	-68.5	-65.5	N/A
NOTE Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.			

Integrated IP Microwave (IS8 mode)

Table 3-112 Typical receiver sensitivity in the Integrated IP microwave mode I (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@BER=10^{-6} (dBm)											
@7 GHz	-96.00	-94.00	-89.50	-87.50	-84.50	-81.50	-78.50	-75.50	-72.00	-69.00	N/A
@8 GHz	-96.00	-94.00	-89.50	-87.50	-84.50	-81.50	-78.50	-75.50	-72.00	-69.00	N/A

Item	Performance (Channel Spacing: 7 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
@7&8 GHz (XMC-3W ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.00	-68.00	N/A
@11 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-68.50	N/A
@13 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00
@13 GHz (XMC-5D ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	N/A	N/A	N/A
@13 GHz (XMC-3W ODU)	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	N/A
@15 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00
@15 GHz (XMC-5D ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	N/A	N/A	N/A
@15 GHz (XMC-3W ODU)	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	N/A
@15 GHz (XMC-3H ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	N/A
@18 GHz	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50

Item	Performance (Channel Spacing: 7 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
@18 GHz (XMC-5D ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	N/A	N/A	N/A
@18 GHz (XMC-3W ODU)	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	N/A
@18 GHz (XMC-3H ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	N/A
@23 GHz	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	N/A
@23 GHz (XMC-3W ODU)	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	N/A
@26 GHz	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	N/A
@28 GHz	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	N/A
@32 GHz	-93.50	-91.50	-87.00	-85.00	-82.00	-79.00	-76.00	-73.00	-70.00	-67.00	N/A
@38 GHz	-92.00	-90.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	N/A

Table 3-113 Typical receiver sensitivity in the Integrated IP microwave mode II (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@BER=10^{-6} (dBm)											
@7 GHz	-94.00	-92.00	-86.50	-84.50	-81.50	-78.50	-75.50	-72.50	-69.00	-66.00	-63.00
@8 GHz	-94.00	-92.00	-86.50	-84.50	-81.50	-78.50	-75.50	-72.50	-69.00	-66.00	-63.00
@7&8 GHz (XMC-3W ODU)	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.00	-65.00	-62.00
@11 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-65.50	-63.00
@13 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@13 GHz (XMC-3W ODU)	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	-62.00
@15 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@15 GHz (XMC-3W ODU)	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	-62.00
@15 GHz (XMC-3H ODU)	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@18 GHz	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	-62.50

Item	Performance (Channel Spacing: 14 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
@18 GHz (XMC-3W ODU)	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	-61.50
@18 GHz (XMC-3H ODU)	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	-62.50
@23 GHz	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	-62.50
@23 GHz (XMC-3W ODU)	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	-61.50
@26 GHz	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	-62.00
@28 GHz	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	-61.50
@32 GHz	-91.50	-89.50	-84.00	-82.00	-79.00	-76.00	-73.00	-70.00	-67.00	-64.00	-61.00
@38 GHz	-90.00	-88.00	-82.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	-62.50	-59.50

Table 3-114 Typical receiver sensitivity in the Integrated IP microwave mode III (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-90.50	-89.00	-83.50	-82.00	-79.00	-75.50	-72.50
@8 GHz	-90.50	-89.00	-83.50	-82.00	-79.00	-75.50	-72.50

Item	Performance (Channel Spacing: 28 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
@7&8 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@11 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@13 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@13 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@15 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@15 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@15 GHz (XMC-3H ODU)	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@18 GHz	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@18 GHz (XMC-3W ODU)	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@18 GHz (XMC-3H ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@23 GHz	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@23 GHz (XMC-3W ODU)	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@26 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@28 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@32 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@38 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50

Table 3-115 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-69.50	-66.00	-63.00	-60.00	-57.00	N/A
@8 GHz	-69.50	-66.00	-63.00	-60.00	-57.00	N/A
@7&8 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	-56.00	N/A
@11 GHz	-69.00	-66.00	-62.50	-60.00	-57.00	N/A
@13 GHz	-69.00	-66.00	-63.00	-60.00	-57.00	N/A
@13 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	-56.00	N/A
@15 GHz	-69.00	-66.00	-63.00	-60.00	-57.00	N/A
@15 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	-56.00	N/A
@15 GHz (XMC-3H ODU)	-69.00	-66.00	-63.00	-60.00	-57.00	-54.00
@18 GHz	-68.50	-65.50	-62.50	-59.50	-56.50	N/A
@18 GHz (XMC-5D ODU)	-68.50	-65.50	-62.50	-59.50	N/A	N/A
@18 GHz (XMC-3W ODU)	-68.00	-65.00	-62.00	-59.00	-56.00	N/A
@18 GHz (XMC-3H ODU)	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50
@23 GHz	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50
@23 GHz (XMC-3W ODU)	-68.00	-65.00	-62.00	-59.00	-56.00	N/A
@26 GHz	-68.00	-65.00	-62.00	-59.00	-56.00	N/A
@28 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	-52.50
@32 GHz	-67.00	-64.00	-61.00	-58.00	N/A	N/A

Item	Performance (Channel Spacing: 28 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@38 GHz	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50

Table 3-116 Typical receiver sensitivity in the Integrated IP microwave mode V (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@8 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@7&8 GHz (XMC-3W ODU)	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@11 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@13 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@13 GHz (XMC-3W ODU)	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@15 GHz (XMC-3W ODU)	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@15 GHz (XMC-3H ODU)	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@18 GHz (XMC-3W ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@18 GHz (XMC-3H ODU)	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@23 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00

Item	Performance (Channel Spacing: 40 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
@23 GHz (XMC-3W ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@26 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@28 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@32 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@38 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00

Table 3-117 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-68.00	-65.00	-61.50	-58.50	-55.50	N/A
@8 GHz	-68.00	-65.00	-61.50	-58.50	-55.50	N/A
@7&8 GHz (XMC-3W ODU)	-67.00	-64.00	-60.50	-57.50	-54.50	N/A
@11 GHz	-67.50	-64.50	-61.00	-58.50	-55.50	N/A
@13 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@13 GHz (XMC-3W ODU)	-66.50	-63.50	-60.50	-57.50	-54.50	N/A
@15 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@15 GHz (XMC-3W ODU)	-66.50	-63.50	-60.50	-57.50	-54.50	N/A
@15 GHz (XMC-3H ODU)	-67.50	-64.50	-61.50	-58.50	-55.50	-52.50
@18 GHz	-67.00	-64.00	-61.00	-58.00	-55.00	N/A
@18 GHz (XMC-5D ODU)	-67.00	-64.00	-61.00	-58.00	N/A	N/A

Item	Performance (Channel Spacing: 40 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@18 GHz (XMC-3W ODU)	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@18 GHz (XMC-3H ODU)	-67.00	-64.00	-61.00	-58.00	-55.00	-52.00
@23 GHz	-67.00	-64.00	-61.00	-58.00	-55.00	-52.00
@23 GHz (XMC-3W ODU)	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@26 GHz	-66.50	-63.50	-60.50	-57.50	-54.50	N/A
@28 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	-51.00
@32 GHz	-65.50	-62.50	-59.50	-56.50	N/A	N/A
@38 GHz	-64.00	-61.00	-58.00	-55.00	-52.00	-49.00

Table 3-118 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@8 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@7&8 GHz (XMC-3W ODU)	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@11 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@13 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@13 GHz (XMC-3W ODU)	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@15 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00

Item	Performance (Channel Spacing: 56 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
@15 GHz (XMC-3W ODU)	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@15 GHz (XMC-3H ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@18 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@18 GHz (XMC-3W ODU)	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@18 GHz (XMC-3H ODU)	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@23 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@23 GHz (XMC-3W ODU)	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@26 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@28 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@32 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00
@38 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50

Table 3-119 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-66.50	-63.00	-60.00	-57.00	-54.00	N/A
@8 GHz	-66.50	-63.00	-60.00	-57.00	-54.00	N/A
@7&8 GHz (XMC-3W ODU)	-65.50	-62.00	-59.00	-56.00	-53.00	N/A
@11 GHz	-66.00	-63.00	-59.50	-57.00	-54.00	N/A
@13 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	N/A

Item	**Performance (Channel Spacing: 56 MHz)**					
	256QAM	**512QAM**	**1024QAM**	**2048QAM**	**4096QAM**	**8192QAM**
@13 GHz (XMC-3W ODU)	-65.00	-62.00	-59.00	-56.00	-53.00	N/A
@15 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@15 GHz (XMC-3W ODU)	-65.00	-62.00	-59.00	-56.00	-53.00	N/A
@15 GHz (XMC-3H ODU)	-66.00	-63.00	-60.00	-57.00	-54.00	-51.00
@18 GHz	-65.50	-62.50	-59.50	-56.50	-53.50	N/A
@18 GHz (XMC-5D ODU)	-65.50	-62.50	-59.50	-56.50	N/A	N/A
@18 GHz (XMC-3W ODU)	-64.50	-61.50	-58.50	-55.50	-52.50	N/A
@18 GHz (XMC-3H ODU)	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@23 GHz	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@23 GHz (XMC-3W ODU)	-64.50	-61.50	-58.50	-55.50	-52.50	N/A
@26 GHz	-65.00	-62.00	-59.00	-56.00	-53.00	N/A
@28 GHz	-64.50	-61.50	-58.50	-55.50	-52.50	-49.50
@32 GHz	-64.00	-61.00	-58.00	-55.00	N/A	N/A
@38 GHz	-62.50	-59.50	-56.50	-53.50	-50.50	-47.50

Table 3-120 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS8 mode, XPIC disabled)

Item	Performance (Channel Spacing: 112 MHz)											
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@BER=10^{-6} (dBm)												
@18 GHz (XMC-3H ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@18 GHz (XMC-5D ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	N/A
@23 GHz (XMC-3H ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@26 GHz (XMC-3 ODU)	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-59.00	-56.00	-53.00	N/A
@28 GHz (XMC-3H ODU)	-82.50	-81.00	-75.50	-74.00	-71.00	-67.50	-64.50	-61.50	-58.50	-55.50	-52.50	-49.50
@32 GHz (XMC-3 ODU)	-81.50	-80.00	-74.50	-73.00	-70.00	-66.50	-63.50	-60.50	-57.50	-55.00	-52.00	N/A
@38 GHz (XMC-3H ODU)	-80.50	-79.00	-73.50	-72.00	-69.00	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50	-47.50

Table 3-121 Typical receiver sensitivity in the Integrated IP microwave mode I (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 7 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@BER=10^{-6} (dBm)											
@7 GHz	-96.00	-94.00	-89.50	-87.50	-84.50	-81.50	-78.50	-75.50	-72.00	N/A	N/A
@8 GHz	-96.00	-94.00	-89.50	-87.50	-84.50	-81.50	-78.50	-75.50	-72.00	N/A	N/A
@7&8 GHz (XMC-3W ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.00	N/A	N/A
@11 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	N/A	N/A
@13 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	N/A
@13 GHz (XMC-5D ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	N/A	N/A	N/A
@13 GHz (XMC-3W ODU)	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	N/A	N/A
@15 GHz	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	N/A
@15 GHz (XMC-5D ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	N/A	N/A	N/A
@15 GHz (XMC-3W ODU)	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	N/A	N/A

Item	Performance (Channel Spacing: 7 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
@15 GHz (XMC-3H ODU)	-95.50	-93.50	-89.00	-87.00	-84.00	-81.00	-78.00	-75.00	-72.00	N/A	N/A
@18 GHz	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	N/A
@18 GHz (XMC-5D ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	N/A	N/A	N/A
@18 GHz (XMC-3W ODU)	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	N/A	N/A
@18 GHz (XMC-3H ODU)	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	N/A	N/A
@23 GHz	-95.00	-93.00	-88.50	-86.50	-83.50	-80.50	-77.50	-74.50	-71.50	N/A	N/A
@23 GHz (XMC-3W ODU)	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	N/A	N/A
@26 GHz	-94.50	-92.50	-88.00	-86.00	-83.00	-80.00	-77.00	-74.00	-71.00	N/A	N/A
@28 GHz	-94.00	-92.00	-87.50	-85.50	-82.50	-79.50	-76.50	-73.50	-70.50	N/A	N/A
@32 GHz	-93.50	-91.50	-87.00	-85.00	-82.00	-79.00	-76.00	-73.00	-70.00	N/A	N/A
@38 GHz	-92.00	-90.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	N/A	N/A

Table 3-122 Typical receiver sensitivity in the Integrated IP microwave mode II (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 14 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	2048 QAM
RSL@BER=10^{-6} (dBm)											
@7 GHz	-94.00	-92.00	-86.50	-84.50	-81.50	-78.50	-75.50	-72.50	-69.00	-66.00	N/A
@8 GHz	-94.00	-92.00	-86.50	-84.50	-81.50	-78.50	-75.50	-72.50	-69.00	-66.00	N/A
@7&8 GHz (XMC-3W ODU)	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.00	-65.00	N/A
@11 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-65.50	N/A
@13 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@13 GHz (XMC-3W ODU)	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	N/A
@15 GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@15 GHz (XMC-3W ODU)	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	N/A
@15 GHz (XMC-3H ODU)	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	N/A
@18 GHz	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	N/A

Item	Performance (Channel Spacing: 14 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	2048 QAM
@18 GHz (XMC-3W ODU)	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	N/A
@18 GHz (XMC-3H ODU)	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	N/A
@23 GHz	-93.00	-91.00	-85.50	-83.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	N/A
@23 GHz (XMC-3W ODU)	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	N/A
@26 GHz	-92.50	-90.50	-85.00	-83.00	-80.00	-77.00	-74.00	-71.00	-68.00	-65.00	N/A
@28 GHz	-92.00	-90.00	-84.50	-82.50	-79.50	-76.50	-73.50	-70.50	-67.50	-64.50	N/A
@32 GHz	-91.50	-89.50	-84.00	-82.00	-79.00	-76.00	-73.00	-70.00	-67.00	-64.00	N/A
@38 GHz	-90.00	-88.00	-82.50	-80.50	-77.50	-74.50	-71.50	-68.50	-65.50	-62.50	N/A

Table 3-123 Typical receiver sensitivity in the Integrated IP microwave mode III (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 28 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-90.50	-89.00	-83.50	-82.00	-79.00	-75.50	-72.50
@8 GHz	-90.50	-89.00	-83.50	-82.00	-79.00	-75.50	-72.50

Item	**Performance (Channel Spacing: 28 MHz)**						
	QPSK Strong	**QPSK**	**16QAM Strong**	**16QAM**	**32QAM**	**64QAM**	**128QAM**
@7&8 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@11 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@13 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@13 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@15 GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@15 GHz (XMC-3W ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@15 GHz (XMC-3H ODU)	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@18 GHz	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@18 GHz (XMC-3W ODU)	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@18 GHz (XMC-3H ODU)	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@23 GHz	-89.50	-88.00	-82.50	-81.00	-78.00	-74.50	-71.50
@23 GHz (XMC-3W ODU)	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@26 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@28 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@32 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@38 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50

Table 3-124 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 28 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-69.50	-66.00	-63.00	-60.00	N/A	N/A
@8 GHz	-69.50	-66.00	-63.00	-60.00	N/A	N/A
@7&8 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	N/A	N/A
@11 GHz	-69.00	-66.00	-62.50	-60.00	N/A	N/A
@13 GHz	-69.00	-66.00	-63.00	-60.00	-57.00	N/A
@13 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	-56.00	N/A
@15 GHz	-69.00	-66.00	-63.00	-60.00	-57.00	N/A
@15 GHz (XMC-3W ODU)	-68.50	-65.00	-62.00	-59.00	N/A	N/A
@15 GHz (XMC-3H ODU)	-69.00	-66.00	-63.00	-60.00	-57.00	N/A
@18 GHz (XMC-5D ODU)	-68.50	-65.50	-62.50	-59.50	-56.50	N/A
@18 GHz	-68.50	-65.50	-62.50	-59.50	N/A	N/A
@18 GHz (XMC-3W ODU)	-68.00	-65.00	-62.00	-59.00	N/A	N/A
@18 GHz (XMC-3H ODU)	-68.50	-65.50	-62.50	-59.50	-56.50	N/A
@23 GHz	-68.50	-65.50	-62.50	-59.50	-56.50	N/A
@23 GHz (XMC-3W ODU)	-68.00	-65.00	-62.00	-59.00	N/A	N/A
@26 GHz	-68.00	-65.00	-62.00	-59.00	-56.00	N/A
@28 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@32 GHz	-67.00	-64.00	-61.00	N/A	N/A	N/A

Item	Performance (Channel Spacing: 28 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@38 GHz	-65.50	-62.50	-59.50	-56.50	-53.50	N/A

Table 3-125 Typical receiver sensitivity in the Integrated IP microwave mode V (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 40 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@8 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00
@7&8 GHz (XMC-3W ODU)	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@11 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@13 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@13 GHz (XMC-3W ODU)	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@15 GHz (XMC-3W ODU)	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@15 GHz (XMC-3H ODU)	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@18 GHz (XMC-3W ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@18 GHz (XMC-3H ODU)	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00
@23 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00

Item	Performance (Channel Spacing: 40 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
@23 GHz (XMC-3W ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@26 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@28 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@32 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@38 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00

Table 3-126 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 40 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-68.00	-65.00	-61.50	-58.50	N/A	N/A
@8 GHz	-68.00	-65.00	-61.50	-58.50	N/A	N/A
@7&8 GHz (XMC-3W ODU)	-67.00	-64.00	-60.50	-57.50	N/A	N/A
@11 GHz	-67.50	-64.50	-61.00	-58.50	N/A	N/A
@13 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@13 GHz (XMC-3W ODU)	-66.50	-63.50	-60.50	-57.50	N/A	N/A
@15 GHz	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@15 GHz (XMC-3W ODU)	-66.50	-63.50	-60.50	-57.50	N/A	N/A
@15 GHz (XMC-3H ODU)	-67.50	-64.50	-61.50	-58.50	-55.50	N/A
@18 GHz	-67.00	-64.00	-61.00	-58.00	-55.00	N/A
@18 GHz (XMC-5D ODU)	-67.00	-64.00	-61.00	-58.00	N/A	N/A

Item	Performance (Channel Spacing: 40 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@18 GHz (XMC-3W ODU)	-66.00	-63.00	-60.00	-57.00	N/A	N/A
@18 GHz (XMC-3H ODU)	-67.00	-64.00	-61.00	-58.00	-55.00	N/A
@23 GHz	-67.00	-64.00	-61.00	-58.00	-55.00	N/A
@23 GHz (XMC-3W ODU)	-66.00	-63.00	-60.00	-57.00	N/A	N/A
@26 GHz	-66.50	-63.50	-60.50	-57.50	N/A	N/A
@28 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@32 GHz	-65.50	-62.50	-59.50	N/A	N/A	N/A
@38 GHz	-64.00	-61.00	-58.00	-55.00	-52.00	N/A

Table 3-127 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 56 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@7 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@8 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50
@7&8 GHz (XMC-3W ODU)	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@11 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@13 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@13 GHz (XMC-3W ODU)	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@15 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00

Item	Performance (Channel Spacing: 56 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
@15 GHz (XMC-3W ODU)	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@15 GHz (XMC-3H ODU)	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@18 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@18 GHz (XMC-3W ODU)	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@18 GHz (XMC-3H ODU)	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@23 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50
@23 GHz (XMC-3W ODU)	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@26 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00
@28 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50
@32 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00
@38 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50

Table 3-128 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 56 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@7 GHz	-66.50	-63.00	-60.00	-57.00	N/A	N/A
@8 GHz	-66.50	-63.00	-60.00	-57.00	N/A	N/A
@7&8 GHz (XMC-3W ODU)	-65.50	-62.00	-59.00	-56.00	N/A	N/A
@11 GHz	-66.00	-63.00	-59.50	-57.00	N/A	N/A
@13 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	N/A

Item	Performance (Channel Spacing: 56 MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@13 GHz (XMC-3W ODU)	-65.00	-62.00	-59.00	-56.00	N/A	N/A
@15 GHz	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@15 GHz (XMC-3W ODU)	-65.00	-62.00	-59.00	-56.00	N/A	N/A
@15 GHz (XMC-3H ODU)	-66.00	-63.00	-60.00	-57.00	-54.00	N/A
@18 GHz	-65.50	-62.50	-59.50	-56.50	-53.50	N/A
@18 GHz (XMC-5D ODU)	-65.50	-62.50	-59.50	-56.50	N/A	N/A
@18 GHz (XMC-3W ODU)	-64.50	-61.50	-58.50	-55.50	N/A	N/A
@18 GHz (XMC-3H ODU)	-65.50	-62.50	-59.50	-56.50	-53.50	N/A
@23 GHz	-65.50	-62.50	-59.50	-56.50	N/A	N/A
@23 GHz (XMC-3W ODU)	-64.50	-61.50	-58.50	-55.50	N/A	N/A
@26 GHz	-65.00	-62.00	-59.00	-56.00	N/A	N/A
@28 GHz	-64.50	-61.50	-58.50	-55.50	-52.50	N/A
@32 GHz	-64.00	-61.00	-58.00	N/A	N/A	N/A
@38 GHz	-62.50	-59.50	-56.50	-53.50	-50.50	N/A

Table 3-129 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS8 mode, XPIC enabled)

Item	Performance (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@BER=10^{-6} (dBm)												
@18 GHz (XMC-3H ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@18 GHz (XMC-5D ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	N/A
@23 GHz (XMC-3H ODU)	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50
@26 GHz (XMC-3 ODU)	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-59.00	-56.00	N/A	N/A
@28 GHz (XMC-3H ODU)	-82.50	-81.00	-75.50	-74.00	-71.00	-67.50	-64.50	-61.50	-58.50	-55.50	-52.50	-49.50
@32 GHz (XMC-3 ODU)	-81.50	-80.00	-74.50	-73.00	-70.00	-66.50	-63.50	-60.50	-57.50	-55.00	N/A	N/A
@38 GHz (XMC-3H ODU)	-80.50	-79.00	-73.50	-72.00	-69.00	-65.50	-62.50	-59.50	-56.50	-53.50	-50.50	-47.50

Typical Receiver Sensitivity (IS8 mode, 4x4 MIMO)

Table 3-130 Typical receiver sensitivity in the Integrated IP microwave mode I (IS8 mode, 4x4 MIMO, 0.33 to 0.4 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)							
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER = 10^{-6} (dBm)								
@13/15 GHz	-76.00	-74.50	-69.00	-67.50	-64.50	-61.00	-58.00	-55.00
@18 GHz	-75.50	-74.00	-68.50	-67.00	-64.00	-60.50	-57.50	-54.50

Table 3-131 Typical receiver sensitivity in the Integrated IP microwave mode II (IS8 mode, 4x4 MIMO, 0.33 to 0.4 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)							
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER = 10^{-6} (dBm)								
@13/15 GHz	-73.00	-71.50	-66.00	-64.50	-61.50	-58.00	-55.00	-52.00
@18 GHz	-72.50	-71.00	-65.50	-64.00	-61.00	-57.50	-54.50	-51.50

Table 3-132 Typical receiver sensitivity in the Integrated IP microwave mode III (IS8 mode, 4x4 MIMO, 0.4 to 0.6 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@13/15 GHz	-79.50	-78.00	-72.50	-71.00	-68.00	-64.50	-61.50	-58.50	-55.50
@18 GHz	-79.00	-77.50	-72.00	-70.50	-67.50	-64.00	-61.00	-58.00	-55.00

Table 3-133 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS8 mode, 4x4 MIMO, 0.4 to 0.6 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@13/15 GHz	-76.50	-75.00	-69.50	-68.00	-65.00	-61.50	-58.50	-55.50	-52.50
@18 GHz	-76.00	-74.50	-69.00	-67.50	-64.50	-61.00	-58.00	-55.00	-52.00

Table 3-134 Typical receiver sensitivity in the Integrated IP microwave mode V (IS8 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)									
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)										
@13/15 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-62.00	-58.00
@18 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50	-57.50

Table 3-135 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS8 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)									
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)										
@13/15 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-59.00	-55.00
@18 GHz	-82.50	-81.00	-75.50	-74.00	-71.00	-67.50	-64.50	-61.50	-58.50	-54.50

Table 3-136 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS8 mode, 4x4 MIMO, 0.7 to 0.9/1.05 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10-6 (dBm)											
@13/15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50	-67.50	-64.50	-60.50	-57.50
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-57.00

Table 3-137 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS8 mode, 4x4 MIMO, 0.7 to 0.9/1.05 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)											
@13/15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50	-57.50	-54.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-54.00

Table 3-138 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS8 mode, 4x4 MIMO, 0.9 to 1.05 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)											
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@BER=10^{-6} (dBm)												
@13/15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50	-67.50	-64.50	-60.50	-57.50	-54.50

Item	Specifications (Channel Spacing: 28 MHz)											
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-57.00	N/A

Table 3-139 Typical receiver sensitivity in the Integrated IP microwave mode X (IS8 mode, 4x4 MIMO, 0.9 to 1.05 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)											
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@BER=10^{-6} (dBm)												
@13/15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50	-57.50	-54.50	-51.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-54.00	N/A

Typical Receiver Sensitivity (IS8 mode, CA)

Table 3-140 Typical receiver sensitivity in the Integrated IP microwave mode II (IS8 mode, CA, XPIC disabled)

Item	Performance (Channel Spacing: 14MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@BER=10^{-6} (dBm)											
@13GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00
@15GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	-63.00

Table 3-141 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS8 mode, CA, XPIC enabled)

Item	Performance (Channel Spacing: 14MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@BER=10^{-6} (dBm)											
@13GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	N/A
@15GHz	-93.50	-91.50	-86.00	-84.00	-81.00	-78.00	-75.00	-72.00	-69.00	-66.00	N/A

Table 3-142 Typical receiver sensitivity in the Integrated IP microwave mode V (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 28MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@13GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00
@15GHz	-90.00	-88.50	-83.00	-81.50	-78.50	-75.00	-72.00

Table 3-143 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 28MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@13GHz	-69.00	-66.00	-63.00	-60.00	N/A	N/A
@15GHz	-69.00	-66.00	-63.00	-60.00	N/A	N/A

Table 3-144 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 40MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@13GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50
@15GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50

Table 3-145 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 40MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@13GHz	-67.50	-64.50	-61.50	-58.50	N/A	N/A
@15GHz	-67.50	-64.50	-61.50	-58.50	N/A	N/A

Table 3-146 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 56MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@BER=10^{-6} (dBm)							
@13GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00
@15GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00

Table 3-147 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS8 mode, CA, XPIC disabled/enabled)

Item	Performance (Channel Spacing: 56MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
RSL@BER=10^{-6} (dBm)						
@13GHz	-66.00	-63.00	-60.00	-57.00	N/A	N/A

Item	Performance (Channel Spacing: 56MHz)					
	256QAM	512QAM	1024QAM	2048QAM	4096QAM	8192QAM
@15GHz	-66.00	-63.00	-60.00	-57.00	N/A	N/A

3.6.7.2.2 Receiver Sensitivity (IS6 Running Mode)

The OptiX RTN 950A running in IS6 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS6 mode)

Table 3-148 Typical receiver sensitivity in SDH microwave mode (IS6 mode)

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/ 128QAM	56 MHz/128QAM	112 MHz/16QAM
RSL@ BER = 10^{-6} (dBm)			
@7GHz	-72.5	-69.5	N/A
@8GHz	-72.5	-69.5	N/A
@7&8GHz (XMC-3W ODU)	-71.5	-68.5	N/A
@11 GHz	-72	-69	N/A
@13 GHz (XMC-3W ODU)	-71	-68	N/A
@13 GHz	-72	-69	N/A
@15 GHz	-72	-69	N/A
@15 GHz (XMC-3W ODU)	-71	-68	N/A
@18 GHz (XMC-3W ODU)	-70.5	-67.5	N/A
@18 GHz	-71.5	-68.5	N/A

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/ 128QAM	56 MHz/128QAM	112 MHz/16QAM
@23 GHz	-71.5	-68.5	N/A
@23 GHz (XMC-3W ODU)	-70.5	-67.5	N/A
@26 GHz	-71	-68	N/A
@28 GHz	-70.5	-67.5	N/A
@32 GHz	-70	-67	-73
@38 GHz	-69.5	-66.5	N/A

NOTE
Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.

Integrated IP Microwave (IS6 mode)

Table 3-149 Typical receiver sensitivity in the Integrated IP microwave mode I (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7&8 GHz (XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13 GHz (XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz (XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@18 GHz (XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz (XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5

Table 3-150 Typical receiver sensitivity in the Integrated IP microwave mode II (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)			
	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)				
@7 GHz	-78.5	-75.5	-72	-69
@8 GHz	-78.5	-75.5	-72	-69
@7&8 GHz(XMC-3W)	-77.5	-74.5	-71	-68
@11 GHz	-78	-75	-72	-68.5
@13 GHz(XMC-3W)	-77	-74	-70	-68
@13 GHz(XMC-5D)	-78	-75	N/A	N/A
@13 GHz	-78	-75	-72	-69
@15 GHz	-78	-75	-72	-69
@15 GHz(XMC-5D)	-78	-75	N/A	N/A
@15 GHz(XMC-3W)	-77	-74	-71	-68
@18 GHz(XMC-3W)	-76.5	-73.5	-69.5	-67.5

Item	Specifications (Channel Spacing: 7 MHz)			
	128QAM	256QAM	512QAM	1024QAM
@18 GHz(XMC-5D)	-77.5	-74.5	N/A	N/A
@18 GHz	-77.5	-74.5	-71.5	-68.5
@23 GHz	-77.5	-74.5	-71.5	-68.5
@23 GHz(XMC-3W)	-76.5	-73.5	-70.5	-67.5
@26 GHz	-77	-74	-71	-68
@28 GHz	-76.5	-73.5	-70.5	-67.5
@32 GHz	-76	-73	-70	-67
@38 GHz	-75.5	-72.5	-69.5	-66.5

Table 3-151 Typical receiver sensitivity in the Integrated IP microwave mode III (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@18 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5

Table 3-152 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-75.5	-72.5	-69	-65	-63
@8 GHz	-75.5	-72.5	-69	-65	-63
@7&8 GHz(XMC-3W)	-74.5	-71.5	-68	-64	-62
@11 GHz	-75	-72	-69	-65.5	-63
@13 GHz(XMC-3W)	-74	-71	-68	-64	-62
@13 GHz	-75	-72	-69	-66	-63
@15 GHz	-75	-72	-69	-66	-63
@15 GHz(XMC-3W)	-74	-71	-68	-65	-62
@18 GHz(XMC-3W)	-73.5	-70.5	-67.5	-63.5	-61.5
@18 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@23 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@23 GHz(XMC-3W)	-73.5	-70.5	-67.5	-64.5	-61.5

Item	Specifications (Channel Spacing: 14 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
@26 GHz	-74	-71	-68	-65	-62
@28 GHz	-73.5	-70.5	-67.5	-64.5	-61.5
@32 GHz	-73	-70	-67	-64	-61
@38 GHz	-72.5	-69.5	-66.5	-63.5	-60.5

Table 3-153 Typical receiver sensitivity in the Integrated IP microwave mode V (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5

Table 3-154 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-72.5	-69.5	-66	-62	-58	-57
@8 GHz	-72.5	-69.5	-66	-62	-58	-57
@7&8 GHz(XMC-3W)	-71.5	-68.5	-65	-61	-57	-56
@11 GHz	-72	-69	-66	-62.5	-60	-57
@13 GHz(XMC-3W)	-71	-68	-65	-62	-58	-56
@13 GHz(XMC-5D)	-72	-69	-66	-63	-60	N/A
@13 GHz	-72	-69	-66	-63	-60	-57
@15 GHz	-72	-69	-66	-63	-60	-57
@15 GHz(XMC-5D)	-72	-69	-66	-63	-60	N/A
@15 GHz(XMC-3W)	-71	-68	-65	-62	-59	-56
@18 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-57.5	-55.5
@18 GHz(XMC-5D)	-71.5	-68.5	-65.5	-62.5	-59.5	N/A
@18 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5

Item	Specifications (Channel Spacing: 28 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@23 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz(XMC-3 W)	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@26 GHz	-71	-68	-65	-62	-59	-56
@28 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@32 GHz	-70	-67	-64	-61	-58	N/A
@38 GHz	-69.5	-66.5	-63.5	-60.5	-57.5	N/A

Table 3-155 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3 W)	-86.5	-85	-79.5	-78	-75	-71.5
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13 GHz(XMC-3 W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3 W)	-86	-84.5	-79	-77.5	-74.5	-71
@18 GHz(XMC-3 W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@23 GHz(XMC-3 W)	-85.5	-84	-78.5	-77	-74	-70.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-156 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-69.5	-66.5	-63	-59	-55	-54
@8 GHz	-69.5	-66.5	-63	-59	-55	-54
@7&8 GHz(XMC-3 W)	-68.5	-65.5	-62	-58	-54	-53
@11 GHz	-69	-66	-63	-59.5	-57	-54
@13 GHz(XMC-3 W)	-68	-65	-62	-59	-56	-53
@13 GHz(XMC-5 D)	-69	-66	-63	-60	-57	N/A
@13 GHz	-69	-66	-63	-60	-57	-54
@15 GHz	-69	-66	-63	-60	-57	-54
@15 GHz(XMC-5 D)	-69	-66	-63	-60	-57	N/A
@15 GHz(XMC-3 W)	-68	-65	-62	-59	-56	-53

Item	Specifications (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@18 GHz(XMC-3 W)	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@18 GHz(XMC-5 D)	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@18 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@23 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@23 GHz(XMC-3 W)	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@26 GHz	-68	-65	-62	-59	-56	-53
@28 GHz	-67.5	-64.5	-61.5	-58.5	-55.5	N/A
@32 GHz	-67	-64	-61	-58	-55	N/A
@38 GHz	-66.5	-63.5	-60.5	-57.5	-54.5	N/A

Table 3-157 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3 W)	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13 GHz(XMC-3 W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@18 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-158 Typical receiver sensitivity in the Integrated IP microwave mode X (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-71	-68	-65	-61.5	-58.5	-55.5
@8 GHz	-71	-68	-65	-61.5	-58.5	-55.5
@7&8 GHz(XMC-3W)	-70	-67	-64	-60.5	-57.5	-54.5
@11 GHz	-70.5	-67.5	-64.5	-61	-58.5	-55.5
@13 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@13 GHz(XMC-5D)	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@13 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5

Item	Specifications (Channel Spacing: 40 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@15 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@15 GHz(XMC-5D)	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@15 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@18 GHz(XMC-3W)	-69	-66	-63	-60	-57	-54
@18 GHz(XMC-5D)	-70	-67	-64	-61	-58	N/A
@18 GHz	-70	-67	-64	-61	-58	-55
@23 GHz	-70	-67	-64	-61	-58	-55
@23 GHz(XMC-3W)	-69	-66	-63	-60	-57	-54
@26 GHz	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@28 GHz	-69	-66	-63	-60	-57	N/A
@32 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@38 GHz	-68	-65	-62	-59	-56	N/A

Table 3-159 Typical receiver sensitivity in the Integrated IP microwave mode XI (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)											
@18 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	2048 QAM
@18 GHz (XMC-5D)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@23 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@26 GHz (XMC-3)	-83.0	-81.5	-76.0	-74.5	-71.5	-68.0	-65.0	-62.0	-59.0	-56.0	-53.0
@28 GHz (XMC-3H)	-82.5	-81.0	-75.5	-74.0	-71.0	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@32 GHz (XMC-3)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-55.0	-52.0
@38 GHz (XMC-3H)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-54.5	-51.5

Table 3-160 Typical receiver sensitivity in the Integrated IP microwave mode XII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@18 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5

Table 3-161 Typical receiver sensitivity in the Integrated IP microwave mode XIII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 7 MHz)		
	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)			
@7 GHz	-78.5	-75.5	-72
@8 GHz	-78.5	-75.5	-72
@7&8 GHz(XMC-3W)	-77.5	-74.5	-71
@11 GHz	-78	-75	-72
@13 GHz(XMC-3W)	-77	-74	-70

Item	Specifications (Channel Spacing: 7 MHz)		
	128QAM	256QAM	512QAM
@13 GHz(XMC-5D)	-78	-75	N/A
@13 GHz	-78	-75	-72
@15 GHz	-78	-75	-72
@15 GHz(XMC-5D)	-78	-75	N/A
@15 GHz(XMC-3W)	-77	-74	-71
@18 GHz(XMC-3W)	-76.5	-73.5	-69.5
@18 GHz(XMC-5D)	-77.5	-74.5	N/A
@18 GHz	-77.5	-74.5	-71.5
@23 GHz	-77.5	-74.5	-71.5
@23 GHz(XMC-3W)	-76.5	-73.5	-70.5
@26 GHz	-77	-74	-71
@28 GHz	-76.5	-73.5	-70.5
@32 GHz	-76	-73	-70
@38 GHz	-75.5	-72.5	-69.5

Table 3-162 Typical receiver sensitivity in the Integrated IP microwave mode XIV (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@18 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5

Table 3-163 Typical receiver sensitivity in the Integrated IP microwave mode XV (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 14 MHz)			
	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)				
@7 GHz	-75.5	-72.5	-69	-66
@8 GHz	-75.5	-72.5	-69	-66
@7&8 GHz(XMC-3W)	-74.5	-71.5	-68	-65
@11 GHz	-75	-72	-69	-65.5
@13 GHz(XMC-3W)	-74	-71	-68	-64
@13 GHz	-75	-72	-69	-66
@15 GHz	-75	-72	-69	-66
@15 GHz(XMC-3W)	-74	-71	-68	-65

Item	Specifications (Channel Spacing: 14 MHz)			
	128QAM	256QAM	512QAM	1024QAM
@18 GHz(XMC-3W)	-73.5	-70.5	-67.5	-63.5
@18 GHz	-74.5	-71.5	-68.5	-65.5
@23 GHz	-74.5	-71.5	-68.5	-65.5
@23 GHz(XMC-3W)	-73.5	-70.5	-67.5	-64.5
@26 GHz	-74	-71	-68	-65
@28 GHz	-73.5	-70.5	-67.5	-64.5
@32 GHz	-73	-70	-67	-64
@38 GHz	-72.5	-69.5	-66.5	-63.5

Table 3-164 Typical receiver sensitivity in the Integrated IP microwave mode XVI (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@18 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3 W)	-88.5	-87	-81.5	-80	-77	-73.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5

Table 3-165 Typical receiver sensitivity in the Integrated IP microwave mode XVII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-72.5	-69.5	-66	-63	-60
@8 GHz	-72.5	-69.5	-66	-63	-60
@7&8 GHz(XMC-3W)	-71.5	-68.5	-65	-62	-59
@11 GHz	-72	-69	-66	-62.5	-60
@13 GHz(XMC-3W)	-71	-68	-65	-62	58
@13 GHz	-72	-69	-66	-63	-60
@15 GHz	-72	-69	-66	-63	-60
@15 GHz(XMC-3W)	-71	-68	-65	-62	-59
@18 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-57.5
@18 GHz	-71.5	-68.5	-65.5	-62.5	-59.5
@23 GHz	-71.5	-68.5	-65.5	-62.5	-59.5
@23 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-58.5

Item	Specifications (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
@26 GHz	-71	-68	-65	-62	-59
@28 GHz	-70.5	-67.5	-64.5	-61.5	N/A
@32 GHz	-70	-67	-64	-61	N/A
@38 GHz	-69.5	-66.5	-63.5	-60.5	N/A

Table 3-166 Typical receiver sensitivity in the Integrated IP microwave mode XVIII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3 W)	-86.5	-85	-79.5	-78	-75	-71.5
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13 GHz(XMC-3 W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3 W)	-86	-84.5	-79	-77.5	-74.5	-71
@18 GHz(XMC-3 W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3 W)	-85.5	-84	-78.5	-77	-74	-70.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-167 Typical receiver sensitivity in the Integrated IP microwave mode XIX (IS6mode, XPIC enabled)

Item	Specifications (Channel Spacing: 56 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-69.5	-66.5	-63	-60	-57
@8 GHz	-69.5	-66.5	-63	-60	-57
@7&8 GHz(XMC-3W)	-68.5	-65.5	-62	-59	-56
@11 GHz	-69	-66	-63	-59.5	-57
@13 GHz(XMC-3W)	-68	-65	-62	-59	-56
@13 GHz	-69	-66	-63	-60	-57
@15 GHz	-69	-66	-63	-60	-57
@15 GHz(XMC-3W)	-68	-65	-62	-59	-56
@18 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5
@18 GHz	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5
@26 GHz	-68	-65	-62	-59	-56
@28 GHz	-67.5	-64.5	-61.5	-58.5	N/A
@32 GHz	-67	-64	-61	-58	N/A
@38 GHz	-66.5	-63.5	-60.5	-57.5	N/A

Table 3-168 Typical receiver sensitivity in the Integrated IP microwave mode XX (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@18 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-169 Typical receiver sensitivity in the Integrated IP microwave mode XXI (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-71	-68	-65	-61.5	-58.5
@8 GHz	-71	-68	-65	-61.5	-58.5
@7&8 GHz(XMC-3W)	-70	-67	-64	-60.5	-57.5
@11 GHz	-70.5	-67.5	-64.5	-61	-58.5
@13 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5
@13 GHz	-70.5	-67.5	-64.5	-61.5	-58.5
@15 GHz	-70.5	-67.5	-64.5	-61.5	-58.5
@15 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5
@18 GHz (XMC-3W)	-69	-66	-63	-60	-57
@18 GHz	-70	-67	-64	-61	-58
@23 GHz	-70	-67	-64	-61	-58
@23 GHz (XMC-3W)	-69	-66	-63	-60	-57
@26 GHz	-69.5	-66.5	-63.5	-60.5	-57.5
@28 GHz	-69	-66	-63	-60	N/A
@32 GHz	-68.5	-65.5	-62.5	-59.5	N/A
@38 GHz	-68	-65	-62	-59	N/A

Table 3-170 Typical receiver sensitivity in the Integrated IP microwave mode XXII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)											

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	2048 QAM
@18 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@23 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@26 GHz (XMC-3)	-83.0	-81.5	-76.0	-74.5	-71.5	-68.0	-65.0	-62.0	-59.0	-56.0	N/A
@28 GHz (XMC-3H)	-82.5	-81.0	-75.5	-74.0	-71.0	-67.5	-64.5	-61.5	-58.5	-55.5	N/A
@32 GHz (XMC-3)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-55.0	N/A
@38 GHz (XMC-3H)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-54.5	N/A

Typical Receiver Sensitivity (IS6 mode, 4x4 MIMO)

Table 3-171 Typical receiver sensitivity in the Integrated IP microwave mode I (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-61.50

Item	Specifications (Channel Spacing: 28 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
@15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00
@23 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00
@38 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	N/A

Table 3-172 Typical receiver sensitivity in the Integrated IP microwave mode II (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-58.50
@15 GHz	-82.50	-81.00	-75.50	-74.00	-71.00	-67.50	-64.50	-61.50	-58.50
@18 GHz	-82.00	-80.50	-75.00	-73.50	-70.50	-67.00	-64.00	-61.00	-58.00
@23 GHz	-82.00	-80.50	-75.00	-73.50	-70.50	-67.00	-64.00	-61.00	-58.00
@38 GHz	-80.00	-78.50	-73.00	-71.50	-68.50	-65.00	-62.00	-59.00	N/A

Table 3-173 Typical receiver sensitivity in the Integrated IP microwave mode III (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 40 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-84.50	-83.00	-77.50	-76.00	-73.00	-69.50	-66.50	-63.50	-60.50
@15 GHz	-84.00	-82.50	-77.00	-75.50	-72.50	-69.00	-66.00	-63.00	-60.00
@18 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50
@23 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50
@38 GHz	-81.50	-80.00	-74.50	-73.00	-70.00	-66.50	-63.50	-60.50	N/A

Table 3-174 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	1024 QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00	-68.00	-64.50	-60.50	-58.50
@15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50	-67.50	-64.50	-60.50	-58.50
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-58.00
@23 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-58.00
@38 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-62.00	N/A	N/A

Table 3-175 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 40 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	1024 QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50	-66.50	-63.50	-59.00	-57.00
@15 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00	-66.00	-63.00	-59.00	-57.00
@18 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50	-65.50	-62.50	-58.50	-56.50
@23 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50	-65.50	-62.50	-58.50	-56.50
@38 GHz	-84.50	-83.00	-77.50	-76.00	-73.00	-69.50	-66.50	-63.50	-60.50	N/A	N/A

Table 3-176 Typical receiver sensitivity in the Integrated IP microwave mode V (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	1024 QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-61.50	-57.50	-55.50
@15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50	-57.50	-55.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-55.00
@23 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-55.00
@38 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-59.00	N/A	N/A

NOTE

The modulation scheme 1024QAM Light is supported only when the antenna installation distance is 0.9 to 1.1 times the Rayleigh distance.

3.6.7.2.3 Receiver Sensitivity (IS3 Running Mode)

The OptiX RTN 950A running in IS3 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS3 mode)

Table 3-177 Typical receiver sensitivity of the SDH microwave (IS3 mode)

Item	Performance	
	1xSTM-1	**2xSTM-1**
	28MHz/128QAM	**56MHz/128QAM**
RSL@ BER = 10^{-6} (dBm)		
@6 GHz	-72.5	-69.5
@7 GHz	-72.5	-69.5
@8 GHz	-72.5	-69.5
@7&8GHz(XMC-3W ODU)	-71.5	-68.5
@10 GHz	-72	-69
@10.5 GHz	-70	N/A
@11 GHz	-72	-69
@13GHz(XMC-3W ODU)	-71	-68
@13 GHz	-72	-69
@15 GHz(XMC-3W ODU)	-71	-68
@15 GHz	-72	-69
@18GHz(XMC-3W ODU)	-70.5	-67.5

Item	Performance	
	1xSTM-1	2xSTM-1
	28MHz/128QAM	56MHz/128QAM
@18 GHz	-71.5	-68.5
@23 GHz(XMC-3W ODU)	-70.5	-67.5
@23 GHz	-71.5	-68.5
@26 GHz	-71	-68
@28 GHz	-70.5	-67.5
@32 GHz	-70	-67
@38 GHz	-69.5	-66.5
@42 GHz	-68	-65
NOTE Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.		

Integrated IP Microwave (IS3 mode)

Table 3-178 Typical receiver sensitivity of the Integrated IP microwave I (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 3.5 MHz)	
	QPSK	16QAM
RSL@ BER = 10^{-6} (dBm)		
@7 GHz	-96.00	-89.50
@8 GHz	-96.00	-89.50
@7&8GHz(XMC-3W ODU)	-95.00	-88.50
@11 GHz	-95.5	-88.5
@13GHz(XMC-3W ODU)	-94.5	-87.5
@13 GHz	-95.5	-88.5
@15 GHz(XMC-3W ODU)	-94	-87.5
@15 GHz	-95	-88.5
@18GHz(XMC-3W ODU)	-93.5	-87
@18 GHz	-94.5	-88

Item	Performance (Channel Spacing: 3.5 MHz)	
	QPSK	16QAM
@23 GHz(XMC-3W ODU)	-93.5	-87
@23 GHz	-94.5	-88
@26 GHz	-94	-87.5
@28 GHz	-93.5	-87
@32 GHz	-93	-86.5
@38 GHz	-93	-86.5

Table 3-179 Typical receiver sensitivity of the Integrated IP microwave II (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@23 GHz(XMC-3 W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77

Table 3-180 Typical receiver sensitivity of the Integrated IP microwave III (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-78.5	-75.5	-73.5	-72	-70
@7 GHz	-78.5	-75.5	-73.5	-72	-70
@8 GHz	-78.5	-75.5	73.5	-72	-70
@7&8 GHz(XMC-3W)	-77.5	-74.5	-72.5	-71	-69
@10 GHz	-78	-75	-73	-71.5	-69.5
@10.5 GHz	-76	-73	-71	-69.5	-67.5
@11 GHz	-78	-75	-73	-71.5	-69.5
@13GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@13 GHz	-78	-75	-73	-71.5	-69.5
@15 GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@15 GHz	-78	-75	-73	-71.5	-69.5
@18GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
@18 GHz	-77.5	-74.5	-72.5	-71	-69
@23 GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68
@23 GHz	-77.5	-74.5	-72.5	-71	-69
@26 GHz	-77	-74	-72	-70.5	-68.5
@28 GHz	-76.5	-73.5	-71.5	N/A	N/A
@32 GHz	-76	-73	-71	-69.5	N/A
@38 GHz	-75.5	-72.5	-70.5	-69	N/A
@42 GHz	-74	-71	-69	-67.5	N/A

Table 3-181 Typical receiver sensitivity of the Integrated IP microwave IV (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@15 GHz	-93.5	-91.5	-86	-84	-81	-78

Item	**Performance (Channel Spacing: 14 MHz)**					
	QPSK Strong	**QPSK**	**16QAM Strong**	**16QAM**	**32QAM**	**64QAM**
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74

Table 3-182 Typical receiver sensitivity of the Integrated IP microwave V (IS3 mode, XPIC disabled)

Item	**Performance (Channel Spacing: 14 MHz)**					
	128QAM	**256QAM**	**512QAM**	**512QAM Light**	**1024QAM**	**1024QAM Light**
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@8 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7&8 GHz(XMC-3W)	-74.5	-71.5	-69.5	-68	-66	-64.5
@10 GHz	-75	-72	-70	-68.5	-66.5	-65
@10.5 GHz	-73	-70	-68	-66.5	-64.5	-63
@11 GHz	-75	-72	-70	-68.5	-66.5	-65
@13GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@13 GHz	-75	-72	-70	-68.5	-66.5	-65

Item	Performance (Channel Spacing: 14 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
@15 GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@15 GHz	-75	-72	-70	-68.5	-66.5	-65
@18GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@18 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@23 GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@23 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@26 GHz	-74	-71	-69	-67.5	-65.5	-64
@28 GHz	-73.5	-70.5	-68.5	-67	-65	N/A
@32 GHz	-73	-70	-68	-66.5	-64.5	N/A
@38 GHz	-72.5	-69.5	-67.5	-66	-64	N/A
@42 GHz	-71	-68	-66	-64.5	-62.5	N/A

Table 3-183 Typical receiver sensitivity of the Integrated IP microwave VI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-184 Typical receiver sensitivity of the Integrated IP microwave VII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@8 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@10 GHz	-72	-69	-67	-65.5	-63.5	-62	N/A

Item	Performance (Channel Spacing: 28 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
@10.5 GHz	-70	-67	-65	-63.5	-61.5	-60	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@13 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@15 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@23 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@26 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@28 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@32 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@38 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@42 GHz	-68	-65	-63	-61.5	-59.5	-58	N/A

Table 3-185 Typical receiver sensitivity of the Integrated IP microwave VIII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-186 Typical receiver sensitivity of the Integrated IP microwave IX (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58

Item	Performance (Channel Spacing: 56 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@7&8 GHz(XMC -3W)	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@10 GHz	-69	-66	-64	-62.5	-60.5	-59	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@13 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@15 GHz(XMC -3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@15 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@23 GHz(XMC -3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@26 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@28 GHz	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@32 GHz	-67	-64	-62	-60.5	-58.5	-57	-55.5
@38 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	-55
@42 GHz	-65	-62	-60	-58.5	-56.5	-55	N/A

Table 3-187 Typical receiver sensitivity of the Integrated IP microwave X (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-188 Typical receiver sensitivity of the Integrated IP microwave XI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@8 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7&8 GHz(XMC -3W)	-70	-67	-65	-63.5	-61.5	-60	-58.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@13 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@15 GHz(XMC -3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@15 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@23 GHz(XMC -3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@23 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@28 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@32 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@38 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@42 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	N/A

Table 3-189 Typical receiver sensitivity of the Integrated IP microwave XII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 7 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@11 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@13 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@15 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80	-77
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5	-75.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77	-74

Table 3-190 Typical receiver sensitivity of the Integrated IP microwave XIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 14 MHz)							
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER = 10^{-6} (dBm)								
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@11 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@13 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@15 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5	-72.5	-69.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74	-71	-68

Table 3-191 Typical receiver sensitivity of the Integrated IP microwave XIV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-192 Typical receiver sensitivity of the Integrated IP microwave XV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-72.5	-69.5	-67.5	-66	-64
@7 GHz	-72.5	-69.5	-67.5	-66	-64
@8 GHz	-72.5	-69.5	-67.5	-66	-64
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63
@10 GHz	-72	-69	-67	-65.5	N/A
@10.5 GHz	-70	-67	-65	-63.5	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@13 GHz	-72	-69	-67	-65.5	-63.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@15 GHz	-72	-69	-67	-65.5	-63.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@18 GHz	-71.5	-68.5	-66.5	-65	-63
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@23 GHz	-71.5	-68.5	-66.5	-65	-63
@26 GHz	-71	-68	-66	-64.5	N/A
@28 GHz	-70.5	-67.5	-65.5	N/A	N/A
@32 GHz	-70	-67	-65	N/A	N/A
@38 GHz	-69.5	-66.5	-64.5	N/A	N/A
@42 GHz	-68	-65	-63	N/A	N/A

Table 3-193 Typical receiver sensitivity of the Integrated IP microwave XVI (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-194 Typical receiver sensitivity of the Integrated IP microwave XVII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7&8 GHz(XMC-3W)	-68.5	-65.5	-63.5	-62	-60	-58.5
@10 GHz	-69	-66	-64	-62.5	-60.5	-59
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@13 GHz	-69	-66	-64	-62.5	-60.5	-59
@15 GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@15 GHz	-69	-66	-64	-62.5	-60.5	-59
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@23 GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@26 GHz	-68	-65	-63	-61.5	-59.5	-58
@28 GHz	-67.5	-64.5	-62.5	-61	N/A	N/A
@32 GHz	-67	-64	-62	-60.5	N/A	N/A
@38 GHz	-66.5	-63.5	-61.5	-60	N/A	N/A
@42 GHz	-65	-62	-60	-58.5	N/A	N/A

Table 3-195 Typical receiver sensitivity of the Integrated IP microwave XVIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-196 Typical receiver sensitivity of the Integrated IP microwave XIX (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-71	-68	-66	-64.5	-62.5
@7 GHz	-71	-68	-66	-64.5	-62.5
@8 GHz	-71	-68	-66	-64.5	-62.5
@7&8 GHz(XMC-3W)	-70	-67	-65	-63.5	-61.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62
@10.5 GHz	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@13 GHz	-70.5	-67.5	-65.5	-64	-62
@15 GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@15 GHz	-70.5	-67.5	-65.5	-64	-62
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@18 GHz	-70	-67	-65	-63.5	-61.5
@23 GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@23 GHz	-70	-67	-65	-63.5	-61.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61
@28 GHz	-69	-66	-64	-62.5	N/A
@32 GHz	-68.5	-65.5	-63.5	-62	N/A
@38 GHz	-68	-65	-63	-61.5	N/A
@42 GHz	-66.5	-63.5	-61.5	-60	N/A

3.6.7.3 IF Performance

The IF performance includes the performance of the IF signal and the performance of the ODU O&M signal.

Table 3-197 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	550 (XMC-3H ODU@112MHz and XMC-5D ODU) 350 (other ODUs)
	Receive frequency of the IF board (MHz)	177 (XMC-3H ODU@112MHz and XMC-5D ODU) 140 (other ODUs)
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

3.6.7.4 Ethernet Service Port Performance

The 10GE port provided by the ISM8 board does not support Ethernet service access. This section describes the type of optical modules supported by this port.

Table 3-198 10GE optical interface specifications (two-fiber bidirectional)

Item	Specifications
Classification code	**10GBASE-LW** **10GBASE-LR**
Nominal wavelength (nm)	1310
Fiber type	Single-mode
Transmission distance (km)	10
Operating wavelength (nm)	1260 to 1355
Average optical output power (dBm)	-8.2 to 0.5
Receiver sensitivity (dBm)	-12.6
Overload (dBm)	0.5
Extinction ratio (dB)	3.5

3.6.7.5 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 3-199 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	Low-density parity check code (LDPC) encoding.
Adaptive time-domain equalizer for baseband signals	Supported.

3.6.7.6 Mechanical Behavior and Power Consumption

An ISM8 board occupies one slot. Its typical power consumption is 38 W.

Mechanical Behaviors and Power Consumption

Table 3-200 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.70 kg
Typical power consumption	38 W

3.7 ISM6

ISM6 boards are new-generation dual-channel IF boards. Each ISM6 board provides two IF ports.

3.7.1 Version Description

The ISM6 board has two functional versions: SL91ISM6 VER.B and SL91ISM6 VER.C. Only the SL91ISM6 VER.C can match the XMC-5D ODU.

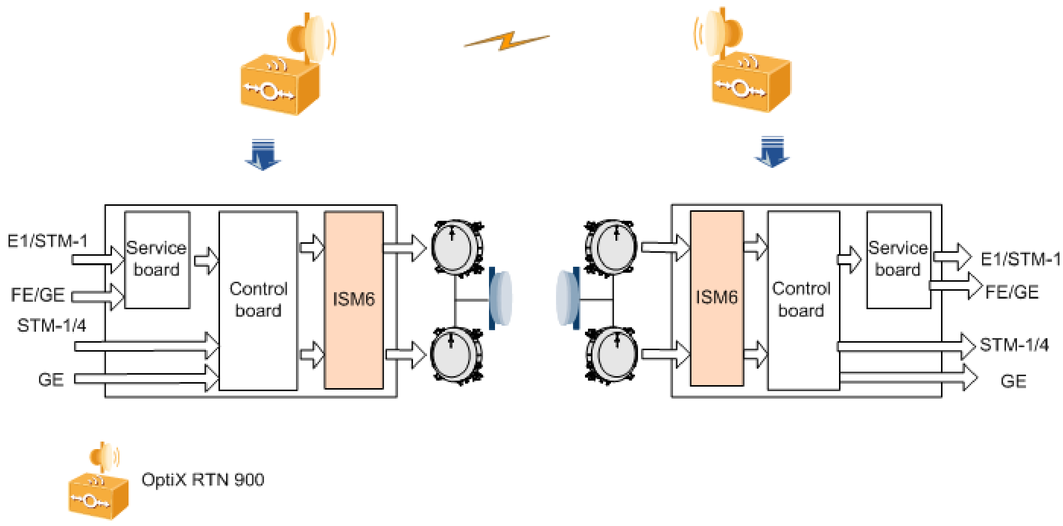
3.7.2 Application

An ISM6 board provides two IF ports. The two IF ports can be used to implement XPIC, 1+1 HSB/FD/SD, or PLA/EPLA/EPLA+ in one microwave direction, or provide microwave links in different directions.

Scenario Where Two IF Ports Are Applied in the Same Microwave Direction

ISM6 boards support XPIC/PLA/EPLA/EPLA+ between intra-board ports as well as 1+1 HSB/FD/SD between intra- and inter-board ports.

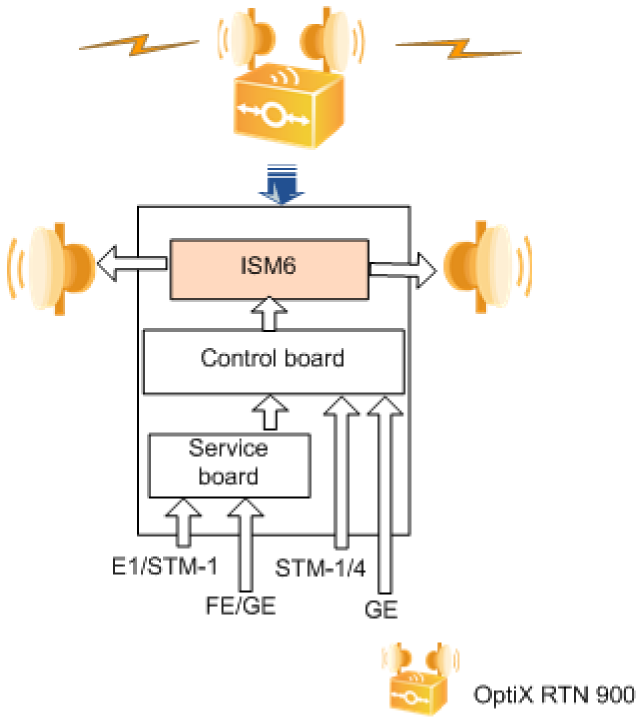
Figure 3-48 Scenario where two IF ports are applied in the same microwave direction



Scenario Where Two IF Ports Are Applied in Different Microwave Directions

An ISM6 board can transmit packets in two microwave directions through its two IF ports.

Figure 3-49 Scenario where two IF ports are applied in different microwave directions



3.7.3 Functions and Features

ISM6 boards receive and transmit 2xIF signals, provide management channels to ODUs, and supply -48 V power to ODUs.

ISM6 boards implement Ethernet and packet service functions by working with packet switching units on system control, switching, and timing boards.

Table 3-201 Functions and features that ISM6 boards support

Function and Feature	Description
Basic functions	● Receives and transmits 2xIF signals. ● Provides management channels to ODUs. ● Supplies -48 V power to ODUs.
Radio types	● Integrated IP microwave ● SDH radio **NOTE** Integrated IP microwave is compatible with Hybrid radio and Packet radio.
Service types in Integrated IP microwave mode	● Native E1 + Ethernet ● Native STM-1 + Ethernet **NOTE** Ethernet services can be native Ethernet services or packet services that are encapsulated into pseudo wire emulation edge-to-edge (PWE3) packets. One STM-1 service is equivalent to 63 E1 services. The total number of E1 and STM-1 services accessed on each board is less than or equal to 126 (the number of E1 services).
Service types in SDH radio mode	● STM-1 ● 2xSTM-1 **NOTE** If one IF port provides 2 × STM-1 microwave, the other IF port can only provide integrated IP microwave (the number of E1/STM-1 services is 0).

Function and Feature	Description
Running modes	• In IS6-PLUS mode, the board newly supports large-capacity working modes. In IS6-PLUS mode, the ISM6 supports modulation schemes QPSK-4096QAM and two extended modulation schemes: QPSK Strong and 16QAM Strong. In addition, the ISM6 supports the 112 MHz channel bandwidth, under which the ISM6 supports modulation schemes QPSK-2048QAM and extended modulation schemes QPSK Strong and 16QAM Strong. • IS6 mode, which is the default mode. In this mode, the modulation schemes QPSK-4096QAM and the two extended modulation schemes QPSK Strong and and 16QAM Strong are supported. The 112 MHz channel spacing is supported, and in this channel spacing, the modulation schemes QPSK-2048QAM and the two extended modulation schemes QPSK Strong and 16QAM Strong are supported. • IS3 mode. In this mode, the modulation schemes QPSK-2048QAM and the four extended modulation schemes QPSK Strong, 16QAM Strong, and 512QAM Light, and 1024QAM Light are supported. ISM6 boards can interconnect only with ISV3 boards or the RTN 905. • IS2 mode. In this mode, the modulation schemes QPSK-256QAM are supported. ISM6 boards can interconnect only with ISU2/ISX2 boards. **NOTE** • Compared with QPSK/16QAM, QPSK Strong/16QAM Strong has stronger FEC capability, and therefore has better receiver sensitivity. It has, however, less air interface bandwidth. Compared with 512QAM/1024QAM, 512QAM Light/1024QAM Light has weaker FEC capability, and therefore has worse receiver sensitivity. It has, however, higher air interface bandwidth. • Once the running mode of either port on the ISM6 is changed, the other port automatically changes to the same running mode.

Function and Feature	Description
Modulation schemes	● IS6-PLUS mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/1024QAM/2048QAM/4096QAM ● IS6 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/1024QAM/2048QAM/4096QAM ● IS3 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/512QAM Light/1024QAM/1024QAM Light/2048QAM ● IS2 mode: QPSK/16QAM/32QAM/64QAM/128QAM/256QAM **NOTE** ● In IS3 mode, 2048QAM is supported only when AM is enabled. ● In IS6 mode, 4096QAM is supported only when AM is enabled. ● In IS6-PLUS mode, 4096QAM can be supported only when AM is enabled. ● The highest-order modulation scheme that can be used by an IF port is determined based on factors such as the ODU frequency band, XPIC status, and channel spacing. For details, see **3.7.7 Technical Specifications**.
112 MHz channel spacing	Supported (only in IS6/IS6-PLUS mode) **NOTE** If a channel spacing of 112 MHz is configured for one port of the two ports on an ISM6 board, the channel spacing of the other port automatically changes to 112 MHz. Similarly, when the channel spacing of one port of the two ports on an ISM6 board changes from 112 MHz to another value, the channel spacing of the other port changes to the new value accordingly.
Backplane bus bandwidth	● CSHO: 1 Gbit/s for slots 4 and 6 when EPLA is supported and 2.5 Gbit/s for slots 4 and 6 when EPLA is not supported. 2.5 Gbit/s for the others. ● CSHOF: 2.5 Gbit/s for slots 1 to 6.
MIMO	Supported (SLF2CSHO)
Automatic transmit power control (ATPC)	Supported
Adaptive modulation (AM)	Supported only in Integrated IP microwave mode
E1 priorities	Supported only if native TDM services transmitted over Integrated IP microwave are E1 services
Compression of Ethernet frame headers	Supported

Function and Feature		Description
XPIC		Supported (only between two IF ports on a board)
Anti-Theft function		Supported
Radio working mode		See ISM6 Board Microwave Working Modes.
Link protection	1+1 HSB/FD/SD protection (HSB stands for hot standby, FD stands for frequency diversity, and SD stands for space diversity.)	Supported **NOTE** ● 1+1 HSB/FD/SD protection is supported between intra-board ports. ● 1+1 HSB/FD/SD protection is supported between inter-board ports.
	N+1 protection	Supported
	Link aggregation groups (LAGs) at air interfaces	Supported
	Physical link aggregation (PLA/EPLA/EPLA+)	Supported **NOTE** Inter-board PLA is not supported.
TDM service protection		Subnetwork connection protection (SNCP)
K byte pass-through		Supported
Ethernet service functions		See **Table 3-202**.
Multiprotocol Label Switching (MPLS) functions		Refer to the description of MPLS/PWE3 functions provided in the sections about system control, switching, and timing boards.
PWE3 functions		
Clock	Physical layer synchronization	Air interface clock
	Physical-layer clock protection	● Protection implemented by providing clock sources with different priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.

Function and Feature		Description
	Packet frequency synchronization	Not supported
Data communication network (DCN)	Inband DCN	Supports inband DCN. DCN bandwidth is configurable.
	Outband DCN	● Supports one data communications channel (DCC) that is composed of three DCC bytes for each channel in Integrated IP microwave mode. ● Supports one DCC that is composed of D1-D3 bytes, D4-D12 bytes, or D1-D12 bytes for each channel in SDH radio mode.
Operation and management	Loopback	● Supports inloops and outloops at IF ports. ● Supports inloops and outloops at composite (COMP) ports.
	Cold and warm resetting	Supported
	In-service field programmable gate array (FPGA) loading	Supported
	Pseudo random binary sequence (PRBS) test at IF ports	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Temperature monitoring	Supported
	Voltage monitoring	Supported

Table 3-202 Ethernet service functions

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td rowspan="2">Ethernet services</td><td>Native Ethernet services</td><td>● E-Line services
– Port-based E-line services
– VLAN-based E-line services
– E-Line services carried by QinQ links
● E-LAN services
– E-LAN services based on IEEE 802.1d bridges
– E-LAN services based on IEEE 802.1q bridges
– E-LAN services based on IEEE 802.1ad bridges</td></tr>
<tr><td>PWE3 Ethernet services</td><td>● E-Line services carried by PWs
● E-Aggr services carried by PWs
● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)</td></tr>
<tr><td colspan="2">Smart Ethernet protection (SEP)</td><td>Supported</td></tr>
<tr><td colspan="2">Ethernet ring protection switching (ERPS)</td><td>Supported (complies with ITU-T G.8032 v1/v2)</td></tr>
<tr><td colspan="2">Operation, administration, and management (OAM)</td><td>● Supports ETH OAM functions that comply with IEEE 802.1ag and IEEE 802.3ah.
● Supports frame loss measurement, frame delay measurement, and delay variation measurement functions that comply with ITU-T Y.1731.</td></tr>
<tr><td colspan="2">Spanning Tree Protocol (STP)</td><td>Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).</td></tr>
<tr><td colspan="2">Quality of service (QoS)</td><td>Refer to the description of QoS functions provided in the sections about system control, switching, and timing boards.</td></tr>
<tr><td colspan="2">Remote network monitoring (RMON)</td><td>Supported</td></tr>
</table>

3.7.4 Working Principle and Signal Flow

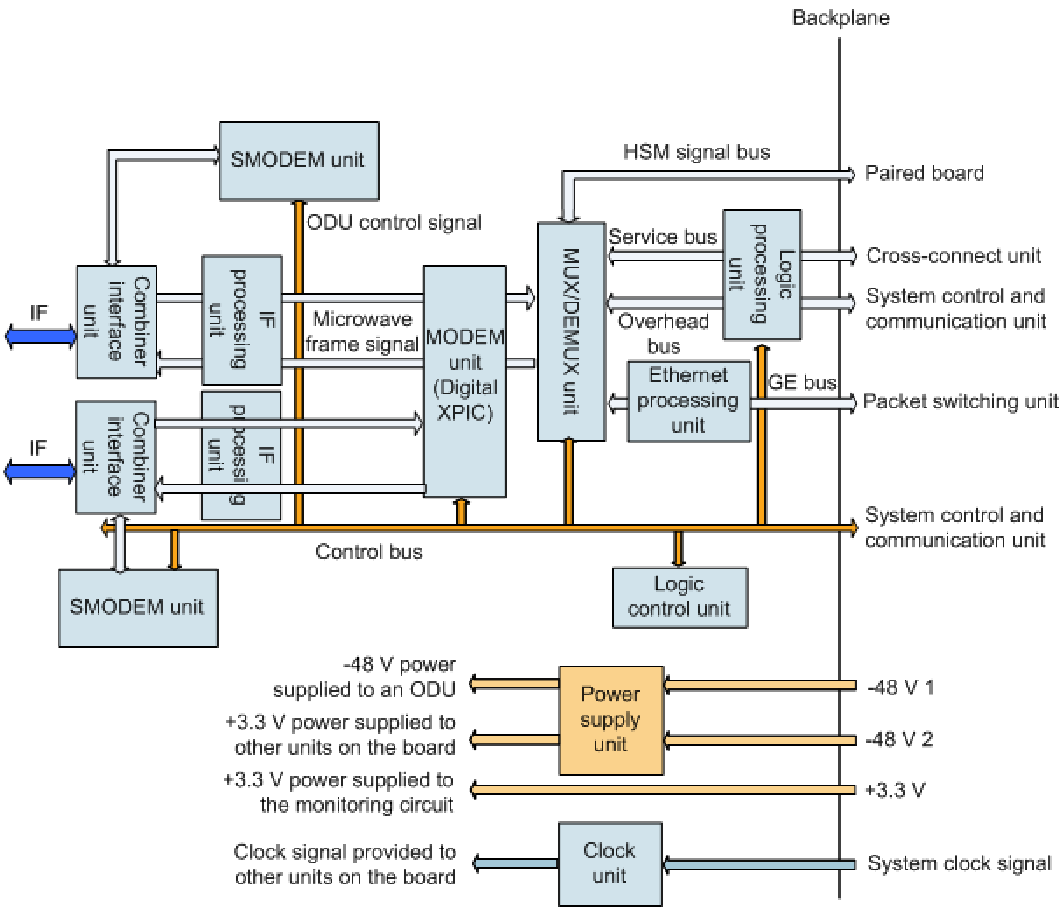
This section describes how the function units of an ISM6 board process Integrated IP microwave IF signals.

NOTE

Although Integrated IP microwave signals and SDH microwave signals have different microwave frame structures and service types, the ISM6 process them in the same manner.

Function Block Diagram

Figure 3-50 ISM6 board's function block diagram



Signal Processing in the Receive Direction

Table 3-203 Signal processing in the receive direction of an ISM6 board

Step	Function Unit	Processing Flow
1	Combiner interface unit	Separates ODU control signals from microwave service signals.
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits ODU control signals to the system control and communication unit.

Step	Function Unit	Processing Flow
3	IF processing unit	Filters signals, performs analog/digital conversion, and transmits the converted signals to the modem unit.
4	Modem unit	● If XPIC is disabled, performs digital demodulation. ● If XPIC is enabled, performs XPIC operations for IF signals. ● Performs time-domain adaptive equalization. ● Performs forward error correction (FEC) decoding and generates alarms, if any.
5	MUX/DEMUX unit	● Detects microwave frame headers and generates alarms and performance events, if any. ● Verifies parity bits in microwave frames and generates alarms and performance events, if any. ● Checks link IDs in microwave frames and generates alarms and performance events, if any. ● Detects changes in both ATPC messages and response messages, and reports the changes to the system control and communication unit over the control bus. ● Extracts orderwire bytes, auxiliary channel bytes (including F1 and serial bytes), and DCC bytes from microwave frames, and transmits the bytes to the logic processing unit. ● Maps E1 service signals to specific positions in VC-4s and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Demaps VC-4s from STM-1 service signals and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Extracts Ethernet signals from the microwave service signals, and transmits the Ethernet signals to the Ethernet processing unit.
6	Ethernet processing unit	● Processes GE signals received from the MUX/DEMUX unit. ● Sends the processed signals to the packet switching unit.
7	Logic processing unit	● Processes clock signals. ● Transmits overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

NOTE

In inter-boards 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

Signal Processing in the Transmit Direction

Table 3-204 Signal processing in the transmit direction of an ISM6 board

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signals from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals that are sent by the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Adds overheads to the VC-4 signals from the logic processing unit to construct STM-1 signals (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Sets overheads for microwave frames. ● Combines Ethernet signals, E1/STM-1 service signals, and microwave frame overheads into microwave frames.
4	Modem unit	● Performs FEC coding. ● Performs digital modulation.
5	IF processing unit	● Performs digital/analog conversion. ● Performs digital modulation. ● Filters signals. ● Amplifies signals.
6	SMODEM unit	Modulates ODU control signals from the system control and communication unit.
7	Combiner interface unit	Combines ODU control signals, microwave service signals, and -48 V power signals, and then sends the combined signals through an IF cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies the power to an ODU. Performs soft-start and filtering operations for the -48 V power received from the power supply bus on the backplane, and supplies -48 V power to an ODU after performing DC-DC conversion.
- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies a +3.3 V power to other units on the ISM6 board.

Clock Unit

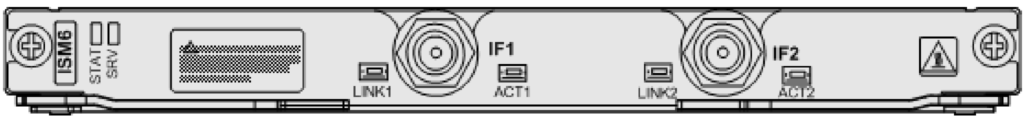
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.7.5 Front Panel

An ISM6 board has indicators, two IF ports, and labels on its front panel.

Front Panel Diagram

Figure 3-51 Front panel of an ISM6 board



Indicators

Table 3-205 Status explanation for indicators on an ISM6 board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.

Indicator	State	Meaning
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor or remote alarm has been reported.
LINK1	On (green)	The first microwave link is normal.
	On (red)	The first microwave link is faulty.
	Off	● The ODU connected to the IF1 port is offline. ● No logical board is configured for the ODU connected to IF1 port.
ACT1	On (green)	● In a 1+1 protected system, the first microwave link is working as the main link. ● In an unprotected system, the first microwave link has been activated.
	Off	● In a 1+1 protected system, the first microwave link is working as the standby link. ● In an unprotected system, no logical board is added for the ODU connected to IF1 port.
LINK2	On (green)	The second microwave link is normal.
	On (red)	The second microwave link is faulty.

Indicator	State	Meaning
	Off	● The ODU connected to the IF2 port is offline. ● No logical board is configured for the ODU connected to IF2 port.
ACT2	On (green)	● In a 1+1 protected system, the second microwave link is working as the main link. ● In an unprotected system, the second microwave link has been activated.
	Off	● In a 1+1 protected system, the second microwave link is working as the standby link. ● In an unprotected system, no logical board is added for the ODU connected to IF2 port.

Ports

Table 3-206 Description of the ports

Port	Description	Connector Type	Corresponding Cable
IF1[a]	IF port	TNC	**IF jumper**
IF2	IF port	TNC	**IF jumper**

NOTE

a: Only the IF1 port can be used to supply power to the XMC-5D ODU.

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

The operation warning label instructs you to connect an IF cable to the ODU before connecting it to the IDU.

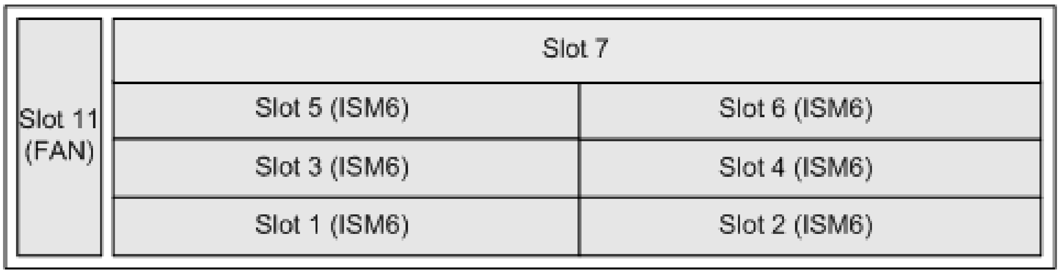
3.7.6 Valid Slots

An ISM6 board can be inserted in any slot 1 to 6. Its logical slot on the network management system (NMS) is the same as its physical slot.

NOTE

For the maximum number of boards supported by the OptiX RTN 950A, see Number of radio directions in *Product Description*.

Figure 3-52 Physical slots for ISM6 boards in a chassis



An ODU does not occupy a physical slot but has a logical slot on the NMS.

- ODU connecting to the IF1 port: Its logical slot ID is equal to the logical slot ID of the connected IF board plus 20.
- ODU connecting to the IF2 port: Its logical slot ID is equal to the logical slot ID of the connected IF board plus 40.

Figure 3-53 Logical slots of ISM6 boards on the NMS

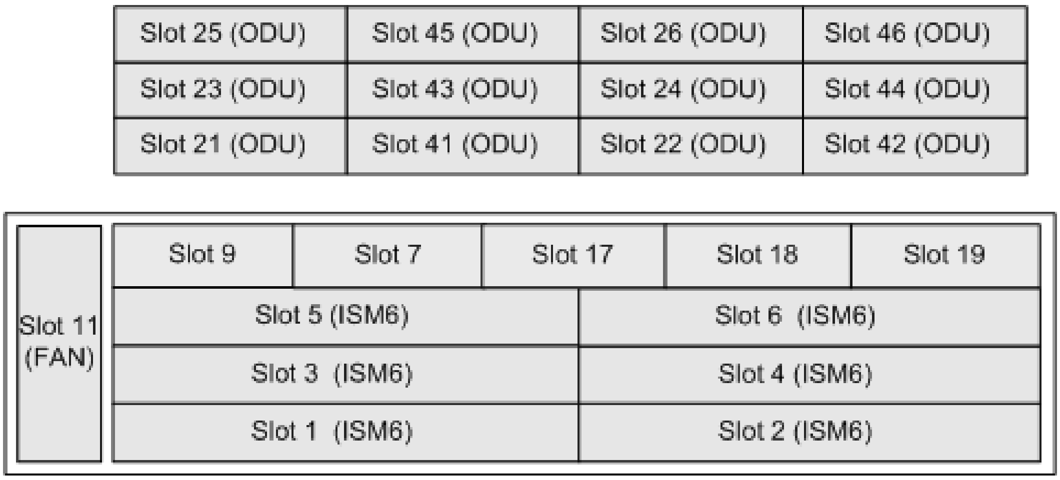


Table 3-207 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 3 and 5 > Slots 1 and 2

Two ISM6 boards can be configured as an inter-board XPIC 1+1 IF protection group only when being housed in two paired slots: Slots 1 and 2, Slots 3 and 5, or Slots 4 and 6.

3.7.7 Technical Specifications

This section describes board specifications, including running modes, microwave working modes, IF performance, modem performance, mechanical behaviors, and power consumption.

3.7.7.1 Microwave Work Modes (ISM6 Board)

This section describes the microwave work modes of the ISM6 board.

3.7.7.1.1 Microwave Work Modes (IS6 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS6 running mode.

NOTE

For ISM6 board, only the SL91ISM6 VER.C can work with the XMC-5D ODU.

SDH microwave work mode

Table 3-208 SDH microwave work mode (IS6 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	16QAM	112
NOTE In IS6 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP microwave work mode (IS6 mode, E1+Ethernet)

Table 3-209 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	4	8 to 10	8 to 12	8 to 19	8 to 25
7	QPSK	5	10 to 13	10 to 16	10 to 25	10 to 32
7	16QAM Strong	8	17 to 21	17 to 26	17 to 41	18 to 53
7	16QAM	10	20 to 26	20 to 32	21 to 49	21 to 63
7	32QAM	12	25 to 32	25 to 39	26 to 61	26 to 78
7	64QAM	15	32 to 40	32 to 50	33 to 77	33 to 98
7	128QAM	18	37 to 47	38 to 58	38 to 90	39 to 116
7	256QAM	20	43 to 54	43 to 66	43 to 102	44 to 131
7	512QAM	22	47 to 60	47 to 73	48 to 113	49 to 145
7	1024QAM	25	51 to 65	52 to 80	52 to 123	53 to 158
14 (13.75)	QPSK Strong	8	17 to 21	17 to 26	17 to 41	18 to 53
14 (13.75)	QPSK	10	20 to 26	21 to 32	21 to 49	21 to 64
14 (13.75)	16QAM Strong	16	35 to 44	35 to 54	36 to 84	36 to 108
14 (13.75)	16QAM	19	41 to 52	42 to 64	42 to 99	43 to 127
14 (13.75)	32QAM	25	52 to 66	52 to 80	53 to 124	54 to 159
14 (13.75)	64QAM	31	65 to 83	66 to 101	66 to 156	68 to 200
14 (13.75)	128QAM	37	77 to 98	78 to 120	79 to 185	80 to 237
14 (13.75)	256QAM	43	89 to 113	90 to 138	91 to 214	93 to 274
14 (13.75)	512QAM	47	99 to 125	99 to 153	101 to 236	103 to 303
14 (13.75)	1024QAM	50	104 to 132	105 to 162	106 to 250	109 to 321
14 (13.75)	2048QAM	55	115 to 146	116 to 179	118 to 276	120 to 354
28 (27.5)	QPSK Strong	17	36 to 46	36 to 56	37 to 86	37 to 111
28 (27.5)	QPSK	20	42 to 54	42 to 66	43 to 101	44 to 130

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	16QAM Strong	35	73 to 93	74 to 114	75 to 175	76 to 225
28 (27.5)	16QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
28 (27.5)	32QAM	52	109 to 139	110 to 170	112 to 262	114 to 337
28 (27.5)	64QAM	65	135 to 172	136 to 210	138 to 324	141 to 416
28 (27.5)	128QAM	75	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	75	185 to 234	186 to 287	189 to 443	192 to 568
28 (27.5)	512QAM	75	207 to 262	208 to 320	211 to 494	215 to 635
28 (27.5)	1024QAM	75	219 to 277	220 to 339	223 to 523	228 to 672
28 (27.5)	2048QAM	75	242 to 306	244 to 374	247 to 578	251 to 742
28 (27.5)	4096QAM	75	258 to 327	260 to 400	263 to 617	268 to 792
56 (55)	QPSK Strong	35	73 to 93	74 to 114	75 to 176	76 to 226
56 (55)	QPSK	41	86 to 109	87 to 133	88 to 206	89 to 264
56 (55)	16QAM Strong	71	148 to 188	149 to 230	151 to 355	154 to 456
56 (55)	16QAM	75	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	75	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	75	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	75	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	75	373 to 473	376 to 578	381 to 891	388 to 1145
56 (55)	512QAM	75	417 to 528	420 to 645	425 to 996	433 to 1278
56 (55)	1024QAM	75	450 to 571	454 to 698	460 to 1076	468 to 1382
56 (55)	2048QAM	75	502 to 636	506 to 777	512 to 1199	522 to 1539
56 (55)	4096QAM	75	535 to 678	540 to 829	546 to 1280	557 to 1643
40	QPSK Strong	24	49 to 63	50 to 77	51 to 119	51 to 153
40	QPSK	28	58 to 74	58 to 90	59 to 139	60 to 179
40	16QAM Strong	48	100 to 127	101 to 156	102 to 240	104 to 309

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	16QAM	56	117 to 149	118 to 182	120 to 281	122 to 360
40	32QAM	72	150 to 190	151 to 232	153 to 359	156 to 460
40	64QAM	75	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	75	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	75	253 to 320	255 to 392	258 to 605	263 to 776
40	512QAM	75	282 to 358	285 to 438	288 to 675	294 to 867
40	1024QAM	75	304 to 386	307 to 472	311 to 728	317 to 934
40	2048QAM	75	330 to 418	332 to 511	337 to 788	343 to 1012
40	4096QAM	75	344 to 436	347 to 533	351 to 823	358 to 1056
112	QPSK Strong	70	148 to 188	149 to 229	151 to 354	154 to 455
112	QPSK	75	173 to 219	174 to 268	177 to 414	180 to 531
112	16QAM Strong	75	298 to 377	300 to 461	304 to 712	310 to 914
112	16QAM	75	348 to 441	351 to 539	355 to 831	362 to 1067
112	32QAM	75	435 to 551	439 to 674	444 to 1040	453 to 1336
112	64QAM	75	548 to 694	552 to 848	559 to 1309	570 to 1680
112	128QAM	75	647 to 820	653 to 1003	661 to 1547	673 to 1987
112	256QAM	75	747 to 947	753 to 1158	763 to 1786	777 to 2293
112	512QAM	75	835 to 1058	841 to 1293	852 to 1995	868 to 2415
112	1024QAM	75	909 to 1143	918 to 1509	921 to 1607	N/A
112	2048QAM	75	965 to 1214	975 to 1603	978 to 1607	N/A

Table 3-210 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	8 to 12	8 to 19	8 to 24
7	QPSK	4	10 to 12	10 to 15	10 to 24	10 to 31
7	16QAM Strong	8	16 to 21	17 to 26	17 to 40	17 to 51
7	16QAM	9	20 to 25	20 to 31	20 to 48	20 to 61
7	32QAM	11	24 to 31	25 to 38	25 to 59	25 to 76
7	64QAM	15	31 to 39	31 to 48	32 to 74	32 to 96
7	128QAM	17	36 to 46	37 to 56	37 to 87	38 to 112
7	256QAM	20	42 to 53	42 to 65	43 to 101	44 to 130
7	512QAM	22	47 to 60	47 to 73	48 to 113	49 to 145
14 (13.75)	QPSK Strong	8	16 to 21	16 to 26	17 to 40	17 to 51
14 (13.75)	QPSK	9	20 to 25	20 to 31	20 to 48	21 to 62
14 (13.75)	16QAM Strong	16	34 to 43	34 to 53	35 to 82	35 to 105
14 (13.75)	16QAM	19	40 to 51	40 to 62	41 to 96	42 to 124
14 (13.75)	32QAM	24	50 to 64	51 to 78	51 to 120	52 to 155
14 (13.75)	64QAM	30	63 to 80	64 to 98	64 to 152	66 to 195
14 (13.75)	128QAM	36	75 to 95	75 to 116	76 to 179	78 to 231
14 (13.75)	256QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
14 (13.75)	512QAM	46	96 to 121	96 to 148	98 to 229	100 to 294
14 (13.75)	1024QAM	50	104 to 132	105 to 162	106 to 250	109 to 321
28 (27.5)	QPSK Strong	17	36 to 46	36 to 56	37 to 86	37 to 111
28 (27.5)	QPSK	20	42 to 54	42 to 66	43 to 101	44 to 130
28 (27.5)	16QAM Strong	35	73 to 93	74 to 114	75 to 175	76 to 225
28 (27.5)	16QAM	41	86 to 109	86 to 133	87 to 205	89 to 263
28 (27.5)	32QAM	52	109 to 139	110 to 170	112 to 262	114 to 337

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	64QAM	65	135 to 172	136 to 210	138 to 324	141 to 416
28 (27.5)	128QAM	75	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	75	184 to 233	185 to 284	187 to 439	191 to 564
28 (27.5)	512QAM	75	198 to 251	200 to 307	202 to 474	206 to 609
28 (27.5)	1024QAM	75	216 to 274	218 to 335	221 to 517	225 to 664
28 (27.5)	2048QAM	75	227 to 287	228 to 351	231 to 542	236 to 696
56 (55)	QPSK Strong	35	73 to 93	74 to 114	75 to 176	76 to 226
56 (55)	QPSK	41	86 to 109	87 to 133	88 to 206	89 to 264
56 (55)	16QAM Strong	71	148 to 188	149 to 230	151 to 355	154 to 456
56 (55)	16QAM	75	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	75	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	75	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	75	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	75	369 to 467	372 to 571	376 to 882	384 to 1132
56 (55)	512QAM	75	400 to 507	403 to 619	408 to 956	416 to 1227
56 (55)	1024QAM	75	436 to 552	439 to 675	445 to 1041	453 to 1337
56 (55)	2048QAM	75	456 to 578	460 to 707	466 to 1091	475 to 1401
40	QPSK Strong	24	49 to 63	50 to 77	51 to 119	51 to 153
40	QPSK	28	58 to 74	58 to 90	59 to 139	60 to 179
40	16QAM Strong	48	100 to 127	101 to 156	102 to 240	104 to 309
40	16QAM	56	117 to 149	118 to 182	120 to 281	122 to 360
40	32QAM	72	150 to 190	151 to 232	153 to 359	156 to 460
40	64QAM	75	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	75	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	75	251 to 318	253 to 389	256 to 600	261 to 770

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	512QAM	75	271 to 344	273 to 420	277 to 648	282 to 832
40	1024QAM	75	295 to 374	298 to 458	302 to 706	307 to 907
40	2048QAM	75	326 to 413	328 to 505	333 to 779	339 to 1000
112	QPSK Strong	70	147 to 188	149 to 229	150 to 354	152 to 455
112	QPSK	75	172 to 219	174 to 268	175 to 414	178 to 531
112	16QAM Strong	75	297 to 377	300 to 461	302 to 712	306 to 914
112	16QAM	75	347 to 441	351 to 539	352 to 831	357 to 1067
112	32QAM	75	434 to 551	439 to 674	441 to 1040	447 to 1336
112	64QAM	75	546 to 694	552 to 848	554 to 1309	562 to 1680
112	128QAM	75	646 to 820	653 to 1003	656 to 1547	665 to 1987
112	256QAM	75	745 to 947	753 to 1158	757 to 1786	768 to 2293
112	512QAM	75	832 to 1058	841 to 1293	845 to 1995	857 to 2415
112	1024QAM	75	910 to 1144	919 to 1510	918 to 1452	N/A

Integrated IP microwave work mode (IS6-mode, STM-1+Ethernet)

Table 3-211 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	1	185 to 234	186 to 287	189 to 443	192 to 568
28 (27.5)	512QAM	1	207 to 262	208 to 320	211 to 494	215 to 635
28 (27.5)	1024QAM	1	219 to 277	220 to 339	223 to 523	228 to 672
28 (27.5)	2048QAM	1	242 to 306	244 to 374	247 to 578	251 to 742

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	4096QAM	1	258 to 327	260 to 400	263 to 617	268 to 792
56 (55)	16QAM	1	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	1	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	1	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	1	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	1	373 to 473	376 to 578	381 to 891	388 to 1145
56 (55)	512QAM	1	417 to 528	420 to 645	425 to 996	433 to 1278
56 (55)	1024QAM	1	450 to 571	454 to 698	460 to 1076	468 to 1382
56 (55)	2048QAM	1	502 to 636	506 to 777	512 to 1199	522 to 1539
56 (55)	4096QAM	1	535 to 678	540 to 829	546 to 1280	557 to 1643
40	64QAM	1	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	1	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	1	253 to 320	255 to 392	258 to 605	263 to 776
40	512QAM	1	282 to 358	285 to 438	288 to 675	294 to 867
40	1024QAM	1	304 to 386	307 to 472	311 to 728	317 to 934
40	2048QAM	1	330 to 418	332 to 511	337 to 788	343 to 1012
40	4096QAM	1	344 to 436	347 to 533	351 to 823	358 to 1056
112	QPSK	1	173 to 219	174 to 268	177 to 414	180 to 531
112	16QAM Strong	1	298 to 377	300 to 461	304 to 712	310 to 914
112	16QAM	1	348 to 441	351 to 539	355 to 831	362 to 1067
112	32QAM	1	435 to 551	439 to 674	444 to 1040	453 to 1336
112	64QAM	1	548 to 694	552 to 848	559 to 1309	570 to 1680
112	128QAM	1	647 to 820	653 to 1003	661 to 1547	673 to 1987
112	256QAM	1	747 to 947	753 to 1158	763 to 1786	777 to 2293
112	512QAM	1	835 to 1058	841 to 1293	852 to 1995	868 to 2415
112	1024QAM	1	909 to 1143	918 to 1509	921 to 1607	TBD

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	2048QAM	1	965 to 1214	975 to 1603	978 to 1607	TBD

Table 3-212 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	161 to 248	163 to 383	167 to 492
28 (27.5)	256QAM	1	184 to 233	185 to 284	187 to 439	191 to 564
28 (27.5)	512QAM	1	198 to 251	200 to 307	202 to 474	206 to 609
28 (27.5)	1024QAM	1	216 to 274	218 to 335	221 to 517	225 to 664
28 (27.5)	2048QAM	1	227 to 287	228 to 351	231 to 542	236 to 696
56 (55)	16QAM	1	173 to 220	175 to 268	177 to 414	180 to 532
56 (55)	32QAM	1	217 to 275	219 to 336	221 to 519	226 to 666
56 (55)	64QAM	1	273 to 346	275 to 423	279 to 653	284 to 838
56 (55)	128QAM	1	323 to 409	326 to 500	330 to 772	336 to 991
56 (55)	256QAM	1	369 to 467	372 to 571	376 to 882	384 to 1132
56 (55)	512QAM	1	400 to 507	403 to 619	408 to 956	416 to 1227
56 (55)	1024QAM	1	436 to 552	439 to 675	445 to 1041	453 to 1337
56 (55)	2048QAM	1	456 to 578	460 to 707	466 to 1091	475 to 1401
40	64QAM	1	185 to 235	187 to 287	189 to 443	192 to 568
40	128QAM	1	219 to 277	221 to 339	223 to 524	228 to 672
40	256QAM	1	251 to 318	253 to 389	256 to 600	261 to 770
40	512QAM	1	271 to 344	273 to 420	277 to 648	282 to 832
40	1024QAM	1	295 to 374	298 to 458	302 to 706	307 to 907
40	2048QAM	1	326 to 413	328 to 505	333 to 779	339 to 1000

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
112	QPSK	1	172 to 219	174 to 268	175 to 414	178 to 531
112	16QAM Strong	1	297 to 377	300 to 461	302 to 712	306 to 914
112	16QAM	1	347 to 441	351 to 539	352 to 831	357 to 1067
112	32QAM	1	434 to 551	439 to 674	441 to 1040	447 to 1336
112	64QAM	1	546 to 694	552 to 848	554 to 1309	562 to 1680
112	128QAM	1	646 to 820	653 to 1003	656 to 1547	665 to 1987
112	256QAM	1	745 to 947	753 to 1158	757 to 1786	768 to 2293
112	512QAM	1	832 to 1058	841 to 1293	845 to 1995	857 to 2415
112	1024QAM	1	910 to 1144	919 to 1510	918 to 1452	TBD

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

Integrated IP microwave work mode (IS6-mode, 4x4 MIMO)

Table 3-213 Integrated IP microwave work mode (IS6 mode, E1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	QPSK Strong	16	33 to 42	34 to 56	34 to 73	34 to 99
28 (27.5)	QPSK	18	39 to 49	39 to 65	40 to 86	40 to 116
28 (27.5)	16QAM Strong	32	68 to 86	69 to 114	69 to 149	70 to 202
28 (27.5)	16QAM	38	79 to 101	80 to 133	81 to 174	82 to 236
28 (27.5)	32QAM	48	100 to 126	101 to 167	102 to 218	103 to 296
28 (27.5)	64QAM	60	125 to 159	126 to 210	128 to 274	130 to 371
28 (27.5)	128QAM	71	148 to 188	150 to 248	151 to 324	154 to 439
28 (27.5)	256QAM	75	171 to 217	173 to 286	174 to 374	177 to 506
28 (27.5)	512QAM	75	194 to 246	196 to 324	198 to 424	201 to 574
28 (27.5)	1024QAM	75	217 to 275	219 to 363	221 to 474	225 to 642
28 (27.5)	1024QAM Light	75	220 to 279	223 to 369	225 to 482	229 to 653
40	QPSK Strong	22	46 to 58	46 to 76	46 to 100	47 to 135
40	QPSK	25	53 to 68	54 to 89	54 to 117	55 to 159
40	16QAM Strong	44	92 to 117	93 to 155	94 to 203	96 to 274
40	16QAM	52	108 to 137	109 to 181	110 to 237	112 to 321
40	32QAM	65	135 to 172	137 to 227	138 to 297	141 to 402
40	64QAM	75	171 to 217	173 to 286	174 to 374	177 to 506
40	128QAM	75	202 to 256	204 to 338	206 to 442	210 to 599
40	256QAM	75	233 to 296	236 to 391	238 to 511	242 to 692
40	512QAM	75	265 to 336	268 to 443	270 to 579	275 to 784
40	1024QAM	75	296 to 375	299 to 495	302 to 648	307 to 877
40	1024QAM Light	75	301 to 382	305 to 504	308 to 659	313 to 893
56 (55)	QPSK Strong	33	69 to 87	69 to 115	70 to 151	71 to 204
56 (55)	QPSK	38	80 to 102	81 to 135	82 to 176	83 to 239

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM Strong	67	139 to 176	141 to 233	142 to 305	144 to 413
56 (55)	16QAM	75	163 to 206	164 to 272	166 to 356	169 to 482
56 (55)	32QAM	75	204 to 258	206 to 341	208 to 446	211 to 604
56 (55)	64QAM	75	257 to 325	259 to 429	262 to 561	266 to 760
56 (55)	128QAM	75	304 to 385	307 to 508	310 to 664	315 to 899
56 (55)	256QAM	75	351 to 444	354 to 587	358 to 767	364 to 1040
56 (55)	512QAM	75	398 to 504	402 to 665	406 to 869	412 to 1178
56 (55)	1024QAM	75	445 to 563	449 to 744	454 to 972	461 to 1320
56 (55)	1024QAM Light	75	452 to 573	457 to 757	462 to 989	469 to 1341

Table 3-214 Integrated IP microwave work mode (IS6 mode, STM-1 + Ethernet, 4x4 MIMO)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	148 to 188	150 to 248	151 to 324	154 to 439
28 (27.5)	256QAM	1	171 to 217	173 to 286	174 to 374	177 to 506
28 (27.5)	512QAM	1	194 to 246	196 to 324	198 to 424	201 to 574
28 (27.5)	1024QAM	1	217 to 275	219 to 363	221 to 474	225 to 642
28 (27.5)	1024QAM Light	1	220 to 279	223 to 369	225 to 482	229 to 653
40	64QAM	1	171 to 217	173 to 286	174 to 374	177 to 506
40	128QAM	1	202 to 256	204 to 338	206 to 442	210 to 599
40	256QAM	1	233 to 296	236 to 391	238 to 511	242 to 692
40	512QAM	1	265 to 336	268 to 443	270 to 579	275 to 784
40	1024QAM	1	296 to 375	299 to 495	302 to 648	307 to 877
40	1024QAM Light	1	301 to 382	305 to 504	308 to 659	313 to 893

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM	1	163 to 206	164 to 272	166 to 356	169 to 482
56 (55)	32QAM	1	204 to 258	206 to 341	208 to 446	211 to 604
56 (55)	64QAM	1	257 to 325	259 to 429	262 to 561	266 to 760
56 (55)	128QAM	1	304 to 385	307 to 508	310 to 664	315 to 899
56 (55)	256QAM	1	351 to 444	354 to 587	358 to 767	364 to 1040
56 (55)	512QAM	1	398 to 504	402 to 665	406 to 869	412 to 1178
56 (55)	1024QAM	1	445 to 563	449 to 744	454 to 972	461 to 1320
56 (55)	1024QAM Light	1	452 to 573	457 to 757	462 to 989	469 to 1341

3.7.7.1.2 Microwave Work Modes (IS6-PLUS Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS6-PLUS running mode.

SDH microwave work mode (IS6-PLUS mode)

Table 3-215 SDH microwave work mode (IS6-PLUS mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	16QAM	112

NOTE
In IS6-PLUS running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.

Integrated IP microwave work mode (IS6-PLUS mode, E1+Ethernet)

Table 3-216 Integrated IP microwave work mode (IS6-PLUS mode, E1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
7	QPSK Strong	4	9 to 11	9 to 14	9 to 19
7	QPSK	5	11 to 14	11 to 17	11 to 24
7	16QAM Strong	8	18 to 23	18 to 28	18 to 40
7	16QAM	10	22 to 28	22 to 34	22 to 48
7	32QAM	12	27 to 34	27 to 42	27 to 59
7	64QAM	15	34 to 43	34 to 53	35 to 75
7	128QAM	18	40 to 51	40 to 62	41 to 88
7	256QAM	20	45 to 58	46 to 71	46 to 100
7	512QAM	22	50 to 64	51 to 78	51 to 110
7	1024QAM	25	55 to 70	55 to 85	56 to 120
14 (13.75)	QPSK Strong	8	19 to 24	19 to 29	19 to 41
14 (13.75)	QPSK	10	22 to 28	22 to 34	22 to 48
14 (13.75)	16QAM Strong	16	39 to 49	39 to 60	40 to 85
14 (13.75)	16QAM	19	46 to 58	46 to 71	47 to 101
14 (13.75)	32QAM	25	56 to 71	56 to 87	57 to 123
14 (13.75)	64QAM	31	69 to 88	70 to 107	71 to 152
14 (13.75)	128QAM	37	82 to 104	83 to 127	84 to 180
14 (13.75)	256QAM	43	95 to 120	96 to 147	97 to 208
14 (13.75)	512QAM	47	105 to 133	106 to 163	107 to 230
14 (13.75)	1024QAM	50	111 to 141	112 to 172	113 to 243
14 (13.75)	2048QAM	55	122 to 154	123 to 189	124 to 267
28 (27.5)	QPSK Strong	17	40 to 50	40 to 62	41 to 87
28 (27.5)	QPSK	20	47 to 59	47 to 73	48 to 103
28 (27.5)	16QAM Strong	35	81 to 103	82 to 126	83 to 178
28 (27.5)	16QAM	41	93 to 118	94 to 144	95 to 204

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
28 (27.5)	32QAM	52	116 to 147	117 to 180	119 to 255
28 (27.5)	64QAM	65	142 to 180	143 to 220	145 to 311
28 (27.5)	128QAM	75	168 to 213	169 to 260	171 to 368
28 (27.5)	256QAM	75	194 to 246	194 to 246	198 to 424
28 (27.5)	512QAM	75	220 to 279	220 to 279	225 to 481
28 (27.5)	1024QAM	75	239 to 303	239 to 303	244 to 523
28 (27.5)	2048QAM	75	258 to 327	260 to 400	264 to 565
28 (27.5)	4096QAM	75	286 to 363	289 to 444	292 to 626
56 (55)	QPSK Strong	35	80 to 102	81 to 124	82 to 175
56 (55)	QPSK	41	94 to 119	95 to 146	96 to 206
56 (55)	16QAM Strong	71	165 to 209	166 to 255	168 to 360
56 (55)	16QAM	75	191 to 242	193 to 296	195 to 418
56 (55)	32QAM	75	239 to 303	241 to 370	244 to 522
56 (55)	64QAM	75	286 to 363	289 to 444	292 to 626
56 (55)	128QAM	75	339 to 429	341 to 525	346 to 741
56 (55)	256QAM	75	376 to 476	379 to 582	384 to 822
56 (55)	512QAM	75	444 to 562	447 to 687	453 to 970
56 (55)	1024QAM	75	492 to 624	496 to 763	502 to 1076
56 (55)	2048QAM	75	526 to 667	530 to 815	537 to 1150
56 (55)	4096QAM	75	576 to 730	581 to 892	588 to 1259
40	QPSK Strong	24	54 to 69	54 to 84	55 to 118
40	QPSK	28	63 to 80	64 to 98	64 to 138
40	16QAM Strong	48	110 to 139	111 to 170	112 to 240
40	16QAM	56	128 to 163	129 to 199	131 to 281
40	32QAM	72	161 to 204	162 to 249	164 to 352
40	64QAM	75	203 to 257	204 to 314	207 to 443
40	128QAM	75	240 to 304	242 to 371	245 to 524

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
40	256QAM	75	277 to 351	279 to 429	283 to 605
40	512QAM	75	314 to 398	316 to 486	320 to 687
40	1024QAM	75	347 to 440	350 to 538	354 to 759
40	2048QAM	75	377 to 478	380 to 584	385 to 825
40	4096QAM	75	395 to 501	398 to 612	403 to 864
112	QPSK Strong	70	161 to 204	162 to 250	164 to 352
112	QPSK	75	180 to 228	181 to 279	183 to 393
112	16QAM Strong	75	323 to 409	325 to 500	329 to 706
112	16QAM	75	364 to 461	367 to 564	372 to 796
112	32QAM	75	459 to 582	463 to 711	469 to 1000
112	64QAM	75	574 to 727	578 to 889	586 to 1000
112	128QAM	75	663 to 840	668 to 1108	676 to 1448
112	256QAM	75	758 to 961	764 to 1268	774 to 1607
112	512QAM	75	865 to 1000	871 to 1446	882 to 1607
112	1024QAM	75	954 to 1201	965 to 1585	967 to 1607
112	2048QAM	75	1018 to 1283	1030 to 1640	1034 to 1607

Table 3-217 Integrated IP microwave work mode (IS6-PLUS mode, E1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)	
			Without Compression	With L2 Frame Header Compression
28 (27.5)	QPSK Strong	17	39 to 50	39 to 66
28 (27.5)	QPSK	20	44 to 56	44 to 74
28 (27.5)	16QAM Strong	35	80 to 101	80 to 133
28 (27.5)	16QAM	41	90 to 114	91 to 150
28 (27.5)	32QAM	52	113 to 143	114 to 188
28 (27.5)	64QAM	65	138 to 175	140 to 231

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)	
			Without Compression	With L2 Frame Header Compression
28 (27.5)	128QAM	75	163 to 207	165 to 274
28 (27.5)	256QAM	75	190 to 241	192 to 318
28 (27.5)	512QAM	75	214 to 271	216 to 358
28 (27.5)	1024QAM	75	234 to 297	237 to 392
28 (27.5)	2048QAM	75	258 to 327	261 to 432
40	QPSK Strong	24	54 to 69	55 to 91
40	QPSK	28	62 to 79	63 to 104
40	16QAM Strong	48	110 to 139	111 to 184
40	16QAM	56	123 to 155	124 to 205
40	32QAM	72	158 to 200	159 to 264
40	64QAM	75	197 to 250	199 to 330
40	128QAM	75	233 to 296	236 to 390
40	256QAM	75	269 to 341	272 to 451
40	512QAM	75	305 to 387	308 to 510
40	1024QAM	75	341 to 432	345 to 571
40	2048QAM	75	373 to 472	377 to 623
56 (55)	QPSK Strong	35	79 to 100	79 to 132
56 (55)	QPSK	41	90 to 114	91 to 150
56 (55)	16QAM Strong	71	162 to 205	163 to 270
56 (55)	16QAM	75	182 to 230	183 to 304
56 (55)	32QAM	75	231 to 292	233 to 386
56 (55)	64QAM	75	280 to 355	283 to 469
56 (55)	128QAM	75	330 to 418	333 to 552
56 (55)	256QAM	75	376 to 477	380 to 630
56 (55)	512QAM	75	436 to 553	441 to 730
56 (55)	1024QAM	75	487 to 617	492 to 815
56 (55)	2048QAM	75	516 to 654	522 to 864

Integrated IP microwave work mode (IS6-PLUS mode, STM-1+Ethernet)

Table 3-218 Integrated IP microwave work mode (IS6-PLUS mode, STM-1 + Ethernet, non-XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
28 (27.5)	128QAM	1	168 to 213	169 to 260	171 to 368
28 (27.5)	256QAM	1	194 to 246	194 to 246	198 to 424
28 (27.5)	512QAM	1	220 to 279	220 to 279	225 to 481
28 (27.5)	1024QAM	1	239 to 303	239 to 303	244 to 523
28 (27.5)	2048QAM	1	258 to 327	260 to 400	264 to 565
28 (27.5)	4096QAM	1	286 to 363	289 to 444	292 to 626
56 (55)	16QAM	1	191 to 242	193 to 296	195 to 418
56 (55)	32QAM	1	239 to 303	241 to 370	244 to 522
56 (55)	64QAM	1	286 to 363	289 to 444	292 to 626
56 (55)	128QAM	1	339 to 429	341 to 525	346 to 741
56 (55)	256QAM	1	376 to 476	379 to 582	384 to 822
56 (55)	512QAM	1	444 to 562	447 to 687	453 to 970
56 (55)	1024QAM	1	492 to 624	496 to 763	502 to 1076
56 (55)	2048QAM	1	526 to 667	530 to 815	537 to 1150
56 (55)	4096QAM	1	576 to 730	581 to 892	588 to 1259
40	64QAM	1	203 to 257	204 to 314	207 to 443
40	128QAM	1	240 to 304	242 to 371	245 to 524
40	256QAM	1	277 to 351	279 to 429	283 to 605
40	512QAM	1	314 to 398	316 to 486	320 to 687
40	1024QAM	1	347 to 440	350 to 538	354 to 759
40	2048QAM	1	377 to 478	380 to 584	385 to 825
40	4096QAM	1	395 to 501	398 to 612	403 to 864
112	QPSK	1	180 to 228	181 to 279	183 to 393
112	16QAM Strong	1	323 to 409	325 to 500	329 to 706
112	16QAM	1	364 to 461	367 to 564	372 to 796

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
112	32QAM	1	459 to 582	463 to 711	469 to 1000
112	64QAM	1	574 to 727	578 to 889	586 to 1000
112	128QAM	1	663 to 840	668 to 1108	676 to 1448
112	256QAM	1	758 to 961	764 to 1268	774 to 1607
112	512QAM	1	865 to 1000	871 to 1446	882 to 1607
112	1024QAM	1	954 to 1201	965 to 1585	967 to 1607
112	2048QAM	1	1018 to 1283	1030 to 1640	1034 to 1607

Table 3-219 Integrated IP microwave work mode (IS6-PLUS mode, STM-1 + Ethernet, XPIC)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)	
			Without Compression	With L2 Frame Header Compression
28 (27.5)	128QAM	1	163 to 207	165 to 274
28 (27.5)	256QAM	1	190 to 241	192 to 318
28 (27.5)	512QAM	1	214 to 271	216 to 358
28 (27.5)	1024QAM	1	234 to 297	237 to 392
28 (27.5)	2048QAM	1	258 to 327	261 to 432
40	64QAM	1	197 to 250	199 to 330
40	128QAM	1	233 to 296	236 to 390
40	256QAM	1	269 to 341	272 to 451
40	512QAM	1	305 to 387	308 to 510
40	1024QAM	1	341 to 432	345 to 571
40	2048QAM	1	373 to 472	377 to 623
56 (55)	16QAM	1	182 to 230	183 to 304
56 (55)	32QAM	1	231 to 292	233 to 386
56 (55)	64QAM	1	280 to 355	283 to 469
56 (55)	128QAM	1	330 to 418	333 to 552

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)	
			Without Compression	With L2 Frame Header Compression
56 (55)	256QAM	1	376 to 477	380 to 630
56 (55)	512QAM	1	436 to 553	441 to 730
56 (55)	1024QAM	1	487 to 617	492 to 815
56 (55)	2048QAM	1	516 to 654	522 to 864

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.7.7.1.3 Microwave Work Modes (IS3 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS3 running mode.

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

When being used in North America, ISV3 boards support the FCC 10/20/30/40/50 MHz channel spacing. For details, see the *User Guide for North America*.

2048QAM is used only when AM is enabled.

NOTE

For ISM6 board, only the SL91ISM6 VER.C can work with the XMC-5D ODU.

SDH Microwave Work Mode

Table 3-220 SDH microwave work modes (IS3 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
NOTE In IS3 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP Microwave Work Mode (IS3 mode, E1+Ethernet)

NOTE

After AES-based encryption at air interfaces is enabled, overheads occupy additional air-interface bandwidth (< 300 kbit/s). As a result, the maximum number of E1 services decreases by one in the following modulation schemes:

- XPIC disabled: 7 MHz/QPSK Strong, 7 MHz/16QAM, 14 MHz/QPSK, and 14 MHz/16QAM
- XPIC enabled: 14 MHz/QPSK Strong

Table 3-221 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 9	4 to 13
3.5	16QAM	4	9 to 11	9 to 14	9 to 19	9 to 27
7	QPSK Strong	4	8 to 10	8 to 14	8 to 18	8 to 24
7	QPSK	5	10 to 13	10 to 17	10 to 22	10 to 31
7	16QAM Strong	8	17 to 22	17 to 29	17 to 37	18 to 51
7	16QAM	10	20 to 26	21 to 34	21 to 45	21 to 61
7	32QAM	12	25 to 32	25 to 42	26 to 55	26 to 75
7	64QAM	15	32 to 40	32 to 54	33 to 70	33 to 95
7	128QAM	18	37 to 48	38 to 63	38 to 82	39 to 112
7	256QAM	20	42 to 53	43 to 71	43 to 92	44 to 125
7	512QAM	21	45 to 57	45 to 75	46 to 98	46 to 133

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	512QAM Light	22	48 to 61	48 to 80	49 to 105	50 to 142
7	1024QAM	23	51 to 65	52 to 86	52 to 112	53 to 152
14 (13.75)	QPSK Strong	8	17 to 22	17 to 29	17 to 38	18 to 51
14 (13.75)	QPSK	10	21 to 26	21 to 35	21 to 45	21 to 62
14 (13.75)	16QAM Strong	16	35 to 45	35 to 59	36 to 77	36 to 105
14 (13.75)	16QAM	20	41 to 53	42 to 69	42 to 91	43 to 123
14 (13.75)	32QAM	24	52 to 66	52 to 87	53 to 114	54 to 154
14 (13.75)	64QAM	31	65 to 83	66 to 109	67 to 143	68 to 194
14 (13.75)	128QAM	37	77 to 98	78 to 129	79 to 169	80 to 229
14 (13.75)	256QAM	42	88 to 112	89 to 148	90 to 193	92 to 262
14 (13.75)	512QAM	44	94 to 119	95 to 157	96 to 205	97 to 278
14 (13.75)	512QAM Light	46	100 to 127	101 to 168	102 to 219	104 to 297
14 (13.75)	1024QAM	48	104 to 131	105 to 174	106 to 227	107 to 307
14 (13.75)	1024QAM Light	50	109 to 138	110 to 182	111 to 238	113 to 323
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 255
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	256QAM	75 63	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	75 63	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	75 63	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	75 63	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	75 63	228 to 289	230 to 382	233 to 499	237 to 676
28 (27.5)	2048QAM	75 63	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	75 63	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	75 63	423 to 536	427 to 708	432 to 925	439 to 1000

Channel Spacing (MHz)	**Modulation Scheme**	**Maximum Number of E1s in Hybrid Microwave**	**Native Ethernet Throughput (Mbit/s)**			
			Without Compression	**With L2 Frame Header Compression**	**With L2+L3 Frame Header Compression (IPv4)**	**With L2+L3 Frame Header Compression (IPv6)**
56 (55)	1024QAM	75 63	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	75 63	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	75 63	502 to 636	507 to 839	512 to 999	520 to 1000
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	75 63	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	75 63	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	75 63	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	75 63	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	75 63	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-222 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	8 to 13	8 to 17	8 to 24
7	QPSK	4	10 to 12	10 to 17	10 to 22	10 to 30
7	16QAM Strong	6	16 to 21	17 to 28	17 to 36	17 to 49
7	16QAM	9	20 to 25	20 to 33	20 to 44	20 to 59
7	32QAM	11	24 to 31	25 to 41	25 to 54	25 to 73
7	64QAM	14	31 to 39	31 to 52	32 to 68	32 to 92
7	128QAM	17	36 to 46	37 to 61	37 to 80	38 to 108
14 (13.75)	QPSK Strong	8	16 to 21	17 to 28	17 to 36	17 to 49
14 (13.75)	QPSK	9	20 to 25	20 to 34	20 to 44	21 to 60
14 (13.75)	16QAM Strong	16	34 to 43	34 to 57	35 to 75	35 to 101
14 (13.75)	16QAM	19	40 to 51	41 to 67	41 to 88	42 to 120
14 (13.75)	32QAM	24	50 to 64	51 to 84	51 to 110	52 to 149
14 (13.75)	64QAM	30	63 to 80	64 to 106	65 to 139	66 to 188
14 (13.75)	128QAM	36	75 to 95	76 to 126	77 to 164	78 to 223
14 (13.75)	256QAM	40	85 to 107	86 to 142	86 to 185	88 to 251
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 254
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	256QAM	75 63	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	75 63	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	75 63	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	75 63	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	75 63	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	75 63	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	75 63	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	75 63	454 to 575	459 to 759	463 to 992	471 to 1000

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	75 63	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	75 63	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	75 63	293 to 372	296 to 491	299 to 641	304 to 869

Integrated IP microwave work mode (IS3 mode, STM-1+Ethernet)

Table 3-223 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	1	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	1	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	1	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	1	228 to 289	230 to 382	233 to 499	237 to 676
28 (27.5)	2048QAM	1	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	1	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	1	423 to 536	427 to 708	432 to 925	439 to 1000
56 (55)	1024QAM	1	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	1	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	1	502 to 636	507 to 839	512 to 999	520 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	1	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	1	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	1	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	1	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	1	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-224 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	1	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	1	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	1	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	1	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	1	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	1	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	1	454 to 575	459 to 759	463 to 992	471 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	1	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	1	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	1	293 to 372	296 to 491	299 to 641	304 to 869

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.7.7.1.4 Microwave Work Modes (IS3 Mode, FCC)

When the ISM6 board with XMC-3W ODU in IS3 mode operates in the 15G frequency band, it supports the microwave working mode that meets FCC-compliant 10/20/30/40/50 MHz channel spacing.

Table 3-225 Service capacity in integrated IP radio mode (IS3 mode, XPIC disabled)

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
10	QPSK Strong	5	11 to 13	11 to 18	11 to 24
10	QPSK	6	13 to 17	13 to 23	14 to 30
10	16QAM Strong	10	22 to 28	22 to 37	23 to 49
10	16QAM	12	27 to 34	27 to 45	27 to 59
10	32QAM	15	33 to 42	33 to 55	34 to 72
10	64QAM	19	42 to 53	42 to 70	42 to 91
10	128QAM	23	49 to 62	49 to 82	50 to 107
10	256QAM	26	55 to 69	55 to 92	56 to 120
10	512QAM	27	58 to 74	59 to 97	59 to 127
10	512QAM Light	29	62 to 79	63 to 104	63 to 136
10	1024QAM	31	66 to 84	67 to 111	68 to 145
10	1024QAM Light	TBD	70 to 88	70 to 117	71 to 153
20	QPSK Strong	11	24 to 30	24 to 40	24 to 53
20	QPSK	13	29 to 37	29 to 49	30 to 64
20	16QAM Strong	23	49 to 62	50 to 82	50 to 108
20	16QAM	27	58 to 73	58 to 97	59 to 127
20	32QAM	34	72 to 92	73 to 121	74 to 158
20	64QAM	43	91 to 115	92 to 152	93 to 199
20	128QAM	51	108 to 137	109 to 180	110 to 236

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
20	256QAM	58	123 to 156	124 to 206	126 to 269
20	512QAM	62	131 to 165	132 to 218	133 to 286
20	512QAM Light	66	140 to 177	141 to 234	143 to 306
20	1024QAM	69	144 to 183	146 to 242	147 to 316
20	1024QAM Light	72	152 to 192	153 to 254	155 to 332
30	QPSK Strong	17	37 to 47	38 to 62	38 to 82
30	QPSK	20	44 to 55	44 to 73	45 to 96
30	16QAM Strong	36	76 to 96	76 to 127	77 to 166
30	16QAM	42	88 to 112	89 to 148	90 to 194
30	32QAM	54	113 to 143	114 to 189	115 to 248
30	64QAM	67	140 to 177	141 to 234	143 to 306
30	128QAM	75	165 to 210	167 to 277	169 to 362
30	256QAM	75	189 to 239	191 to 316	193 to 413
30	512QAM	75	202 to 257	205 to 339	207 to 443
30	512QAM Light	75	217 to 275	219 to 362	221 to 474
30	1024QAM	75	224 to 284	226 to 375	229 to 490
30	1024QAM Light	75	235 to 298	238 to 394	240 to 515
30	2048QAM	75	246 to 312	249 to 412	251 to 538
40	QPSK Strong	24	50 to 64	51 to 85	51 to 111
40	QPSK	28	59 to 75	60 to 99	60 to 130
40	16QAM Strong	49	102 to 130	103 to 171	104 to 224
40	16QAM	58	121 to 154	122 to 203	124 to 265

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
40	32QAM	73	153 to 193	154 to 255	156 to 334
40	64QAM	75	188 to 239	190 to 315	192 to 412
40	128QAM	75	223 to 282	225 to 373	227 to 487
40	256QAM	75	257 to 326	260 to 431	263 to 563
40	512QAM	75	273 to 346	276 to 456	278 to 597
40	512QAM Light	75	292 to 370	295 to 488	298 to 638
40	1024QAM	75	308 to 390	311 to 515	314 to 672
40	1024QAM Light	75	323 to 409	326 to 540	329 to 706
40	2048QAM	75	336 to 425	339 to 561	343 to 734
50	QPSK Strong	30	64 to 81	64 to 107	65 to 140
50	QPSK	35	75 to 95	75 to 125	76 to 164
50	16QAM Strong	61	129 to 163	130 to 216	132 to 282
50	16QAM	71	151 to 191	152 to 252	154 to 330
50	32QAM	75	191 to 242	193 to 319	195 to 417
50	64QAM	75	238 to 301	240 to 397	242 to 520
50	128QAM	75	281 to 356	284 to 470	287 to 614
50	256QAM	75	321 to 406	324 to 537	327 to 701
50	512QAM	75	344 to 436	347 to 575	351 to 752
50	512QAM Light	75	368 to 466	372 to 615	375 to 804
50	1024QAM	75	389 to 493	393 to 651	397 to 850
50	1024QAM Light	75	418 to 530	423 to 700	427 to 915
50	2048QAM	75	431 to 546	435 to 720	440 to 942

Table 3-226 Service capacity in integrated IP radio mode (IS3 mode, XPIC enabled)

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
10	QPSK Strong	5	10 to 13	10 to 17	10 to 23
10	QPSK	6	13 to 16	13 to 22	13 to 29
10	16QAM Strong	10	22 to 27	22 to 36	22 to 47
10	16QAM	12	26 to 33	26 to 43	26 to 57
10	32QAM	15	32 to 40	32 to 54	33 to 70
10	64QAM	19	40 to 51	41 to 68	41 to 89
10	128QAM	22	47 to 60	48 to 79	48 to 104
20	QPSK Strong	11	23 to 30	23 to 39	24 to 51
20	QPSK	13	28 to 36	28 to 47	29 to 62
20	16QAM Strong	22	48 to 60	48 to 80	49 to 105
20	16QAM	27	56 to 71	57 to 94	57 to 123
20	32QAM	33	70 to 89	71 to 118	72 to 154
20	64QAM	42	88 to 112	89 to 148	90 to 193
20	128QAM	50	105 to 133	106 to 175	107 to 229
20	256QAM	56	118 to 150	119 to 198	120 to 258
30	QPSK Strong	17	37 to 47	38 to 62	38 to 82
30	QPSK	20	44 to 55	44 to 73	45 to 96
30	16QAM Strong	36	76 to 96	76 to 127	77 to 166
30	16QAM	42	88 to 112	89 to 148	90 to 194
30	32QAM	54	113 to 143	114 to 189	115 to 247
30	64QAM	67	140 to 177	141 to 234	143 to 306
30	128QAM	75	165 to 210	167 to 277	169 to 362

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
30	256QAM	75	183 to 232	185 to 307	187 to 401
30	512QAM	75	194 to 246	196 to 325	198 to 425
30	512QAM Light	75	208 to 263	210 to 348	212 to 455
30	1024QAM	75	221 to 281	224 to 371	226 to 484
30	1024QAM Light	75	232 to 295	235 to 389	237 to 508
40	QPSK Strong	24	50 to 64	51 to 85	51 to 111
40	QPSK	28	59 to 75	60 to 99	60 to 129
40	16QAM Strong	49	102 to 130	103 to 171	104 to 224
40	16QAM	58	121 to 154	122 to 203	124 to 265
40	32QAM	73	153 to 193	154 to 255	156 to 334
40	64QAM	75	188 to 239	190 to 315	192 to 412
40	128QAM	75	223 to 282	225 to 373	227 to 487
40	256QAM	75	250 to 317	253 to 418	255 to 547
40	512QAM	75	262 to 332	265 to 438	267 to 573
40	512QAM Light	75	280 to 355	283 to 469	286 to 613
40	1024QAM	75	298 to 378	302 to 499	305 to 653
40	1024QAM Light	75	313 to 397	317 to 524	320 to 685
50	QPSK Strong	30	64 to 81	64 to 107	65 to 140
50	QPSK	35	75 to 95	75 to 125	76 to 164
50	16QAM Strong	61	129 to 163	130 to 216	132 to 282
50	16QAM	71	151 to 191	152 to 252	154 to 330
50	32QAM	75	191 to 242	193 to 319	195 to 417

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
50	64QAM	75	238 to 301	240 to 397	242 to 519
50	128QAM	75	281 to 356	284 to 470	287 to 614
50	256QAM	75	317 to 402	321 to 531	324 to 694
50	512QAM	75	330 to 418	334 to 552	337 to 722
50	512QAM Light	75	353 to 447	357 to 591	360 to 772
50	1024QAM	75	376 to 477	380 to 629	384 to 822
50	1024QAM Light	75	395 to 500	399 to 661	403 to 863

3.7.7.1.5 Microwave Work Modes (IS2 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS2 running mode.

NOTE

In IS2 mode, the ISM6 board does not support the 50 MHz channel spacing.

In IS2 mode, the ISX2 board does not support the 3.5 MHz channel spacing.

SDH Microwave Work Modes

Table 3-227 SDH microwave work modes (IS2 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	256QAM	50
NOTE In IS2 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP Microwave Work Mode (IS2 mode, E1+Ethernet)

Table 3-228 Integrated IP microwave work modes (IS2 mode, E1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 6	4 to 10
3.5	16QAM	4	9 to 11	9 to 13	9 to 13	9 to 20
7	QPSK	5	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	10	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	12	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	15	31 to 40	31 to 47	31 to 67	31 to 100
7	128QAM	18	37 to 47	37 to 56	37 to 80	37 to 119
7	256QAM	20	41 to 53	41 to 62	41 to 90	42 to 134
14 (13.75)	QPSK	10	20 to 26	20 to 31	20 to 44	20 to 66
14 (13.75)	16QAM	20	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	31	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	37	76 to 97	76 to 113	76 to 165	76 to 245
14 (13.75)	256QAM	42	87 to 111	87 to 131	87 to 189	88 to 281
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-229 Integrated IP microwave work modes (IS2 mode, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK	4	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	9	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	11	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	14	31 to 40	31 to 47	31 to 67	31 to 100
14 (13.75)	QPSK	9	20 to 26	20 to 31	20 to 44	20 to 66

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	16QAM	19	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	30	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	36	76 to 97	76 to 113	76 to 165	76 to 245
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Integrated IP Microwave Work Mode (IS2 mode, STM-1+Ethernet)

Table 3-230 Integrated IP microwave work modes (IS2 mode, STM-1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	1	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	1	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	1	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	1	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	1	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	1	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-231 Integrated IP microwave work modes (IS2 mode, STM-1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	1	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	QPSK	1	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	1	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	1	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	1	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	1	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.7.7.2 Receiver Sensitivity (ISM6 Board)

This section describes the receiver sensitivity of the ISM6 board.

3.7.7.2.1 Receiver Sensitivity (IS6 Running Mode)

The OptiX RTN 950A running in IS6 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS6 mode)

Table 3-232 Typical receiver sensitivity in SDH microwave mode (IS6 mode)

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/ 128QAM	56 MHz/128QAM	112 MHz/16QAM
RSL@ BER = 10^{-6} (dBm)			
@7GHz	-72.5	-69.5	N/A
@8GHz	-72.5	-69.5	N/A
@7&8GHz (XMC-3W ODU)	-71.5	-68.5	N/A
@11 GHz	-72	-69	N/A
@13 GHz (XMC-3W ODU)	-71	-68	N/A
@13 GHz	-72	-69	N/A
@15 GHz	-72	-69	N/A
@15 GHz (XMC-3W ODU)	-71	-68	N/A
@18 GHz (XMC-3W ODU)	-70.5	-67.5	N/A
@18 GHz	-71.5	-68.5	N/A
@23 GHz	-71.5	-68.5	N/A
@23 GHz (XMC-3W ODU)	-70.5	-67.5	N/A
@26 GHz	-71	-68	N/A
@28 GHz	-70.5	-67.5	N/A

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/ 128QAM	56 MHz/128QAM	112 MHz/16QAM
@32 GHz	-70	-67	-73
@38 GHz	-69.5	-66.5	N/A

NOTE
Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.

Integrated IP Microwave (IS6 mode)

Table 3-233 Typical receiver sensitivity in the Integrated IP microwave mode I (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7&8 GHz (XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13 GHz (XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz (XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@18 GHz (XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz (XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5

Table 3-234 Typical receiver sensitivity in the Integrated IP microwave mode II (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)			
	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)				
@7 GHz	-78.5	-75.5	-72	-69
@8 GHz	-78.5	-75.5	-72	-69
@7&8 GHz(XMC-3W)	-77.5	-74.5	-71	-68
@11 GHz	-78	-75	-72	-68.5
@13 GHz(XMC-3W)	-77	-74	-70	-68
@13 GHz(XMC-5D)	-78	-75	N/A	N/A
@13 GHz	-78	-75	-72	-69
@15 GHz	-78	-75	-72	-69
@15 GHz(XMC-5D)	-78	-75	N/A	N/A
@15 GHz(XMC-3W)	-77	-74	-71	-68
@18 GHz(XMC-3W)	-76.5	-73.5	-69.5	-67.5
@18 GHz(XMC-5D)	-77.5	-74.5	N/A	N/A
@18 GHz	-77.5	-74.5	-71.5	-68.5
@23 GHz	-77.5	-74.5	-71.5	-68.5
@23 GHz(XMC-3W)	-76.5	-73.5	-70.5	-67.5

Item	Specifications (Channel Spacing: 7 MHz)			
	128QAM	256QAM	512QAM	1024QAM
@26 GHz	-77	-74	-71	-68
@28 GHz	-76.5	-73.5	-70.5	-67.5
@32 GHz	-76	-73	-70	-67
@38 GHz	-75.5	-72.5	-69.5	-66.5

Table 3-235 Typical receiver sensitivity in the Integrated IP microwave mode III (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@18 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5

Table 3-236 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-75.5	-72.5	-69	-65	-63
@8 GHz	-75.5	-72.5	-69	-65	-63
@7&8 GHz(XMC-3W)	-74.5	-71.5	-68	-64	-62
@11 GHz	-75	-72	-69	-65.5	-63
@13 GHz(XMC-3W)	-74	-71	-68	-64	-62
@13 GHz	-75	-72	-69	-66	-63
@15 GHz	-75	-72	-69	-66	-63
@15 GHz(XMC-3W)	-74	-71	-68	-65	-62
@18 GHz(XMC-3W)	-73.5	-70.5	-67.5	-63.5	-61.5
@18 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@23 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@23 GHz(XMC-3W)	-73.5	-70.5	-67.5	-64.5	-61.5
@26 GHz	-74	-71	-68	-65	-62
@28 GHz	-73.5	-70.5	-67.5	-64.5	-61.5
@32 GHz	-73	-70	-67	-64	-61
@38 GHz	-72.5	-69.5	-66.5	-63.5	-60.5

Table 3-237 Typical receiver sensitivity in the Integrated IP microwave mode V (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5

Table 3-238 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						

Item	Specifications (Channel Spacing: 28 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@7 GHz	-72.5	-69.5	-66	-62	-58	-57
@8 GHz	-72.5	-69.5	-66	-62	-58	-57
@7&8 GHz(XMC-3W)	-71.5	-68.5	-65	-61	-57	-56
@11 GHz	-72	-69	-66	-62.5	-60	-57
@13 GHz(XMC-3W)	-71	-68	-65	-62	-58	-56
@13 GHz(XMC-5D)	-72	-69	-66	-63	-60	N/A
@13 GHz	-72	-69	-66	-63	-60	-57
@15 GHz	-72	-69	-66	-63	-60	-57
@15 GHz(XMC-5D)	-72	-69	-66	-63	-60	N/A
@15 GHz(XMC-3W)	-71	-68	-65	-62	-59	-56
@18 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-57.5	-55.5
@18 GHz(XMC-5D)	-71.5	-68.5	-65.5	-62.5	-59.5	N/A
@18 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@26 GHz	-71	-68	-65	-62	-59	-56
@28 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@32 GHz	-70	-67	-64	-61	-58	N/A
@38 GHz	-69.5	-66.5	-63.5	-60.5	-57.5	N/A

Table 3-239 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@18 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-240 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-69.5	-66.5	-63	-59	-55	-54
@8 GHz	-69.5	-66.5	-63	-59	-55	-54
@7&8 GHz(XMC-3W)	-68.5	-65.5	-62	-58	-54	-53
@11 GHz	-69	-66	-63	-59.5	-57	-54
@13 GHz(XMC-3W)	-68	-65	-62	-59	-56	-53
@13 GHz(XMC-5D)	-69	-66	-63	-60	-57	N/A
@13 GHz	-69	-66	-63	-60	-57	-54
@15 GHz	-69	-66	-63	-60	-57	-54
@15 GHz(XMC-5D)	-69	-66	-63	-60	-57	N/A
@15 GHz(XMC-3W)	-68	-65	-62	-59	-56	-53
@18 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@18 GHz(XMC-5D)	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@18 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@23 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@23 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@26 GHz	-68	-65	-62	-59	-56	-53
@28 GHz	-67.5	-64.5	-61.5	-58.5	-55.5	N/A
@32 GHz	-67	-64	-61	-58	-55	N/A

Item	Specifications (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@38 GHz	-66.5	-63.5	-60.5	-57.5	-54.5	N/A

Table 3-241 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@18 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-242 Typical receiver sensitivity in the Integrated IP microwave mode X (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-71	-68	-65	-61.5	-58.5	-55.5
@8 GHz	-71	-68	-65	-61.5	-58.5	-55.5
@7&8 GHz(XMC-3W)	-70	-67	-64	-60.5	-57.5	-54.5
@11 GHz	-70.5	-67.5	-64.5	-61	-58.5	-55.5
@13 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@13 GHz(XMC-5D)	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@13 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@15 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@15 GHz(XMC-5D)	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@15 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@18 GHz(XMC-3W)	-69	-66	-63	-60	-57	-54
@18 GHz(XMC-5D)	-70	-67	-64	-61	-58	N/A
@18 GHz	-70	-67	-64	-61	-58	-55
@23 GHz	-70	-67	-64	-61	-58	-55
@23 GHz(XMC-3W)	-69	-66	-63	-60	-57	-54
@26 GHz	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@28 GHz	-69	-66	-63	-60	-57	N/A
@32 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	N/A

Item	Specifications (Channel Spacing: 40 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
@38 GHz	-68	-65	-62	-59	-56	N/A

Table 3-243 Typical receiver sensitivity in the Integrated IP microwave mode XI (IS6 mode, XPIC disabled)

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)											
@18 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@18 GHz (XMC-5D)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@23 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@26 GHz (XMC-3)	-83.0	-81.5	-76.0	-74.5	-71.5	-68.0	-65.0	-62.0	-59.0	-56.0	-53.0
@28 GHz (XMC-3H)	-82.5	-81.0	-75.5	-74.0	-71.0	-67.5	-64.5	-61.5	-58.5	-55.5	-52.5
@32 GHz (XMC-3)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-55.0	-52.0
@38 GHz (XMC-3H)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-54.5	-51.5

Table 3-244 Typical receiver sensitivity in the Integrated IP microwave mode XII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@18 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5

Table 3-245 Typical receiver sensitivity in the Integrated IP microwave mode XIII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 7 MHz)		
	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)			
@7 GHz	-78.5	-75.5	-72
@8 GHz	-78.5	-75.5	-72
@7&8 GHz(XMC-3W)	-77.5	-74.5	-71
@11 GHz	-78	-75	-72
@13 GHz(XMC-3W)	-77	-74	-70
@13 GHz(XMC-5D)	-78	-75	N/A
@13 GHz	-78	-75	-72
@15 GHz	-78	-75	-72
@15 GHz(XMC-5D)	-78	-75	N/A
@15 GHz(XMC-3W)	-77	-74	-71
@18 GHz(XMC-3W)	-76.5	-73.5	-69.5
@18 GHz(XMC-5D)	-77.5	-74.5	N/A
@18 GHz	-77.5	-74.5	-71.5
@23 GHz	-77.5	-74.5	-71.5
@23 GHz(XMC-3W)	-76.5	-73.5	-70.5
@26 GHz	-77	-74	-71
@28 GHz	-76.5	-73.5	-70.5
@32 GHz	-76	-73	-70
@38 GHz	-75.5	-72.5	-69.5

Table 3-246 Typical receiver sensitivity in the Integrated IP microwave mode XIV (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@7&8 GHz(XMC-3 W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13 GHz(XMC-3 W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3 W)	-92.5	-90.5	-85	-83	-80	-77
@18 GHz(XMC-3 W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3 W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5

Table 3-247 Typical receiver sensitivity in the Integrated IP microwave mode XV (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 14 MHz)			
	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)				
@7 GHz	-75.5	-72.5	-69	-66
@8 GHz	-75.5	-72.5	-69	-66

Item	Specifications (Channel Spacing: 14 MHz)			
	128QAM	256QAM	512QAM	1024QAM
@7&8 GHz(XMC-3W)	-74.5	-71.5	-68	-65
@11 GHz	-75	-72	-69	-65.5
@13 GHz(XMC-3W)	-74	-71	-68	-64
@13 GHz	-75	-72	-69	-66
@15 GHz	-75	-72	-69	-66
@15 GHz(XMC-3W)	-74	-71	-68	-65
@18 GHz(XMC-3W)	-73.5	-70.5	-67.5	-63.5
@18 GHz	-74.5	-71.5	-68.5	-65.5
@23 GHz	-74.5	-71.5	-68.5	-65.5
@23 GHz(XMC-3W)	-73.5	-70.5	-67.5	-64.5
@26 GHz	-74	-71	-68	-65
@28 GHz	-73.5	-70.5	-67.5	-64.5
@32 GHz	-73	-70	-67	-64
@38 GHz	-72.5	-69.5	-66.5	-63.5

Table 3-248 Typical receiver sensitivity in the Integrated IP microwave mode XVI (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@13 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@18 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5

Table 3-249 Typical receiver sensitivity in the Integrated IP microwave mode XVII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-72.5	-69.5	-66	-63	-60
@8 GHz	-72.5	-69.5	-66	-63	-60
@7&8 GHz(XMC-3W)	-71.5	-68.5	-65	-62	-59
@11 GHz	-72	-69	-66	-62.5	-60
@13 GHz(XMC-3W)	-71	-68	-65	-62	58

Item	Specifications (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
@13 GHz	-72	-69	-66	-63	-60
@15 GHz	-72	-69	-66	-63	-60
@15 GHz(XMC-3W)	-71	-68	-65	-62	-59
@18 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-57.5
@18 GHz	-71.5	-68.5	-65.5	-62.5	-59.5
@23 GHz	-71.5	-68.5	-65.5	-62.5	-59.5
@23 GHz(XMC-3W)	-70.5	-67.5	-64.5	-61.5	-58.5
@26 GHz	-71	-68	-65	-62	-59
@28 GHz	-70.5	-67.5	-64.5	-61.5	N/A
@32 GHz	-70	-67	-64	-61	N/A
@38 GHz	-69.5	-66.5	-63.5	-60.5	N/A

Table 3-250 Typical receiver sensitivity in the Integrated IP microwave mode XVIII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@18 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-251 Typical receiver sensitivity in the Integrated IP microwave mode XIX (IS6mode, XPIC enabled)

Item	Specifications (Channel Spacing: 56 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-69.5	-66.5	-63	-60	-57
@8 GHz	-69.5	-66.5	-63	-60	-57
@7&8 GHz(XMC-3W)	-68.5	-65.5	-62	-59	-56
@11 GHz	-69	-66	-63	-59.5	-57
@13 GHz(XMC-3W)	-68	-65	-62	-59	-56
@13 GHz	-69	-66	-63	-60	-57
@15 GHz	-69	-66	-63	-60	-57
@15 GHz(XMC-3W)	-68	-65	-62	-59	-56

Item	Specifications (Channel Spacing: 56 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
@18 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5
@18 GHz	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz(XMC-3W)	-67.5	-64.5	-61.5	-58.5	-55.5
@26 GHz	-68	-65	-62	-59	-56
@28 GHz	-67.5	-64.5	-61.5	-58.5	N/A
@32 GHz	-67	-64	-61	-58	N/A
@38 GHz	-66.5	-63.5	-60.5	-57.5	N/A

Table 3-252 Typical receiver sensitivity in the Integrated IP microwave mode XX (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3 W)	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13 GHz(XMC-3 W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3 W)	-87.5	-86	-80.5	-79	-76	-72.5
@18 GHz(XMC-3 W)	-87	-85.5	-80	-78.5	-75.5	-72

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-253 Typical receiver sensitivity in the Integrated IP microwave mode XXI (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@7 GHz	-71	-68	-65	-61.5	-58.5
@8 GHz	-71	-68	-65	-61.5	-58.5
@7&8 GHz(XMC-3W)	-70	-67	-64	-60.5	-57.5
@11 GHz	-70.5	-67.5	-64.5	-61	-58.5
@13 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5
@13 GHz	-70.5	-67.5	-64.5	-61.5	-58.5
@15 GHz	-70.5	-67.5	-64.5	-61.5	-58.5
@15 GHz(XMC-3W)	-69.5	-66.5	-63.5	-60.5	-57.5
@18 GHz (XMC-3W)	-69	-66	-63	-60	-57
@18 GHz	-70	-67	-64	-61	-58
@23 GHz	-70	-67	-64	-61	-58
@23 GHz (XMC-3W)	-69	-66	-63	-60	-57

Item	Specifications (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
@26 GHz	-69.5	-66.5	-63.5	-60.5	-57.5
@28 GHz	-69	-66	-63	-60	N/A
@32 GHz	-68.5	-65.5	-62.5	-59.5	N/A
@38 GHz	-68	-65	-62	-59	N/A

Table 3-254 Typical receiver sensitivity in the Integrated IP microwave mode XXII (IS6 mode, XPIC enabled)

Item	Specifications (Channel Spacing: 112 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	2048 QAM
RSL@ BER = 10^{-6} (dBm)											
@18 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@23 GHz (XMC-3H)	-83.5	-82.0	-76.5	-75.0	-72.0	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@26 GHz (XMC-3)	-83.0	-81.5	-76.0	-74.5	-71.5	-68.0	-65.0	-62.0	-59.0	-56.0	N/A
@28 GHz (XMC-3H)	-82.5	-81.0	-75.5	-74.0	-71.0	-67.5	-64.5	-61.5	-58.5	-55.5	N/A
@32 GHz (XMC-3)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-55.0	N/A
@38 GHz (XMC-3H)	-81.5	-80.0	-74.5	-73.0	-70.0	-66.5	-63.5	-60.5	-57.5	-54.5	N/A

Typical Receiver Sensitivity (IS6 mode, 4x4 MIMO)

Table 3-255 Typical receiver sensitivity in the Integrated IP microwave mode I (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-61.50
@15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00
@23 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00
@38 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	N/A

Table 3-256 Typical receiver sensitivity in the Integrated IP microwave mode II (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-58.50
@15 GHz	-82.50	-81.00	-75.50	-74.00	-71.00	-67.50	-64.50	-61.50	-58.50
@18 GHz	-82.00	-80.50	-75.00	-73.50	-70.50	-67.00	-64.00	-61.00	-58.00
@23 GHz	-82.00	-80.50	-75.00	-73.50	-70.50	-67.00	-64.00	-61.00	-58.00
@38 GHz	-80.00	-78.50	-73.00	-71.50	-68.50	-65.00	-62.00	-59.00	N/A

Table 3-257 Typical receiver sensitivity in the Integrated IP microwave mode III (IS6 mode, 4x4 MIMO, 0.6 to 0.7 times Rayleigh distance)

Item	Specifications (Channel Spacing: 40 MHz)								
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM
RSL@ BER = 10^{-6} (dBm)									
@7 GHz	-84.50	-83.00	-77.50	-76.00	-73.00	-69.50	-66.50	-63.50	-60.50
@15 GHz	-84.00	-82.50	-77.00	-75.50	-72.50	-69.00	-66.00	-63.00	-60.00
@18 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50
@23 GHz	-83.50	-82.00	-76.50	-75.00	-72.00	-68.50	-65.50	-62.50	-59.50
@38 GHz	-81.50	-80.00	-74.50	-73.00	-70.00	-66.50	-63.50	-60.50	N/A

Table 3-258 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 28 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024 QAM	1024 QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-89.00	-87.50	-82.00	-80.50	-77.50	-74.00	-71.00	-68.00	-64.50	-60.50	-58.50
@15 GHz	-88.50	-87.00	-81.50	-80.00	-77.00	-73.50	-70.50	-67.50	-64.50	-60.50	-58.50
@18 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-58.00
@23 GHz	-88.00	-86.50	-81.00	-79.50	-76.50	-73.00	-70.00	-67.00	-64.00	-60.00	-58.00
@38 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-62.00	N/A	N/A

Table 3-259 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 40 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-87.50	-86.00	-80.50	-79.00	-76.00	-72.50	-69.50	-66.50	-63.50	-59.00	-57.00
@15 GHz	-87.00	-85.50	-80.00	-78.50	-75.50	-72.00	-69.00	-66.00	-63.00	-59.00	-57.00
@18 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50	-65.50	-62.50	-58.50	-56.50
@23 GHz	-86.50	-85.00	-79.50	-78.00	-75.00	-71.50	-68.50	-65.50	-62.50	-58.50	-56.50
@38 GHz	-84.50	-83.00	-77.50	-76.00	-73.00	-69.50	-66.50	-63.50	-60.50	N/A	N/A

Table 3-260 Typical receiver sensitivity in the Integrated IP microwave mode V (IS6 mode, 4x4 MIMO, 0.7 to 1.2 times Rayleigh distance)

Item	Specifications (Channel Spacing: 56 MHz)										
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)											
@7 GHz	-86.00	-84.50	-79.00	-77.50	-74.50	-71.00	-68.00	-65.00	-61.50	-57.50	-55.50
@15 GHz	-85.50	-84.00	-78.50	-77.00	-74.00	-70.50	-67.50	-64.50	-61.50	-57.50	-55.50
@18 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-55.00
@23 GHz	-85.00	-83.50	-78.00	-76.50	-73.50	-70.00	-67.00	-64.00	-61.00	-57.00	-55.00
@38 GHz	-83.00	-81.50	-76.00	-74.50	-71.50	-68.00	-65.00	-62.00	-59.00	N/A	N/A

NOTE

The modulation scheme 1024QAM Light is supported only when the antenna installation distance is 0.9 to 1.1 times the Rayleigh distance.

3.7.7.2.2 Receiver Sensitivity (IS6-PLUS Running Mode)

The OptiX RTN 950A running in IS6-PLUS mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS6-PLUS mode)

Table 3-261 Typical receiver sensitivity in SDH microwave mode (IS6-PLUS mode)

Item	Specifications		
	1xSTM-1	2xSTM-1	2xSTM-1
	28 MHz/128QAM	56 MHz/128QAM	112 MHz/16QAM
RSL@ BER = 10^{-6} (dBm)			
@11 GHz	-72	-69	N/A
@13 GHz	-72	-69	N/A
@15 GHz	-72	-69	N/A
@18 GHz	-71.5	-68.5	N/A
@23 GHz	-71.5	-68.5	N/A
@26 GHz	-71	-68	N/A
@28 GHz	-70.5	-67.5	N/A
@32 GHz	-70	-67	-73
@38 GHz	-68.5	-65.5	N/A
NOTE Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.			

Integrated IP Microwave (IS6-PLUS Mode, XPIC disabled)

Table 3-262 Typical receiver sensitivity in the Integrated IP microwave mode I (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-92	-90	-85.5	-83.5	-80.5	-77.5

Table 3-263 Typical receiver sensitivity in the Integrated IP microwave mode II (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 7 MHz)			
	128QAM	256QAM	512QAM	1024QAM
RSL@ BER = 10^{-6} (dBm)				
@11 GHz	-78	-75	-72	-68.5
@13 GHz	-78	-75	-72	-69
@15 GHz	-78	-75	-72	-69
@18 GHz	-77.5	-74.5	-71.5	-68.5
@23 GHz	-77.5	-74.5	-71.5	-68.5
@26 GHz	-77	-74	-71	-68
@28 GHz	-76.5	-73.5	-70.5	-67.5
@32 GHz	-76	-73	-70	-67
@38 GHz	-74.5	-71.5	-68.5	-65.5

Table 3-264 Typical receiver sensitivity in the Integrated IP microwave mode III (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-90	-88	-82.5	-80.5	-77.5	-74.5

Table 3-265 Typical receiver sensitivity in the Integrated IP microwave mode IV (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 14 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@11 GHz	-75	-72	-69	-65.5	-63
@13 GHz	-75	-72	-69	-66	-63
@15 GHz	-75	-72	-69	-66	-63
@18 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@23 GHz	-74.5	-71.5	-68.5	-65.5	-62.5
@26 GHz	-74	-71	-68	-65	-62
@28 GHz	-73.5	-70.5	-67.5	-64.5	-61.5
@32 GHz	-73	-70	-67	-64	-61
@38 GHz	-71.5	-68.5	-65.5	-62.5	-59.5

Table 3-266 Typical receiver sensitivity in the Integrated IP microwave mode V (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-86.5	-85	-79.5	-78	-75	-71.5

Table 3-267 Typical receiver sensitivity in the Integrated IP microwave mode VI (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 28 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-72	-69	-66	-62.5	-60	-57
@13 GHz	-72	-69	-66	-63	-60	-57
@15 GHz	-72	-69	-66	-63	-60	-57
@18 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5
@23 GHz	-71.5	-68.5	-65.5	-62.5	-59.5	-56.5
@26 GHz	-71	-68	-65	-62	-59	-56
@28 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	N/A
@32 GHz	-70	-67	-64	-61	-58	N/A
@38 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	N/A

Table 3-268 Typical receiver sensitivity in the Integrated IP microwave mode VII (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-83.5	-82	-76.5	-75	-72	-68.5

Table 3-269 Typical receiver sensitivity in the Integrated IP microwave mode VIII (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-69	-66	-63	-59.5	-57	-54
@13 GHz	-69	-66	-63	-60	-57	-54
@15 GHz	-69	-66	-63	-60	-57	-54
@18 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@23 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	-53.5
@26 GHz	-68	-65	-62	-59	-56	-53
@28 GHz	-67.5	-64.5	-61.5	-58.5	-55.5	N/A
@32 GHz	-67	-64	-61	-58	-55	N/A
@38 GHz	-65.5	-62.5	-59.5	-56.5	-53.5	N/A

Table 3-270 Typical receiver sensitivity in the Integrated IP microwave mode IX (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-85	-83.5	-78	-76.5	-73.5	-70

Table 3-271 Typical receiver sensitivity in the Integrated IP microwave mode X (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 40 MHz)					
	128QAM	256QAM	512QAM	1024QAM	2048QAM	4096QAM
RSL@ BER = 10^{-6} (dBm)						
@11 GHz	-70.5	-67.5	-64.5	-61	-58.5	-55.5
@13 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@15 GHz	-70.5	-67.5	-64.5	-61.5	-58.5	-55.5
@18 GHz	-70	-67	-64	-61	-58	-55
@23 GHz	-70	-67	-64	-61	-58	-55
@26 GHz	-69.5	-66.5	-63.5	-60.5	-57.5	-54.5
@28 GHz	-69	-66	-63	-60	-57	N/A
@32 GHz	-68.5	-65.5	-62.5	-59.5	-56.5	N/A
@38 GHz	-67	-64	-61	-58	-55	N/A

Table 3-272 Typical receiver sensitivity in the Integrated IP microwave mode XI (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 112 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@32 GHz	-81.5	-80	-74.5	-73	-70	-66.5

Table 3-273 Typical receiver sensitivity in the Integrated IP microwave mode XII (IS6-PLUS mode, XPIC disabled)

Item	Specifications (Channel Spacing: 112 MHz)				
	128QAM	256QAM	512QAM	1024QAM	2048QAM
RSL@ BER = 10^{-6} (dBm)					
@32 GHz	-63.5	-60.5	-57.5	-55	-52

3.7.7.2.3 Receiver Sensitivity (IS3 Running Mode)

The OptiX RTN 950A running in IS3 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS3 mode)

Table 3-274 Typical receiver sensitivity of the SDH microwave (IS3 mode)

Item	Performance	
	1xSTM-1	2xSTM-1
	28MHz/128QAM	56MHz/128QAM
RSL@ BER = 10^{-6} (dBm)		
@6 GHz	-72.5	-69.5
@7 GHz	-72.5	-69.5
@8 GHz	-72.5	-69.5

Item	Performance	
	1xSTM-1	2xSTM-1
	28MHz/128QAM	56MHz/128QAM
@7&8GHz(XMC-3W ODU)	-71.5	-68.5
@10 GHz	-72	-69
@10.5 GHz	-70	N/A
@11 GHz	-72	-69
@13GHz(XMC-3W ODU)	-71	-68
@13 GHz	-72	-69
@15 GHz(XMC-3W ODU)	-71	-68
@15 GHz	-72	-69
@18GHz(XMC-3W ODU)	-70.5	-67.5
@18 GHz	-71.5	-68.5
@23 GHz(XMC-3W ODU)	-70.5	-67.5
@23 GHz	-71.5	-68.5
@26 GHz	-71	-68
@28 GHz	-70.5	-67.5
@32 GHz	-70	-67
@38 GHz	-69.5	-66.5
@42 GHz	-68	-65

NOTE
Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.

Integrated IP Microwave (IS3 mode)

Table 3-275 Typical receiver sensitivity of the Integrated IP microwave I (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 3.5 MHz)	
	QPSK	16QAM
RSL@ BER = 10^{-6} (dBm)		
@7 GHz	-96.00	-89.50
@8 GHz	-96.00	-89.50
@7&8GHz(XMC-3W ODU)	-95.00	-88.50
@11 GHz	-95.5	-88.5
@13GHz(XMC-3W ODU)	-94.5	-87.5
@13 GHz	-95.5	-88.5
@15 GHz(XMC-3W ODU)	-94	-87.5
@15 GHz	-95	-88.5
@18GHz(XMC-3W ODU)	-93.5	-87
@18 GHz	-94.5	-88
@23 GHz(XMC-3W ODU)	-93.5	-87
@23 GHz	-94.5	-88
@26 GHz	-94	-87.5
@28 GHz	-93.5	-87
@32 GHz	-93	-86.5
@38 GHz	-93	-86.5

Table 3-276 Typical receiver sensitivity of the Integrated IP microwave II (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77

Table 3-277 Typical receiver sensitivity of the Integrated IP microwave III (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-78.5	-75.5	-73.5	-72	-70

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
@7 GHz	-78.5	-75.5	-73.5	-72	-70
@8 GHz	-78.5	-75.5	73.5	-72	-70
@7&8 GHz(XMC-3W)	-77.5	-74.5	-72.5	-71	-69
@10 GHz	-78	-75	-73	-71.5	-69.5
@10.5 GHz	-76	-73	-71	-69.5	-67.5
@11 GHz	-78	-75	-73	-71.5	-69.5
@13GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@13 GHz	-78	-75	-73	-71.5	-69.5
@15 GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@15 GHz	-78	-75	-73	-71.5	-69.5
@18GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68
@18 GHz	-77.5	-74.5	-72.5	-71	-69
@23 GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68
@23 GHz	-77.5	-74.5	-72.5	-71	-69
@26 GHz	-77	-74	-72	-70.5	-68.5
@28 GHz	-76.5	-73.5	-71.5	N/A	N/A
@32 GHz	-76	-73	-71	-69.5	N/A
@38 GHz	-75.5	-72.5	-70.5	-69	N/A
@42 GHz	-74	-71	-69	-67.5	N/A

Table 3-278 Typical receiver sensitivity of the Integrated IP microwave IV (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74

Table 3-279 Typical receiver sensitivity of the Integrated IP microwave V (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@8 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7&8 GHz(XMC-3W)	-74.5	-71.5	-69.5	-68	-66	-64.5
@10 GHz	-75	-72	-70	-68.5	-66.5	-65
@10.5 GHz	-73	-70	-68	-66.5	-64.5	-63
@11 GHz	-75	-72	-70	-68.5	-66.5	-65
@13GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@13 GHz	-75	-72	-70	-68.5	-66.5	-65
@15 GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@15 GHz	-75	-72	-70	-68.5	-66.5	-65
@18GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@18 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@23 GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@23 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@26 GHz	-74	-71	-69	-67.5	-65.5	-64
@28 GHz	-73.5	-70.5	-68.5	-67	-65	N/A
@32 GHz	-73	-70	-68	-66.5	-64.5	N/A
@38 GHz	-72.5	-69.5	-67.5	-66	-64	N/A
@42 GHz	-71	-68	-66	-64.5	-62.5	N/A

Table 3-280 Typical receiver sensitivity of the Integrated IP microwave VI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-281 Typical receiver sensitivity of the Integrated IP microwave VII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@8 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@10 GHz	-72	-69	-67	-65.5	-63.5	-62	N/A
@10.5 GHz	-70	-67	-65	-63.5	-61.5	-60	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@13 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@15 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@23 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@26 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@28 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@32 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@38 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@42 GHz	-68	-65	-63	-61.5	-59.5	-58	N/A

Table 3-282 Typical receiver sensitivity of the Integrated IP microwave VIII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-283 Typical receiver sensitivity of the Integrated IP microwave IX (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@7&8 GHz(XMC-3W)	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@10 GHz	-69	-66	-64	-62.5	-60.5	-59	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@13 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@15 GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@15 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@23 GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@26 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@28 GHz	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@32 GHz	-67	-64	-62	-60.5	-58.5	-57	-55.5
@38 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	-55
@42 GHz	-65	-62	-60	-58.5	-56.5	-55	N/A

Table 3-284 Typical receiver sensitivity of the Integrated IP microwave X (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-285 Typical receiver sensitivity of the Integrated IP microwave XI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@8 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7&8 GHz(XMC-3W)	-70	-67	-65	-63.5	-61.5	-60	-58.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@13 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@15 GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@15 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@23 GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@23 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@28 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@32 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@38 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@42 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	N/A

Table 3-286 Typical receiver sensitivity of the Integrated IP microwave XII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 7 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@11 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@13 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@15 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80	-77
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5	-75.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77	-74

Table 3-287 Typical receiver sensitivity of the Integrated IP microwave XIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 14 MHz)							
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER = 10^{-6} (dBm)								
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@11 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@13 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@15 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5	-72.5	-69.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74	-71	-68

Table 3-288 Typical receiver sensitivity of the Integrated IP microwave XIV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-289 Typical receiver sensitivity of the Integrated IP microwave XV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-72.5	-69.5	-67.5	-66	-64
@7 GHz	-72.5	-69.5	-67.5	-66	-64
@8 GHz	-72.5	-69.5	-67.5	-66	-64
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63
@10 GHz	-72	-69	-67	-65.5	N/A
@10.5 GHz	-70	-67	-65	-63.5	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@13 GHz	-72	-69	-67	-65.5	-63.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@15 GHz	-72	-69	-67	-65.5	-63.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@18 GHz	-71.5	-68.5	-66.5	-65	-63
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@23 GHz	-71.5	-68.5	-66.5	-65	-63
@26 GHz	-71	-68	-66	-64.5	N/A
@28 GHz	-70.5	-67.5	-65.5	N/A	N/A
@32 GHz	-70	-67	-65	N/A	N/A
@38 GHz	-69.5	-66.5	-64.5	N/A	N/A
@42 GHz	-68	-65	-63	N/A	N/A

Table 3-290 Typical receiver sensitivity of the Integrated IP microwave XVI (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-291 Typical receiver sensitivity of the Integrated IP microwave XVII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7&8 GHz(XMC-3W)	-68.5	-65.5	-63.5	-62	-60	-58.5
@10 GHz	-69	-66	-64	-62.5	-60.5	-59
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@13 GHz	-69	-66	-64	-62.5	-60.5	-59
@15 GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@15 GHz	-69	-66	-64	-62.5	-60.5	-59
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@23 GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@26 GHz	-68	-65	-63	-61.5	-59.5	-58
@28 GHz	-67.5	-64.5	-62.5	-61	N/A	N/A
@32 GHz	-67	-64	-62	-60.5	N/A	N/A
@38 GHz	-66.5	-63.5	-61.5	-60	N/A	N/A
@42 GHz	-65	-62	-60	-58.5	N/A	N/A

Table 3-292 Typical receiver sensitivity of the Integrated IP microwave XVIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-293 Typical receiver sensitivity of the Integrated IP microwave XIX (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-71	-68	-66	-64.5	-62.5
@7 GHz	-71	-68	-66	-64.5	-62.5
@8 GHz	-71	-68	-66	-64.5	-62.5
@7&8 GHz(XMC-3W)	-70	-67	-65	-63.5	-61.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62
@10.5 GHz	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@13 GHz	-70.5	-67.5	-65.5	-64	-62
@15 GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@15 GHz	-70.5	-67.5	-65.5	-64	-62
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@18 GHz	-70	-67	-65	-63.5	-61.5
@23 GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@23 GHz	-70	-67	-65	-63.5	-61.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61
@28 GHz	-69	-66	-64	-62.5	N/A
@32 GHz	-68.5	-65.5	-63.5	-62	N/A
@38 GHz	-68	-65	-63	-61.5	N/A
@42 GHz	-66.5	-63.5	-61.5	-60	N/A

3.7.7.2.4 Receiver Sensitivity (IS2 Running Mode)

The OptiX RTN 950A running in IS2 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

NOTE

- For an XMC-2 ODU at the 18 GHz frequency band, when the IF board works in IS2 running mode, remove 2 dB from the sensitivity values specified in the table.
- For an XMC-2 ODU at the 38 GHz frequency band, when the IF board works in IS2 running mode and the XPIC function is enabled, remove 2 dB from the sensitivity value specified in the table when the working mode is 28MHz/256QAM.

SDH Microwave (IS2 mode)

Table 3-294 Typical receiver sensitivity of the SDH microwave (IS2 mode, XPIC disabled)

Item	Performance	
	1xSTM-1	2xSTM-1
	128QAM/28 MHz	128QAM/56 MHz
RSL@ BER = 10^{-6} (dBm)		
@6 GHz	-71	-68
@7 GHz	-71	-68
@8 GHz	-71	-68
@10 GHz	-70.5	-67.5
@10.5 GHz	-68.5	N/A
@11 GHz	-70.5	-67.5
@13 GHz	-70.5	-67.5
@15 GHz	-70.5	-67.5
@18 GHz	-70.5	-67.5
@23 GHz	-70	-67
@26 GHz	-69.5	-66.5
@28 GHz	-69	-66
@32 GHz	-68.5	-65.5
@38 GHz	-68	-65
@42 GHz	-66.5	-63.5

Item	Performance	
	1xSTM-1	2xSTM-1
	128QAM/28 MHz	128QAM/56 MHz

NOTE
Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.

Integrated IP Microwave (IS2 mode)

Table 3-295 Typical receiver sensitivity of the Integrated IP microwave I (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@7 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@8 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@10 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@10.5 GHz	-90	-84	-80	-77.5	-74.5	-71.5
@11 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@13 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@15 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@18 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@23 GHz	-91.5	-85.5	-81.5	-79	-76	-73
@26 GHz	-91	-85	-81	-78.5	-75.5	-72.5
@28 GHz	-90.5	-84.5	-80.5	-78	-75	-72
@32 GHz	-90	-84	-80	-77.5	-74.5	-71.5
@38 GHz	-89.5	-83.5	-79.5	-77	-74	-71
@42 GHz	-88	-82	-78	-75.5	-72.5	-69.5

Table 3-296 Typical receiver sensitivity of the Integrated IP microwave II (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@7 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@8 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@10 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@10.5 GHz	-88	-81	-77	-74.5	-71.5	-68.5
@11 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@13 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@15 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@18 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@23 GHz	-89.5	-82.5	-78.5	-76	-73	-70
@26 GHz	-89	-82	-78	-75.5	-72.5	-69.5
@28 GHz	-88.5	-81.5	-77.5	-75	-72	-69
@32 GHz	-88	-81	-77	-74.5	-71.5	-68.5
@38 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@42 GHz	-86	-79	-75	-72.5	-69.5	-66.5

Table 3-297 Typical receiver sensitivity of the Integrated IP microwave III (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@7 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@8 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@10 GHz	-87	-80	-76	-73.5	-70.5	-67.5

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@10.5 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@11 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@13 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@15 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@18 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@23 GHz	-86.5	-79.5	-75.5	-73	-70	-67
@26 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@28 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@32 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@38 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@42 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Table 3-298 Typical receiver sensitivity of the Integrated IP microwave IV (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@7 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@8 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@10 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@13 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@15 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@18 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@23 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@26 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@28 GHz	-82.5	-75.5	-71.5	-69	-66	-63
@32 GHz	-82	-75	-71	-68.5	-65.5	-62.5
@38 GHz	-81.5	-74.5	-70.5	-68	-65	-62
@42 GHz	-80	-73	-69	-66.5	-63.5	-60.5

Table 3-299 Typical receiver sensitivity of the Integrated IP microwave V (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@7 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@8 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@10 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@13 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@15 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@18 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@23 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@26 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@28 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@32 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@38 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@42 GHz	-81.5	-74.5	-70.5	-68	-65	-62

Table 3-300 Typical receiver sensitivity of the Integrated IP microwave VI (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@18 GHz	-85	-77	-73.5	-71	-68	-65
@23 GHz	-86	-78	-74.5	-72	-69	-66

Table 3-301 Typical receiver sensitivity of the Integrated IP microwave VII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@7 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@8 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@10 GHz	-92	-86	-82	-79	N/A	N/A
@10.5 GHz	-90	-84	-80	-77	N/A	N/A
@11 GHz	-92	-86	-82	-79	N/A	N/A
@13 GHz	-92	-86	-82	-79	N/A	N/A
@15 GHz	-92	-86	-82	-79	N/A	N/A
@18 GHz	-92	-86	-82	-79	N/A	N/A
@23 GHz	-91.5	-85.5	-81.5	-78.5	N/A	N/A
@26 GHz	-91	-85	-81	N/A	N/A	N/A
@28 GHz	-90.5	-84.5	-80.5	N/A	N/A	N/A
@32 GHz	-90	-84	-80	N/A	N/A	N/A
@38 GHz	-89.5	-83.5	-79.5	N/A	N/A	N/A
@42 GHz	-88	-82	-78	N/A	N/A	N/A

Table 3-302 Typical receiver sensitivity of the Integrated IP microwave VIII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@7 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@8 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@10 GHz	-90	-83	-79	-76	-73	N/A
@10.5 GHz	-88	-81	-77	-74	-71	N/A
@11 GHz	-90	-83	-79	-76	-73	N/A
@13 GHz	-90	-83	-79	-76	-73	N/A
@15 GHz	-90	-83	-79	-76	-73	N/A
@18 GHz	-90	-83	-79	-76	-73	N/A
@23 GHz	-89.5	-82.5	-78.5	-75.5	-72.5	N/A
@26 GHz	-89	-82	-78	-75	N/A	N/A
@28 GHz	-88.5	-81.5	-77.5	-74.5	N/A	N/A
@32 GHz	-88	-81	-77	-74	N/A	N/A
@38 GHz	-87.5	-80.5	-76.5	-73.5	N/A	N/A
@42 GHz	-86	-79	-75	-72	N/A	N/A

Table 3-303 Typical receiver sensitivity of the Integrated IP microwave IX (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@7 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@8 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@10 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@10.5 GHz	-85	-78	-74	-71.5	-68.5	-65.5

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@11 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@13 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@15 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@18 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@23 GHz	-86.5	-79.5	-75.5	-73	-70	-67
@26 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@28 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@32 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@38 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@42 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Table 3-304 Typical receiver sensitivity of the Integrated IP microwave X (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@7 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@8 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@10 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@13 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@15 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@18 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@23 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@26 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@28 GHz	-82.5	-75.5	-71.5	-69	-66	-63
@32 GHz	-82	-75	-71	-68.5	-65.5	-62.5

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@38 GHz	-81.5	-74.5	-70.5	-68	-65	-62
@42 GHz	-80	-73	-69	-66.5	-63.5	-60.5

Table 3-305 Typical receiver sensitivity of the Integrated IP microwave XI (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@7 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@8 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@10 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@13 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@15 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@18 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@23 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@26 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@28 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@32 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@38 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@42 GHz	-81.5	-74.5	-70.5	-68	-65	-62

Table 3-306 Typical receiver sensitivity of the Integrated IP microwave XII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@18 GHz	-85	-77	-73.5	-71	-68	-65
@23 GHz	-86	-78	-74.5	-72	-69	-66

3.7.7.2.5 Receiver Sensitivity (IS3 Mode, FCC)

When the ISM6 board with XMC-3W ODU in IS3 mode operates in the 15G frequency band, it supports the receiver sensitivity that meets FCC-compliant 10/20/30/40/50 MHz channel spacing

Table 3-307 Typical receiver sensitivity I (IS3 mode, FCC, XPIC disabled)

ODU Type	Frequency Band	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM
XMC-3W	15GHz	-84.50	-82.50	-80.00	-77.00	-74.00	-71.50	-68.50	-66.00	-63.00	-61.50	N/A
XMC-3W	15GHz	N/A	-86.50	-84.00	-82.50	-79.50	-76.00	-73.50	-70.50	-68.50	-67.00	-63.50

Table 3-308 Typical receiver sensitivity II (IS3 mode, FCC, XPIC disabled)

ODU Type	Frequency Band	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
XMC-3W	15GHz	-81.00	-78.50	-77.00	-74.00	-71.00	-68.50	-65.50	-63.00	-60.00	-58.50	-55.00	N/A
XMC-3W	15GHz	N/A	-83.00	-80.50	-79.00	-76.00	-73.00	-70.50	-67.50	-65.50	-64.00	-60.50	-58.50

Table 3-309 Typical receiver sensitivity III (IS3 mode, FCC, XPIC disabled)

ODU Type	Frequency Band	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
XMC-3W	15GHz	-78.50	-75.50	-74.50	-71.00	-68.00	-66.00	-62.50	-60.00	-57.00	-55.50	-52.00	-51.00	N/A
XMC-3W	15GHz	N/A	-80.00	-77.50	-76.00	-73.00	-70.00	-67.50	-64.50	-62.50	-61.00	-57.50	-55.50	-54.50

Table 3-310 Typical receiver sensitivity IV (IS3 mode, FCC, XPIC disabled)

ODU Type	Frequency Band	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
XMC-3W	15GHz	-77.50	-75.00	-73.50	-70.50	-67.50	-64.00	-61.00	-58.50	-55.50	-52.50	-48.50	-47.50	N/A
XMC-3W	15GHz	N/A	-79.00	-76.50	-75.50	-72.50	-69.50	-66.50	-63.50	-60.50	-59.00	-56.00	-53.00	-52.00

Table 3-311 Typical receiver sensitivity V (IS3 mode, FCC, XPIC disabled)

ODU Type	Frequency Band	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
XMC-3W	15GHz	-75.50	-73.00	-71.50	-69.50	-65.50	-62.50	-59.00	-56.50	-53.50	-50.50	-46.50	-45.50	N/A
XMC-3W	15GHz	N/A	-77.50	-75.00	-73.50	-70.50	-67.00	-64.50	-61.50	-58.50	-57.00	-54.00	-51.00	-50.00

Table 3-312 Typical receiver sensitivity VI (IS3 mode, FCC, XPIC enabled)

ODU Type	Frequency Band	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M	FCC10M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
XMC-3W	15GHz	-84.50	-82.50	-80.00	-77.00	-74.00	-71.50	-68.50
XMC-3W	15GHz	N/A	-86.50	-84.00	-82.50	-79.50	-76.00	-73.50

Table 3-313 Typical receiver sensitivity VII (IS3 mode, FCC, XPIC enabled)

ODU Type	Frequency Band	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
XMC-3W	15GHz	-81.00	-78.50	-77.00	-74.00	-71.00	-68.50	-65.50	-63.00

ODU Type	Frequency Band	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M	FCC20M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
XMC-3W	15GHz	N/A	-83.00	-80.50	-79.00	-76.00	-73.00	-70.50	-67.50

Table 3-314 Typical receiver sensitivity VIII (IS3 mode, FCC, XPIC enabled)

ODU Type	Frequency Band	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M	FCC30M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM
XMC-3W	15GHz	-78.50	-75.50	-74.50	-71.00	-68.00	-66.00	-62.50	-60.00	-57.00	-55.50	-52.00
XMC-3W	15GHz	N/A	-80.00	-77.50	-76.00	-73.00	-70.00	-67.50	-64.50	-62.50	-61.00	-57.50

Table 3-315 Typical receiver sensitivity IX (IS3 mode, FCC, XPIC enabled)

ODU Type	Frequency Band	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M	FCC40M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM
XMC-3W	15GHz	-77.50	-75.00	-73.50	-70.50	-67.50	-64.00	-61.00	-58.50	-55.50	-52.50	-48.50
XMC-3W	15GHz	N/A	-79.00	-76.50	-75.50	-72.50	-69.50	-66.50	-63.50	-60.50	-59.00	-56.00

Table 3-316 Typical receiver sensitivity X (IS3 mode, FCC, XPIC enabled)

ODU Type	Frequency Band	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M	FCC50M
		QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
XMC-3W	15GHz	-75.50	-73.00	-71.50	-69.50	-65.50	-62.50	-59.00	-56.50	-53.50	-50.50	-46.50	-45.50
XMC-3W	15GHz	N/A	-77.50	-75.00	-73.50	-70.50	-67.00	-64.50	-61.50	-58.50	-57.00	-54.00	-51.00

3.7.7.3 IF Performance

The IF performance includes the performance of the IF signal and the performance of the ODU O&M signal.

Table 3-317 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	350
	Receive frequency of the IF board (MHz)	140
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

3.7.7.4 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 3-318 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	Low-density parity check code (LDPC) encoding.
Adaptive time-domain equalizer for baseband signals	Supported.

3.7.7.5 Mechanical Behavior and Power Consumption

An ISM6 board occupies one slot. Its power consumption is less than 40 W.

Mechanical Behaviors and Power Consumption

Table 3-319 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.65 kg
Power consumption	< 40 W

3.8 ISV3

ISV3 boards are multi-purpose IF boards that support Integrated IP microwave, SDH radio, and DC-I power distribution. Once the appropriate license files are loaded, the boards also support cross polarization interference cancellation (XPIC).

3.8.1 Version Description

The functional version of ISV3 boards is SL91.

3.8.2 Application

ISV3 boards function as SDH IF boards to transmit SDH radio services, or as Integrated IP microwave IF boards to transmit Integrated IP microwave services (native E1+Ethernet or native STM-1+Ethernet). If transmission capacity needs to be expanded, XPIC can be used.

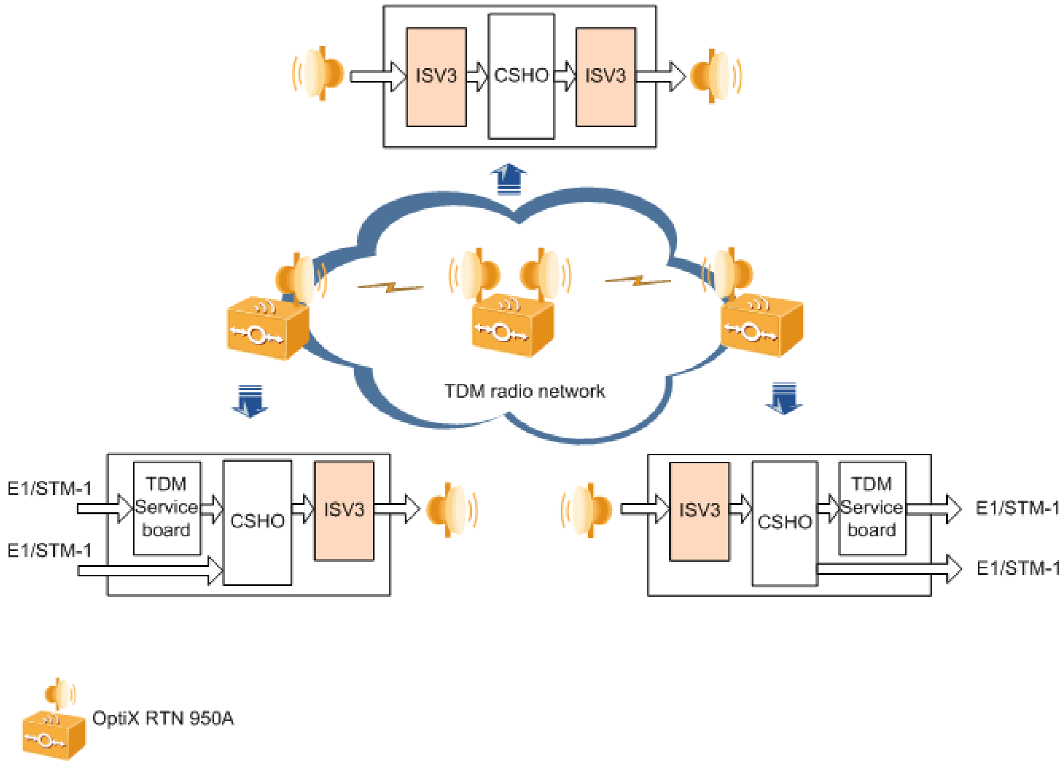
NOTE

Compared with ISU2/ISX2 boards, ISV3 boards support 512QAM or higher-order modulation schemes.

Functioning as SDH IF Boards

If applied to OptiX RTN 950A NEs building TDM radio networks, ISV3 boards function as large-capacity SDH IF boards to transmit TDM services.

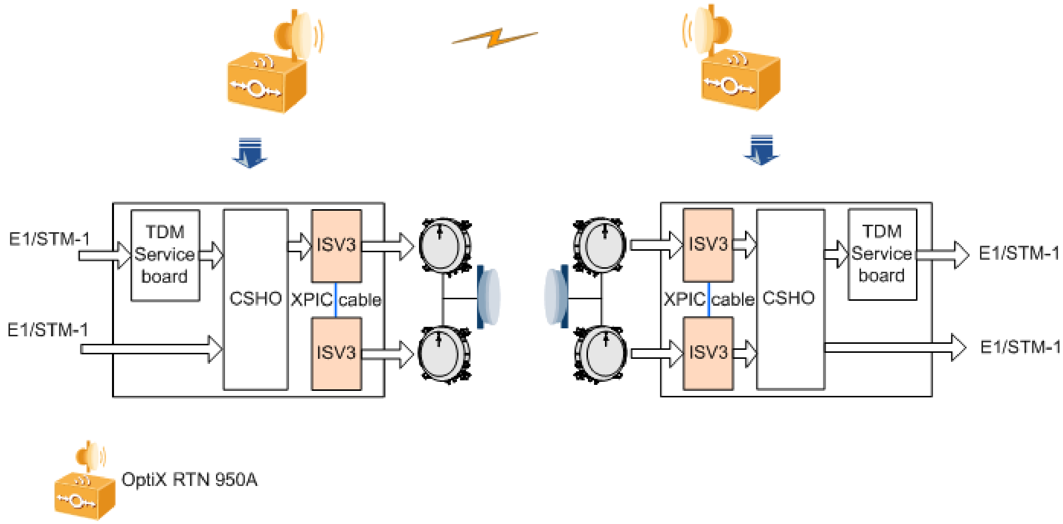
Figure 3-54 Application scenario of ISV3 boards with XPIC disabled (1)



NOTE

- When working in SDH radio mode, ISV3 boards transmit 1xSTM-1 or 2xSTM-1 SDH radio services.
- If a TDM radio network needs to transmit a small number of FE/GE services, these services must be encapsulated into TDM services by EMS6/EFP8 boards before transmission.
- To expand the capacity of an SDH radio hop, use ISV3 boards with XPIC enabled to transmit TDM services, as shown in **Figure 3-55**.

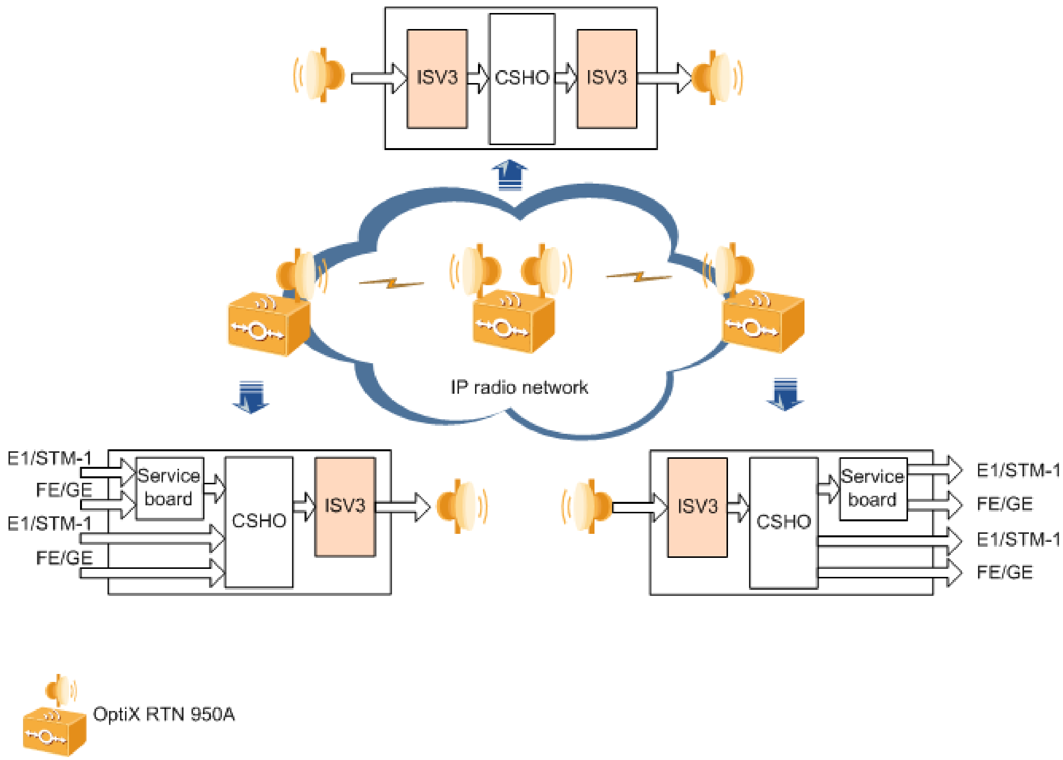
Figure 3-55 Application scenario of ISV3 boards with XPIC enabled (2)



Functioning as Integrated IP microwave IF Boards

ISV3 boards also apply to OptiX RTN 950A NEs to transmit native E1 services, native STM-1 services, native Ethernet services, native MPLS/PWE3 services, or a combination of these services over Integrated IP microwave.

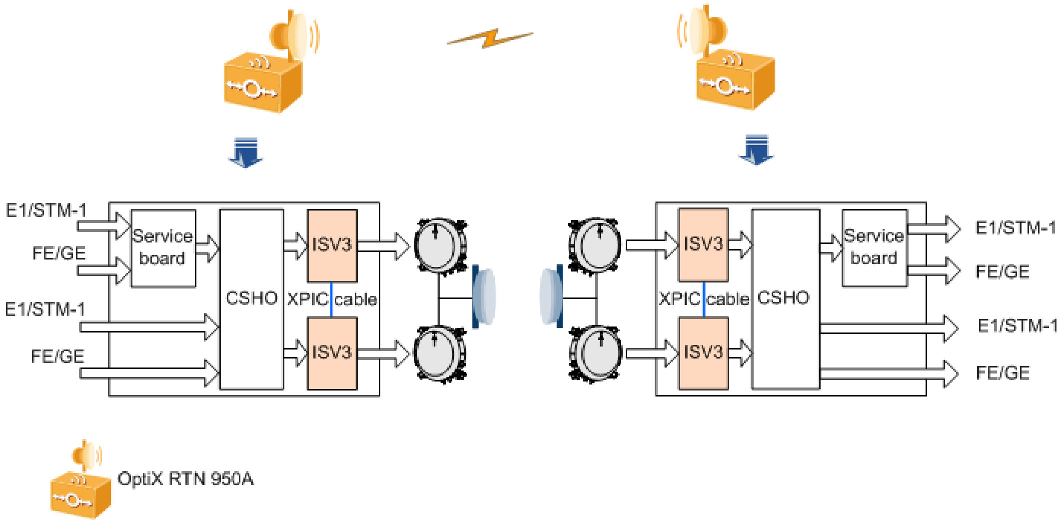
Figure 3-56 Application scenario of ISV3 boards with XPIC disabled (1)



NOTE

- In the preceding figure, if being transmitted over Integrated IP microwave, E1 services can be native E1 services or CES/ATM E1 services, Ethernet services can be native Ethernet services or ETH PWE3 services, and STM-1 services must be native STM-1 services.
- ISV3 boards will transmit native E1 services only when these boards work in native E1+Ethernet mode, and will transmit native STM-1 services only when these boards work in native STM-1+Ethernet mode.
- Service boards shown in the preceding figure can be Ethernet interface boards, STM-1 interface boards, E1 interface boards, or Smart E1 processing boards.
- To expand the capacity of an Integrated IP microwave hop, use ISV3 boards with XPIC enabled, as shown in **Figure 3-57**.

Figure 3-57 Application scenario of ISV3 boards with XPIC enabled (2)



3.8.3 Functions and Features

The ISV3 board receives and transmits one channel of IF signals, provide a management channel to the ODU, and supplies -48 V power to the ODU. When the XPIC function is enabled, the ISV3 board also implements XPIC for IF signals by transmitting and receiving XPIC reference signals.

Table 3-320 lists the functions and features that the ISV3 board supports. The ISV3 board implements Ethernet and packet service functions by working with the packet switching unit integrated on the system control, switching, and timing board.

Table 3-320 Functions and features that the ISV3 supports

Function and Feature	Description
Basic functions	● Receives and transmits one channel of IF signals. ● Provides a management channel to ODUs. ● Supplies -48 V power to ODUs.

Function and Feature	Description
Microwave types	● Integrated IP microwave ● SDH microwave **NOTE** Integrated IP microwave is compatible with Hybrid microwave and Packet microwave.
Running modes	● IS2 mode: When running in this mode, the ISV3 board supports the modulation schemes QPSK-256QAM, and can interconnect only with ISU2/ISX2 boards. ● IS3 mode: When running in this mode, the ISV3 boards supports the modulation schemes QPSK-2048QAM and the four extended modulation schemes QPSK Strong, 16QAM Strong, and 512QAM Light, and 1024QAM Light. ISV3 boards can interconnect with ISV3 boards or the RTN 905. **NOTE** Compared with QPSK/16QAM, QPSK Strong/16QAM Strong has stronger FEC capability, and therefore has better receiver sensitivity. It has, however, less air interface bandwidth. Compared with 512QAM/1024QAM, 512QAM Light/1024QAM Light has weaker FEC capability, and therefore has worse receiver sensitivity. It has, however, higher air interface bandwidth.
Modulation schemes	● IS2 mode: QPSK/16QAM/32QAM/64QAM/128QAM/256QAM ● IS3 mode: QPSK Strong/QPSK/16QAM Strong/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/512QAM Light/1024QAM/1024QAM Light/2048QAM **NOTE** ● When running in IS3 mode, the ISV3 boards supports 2048QAM only when AM is enabled. ● The highest-order modulation scheme that an IF port supports depends on factors such as the ODU frequency band, XPIC status, and channel spacing. For details, see **3.8.7 Technical Specifications**.
Service types in Integrated IP microwave mode	● Native E1 + Ethernet ● Native STM-1 + Ethernet **NOTE** Ethernet services can be native Ethernet services or packet services that are encapsulated into pseudo wire emulation edge-to-edge (PWE3) packets.
Service types in SDH microwave mode	● STM-1 ● 2xSTM-1
Backplane bus bandwidth	1 Gbit/s

Function and Feature		Description
Automatic transmit power control (ATPC)		Supported
Adaptive modulation (AM)		Supported only in Integrated IP microwave mode
E1 priorities		Supported only if native TDM services transmitted over Integrated IP microwave are E1 services
Compression of Ethernet frame headers		Supported
Ethernet payload compression		Supported
XPIC		Supported
Anti-Theft function		Supported
Radio working mode		See **3.8.7 Technical Specifications**
Link protection	1+1 HSB/FD/SD protection (HSB stands for hot standby, FD stands for frequency diversity, and SD stands for space diversity.)	Supported
	N+1 protection	Supported
	Link aggregation groups (LAGs) at air interfaces	Supported
	Physical link aggregation (PLA/EPLA/ EPLA+)	Supported **NOTE** EPLA+ is available only when ISV3 boards work with ISM6 boards.
TDM service protection		Subnetwork connection protection (SNCP)
AES-based encryption at air interfaces		Supported
K byte pass-through		Supported
Ethernet service functions		See **Table 3-321**.
Multiprotocol Label Switching (MPLS) functions		Refer to the description of Multiprotocol label switching (MPLS)/Pseudo wire emulation edge-to-edge (PWE3) functions provided in the sections about system control, switching, and timing boards.
PWE3 functions		

Function and Feature		Description
Clock	Physical layer synchronization	Air interface clock
	Physical-layer clock protection	● Protection implemented based on different clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.
	Packet frequency synchronization	Not supported
Data communication network (DCN)	Inband DCN	Supports inband DCN. DCN bandwidth is configurable.
	Outband DCN	● Provides one 3-byte DCC for each Integrated IP microwave channel. ● Supports one DCC that is composed of D1-D3 bytes, D4-D12 bytes, or D1-D12 bytes for each SDH microwave channel.
Operation and management	Loopback	● Supports inloops and outloops at IF ports. ● Supports inloops and outloops at composite (COMP) ports.
	Cold and warm resets	Supported
	In-service field programmable gate array (FPGA) loading	Supported
	Pseudo random binary sequence (PRBS) test at IF ports	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported

Function and Feature		Description
	Temperature monitoring	Supported
	Voltage monitoring	Supported

Table 3-321 Ethernet service functions

Function and Feature		Description
Ethernet services	Native Ethernet services	● E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links ● E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	● E-Line services carried by PWs ● E-Aggr services carried by PWs ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
Ethernet ring protection switching (ERPS)		Supported (complies with ITU-T G.8032 v1/v2)
Smart Ethernet protection (SEP)		Supported
Operation, administration, and management (OAM)		● Supports ETH OAM functions that comply with IEEE 802.1ag and IEEE 802.3ah. ● Supports frame loss measurement, frame delay measurement, and delay variation measurement functions that comply with ITU-T Y.1731.
Spanning Tree Protocol (STP)		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).
Quality of service (QoS)		Refer to the description of QoS functions provided in the sections about system control, switching, and timing boards.
Remote network monitoring (RMON)		Supported

3.8.4 Working Principle and Signal Flow

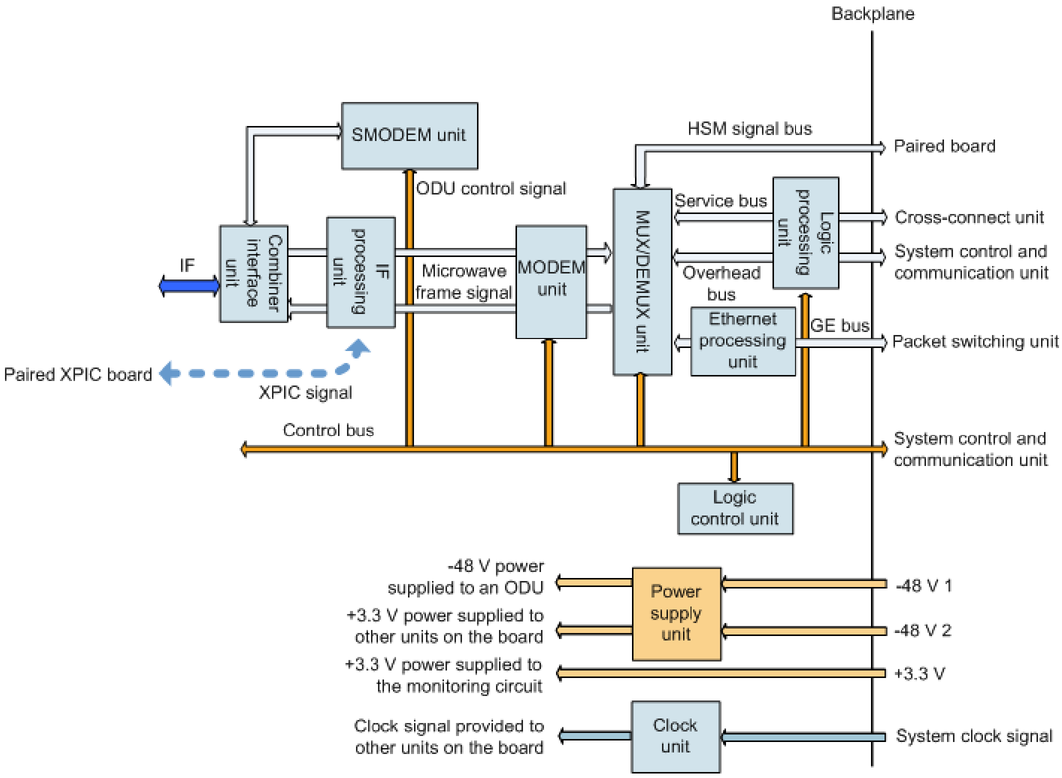
This section describes how the function units of an ISV3 board process Integrated IP microwave IF signals.

NOTE

ISV3 boards process signals transmitted over SDH radio in the same way as they process signals transmitted over Integrated IP radio. The only differences are with regard to the microwave frame structure and processed service types.

Function Block Diagram

Figure 3-58 ISV3 board function block diagram



Signal Processing in the Receive Direction

Table 3-322 Signal processing in the receive direction of an ISV3 board

Step	Function Unit	Processing Flow
1	Combiner interface unit	Separates ODU control signals from microwave service signals.

Step	Function Unit	Processing Flow
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits ODU control signals to the system control and communication unit.
3	IF processing unit	● Filters microwave service signals. ● If XPIC is disabled, converts microwave service signals into digital signals and transmits these signals to the modem unit. ● If XPIC is enabled: – Splits microwave service signals into two channels of signals, converts one channel of signals into digital signals and transmits them to the modem unit, and transmits the other channel of signals to the paired board as XPIC signals. – Converts XPIC signals from the paired board into digital signals and transmits the digital signals to the modem unit.
4	Modem unit	● If XPIC is disabled, performs digital demodulation. ● If XPIC is enabled: – Performs digital demodulation using XPIC IF signals from the paired board as reference signals. – Performs XPIC operations for IF signals. ● Performs time-domain adaptive equalization. ● Performs forward error correction (FEC) decoding and generates alarms, if any.

Step	Function Unit	Processing Flow
5	MUX/DEMUX unit	● Detects microwave frame headers and generates alarms and performance events, if any. ● Verifies parity bits in microwave frames and generates alarms and performance events, if any. ● Checks link IDs in microwave frames and generates alarms and performance events, if any. ● Detects changes in both ATPC messages and response messages, and reports the changes to the system control and communication unit over the control bus. ● Extracts orderwire bytes, auxiliary channel bytes (including F1 and serial bytes), and DCC bytes from microwave frames, and transmits the bytes to the logic processing unit. ● Maps E1 service signals to specific positions in VC-4s and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Demaps VC-4s from STM-1 service signals and transmits the VC-4s to the logic processing unit (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Extracts Ethernet signals from the microwave service signals, and transmits the Ethernet signals to the Ethernet processing unit.
6	Ethernet processing unit	● Processes GE signals received from the MUX/DEMUX unit. ● Sends the processed signals to the packet switching unit.
7	Logic processing unit	● Processes clock signals. ● Transmits overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

NOTE

In 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

Signal Processing in the Transmit Direction

Table 3-323 Signal processing in the transmit direction of an ISV3 board

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signals from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals that are sent by the logic processing unit (if native TDM services transmitted over Integrated IP microwave are E1 services). ● Adds overheads to the VC-4 signals from the logic processing unit to construct STM-1 signals (if native TDM services transmitted over Integrated IP microwave are STM-1 services). ● Sets overheads for microwave frames. ● Combines Ethernet signals, E1/STM-1 service signals, and microwave frame overheads into microwave frames.
4	Modem unit	● Performs FEC coding. ● Performs digital modulation.
5	IF processing unit	● Performs digital/analog conversion. ● Performs analog modulation. ● Filters signals. ● Amplifies signals.
6	SMODEM unit	Modulates ODU control signals from the system control and communication unit.
7	Combiner interface unit	Combines ODU control signals, microwave service signals, and -48 V power signals, and then sends the combined signals through an IF cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies the power to an ODU.
- Receives the -48 V power from the power supply bus on the backplane, soft-starts and filters the -48 V power, DC-DC converts it, and then supplies a +3.3 V power to other units on the ISV3 board.

Clock Unit

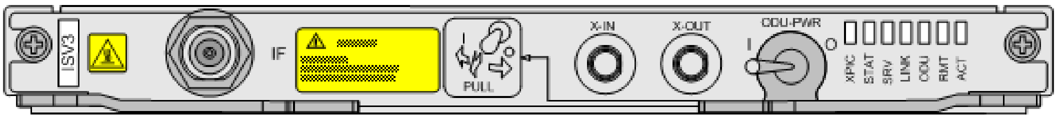
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.8.5 Front Panel

An ISV3 board has indicators, XPIC signal ports, one IF port, one ODU power switch, and labels on its front panel.

Front Panel Diagram

Figure 3-59 Front panel of an ISV3 board



Indicators

Table 3-324 Status explanation for indicators on an ISV3 board

Indicator	State	Meaning
XPIC	On (green)	XPIC input signals are normal.
	On (red)	XPIC input signals are lost.
	Off	XPIC is disabled.
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.

Indicator	State	Meaning
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor or remote alarm has been reported.
LINK	On (green)	The radio link is normal.
	On (red)	The radio link is faulty.
ODU	On (green)	The ODU is working properly.
	On (red)	The ODU has reported a critical or major alarm, or was not powered on.
	On (yellow)	The ODU has reported a minor alarm.
	Blinks on (yellow) and off at 300 ms intervals	Antennas are not well aligned.
	Off	The ODU is offline.
RMT	On (yellow)	The remote equipment has reported a defect.
	Off	The remote equipment is free of defects.
ACT	On (green)	In a 1+1 protected system, the board is working as the main board. In an unprotected system, the board has been activated.
	Off	In a 1+1 protected system, the board is working as the standby board. In an unprotected system, the board has not been activated.

Ports

Table 3-325 Description of the ports

Port	Description	Connector Type	Corresponding Cable
IF	IF port	TNC	**IF jumper**[b]
ODU-PWR[a]	ODU power switch	-	-
X-IN	XPIC signal input port	SMA	**XPIC cable**
X-OUT	XPIC signal output port	SMA	

NOTE

a: The ODU-PWR switch is equipped with a lockup device. To turn on or turn off the switch, you need to first pull the switch lever slightly outwards. When the switch is set to "O", it indicates that the circuit is open. When the switch is set to "I", it indicates that the circuit is closed.

b: A 5D IF cable is connected to an IF board; therefore, an IF jumper is not required.

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

The operation warning label indicates that the ODU-PWR switch must be turned off before the IF cable is removed.

The operation guidance label indicates that the switch must be pulled slightly outwards before the switch is set to the "I" or "O" position.

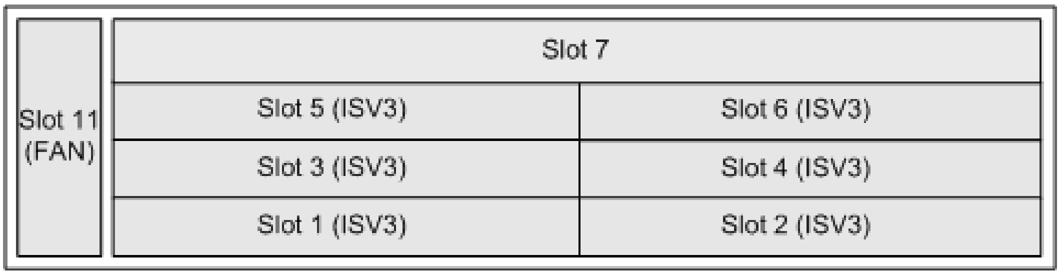
3.8.6 Valid Slots

The ISV3 board can be inserted in Slots 1 to 6, which have consistent logical slot numbers on the NMS.

NOTE

For the maximum number of boards supported by the OptiX RTN 950A, see Number of radio directions in *Product Description*.

Figure 3-60 Physical slots for ISV3 boards in a chassis



An ODU does not occupy a physical slot but has a logical slot on the NMS. The logical slot ID of an ODU is equal to the logical slot ID of the connected IF board plus 20.

Figure 3-61 Logical slots of ISV3 boards on the NMS

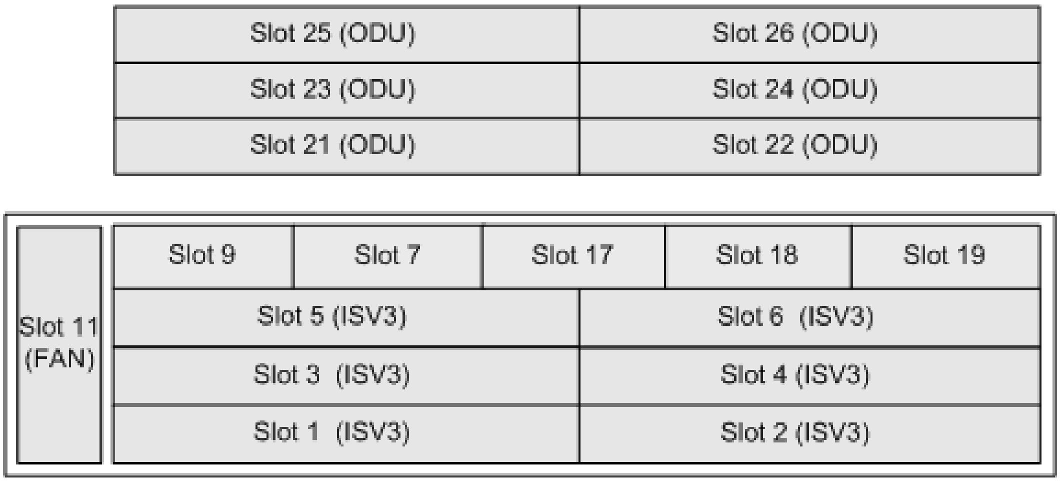


Table 3-326 Slot allocation

Item	Description
Slot allocation priority	Slots 3 and 5 > Slots 4 and 6 > Slots 1 and 2

Two IF1 boards can be configured as a 1+1 FD/SD protection group only when being housed in two paired slots: Slots 1 and 2, Slots 3 and 5, or Slot 4 and 6.

When forming an XPIC group, the two ISV3 boards must be inserted in two adjacent slots in the same row or column. For details, see Planning Guidelines (XPIC) in *Feature Description*.

3.8.7 Technical Specifications

This section describes board specifications, including running modes, radio working modes, IF performance, modem performance, mechanical behaviors, and power consumption.

3.8.7.1 Microwave Work Modes (ISV3 Board)

This section describes the microwave work modes of the ISV3 board.

3.8.7.1.1 Microwave Work Modes (IS3 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS3 running mode.

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

When being used in North America, ISV3 boards support the FCC 10/20/30/40/50 MHz channel spacing. For details, see the *User Guide for North America*.

2048QAM is used only when AM is enabled.

NOTE

For ISM6 board, only the SL91ISM6 VER.C can work with the XMC-5D ODU.

SDH Microwave Work Mode

Table 3-327 SDH microwave work modes (IS3 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
NOTE In IS3 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP Microwave Work Mode (IS3 mode, E1+Ethernet)

NOTE

After AES-based encryption at air interfaces is enabled, overheads occupy additional air-interface bandwidth (< 300 kbit/s). As a result, the maximum number of E1 services decreases by one in the following modulation schemes:

- XPIC disabled: 7 MHz/QPSK Strong, 7 MHz/16QAM, 14 MHz/QPSK, and 14 MHz/16QAM
- XPIC enabled: 14 MHz/QPSK Strong

Table 3-328 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 9	4 to 13
3.5	16QAM	4	9 to 11	9 to 14	9 to 19	9 to 27
7	QPSK Strong	4	8 to 10	8 to 14	8 to 18	8 to 24
7	QPSK	5	10 to 13	10 to 17	10 to 22	10 to 31
7	16QAM Strong	8	17 to 22	17 to 29	17 to 37	18 to 51
7	16QAM	10	20 to 26	21 to 34	21 to 45	21 to 61
7	32QAM	12	25 to 32	25 to 42	26 to 55	26 to 75
7	64QAM	15	32 to 40	32 to 54	33 to 70	33 to 95
7	128QAM	18	37 to 48	38 to 63	38 to 82	39 to 112
7	256QAM	20	42 to 53	43 to 71	43 to 92	44 to 125
7	512QAM	21	45 to 57	45 to 75	46 to 98	46 to 133
7	512QAM Light	22	48 to 61	48 to 80	49 to 105	50 to 142
7	1024QAM	23	51 to 65	52 to 86	52 to 112	53 to 152
14 (13.75)	QPSK Strong	8	17 to 22	17 to 29	17 to 38	18 to 51
14 (13.75)	QPSK	10	21 to 26	21 to 35	21 to 45	21 to 62
14 (13.75)	16QAM Strong	16	35 to 45	35 to 59	36 to 77	36 to 105
14 (13.75)	16QAM	20	41 to 53	42 to 69	42 to 91	43 to 123
14 (13.75)	32QAM	24	52 to 66	52 to 87	53 to 114	54 to 154
14 (13.75)	64QAM	31	65 to 83	66 to 109	67 to 143	68 to 194
14 (13.75)	128QAM	37	77 to 98	78 to 129	79 to 169	80 to 229
14 (13.75)	256QAM	42	88 to 112	89 to 148	90 to 193	92 to 262
14 (13.75)	512QAM	44	94 to 119	95 to 157	96 to 205	97 to 278
14 (13.75)	512QAM Light	46	100 to 127	101 to 168	102 to 219	104 to 297

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	1024QAM	48	104 to 131	105 to 174	106 to 227	107 to 307
14 (13.75)	1024QAM Light	50	109 to 138	110 to 182	111 to 238	113 to 323
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 255
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	75 63	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	75 63	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	75 63	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	75 63	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	75 63	228 to 289	230 to 382	233 to 499	237 to 676
28 (27.5)	2048QAM	75 63	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	75 63	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	75 63	423 to 536	427 to 708	432 to 925	439 to 1000
56 (55)	1024QAM	75 63	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	75 63	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	75 63	502 to 636	507 to 839	512 to 999	520 to 1000
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	75 63	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	75 63	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	75 63	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	75 63	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	75 63	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-329 Integrated IP microwave work modes (IS3 mode, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK Strong	3	8 to 10	8 to 13	8 to 17	8 to 24
7	QPSK	4	10 to 12	10 to 17	10 to 22	10 to 30
7	16QAM Strong	6	16 to 21	17 to 28	17 to 36	17 to 49
7	16QAM	9	20 to 25	20 to 33	20 to 44	20 to 59
7	32QAM	11	24 to 31	25 to 41	25 to 54	25 to 73
7	64QAM	14	31 to 39	31 to 52	32 to 68	32 to 92
7	128QAM	17	36 to 46	37 to 61	37 to 80	38 to 108

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	QPSK Strong	8	16 to 21	17 to 28	17 to 36	17 to 49
14 (13.75)	QPSK	9	20 to 25	20 to 34	20 to 44	21 to 60
14 (13.75)	16QAM Strong	16	34 to 43	34 to 57	35 to 75	35 to 101
14 (13.75)	16QAM	19	40 to 51	41 to 67	41 to 88	42 to 120
14 (13.75)	32QAM	24	50 to 64	51 to 84	51 to 110	52 to 149
14 (13.75)	64QAM	30	63 to 80	64 to 106	65 to 139	66 to 188
14 (13.75)	128QAM	36	75 to 95	76 to 126	77 to 164	78 to 223
14 (13.75)	256QAM	40	85 to 107	86 to 142	86 to 185	88 to 251
28 (27.5)	QPSK Strong	17	36 to 46	36 to 61	37 to 79	37 to 107
28 (27.5)	QPSK	20	42 to 54	43 to 71	43 to 93	44 to 126
28 (27.5)	16QAM Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
28 (27.5)	16QAM	40	86 to 109	87 to 144	88 to 188	89 to 254
28 (27.5)	32QAM	52	110 to 139	111 to 184	112 to 240	114 to 325
28 (27.5)	64QAM	64 63	135 to 172	137 to 227	138 to 296	140 to 402
28 (27.5)	128QAM	75 63	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	75 63	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	75 63	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	75 63	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	75 63	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	QPSK Strong	34	73 to 93	74 to 123	75 to 161	76 to 218
56 (55)	QPSK	40	86 to 109	87 to 144	88 to 188	89 to 255

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	16QAM Strong	68 63	148 to 188	150 to 248	151 to 325	154 to 440
56 (55)	16QAM	75 63	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	75 63	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	75 63	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	75 63	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	75 63	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	75 63	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	75 63	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	75 63	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	75 63	454 to 575	459 to 759	463 to 992	471 to 1000
40	QPSK Strong	23	50 to 63	50 to 83	51 to 109	51 to 147
40	QPSK	27	58 to 74	59 to 97	59 to 127	60 to 173
40	16QAM Strong	46	100 to 127	101 to 168	102 to 220	104 to 298
40	16QAM	55	117 to 149	119 to 197	120 to 257	122 to 348
40	32QAM	71 63	150 to 190	152 to 251	153 to 328	156 to 444
40	64QAM	75 63	185 to 235	187 to 310	189 to 405	192 to 549

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	75 63	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	75 63	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	75 63	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	75 63	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	75 63	293 to 372	296 to 491	299 to 641	304 to 869

Integrated IP microwave work mode (IS3 mode, STM-1+Ethernet)

Table 3-330 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	183 to 232	185 to 306	187 to 400	190 to 542
28 (27.5)	512QAM	1	196 to 249	198 to 328	200 to 429	203 to 581
28 (27.5)	512QAM Light	1	210 to 266	212 to 351	214 to 459	218 to 622
28 (27.5)	1024QAM	1	217 to 275	220 to 364	222 to 475	225 to 644
28 (27.5)	1024QAM Light	1	228 to 289	230 to 382	233 to 499	237 to 676

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	2048QAM	1	242 to 306	244 to 405	247 to 529	251 to 716
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	369 to 467	373 to 617	376 to 806	383 to 999
56 (55)	512QAM	1	395 to 501	400 to 661	404 to 864	410 to 1000
56 (55)	512QAM Light	1	423 to 536	427 to 708	432 to 925	439 to 1000
56 (55)	1024QAM	1	447 to 567	452 to 748	456 to 978	464 to 1000
56 (55)	1024QAM Light	1	481 to 609	486 to 805	491 to 999	499 to 1000
56 (55)	2048QAM	1	502 to 636	507 to 839	512 to 999	520 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	253 to 321	256 to 423	258 to 553	262 to 749
40	512QAM	1	268 to 340	271 to 449	274 to 586	278 to 794
40	512QAM Light	1	287 to 363	290 to 480	293 to 627	298 to 850
40	1024QAM	1	302 to 383	305 to 506	309 to 661	314 to 895
40	1024QAM Light	1	317 to 402	321 to 531	324 to 694	329 to 940
40	2048QAM	1	330 to 418	333 to 552	337 to 721	342 to 977

Table 3-331 Integrated IP microwave work modes (IS3 mode, STM-1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	160 to 203	162 to 268	164 to 351	166 to 475
28 (27.5)	256QAM	1	182 to 230	183 to 304	185 to 397	188 to 538
28 (27.5)	512QAM	1	188 to 239	190 to 315	192 to 412	195 to 558
28 (27.5)	512QAM Light	1	201 to 255	204 to 337	206 to 441	209 to 597
28 (27.5)	1024QAM	1	215 to 272	217 to 359	219 to 470	223 to 636
56 (55)	16QAM	1	173 to 220	175 to 290	177 to 379	180 to 514
56 (55)	32QAM	1	217 to 275	219 to 363	222 to 475	225 to 643
56 (55)	64QAM	1	273 to 346	276 to 457	279 to 597	283 to 809
56 (55)	128QAM	1	323 to 409	327 to 541	330 to 706	335 to 957
56 (55)	256QAM	1	365 to 462	369 to 610	372 to 797	378 to 999
56 (55)	512QAM	1	379 to 481	383 to 635	387 to 830	394 to 1000
56 (55)	512QAM Light	1	406 to 514	410 to 679	414 to 888	421 to 1000
56 (55)	1024QAM	1	433 to 548	437 to 724	441 to 946	449 to 1000
56 (55)	1024QAM Light	1	454 to 575	459 to 759	463 to 992	471 to 1000
40	64QAM	1	185 to 235	187 to 310	189 to 405	192 to 549
40	128QAM	1	219 to 278	221 to 367	224 to 479	227 to 649
40	256QAM	1	251 to 318	254 to 420	256 to 549	260 to 744
40	512QAM	1	257 to 326	260 to 431	263 to 563	267 to 762
40	512QAM Light	1	275 to 349	278 to 461	281 to 602	286 to 816
40	1024QAM	1	293 to 372	296 to 491	299 to 641	304 to 869

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.8.7.1.2 Microwave Work Modes (IS2 Running Mode)

This section lists the microwave work modes that the OptiX RTN 950A supports on IS2 running mode.

NOTE

In IS2 mode, the ISM6 board does not support the 50 MHz channel spacing.

In IS2 mode, the ISX2 board does not support the 3.5 MHz channel spacing.

SDH Microwave Work Modes

Table 3-332 SDH microwave work modes (IS2 mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	256QAM	50
NOTE In IS2 running mode and SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Integrated IP Microwave Work Mode (IS2 mode, E1+Ethernet)

Table 3-333 Integrated IP microwave work modes (IS2 mode, E1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 6	4 to 10
3.5	16QAM	4	9 to 11	9 to 13	9 to 13	9 to 20
7	QPSK	5	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	10	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	12	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	15	31 to 40	31 to 47	31 to 67	31 to 100
7	128QAM	18	37 to 47	37 to 56	37 to 80	37 to 119
7	256QAM	20	41 to 53	41 to 62	41 to 90	42 to 134
14 (13.75)	QPSK	10	20 to 26	20 to 31	20 to 44	20 to 66
14 (13.75)	16QAM	20	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	31	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	37	76 to 97	76 to 113	76 to 165	76 to 245
14 (13.75)	256QAM	42	87 to 111	87 to 131	87 to 189	88 to 281
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-334 Integrated IP microwave work modes (IS2 mode, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK	4	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	9	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	11	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	14	31 to 40	31 to 47	31 to 67	31 to 100
14 (13.75)	QPSK	9	20 to 26	20 to 31	20 to 44	20 to 66

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	16QAM	19	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	30	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	36	76 to 97	76 to 113	76 to 165	76 to 245
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Integrated IP Microwave Work Mode (IS2 mode, STM-1+Ethernet)

Table 3-335 Integrated IP microwave work modes (IS2 mode, STM-1 + Ethernet, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	1	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	1	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	1	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	1	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	1	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	1	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-336 Integrated IP microwave work modes (IS2 mode, STM-1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	1	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	QPSK	1	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	1	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	1	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	1	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	1	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000

NOTE

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

3.8.7.1.3 Microwave Work Modes (FCC)

When the ISV3 board works in IS3 mode, it supports the microwave working mode that meets FCC-compliant 10/20/30/40/50 MHz channel spacing.

Microwave Working Modes (FCC)

NOTE

The microwave work modes are those complying with North America standards and corresponding to the FCC channel spacings 10/20/30/40//50 MHz. In these modes, IF boards run in IS3 mode.

Table 3-337 Service capacity in integrated IP radio mode (IS3 mode, XPIC disabled)

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
10	QPSK Strong	5	11 to 13	11 to 18	11 to 24
10	QPSK	6	13 to 17	13 to 23	14 to 30
10	16QAM Strong	10	22 to 28	22 to 37	23 to 49
10	16QAM	12	27 to 34	27 to 45	27 to 59
10	32QAM	15	33 to 42	33 to 55	34 to 72
10	64QAM	19	42 to 53	42 to 70	42 to 91
10	128QAM	23	49 to 62	49 to 82	50 to 107
10	256QAM	26	55 to 69	55 to 92	56 to 120
10	512QAM	27	58 to 74	59 to 97	59 to 127
10	512QAM Light	29	62 to 79	63 to 104	63 to 136
10	1024QAM	31	66 to 84	67 to 111	68 to 145
10	1024QAM Light	TBD	70 to 88	70 to 117	71 to 153
20	QPSK Strong	11	24 to 30	24 to 40	24 to 53
20	QPSK	13	29 to 37	29 to 49	30 to 64
20	16QAM Strong	23	49 to 62	50 to 82	50 to 108
20	16QAM	27	58 to 73	58 to 97	59 to 127
20	32QAM	34	72 to 92	73 to 121	74 to 158
20	64QAM	43	91 to 115	92 to 152	93 to 199

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
20	128QAM	51	108 to 137	109 to 180	110 to 236
20	256QAM	58	123 to 156	124 to 206	126 to 269
20	512QAM	62	131 to 165	132 to 218	133 to 286
20	512QAM Light	66	140 to 177	141 to 234	143 to 306
20	1024QAM	69	144 to 183	146 to 242	147 to 316
20	1024QAM Light	72	152 to 192	153 to 254	155 to 332
30	QPSK Strong	17	37 to 47	38 to 62	38 to 82
30	QPSK	20	44 to 55	44 to 73	45 to 96
30	16QAM Strong	36	76 to 96	76 to 127	77 to 166
30	16QAM	42	88 to 112	89 to 148	90 to 194
30	32QAM	54	113 to 143	114 to 189	115 to 248
30	64QAM	67	140 to 177	141 to 234	143 to 306
30	128QAM	75	165 to 210	167 to 277	169 to 362
30	256QAM	75	189 to 239	191 to 316	193 to 413
30	512QAM	75	202 to 257	205 to 339	207 to 443
30	512QAM Light	75	217 to 275	219 to 362	221 to 474
30	1024QAM	75	224 to 284	226 to 375	229 to 490
30	1024QAM Light	75	235 to 298	238 to 394	240 to 515
30	2048QAM	75	246 to 312	249 to 412	251 to 538
40	QPSK Strong	24	50 to 64	51 to 85	51 to 111
40	QPSK	28	59 to 75	60 to 99	60 to 130
40	16QAM Strong	49	102 to 130	103 to 171	104 to 224

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
40	16QAM	58	121 to 154	122 to 203	124 to 265
40	32QAM	73	153 to 193	154 to 255	156 to 334
40	64QAM	75	188 to 239	190 to 315	192 to 412
40	128QAM	75	223 to 282	225 to 373	227 to 487
40	256QAM	75	257 to 326	260 to 431	263 to 563
40	512QAM	75	273 to 346	276 to 456	278 to 597
40	512QAM Light	75	292 to 370	295 to 488	298 to 638
40	1024QAM	75	308 to 390	311 to 515	314 to 672
40	1024QAM Light	75	323 to 409	326 to 540	329 to 706
40	2048QAM	75	336 to 425	339 to 561	343 to 734
50	QPSK Strong	30	64 to 81	64 to 107	65 to 140
50	QPSK	35	75 to 95	75 to 125	76 to 164
50	16QAM Strong	61	129 to 163	130 to 216	132 to 282
50	16QAM	71	151 to 191	152 to 252	154 to 330
50	32QAM	75	191 to 242	193 to 319	195 to 417
50	64QAM	75	238 to 301	240 to 397	242 to 520
50	128QAM	75	281 to 356	284 to 470	287 to 614
50	256QAM	75	321 to 406	324 to 537	327 to 701
50	512QAM	75	344 to 436	347 to 575	351 to 752
50	512QAM Light	75	368 to 466	372 to 615	375 to 804
50	1024QAM	75	389 to 493	393 to 651	397 to 850
50	1024QAM Light	75	418 to 530	423 to 700	427 to 915
50	2048QAM	75	431 to 546	435 to 720	440 to 942

Table 3-338 Service capacity in integrated IP radio mode (IS3 mode, XPIC enabled)

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
10	QPSK Strong	5	10 to 13	10 to 17	10 to 23
10	QPSK	6	13 to 16	13 to 22	13 to 29
10	16QAM Strong	10	22 to 27	22 to 36	22 to 47
10	16QAM	12	26 to 33	26 to 43	26 to 57
10	32QAM	15	32 to 40	32 to 54	33 to 70
10	64QAM	19	40 to 51	41 to 68	41 to 89
10	128QAM	22	47 to 60	48 to 79	48 to 104
20	QPSK Strong	11	23 to 30	23 to 39	24 to 51
20	QPSK	13	28 to 36	28 to 47	29 to 62
20	16QAM Strong	22	48 to 60	48 to 80	49 to 105
20	16QAM	27	56 to 71	57 to 94	57 to 123
20	32QAM	33	70 to 89	71 to 118	72 to 154
20	64QAM	42	88 to 112	89 to 148	90 to 193
20	128QAM	50	105 to 133	106 to 175	107 to 229
20	256QAM	56	118 to 150	119 to 198	120 to 258
30	QPSK Strong	17	37 to 47	38 to 62	38 to 82
30	QPSK	20	44 to 55	44 to 73	45 to 96
30	16QAM Strong	36	76 to 96	76 to 127	77 to 166
30	16QAM	42	88 to 112	89 to 148	90 to 194
30	32QAM	54	113 to 143	114 to 189	115 to 247
30	64QAM	67	140 to 177	141 to 234	143 to 306

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
30	128QAM	75	165 to 210	167 to 277	169 to 362
30	256QAM	75	183 to 232	185 to 307	187 to 401
30	512QAM	75	194 to 246	196 to 325	198 to 425
30	512QAM Light	75	208 to 263	210 to 348	212 to 455
30	1024QAM	75	221 to 281	224 to 371	226 to 484
30	1024QAM Light	75	232 to 295	235 to 389	237 to 508
40	QPSK Strong	24	50 to 64	51 to 85	51 to 111
40	QPSK	28	59 to 75	60 to 99	60 to 129
40	16QAM Strong	49	102 to 130	103 to 171	104 to 224
40	16QAM	58	121 to 154	122 to 203	124 to 265
40	32QAM	73	153 to 193	154 to 255	156 to 334
40	64QAM	75	188 to 239	190 to 315	192 to 412
40	128QAM	75	223 to 282	225 to 373	227 to 487
40	256QAM	75	250 to 317	253 to 418	255 to 547
40	512QAM	75	262 to 332	265 to 438	267 to 573
40	512QAM Light	75	280 to 355	283 to 469	286 to 613
40	1024QAM	75	298 to 378	302 to 499	305 to 653
40	1024QAM Light	75	313 to 397	317 to 524	320 to 685
50	QPSK Strong	30	64 to 81	64 to 107	65 to 140
50	QPSK	35	75 to 95	75 to 125	76 to 164
50	16QAM Strong	61	129 to 163	130 to 216	132 to 282
50	16QAM	71	151 to 191	152 to 252	154 to 330

Channel Spacing (MHz, FCC)	Modulation Scheme	Maximum Number of T1s/E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)		
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)
50	32QAM	75	191 to 242	193 to 319	195 to 417
50	64QAM	75	238 to 301	240 to 397	242 to 519
50	128QAM	75	281 to 356	284 to 470	287 to 614
50	256QAM	75	317 to 402	321 to 531	324 to 694
50	512QAM	75	330 to 418	334 to 552	337 to 722
50	512QAM Light	75	353 to 447	357 to 591	360 to 772
50	1024QAM	75	376 to 477	380 to 629	384 to 822
50	1024QAM Light	75	395 to 500	399 to 661	403 to 863

3.8.7.2 Receiver Sensitivity (ISV3 Board)

This section describes the receiver sensitivity of the ISV3 board.

3.8.7.2.1 Receiver Sensitivity (IS3 Running Mode)

The OptiX RTN 950A running in IS3 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

SDH Microwave (IS3 mode)

Table 3-339 Typical receiver sensitivity of the SDH microwave (IS3 mode)

Item	Performance	
	1xSTM-1	2xSTM-1
	28MHz/128QAM	56MHz/128QAM
RSL@ BER = 10^{-6} (dBm)		

Item	Performance	
	1xSTM-1	2xSTM-1
	28MHz/128QAM	56MHz/128QAM
@6 GHz	-72.5	-69.5
@7 GHz	-72.5	-69.5
@8 GHz	-72.5	-69.5
@7&8GHz(XMC-3W ODU)	-71.5	-68.5
@10 GHz	-72	-69
@10.5 GHz	-70	N/A
@11 GHz	-72	-69
@13GHz(XMC-3W ODU)	-71	-68
@13 GHz	-72	-69
@15 GHz(XMC-3W ODU)	-71	-68
@15 GHz	-72	-69
@18GHz(XMC-3W ODU)	-70.5	-67.5
@18 GHz	-71.5	-68.5
@23 GHz(XMC-3W ODU)	-70.5	-67.5
@23 GHz	-71.5	-68.5
@26 GHz	-71	-68
@28 GHz	-70.5	-67.5
@32 GHz	-70	-67
@38 GHz	-69.5	-66.5
@42 GHz	-68	-65

NOTE
Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.

Integrated IP Microwave (IS3 mode)

Table 3-340 Typical receiver sensitivity of the Integrated IP microwave I (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 3.5 MHz)	
	QPSK	16QAM
RSL@ BER = 10^{-6} (dBm)		
@7 GHz	-96.00	-89.50
@8 GHz	-96.00	-89.50
@7&8GHz(XMC-3W ODU)	-95.00	-88.50
@11 GHz	-95.5	-88.5
@13GHz(XMC-3W ODU)	-94.5	-87.5
@13 GHz	-95.5	-88.5
@15 GHz(XMC-3W ODU)	-94	-87.5
@15 GHz	-95	-88.5
@18GHz(XMC-3W ODU)	-93.5	-87
@18 GHz	-94.5	-88
@23 GHz(XMC-3W ODU)	-93.5	-87
@23 GHz	-94.5	-88
@26 GHz	-94	-87.5
@28 GHz	-93.5	-87
@32 GHz	-93	-86.5
@38 GHz	-93	-86.5

Table 3-341 Typical receiver sensitivity of the Integrated IP microwave II (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79
@11 GHz	-95.5	-93.5	-89	-87	-84	-81
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@13 GHz	-95.5	-93.5	-89	-87	-84	-81
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80
@15 GHz	-95.5	-93.5	-89	-87	-84	-81
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77

Table 3-342 Typical receiver sensitivity of the Integrated IP microwave III (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-78.5	-75.5	-73.5	-72	-70

Item	Performance (Channel Spacing: 7 MHz)				
	128QAM	**256QAM**	**512QAM**	**512QAM Light**	**1024QAM**
@7 GHz	-78.5	-75.5	-73.5	-72	-70
@8 GHz	-78.5	-75.5	73.5	-72	-70
@7&8 GHz(XMC-3W)	-77.5	-74.5	-72.5	-71	-69
@10 GHz	-78	-75	-73	-71.5	-69.5
@10.5 GHz	-76	-73	-71	-69.5	-67.5
@11 GHz	-78	-75	-73	-71.5	-69.5
@13GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@13 GHz	-78	-75	-73	-71.5	-69.5
@15 GHz(XMC-3W)	-77	-74	-72	-70.5	-68.5
@15 GHz	-78	-75	-73	-71.5	-69.5
@18GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68
@18 GHz	-77.5	-74.5	-72.5	-71	-69
@23 GHz(XMC-3W)	-76.5	-73.5	-71.5	-70	-68
@23 GHz	-77.5	-74.5	-72.5	-71	-69
@26 GHz	-77	-74	-72	-70.5	-68.5
@28 GHz	-76.5	-73.5	-71.5	N/A	N/A
@32 GHz	-76	-73	-71	-69.5	N/A
@38 GHz	-75.5	-72.5	-70.5	-69	N/A
@42 GHz	-74	-71	-69	-67.5	N/A

Table 3-343 Typical receiver sensitivity of the Integrated IP microwave IV (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK Strong	**QPSK**	**16QAM Strong**	**16QAM**	**32QAM**	**64QAM**
RSL@ BER = 10^{-6} (dBm)						

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76
@11 GHz	-93.5	-91.5	-86	-84	-81	-78
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@13 GHz	-93.5	-91.5	-86	-84	-81	-78
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77
@15 GHz	-93.5	-91.5	-86	-84	-81	-78
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74

Table 3-344 Typical receiver sensitivity of the Integrated IP microwave V (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@8 GHz	-75.5	-72.5	-70.5	-69	-67	-65.5
@7&8 GHz(XMC-3W)	-74.5	-71.5	-69.5	-68	-66	-64.5
@10 GHz	-75	-72	-70	-68.5	-66.5	-65
@10.5 GHz	-73	-70	-68	-66.5	-64.5	-63
@11 GHz	-75	-72	-70	-68.5	-66.5	-65
@13GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@13 GHz	-75	-72	-70	-68.5	-66.5	-65
@15 GHz(XMC-3W)	-74	-71	-69	-67.5	-65.5	-64
@15 GHz	-75	-72	-70	-68.5	-66.5	-65
@18GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@18 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@23 GHz(XMC-3W)	-73.5	-70.5	-68.5	-67	-65	-63.5
@23 GHz	-74.5	-71.5	-69.5	-68	-66	-64.5
@26 GHz	-74	-71	-69	-67.5	-65.5	-64
@28 GHz	-73.5	-70.5	-68.5	-67	-65	N/A
@32 GHz	-73	-70	-68	-66.5	-64.5	N/A
@38 GHz	-72.5	-69.5	-67.5	-66	-64	N/A
@42 GHz	-71	-68	-66	-64.5	-62.5	N/A

Table 3-345 Typical receiver sensitivity of the Integrated IP microwave VI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-346 Typical receiver sensitivity of the Integrated IP microwave VII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@8 GHz	-72.5	-69.5	-67.5	-66	-64	-62.5	-61
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@10 GHz	-72	-69	-67	-65.5	-63.5	-62	N/A
@10.5 GHz	-70	-67	-65	-63.5	-61.5	-60	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@13 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5	-61	-59.5
@15 GHz	-72	-69	-67	-65.5	-63.5	-62	-60.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@23 GHz	-71.5	-68.5	-66.5	-65	-63	-61.5	-60
@26 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@28 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@32 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@38 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@42 GHz	-68	-65	-63	-61.5	-59.5	-58	N/A

Table 3-347 Typical receiver sensitivity of the Integrated IP microwave VIII (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-348 Typical receiver sensitivity of the Integrated IP microwave IX (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@7&8 GHz(XMC-3W)	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@10 GHz	-69	-66	-64	-62.5	-60.5	-59	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@13 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@15 GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58	-56.5
@15 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@23 GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@26 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@28 GHz	-67.5	-64.5	-62.5	-61	-59	-57.5	-56
@32 GHz	-67	-64	-62	-60.5	-58.5	-57	-55.5
@38 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	-55
@42 GHz	-65	-62	-60	-58.5	-56.5	-55	N/A

Table 3-349 Typical receiver sensitivity of the Integrated IP microwave X (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-350 Typical receiver sensitivity of the Integrated IP microwave XI (IS3 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)						
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light	2048QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@8 GHz	-71	-68	-66	-64.5	-62.5	-61	-59.5
@7&8 GHz(XMC -3W)	-70	-67	-65	-63.5	-61.5	-60	-58.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	N/A
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@13 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@15 GHz(XMC -3W)	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@15 GHz	-70.5	-67.5	-65.5	-64	-62	-60.5	-59
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@18 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@23 GHz(XMC -3W)	-69	-66	-64	-62.5	-60.5	-59	-57.5
@23 GHz	-70	-67	-65	-63.5	-61.5	-60	-58.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5	-58
@28 GHz	-69	-66	-64	-62.5	-60.5	-59	-57.5
@32 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5	-57
@38 GHz	-68	-65	-63	-61.5	-59.5	-58	-56.5
@42 GHz	-66.5	-63.5	-61.5	-60	-58	-56.5	N/A

Table 3-351 Typical receiver sensitivity of the Integrated IP microwave XII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 7 MHz)						
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM
RSL@ BER = 10^{-6} (dBm)							
@6 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@8 GHz	-96	-94	-89.5	-87.5	-84.5	-81.5	-78.5
@7&8 GHz(XMC-3W)	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@10 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@10.5 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@11 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@13GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@13 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@15 GHz(XMC-3W)	-94.5	-92.5	-88	-86	-83	-80	-77
@15 GHz	-95.5	-93.5	-89	-87	-84	-81	-78
@18GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@18 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@23 GHz(XMC-3W)	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@23 GHz	-95	-93	-88.5	-86.5	-83.5	-80.5	-77.5
@26 GHz	-94.5	-92.5	-88	-86	-83	-80	-77
@28 GHz	-94	-92	-87.5	-85.5	-82.5	-79.5	-76.5
@32 GHz	-93.5	-91.5	-87	-85	-82	-79	-76
@38 GHz	-93	-91	-86.5	-84.5	-81.5	-78.5	-75.5
@42 GHz	-91.5	-89.5	-85	-83	-80	-77	-74

Table 3-352 Typical receiver sensitivity of the Integrated IP microwave XIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 14 MHz)							
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER = 10^{-6} (dBm)								
@6 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@8 GHz	-94	-92	-86.5	-84.5	-81.5	-78.5	-75.5	-72.5
@7&8 GHz(XMC-3W)	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@10 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@10.5 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@11 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@13GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@13 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@15 GHz(XMC-3W)	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@15 GHz	-93.5	-91.5	-86	-84	-81	-78	-75	-72
@18GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@18 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@23 GHz(XMC-3W)	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@23 GHz	-93	-91	-85.5	-83.5	-80.5	-77.5	-74.5	-71.5
@26 GHz	-92.5	-90.5	-85	-83	-80	-77	-74	-71
@28 GHz	-92	-90	-84.5	-82.5	-79.5	-76.5	-73.5	-70.5
@32 GHz	-91.5	-89.5	-84	-82	-79	-76	-73	-70
@38 GHz	-91	-89	-83.5	-81.5	-78.5	-75.5	-72.5	-69.5
@42 GHz	-89.5	-87.5	-82	-80	-77	-74	-71	-68

Table 3-353 Typical receiver sensitivity of the Integrated IP microwave XIV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@8 GHz	-90.5	-89	-83.5	-82	-79	-75.5
@7&8 GHz(XMC-3W)	-89.5	-88	-82.5	-81	-78	-74.5
@10 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@10.5 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@11 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@13GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@13 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@15 GHz(XMC-3W)	-89	-87.5	-82	-80.5	-77.5	-74
@15 GHz	-90	-88.5	-83	-81.5	-78.5	-75
@18GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@18 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@23 GHz(XMC-3W)	-88.5	-87	-81.5	-80	-77	-73.5
@23 GHz	-89.5	-88	-82.5	-81	-78	-74.5
@26 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@28 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@32 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@38 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@42 GHz	-86	-84.5	-79	-77.5	-74.5	-71

Table 3-354 Typical receiver sensitivity of the Integrated IP microwave XV (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-72.5	-69.5	-67.5	-66	-64
@7 GHz	-72.5	-69.5	-67.5	-66	-64
@8 GHz	-72.5	-69.5	-67.5	-66	-64
@7&8 GHz(XMC-3W)	-71.5	-68.5	-66.5	-65	-63
@10 GHz	-72	-69	-67	-65.5	N/A
@10.5 GHz	-70	-67	-65	-63.5	N/A
@11 GHz	-72	-69	-67	-65.5	-63.5
@13GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@13 GHz	-72	-69	-67	-65.5	-63.5
@15 GHz(XMC-3W)	-71	-68	-66	-64.5	-62.5
@15 GHz	-72	-69	-67	-65.5	-63.5
@18GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@18 GHz	-71.5	-68.5	-66.5	-65	-63
@23 GHz(XMC-3W)	-70.5	-67.5	-65.5	-64	-62
@23 GHz	-71.5	-68.5	-66.5	-65	-63
@26 GHz	-71	-68	-66	-64.5	N/A
@28 GHz	-70.5	-67.5	-65.5	N/A	N/A
@32 GHz	-70	-67	-65	N/A	N/A
@38 GHz	-69.5	-66.5	-64.5	N/A	N/A
@42 GHz	-68	-65	-63	N/A	N/A

Table 3-355 Typical receiver sensitivity of the Integrated IP microwave XVI (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@8 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@7&8 GHz(XMC-3W)	-86.5	-85	-79.5	-78	-75	-71.5
@10 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@13GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@13 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@15 GHz(XMC-3W)	-86	-84.5	-79	-77.5	-74.5	-71
@15 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@18GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@18 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@23 GHz(XMC-3W)	-85.5	-84	-78.5	-77	-74	-70.5
@23 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@26 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@28 GHz	-85.5	-84	-78.5	-77	-74	-70.5
@32 GHz	-85	-83.5	-78	-76.5	-73.5	-70
@38 GHz	-84.5	-83	-77.5	-76	-73	-69.5
@42 GHz	-83	-81.5	-76	-74.5	-71.5	-68

Table 3-356 Typical receiver sensitivity of the Integrated IP microwave XVII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	128QAM	256QAM	512QAM	512QAM Light	1024QAM	1024QAM Light
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@8 GHz	-69.5	-66.5	-64.5	-63	-61	-59.5
@7&8 GHz(XMC-3W)	-68.5	-65.5	-63.5	-62	-60	-58.5
@10 GHz	-69	-66	-64	-62.5	-60.5	-59
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-69	-66	-64	-62.5	-60.5	-59
@13GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@13 GHz	-69	-66	-64	-62.5	-60.5	-59
@15 GHz(XMC-3W)	-68	-65	-63	-61.5	-59.5	-58
@15 GHz	-69	-66	-64	-62.5	-60.5	-59
@18GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@18 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@23 GHz(XMC-3W)	-67.5	-64.5	-62.5	-61	-59	-57.5
@23 GHz	-68.5	-65.5	-63.5	-62	-60	-58.5
@26 GHz	-68	-65	-63	-61.5	-59.5	-58
@28 GHz	-67.5	-64.5	-62.5	-61	N/A	N/A
@32 GHz	-67	-64	-62	-60.5	N/A	N/A
@38 GHz	-66.5	-63.5	-61.5	-60	N/A	N/A
@42 GHz	-65	-62	-60	-58.5	N/A	N/A

Table 3-357 Typical receiver sensitivity of the Integrated IP microwave XVIII (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK Strong	QPSK	16QAM Strong	16QAM	32QAM	64QAM
RSL@ BER = 10^{-6} (dBm)						
@6 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@8 GHz	-89	-87.5	-82	-80.5	-77.5	-74
@7&8 GHz(XMC-3W)	-88	-86.5	-81	-79.5	-76.5	-73
@10 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@13GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@13 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@15 GHz(XMC-3W)	-87.5	-86	-80.5	-79	-76	-72.5
@15 GHz	-88.5	-87	-81.5	-80	-77	-73.5
@18GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@18 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@23 GHz(XMC-3W)	-87	-85.5	-80	-78.5	-75.5	-72
@23 GHz	-88	-86.5	-81	-79.5	-76.5	-73
@26 GHz	-87.5	-86	-80.5	-79	-76	-72.5
@28 GHz	-87	-85.5	-80	-78.5	-75.5	-72
@32 GHz	-86.5	-85	-79.5	-78	-75	-71.5
@38 GHz	-86	-84.5	-79	-77.5	-74.5	-71
@42 GHz	-84.5	-83	-77.5	-76	-73	-69.5

Table 3-358 Typical receiver sensitivity of the Integrated IP microwave XIX (IS3 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)				
	128QAM	256QAM	512QAM	512QAM Light	1024QAM
RSL@ BER = 10^{-6} (dBm)					
@6 GHz	-71	-68	-66	-64.5	-62.5
@7 GHz	-71	-68	-66	-64.5	-62.5
@8 GHz	-71	-68	-66	-64.5	-62.5
@7&8 GHz(XMC-3W)	-70	-67	-65	-63.5	-61.5
@10 GHz	-70.5	-67.5	-65.5	-64	-62
@10.5 GHz	N/A	N/A	N/A	N/A	N/A
@11 GHz	-70.5	-67.5	-65.5	-64	-62
@13GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@13 GHz	-70.5	-67.5	-65.5	-64	-62
@15 GHz(XMC-3W)	-69.5	-66.5	-64.5	-63	-61
@15 GHz	-70.5	-67.5	-65.5	-64	-62
@18GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@18 GHz	-70	-67	-65	-63.5	-61.5
@23 GHz(XMC-3W)	-69	-66	-64	-62.5	-60.5
@23 GHz	-70	-67	-65	-63.5	-61.5
@26 GHz	-69.5	-66.5	-64.5	-63	-61
@28 GHz	-69	-66	-64	-62.5	N/A
@32 GHz	-68.5	-65.5	-63.5	-62	N/A
@38 GHz	-68	-65	-63	-61.5	N/A
@42 GHz	-66.5	-63.5	-61.5	-60	N/A

3.8.7.2.2 Receiver Sensitivity (IS2 Running Mode)

The OptiX RTN 950A running in IS2 mode supports SDH microwave work modes and Integrated IP microwave work modes.

NOTE

- Unless otherwise specified (for example, XMC-3W ODU), the receiver sensitivity values in the following tables do not vary with the ODU type, although different types of ODUs may use different frequency bands and modulation schemes.
- N/A means that microwave working mode is not supported.

NOTE

- For an XMC-2 ODU at the 18 GHz frequency band, when the IF board works in IS2 running mode, remove 2 dB from the sensitivity values specified in the table.
- For an XMC-2 ODU at the 38 GHz frequency band, when the IF board works in IS2 running mode and the XPIC function is enabled, remove 2 dB from the sensitivity value specified in the table when the working mode is 28MHz/256QAM.

SDH Microwave (IS2 mode)

Table 3-359 Typical receiver sensitivity of the SDH microwave (IS2 mode, XPIC disabled)

Item	Performance	
	1xSTM-1	2xSTM-1
	128QAM/28 MHz	128QAM/56 MHz
RSL@ BER = 10^{-6} (dBm)		
@6 GHz	-71	-68
@7 GHz	-71	-68
@8 GHz	-71	-68
@10 GHz	-70.5	-67.5
@10.5 GHz	-68.5	N/A
@11 GHz	-70.5	-67.5
@13 GHz	-70.5	-67.5
@15 GHz	-70.5	-67.5
@18 GHz	-70.5	-67.5
@23 GHz	-70	-67
@26 GHz	-69.5	-66.5
@28 GHz	-69	-66
@32 GHz	-68.5	-65.5
@38 GHz	-68	-65
@42 GHz	-66.5	-63.5

Item	Performance	
	1xSTM-1	2xSTM-1
	128QAM/28 MHz	128QAM/56 MHz
NOTE Working in SDH service mode, its receiver sensitivity values do not change according to the XPIC enabled/disabled state.		

Integrated IP Microwave (IS2 mode)

Table 3-360 Typical receiver sensitivity of the Integrated IP microwave I (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@7 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@8 GHz	-92.5	-86.5	-82.5	-80	-77	-74
@10 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@10.5 GHz	-90	-84	-80	-77.5	-74.5	-71.5
@11 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@13 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@15 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@18 GHz	-92	-86	-82	-79.5	-76.5	-73.5
@23 GHz	-91.5	-85.5	-81.5	-79	-76	-73
@26 GHz	-91	-85	-81	-78.5	-75.5	-72.5
@28 GHz	-90.5	-84.5	-80.5	-78	-75	-72
@32 GHz	-90	-84	-80	-77.5	-74.5	-71.5
@38 GHz	-89.5	-83.5	-79.5	-77	-74	-71
@42 GHz	-88	-82	-78	-75.5	-72.5	-69.5

Table 3-361 Typical receiver sensitivity of the Integrated IP microwave II (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@7 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@8 GHz	-90.5	-83.5	-79.5	-77	-74	-71
@10 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@10.5 GHz	-88	-81	-77	-74.5	-71.5	-68.5
@11 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@13 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@15 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@18 GHz	-90	-83	-79	-76.5	-73.5	-70.5
@23 GHz	-89.5	-82.5	-78.5	-76	-73	-70
@26 GHz	-89	-82	-78	-75.5	-72.5	-69.5
@28 GHz	-88.5	-81.5	-77.5	-75	-72	-69
@32 GHz	-88	-81	-77	-74.5	-71.5	-68.5
@38 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@42 GHz	-86	-79	-75	-72.5	-69.5	-66.5

Table 3-362 Typical receiver sensitivity of the Integrated IP microwave III (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@7 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@8 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@10 GHz	-87	-80	-76	-73.5	-70.5	-67.5

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@10.5 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@11 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@13 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@15 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@18 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@23 GHz	-86.5	-79.5	-75.5	-73	-70	-67
@26 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@28 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@32 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@38 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@42 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Table 3-363 Typical receiver sensitivity of the Integrated IP microwave IV (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@7 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@8 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@10 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@13 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@15 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@18 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@23 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@26 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@28 GHz	-82.5	-75.5	-71.5	-69	-66	-63
@32 GHz	-82	-75	-71	-68.5	-65.5	-62.5
@38 GHz	-81.5	-74.5	-70.5	-68	-65	-62
@42 GHz	-80	-73	-69	-66.5	-63.5	-60.5

Table 3-364 Typical receiver sensitivity of the Integrated IP microwave V (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@7 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@8 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@10 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@13 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@15 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@18 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@23 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@26 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@28 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@32 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@38 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@42 GHz	-81.5	-74.5	-70.5	-68	-65	-62

Table 3-365 Typical receiver sensitivity of the Integrated IP microwave VI (IS2 mode, XPIC disabled)

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@18 GHz	-85	-77	-73.5	-71	-68	-65
@23 GHz	-86	-78	-74.5	-72	-69	-66

Table 3-366 Typical receiver sensitivity of the Integrated IP microwave VII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 7 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@7 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@8 GHz	-92.5	-86.5	-82.5	-79.5	N/A	N/A
@10 GHz	-92	-86	-82	-79	N/A	N/A
@10.5 GHz	-90	-84	-80	-77	N/A	N/A
@11 GHz	-92	-86	-82	-79	N/A	N/A
@13 GHz	-92	-86	-82	-79	N/A	N/A
@15 GHz	-92	-86	-82	-79	N/A	N/A
@18 GHz	-92	-86	-82	-79	N/A	N/A
@23 GHz	-91.5	-85.5	-81.5	-78.5	N/A	N/A
@26 GHz	-91	-85	-81	N/A	N/A	N/A
@28 GHz	-90.5	-84.5	-80.5	N/A	N/A	N/A
@32 GHz	-90	-84	-80	N/A	N/A	N/A
@38 GHz	-89.5	-83.5	-79.5	N/A	N/A	N/A
@42 GHz	-88	-82	-78	N/A	N/A	N/A

Table 3-367 Typical receiver sensitivity of the Integrated IP microwave VIII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 14 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@7 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@8 GHz	-90.5	-83.5	-79.5	-76.5	-73.5	N/A
@10 GHz	-90	-83	-79	-76	-73	N/A
@10.5 GHz	-88	-81	-77	-74	-71	N/A
@11 GHz	-90	-83	-79	-76	-73	N/A
@13 GHz	-90	-83	-79	-76	-73	N/A
@15 GHz	-90	-83	-79	-76	-73	N/A
@18 GHz	-90	-83	-79	-76	-73	N/A
@23 GHz	-89.5	-82.5	-78.5	-75.5	-72.5	N/A
@26 GHz	-89	-82	-78	-75	N/A	N/A
@28 GHz	-88.5	-81.5	-77.5	-74.5	N/A	N/A
@32 GHz	-88	-81	-77	-74	N/A	N/A
@38 GHz	-87.5	-80.5	-76.5	-73.5	N/A	N/A
@42 GHz	-86	-79	-75	-72	N/A	N/A

Table 3-368 Typical receiver sensitivity of the Integrated IP microwave IX (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@7 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@8 GHz	-87.5	-80.5	-76.5	-74	-71	-68
@10 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@10.5 GHz	-85	-78	-74	-71.5	-68.5	-65.5

Item	Performance (Channel Spacing: 28 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@11 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@13 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@15 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@18 GHz	-87	-80	-76	-73.5	-70.5	-67.5
@23 GHz	-86.5	-79.5	-75.5	-73	-70	-67
@26 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@28 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@32 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@38 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@42 GHz	-83	-76	-72	-69.5	-66.5	-63.5

Table 3-369 Typical receiver sensitivity of the Integrated IP microwave X (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@7 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@8 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@10 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@13 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@15 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@18 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@23 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@26 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@28 GHz	-82.5	-75.5	-71.5	-69	-66	-63
@32 GHz	-82	-75	-71	-68.5	-65.5	-62.5

Item	Performance (Channel Spacing: 56 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@38 GHz	-81.5	-74.5	-70.5	-68	-65	-62
@42 GHz	-80	-73	-69	-66.5	-63.5	-60.5

Table 3-370 Typical receiver sensitivity of the Integrated IP microwave XI (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 40 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						
@6 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@7 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@8 GHz	-86	-79	-75	-72.5	-69.5	-66.5
@10 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@10.5 GHz	N/A	N/A	N/A	N/A	N/A	N/A
@11 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@13 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@15 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@18 GHz	-85.5	-78.5	-74.5	-72	-69	-66
@23 GHz	-85	-78	-74	-71.5	-68.5	-65.5
@26 GHz	-84.5	-77.5	-73.5	-71	-68	-65
@28 GHz	-84	-77	-73	-70.5	-67.5	-64.5
@32 GHz	-83.5	-76.5	-72.5	-70	-67	-64
@38 GHz	-83	-76	-72	-69.5	-66.5	-63.5
@42 GHz	-81.5	-74.5	-70.5	-68	-65	-62

Table 3-371 Typical receiver sensitivity of the Integrated IP microwave XII (IS2 mode, XPIC)

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
RSL@ BER=10^{-6} (dBm)						

Item	Performance (Channel Spacing: 50 MHz)					
	QPSK	16QAM	32QAM	64QAM	128QAM	256QAM
@18 GHz	-85	-77	-73.5	-71	-68	-65
@23 GHz	-86	-78	-74.5	-72	-69	-66

3.8.7.3 IF Performance

The IF performance includes the performance of the IF signal and the performance of the ODU O&M signal.

Table 3-372 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	350
	Receive frequency of the IF board (MHz)	140
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

3.8.7.4 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 3-373 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	Low-density parity check code (LDPC) encoding.
Adaptive time-domain equalizer for baseband signals	Supported.

3.8.7.5 Mechanical Behaviors and Power Consumption

An ISV3 board occupies one slot. Its power consumption is less than 23 W.

Mechanical Behaviors and Power Consumption

Table 3-374 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.65 kg
Power consumption	< 23 W

3.9 ISU2

The ISU2 is a universal IF board that supports the Integrated IP microwave mode and SDH radio mode at the same time. The ISU2 uses the DC-I power distribution mode.

3.9.1 Version Description

The functional version of the ISU2 is SL91.

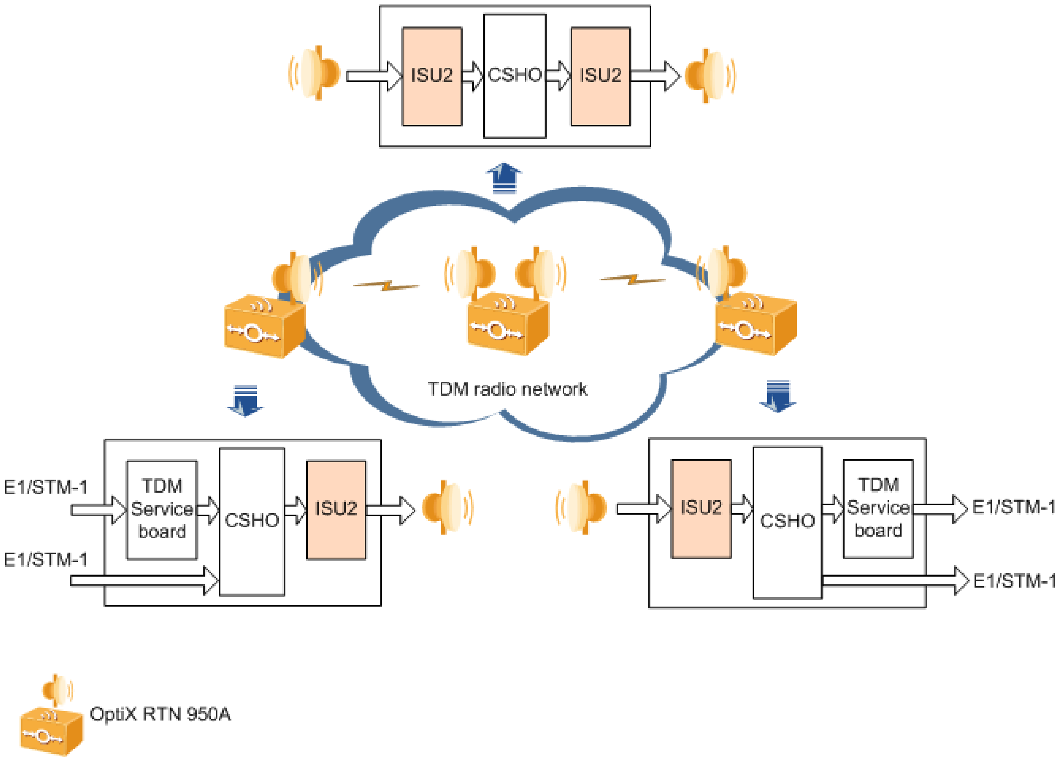
3.9.2 Application

ISU2 boards function as SDH IF boards to transmit SDH radio services, or as Integrated IP microwave IF boards to transmit Integrated IP microwave services (native E1+Ethernet or native STM-1+Ethernet).

Functioning as SDH IF Boards

If applied to OptiX RTN 950A NEs building TDM radio networks, ISU2 boards function as large-capacity SDH IF boards to transmit TDM services.

Figure 3-62 Application scenario of ISU2 boards (1)



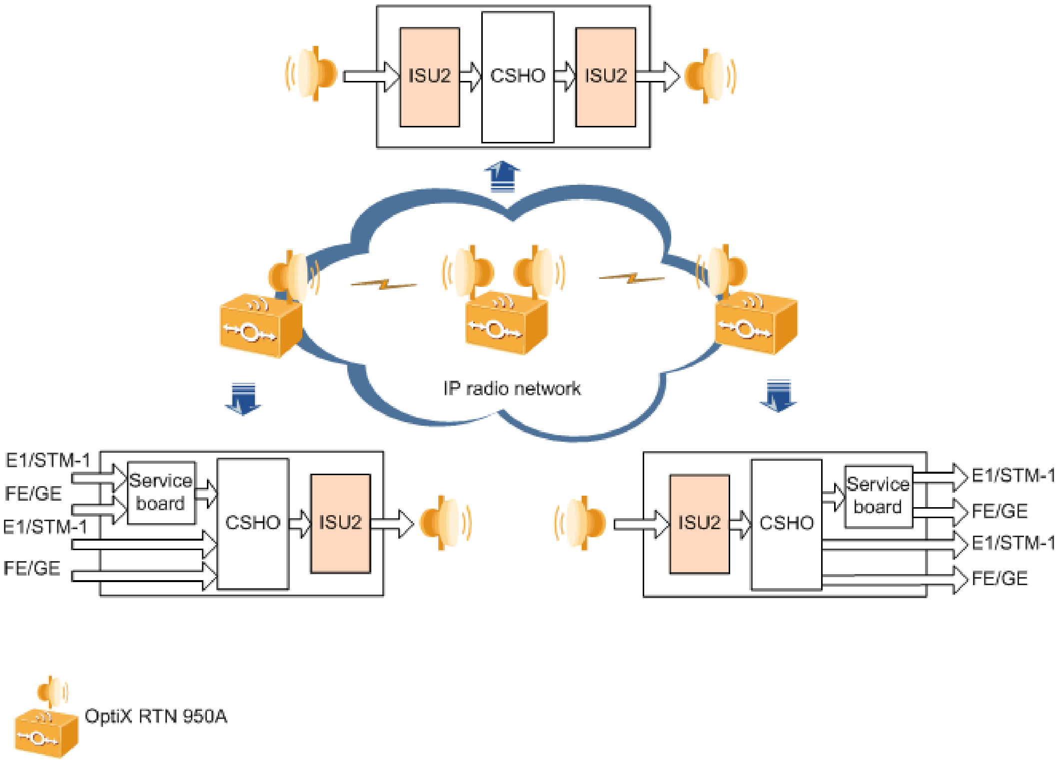
NOTE

- When working in SDH radio mode, ISU2 boards transmit 1xSTM-1 or 2xSTM-1 SDH radio services.
- If a TDM radio network needs to transmit a small number of FE/GE services, these services must be encapsulated into TDM services by EMS6/EFP8 boards before being transmitted.

Functioning as Integrated IP microwave IF Boards

ISU2 boards apply to OptiX RTN 950A NEs to transmit native E1 services, native STM-1 services, native Ethernet services, native MPLS/PWE3 services, or a combination of these services over Integrated IP microwave.

Figure 3-63 Application scenario of ISU2 boards (2)



NOTE

- In the preceding figure, if transmitted over Integrated IP microwave, E1 services can be native E1 services or CES/ATM E1 services, Ethernet services can be native Ethernet services or ETH PWE3 services, and STM-1 services must be native STM-1 services.
- ISU2 boards transmit native E1 services only when these boards work in native E1+Ethernet mode, and transmit native STM-1 services only when these boards work in native STM-1+Ethernet mode.
- Service boards shown in the preceding figure can be Ethernet interface boards, STM-1 interface boards, E1 interface boards, or Smart E1 processing boards.

3.9.3 Functions and Features

The ISU2 receives and transmits one channel of IF signal, and provides a management channel and -48 V power supply to the ODU.

Table 3-375 lists the functions and features that the ISU2 supports. The ISU2 needs to work with the packet switching unit to implement Ethernet service functions.

Table 3-375 Functions and features that the ISU2 supports

Function and Feature	Description
Basic functions	● Receives and transmits one channel of IF signal. ● Provides a management channel to the ODU. ● Supplies the required -48 V power to the ODU.

Function and Feature		Description
Microwave type		● Integrated IP microwave ● SDH microwave **NOTE** The Integrated IP microwave is compatible with the Hybrid microwave and the Packet microwave.
Service categories in Integrated IP microwave mode		● Native E1 + Ethernet ● Native STM-1 + Ethernet **NOTE** Ethernet services can be native Ethernet services or PWE3-encapsulated packet services.
Service categories in SDH microwave mode		● STM-1 ● 2xSTM-1
Backplane bus bandwidth		1 Gbit/s
ATPC		Supported
AM		Supported only in Integrated IP microwave mode
Ethernet frame header compression		Supported
E1 priority		Supported only in Integrated IP microwave mode with native TDM services being E1 services
Microwave working mode		See **Technical specifications of the ISU2**
Link-level protection	1+1 HSB/FD/SD protection	Supported
	N+1 protection	Supported
	LAG protection at air interfaces	Supported
	PLA/EPLA	Supported **NOTE** EPLA is available only when the ISU2 works with the CSHOF boards.
TDM service protection		SNCP
K byte pass-through		Supported
Ethernet service functions		See **Table 3-376**.
MPLS functions		See the description of Multiprotocol label switching (MPLS)/Pseudo wire emulation edge-to-edge (PWE3) functions provided in the section for the system control, switching, and timing board.
PWE3 functions		

Function and Feature		Description
License	Air-interface capacity license	Supported
	AM license	Supported
Clock	Physical layer synchronization	Clock at the air interface
	Physical-layer clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the SSM protocol ● Protection by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.
	Packet frequency synchronization	Not supported
Data communication network (DCN)	Inband DCN	Supported
	Outband DCN	● Supports one DCC that is composed of three DCC bytes for each channel in Integrated IP microwave mode. ● Supports one DCC that is composed of D1-D3 bytes, D4-D12 bytes, or D1-D12 bytes for each channel in SDH microwave mode.
O&M	Loopback	Supports the following loopback types: ● Inloops and outloops at IF ports ● Inloops and outloops at MUX ports
	Cold reset and warm reset	Supported
	In-service FPGA loading	Supported
	PRBS BER test at IF ports	Supported
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported

Function and Feature		Description
	Board temperature monitoring	Supported
	Board power monitoring	Supported

Table 3-376 Ethernet service functions

Function and Feature		Description
Services	Native Ethernet services	● E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links ● E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	● E-Line services carried by PWs ● E-Aggr services carried by PWs ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
ERPS		Supports the ERPS function that complies with ITU-T G.8032 v1/v2.
Smart Ethernet protection (SEP)		Supported
OAM		● Supports IEEE 802.1ag-compliant ETH-OAM function. ● Supports IEEE 802.3ah-compliant ETH-OAM function. ● Supports packet loss, delay, and delay variation measurement functions that comply with ITU-T Y. 1731.
LAG		Supported
Spanning tree protocol		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).

Function and Feature	Description
Quality of service (QoS) functions	See the description of QoS functions provided in the section for the system control, switching, and timing board.
RMON	Supported

3.9.4 Working Principle and Signal Flow

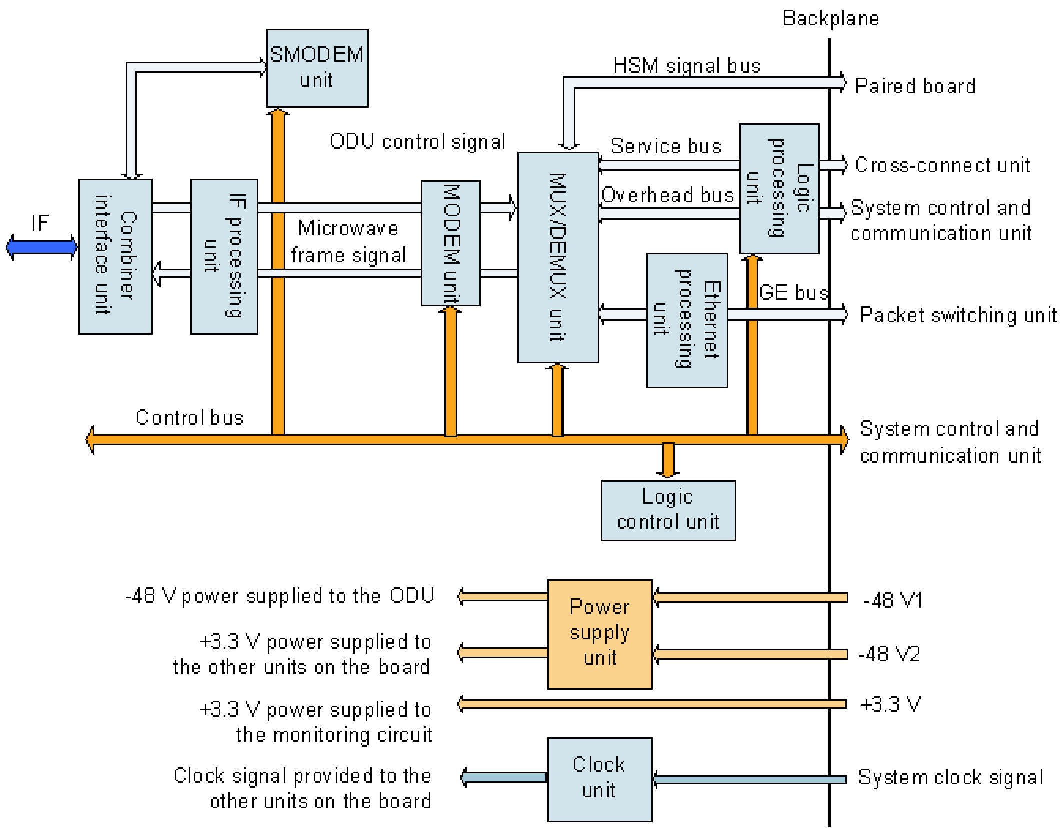
This section describes how to process one IF signal in Integrated IP microwave mode, and it serves as an example to describe the working principle and signal flow of the ISU2.

NOTE

The ISU2 adopts the same principle to process signals transmitted/received in Integrated IP microwave mode and signals transmitted/received in SDH radio mode. The difference is with regard to the microwave frame structure and processed service categories.

Functional Block Diagram

Figure 3-64 Functional block diagram of the ISU2



Signal Processing in the Receive Direction

Table 3-377 Signal processing in the receive direction of the ISU2

Step	Function Unit	Processing Flow
1	Combiner interface unit	Divides the received IF signals into ODU control signals and microwave service signals.
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits the ODU control signals to the system control and communication unit.
3	IF processing unit	● Filters signals. ● Performs A/D conversion.
4	MODEM unit	● Performs digital demodulation. ● Performs time domain adaptive equalization. ● Performs FEC decoding and generates specific alarms.
5	MUX/DEMUX unit	● Detects microwave frame headers and generates specific alarms and performance events. ● Verifies parity bits in microwave frames and generates specific alarms and performance events. ● Checks link IDs in microwave frames and generates specific alarms and performance events. ● Detects changes in ATPC messages and returned microwave messages and reports the changes to the system control and communication unit over the control bus. ● Extracts orderwire bytes, auxiliary channel bytes including F1 and SERIAL bytes, and DCC bytes in microwave frames and transmits to the logic processing unit. ● Maps E1 service signals to the specific positions in VC-4s and then transmits the VC-4s to the logic processing unit, if native TDM services in Integrated IP microwave mode are E1 services. ● Demaps VC-4s from STM-1 service signals and then transmits the VC-4s to the logic processing unit, if native TDM services in Integrated IP microwave mode are STM-1 services. ● Extracts the Ethernet service signals from microwave frames and transmits to the Ethernet processing unit.

Step	Function Unit	Processing Flow
6	Ethernet processing unit	● Processes the GE signals received from the MUX/DEMUX unit. ● Sends the processed signals to the packet switching unit.
7	Logic processing unit	● Processes clock signals. ● Transmits the overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

NOTE

In 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

Signal Processing in the Transmit Direction

Table 3-378 Signal processing in the transmit direction of the ISU2

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signals from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals that are from the logic processing unit, if native TDM services in Integrated IP microwave mode are E1 services. ● Adds overheads to the VC-4 signals that are from the logic processing unit to form STM-1 signals, if native TDM services in Integrated IP microwave mode are STM-1 services. ● Sets microwave frame overheads. ● Combines the E1/STM-1 signals, Ethernet signals, and microwave frame overheads to form microwave frames.
4	MODEM unit	● Performs FEC coding. ● Performs digital modulation.

Step	Function Unit	Processing Flow
6	IF processing unit	● Performs D/A conversion. ● Performs analog modulation. ● Filters signals. ● Amplifies signals.
7	SMODEM unit	Modulates the ODU control signals transmitted from the system control and communication unit.
8	Combiner interface unit	Combines the ODU control signals, microwave service signals, and -48 V power supplies and transmits the combined signals to the IF cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies -48 V power to the ODU after performing DC-DC conversion.
- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies +3.3 V power to the other units on the ISU2 after performing DC-DC conversion.

Clock Unit

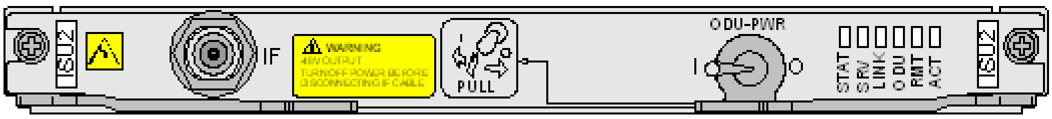
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.9.5 Front Panel

There are indicators, an IF port, an ODU power switch, and labels on the front panel.

Front Panel Diagram

Figure 3-65 Front panel of the ISU2



Indicators

Table 3-379 Status explanation for indicators on the ISU2

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
LINK	On (green)	The radio link is normal.
	On (red)	The radio link is faulty.
ODU	On (green)	The ODU is working properly.
	On (red)	● The ODU is reporting critical or major alarms. ● There is no power supplied to the ODU.
	On (yellow)	The ODU is reporting minor alarms.
	Blinks on (yellow) and off at 300 ms intervals	The antennas are not aligned.
	Off	The ODU is offline.
RMT	On (yellow)	The remote equipment is reporting defects.
	Off	The remote equipment is free of defects.

Indicator	State	Meaning
ACT	On (green)	● In a 1+1 protected system, the board works as the active one. ● In an unprotected system, the board has been activated.
	Off	● In a 1+1 protected system, the board works as the standby one. ● In an unprotected system, the board is not activated.

Ports

Table 3-380 Description of the ports

Port	Description	Connector Type	Corresponding Cable
IF	IF port	TNC	**IF jumper**[b]
ODU-PWR[a]	ODU power switch	-	-

NOTE

a: The ODU-PWR switch is equipped with a lockup device. To turn on or turn off the switch, you need to first pull the switch lever slightly outwards. When the switch is set to "O", it indicates that the circuit is open. When the switch is set to "I", it indicates that the circuit is closed.

b: A 5D IF cable is connected to an IF board; therefore, an IF jumper is not required.

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

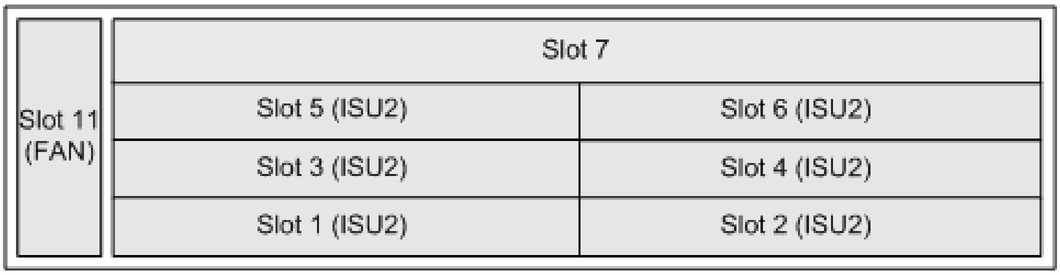
The operation warning label indicates that the ODU-PWR switch must be turned off before the IF cable is removed.

The operation guidance label indicates that the switch must be pulled slightly outwards before the switch is set to the "I" or "O" position.

3.9.6 Valid Slots

The ISU2 can be inserted in Slots 1 to 6, which have consistent logical slot numbers on the NMS.

Figure 3-66 Physical slots for the ISU2 in the IDU chassis



An ODU does not occupy any physical slot but has a logical slot on the NMS. The logical slot number of the ODU is 20 plus the logical slot number of the IF board that is connected to the ODU.

Figure 3-67 Logical slots of the ISU2 on the NMS

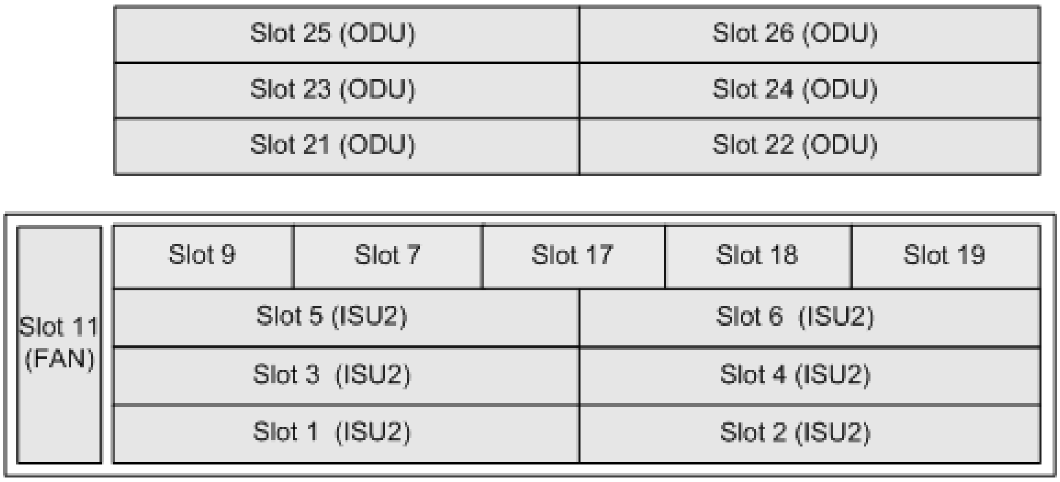


Table 3-381 Slot allocation priority

Item	Description
Slot allocation priority	Slots 3 and 5 > Slots 4 and 6 > Slots 1 and 2

Two IF1 boards can be configured as a 1+1 FD/SD protection group only when being housed in two paired slots: Slots 1 and 2, Slots 3 and 5, or Slot 4 and 6.

3.9.7 Technical Specifications

This section describes the board specifications, including microwave work modes, IF performance, modem performance, board mechanical behavior, and board power consumption.

Radio Work Modes

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

Table 3-382 SDH microwave work modes (ISU2 board)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	256QAM	50

Table 3-383 Integrated IP microwave work modes (ISU2, E1 + Ethernet)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
3.5	QPSK	2	4 to 5	4 to 6	4 to 6	4 to 10
3.5	16QAM	4	9 to 11	9 to 13	9 to 13	9 to 20
7	QPSK	5	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	10	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	12	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	15	31 to 40	31 to 47	31 to 67	31 to 100
7	128QAM	18	37 to 47	37 to 56	37 to 80	37 to 119
7	256QAM	20	41 to 53	41 to 62	41 to 90	42 to 134
14 (13.75)	QPSK	10	20 to 26	20 to 31	20 to 44	20 to 66
14 (13.75)	16QAM	20	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
14 (13.75)	64QAM	31	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	37	76 to 97	76 to 113	76 to 165	76 to 245
14 (13.75)	256QAM	42	87 to 111	87 to 131	87 to 189	88 to 281
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-384 Integrated IP microwave work modes (ISU2 board, Native STM-1 + Ethernet service)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000

NOTE

For the integrated IP microwave work mode the board supports:

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

IF Performance

Table 3-385 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	350
	Receive frequency of the IF board (MHz)	140
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

Baseband Signal Processing Performance of the Modem

Table 3-386 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	LDPC encoding
Adaptive time-domain equalizer for baseband signals	Supported

Mechanical Behavior and Power Consumption

Table 3-387 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.60 kg
Power consumption	< 22 W

3.10 ISX2

The ISX2 is a universal XPIC IF board and provides the XPIC function for signals transmitted/received in Integrated IP microwave mode and SDH radio mode. The ISX2 uses the DC-I power distribution mode.

3.10.1 Version Description

The functional version of the ISX2 is SL91.

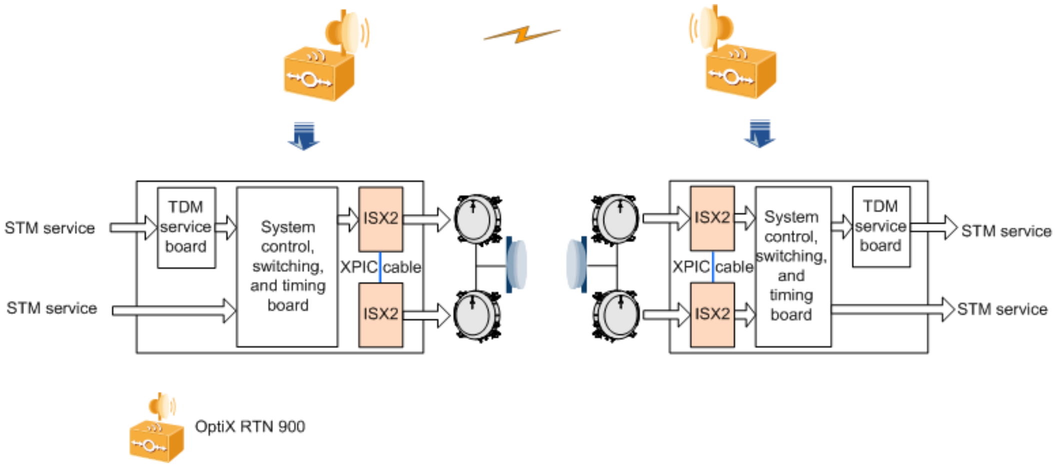
3.10.2 Application

ISX2 boards form XPIC workgroups to expand the capacity of an SDH radio hop or Integrated IP microwave hop when transmitting native E1 services, native STM-1 services, native Ethernet services, native MPLS/PWE3 services, or a combination of these services.

Functioning as SDH IF Boards

If applied to OptiX RTN 950A NEs building TDM radio networks, ISX2 boards function as large-capacity SDH IF boards to transmit TDM services.

Figure 3-68 Application scenario of ISX2 boards (I)



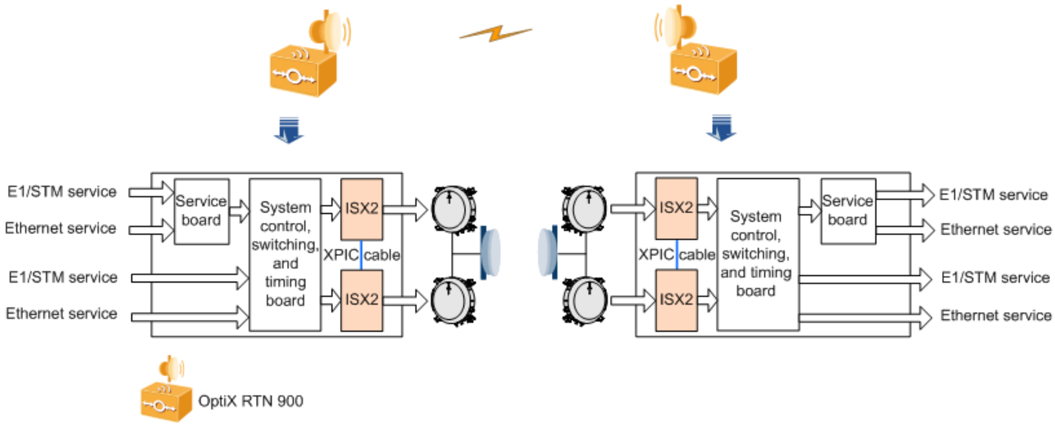
NOTE

- When working in SDH radio mode, ISX2 boards transmit 1xSTM-1 or 2xSTM-1 SDH radio services.
- If a TDM radio network needs to transmit a small number of FE/GE services, these services must be encapsulated into TDM services by EMS6/EFP8 boards before being transmitted.

Functioning as Integrated IP microwave IF Boards

ISX2 boards apply to OptiX RTN 950A NEs to transmit native E1 services, native STM-1 services, native Ethernet services, native MPLS/PWE3 services, or a combination of these services over Integrated IP microwave.

Figure 3-69 Application scenario of ISX2 boards (II)



NOTE

- In the preceding figure, if transmitted over Integrated IP microwave, E1 services can be native E1 services or CES/ATM E1 services, Ethernet services can be native Ethernet services or ETH PWE3 services, and STM-1 services must be native STM-1 services.
- ISX2 boards transmit native E1 services only when they work in native E1+Ethernet mode, and transmit native STM-1 services only when they work in native STM-1+Ethernet mode.
- Service boards shown in the preceding figure can be Ethernet interface boards, STM-1 interface boards, E1 interface boards, or Smart E1 processing boards.

3.10.3 Functions and Features

The ISX2 receives and transmits one channel of IF signal, and provides a management channel and -48 V power supply to the ODU. In addition, the ISX2 provides the cross-polarization interference cancellation (XPIC) function for IF signals by transmitting/receiving XPIC reference signals.

Table 3-388 lists the functions and features that the ISX2 supports. The ISX2 needs to work with the packet switching unit to implement Ethernet service functions and packet service functions.

Table 3-388 Functions and features that the ISX2 supports

Function and Feature	Description
Basic functions	• Receives and transmits one channel of IF signal. • Provides a management channel to the ODU. • Supplies the required -48 V power to the ODU.
Microwave type	• Integrated IP microwave • SDH microwave **NOTE** The Integrated IP microwave is compatible with the Hybrid microwave, the Packet microwave and the Routing microwave.

Function and Feature		Description
Service categories in Integrated IP microwave mode		● Native E1 + Ethernet ● Native STM-1 + Ethernet **NOTE** Ethernet services can be native Ethernet services or PWE3-encapsulated packet services.
Service categories in SDH microwave mode		● STM-1 ● 2xSTM-1
Backplane bus bandwidth		1 Gbit/s
ATPC		Supported
AM		Supported only in Integrated IP microwave mode
AM Booster		Supported
Ethernet frame header compression		Supported
E1 priority		Supported only in Integrated IP microwave mode with native TDM services being E1 services
XPIC		Supported
Microwave working mode		See **3.10.7 Technical Specifications**.
Link-level protection	1+1 HSB/FD/SD protection	Supported
	N+1 protection	Supported
	LAG protection at air interfaces	Supported
	PLA/EPLA	Supported
TDM service protection		SNCP
K byte pass-through		Supported
Ethernet service functions		See **Table 3-389**.
MPLS functions		See the description of Multiprotocol label switching (MPLS)/Pseudo wire emulation edge-to-edge (PWE3) functions provided in the section for the system control, switching, and timing board.
PWE3 functions		
License	Air-interface capacity license	Supported
	AM license	Supported
Clock	Physical layer synchronization	Clock at the air interface

Function and Feature		Description
	Physical-layer clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the SSM protocol ● Protection by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 and ITU-T G.8275.1 time synchronization.
	Packet frequency synchronization	Not supported
Data communication network (DCN)	Inband DCN	Supported
	Outband DCN	● Supports one DCC that is composed of three DCC bytes for each channel in Integrated IP microwave mode. ● Supports one DCC that is composed of D1-D3 bytes, D4-D12 bytes, or D1-D12 bytes, for each SDH microwave channel.
O&M	Loopback	Supports the following loopback types: ● Inloops and outloops at IF ports ● Inloops and outloops at MUX ports
	Cold reset and warm reset	Supported
	In-service FPGA loading	Supported
	PRBS BER test at IF ports	Supported
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported
	Board temperature monitoring	Supported
	Board power monitoring	Supported

Table 3-389 Ethernet service functions

Function and Feature		Description
Services	Native Ethernet services	• E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links • E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	• E-Line services carried by PWs • E-Aggr services carried by PWs • E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
ERPS		Supports the ERPS function that complies with ITU-T G.8032 v1/v2.
Smart Ethernet protection (SEP)		Supported
OAM		• Supports IEEE 802.1ag-compliant ETH-OAM function. • Supports IEEE 802.3ah-compliant ETH-OAM function. • Supports packet loss, delay, and delay variation measurement functions that comply with ITU-T Y. 1731.
LAG		Supported
Spanning tree protocol		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).
Quality of service (QoS) functions		See the description of QoS functions provided in the section for the system control, switching, and timing board.
RMON		Supported

3.10.4 Working Principle and Signal Flow

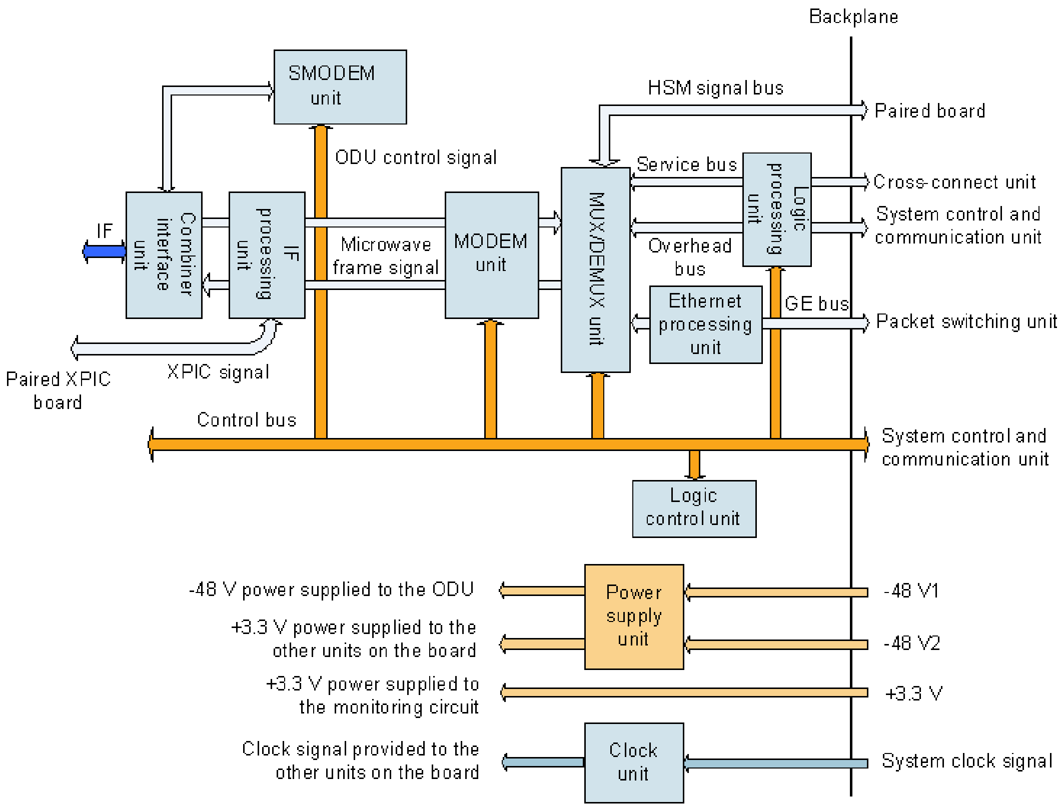
This section describes how to process one IF signal in Integrated IP microwave mode, and it serves as an example to describe the working principle and signal flow of the ISX2.

NOTE

The ISX2 adopts the same principle to process signals transmitted/received in Integrated IP microwave mode and signals transmitted/received in SDH radio mode. The difference is with regard to the microwave frame structure and processed service types.

Functional Block Diagram

Figure 3-70 Functional block diagram of the ISX2



Signal Processing in the Receive Direction

Table 3-390 Signal processing in the receive direction of the ISX2

Step	Function Unit	Processing Flow
1	Combiner interface unit	Divides the received IF signals into ODU control signals and microwave service signals.
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits the ODU control signals to the system control and communication unit.

Step	Function Unit	Processing Flow
3	IF processing unit	● Filters the received signals and splits the signals to two channels of signals. – Performs A/D conversion for one channel of filtered signals and transmits the converted signals to the MODEM unit. – Outputs the other channel of filtered signals as the XPIC signals. ● Performs A/D conversion for XPIC signals transmitted from the paired ISX2 and transmits the converted signals to the MODEM unit.
4	MODEM unit	● Performs digital demodulation by using XPIC IF signals transmitted from the paired ISX2 as reference signals. ● Performs XPIC operations for IF signals. ● Performs time domain adaptive equalization. ● Performs FEC decoding and generates specific alarms.
5	MUX/DEMUX unit	● Detects microwave frame headers and generates specific alarms and performance events. ● Verifies parity bits in microwave frames and generates specific alarms and performance events. ● Checks link IDs in microwave frames and generates specific alarms and performance events. ● Detects changes in ATPC messages and returned microwave messages and reports the changes to the system control and communication unit over the control bus. ● Extracts auxiliary channel bytes including orderwire bytes, F1 and SERIAL bytes, and DCC bytes in microwave frames and transmits to the logic processing unit. ● Maps E1 service signals to the specific positions in VC-4s and then transmits the VC-4s to the logic processing unit, if native TDM services in Integrated IP microwave mode are E1 services. ● Demaps VC-4s from STM-1 service signals and then transmits the VC-4s to the logic processing unit, if native TDM services in Integrated IP microwave mode are STM-1 services. ● Extracts the Ethernet service signals from microwave frames and transmits to the Ethernet processing unit.

Step	Function Unit	Processing Flow
6	Ethernet processing unit	● Processes the GE signals received from the MUX/DEMUX unit. ● Sends the processed signals to the packet switching unit.
7	Logic processing unit	● Processes clock signals. ● Transmits the overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

NOTE

In 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

Signal Processing in the Transmit Direction

Table 3-391 Signal processing in the transmit direction of the ISX2

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signals from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals that are from the logic processing unit, if native TDM services in Integrated IP microwave mode are E1 services. ● Adds overheads to the VC-4 signals that are from the logic processing unit to form STM-1 signals, if native TDM services in Integrated IP microwave mode are STM-1 services. ● Sets microwave frame overheads. ● Combines the E1/STM-1 signals, Ethernet signals, and microwave frame overheads to form microwave frames.
4	MODEM unit	● Performs FEC coding. ● Performs digital modulation.

Step	Function Unit	Processing Flow
5	IF processing unit	● Performs D/A conversion. ● Performs analog modulation. ● Filters signals. ● Amplifies signals.
6	SMODEM unit	Modulates the ODU control signals transmitted from the system control and communication unit.
7	Combiner interface unit	Combines the ODU control signals, microwave service signals, and -48 V power supplies and transmits the combined signals to the IF cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies -48 V power to the ODU after performing DC-DC conversion.
- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies +3.3 V power to the other units on the ISU2 after performing DC-DC conversion.

Clock Unit

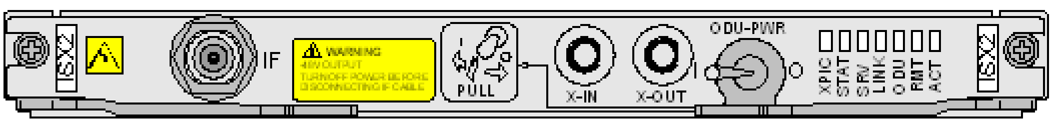
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.10.5 Front Panel

There are indicators, an IF port, XPIC signal ports, an ODU power switch, and labels on the front panel.

Front Panel Diagram

Figure 3-71 Front panel of the ISX2



Indicators

Table 3-392 Status explanation for indicators on the ISX2

Indicator	State	Meaning
XPIC	On (green)	The XPIC input signal is normal.
	On (red)	The XPIC input signal is lost.
	Off	The XPIC function is disabled.
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
LINK	On (green)	The radio link is normal.
	On (red)	The radio link is faulty.
ODU	On (green)	The ODU is working properly.
	On (red)	● The ODU is reporting critical or major alarms. ● There is no power supplied to the ODU.
	On (yellow)	The ODU is reporting minor alarms.
	Blinks on (yellow) and off at 300 ms intervals	The antennas are not aligned.
	Off	The ODU is offline.

Indicator	State	Meaning
RMT	On (yellow)	The remote equipment is reporting defects.
	Off	The remote equipment is free of defects.
ACT	On (green)	● In a 1+1 protected system, the board works as the active one. ● In an unprotected system, the board has been activated.
	Off	● In a 1+1 protected system, the board works as the standby one. ● In an unprotected system, the board is not activated.

Ports

Table 3-393 Description of the ports

Port	Description	Connector Type	Corresponding Cable
IF	IF port	TNC	**IF jumper**[b]
ODU-PWR[a]	ODU power switch	-	-
X-IN	XPIC signal input port	SMA	**XPIC cable**
X-OUT	XPIC signal output port	SMA	

NOTE

a: The ODU-PWR switch is equipped with a lockup device. To turn on or turn off the switch, you need to first pull the switch lever slightly outwards. When the switch is set to "O", it indicates that the circuit is open. When the switch is set to "I", it indicates that the circuit is closed.

b: A 5D IF cable is connected to an IF board; therefore, an IF jumper is not required.

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

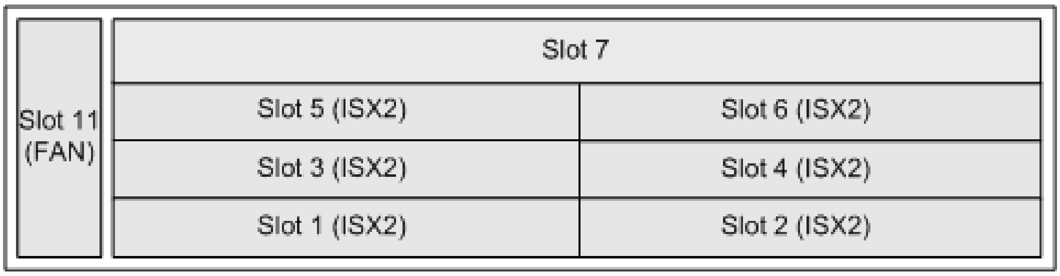
The operation warning label indicates that the ODU-PWR switch must be turned off before the IF cable is removed.

The operation guidance label indicates that the switch must be pulled slightly outwards before the switch is set to the "I" or "O" position.

3.10.6 Valid Slots

The ISX2 can be inserted in Slots 1 to 6, which have consistent logical slot numbers on the NMS.

Figure 3-72 Physical slots for the ISX2 in the IDU chassis



An ODU does not occupy any physical slot but has a logical slot on the NMS. The logical slot number of the ODU is equal to the logical slot number of the IF board that is connected to the ODU plus 20.

Figure 3-73 Logical slots of the ISX2 on the NMS

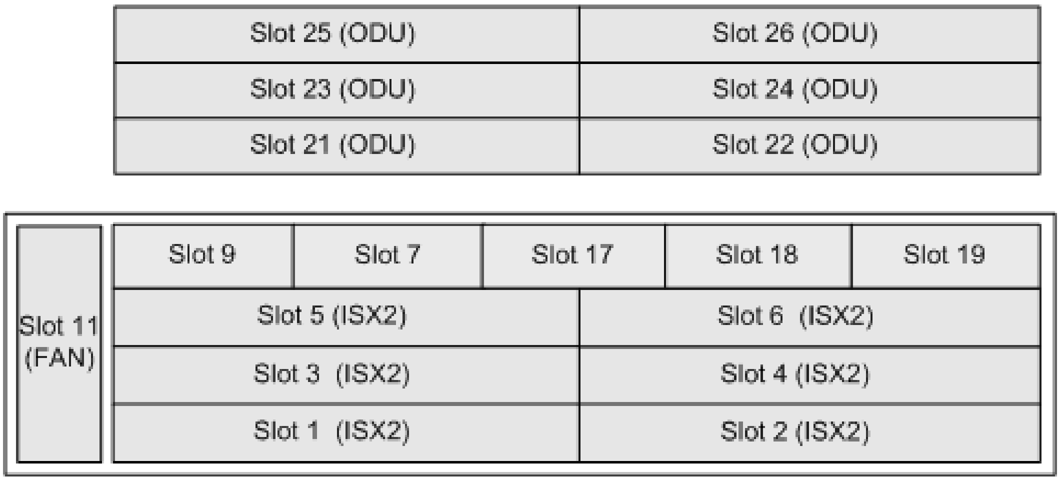


Table 3-394 Slot allocation priority

Item	Description
Slot allocation priority	Slots 3 and 5 > Slots 4 and 6 > Slots 1 and 2

Two IF1 boards can be configured as a 1+1 FD/SD protection group only when being housed in two paired slots: Slots 1 and 2, Slots 3 and 5, or Slot 4 and 6.

One ISX2 pair for implementing the XPIC function must be installed on the same row or adjacently in the same column.

3.10.7 Technical Specifications

This section describes the board specifications, including radio work modes, IF performance, modem performance, board mechanical behavior, and board power consumption.

Radio Work Modes

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

Table 3-395 SDH microwave work modes (ISX2 board@IS2-mode)

Service Capacity	Modulation Scheme	Channel Spacing (MHz)
STM-1	128QAM	28 (27.5)
2xSTM-1	128QAM	56 (55)
2xSTM-1	256QAM	50
NOTE For the ISX2 board in SDH service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.		

Table 3-396 Integrated IP microwave work modes (ISX2 board, E1 + Ethernet service, XPIC disabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK	5	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	10	20 to 26	20 to 30	20 to 44	20 to 66

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	32QAM	12	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	15	31 to 40	31 to 47	31 to 67	31 to 100
7	128QAM	18	37 to 47	37 to 56	37 to 80	37 to 119
7	256QAM	20	41 to 53	41 to 62	41 to 90	42 to 134
14 (13.75)	QPSK	10	20 to 26	20 to 31	20 to 44	20 to 66
14 (13.75)	16QAM	20	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	31	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	37	76 to 97	76 to 113	76 to 165	76 to 245
14 (13.75)	256QAM	42	87 to 111	87 to 131	87 to 189	88 to 281
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

Table 3-397 Integrated IP microwave work modes (ISX2, E1 + Ethernet, XPIC enabled)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
7	QPSK	4	10 to 13	10 to 15	10 to 22	10 to 33
7	16QAM	9	20 to 26	20 to 30	20 to 44	20 to 66
7	32QAM	11	25 to 32	25 to 36	25 to 54	25 to 80
7	64QAM	14	31 to 40	31 to 47	31 to 67	31 to 100
14 (13.75)	QPSK	9	20 to 26	20 to 31	20 to 44	20 to 66
14 (13.75)	16QAM	19	41 to 52	41 to 61	41 to 89	41 to 132
14 (13.75)	32QAM	24	51 to 65	51 to 77	51 to 110	51 to 164
14 (13.75)	64QAM	30	65 to 83	65 to 96	65 to 140	65 to 209
14 (13.75)	128QAM	36	76 to 97	76 to 113	76 to 165	76 to 245
28 (27.5)	QPSK	20	41 to 52	41 to 62	41 to 89	41 to 132
28 (27.5)	16QAM	40	82 to 105	82 to 124	82 to 178	83 to 265
28 (27.5)	32QAM	52	107 to 136	107 to 161	107 to 230	107 to 343
28 (27.5)	64QAM	64	131 to 168	131 to 198	131 to 283	132 to 424

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	75	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	75	181 to 230	181 to 272	181 to 388	182 to 577
56 (55)	QPSK	40	82 to 105	82 to 124	82 to 178	83 to 265
56 (55)	16QAM	75	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	75	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	75	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	75	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	75	360 to 456	360 to 538	360 to 777	362 to 1000
40	QPSK	27	56 to 72	56 to 84	56 to 122	57 to 182
40	16QAM	55	114 to 145	114 to 172	114 to 247	114 to 366
40	32QAM	71	147 to 187	147 to 221	147 to 318	148 to 474
40	64QAM	75	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	75	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	75	249 to 318	249 to 375	249 to 538	251 to 800
50	QPSK	35	73 to 92	73 to 107	73 to 153	73 to 235
50	16QAM	71	148 to 186	148 to 216	148 to 309	148 to 473
50	32QAM	75	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	75	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	75	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	75	317 to 396	317 to 459	317 to 659	317 to 1000

NOTE

When the channel spacing is 7 MHz or 14 MHz and the XPIC function is enabled, the ISX2 board only supports the XMC-2 ODU.

When the XPIC function is enabled and the frequency band is 26 GHz to 42 GHz, the 7MHz/64QAM and 14MHz/128QAM work modes are not supported.

Table 3-398 Integrated IP microwave work modes (ISX2 board, Native STM-1 + Ethernet service)

Channel Spacing (MHz)	Modulation Scheme	Number of STM-1 Services in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)			
			Without Compression	With L2 Frame Header Compression	With L2+L3 Frame Header Compression (IPv4)	With L2+L3 Frame Header Compression (IPv6)
28 (27.5)	128QAM	1	155 to 198	155 to 233	155 to 333	156 to 495
28 (27.5)	256QAM	1	181 to 230	181 to 272	181 to 388	182 to 577
40	64QAM	1	181 to 230	181 to 272	181 to 388	182 to 583
40	128QAM	1	215 to 272	215 to 323	215 to 456	216 to 691
40	256QAM	1	249 to 318	249 to 375	249 to 538	251 to 800
50	32QAM	1	191 to 240	191 to 278	191 to 398	191 to 610
50	64QAM	1	235 to 295	235 to 340	235 to 490	235 to 750
50	128QAM	1	275 to 345	275 to 400	275 to 570	275 to 875
50	256QAM	1	317 to 396	317 to 459	317 to 659	317 to 1000
56 (55)	16QAM	1	166 to 212	166 to 250	165 to 356	167 to 533
56 (55)	32QAM	1	206 to 262	206 to 308	206 to 437	207 to 659
56 (55)	64QAM	1	262 to 333	262 to 388	262 to 567	264 to 836
56 (55)	128QAM	1	309 to 396	309 to 466	309 to 656	311 to 983
56 (55)	256QAM	1	360 to 456	360 to 538	360 to 777	362 to 1000

NOTE
For the ISX2 board in STM-1 + Ethernet service mode, the microwave work modes are the same regardless of whether the XPIC function is enabled or disabled.

NOTE

For the integrated IP microwave work mode the board supports:

- The throughput specifications listed in the tables are based on the following conditions.
  - Without compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2 frame header compression: untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv4): UDP messages, untagged Ethernet frames with a length ranging from 64 bytes to 9600 bytes
  - With L2+L3 frame header compression (IPv6): UDP messages, S-tagged Ethernet frames with a length ranging from 92 bytes to 9600 bytes
- E1/STM-1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1/STM-1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

IF Performance

Table 3-399 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	350
	Receive frequency of the IF board (MHz)	140
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

Baseband Signal Processing Performance of the Modem

Table 3-400 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	LDPC encoding
Adaptive time-domain equalizer for baseband signals	Supported

Mechanical Behavior and Power Consumption

Table 3-401 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.60 kg
Power consumption	< 23 W

3.11 IFU2

The IFU2 is a universal IF board that supports the Integrated IP microwave mode. The IFU2 uses the DC-I power distribution mode.

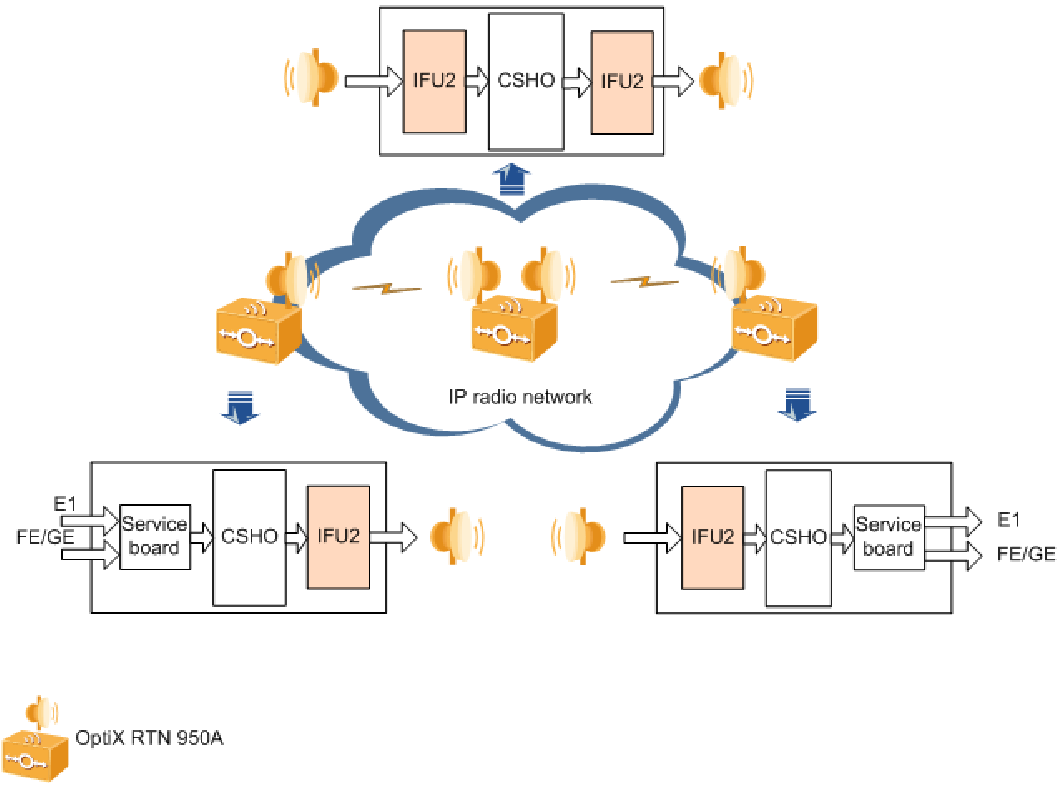
3.11.1 Version Description

The functional version of the IFU2 is SL91.

3.11.2 Application

IFU2 boards apply to OptiX RTN 950A NEs to transmit native E1 services, native Ethernet services, MPLS/PWE3 services, or a combination of these services over Integrated IP microwave (native E1+Ethernet).

Figure 3-74 Application scenario of IFU2 boards



NOTE

- In the preceding figure, if transmitted over Integrated IP microwave, E1 services can be native E1 services or CES/ATM E1 services, and Ethernet services can be native Ethernet services or ETH PWE3 services.
- Service boards shown in the preceding figure can be Ethernet interface boards, E1 interface boards, or Smart E1 processing boards.

3.11.3 Functions and Features

The IFU2 receives and transmits one channel of IF signal, and provides a management channel and -48 V power supply to the ODU.

Table 3-402 lists the functions and features that the IFU2 supports. The IFU2 needs to work with the packet switching unit to implement Ethernet service functions.

Table 3-402 Functions and features that the IFU2 supports

Function and Feature		Description
Basic functions		• Receives and transmits one channel of IF signal. • Provides a management channel to the ODU. • Supplies the required -48 V power to the ODU.
Microwave type		Integrated IP microwave **NOTE** The Integrated IP microwave is compatible with the Hybrid microwave and the Packet microwave.
Service categories		Native E1 + Ethernet **NOTE** Ethernet services can be native Ethernet services or PWE3-encapsulated packet services.
Backplane bus bandwidth		1 Gbit/s
AM		Supported
ATPC		Supported
E1 priority		Supported only in Integrated IP microwave mode with native TDM services being E1 services
Microwave working mode		See **Technical Specifications of the IFU2**.
Protection	1+1 HSB/FD/SD protection	Supported
	N+1 protection	Supported
	SNCP for TDM services	Supported
EPLA		Supported
License	Air-interface capacity license	Supported
	AM license	Supported
Clock	Physical layer synchronization	Clock at the air interface

Function and Feature		Description
	Physical-layer clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the SSM protocol ● Protection by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.
	Packet frequency synchronization	Not supported
Data communication network (DCN)	Inband DCN	Supported. The DCN bandwidth is configurable.
	Outband DCN	Supports one DCC that is composed of three DCC bytes.
Ethernet service functions		See **Table 3-403**.
MPLS functions		See the description of Multiprotocol label switching (MPLS)/Pseudo wire emulation edge-to-edge (PWE3) functions provided in the section for the system control, switching, and timing board.
PWE3 functions		
O&M	Loopback	Supports the following loopback types: ● Inloops and outloops at IF ports ● Inloops and outloops at MUX ports ● Inloops at the MAC layer of IF_ETH ports **NOTE** An IF_ETH port is an internal Ethernet port on the IF board operating in Integrated IP microwave mode and is used to receive or transmit Ethernet services transmitted in Integrated IP microwave mode.
	Cold reset and warm reset	Supported
	In-service FPGA loading	Supported
	PRBS BER test at IF ports	Supported
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported

Function and Feature		Description
	Board temperature monitoring	Supported
	Board power monitoring	Supported

Table 3-403 Ethernet service functions that the IFU2 supports

Function and Feature		Description
Services	Native Ethernet services	● E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links ● E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	● E-Line services carried by PWs ● E-Aggr services carried by PWs ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
ERPS		Supports the ERPS function that complies with ITU-T G.8032 v1/v2.
Smart Ethernet protection (SEP)		Supported
OAM		● Supports IEEE 802.1ag-compliant ETH-OAM function. ● Supports IEEE 802.3ah-compliant ETH-OAM function. ● Supports packet loss, delay, and delay variation measurement functions that comply with ITU-T Y. 1731.
LAG		Supported
Spanning tree protocol		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).

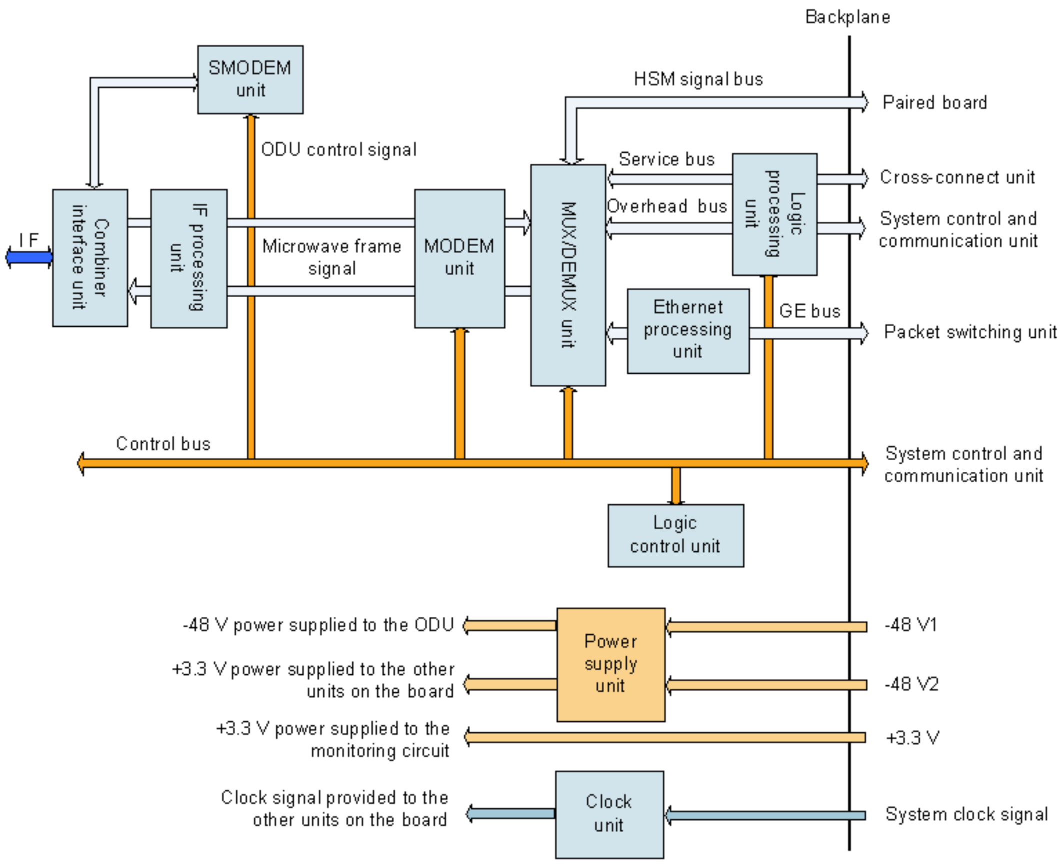
Function and Feature	Description
Quality of service (QoS) functions	See the description of QoS functions provided in the section for the system control, switching, and timing board.
RMON	Supported

3.11.4 Working Principle and Signal Flow

This section describes how to process one IF signal in Integrated IP microwave mode, and it serves as an example to describe the working principle and signal flow of the IFU2.

Functional Block Diagram

Figure 3-75 Functional block diagram of the IFU2



Signal Processing in the Receive Direction

Table 3-404 Signal processing in the receive direction of the IFU2

Step	Function Unit	Processing Flow
1	Combiner interface unit	Divides the received IF signals into ODU control signals and microwave service signals.
2	SMODEM unit	● Demodulates ODU control signals. ● Transmits the ODU control signals to the system control and communication unit.
3	IF processing unit	● Filters signals. ● Performs A/D conversion.
4	MODEM unit	● Performs digital demodulation. ● Performs time domain adaptive equalization. ● Performs FEC decoding and generates specific alarms.
5	MUX/DEMUX unit	● Detects microwave frame headers in Integrated IP microwave mode and generates specific alarms and performance events. ● Verifies parity bits in microwave frames in Integrated IP microwave mode and generates specific alarms and performance events. ● Checks link IDs in microwave frames in Integrated IP microwave mode and generates specific alarms and performance events. ● Detects changes in ATPC messages and returned microwave messages in Integrated IP microwave mode and reports the changes to the system control and communication unit over the control bus. ● Extracts auxiliary channel bytes including orderwire bytes, F1 and SERIAL bytes, SSM bytes, and DCC bytes in microwave frames and transmits the overhead signals to the logic processing unit. ● Maps E1 service signals in Integrated IP microwave mode to the specific positions in VC-4s and then transmits the VC-4s to the logic processing unit. ● Extracts the Ethernet service signals from microwave frames and transmits to the Ethernet processing unit.
6	Ethernet processing unit	● Processes the GE signals received from the MUX/ DEMUX unit. ● Sends the processed signals to the packet switching unit.

Step	Function Unit	Processing Flow
7	Logic processing unit	● Processes clock signals. ● Transmits the overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

NOTE

In 1+1 FD/SD mode, the MUX/DEMUX unit transmits service signals over the HSM bus to the MUX/DEMUX unit of the paired board. The main MUX/DEMUX unit selects the higher quality signals for subsequent processing.

Signal Processing in the Transmit Direction

Table 3-405 Signal processing in the transmit direction of the IFU2

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Ethernet processing unit	● Receives GE signal from the packet switching unit. ● Processes GE signals.
3	MUX/DEMUX unit	● Demaps E1 signals from the VC-4 signals. ● Sets the microwave frame overheads in Integrated IP microwave mode. ● Combines the E1 signals, Ethernet signals, and microwave frame overheads to form microwave frames.
4	MODEM unit	● Performs FEC coding. ● Performs digital modulation.
5	IF processing unit	● Performs D/A conversion. ● Performs analog modulation. ● Filters signals. ● Amplifies signals.
6	SMODEM unit	Modulates the ODU control signals transmitted from the system control and communication unit.
7	Combiner interface unit	Combines the ODU control signals, microwave service signals, and -48 V power supplies and transmits the combined signals to the IF cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies -48 V power to the ODU after performing DC-DC conversion.
- Performs soft-start and filtering operations for the -48 V power received from the power supply bus in the backplane and supplies +3.3 V power to the other units on the IFU2 after performing DC-DC conversion.

Clock Unit

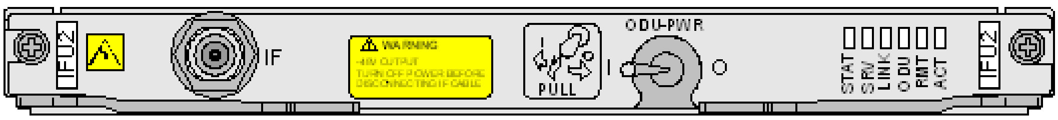
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.11.5 Front Panel

There are indicators, an IF port, an ODU power switch, and labels on the front panel.

Front Panel Diagram

Figure 3-76 Front panel of the IFU2



Indicators

Table 3-406 Status explanation for indicators on the IFU2

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.

Indicator	State	Meaning
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
LINK	On (green)	The radio link is normal.
	On (red)	The radio link is faulty.
ODU	On (green)	The ODU is working properly.
	On (red)	● The ODU is reporting critical or major alarms. ● There is no power supplied to the ODU.
	On (yellow)	The ODU is reporting minor alarms.
	Blinks on (yellow) and off at 300 ms intervals	The antennas are not aligned.
	Off	The ODU is offline.
RMT	On (yellow)	The remote equipment is reporting defects.
	Off	The remote equipment is free of defects.
ACT	On (green)	● In a 1+1 protected system, the board works as the active one. ● In an unprotected system, the board has been activated.
	Off	● In a 1+1 protected system, the board works as the standby one. ● In an unprotected system, the board is not activated.

Ports

Table 3-407 Description of the ports

Port	Description	Connector Type	Corresponding Cable
IF	IF port	TNC	**IF jumper**[b]
ODU-PWR[a]	ODU power switch	-	-

NOTE

a: The ODU-PWR switch is equipped with a lockup device. To turn on or turn off the switch, you need to first pull the switch lever slightly outwards. When the switch is set to "O", it indicates that the circuit is open. When the switch is set to "I", it indicates that the circuit is closed.

b: A 5D IF cable is connected to an IF board; therefore, an IF jumper is not required.

Labels

There is a high temperature warning label, an operation warning label, and an operation guidance label on the front panel.

The high temperature warning label indicates that the board surface temperature may exceed 70°C when the ambient temperature is higher than 55°C. If surface temperature reaches this level, you need to wear protective gloves before handling the board.

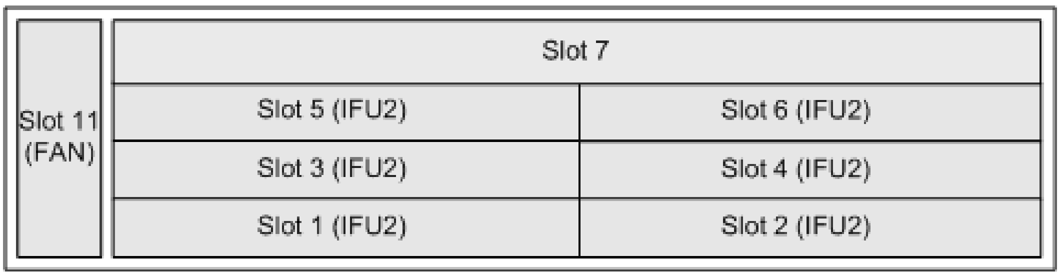
The operation warning label indicates that the ODU-PWR switch must be turned off before the IF cable is removed.

The operation guidance label indicates that the switch must be pulled slightly outwards before the switch is set to the "I" or "O" position.

3.11.6 Valid Slots

The IFU2 can be inserted in Slots 1-6, which have consistent logical slot numbers on the NMS.

Figure 3-77 Physical slots for the IFU2 in the IDU chassis



An ODU does not occupy any physical slot but has a logical slot on the NMS. The logical slot number of the ODU is 20 plus the logical slot number of the IF board.

Figure 3-78 Logical slots of the IFU2 on the NMS

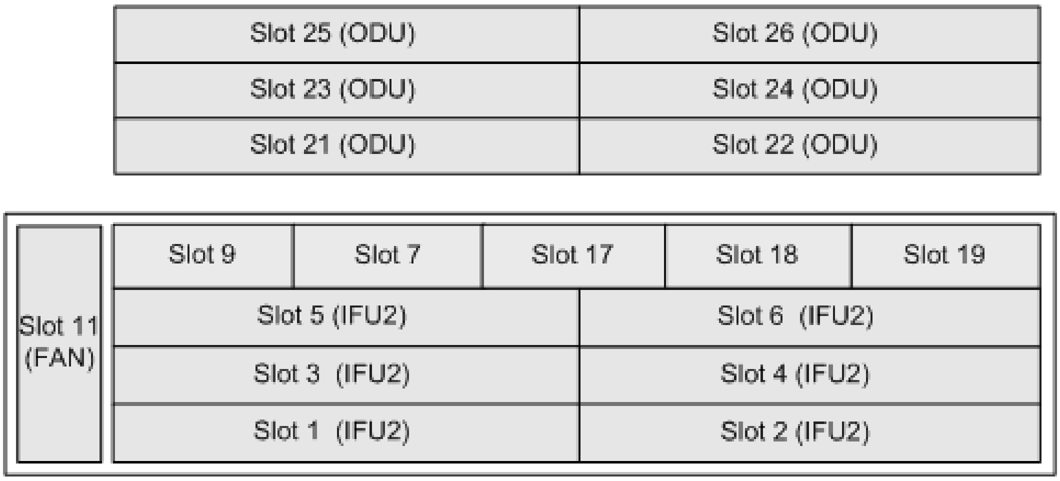


Table 3-408 Slot allocation

Item	Description
Slot allocation priority	Slots 3 and 5 > Slots 4 and 6 > Slots 1 and 2

Two IF1 boards can be configured as a 1+1 FD/SD protection group only when being housed in two paired slots: Slots 1 and 2, Slots 3 and 5, or Slot 4 and 6.

3.11.7 Technical Specifications

This section describes the board specifications, including radio work modes, IF performance, modem performance, board mechanical behavior, and board power consumption.

Radio Work Modes

NOTE

The channel spacings supported by the OptiX RTN 950A comply with ETSI standards. Channel spacings 14/28/56 MHz apply to most frequency bands; but channel spacings 13.75/27.5/55 MHz apply to the 18 GHz frequency band.

Table 3-409 Integrated IP microwave work modes (IFU2 board)

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
7	QPSK	5	9 to 12
7	16QAM	10	20 to 24

Channel Spacing (MHz)	Modulation Scheme	Maximum Number of E1s in Hybrid Microwave	Native Ethernet Throughput (Mbit/s)
7	32QAM	12	24 to 29
7	64QAM	15	31 to 37
7	128QAM	18	37 to 44
7	256QAM	21	43 to 51
14 (13.75)	QPSK	10	20 to 23
14 (13.75)	16QAM	20	41 to 48
14 (13.75)	32QAM	24	50 to 59
14 (13.75)	64QAM	31	65 to 76
14 (13.75)	128QAM	37	77 to 90
14 (13.75)	256QAM	43	90 to 104
28 (27.5)	QPSK	20	41 to 48
28 (27.5)	16QAM	40	82 to 97
28 (27.5)	32QAM	52	108 to 125
28 (27.5)	64QAM	64	130 to 150
28 (27.5)	128QAM	75	160 to 180
28 (27.5)	256QAM	75	180 to 210
56 (55)	QPSK	40	82 to 97
56 (55)	16QAM	75	165 to 190
56 (55)	32QAM	75	208 to 240
56 (55)	64QAM	75	260 to 310
56 (55)	128QAM	75	310 to 360
56 (55)	256QAM	75	360 to 420

NOTE

For the integrated IP microwave work mode that the IFU2 board supports:

- The throughput specifications listed in the tables are based on untagged Ethernet frames with a length ranging from 64 bytes to 1518 bytes
- E1 services need to occupy the corresponding bandwidth of the air interface capacity. The bandwidth remaining after the E1 service capacity is subtracted from the air interface capacity can be provided for Ethernet services.

IF Performance

Table 3-410 IF performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	550 (XMC-3H ODU@112MHz and XMC-5D ODU) 350 (other ODUs)
	Receive frequency of the IF board (MHz)	177 (XMC-3H ODU@112MHz and XMC-5D ODU) 140 (other ODUs)
ODU O&M signal	Modulation scheme	ASK
	Transmit frequency of the IF board (MHz)	5.5
	Receive frequency of the IF board (MHz)	10
Interface impedance (ohm)		50

Baseband Signal Processing Performance of the Modem

Table 3-411 Baseband signal processing performance of the modem

Item	Performance
Encoding mode	LDPC encoding
Adaptive time-domain equalizer for baseband signals	Supported

Mechanical Behavior and Power Consumption

Table 3-412 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.79 kg
Power consumption	< 23 W

3.12 EG4/EG4P

EG4/EG4P boards are 4xGE interface boards, which provide flexible combinations of port types to meet a wide variety of service requirements. One EG4/EG4P board provides a maximum of four ports, two always being RJ45 electrical ports and the other two being small form-factor pluggable (SFP) ports or RJ45 electrical ports. On an EG4P board, the two fixed RJ45 electrical ports provide the RTN 300 full-outdoor radio equipment series with power and service signals simultaneously.

3.12.1 Version Description

The functional version of EG4/EG4P boards is SL91.

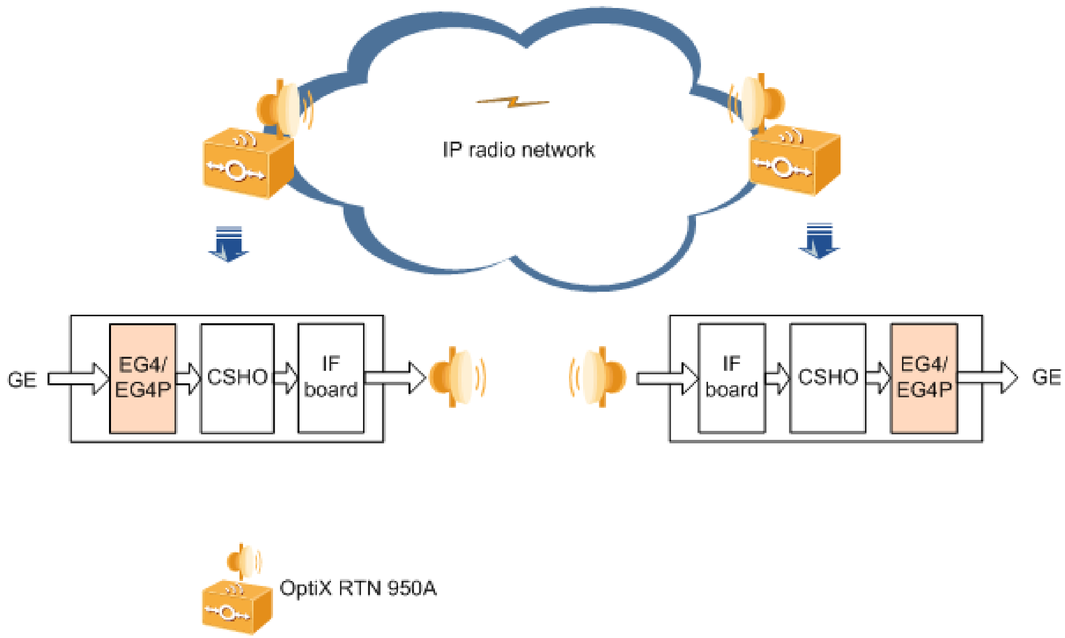
3.12.2 Application

EG4/EG4P boards receive and transmit GE services or carry Multiprotocol Label Switching (MPLS) tunnels. Because one EG4P board provides two power-over-Ethernet ports, EG4P boards can also build networks in conjunction with OptiX RTN 310/380.

Receiving and Transmitting Ethernet Services

EG4/EG4P boards apply to OptiX RTN 950A NEs to receive and transmit Ethernet services over Integrated IP microwave. The GE services come from user-side equipment (such as base stations, routers, and switches) or Layer 2 networks.

Figure 3-79 Application scenario of EG4/EG4P boards (1)



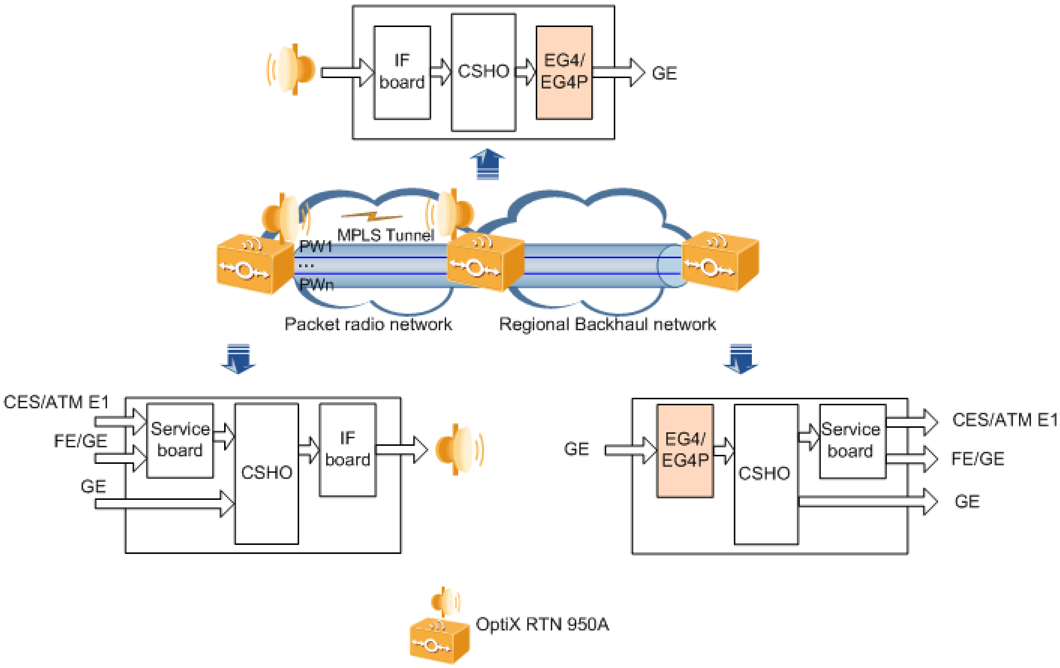
NOTE

- IF boards shown in the preceding figure must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- In the preceding figure, if transmitted over Integrated IP microwave, Ethernet services can be native Ethernet services or ETH pseudo wire emulation edge-to-edge (PWE3) services.

Carrying MPLS Tunnels

EG4/EG4P boards can carry MPLS tunnels when required, allowing MPLS/PWE3 services traversing radio networks and regional backhaul networks to be transmitted in end-to-end mode.

Figure 3-80 Application scenario of EG4/EG4P boards (2)



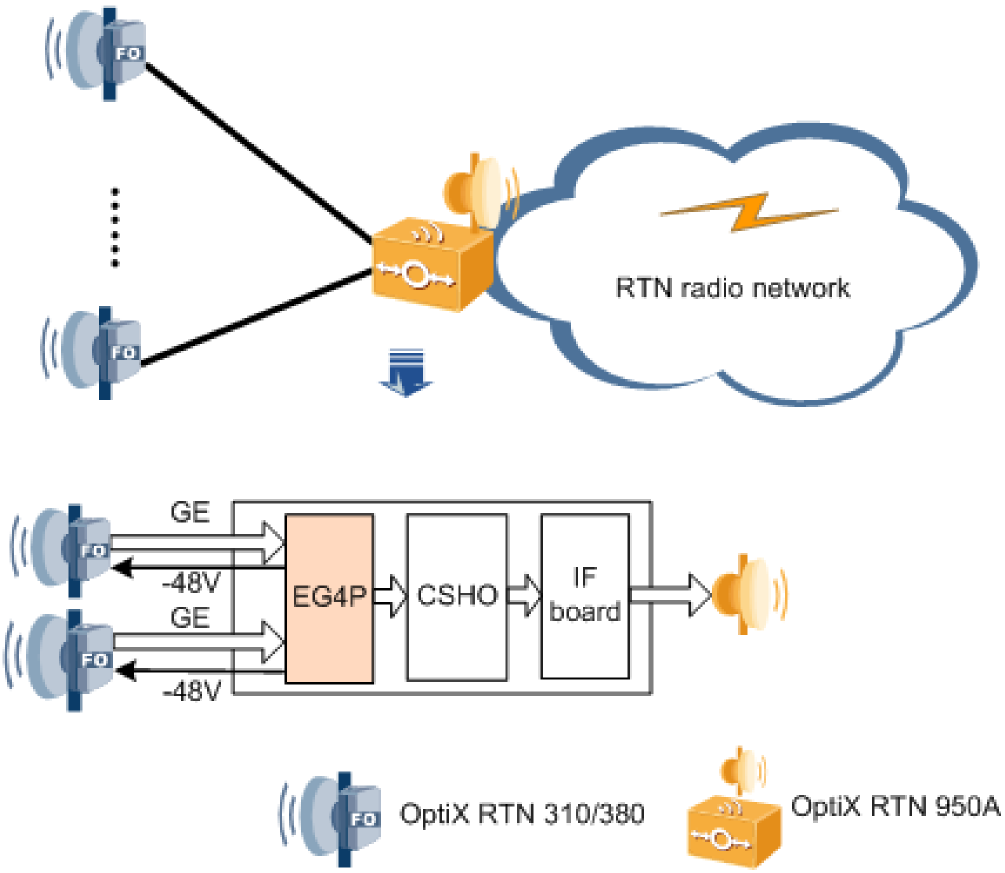
NOTE

- IF boards shown in the preceding figure must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- If required, two MPLS tunnels can be created on both the packet radio network and regional backhaul network, so PWE3 services can be transmitted on multi-segment pseudo wires (MS-PWs) in end-to-end mode.
- Service boards shown in the preceding figure can be either Smart E1 processing boards or Ethernet interface boards.

Working with OptiX RTN 310s/380s

EG4P boards provide electrical GE ports that can supply power over Ethernet to full-outdoor OptiX RTN 310s/380s. Cooperation between EG4P boards and OptiX RTN 310s/380s increases service convergence capabilities of OptiX RTN 950As.

Figure 3-81 Application scenario of EG4/EG4P boards (3)



NOTE

- One EG4P board can supply power to a maximum of two OptiX RTN 310s/OptiX RTN 380s/OptiX RTN 380As.
- One OptiX RTN 950A can supply power to a maximum of six OptiX RTN 310s/OptiX RTN 380s.
- An OptiX RTN 950A can be connected to a maximum of six ODUs+OptiX RTN 310s/OptiX RTN 380s.

3.12.3 Functions and Features

EG4/EG4P boards receive/transmit, process, and converge 4xGE service signals. They also can receive/transmit 2xFE optical signals using FE SFP optical modules installed at their SFP ports.

Table 3-413 lists the functions and features supported by EG4/EG4P boards. EG4/EG4P boards implement Ethernet service functions by working with packet switching units on the system control, switching, and timing boards.

Table 3-413 Functions and features that EG4/EG4P boards support

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td colspan="2">Basic functions</td><td>Receives/Transmits GE service signals, and processes these signals by working with the packet switching unit.</td></tr>
<tr><td>Port specifications</td><td>GE port</td><td>Provides four GE ports.
Provides two unpluggable GE electrical ports (through which EG4P boards support power-over-Ethernet).
Provides two unpluggable GE electrical ports or two SFP optical ports.
Supports the following types of SFP modules:
Dual-fiber bidirectional FE/GE optical module
Single-fiber bidirectional FE/GE module</td></tr>
<tr><td colspan="2">Backplane bus bandwidth</td><td>2x2.5 Gbit/s for slot 1/2 and 2.5 Gbit/s for slots 3 – 6 (working with the CSHOF)
2.5 Gbit/s (working with other system control boards)</td></tr>
<tr><td colspan="2">Switching mode</td><td>Centralized mode
NOTE
When a board works in centralized mode, all Ethernet services carried on the board must be forwarded by the packet switching unit of the cooperating system control board.</td></tr>
<tr><td rowspan="4">Port attributes</td><td>Working mode</td><td>GE electrical ports support 10M/100M/1000M full-duplex and auto-negotiation.
GE optical ports support 1000M full-duplex and auto-negotiation.
FE optical ports support 100M full-duplex.</td></tr>
<tr><td>Tag attributes</td><td>The tag attribute can be tag aware, access, or hybrid.
Sets and queries the tag attribute of a port.</td></tr>
<tr><td>Jumbo frames</td><td>Supports jumbo frames with a maximum length of 9600 bytes.</td></tr>
<tr><td>Traffic control</td><td>Supports port-based traffic control that complies with IEEE 802.3x.</td></tr>
</table>

Function and Feature		Description
Services	Native Ethernet services	● E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links ● E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	● E-Line services carried by PWs ● E-Aggr services carried by PWs ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
Link aggregation group (LAG)	Inter-board LAG	Supported
	Intra-board LAG	Supported
Ethernet ring protection switching (ERPS)		Supported (complies with ITU-T G.8032 v1/v2)
Smart Ethernet protection (SEP)		Supported
MPLS functions		Refer to the description of MPLS/PWE3 functions provided in the sections about system control, switching, and timing boards.
PWE3 functions		
Spanning Tree Protocol (STP)		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).
IGMP snooping		Supported
Link-state pass through (LPT)		Supported
Port mirroring		Supported
LLDP		Supported
Anti-Theft function		Supported
Quality of service (QoS)	DiffServ	Supports simple traffic classification by specifying per-hop behaviors (PHBs) based on packets-carried QoS information (including C-VLAN priority, S-VLAN priority, DSCP value, and MPLS EXP value).

Function and Feature		Description
	Complex traffic classification	Supports traffic classification based on the following information carried by packets: SMAC, DMAC, C-VLAN IDs, S-VLAN IDs, C-VLAN priorities, S-VLAN priorities, C-VLAN IDs + C-VLAN priorities, S-VLAN IDs + S-VLAN priorities, or DSCP values.
	Committed access rate (CAR)	Provides the CAR processing for traffic flows at ports.
	Shaping	Supports traffic shaping for a specific port, prioritized queue, or traffic flow.
	Queue scheduling policies	● Strict-priority (SP) ● Weighted round robin (WRR) ● SP+WRR
	Congestion avoidance	Supports tail drop.
	Traffic shaping	Supports shaping for a specified port, priority queue, or service flow, and allows the peak information rate (PIR) and committed information rate (CIR) to be modified in 64 kbit/s steps.
ETH OAM functions	Ethernet service OAM	● Supports ETH OAM functions that comply with IEEE 802.1ag. ● Supports frame loss measurement, frame delay measurement, and delay variation measurement functions that comply with ITU-T Y.1731.
	Ethernet port OAM	Supports ETH OAM functions that comply with IEEE 802.3ah.
Remote network monitoring (RMON)		Supported
Clock	Physical layer synchronization	Synchronous Ethernet
	Physical-layer clock protection	● Protection implemented based on different clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization. Supports use of the AE 905S module as the clock source for time synchronization.

Function and Feature		Description
	Packet frequency synchronization	● Supports IEEE 1588v2 frequency synchronization. ● Supports IEEE 1588 ACR.
Data communication network (DCN)	Inband DCN	Each port provides one inband DCN channel.
Power over Ethernet (available only on EG4P boards)	Number of ports supporting power over Ethernet	2
	Enabling/ Disabling power over Ethernet	Software controlled
	Power protection	Supported
Operation and management	Loopback	● Supports inloops at the PHY layer of Ethernet ports. ● Supports inloops at the MAC layer of Ethernet ports.
	Warm and cold resetting	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Voltage monitoring	Supported
	Temperature monitoring	Supported
	SFP module information query	Supported

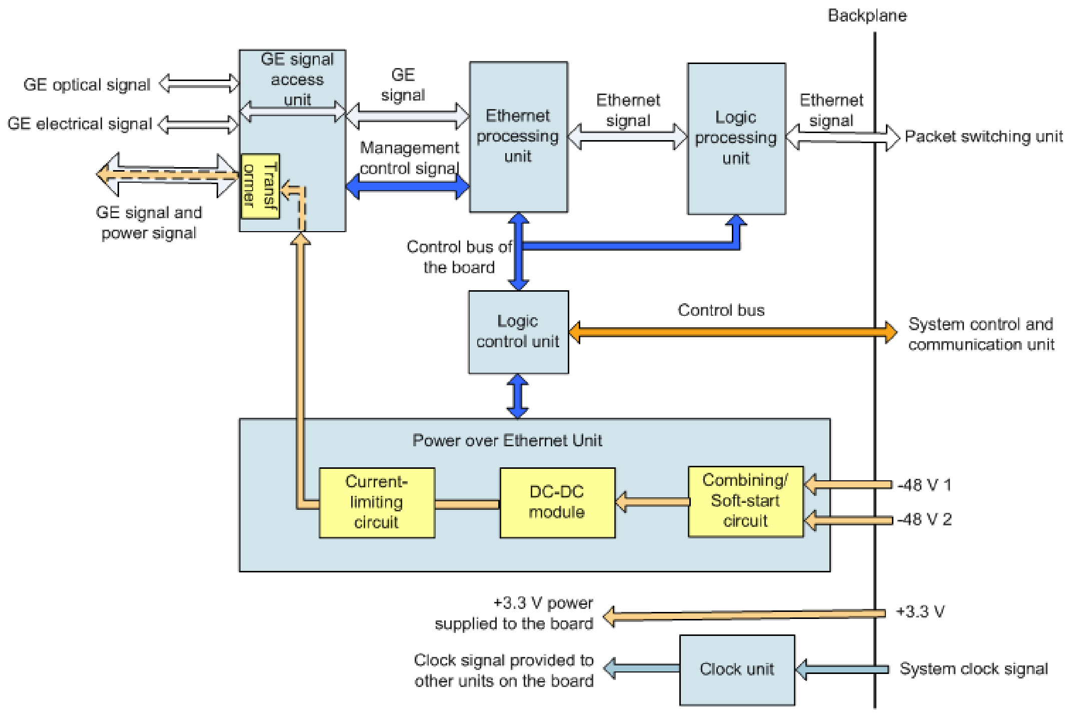
3.12.4 Working Principle and Signal Flow

This section describes how the function units of an EG4/EG4P board process GE signals.

Function Block Diagram

EG4 boards process GE signals in the same way as EG4P boards process GE signals. The only difference is that EG4 boards do not support power over Ethernet.

Figure 3-82 EG4P board function block diagram



Signal Processing in the Receive Direction

Table 3-414 Signal processing in the receive direction of an EG4P board

Step	Function Unit	Processing Flow
1	GE signal access unit	● Receives GE signals. ● Performs restructuring, decoding, and serial/parallel conversion for GE signals. ● Performs frame delimitation, preamble stripping, cyclic redundancy check (CRC), and Ethernet performance measurement for frame signals.

Step	Function Unit	Processing Flow
2	Ethernet processing unit	● Adds tags identifying ingress ports to Ethernet data frames. ● Processes VLAN tags in Ethernet data frames. ● Processes labels in MPLS/PWE3 packets. ● Performs QoS processing such as traffic classification and CAR traffic monitoring for Ethernet data frames. ● Forwards Ethernet data frames to the logic processing unit.
3	Logic processing unit	Transmits Ethernet data frames to the packet switching unit.

Signal Processing in the Transmit Direction

Table 3-415 Signal processing in the transmit direction of an EG4P board

Step	Function Unit	Processing Flow
1	Logic processing unit	● Selects Ethernet data frames from the packet switching unit. ● Transmits Ethernet data frames to the Ethernet processing unit.
2	Ethernet processing unit	● Processes labels in MPLS/PWE3 packets. ● Processes VLAN tags in Ethernet data frames. ● Performs QoS processing such as traffic shaping and queue scheduling for Ethernet data frames. ● Forwards Ethernet data frames to proper egress ports based on egress tags contained in Ethernet data frames.
3	GE signal access unit	● Performs frame delimitation, preamble addition, CRC code computing, and Ethernet performance measurement. ● Performs parallel/serial conversion and coding for Ethernet data frames. ● GE electrical ports transmit GE electrical signals. ● Power over Ethernet ports couple GE signals and power signals from the power-over-Ethernet unit, and transmit the coupled signals. ● GE optical ports convert optical signals into electrical signals and transmit the electrical signals.

Power-over-Ethernet Unit

The power-over-Ethernet unit consists of a combining/soft-start circuit, a DC-DC module, a current-limiting circuit, and a coupling transformer. This unit processes signals as follows:

- The unit receives two -48 V power supplies.
- The combining/soft-start circuit combines two power supplies and performs soft-start and electromagnetic compatibility (EMC) filtering for the combined power signals.
- The DC-DC module converts the power voltage to -52.2 V.
- The current-limiting circuit limits the current of the power signals and sends the power signals to the coupling transformer at each power-over-Ethernet port.
- The coupling transformer combines the power signals and Ethernet service signals and sends them to an OptiX RTN 310/380 through an Ethernet cable.

Control Signal Processing

The Ethernet processing unit controls the GE signal access unit using management control signals.

The logic control unit controls the Ethernet processing unit and logic processing unit using the control bus.

The logic control unit communicates with the system control and communication unit using the system control bus. Specifically, the logic control unit transmits configuration data and query commands from the system control and communication unit to other units on the EG4/EG4P; it also transmits response messages, alarms, and performance events from other units on the EG4/EG4P to the system control and communication unit.

Clock Unit

This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.12.5 Front Panel

An EG4/EG4P board has indicators, GE service ports, and a power caution label on its front panel.

Front Panel Diagram

Figure 3-83 Front panel of an EG4 board

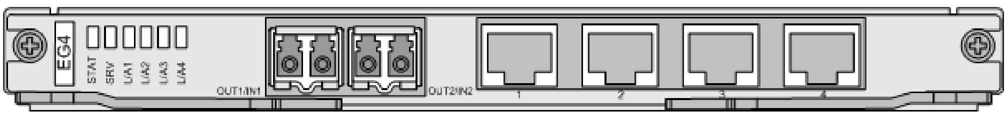
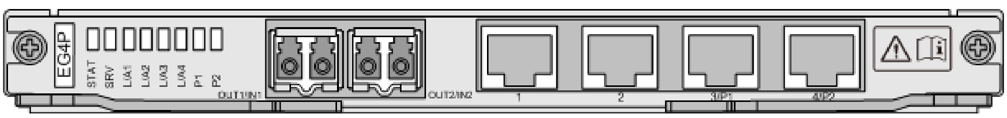


Figure 3-84 Front panel of an EG4P board



Indicators

Table 3-416 Status explanation for indicators on an EG4/EG4P board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor alarm has been reported.
	Off	No service is configured.
L/A1 (optical/ electrical port 1)	On (green)	Port GE1 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE1 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE1 has received extremely low optical power (applicable only to an optical port).
	Blinks (yellow)	Port GE1 is receiving or transmitting data.
	Off	Port GE1 is not connected or is incorrectly connected.
L/A2 (optical/ electrical port 2)	On (green)	Port GE2 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE2 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE2 has received extremely low optical power (applicable only to an optical port).
	Blinks (yellow)	Port GE2 is receiving or transmitting data.
	Off	Port GE2 is not connected or is incorrectly connected.
L/A3 (electrical port 3)	On (green)	Port GE3 is connected correctly but is not receiving or transmitting data.
	Blinks (yellow)	Port GE3 is receiving or transmitting data.

Indicator	State	Meaning
	Off	Port GE3 is not connected or is incorrectly connected.
L/A4 (electrical port 4)	On (green)	Port GE4 is connected correctly but is not receiving or transmitting data.
	Blinks (yellow)	Port GE4 is receiving or transmitting data.
	Off	Port GE4 is not connected or is incorrectly connected.
P1	On (green)	Power over Ethernet port 1 is enabled.
	Off	Power over Ethernet port 1 is disabled or is working abnormally.
P2	On (green)	Power over Ethernet port 2 is enabled.
	Off	Power over Ethernet port 2 is disabled or is working abnormally.
NOTE Indicators P1 and P2 are available only on the front panels of EG4P boards, indicating the power supply status of power-over-Ethernet ports.		

Ports

Table 3-417 Ports on an EG4/EG4P board

Port	Description	Connector Type	Required Cable
OUT1/IN1	FE/GE optical port	LC SFP optical module AE 905S module (supported only by EG4) **NOTE** Each board supports a maximum of one AE 905S module.	**5.6 Fiber Jumper**
OUT2/IN2			
1	GE service port (unpluggable electrical port)	RJ45	**5.10 Network Cable**

Port	Description	Connector Type	Required Cable
2	**NOTE** Optical port 1 and electrical port 1 share one physical channel, and optical port 2 and electrical port 2 share another physical channel.		
3 (EG4)	GE service port (fixed electrical port)	RJ45	
4 (EG4)			
3/P1 (EG4P)	GE service port (unpluggable electrical port) + Power over Ethernet port **NOTICE** When a power over Ethernet port is connected to a device that is not OptiX RTN 310/380, the power over Ethernet function must be disabled. Otherwise, the peer device may be damaged.	RJ45	P&E (8-core) cable provided by the OptiX RTN 310/380
4/P2 (EG4P)			

GE electrical ports on EG4/EG4P boards comply with the 10/100/1000BASE-T(X) standard in performance and support the medium dependent interface (MDI), MDI crossover (MDI-X), and auto-MDI/MDI-X modes. Ports 3/P1 and 4/P2 on EG4P boards transmit both Ethernet service signals and power signals. All GE electrical ports on EG4/EG4P boards use RJ45 connectors. For the front view of an RJ45 connector, see **Figure 3-85**. For pin assignments for RJ45 connectors, see **Table 3-418** and **Table 3-419**.

Figure 3-85 Front view of the RJ45 connector

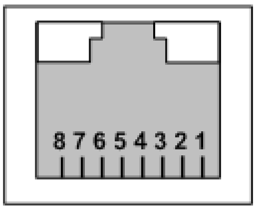


Table 3-418 Pin assignments for RJ45 connectors in MDI mode

Pin	10/100BASE-T(X)		1000BASE-T		Power over Ethernet Signal (EG4P)	
	Signal	Function	Signal	Function	Signal	Function
1	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)	BGND	Power ground (0 V)
2	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)	BGND	Power ground (0 V)
3	RX+	Receiving data (+)	BIDB+	Bidirectional data wire B (+)	-48 V	Power signal (-48 V)
4	Reserved	-	BIDC+	Bidirectional data wire C (+)	BGND	Power ground (0 V)
5	Reserved	-	BIDC-	Bidirectional data wire C (-)	BGND	Power ground (0 V)
6	RX-	Receiving data (-)	BIDB-	Bidirectional data wire B (-)	-48 V	Power signal (-48 V)
7	Reserved	-	BIDD+	Bidirectional data wire D (+)	-48 V	Power signal (-48 V)
8	Reserved	-	BIDD-	Bidirectional data wire D (-)	-48 V	Power signal (-48 V)

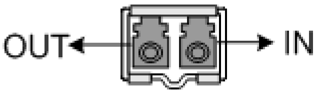
Table 3-419 Pin assignments for RJ45 connectors in MDI-X mode

Pin	10/100BASE-T(X)		1000BASE-T		Power over Ethernet Signal (EG4P)	
	Signal	Function	Signal	Function	Signal	Function
1	RX+	Receiving data (+)	BIDB+	Bidirectional data wire B (+)	BGND	Power ground (0 V)
2	RX-	Receiving data (-)	BIDB-	Bidirectional data wire B (-)	BGND	Power ground (0 V)
3	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)	-48 V	Power signal (-48 V)
4	Reserved	-	BIDD+	Bidirectional data wire D (+)	BGND	Power ground (0 V)
5	Reserved	-	BIDD-	Bidirectional data wire D (-)	BGND	Power ground (0 V)
6	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)	-48 V	Power signal (-48 V)
7	Reserved	-	BIDC+	Bidirectional data wire C (+)	-48 V	Power signal (-48 V)
8	Reserved	-	BIDC-	Bidirectional data wire C (-)	-48 V	Power signal (-48 V)

EG4/EG4P boards require SFP optical modules to provide GE optical ports.

- When dual-fiber bidirectional SFP optical modules are used, one optical module provides one OUT port and one IN port. For details, see **Figure 3-86**, in which OUT represents the transmit port and IN represents the receive port. One optical fiber is connected to each port.
- When single-fiber bidirectional optical modules are used, one optical module provides only port, which can both receive and transmit service signals. One optical fiber is connected to this port.

Figure 3-86 Ports of an SFP optical module



Labels

An EG4P board has a power caution label on its front panel.

Power caution labels on EG4P boards instruct you not to remove or install cables while equipment is powered on, as power-over-Ethernet ports on the EG4P boards have power output.

3.12.6 Valid Slots

The EG4/EG4P board can be inserted in Slots 1 – 6, which have consistent logical slot numbers on the NMS.

Figure 3-87 Physical slots for EG4/EG4P boards in a chassis

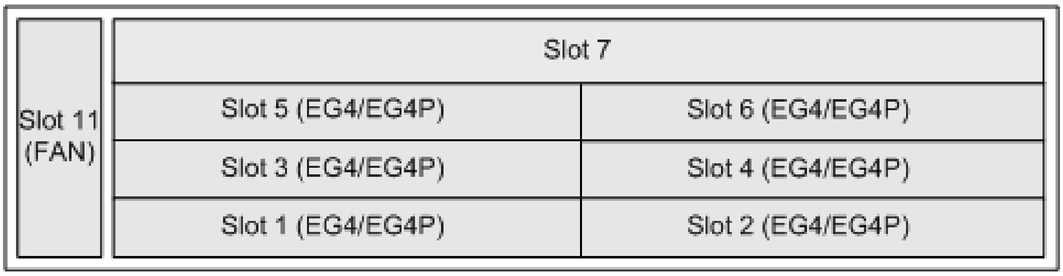


Figure 3-88 Logical slots of EG4/EG4P boards on the NMS

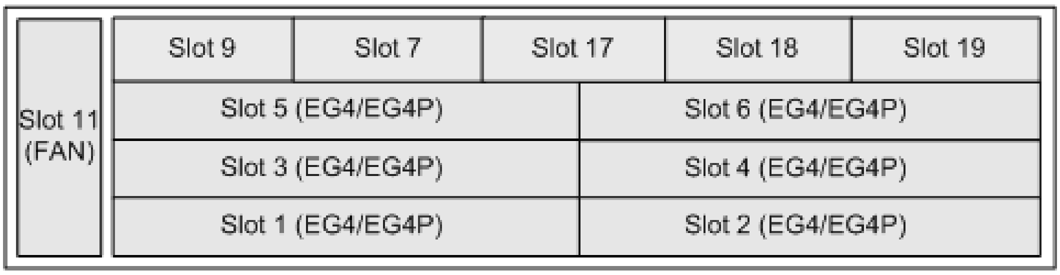


Table 3-420 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.12.7 Types of SFP Modules

FE/GE SFP ports on EG4/EG4P boards support multiple types of SFP modules.

EG4 and EG4P boards support the same types of optical modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-421 Types of SFP modules that FE/GE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060286	1000BASE-SX	850 nm, 0.5 km
	34060473	1000BASE-LX	1310 nm, 10 km
	34060298	1000BASE-VX	1310 nm, 40 km
	34060513		1550 nm, 40 km
	34060360	1000BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional GE module	34060475	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 10 km
	34060470	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 10 km
	34060540	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 40 km
	34060539	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 40 km
Dual-fiber bidirectional FE module	34060287	100BASE-FX	1310 nm, 2 km
	34060276	100BASE-LX	1310 nm, 15 km
	34060281	100BASE-VX	1310 nm, 40 km
	34060282	100BASE-ZX	1550 nm, 80 km

Category	Part Number	Type	Wavelength and Transmission Distance
Single-fiber bidirectional FE module	34060364	100BASE-BX-D	Transmit wavelength: 1550 nm; receive wavelength: 1310 nm 15 km
	34060363	100BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1550 nm 15 km
	34060329	100BASE-BX-D	Transmit: 1550 nm; receive: 1310 nm 40 km
	34060328	100BASE-BX-U	Transmit: 1310 nm; receive: 1550 nm 40 km

NOTE

For specifications for each type of optical module, see **Table 3-424** to **Table 3-427** in **3.12.8 Technical Specifications**.

The types of SFP modules listed in the following table can be identified by feature codes in the bar codes of EG4/EG4P boards. A feature code refers to the number next to the board name in a bar code.

Table 3-422 Feature codes of EG4/EG4P boards

Feature Code	Module Type	Part Number of the Module
01	**1000Base-SX**	34060286
02	**1000Base-LX**	34060473
10	**100BASE-FX**	34060287
11	**100BASE-LX**	34060276

3.12.8 Technical Specifications

This section describes board specifications, including the Ethernet service port performance, power-over-Ethernet performance, mechanical behaviors, and power consumption.

FE/GE Optical Port Performance

FE/GE optical ports on EG4/EG4P boards comply with IEEE 802.3. The following tables list main specifications for the FE/GE optical ports.

NOTE

The OptiX RTN 950A uses SFP modules to provide GE optical ports. Different types of SFP optical modules can be used to provide GE optical ports with different classification codes and transmission distances.

Table 3-423 GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.5	10
Operating wavelength (nm)	770 to 860	1270 to 1355
Average optical output power (dBm)	-9 to -3	-9 to -3
Receiver sensitivity (dBm)	-17	-20
Overload (dBm)	0	-3
Extinction ratio (dB)	9.5	9.5

Table 3-424 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

Table 3-425 GE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Nominal bit rate (Mbit/s)	1000	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	10	10	40	40
Operating wavelength (nm)	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500
Average optical output power (dBm)	-9 to -3	-9 to -3	-3 to +3	-3 to +3
Receiver sensitivity (dBm)	-19.5	-19.5	-23	-23
Overload (dBm)	-3	-3	-3	-3
Extinction ratio (dB)	6	6	6	6

Table 3-426 FE optical interface specifications (two-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1310	1310	1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Multi-mode	Single-mode	Single-mode	Single-mode

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Average optical output power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-30	-28	-34	-34
Overload (dBm)	-14	-8	-10	-10
Extinction ratio (dB)	10	8.2	10	10.5

Table 3-427 FE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	15	15	40	40
Operating wavelength (nm)	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580
Average optical output power (dBm)	-15 to -8	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-32	-32	-32	-32
Overload (dBm)	-8	-8	-10	-10
Extinction ratio (dB)	8.5	8.5	10	10

GE Electrical Port Performance

GE electrical ports on EG4/EG4P boards comply with IEEE 802.3. The following table lists main specifications for the GE electrical ports.

Table 3-428 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

Power-over-Ethernet Performance

Item	Performance
Output voltage	-52.2 V
Maximum power output of a port	55 W

Mechanical Behaviors and Power Consumption

Table 3-429 Mechanical behaviors and Power Consumption of EG4

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.3 kg
Power consumption	< 6 W

Table 3-430 Mechanical behaviors and Power Consumption of EG4P

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.30 kg
Power consumption	● < 20 W (with maximum P&E loads) ● < 14.7 W (with 50% P&E loads) ● < 9.3 W (no P&E loads)

3.13 EX1

EX1 boards are 1x10GE processing boards. This board can be used only with the CSHOF board.

3.13.1 Version Description

The functional version of EX1 boards is SL91.

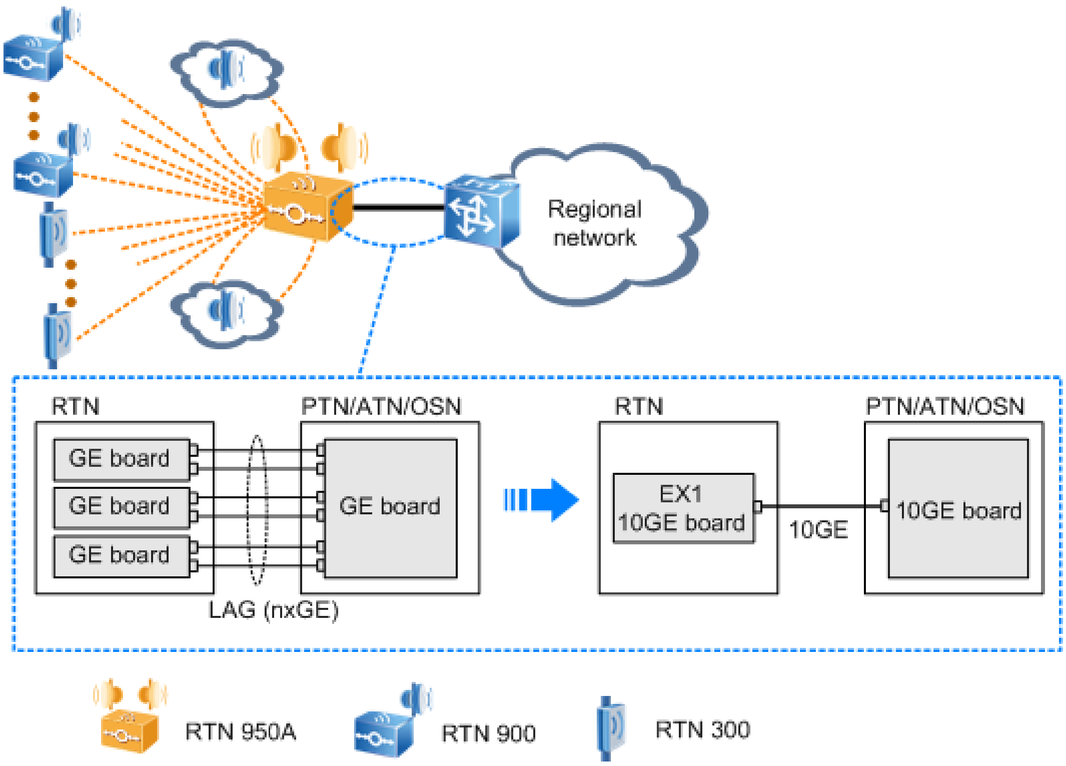
3.13.2 Application

EX1 boards provide large-capacity Ethernet aggregation links between a microwave network and the local metropolitan area network.

Access of Ethernet Services at an Aggregation Site for Upstream Transmission

The upstream capacity of a high-density aggregation site is usually higher than 1 Gbit/s. A single port on an EX1 board can provide a 10 Gbit/s bandwidth. It is unnecessary to configure multiple GE ports into a LAG for load sharing. The use of EX1 boards can reduce deployment costs and simplify installation.

Figure 3-89 Access of Ethernet services at an aggregation site for upstream transmission



3.13.3 Functions and Features

EX1 board receive/transmit, process, and converge 1x10GE service signals.

Table 3-431 lists the functions and features supported by EX1 boards.

Table 3-431 Functions and features that EX1 boards support

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td colspan="2">Basic functions</td><td>Receives/Transmits 10GE service signals, and processes these signals by working with the packet switching unit.</td></tr>
<tr><td>Port specifications</td><td>10GE port</td><td>One (XFP optical module)</td></tr>
<tr><td colspan="2">Backplane bus bandwidth</td><td>CSHOF boards: 10 Gbit/s</td></tr>
<tr><td colspan="2">Switching mode</td><td>Centralized mode
NOTE
When a board works in centralized mode, all Ethernet services carried on the board must be forwarded by the packet switching unit of the cooperating system control board.</td></tr>
<tr><td rowspan="4">Port attributes</td><td>Working mode</td><td>Supports the 10 Gbit/s full-duplex mode and supports the LAN mode.</td></tr>
<tr><td>Tag attributes</td><td>● The tag attribute can be tag aware, access, or hybrid.
● Sets and queries the tag attribute of a port.</td></tr>
<tr><td>Jumbo frames</td><td>Supports jumbo frames with a maximum length of 9600 bytes.</td></tr>
<tr><td>Traffic control</td><td>Supports port-based traffic control that complies with IEEE 802.3x.</td></tr>
<tr><td rowspan="2">LAG</td><td>Inter-board LAG</td><td>Supported</td></tr>
<tr><td>Intra-board LAG</td><td>Supported</td></tr>
<tr><td colspan="2">ERPS</td><td>Supported (complies with ITU-T G.8032 v1/v2)</td></tr>
<tr><td colspan="2">MPLS functions</td><td rowspan="2">Refer to the description of MPLS/PWE3 functions provided in the sections about system control, switching, and timing boards.</td></tr>
<tr><td colspan="2">PWE3 functions</td></tr>
<tr><td colspan="2">LPT</td><td>Supported</td></tr>
<tr><td colspan="2">Port mirroring</td><td>Supported</td></tr>
<tr><td colspan="2">LLDP</td><td>Supported</td></tr>
<tr><td>QoS</td><td>DiffServ</td><td>Supports simple traffic classification by specifying per-hop behaviors (PHBs) for traffic flows based on their QoS information, such as C-VLAN priorities, S-VLAN priorities, DSCP values, or MPLS EXP values.</td></tr>
</table>

Function and Feature		Description
	Complex traffic classification	Supports traffic classification based on the following information carried by packets: SAMC, DMAC, C-VLAN IDs, S-VLAN IDs, C-VLAN priorities, S-VLAN priorities, C-VLAN IDs + C-VLAN priorities, S-VLAN IDs + S-VLAN priorities, or DSCP values.
	Committed access rate (CAR)	Provides the CAR function for traffic flows at ports.
	Queue scheduling policies	● SP ● WRR ● SP+WRR
	Congestion avoidance	Supports tail drop and weighted random early detection (WRED).
	Traffic shaping	Supports shaping for a specified port, priority queue, or service flow, and supports a step of 64 kbit/s for the peak information rate (PIR) and committed information rate (CIR).
Remote network monitoring (RMON)		Supported
Anti-theft		Supported **NOTE** Supported only when it is used with the CSHOF board.
Clock	Physical layer synchronizatio n	Synchronous Ethernet
	Physical-layer clock protection	● Protection implemented by providing clock sources with different priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronizatio n	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization.
	Packet frequency synchronizatio n	Supports IEEE 1588v2 frequency synchronization. Supports IEEE 1588 ACR.

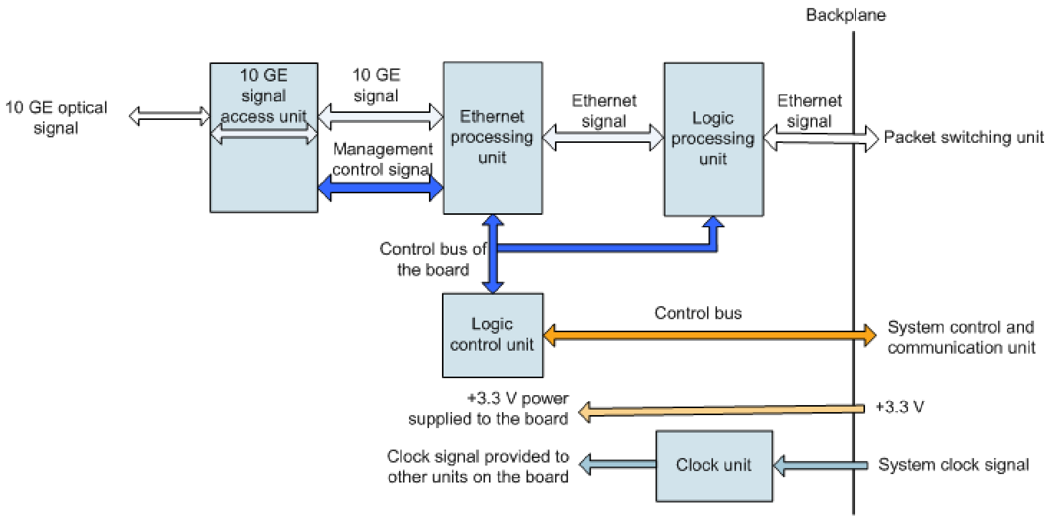
Function and Feature		Description
Data communication network (DCN)	Inband DCN	Each port provides one inband DCN channel.
Operation and management	Loopback	● Supports inloops at the PHY layer of Ethernet ports. ● Supports inloops at the MAC layer of Ethernet ports.
	Warm and cold resetting	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Voltage monitoring	Supported
	Temperature monitoring	Supported
	XFP module information query	Supported

3.13.4 Working Principle and Signal Flow

This section describes how the function units of an EX1 board process 10GE signals.

Function Block Diagram

Figure 3-90 EX1 board function block diagram



Signal Processing in the Receive Direction

Table 3-432 Signal processing in the receive direction of an EX1 board

Step	Function Unit	Processing Flow
1	10GE signal access unit	● Receives 10GE signals. ● Performs restructuring, decoding, and serial/parallel conversion for 10GE signals. ● Performs frame delimitation, preamble stripping, cyclic redundancy check (CRC), and Ethernet performance measurement for frame signals.
2	Ethernet processing unit	● Adds tags identifying ingress ports to Ethernet data frames. ● Processes VLAN tags in Ethernet data frames. ● Processes labels in MPLS/PWE3 packets. ● Performs QoS processing such as traffic classification and CAR traffic monitoring for Ethernet data frames. ● Forwards Ethernet data frames to the logic processing unit.
3	Logic processing unit	Transmits Ethernet data frames to the main and standby packet switching units.

Signal Processing in the Transmit Direction

Table 3-433 Signal processing in the transmit direction of an EX1 board

Step	Function Unit	Processing Flow
1	Logic processing unit	● Selects Ethernet data frames from the packet switching unit. ● Transmits Ethernet data frames to the Ethernet processing unit.
2	Ethernet processing unit	● Processes labels in MPLS/PWE3 packets. ● Processes VLAN tags in Ethernet data frames. ● Performs QoS processing such as traffic shaping and queue scheduling for Ethernet data frames. ● Forwards Ethernet data frames to proper egress ports based on egress tags contained in Ethernet data frames.
3	GE signal access unit	● Performs frame delimitation, preamble addition, CRC code computing, and Ethernet performance measurement. ● Performs parallel/serial conversion and coding for Ethernet data frames. ● Transmits 10GE signals through an Ethernet port.

Control Signal Processing

The Ethernet processing unit controls the GE signal access unit using management control signals.

The logic control unit controls the Ethernet processing unit and logic processing unit using the control bus.

The logic control unit communicates with the main and standby system control and communication units using the system control bus. Specifically, the logic control unit transmits configuration data and query commands from the main and standby system control and communication units to other units on the EX1; it also transmits response messages, alarms, and performance events from other units on the EX1 to the main and standby system control and communication units.

Clock Unit

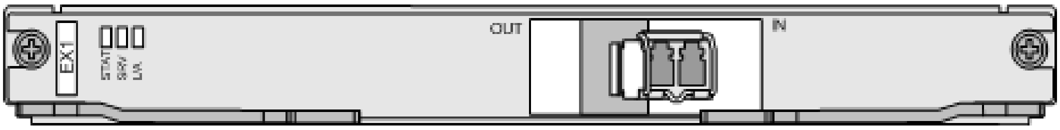
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.13.5 Front Panel

There are indicators and ports on the front panel.

Front Panel Diagram

Figure 3-91 Front panel of the EX1



Indicators

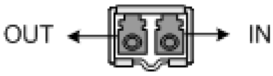
Table 3-434 Status explanation for indicators on an EX1

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working or created. ● There is no power supplied to the board.
SRV	On (green)	The system/service is normal.
	On (red)	A critical or major alarm occurs in the system/service.
	On (yellow)	A minor or remote alarm occurs in the system/service.
	Off	No service is configured.
L/A	On (green)	The port is connected correctly (link up), but is not receiving or transmitting data.
	Blinks (red) three times every second, 300 ms on and 300 ms off	The port on the board receives too strong power.
	Blinks (red) once every second, 300 ms on and 700 ms off	The port on the board receives too weak power.

Indicator	State	Meaning
	Blinks (orange)	The port is connected correctly (link up), and is receiving and transmitting data.
	Off	The optical fiber is not connected to the port, or the port is abnormal (link down/ LOS).

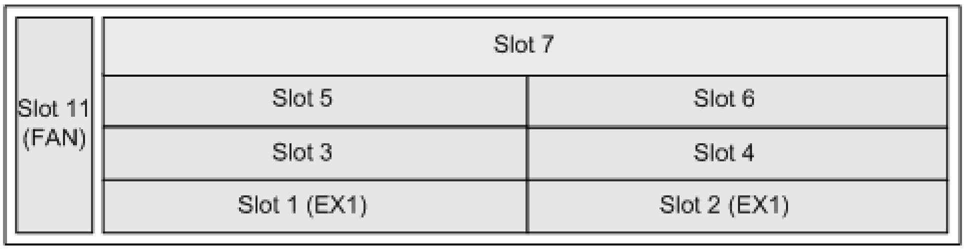
Ports

Table 3-435 Ports on an EX1 board

Port	Description	Connector Type	Pin Assignment	Required Cable
IN	Receives 10GE signals.	XFP optical module 	• OUT represents the transmit port. • IN represents the receive port.	**5.6 Fiber Jumper**
OUT	Transmits 10GE signals.			

3.13.6 Valid Slots

An EX1 board can be inserted in any of slot 1/2. Its logical slot on the network management system (NMS) is the same as its physical slot.



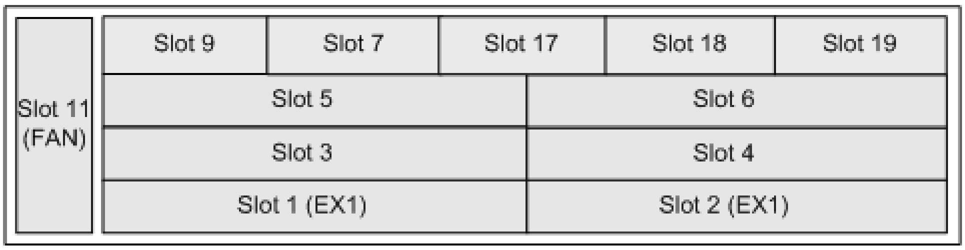


Table 3-436 Slot allocation

Item	Description
Slot allocation	Slot 1, slot 2

3.13.7 Types of XFP Modules

The 10GE XFP port on an EX1 board supports multiple types of XFP optical modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-437 Types of XFP modules supported by a 10GE port

Category	BOM Number	Module Type	Wavelength and Transmission Distance
Dual-fiber bidirectional 10GE module	34060362	10GBase-SW/SR	850 nm, 0.3 km
	34060313	10GBASE-LW/LR	1310 nm, 10 km
	34060322	10GBASE-EW/ER	1550 nm, 40 km
	34060361	10GBASE-ZW/ZR	1550 nm, 80 km
	34060577	10GBASE-EW/ER	1550 nm, 40 km
Single-fiber bidirectional 10GE module	34060780	10GBASE-LW-D, 10GBASE-LR-D	Transmit wavelength: 1330 nm; receive wavelength: 1270 nm 10 km
	34060781	10GBASE-LW-U, 10GBASE-LR-U	Transmit wavelength: 1270 nm; receive wavelength: 1330 nm 10 km

NOTE

For the detailed specifications of each type of optical module, see **3.13.8 Technical Specifications**.

3.13.8 Technical Specifications

This section describes board specifications, including the Ethernet service port performance, mechanical behaviors, and power consumption.

Table 3-438 10GE optical interface specifications (two-fiber bidirectional)

Item	Specifications			
Classification code	**10GBASE-SW 10GBASE-SR**	**10GBASE-LW 10GBASE-LR**	**10GBASE-EW 10GBASE-ER**	**10GBASE-ZW 10GBASE-ZR**
Nominal wavelength (nm)	850	1310	1550	1550
Fiber type	Multi-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	0.3	10	40	80
Operating wavelength (nm)	840 to 860	1260 to 1355	1530 to 1565	1530 to 1565
Average optical output power (dBm)	-1.3 to -7.3	-8.2 to 0.5	-4.7 to 4	0 to 4
Receiver sensitivity (dBm)	-7.5	-12.6	-14.1	-21
Overload (dBm)	-1	0.5	-1	-7
Extinction ratio (dB)	3	3.5	3	3

Table 3-439 10GE optical interface specifications (single-fiber bidirectional)

Item	Specifications	
Classification code	**10GBASE-LW-D 10GBASE-LR-D**	**10GBASE-LW-U 10GBASE-LR-U**
Nominal wavelength (nm)	Tx: 1330 Rx: 1270	Tx: 1270 Rx: 1330
Fiber type	Single-mode	Single-mode
Transmission distance (km)	10	10
Operating wavelength (nm)	Tx: 1320 to 1340 Rx: 1260 to 1280	Tx: 1260 to 1360 Rx: 1480 to 1500
Average optical output power (dBm)	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-14	-14

Item	Specifications	
Classification code	**10GBASE-LW-D** **10GBASE-LR-D**	**10GBASE-LW-U** **10GBASE-LR-U**
Overload (dBm)	0.5	0.5
Extinction ratio (dB)	3.5	3.5

Mechanical Behaviors and Power Consumption

Table 3-440 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.5 kg
Power consumption	≤ 13.1 W

3.14 EM6

EM6 boards are 6-port Ethernet interface boards. The interface types can be flexibly combined based on service requirements. An EM6 board provides two fixed RJ45 FE electrical ports and the other four ports can be SFP ports or RJ45 electrical ports.

3.14.1 Version Description

The functional version of an EM6 board is SL91.

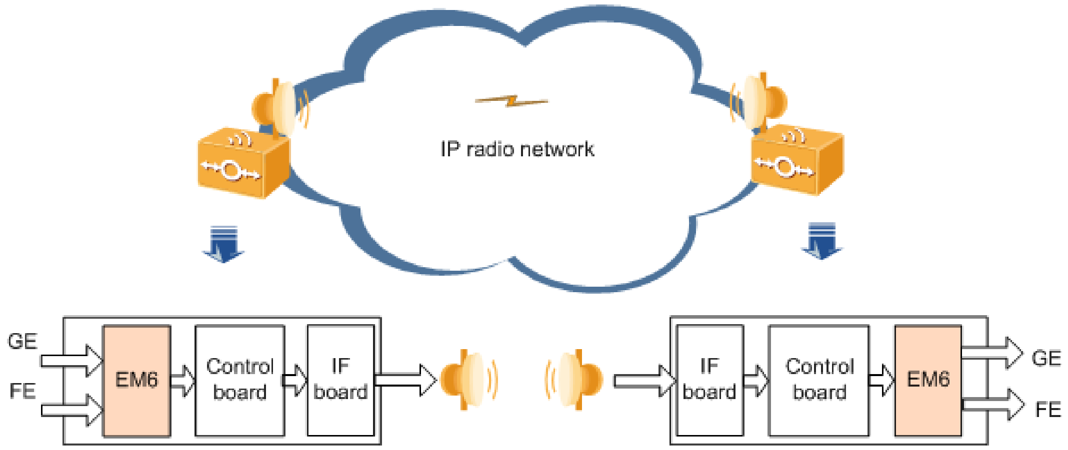
3.14.2 Application

EM6 boards can be used to receive and transmit GE/FE services or carry Multiprotocol Label Switching (MPLS) tunnels.

Receiving and Transmitting Ethernet Services

When OptiX RTN 950A uses Integrated IP microwave to transmit Ethernet services, EM6 boards can be used to receive and transmit GE/FE services. The FE/GE services may be from client equipment or Layer 2 networks.

Figure 3-92 Application scenario for EM6 boards to receive and transmit GE/FE services



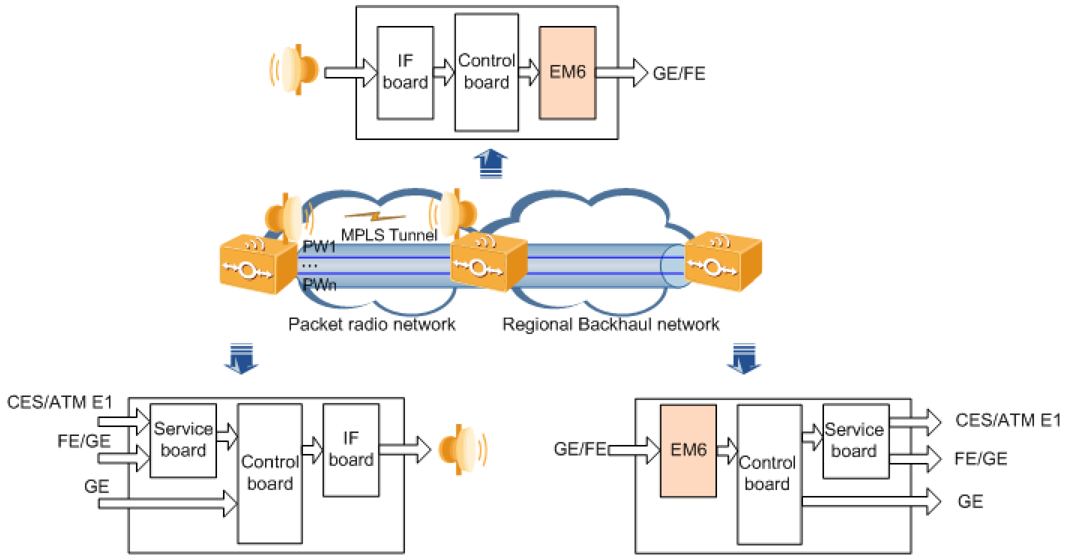
NOTE

- IF boards shown in the preceding figure must be common IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- In the preceding figure, if being transmitted over Integrated IP microwave, Ethernet services can be native Ethernet services or ETH pseudo wire emulation edge-to-edge (PWE3) services.

Carrying MPLS Tunnels

EM6 boards can carry MPLS tunnels to allow MPLS or PWE3 services to traverse microwave networks and local backhaul networks. In this way, E2E transmission is achieved.

Figure 3-93 Application scenario for EM6 boards to carry MPLS tunnels



NOTE

- IF boards shown in the preceding figure must be common IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- If required, two MPLS tunnels can be created on both the packet microwave network and local backhaul network so that PWE3 services are transmitted on multi-segment pseudo wires (MS-PWs) in end-to-end mode.
- Service boards shown in the preceding figure can be Smart E1 processing boards or Ethernet interface boards.

3.14.3 Functions and Features

EM6 boards receive/transmit, process, and converge 4xGE+2xFE service signals. They also can receive/transmit 4xFE optical signals using FE SFP optical modules installed at their SFP ports.

Table 3-441 lists the functions and features supported by EM6 boards. EM6 boards implement Ethernet service functions by working with packet switching units on the system control, switching, and timing boards.

Table 3-441 Functions and features that EM6 boards support

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td colspan="2">Basic functions</td><td>Receives/Transmits GE/FE service signals, and processes these signals by working with the packet switching unit.</td></tr>
<tr><td>Port specifications</td><td>Ethernet port</td><td>Provides six Ethernet ports.
● Provides two unpluggable FE electrical ports.
● Provides four unpluggable GE electrical ports or four SFP optical ports.
Supports the following types of SFP modules:
– Dual-fiber bidirectional FE/GE optical module
– Colored CWDM GE optical module (CWDM stands for coarse wavelength division multiplexing)
– Single-fiber bidirectional FE/GE module</td></tr>
<tr><td colspan="2">Backplane bus bandwidth</td><td>● 2x2.5 Gbit/s for slot 1/2 and 2.5 Gbit/s for slots 3 – 6 (working with the CSHOF)
● 2.5 Gbit/s (working with other system control boards)</td></tr>
<tr><td colspan="2">Switching mode</td><td>Centralized mode
NOTE
When a board works in centralized mode, all Ethernet services carried on the board must be forwarded by the packet switching unit of the cooperating system control board.</td></tr>
</table>

Function and Feature		Description
Port attributes	Working mode	● GE electrical ports support 10M/100M/1000M full-duplex and auto-negotiation. ● GE optical ports support 1000M full-duplex and auto-negotiation. ● FE electrical ports support 10M/100M full-duplex, and auto-negotiation. ● FE optical ports support 100M full-duplex.
	Tag attributes	● The tag attribute can be tag aware, access, or hybrid. ● Sets and queries the tag attribute of a port.
	Jumbo frames	Supports jumbo frames with a maximum length of 9600 bytes.
	Traffic control	Supports port-based traffic control that complies with IEEE 802.3x.
Services	Native Ethernet services	● E-Line services – Port-based E-line services – VLAN-based E-line services – E-Line services carried by QinQ links ● E-LAN services – E-LAN services based on IEEE 802.1d bridges – E-LAN services based on IEEE 802.1q bridges – E-LAN services based on IEEE 802.1ad bridges
	PWE3 Ethernet services	● E-Line services carried by PWs ● E-Aggr services carried by PWs ● E-LAN services carried by PWs, that is, virtual private LAN services (VPLSs)
Link aggregation group (LAG)	Inter-board LAG	Supported
	Intra-board LAG	Supported
Ethernet ring protection switching (ERPS)		Supported (complies with ITU-T G.8032 v1/v2)
Smart Ethernet protection (SEP)		Supported
MPLS functions		Refer to the description of MPLS/PWE3 functions provided in the sections about system control, switching, and timing boards.
PWE3 functions		

Function and Feature		Description
Spanning Tree Protocol (STP)		Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).
IGMP snooping		Supported
Link-state pass through (LPT)		Supported
Port mirroring		Supported
LLDP		Supported
Quality of service (QoS)	DiffServ	Supports simple traffic classification by specifying per-hop behaviors (PHBs) based on packets-carried QoS information (including C-VLAN priority, S-VLAN priority, DSCP value, and MPLS EXP value).
	Complex traffic classification	Supports traffic classification based on the following information carried by packets: SMAC, DMAC, C-VLAN IDs, S-VLAN IDs, C-VLAN priorities, S-VLAN priorities, C-VLAN IDs + C-VLAN priorities, S-VLAN IDs + S-VLAN priorities, or DSCP values.
	Committed access rate (CAR)	Provides the CAR processing for traffic flows at ports.
	Shaping	Supports traffic shaping for a specific port, prioritized queue, or traffic flow.
	Queue scheduling policies	● Strict-priority (SP) ● Weighted round robin (WRR) ● SP+WRR
	Congestion avoidance	Supports tail drop and weighted random early detection (WRED).
	Traffic shaping	Supports shaping for a specified port, priority queue, or service flow, and allows the peak information rate (PIR) and committed information rate (CIR) to be modified in 64 kbit/s steps.
ETH OAM functions	Ethernet service OAM	● Supports ETH OAM functions that comply with IEEE 802.1ag. ● Supports frame loss measurement, frame delay measurement, and delay variation measurement functions that comply with ITU-T Y.1731.
	Ethernet port OAM	Supports ETH OAM functions that comply with IEEE 802.3ah.

Function and Feature		Description
Remote network monitoring (RMON)		Supported
Clock	Physical layer synchronization	Synchronous Ethernet
	Physical-layer clock protection	● Protection implemented based on different clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization. Supports use of the AE 905S module as the clock source for time synchronization.
	Packet frequency synchronization	● Supports IEEE 1588v2 frequency synchronization. ● Supports IEEE 1588 ACR.
Data communication network (DCN)	Inband DCN	Each port provides one inband DCN channel.
Operation and management	Loopback	● Supports inloops at the PHY layer of Ethernet ports. ● Supports inloops at the MAC layer of Ethernet ports.
	Warm and cold resetting	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Voltage monitoring	Supported
	Temperature monitoring	Supported

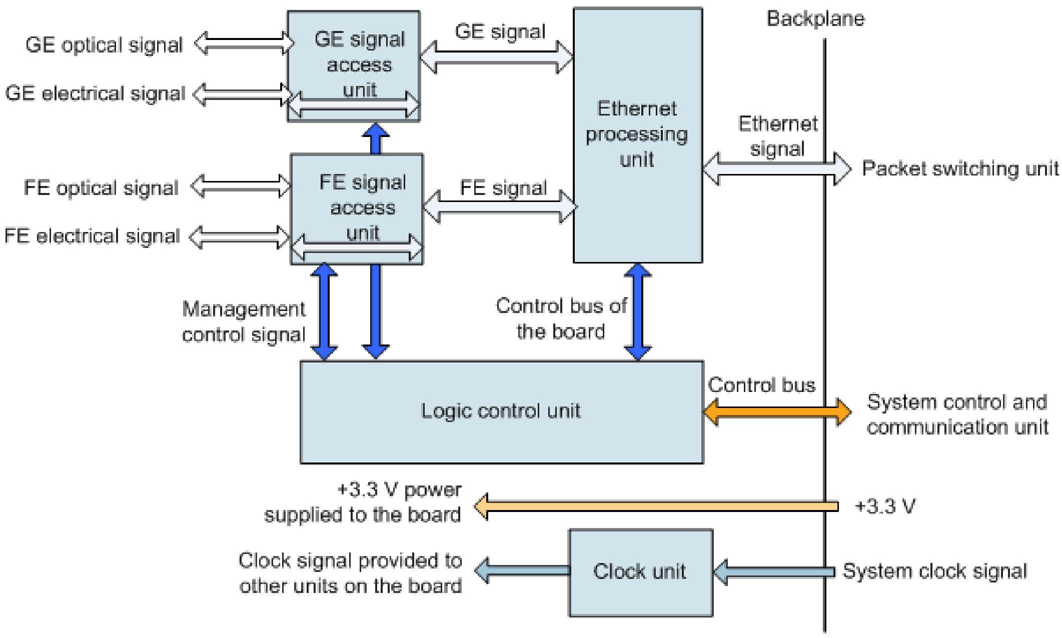
Function and Feature		Description
	SFP module information query	Supported

3.14.4 Working Principle and Signal Flow

This section describes how the function units of an EM6 board process GE/FE signals.

Function Block Diagram

Figure 3-94 EM6 board function block diagram



Signal Processing in the Receive Direction

Table 3-442 Signal processing in the receive direction of an EM6 board

Step	Function Unit	Processing Flow
1	GE signal access unit or FE signal access unit	● Receives GE/FE signals. ● Performs restructuring, decoding, and serial/parallel conversion for GE/FE signals. ● Performs frame delimitation, preamble stripping, cyclic redundancy check (CRC), and Ethernet performance measurement for frame signals.

Step	Function Unit	Processing Flow
2	Ethernet processing unit	● Adds tags identifying ingress ports to Ethernet data frames. ● Processes VLAN tags in Ethernet data frames. ● Processes labels in MPLS/PWE3 packets. ● Performs QoS processing such as traffic classification and CAR traffic monitoring for Ethernet data frames. ● Transmits Ethernet data frames to the packet switching unit.

Signal Processing in the Transmit Direction

Table 3-443 Signal processing in the transmit direction of an EM6 board

Step	Function Unit	Processing Flow
1	Ethernet processing unit	● Selects Ethernet data frames from the packet switching unit. ● Processes labels in MPLS/PWE3 packets. ● Processes VLAN tags in Ethernet data frames. ● Performs QoS processing such as traffic shaping and queue scheduling for Ethernet data frames. ● Forwards Ethernet data frames to proper egress ports based on egress tags contained in Ethernet data frames.
2	GE signal access unit or FE signal access unit	● Performs frame delimitation, preamble addition, CRC code computing, and Ethernet performance measurement. ● Performs parallel/serial conversion and coding for Ethernet data frames. ● GE/FE electrical ports transmit GE/FE electrical signals. ● GE/FE optical ports convert optical signals into electrical signals and transmit the electrical signals.

Control Signal Processing

The logic control unit controls the GE/FE signal access unit using management control signals.

The logic control unit controls the Ethernet processing unit using the control bus.

The logic control unit communicates with the system control and communication unit using the system control bus. Specifically, the logic control unit transmits configuration data and query commands from the system control and communication unit to other units on the EM6; it also transmits response messages, alarms, and performance events from other units on the EM6 to the system control and communication unit.

Clock Unit

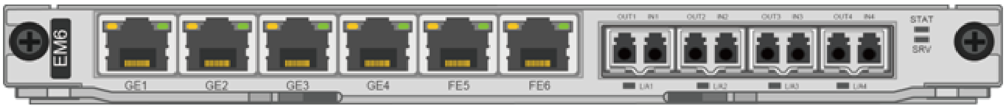
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.14.5 Front Panel

An EM6 board has indicators, GE service ports, and FE service ports on its front panel.

Front Panel Diagram

Figure 3-95 Front panel of an EM6 board



Indicators

Table 3-444 Status explanation for indicators on an EM6 board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor alarm has been reported.
	Off	No service is configured.
L/A1 (optical/ electrical port 1)	On (green)	Port GE1 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE1 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE1 has received extremely low optical power (applicable only to an optical port).

Indicator	State	Meaning
	Blinks (yellow)	Port GE1 is receiving or transmitting data.
	Off	Port GE1 is not connected or is incorrectly connected.
L/A2 (optical/ electrical port 2)	On (green)	Port GE2 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE2 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE2 has received extremely low optical power (applicable only to an optical port).
	Blinks (yellow)	Port GE2 is receiving or transmitting data.
	Off	Port GE2 is not connected or is incorrectly connected.
L/A3 (optical/ electrical port 3)	On (green)	Port GE3 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE3 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE3 has received extremely low optical power (applicable only to an optical port).
	Blinks (yellow)	Port GE3 is receiving or transmitting data.
	Off	Port GE3 is not connected or is incorrectly connected.
L/A4 (optical/ electrical port 4)	On (green)	Port GE4 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE4 has received extremely high optical power (applicable only to an optical port).
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE4 has received extremely low optical power (applicable only to an optical port).
	Blinks (yellow)	Port GE4 is receiving or transmitting data.
	Off	Port GE4 is not connected or is incorrectly connected.

Ports

Table 3-445 Ports on an EM6 board

Port	Description	Connector Type	Required Cable
OUT1/IN1 to OUT4/IN4	FE/GE optical port	LC SFP optical module AE 905S module (OUT1/IN1 and OUT2/IN2 ports)	**5.6 Fiber Jumper**
GE1 to GE4	GE service port (unpluggable electrical port) **NOTE** Four optical ports and four GE electrical ports share the same physical channel. For example, GE1 and OUT1/IN1 share the same physical channel.	RJ45	**5.10 Network Cable**
FE5 to FE6	FE service port (unpluggable electrical port)		

GE electrical ports on EM6 board comply with the 10/100/1000BASE-T(X) standard in performance. FE electrical ports on EM6 board comply with the 10/100BASE-T(X) standard in performance. Both the two types of ports support the medium dependent interface (MDI), MDI crossover (MDI-X), and auto-MDI/MDI-X modes. All GE electrical ports and FE electrical ports on EM6 board use RJ45 connectors.

Figure 3-96 Front view of the RJ45 connector

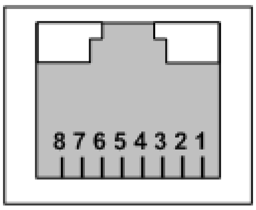


Table 3-446 Pin assignments for RJ45 connectors in MDI mode

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

Table 3-447 Pin assignments for RJ45 connectors in MDI-X mode

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

Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
8	Reserved	-	BIDC-	Bidirectional data wire C (-)

An RJ45 connector has two indicators. For status explanation for these indicators, see **Table 3-448**.

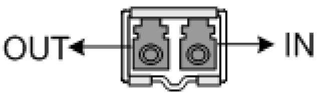
Table 3-448 Status explanation for the indicators of the RJ45 connector

Indicator	State	Meaning
LINK (green)	On	The link is working properly.
	Off	The link is interrupted.
ACT (yellow)	On or blinking	The port is transmitting or receiving data.
	Off	The port is not transmitting or receiving data.

EM6 boards require SFP optical modules to provide GE/FE optical ports.

- When dual-fiber bidirectional SFP optical modules are used, one optical module provides one OUT port and one IN port. For details, see **Figure 3-97**, in which OUT represents the transmit port and IN represents the receive port. One optical fiber is connected to each port.
- When single-fiber bidirectional optical modules are used, one optical module provides only port, which can both receive and transmit service signals. One optical fiber is connected to this port.

Figure 3-97 Ports of an SFP optical module



3.14.6 Valid Slots

The EM6 board can be inserted in , which have consistent logical slot numbers on the NMS.

Figure 3-98 Physical slots for EM6 boards in a chassis

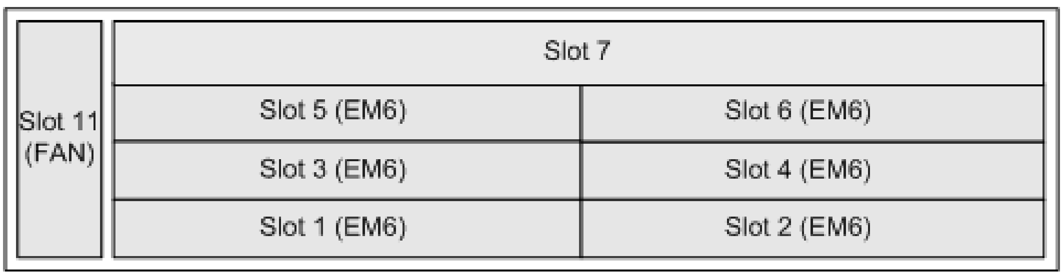


Figure 3-99 Logical slots of EM6 boards on the NMS

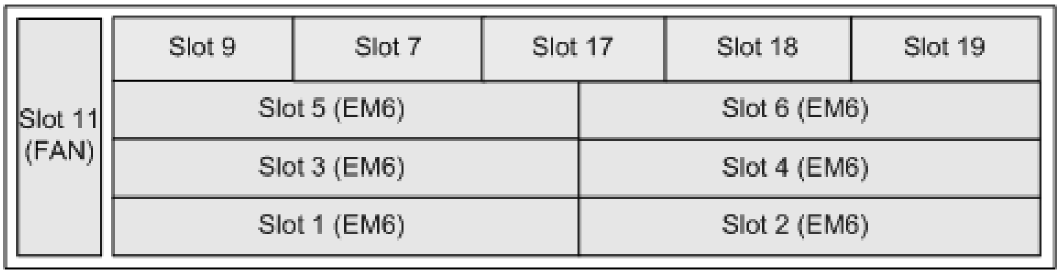


Table 3-449 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.14.7 Types of SFP Modules

FE/GE SFP ports on EM6 boards support multiple types of SFP modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-450 Types of SFP modules that FE/GE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060286	1000BASE-SX	850 nm, 0.5 km
	34060473	1000BASE-LX	1310 nm, 10 km
	34060298	1000BASE-VX	1310 nm, 40 km
	34060513		1550 nm, 40 km
	34060360	1000BASE-ZX	1550 nm, 80 km
	02238065	1000BASE-CWDM	Nominal wavelength ± 6.5, 40 km
	02239266	1000BASE-CWDM	Nominal wavelength ± 6.5, 80 km

Category	Part Number	Type	Wavelength and Transmission Distance
Single-fiber bidirectional GE module	34060475	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 10 km
	34060470	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 10 km
	34060540	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 40 km
	34060539	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 40 km
Dual-fiber bidirectional FE module	34060287	100BASE-FX	1310 nm, 2 km
	34060276	100BASE-LX	1310 nm, 15 km
	34060281	100BASE-VX	1310 nm, 40 km
	34060282	100BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional FE module	34060364	100BASE-BX-D	Transmit wavelength: 1550 nm; receive wavelength: 1310 nm 15 km
	34060363	100BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1550 nm 15 km
	34060329	100BASE-BX-D	Transmit: 1550 nm; receive: 1310 nm 40 km
	34060328	100BASE-BX-U	Transmit: 1310 nm; receive: 1550 nm 40 km

NOTE

For specifications for each type of optical module, see **3.14.8 Technical Specifications**.

The types of SFP modules listed in the following table can be identified by feature codes in the bar codes of EM6 boards. A feature code refers to the number next to the board name in a bar code.

Table 3-451 Feature codes of EM6 boards

Feature Code	Module Type	Part Number of the Module
01	**1000Base-SX**	34060286
02	**1000Base-SX**	34060473
10	**100BASE-FX**	34060287
11	**100BASE-LX**	34060276

3.14.8 Technical Specifications

This section describes board specifications, including the Ethernet service port performance, mechanical behaviors, and power consumption.

FE/GE Optical Port Performance

FE/GE optical ports on EM6 boards comply with IEEE 802.3. The following tables list main specifications for the FE/GE optical ports.

NOTE

The OptiX RTN 950A uses SFP modules to provide GE/FE optical ports. Different types of SFP optical modules can be used to provide GE/FE optical ports with different classification codes and transmission distances.

Table 3-452 GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.5	10
Operating wavelength (nm)	770 to 860	1270 to 1355

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Average optical output power (dBm)	-9 to -3	-9 to -3
Receiver sensitivity (dBm)	-17	-20
Overload (dBm)	0	-3
Extinction ratio (dB)	9.5	9.5

Table 3-453 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

Table 3-454 GE optical interface specifications (two-fiber bidirectional, CWDM)

Item	**Specifications**	
Classification code	**1000BASE-CWDM (40 km)**	**1000BASE-CWDM (80 km)**
Nominal wavelength (nm)	• Channel 1: 1471 • Channel 2: 1491 • Channel 3: 1511 • Channel 4: 1531 • Channel 5: 1551 • Channel 6: 1571 • Channel 7: 1591 • Channel 8: 1611	• Channel 1: 1471 • Channel 2: 1491 • Channel 3: 1511 • Channel 4: 1531 • Channel 5: 1551 • Channel 6: 1571 • Channel 7: 1591 • Channel 8: 1611
Nominal bit rate (Mbit/s)	1000	1000
Fiber type	Single-mode	Single-mode
Transmission distance (km)	40	80
Operating wavelength (nm)	Nominal wavelength ±6.5	Nominal wavelength ±6.5
Average optical output power (dBm)	0 to +5	0 to +5
Receiver sensitivity (dBm)	-19	-28
Overload (dBm)	0	-9
Extinction ratio (dB)	8.2	8.2

Table 3-455 GE optical interface specifications (single-fiber bidirectional)

Item	**Specifications**			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Nominal bit rate (Mbit/s)	1000	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	10	10	40	40
Operating wavelength (nm)	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Average optical output power (dBm)	-9 to -3	-9 to -3	-3 to +3	-3 to +3
Receiver sensitivity (dBm)	-19.5	-19.5	-23	-23
Overload (dBm)	-3	-3	-3	-3
Extinction ratio (dB)	6	6	6	6

Table 3-456 FE optical interface specifications (two-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-FX (2 km)**	**100BASE-LX (15 km)**	**100BASE-VX (40 km)**	**100BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1310	1310	1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Multi-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Average optical output power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-30	-28	-34	-34
Overload (dBm)	-14	-8	-10	-10
Extinction ratio (dB)	10	8.2	10	10.5

Table 3-457 FE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550
Nominal bit rate (Mbit/s)	100	100	100	100
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode

Item	Specifications			
Classification code	**100BASE-BX-D (15 km)**	**100BASE-BX-U (15 km)**	**100BASE-BX-D (40 km)**	**100BASE-BX-U (40 km)**
Transmission distance (km)	15	15	40	40
Operating wavelength (nm)	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580
Average optical output power (dBm)	-15 to -8	-15 to -8	-5 to 0	-5 to 0
Receiver sensitivity (dBm)	-32	-32	-32	-32
Overload (dBm)	-8	-8	-10	-10
Extinction ratio (dB)	8.5	8.5	10	10

GE/FE Electrical Port Performance

GE/FE electrical ports on EM6 boards comply with IEEE 802.3. The following table lists main specifications for the GE/FE electrical ports.

Table 3-458 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

Table 3-459 FE electrical interface specifications

Item	Specifications
Nominal bit rate (Mbit/s)	10 (10BASE-T) 100 (100BASE-TX)
Code pattern	Manchester encoding signal (10BASE-T) MLT-3 encoding signal (100BASE-TX)

Item	Specifications
Interface type	RJ45

Mechanical Behaviors and Power Consumption

Table 3-460 Mechanical behaviors and Power Consumption of EM6

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.55 kg
Power consumption	< 7.5 W

3.15 EM6D

EM6D is a 6-port Ethernet processing board that supports the Super Dual Band feature. It provides two 10GE ports, two 2.5GE ports, and two GE ports.

3.15.1 Version Description

The functional version of EM6D boards is SL91.

3.15.2 Application

EM6D also supports the Super Dual Band feature.

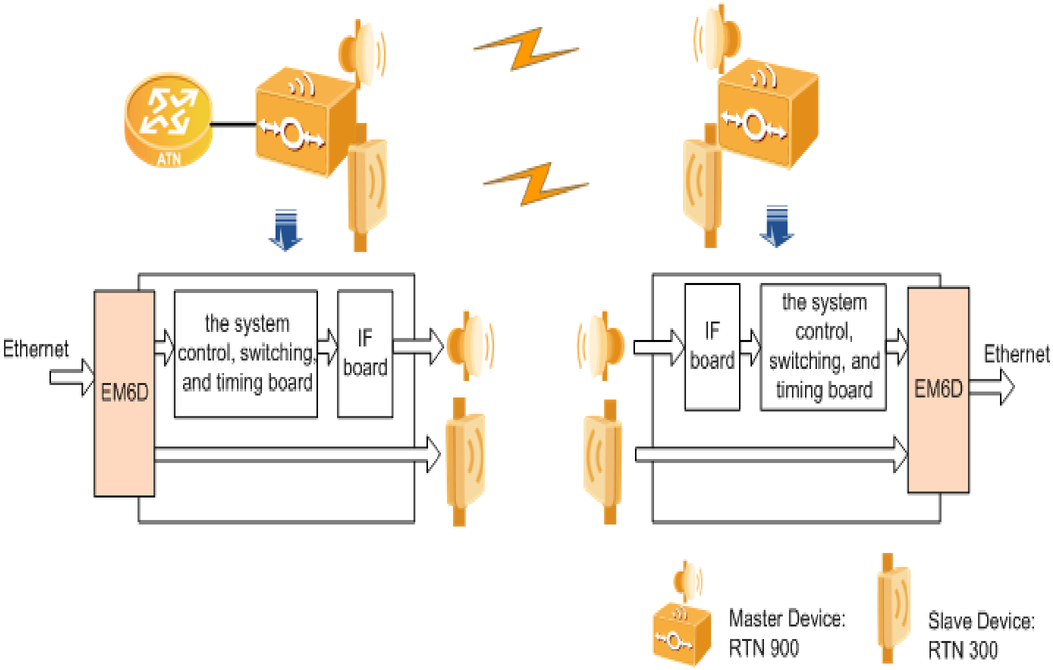
Super Dual Band Application

Super Dual Band uses physical link aggregation, adaptive modulation, and QoS technologies to constructing a best-experience large-bandwidth long-distance MBB network, matching all MBB requirements on frequency resources, capacities, transmission distances, and reliability.

NOTE

When the master device is RTN 950A, the EM6D board can be used only with the SLF2CSHO board. The slave device can be the RTN 380 series.

Figure 3-100 Super Dual Band's Ethernet service scenario



3.15.3 Functions and Features

An EM6D provides six Ethernet ports (two 10GE ports, two 2.5 GE ports, and two GE ports). It supports intra-board Ethernet service switching.

Table 3-461 Functions and features that EM6D boards support

Function and Feature		Description
Basic functions		Receives/Transmits GE service signals, and processes these signals by working with the packet switching unit.
Port specifications	Fixed GE electrical port	2
	GE port	Two ports with any of the following SFP+/SFP module types: ● Dual-fiber bidirectional GE optical module ● Single-fiber bidirectional GE optical module ● Dual-fiber bidirectional 2.5GE optical module
	10GE port	Two ports with any of the following SFP+/SFP module types: ● Dual-fiber bidirectional 10GE optical module ● Dual-fiber bidirectional 2.5GE optical module ● Dual-fiber bidirectional GE optical module ● Single-fiber bidirectional GE optical module

Function and Feature		Description
Backplane bus bandwidth		2.5 Gbit/s **NOTE** The EM6D backplane bus transmits only super EPLA members' signals.
Port attributes	Working mode	● GE electrical ports support 10M/100M/1000M full-duplex and auto-negotiation. ● GE optical ports support 1000M full-duplex and auto-negotiation. ● 2.5GE optical ports support 2500M full-duplex. ● 10GE optical ports support 10G full-duplex.
	Tag attributes	● The tag attribute can be tag aware, access, or hybrid. ● Sets and queries the tag attribute of a port.
	Jumbo frames	Supports jumbo frames with a maximum length of 9600 bytes.
	Traffic control	Supports responding to the received Pause frames.
Services	Native Ethernet services	Intra-board E-Line services ● Port-based E-line services ● VLAN-based E-line services ● E-Line services carried by QinQ links Intra-board E-LAN services ● E-LAN services based on IEEE 802.1d bridges ● Supports the E-LAN services based on IEEE 802.1q bridges ● E-LAN service based on IEEE 802.1ad bridges
LAG		Intra-board LAG is supported.
LLDP		Supported
Super EPLA		Supported
ERPS		Supported
Smart Ethernet protection (SEP)		Supported
MSTP		Supported
Quality of service (QoS)	DiffServ	Supports simple traffic classification by specifying per-hop behaviors (PHBs) for traffic flows based on their QoS information, such as C-VLAN priorities, S-VLAN priorities, DSCP values, or MPLS EXP values.

Function and Feature		Description
	Complex traffic classification	Supports traffic classification based on the following information carried by packets: ● SMAC ● DMAC ● C-VLAN ID ● S-VLAN ID ● C-VLAN priorities ● S-VLAN priorities ● C-VLAN IDs + C-VLAN priorities ● S-VLAN IDs + S-VLAN priorities ● Source IPv4 address ● Destination IPv4 address ● Protocol type ● Protocol type (TCP/UDP)+Source port ID ● Protocol type (TCP/UDP)+Destination port ID ● Protocol type (ICMP)+ICMP packet type code ● DSCP value
	Committed access rate (CAR)	Provides the CAR processing for traffic flows at ports.
	Queue scheduling policies	● Strict-priority (SP) ● Weighted round robin (WRR) ● SP+WRR
	Congestion avoidance	Supports tail drop and weighted random early detection (WRED).
	Traffic shaping	Supports shaping for a specified port, priority queue, or service flow, and supports a step of 64 kbit/s for the peak information rate (PIR) and committed information rate (CIR).
ETH OAM functions	Ethernet service OAM	Supports ETH OAM functions that comply with IEEE 802.1ag.
	Ethernet port OAM	Supports ETH OAM functions that comply with IEEE 802.3ah.
Remote network monitoring (RMON)		Supported

Function and Feature		**Description**
Clock	Physical layer synchronization	Synchronous Ethernet
	Physical-layer clock protection	● Protection implemented based on different clock source priorities ● Protection implemented by running the Synchronization Status Message (SSM) protocol ● Protection implemented by running the extended SSM protocol
	Packet time synchronization	Supports IEEE 1588v2 time synchronization. Supports ITU-T G.8275.1 time synchronization. Supports use of the AE 905S module as the clock source for time synchronization.
	Packet frequency synchronization	● Supports IEEE 1588v2 frequency synchronization. ● Supports IEEE 1588 ACR.
Data communication network (DCN)	Inband DCN	Each port provides one inband DCN channel.
Operation and management	Loopback	● Supports inloops at the PHY layer of Ethernet ports. ● Supports inloops at the MAC layer of Ethernet ports.
	Warm and cold resetting	Supported
	Manufacturer information query	Supported
	Power consumption query	Supported
	Voltage monitoring	Supported
	Temperature monitoring	Supported

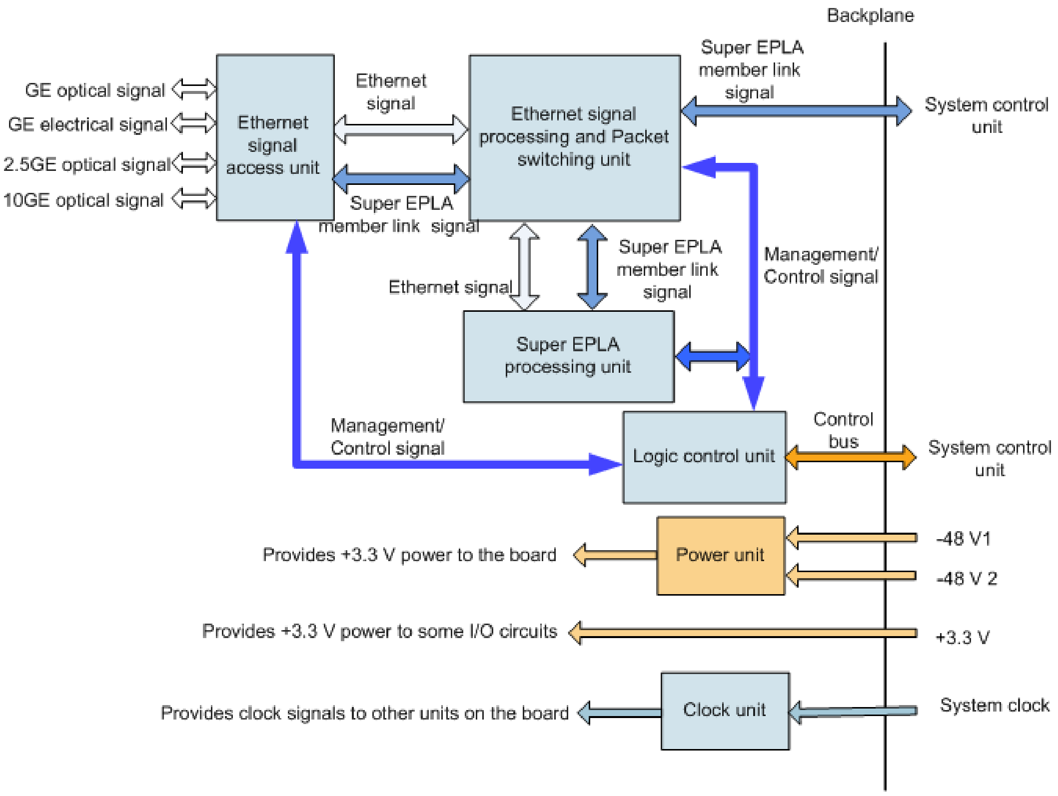
Function and Feature		Description
	SFP module information query	Supported

3.15.4 Working Principle and Signal Flow

This section describes the working principle and signal flow of EM6Ds when providing a Super Dual Band solution.

Function Block Diagram

Figure 3-101 EM6D board function block diagram



Signal Processing in the Receive Direction

Table 3-462 Signal processing in the receive direction of an EM6D

Step	Function Unit	Processing Flow
1	Ethernet signal access unit	● Accesses Ethernet signals. ● Performs restructuring, decoding, and serial/parallel conversion for Ethernet signals. ● Performs frame delimitation, preamble stripping, CRC checks, and Ethernet performance measurement for frame signals. ● Accesses signals of super EPLA group's E-Band member links and transfers the signals to the Ethernet signal processing and packet switching unit.
2	Ethernet signal processing and packet switching unit	● Adds tags identifying ingress ports to Ethernet data frames. ● Processes VLAN tags in Ethernet data frames. ● Performs QoS processing, such as traffic classification and CAR, for the Ethernet data frames. ● Sends the signals received by the Ethernet signal access unit from the super EPLA group's E-Band member links and Ethernet data to the super EPLA processing unit. ● Processes the general-band super EPLA member link signals that are received from the super EPLA processing unit, and then sends the signals, to the system control and switching unit. ● Forwards the signals that are received by the super EPLA processing unit from super EPLA group's E-Band member links to the Ethernet signal access unit.
3	Super EPLA processing unit	Allocates Ethernet services to different super EPLA group member links according to the services' QoS policies and capacities.

Signal Processing in the Transmit Direction

Table 3-463 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Super EPLA processing unit	Combines signals from different-band super EPLA group member links to Ethernet signals and backhauls the signals to the Ethernet signal processing unit.

Step	Function Unit	Processing Flow
2	Ethernet signal processing and packet switching unit	● Forwards the signals that the Ethernet signal access unit receives from super EPLA group's E-Band member links to the super EPLA processing unit. ● Forwards the general-band super EPLA member link signals that are received from the system control and switching unit through the backplane, to the super EPLA processing unit. ● Processes VLAN tags in Ethernet data frames. ● Performs QoS processing such as traffic shaping and queue scheduling for Ethernet data frames. ● Forwards Ethernet data frames to specific egress ports based on egress tags contained in the Ethernet data frames.
3	Ethernet signal access unit	● Sends signals from the super EPLA group's E-Band member links through 2.5GE ports to RTN 380s. ● Performs frame delimitation, preamble addition, CRC code computing, and Ethernet performance measurement. ● Performs parallel/serial conversion and coding for Ethernet data frames. ● When using fixed electrical ports, sends out GE electrical signals. ● When using FE/GE/2.5GE/10GE optical ports, converts optical signals into electrical signals and sends out the electrical signals.

Logic Control Unit

The logic control unit controls the Ethernet signal access unit through the management and control signals.

The logic control unit controls the Ethernet signal processing and packet switching unit through the local-board control bus.

The logic control unit communicates with the main and standby system control and communication units using the system control bus. Specifically, the logic control unit transmits configuration data and query commands from the main and standby system control and communication units to other units on the EM6D; it also transmits response messages, alarms, and performance events from other units on the EM6D to the main and standby system control and communication units.

Power Unit

- The power unit receives the -48 V power from the power supply bus in the backplane, performs the soft-start, filtering, and DC-DC conversion, and then supplies the -48 V power to the ODU.

- The power unit supplies the +3.3 V power received from the backplane power bus to other units on the same board.

Clock Unit

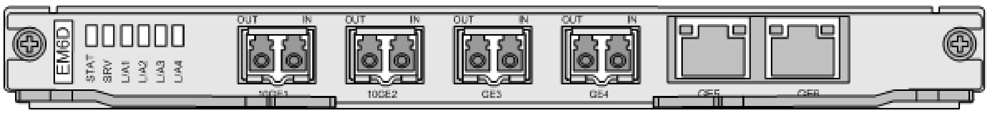
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.15.5 Front Panel

An EM6D board has indicators, Ethernet service ports on its front panel.

Front Panel Diagram

Figure 3-102 Front panel of an EM6D board



Indicators

Table 3-464 Status explanation for indicators on an EM6D board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor alarm has been reported.
	Off	No service is configured.
L/A1 (10GE1)	On (green)	Port 10GE1 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port 10GE1 has received extremely high optical power.
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port 10GE1 has received extremely low optical power.

Indicator	State	Meaning
	Blinks (yellow)	Port 10GE1 is receiving or transmitting data.
	Off	Port 10GE1 is not connected or is incorrectly connected.
L/A2 (10GE2)	On (green)	Port 10GE2 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port 10GE2 has received extremely high optical power.
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port 10GE2 has received extremely low optical power.
	Blinks (yellow)	Port 10GE2 is receiving or transmitting data.
	Off	Port 10GE2 is not connected or is incorrectly connected.
L/A3 (GE3)	On (green)	Port GE3 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE3 has received extremely high optical power.
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE3 has received extremely low optical power.
	Blinks (yellow)	Port GE3 is receiving or transmitting data.
	Off	Port GE3 is not connected or is incorrectly connected.
L/A4 (GE4)	On (green)	Port GE4 is connected correctly but is not receiving or transmitting data.
	Blinks on (red) and off at 300 ms intervals	Port GE4 has received extremely high optical power.
	Blinks on (red) for 300 ms and off for 700 ms at 1000 ms intervals	Port GE4 has received extremely low optical power.
	Blinks (yellow)	Port GE4 is receiving or transmitting data.
	Off	Port GE4 is not connected or is incorrectly connected.

Ports

Table 3-465 Ports on an EM6D board

Port	Description	Connector Type	Required Cable
10GE1	10GE/2.5GE/GE service port (SFP+/SFP)	SFP+/SFP optical module AE 905S module	**5.6 Fiber Jumper**
10GE2			
GE3	2.5GE/GE service port (SFP+/SFP)	LC SFP+/SFP optical module	**5.6 Fiber Jumper**
GE4			
GE5	GE service port (fixed electrical port)	RJ45	**5.10 Network Cable**
GE6			

GE electrical ports on EM6D boards comply with the 10/100/1000BASE-T(X) standard in performance and support the medium dependent interface (MDI), MDI crossover (MDI-X), and auto-MDI/MDI-X modes. The two unpluggable GE electrical ports on an EM6D use RJ45 connectors.

Figure 3-103 Front view of the RJ45 connector

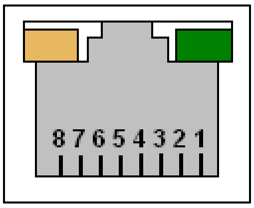


Table 3-466 Pin assignments for RJ45 connectors in MDI mode

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

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

Table 3-467 Pin assignments for RJ45 connectors in MDI-X mode

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

An RJ45 connector has two indicators. For status explanation for these indicators, see **Table 3-468**.

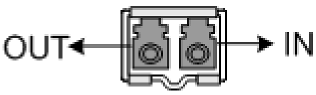
Table 3-468 Status explanation for the indicators of the RJ45 connector

Indicator	State	Meaning
LINK (green)	On	The link is working properly.
	Off	The link is interrupted.
ACT (yellow)	On or blinking	The port is transmitting or receiving data.
	Off	The port is not transmitting or receiving data.

EM6D boards can use only single-fiber bidirectional SFP or two-fiber bidirectional SFP+/SFP optical modules to provide 10GE, 2.5GE and GE optical ports.

- A two-fiber bidirectional SFP+/SFP optical module provides two ports, with the left port (OUT) being the TX port and the right port (IN) being the RX port, as shown in **Figure 3-104**. The IN and OUT ports are connected with two optical fibers for receiving and transmitting service signals respectively.
- A single-fiber bidirectional SFP optical module provides a port only on the left. This port is connected with only an optical fiber that both receives and transmits service signals.

Figure 3-104 Ports of an SFP+/SFP optical module



3.15.6 Valid Slots

An EM6D board can be inserted in any of slots 1, 3, and 5. Its logical slot on the network management system (NMS) is the same as its physical slot.

NOTE

An NE can house a maximum of three EM6D boards.

Figure 3-105 Slots for EM6D boards in a chassis

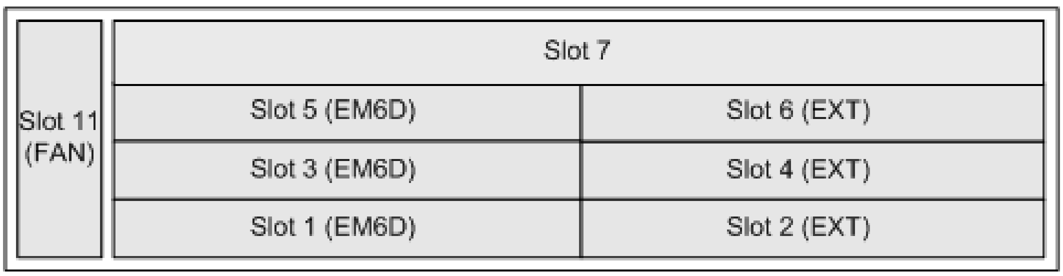


Figure 3-106 Logical slots of EM6D boards on the NMS

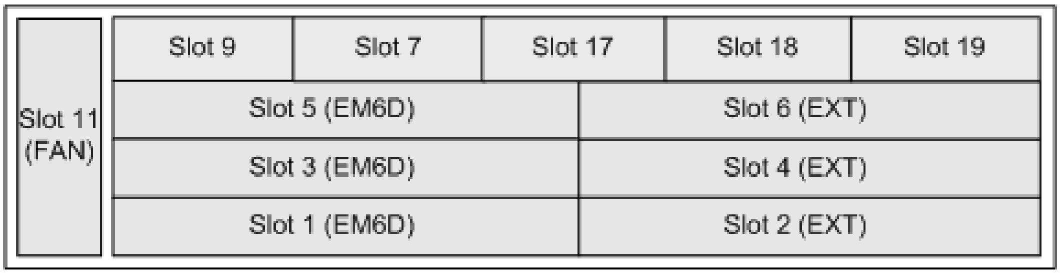


Table 3-469 Slot allocation

Item	Description
Slot allocation priority	Slot 1, 3 and 5

3.15.7 Types of SFP+/SFP Modules

10GE SFP+ ports and GE SFP ports on EM6D boards support multiple types of SFP+/SFP modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-470 Types of SFP modules that GE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060286	1000BASE-SX	850 nm, 0.5 km
	34060473	1000BASE-LX	1310 nm, 10 km
	34060298	1000BASE-VX	1310 nm, 40 km
	34060513		1550 nm, 40 km
	34060360	1000BASE-ZX	1550 nm, 80 km
Single-fiber bidirectional GE module	34060475	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 10 km

Category	Part Number	Type	Wavelength and Transmission Distance
	34060470	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 10 km
	34060540	1000BASE-BX-D	Transmit wavelength: 1490 nm; receive wavelength: 1310 nm 40 km
	34060539	1000BASE-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1490 nm 40 km

Table 3-471 Types of SFP+/SFP modules that 2.5GE ports support

Category	Part Number	Wavelength and Transmission Distance
Dual-fiber bidirectional 2.5GE module	34060365	850 nm, 0.3 km
	34060517	1310 nm, 2 km
	34060528	1310 nm, 10 km

Table 3-472 Types of SFP+/SFP modules that 10GE ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional 10GE module	34060668	10GBase-SR	850 nm, 0.1 km
	34060494	10GBase-SR	850 nm, 0.3 km
	34060713-001	10GBase-SR	1310 nm, 1.4 km
	34060495	10GBase-LR	1310 nm, 10 km

NOTE

For specifications for each type of optical module, see **3.15.8 Technical Specifications**.

3.15.8 Technical Specifications

This section describes board specifications, including the Ethernet service port performance, mechanical behaviors, and power consumption.

Switching Capacity

EM6D supports 10 Gbit/s packet switching capacity.

GE Optical Port Performance

GE optical ports on EM6D boards comply with IEEE 802.3. The following tables list main specifications for the GE optical ports.

NOTE

The OptiX RTN 950A uses SFP modules to provide GE optical ports. Different types of SFP optical modules can be used to provide GE optical ports with different classification codes and transmission distances.

Table 3-473 GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.5	10
Operating wavelength (nm)	770 to 860	1270 to 1355
Average optical output power (dBm)	-9 to -3	-9 to -3
Receiver sensitivity (dBm)	-17	-20
Overload (dBm)	0	-3
Extinction ratio (dB)	9.5	9.5

Table 3-474 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

Table 3-475 GE optical interface specifications (single-fiber bidirectional)

Item	Specifications			
Classification code	**1000BASE-BX-D (10 km)**	**1000BASE-BX-U (10 km)**	**1000BASE-BX-D (40 km)**	**1000BASE-BX-U (40 km)**
Nominal wavelength (nm)	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Nominal bit rate (Mbit/s)	1000	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode	Single-mode
Transmission distance (km)	10	10	40	40
Operating wavelength (nm)	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500	Tx: 1480 to 1500 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1500
Average optical output power (dBm)	-9 to -3	-9 to -3	-3 to +3	-3 to +3
Receiver sensitivity (dBm)	-19.5	-19.5	-23	-23
Overload (dBm)	-3	-3	-3	-3
Extinction ratio (dB)	6	6	6	6

2.5GE Optical Interface Specifications

Table 3-476 2.5GE optical interface specifications (two-fiber bidirectional)

Item	Specifications		
BOM code	**34060365**	**34060517**	**34060528**
Nominal wavelength (nm)	850	1310	1310
Fiber type	Multi-mode	Single-mode	Single-mode
Transmission distance (km)	0.3	2	10
Operating wavelength (nm)	770 to 860	1261 to 1360	1261 to 1360
Average optical output power (dBm)	-9 to -1.5	-8.4 to 0.5	-8.4 to 0.5
Receiver sensitivity (dBm)	-15	-13.8	-13.8
Overload (dBm)	0	0.5	0.5
Extinction ratio (dB)	3	3.5	3.5

10GE Optical Interface Specifications

Table 3-477 10GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications		
Classification code	**10GBase-SR (0.1 km)**	**10GBase-SR (0.3 km)**	**10GBase-LR (10 km)**
Nominal wavelength (nm)	850	850	1310
Fiber type	Multi-mode	Multi-mode	Single-mode
Transmission distance (km)	0.1	0.3	10

Item	Specifications		
Classification code	**10GBase-SR (0.1 km)**	**10GBase-SR (0.3 km)**	**10GBase-LR (10 km)**
Operating wavelength (nm)	770 to 860	770 to 860	1261 to 1360
Average optical output power (dBm)	-5 to -1	-7.3 to -1	-8.2 to 0.5
Receiver sensitivity (dBm)	-11.1	-11.1	-14.4
Overload (dBm)	-1	-1	0.5
Extinction ratio (dB)	3	3	3.5

GE Electrical Port Performance

GE electrical ports on EM6D boards comply with IEEE 802.3. The following table lists main specifications for the GE electrical ports.

Table 3-478 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

Mechanical Behaviors and Power Consumption

Table 3-479 Mechanical behaviors and power consumption of EM6D

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm

Item	Performance
Weight	0.6 kg
Power consumption	≤ 40 W

3.16 EMS6

The EMS6 is an FE/GE EoSDH processing board providing the L2 switching function. It provides four FE electrical ports and two GE ports using small form-factor pluggable (SFP) optical/electrical modules.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EMS6 board.

3.16.1 Version Description

The functional version of the EMS6 is SL91.

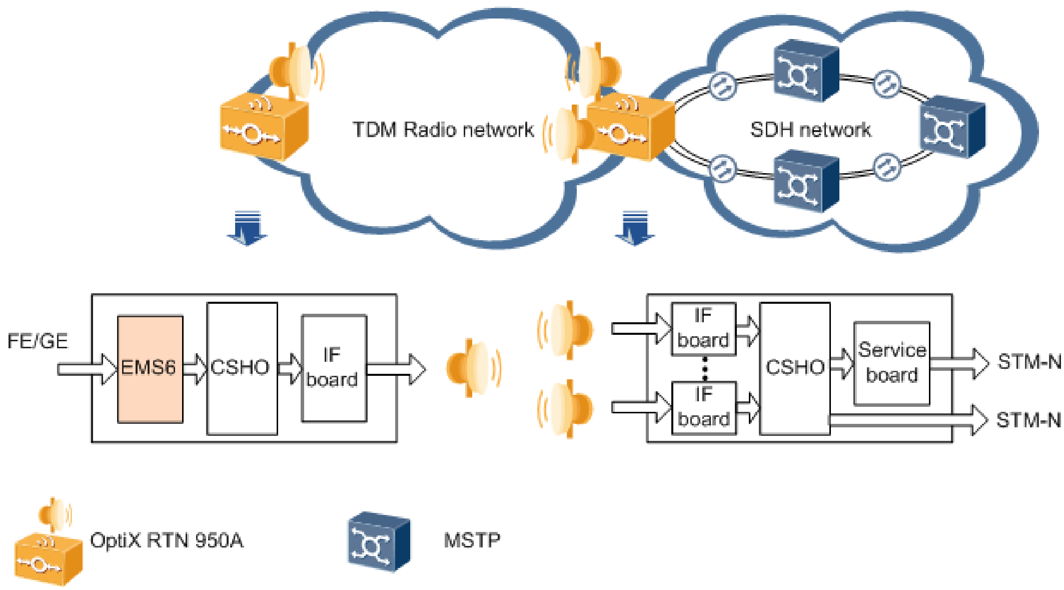
3.16.2 Application

EMS6 boards transmit Ethernet services on TDM radio networks or native Ethernet services from Hybrid radio networks through third-party SDH optical networks.

Transmitting Ethernet Services over SDH/PDH Radio

If OptiX RTN 950A NEs transmit Ethernet services over SDH/PDH radio, EMS6 boards receive, transmit, encapsulate, and map Ethernet services that come from customer premises or Layer 2 networks.

Figure 3-107 Application scenario of EMS6 boards (1)



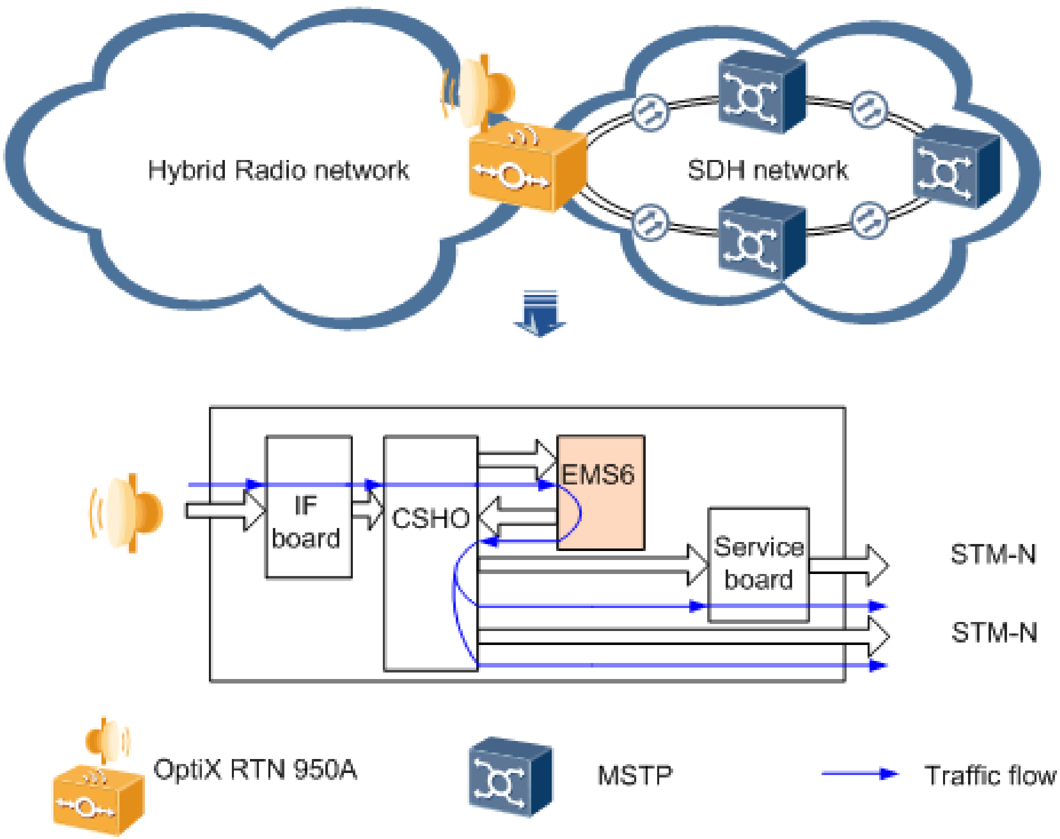
NOTE

- IF boards shown in the preceding figure can be TDM IF boards, or general-purpose IF boards or XPIC IF boards working in SDH radio mode.
- Service boards shown in the preceding figure are STM-1 interface boards.

Helping Hybrid Radio Services Traverse Third-Party SDH Optical Networks

If OptiX RTN 950A NEs converge Ethernet services over Hybrid radio and the converged Ethernet services need to traverse third-party SDH optical networks, EMS6 boards can apply to the NEs to encapsulate and map converged and locally received Ethernet services.

Figure 3-108 Application scenario of EMS6 boards (2)



NOTE

- As shown in the preceding figure, the traffic flow is as follows: Hybrid IF board sends received Ethernet services to the packet switching unit of the CSHO board, the packet switching unit sends the Ethernet services to the EMS6 board, the EMS6 board encapsulates the Ethernet services into VC-4s and transmits the VC-4s to the cross-connect unit of the CSHO board, the cross-connect unit grooms the VC-4s to SDH service ports, and the ports send the VC-4s to the third-party SDH optical network.
- IF boards shown in the preceding figure must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- Service boards shown in the preceding figure are STM-1 interface boards.

3.16.3 Functions and Features

An EMS6 receives/transmits 4xFE signals and 2xGE signals from the front panel and 1xGE packet plane signals from the backplane, and encapsulates these Ethernet signals into synchronous digital hierarchy (SDH) signals so that they can be transmitted over the SDH network. The EMS6 supports transparent service transmission and Layer 2 switching.

Table 3-480 lists the functions and features that the EMS6 supports.

Table 3-480 Functions and features

Function and Feature		Description
Basic functions		Receives/transmits 4xFE signals, 2xGE signals, and 1xGE packet plane signals, and performs EoSDH processing.
Port specifications	FE electrical port	Provides four 10/100BASE-T(X) ports.
	GE port	Provides two GE ports by using small form-factor pluggable (SFP) modules of any of the following types: ● 1000Base-SX ● 1000Base-LX ● 1000Base-VX ● 1000Base-ZX ● 10/100/1000BASE-T(X)
Port attributes	Working mode	● The FE ports support 10M full-duplex, 100M full-duplex, and auto-negotiation. ● The GE electrical ports support 10M full-duplex, 10M half-duplex, 100M full-duplex, 100M half-duplex, 1000M full-duplex, and auto-negotiation. ● The GE optical ports support 1000M full-duplex and auto-negotiation.
	TAG attributes	● Allows an Ethernet port's tag attribute to be specified and queried. ● Supports three tag attributes: tag aware, access, and hybrid.
	Jumbo frame	Supports jumbo frames with a maximum frame length of 9600 bytes.
	Traffic control function	Supports IEEE 802.3x-compliant by-port traffic control.

Function and Feature		Description
Services	Ethernet private line (EPL) services	Supports the EPL services based on ports.
	Ethernet virtual private line (EVPL) services	Supports the following types of EVPL services: ● EVPL services based on port+VLAN ● EVPL services based on QinQ
	Ethernet private LAN (EPLAN) services	Supports the EPLAN services based on IEEE 802.1d bridges.
	Ethernet virtual private LAN (EVPLAN) services	Supports the following types of EVPLAN services: ● EVPLAN services based on IEEE 802.1q bridges ● EVPLAN services based on IEEE 802.1ad bridges
Encapsulation and mapping	Encapsulation format	Supports the following encapsulation formats: ● Generic Framing Procedure (GFP) ● High Level Data Link Control (HDLC) ● Link Access Protocol-SDH (LAPS)
	Maximum TDM service capacity supported by the backplane	4xVC-4
	VCTRUNK Level	VC-12/VC-12 VX/VC-3/VC-3 VX
	Maximum number of VCTRUNKs supported by the board	8

Function and Feature		Description
	Maximum bandwidth supported by each VCTRUNK	● VCTRUNK1 to VCTRUNK7: 100 Mbit/s ● VCTRUNK8: 622 Mbit/s
	Link capacity adjustment scheme (LCAS)	Supported
Link aggregation group (LAG)	Inter-board LAG	Not supported
	Intra-board LAG	Supported **NOTE** Port 7 (bridging port) on the EMS6 does not support intra-board LAG.
Ethernet ring protection switching (ERPS)		Supports the ERPS function that complies with ITU-T G.8032 v1.
Spanning Tree Protocol (STP)		Supports the STP and Rapid Spanning Tree Protocol (RSTP), which comply with IEEE 802.1w.
IGMP Snooping		Supported
Link-state pass through (LPT)[a]		Supported **NOTE** Port 7 (bridging port) on the EMS6 does not support LPT.
QoS	Traffic classification	Supports the following traffic classification modes: ● Traffic classification by ports ● Traffic classification by port+C-VLAN ID ● Traffic classification by port+S-VLAN ID ● Traffic classification by port+C-VLAN ID+S-VLAN ID
	CoS	Schedules packets to egress queues with PHB classes according to the following traffic classification types: ● Simple ● VLAN priority ● IP TOS value ● DSCP value
	Committed access rate (CAR)	Provides the CAR processing for traffic flows.

Function and Feature		Description
	Shaping	Supports traffic shaping for a specific port or egress queue.
	Queue scheduling policy	Supports the following scheduling policies: ● SP ● WRR ● SP+WRR
ETH OAM		● Supports IEEE 802.1ag-compliant ETH-OAM function. ● Supports IEEE 802.3ah-compliant ETH-OAM function. **NOTE** Port 7 (bridging port) on the EMS6 does not support IEEE 802.3ah-compliant ETH-OAM function.
Remote monitoring (RMON)		Supported
Port mirroring		Supported
Clock	Clock source	Synchronous Ethernet **NOTE** Ports 7 and 8 (bridging ports) on the EMS6 board do not support synchronous Ethernet.
	Clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the Synchronization Status Message (SSM) protocol ● Protection by running the extended SSM protocol
Check for MAC address flapping		Supported
OM	Loopback	Supports the following loopback types: ● Supports inloops at the PHY layer of Ethernet ports excluding ports 7 and 8 (bridging ports). ● Supports inloops at the MAC layer of Ethernet ports excluding port 8 (bridging port). ● Supports inloops on VC-3 paths.
	Traffic monitoring	Supported
	Warm reset and cold reset	Supported

Function and Feature		Description
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported
	Board temperature monitoring	Supported

NOTE

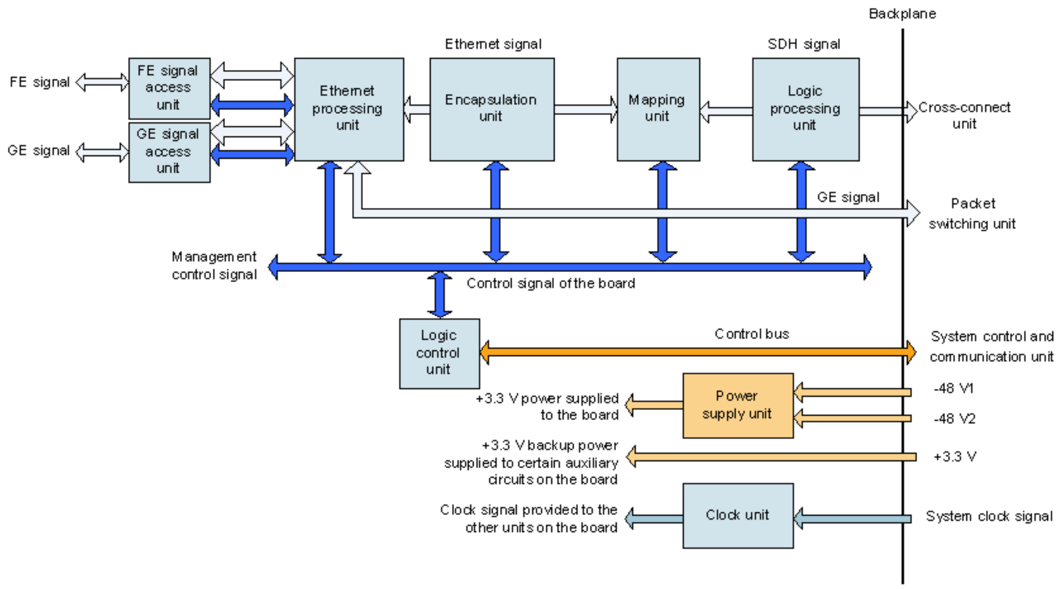
a: The LPT function checks for faults on a service access node or an intermediate transmission network, and instructs the service access node to immediately start the backup network for communication. The LPT function ensures the normal transmission of important data.

3.16.4 Working Principle and Signal Flow

This section describes the working principle and signal flow of the EMS6, using FE/GE signal processing as an example.

Functional Block Diagram

Figure 3-109 Functional block diagram of the EMS6



Signal Processing in the Receive Direction

Table 3-481 Signal processing in the receive direction

Step	Function Unit	Processing Flow
1	FE/GE signal access unit	● Receives FE/GE signals. If GE signals are received through a GE optical port, O/E conversion is required. ● Performs restructuring, decoding, and serial/parallel conversion for FE/GE signals. ● Performs frame delimitation, preamble stripping, cyclic redundancy check (CRC) code processing, and Ethernet performance measurement for frames.
2	Ethernet processing unit	● Receives Ethernet signals from the FE/GE signal access unit and GE signals from the packet switching unit. ● Performs QoS processing, such as traffic classification and committed access rate (CAR) control, for Ethernet data frames based on service types. ● Processes tags based on service types. ● Forwards Ethernet data frames based on service types.
3	Encapsulation unit	Performs the High Level Data Link Control (HDLC), Link Access Protocol-SDH (LAPS), or Generic Framing Procedure (GFP) encapsulation for Ethernet frames.
4	Mapping unit	Maps encapsulated Ethernet data frames into VC-12s, VC-3s, VC-12-Xvs, or VC-3-Xvs.
5	Logic processing unit	Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

Signal Processing in the Transmit Direction

Table 3-482 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Logic processing unit	Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Mapping unit	Demaps encapsulated Ethernet data frames from VC-12s, VC-3s, VC-12-Xvs, or VC-3-Xvs.
3	Encapsulation unit	Decapsulates Ethernet data frames after they are demapped.

Step	Function Unit	Processing Flow
4	Ethernet processing unit	● Processes tags based on service types. ● Performs QoS processing, such as traffic shaping and queue scheduling, for Ethernet data frames. ● Performs Ethernet data frame delimitation, preamble addition, CRC code computation, and Ethernet performance measurement. ● Forwards Ethernet data frames to the FE/GE signal access unit or the GE port connected to the packet switching unit based on egress tags contained in the Ethernet data frames.
5	FE signal access unit	Performs parallel/serial conversion and coding for Ethernet data frames, and transmits generated FE/GE signals through Ethernet ports. For a GE optical port, the FE signal access unit needs to perform E/O conversion before transmitting signals through the GE optical port.

Control Signal Processing

The Ethernet processing unit controls the FE/GE signal access unit by using management control signals.

The logic control unit controls the Ethernet processing unit, encapsulation unit, mapping unit, and logic processing unit using the control bus on the board.

The logic control unit communicates with the system control and communication unit using the system control bus. The logic control unit issues configuration and query commands from the system control and communication unit to various units on the board, and reports command responses, alarms, and performance events reported by various units on the board to the system control and communication unit.

Power Supply Unit

The power supply unit receives two -48 V power supplies from the backplane, converts the -48 V power into +3.3 V power using the DC-DC module, and supplies the +3.3 V power to the other units on the board.

The power supply unit receives one +3.3 V power supply from the backplane and supplies the +3.3 V power to certain auxiliary circuits on the board.

Clock Unit

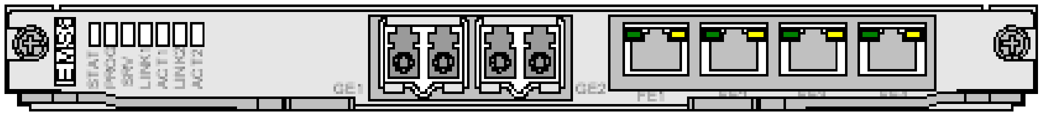
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.16.5 Front Panel

There are indicators, four FE ports, and two small form-factor pluggable (SFP) GE ports on the front panel.

Front Panel Diagram

Figure 3-110 Front panel of the EMS6



Indicators

Table 3-483 Status explanation for indicators on the EMS6

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
PROG	Blinks on (green) and off at 100 ms intervals	Software is being loaded to the board during the power-on or resetting process of the board.
	Blinks on (green) and off at 300 ms intervals	The board software is in BIOS boot state during the power-on or resetting process of the board.
	On (green)	● The upper layer software is being initialized during the power-on or resetting process of the board. ● The software is running properly during the running process of the board.
	Blinks on (red) and off at 100 ms intervals	The BOOTROM self-check fails during the power-on or resetting process of the board.
	On (red)	● The memory self-check fails or loading upper layer software fails during the power-on or resetting process of the board. ● The logic file or upper layer software is lost during the running process of the board. ● The pluggable storage card is faulty.

Indicator	State	Meaning
SRV	On (green)	The system is working normally.
	On (red)	A critical or major alarm occurs in the system.
	On (yellow)	A minor alarm occurs in the system.
	Off	There is no power supplied to the system.
LINK1	On (green)	The GE1 port is connected correctly.
	Blinks on (red) and off at 300 ms intervals	The receive optical power at the GE1 optical port is higher than the upper threshold.
	Blinks 300 ms on (red) and 700 ms off	The receive optical power at the GE1 optical port is lower than the lower threshold.
	Off	The GE1 port is not connected or is connected incorrectly.
ACT1	Blinking (yellow)	The GE1 port is receiving or transmitting data.
	Off	The GE1 port is not receiving or transmitting data.
LINK2	On (green)	The GE2 port is connected correctly.
	Blinks on (red) and off at 300 ms intervals	The receive optical power at the GE2 optical port is higher than the upper threshold.
	Blinks 300 ms on (red) and 700 ms off	The receive optical power at the GE2 optical port is lower than the lower threshold.
	Off	The GE1 port is not connected or is connected incorrectly.
ACT2	Blinking (yellow)	The GE2 port is receiving or transmitting data.
	Off	The GE2 port is not receiving or transmitting data.

Ports

Table 3-484 Description of the ports on the EMS6

Port	Description	Connector Type	Corresponding Cable
GE1	GE service port (using SFP modules)	RJ45 SFP electrical module/LC SFP optical module	**5.10 Network Cable/5.6 Fiber Jumper**
GE2			
FE1	FE service port	RJ45	**5.10 Network Cable**
FE2			
FE3			
FE4			

NOTE

On the network management system (NMS), GE1 and GE2 correspond to PORT1 and PORT2 respectively, and FE1 to FE4 correspond to PORT3 to PORT6 respectively.

The performance of the FE electrical ports on the EMS6 complies with the 10/100BASE-T(X) standard, and the performance of the GE electrical ports on the EMS6 complies with the 10/100/1000BASE-T(X) standard if SFP electrical modules are used. The two types of ports support the MDI, MDI-X, auto-MDI, and auto-MDI-X modes. For the front view of an RJ45 connector, see **Figure 3-111**. For the pin assignments for the ports, see **Table 3-485** and **Table 3-486**.

Figure 3-111 Front view of the RJ45 connector

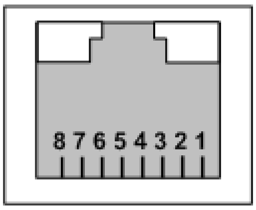


Table 3-485 Pin assignments for the RJ45 connector in MDI mode

Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
1	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)
2	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)

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

Table 3-486 Pin assignments for the RJ45 connector in MDI-X mode

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

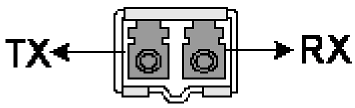
The RJ45 connector has two indicators. For status explanation for these indicators, see **Table 3-487**.

Table 3-487 Status explanation for the indicators of the RJ45 connector

Indicator	State	Meaning
LINK (green)	On	The link is working properly.
	Off	The link is interrupted.
ACT (yellow)	On or blinking	The port is transmitting or receiving data.
	Off	The port is not transmitting or receiving data.

SFP optical modules are used to provide GE ports on the EMS6. One SFP optical module provides one TX port and one RX port. For details, see **Figure 3-112**, in which TX represents the transmit port and RX represents the receive port.

Figure 3-112 Ports of an SFP optical module



3.16.6 Valid Slots

The EMS6 can be inserted in Slots 1-6, which have consistent logical slot numbers on the NMS.

Figure 3-113 Physical slots for the EMS6 in the IDU chassis

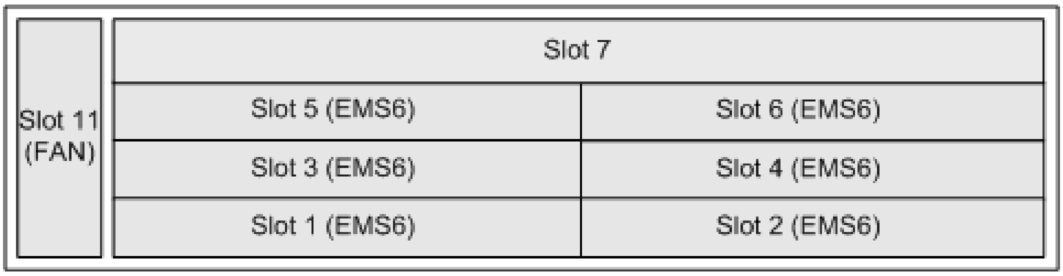


Figure 3-114 Logical slots for the EMS6 on the NMS

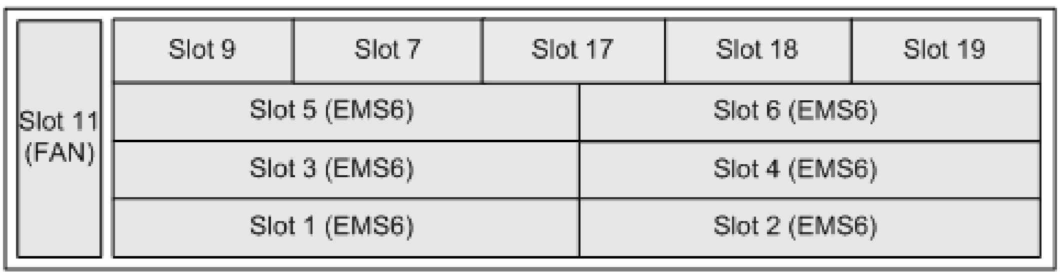


Table 3-488 Slot configuration for the EMS6

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.16.7 Types of SFP Modules

The GE port on the EMS6 board supports multiple types of small form-factor pluggable (SFP) modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-489 Types of SFP modules that the GE port supports

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional GE module	34060286	**1000Base-SX**	850 nm, 0.5 km
	34060473	**1000Base-LX**	1310 nm, 10 km
	34060298	**1000Base-VX (40 km, 1310 nm)**	1310 nm, 40 km
	34060513	**1000Base-VX (40 km, 1550 nm)**	1550 nm, 40 km
	34060360	**1000Base-ZX**	1550 nm, 80 km
Electrical module	34100052	**10/100/1000BASE-T(X)**	-

The types of SFP modules listed in the following table can be identified by board feature codes in the bar codes of EMS6 boards. A board feature code refers to the number next to the board name in a bar code.

Table 3-490 Board feature codes of the EMS6

Board Feature Code	Module Type
01	**1000Base-SX**
02	**1000Base-LX**

Board Feature Code	Module Type
03	**10/100/1000BASE-T(X)**

NOTE

If the board feature code in the bar code of the EMS6 is empty, no SFP module is installed on the EMS6.

3.16.8 Technical Specifications

This section describes the board specifications, including the GE port performance, FE port performance, board mechanical behavior, and board power consumption.

Performance of GE Optical Ports

The GE optical ports on the EMS6 comply with IEEE 802.3. The following table lists the main specifications for the GE optical ports.

Table 3-491 GE optical interface specifications (two-fiber bidirectional, short-distance transmission)

Item	Specifications	
Classification code	**1000BASE-SX (0.5 km)**	**1000BASE-LX (10 km)**
Nominal wavelength (nm)	850	1310
Nominal bit rate (Mbit/s)	1000	
Fiber type	Multi-mode	Single-mode
Transmission distance (km)	0.5	10
Operating wavelength (nm)	770 to 860	1270 to 1355
Average optical output power (dBm)	-9 to -3	-9 to -3
Receiver sensitivity (dBm)	-17	-20
Overload (dBm)	0	-3
Extinction ratio (dB)	9.5	9.5

Table 3-492 GE optical interface specifications (two-fiber bidirectional, long-haul transmission)

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal wavelength (nm)	1310	1550	1550

Item	Specifications		
Classification code	**1000BASE-LX (40 km)**	**1000BASE-VX (40 km)**	**1000BASE-ZX (80 km)**
Nominal bit rate (Mbit/s)	1000	1000	1000
Fiber type	Single-mode	Single-mode	Single-mode
Transmission distance (km)	40	40	80
Operating wavelength (nm)	1270 to 1350	1480 to 1580	1500 to 1580
Average optical output power (dBm)	-5 to 0	-5 to 0	-2 to +5
Receiver sensitivity (dBm)	-23	-22	-22
Overload (dBm)	-3	-3	-3
Extinction ratio (dB)	9	9	9

NOTE

The OptiX RTN 950A uses SFP modules to provide GE optical interfaces. Users can use different types of SFP modules to provide GE optical interfaces with different classification codes and transmission distances.

Performance of GE Electrical Ports

The GE electrical ports on the EMS6 comply with IEEE 802.3. The following table lists the main specifications for the GE electrical ports.

Table 3-493 GE electrical interface specifications

Item	Specifications
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)
Interface type	RJ45

Performance of FE Electrical Ports

The FE electrical ports on the EMS6 comply with IEEE 802.3. The following table lists the main specifications for the FE electrical ports.

Table 3-494 FE electrical interface specifications

Item	Specifications
Nominal bit rate (Mbit/s)	10 (10BASE-T) 100 (100BASE-TX)
Code pattern	Manchester encoding signal (10BASE-T) MLT-3 encoding signal (100BASE-TX)
Interface type	RJ45

Mechanical Behavior and Power Consumption

Table 3-495 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.50 kg
Power consumption	< 16.5 W

3.17 EFP8

The EFP8 is an 8-port FE EoPDH processing board. The EFP board is connected to the packet plane through its bridging GE port.

NOTE

Since V100R019C00, the OptiX RTN 950A no longer supports EFP8 board.

3.17.1 Version Description

The functional version of the EFP8 is SL91.

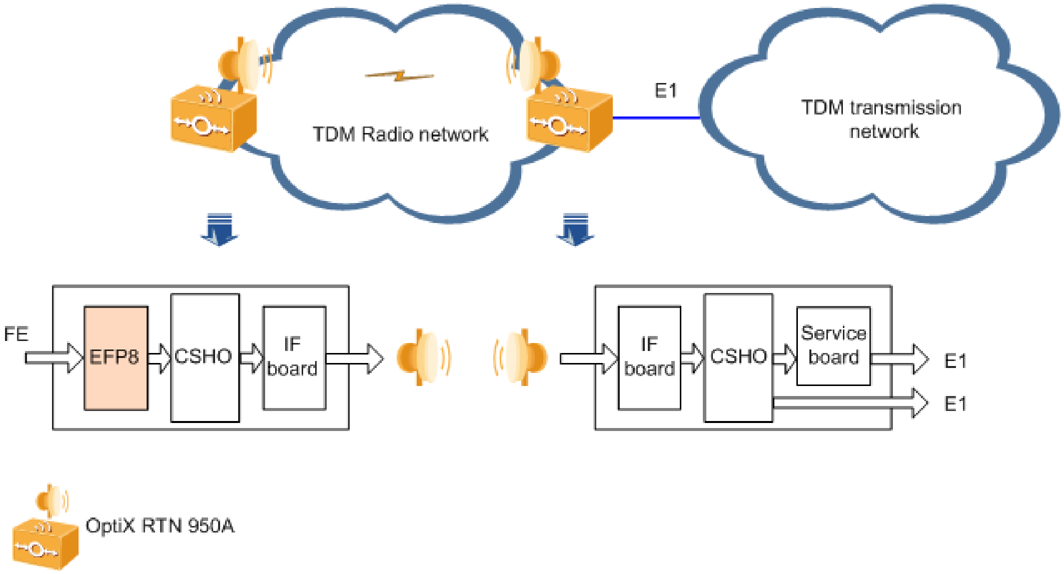
3.17.2 Application

EFP8 boards help transmit a small number of Ethernet services on TDM radio networks, or transmit native Ethernet services from Hybrid radio networks on third-party TDM networks.

Helping Transmit Ethernet Services over SDH/PDH Radio

If OptiX RTN 950A NEs transmit Ethernet services over SDH/PDH radio, EFP8 boards receive, transmit, encapsulate, and map Ethernet services that come from customer premises or Layer 2 networks.

Figure 3-115 Application scenario of EFP8 boards (1)



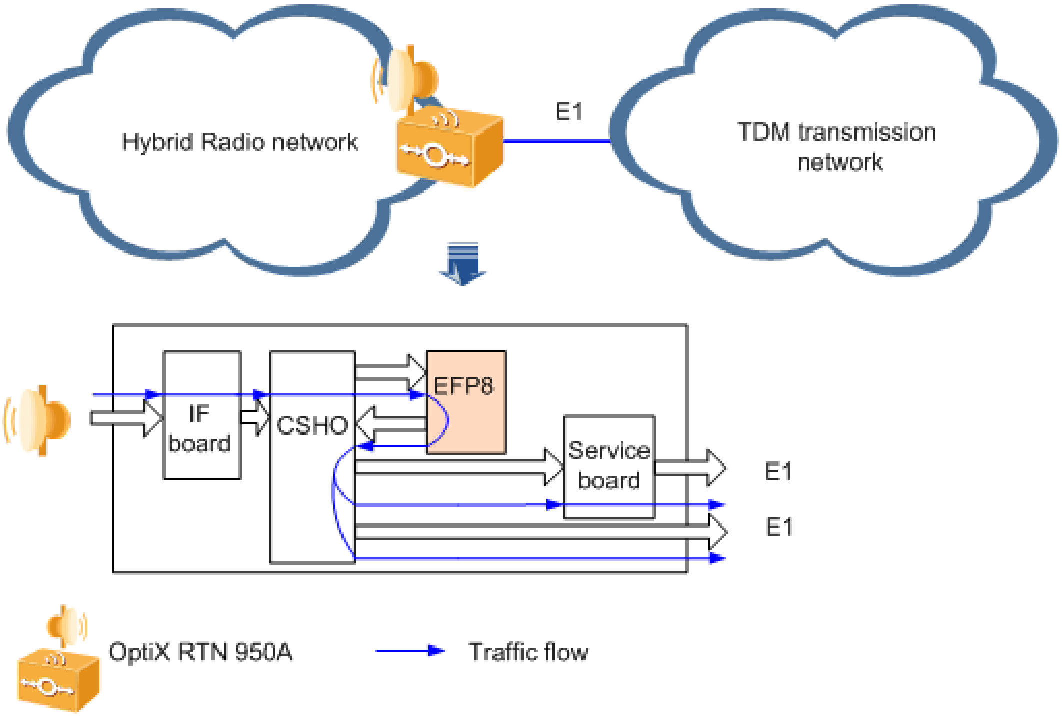
NOTE

- IF boards shown in the preceding figure can be TDM IF boards, or general-purpose IF boards or XPIC IF boards working in SDH radio mode.
- Service boards shown in the preceding figure are E1 interface boards.

Helping Hybrid Radio Services Traverse Third-Party TDM Networks

If OptiX RTN 950A NEs converge Ethernet services over Hybrid radio and the converged Ethernet services need to traverse third-party SDH/PDH networks, EFP8 boards can apply to the NEs to encapsulate and map converged and locally received Ethernet services.

Figure 3-116 Application scenario of EFP8 boards (2)



NOTE

- As shown in the preceding figure, the traffic flow is as follows: Hybrid IF board sends received Ethernet services to the packet switching unit of the CSHO board, the packet switching unit sends the Ethernet services to the EFP8 board, the EFP8 board encapsulates the Ethernet services into E1s and transmits the E1s to the cross-connect unit of the CSHO board, the cross-connect unit grooms the E1s to E1 service ports, and the ports then send the E1s to the third-party TDM network.
- IF boards shown in the preceding figure must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.
- Service boards shown in the preceding figure are E1 interface boards.

3.17.3 Functions and Features

An EFP8 receives/transmits 8xFE signals from its front panel and 1xGE packet-plane signals from the backplane and encapsulates the Ethernet signals into E1 signals, so that they can be transmitted over a PDH network.

Table 3-496 lists the functions and features that the EFP8 supports.

Table 3-496 Functions and features that the EFP8 supports

Function and Feature		Description
Basic functions		Receives/Transmits 8xFE signals and 1xGE packet plane signals and performs EoPDH processing.
Port specifications	FE electrical port: 10/100BASE-T(X)	8

Function and Feature		Description
Port attributes	Working mode	The FE port supports 10M full-duplex, 100M full-duplex, and auto-negotiation.
	TAG attributes	● Allows an Ethernet port's tag attribute to be specified and queried. ● Supports three tag attributes: tag aware, access, and hybrid.
	Jumbo frame	Supports jumbo frames with a maximum frame length of 2000 bytes.
	Traffic control function	Supports IEEE 802.3x-compliant by-port traffic control.
Services	EPL services	Supports the port-based EPL services.
	EVPL services	Supports the following types of EVPL services: ● EVPL services based on port+VLAN ● EVPL services based on QinQ
	EPLAN services	Supports the EPLAN services that are based on IEEE 802.1d bridges.
	EVPLAN services	Supports the following types of EVPLAN services: ● EVPLAN services based on IEEE 802.1q bridges ● EVPLAN services based on IEEE 802.1ad bridges
Encapsulation and mapping	Encapsulation format	Generic framing procedure (GFP)
	Maximum number of VCTRUNKs supported by the board	16
	Maximum TDM service capacity supported by the backplane	1xVC-4 (63xE1)
	Maximum number of E1s that can be bound with a single VCTRUNK	16xE1
	Link capacity adjustment scheme (LCAS)	Supported

<table>
<tr><th colspan="2">Function and Feature</th><th>Description</th></tr>
<tr><td rowspan="2">LAG</td><td>Inter-board LAG</td><td>Not supported</td></tr>
<tr><td>Intra-board LAG</td><td>Supported
NOTE
Port 9 (bridging port) on the EFP8 does not support intra-board LAG.</td></tr>
<tr><td colspan="2">Spanning tree protocol</td><td>Supports Multiple Spanning Tree Protocol (MSTP) that runs only Common and Internal Spanning Tree (CIST) instances. This type of MSTP provides the same functions as Rapid Spanning Tree Protocol (RSTP).</td></tr>
<tr><td colspan="2">Ethernet ring protection switching (ERPS)</td><td>Supports the ERPS function that complies with ITU-T G.8032 v1.</td></tr>
<tr><td colspan="2">IGMP snooping function</td><td>Supported</td></tr>
<tr><td colspan="2">LPT[a]</td><td>Supported
NOTE
Port 9 (bridging port) on the EFP8 does not support LPT.</td></tr>
<tr><td rowspan="5">QoS</td><td>Traffic classification</td><td>● Traffic classification by ports
● Traffic classification by port+VLAN ID
● Traffic classification by port+VLAN ID+VLAN PRI
● Traffic classification by port+S-VLAN ID
● Traffic classification by port+C-VLAN ID+S-VLAN ID</td></tr>
<tr><td>CoS</td><td>Schedules packets to egress queues with PHB classes according to the following traffic classification types:
● Simple
● VLAN priority
● IP TOS value
● DSCP value</td></tr>
<tr><td>CAR</td><td>Provides the CAR processing for traffic flows.</td></tr>
<tr><td>Shaping</td><td>Supports traffic shaping for queues at ports.</td></tr>
<tr><td>Queue scheduling policies</td><td>Supports SP+WRR.</td></tr>
<tr><td colspan="2">ETH OAM</td><td>● Supports IEEE 802.1ag-compliant ETH-OAM.
● Supports IEEE 802.3ah-compliant ETH-OAM.
NOTE
Port 9 (bridging port) of the EFP8 does not support the IEEE 802.3ah-compliant OAM function</td></tr>
</table>

Function and Feature		Description
RMON		Supported
Port mirroring		Supported
Clock	Clock source	Synchronous Ethernet **NOTE** Ports 9 and 10 (bridging ports) on the EFP8 board do not support synchronous Ethernet.
	Clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the SSM protocol ● Protection by running the extended SSM protocol
OM	Loopback	Supports the following loopback types: ● Inloops at the PHY layer of Ethernet ports excluding ports 9 and 10 (bridging ports) ● Inloops at the MAC layer of Ethernet ports excluding port 10 (bridging port) ● Inloops on VC-12 paths
	Warm reset and cold reset	Supported
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported
	Board temperature monitoring	Supported

NOTE

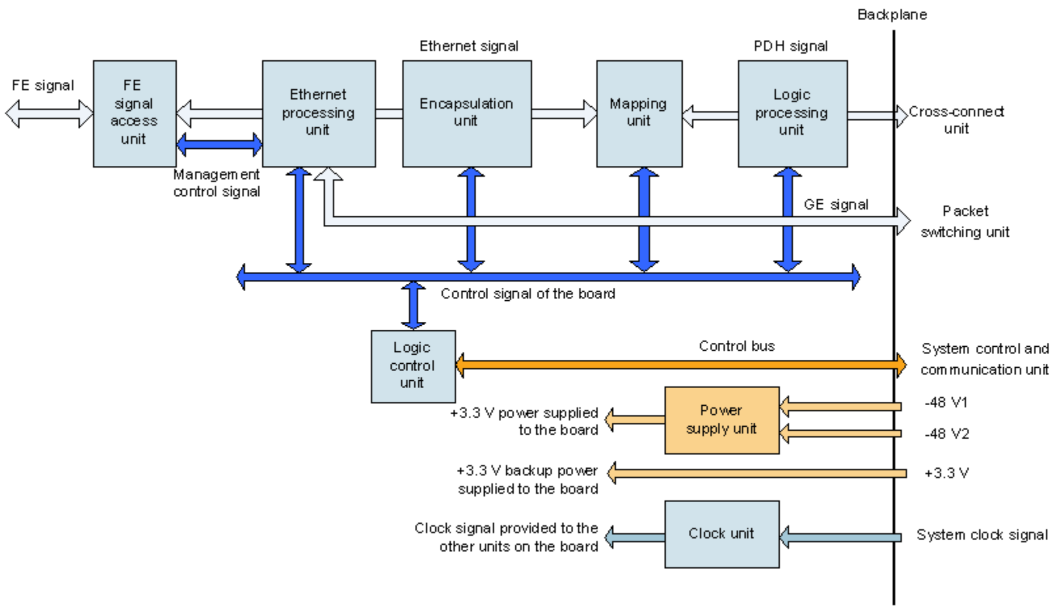
a: The LPT function checks for faults on a service access node and on an intermediate transmission network. Upon detection of a fault, LPT notifies the accessed service equipment to start its backup network, thereby ensuring normal communication and preventing important data from being affected by the fault.

3.17.4 Working Principle and Signal Flow

This section describes how to process one FE signal, and it serves as an example to describe the working principle and signal flow of the EFP8.

Functional Block Diagram

Figure 3-117 Functional block diagram of the EFP8



Signal Processing in the Receive Direction

Table 3-497 Signal processing in the receive direction of the EFP8

Step	Function Unit	Processing Flow
1	FE signal access unit	● Receives/Transmits FE signals. ● Performs restructuring, decoding, and serial/parallel conversion for FE signals. ● Performs frame delimitation, preamble stripping, CRC code checks, and Ethernet performance measurement for frame signals.
2	Ethernet processing unit	● Receives/Transmits GE signals from the packet switching unit. ● Performs QoS processing such as traffic classification and CAR for Ethernet data frames based on service categories. ● Processes tags based on service categories. ● Forwards data frames based on service categories.
3	Encapsulation unit	Performs GFP encapsulation for Ethernet frames.

Step	Function Unit	Processing Flow
4	Mapping unit	● Maps encapsulated data frames based on E1 virtual concatenation and then encapsulates the data frames to proper VC-12s. ● Processes pointers to form TU-12s. ● Performs byte interleaving for three TU-12s to form one TUG-2. ● Performs byte interleaving for seven TUG-2s to form one TUG-3. ● Performs byte interleaving for three TUG-3s to form one C-4. ● Adds higher order path overhead bytes to one C-4 to form one VC-4.
5	Logic processing unit	Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

Signal Processing in the Transmit Direction

Table 3-498 Signal processing in the transmit direction of the EFP8

Step	Function Unit	Processing Flow
1	Logic processing unit	Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Mapping unit	● Demultiplexes three TUG-3s from one VC-4. ● Demultiplexes seven TUG-2s from one TUG-3. ● Demultiplexes three VC-12s from one TUG-2. ● Extracts E1 payload from VC-12s and demaps the E1 payload based on E1 virtual concatenation.
3	Encapsulation unit	Decapsulates signals after demapping.
4	Ethernet signal processing unit	● Processes tags based on service categories. ● Performs QoS processing such as traffic shaping and queue scheduling for Ethernet data frames. ● Performs frame delimitation, preamble adding, CRC code computing, and Ethernet performance measurement for Ethernet data frames. ● Forwards Ethernet data frames to the FE signal access unit or the GE port that is connected to the packet switching unit according to the egress flag.
5	FE signal access unit	Performs parallel/serial conversion and coding for Ethernet data frames, and sends the generated FE signals to an Ethernet port.

Control Signal Processing

The Ethernet processing unit controls the FE signal access unit by using management control signals.

The logic control unit controls the Ethernet processing unit, encapsulation unit, mapping unit, and logic processing unit over the control bus on the board.

The logic control unit communicates with the system control and communication unit over the system control bus. The configuration data and query commands from the system control and communication unit are issued to the various units of the board through the logic control unit. The command response reported by each unit on the board, and alarms and performance events are reported to the system control and communication unit also through the logic control unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives two -48 V power supplies from the backplane, converts the -48 V power supplies into +3.3 V power, and then supplies the +3.3 V power to the other units on the board.
- Receives one +3.3 V power supply from the backplane, which functions as a +3.3 V power backup for the other units on the board.

Clock Unit

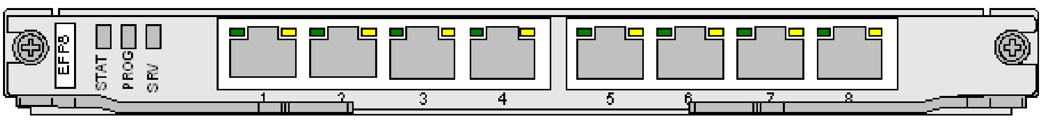
This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.17.5 Front Panel

There are indicators and eight FE ports on the front panel.

Front Panel Diagram

Figure 3-118 Front panel of the EFP8



Indicators

Table 3-499 Status explanation for indicators on the EFP8

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.

Indicator	State	Meaning
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
PROG	Blinks on (green) and off at 100 ms intervals	Software is being loaded to the board during the power-on or resetting process of the board.
	Blinks on (green) and off at 300 ms intervals	The board software is in BIOS boot state during the power-on or resetting process of the board.
	On (green)	● When the board is being powered on or being reset, the upper layer software is being initialized. ● When the board is running, the software is running normally.
	Blinks on (red) and off at 100 ms intervals	The BOOTROM self-check fails during the power-on or resetting process of the board.
	On (red)	● The memory self-check fails or loading upper layer software fails during the power-on or resetting process of the board. ● The logic file or upper layer software is lost during the running process of the board. ● The pluggable storage card is faulty.
SRV	On (green)	The system is working properly.
	On (red)	A critical or major alarm occurs in the system.
	On (yellow)	A minor alarm occurs in the system.
	Off	There is no power supplied to the system.

Ports

Table 3-500 Description of the ports on the EFP8

Port	Description	Connector Type	Corresponding Cable
FE1 to FE8	FE port	RJ45	**5.10 Network Cable**

The FE electrical ports support the MDI, MDI-X, and auto-MDI/MDI-X modes. For the pin assignments for the ports, see **Table 3-501** and **Table 3-502**. For the front view of an RJ45 connector, see **Figure 3-119**.

Figure 3-119 Front view of the RJ45 connector

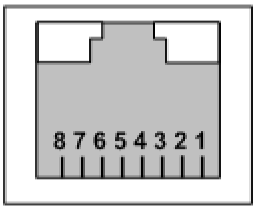


Table 3-501 Pin assignments for the RJ45 connector in MDI mode

Pin	10/100BASE-T(X)	
	Signal	Function
1	TX+	Transmitting data (+)
2	TX-	Transmitting data (-)
3	RX+	Receiving data (+)
4	Reserved	-
5	Reserved	-
6	RX-	Receiving data (-)
7	Reserved	-
8	Reserved	-

Table 3-502 Pin assignments for the RJ45 connector in MDI-X mode

Pin	10/100BASE-T(X)	
	Signal	Function
1	RX+	Receiving data (+)
2	RX-	Receiving data (-)
3	TX+	Transmitting data (+)
4	Reserved	-
5	Reserved	-
6	TX-	Transmitting data (-)
7	Reserved	-

Pin	10/100BASE-T(X)	
	Signal	Function
8	Reserved	-

The RJ45 port has two indicators. For status explanation for these indicators, see **Table 3-503**.

Table 3-503 Status explanation for the indicators of the RJ45 connector

Indicator	State	Meaning
LINK (green)	On	The link is working properly.
	Off	The link is interrupted.
ACT (yellow)	On or blinking	The port is transmitting or receiving data.
	Off	The port is not transmitting or receiving data.

3.17.6 Valid Slots

The EFP8 can be inserted in Slots 1-6, which have consistent logical slot numbers on the NMS.

Figure 3-120 Physical slots for the EFP8 in the IDU chassis

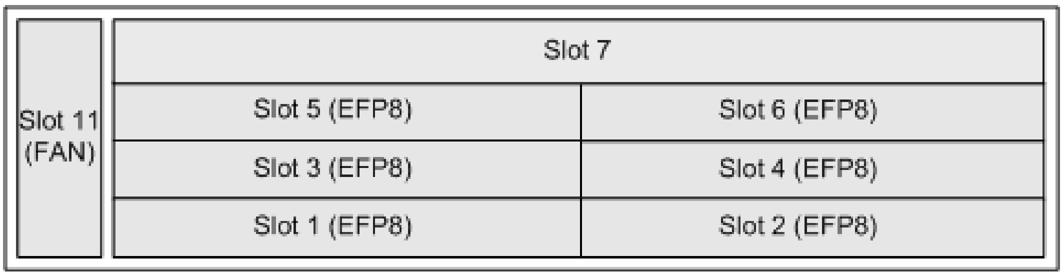


Figure 3-121 Logical slots of the EFP8 on the NMS

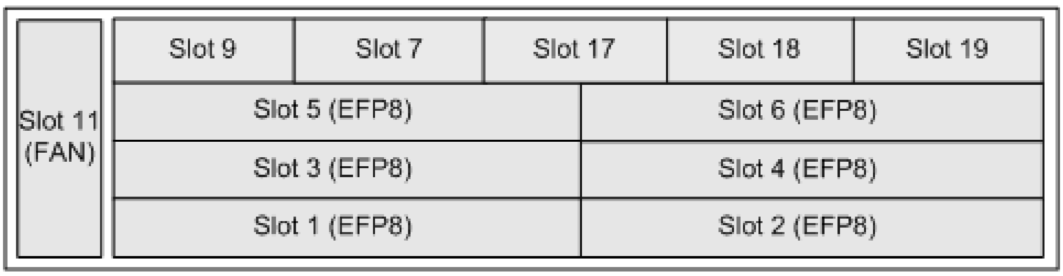


Table 3-504 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.17.7 Technical Specifications

This section describes the board specifications, including the FE port performance, board mechanical behavior, and board power consumption.

Performance of FE Electrical Ports

The FE electrical ports on the EFP8 comply with IEEE 802.3. The following table lists the main specifications for the FE electrical ports.

Table 3-505 FE electrical interface specifications

Item	Specifications
Nominal bit rate (Mbit/s)	10 (10BASE-T) 100 (100BASE-TX)
Code pattern	Manchester encoding signal (10BASE-T) MLT-3 encoding signal (100BASE-TX)
Interface type	RJ45

Mechanical Behavior and Power Consumption

Table 3-506 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.6 kg
Power consumption	< 13.5 W

3.18 SL1DA

The SL1DA is a 2xSTM-1 optical interface board. The SL1DA can also provide STM-1 electrical ports by using SFP electrical modules.

3.18.1 Version Description

The functional version of the SL1DA is SL91.

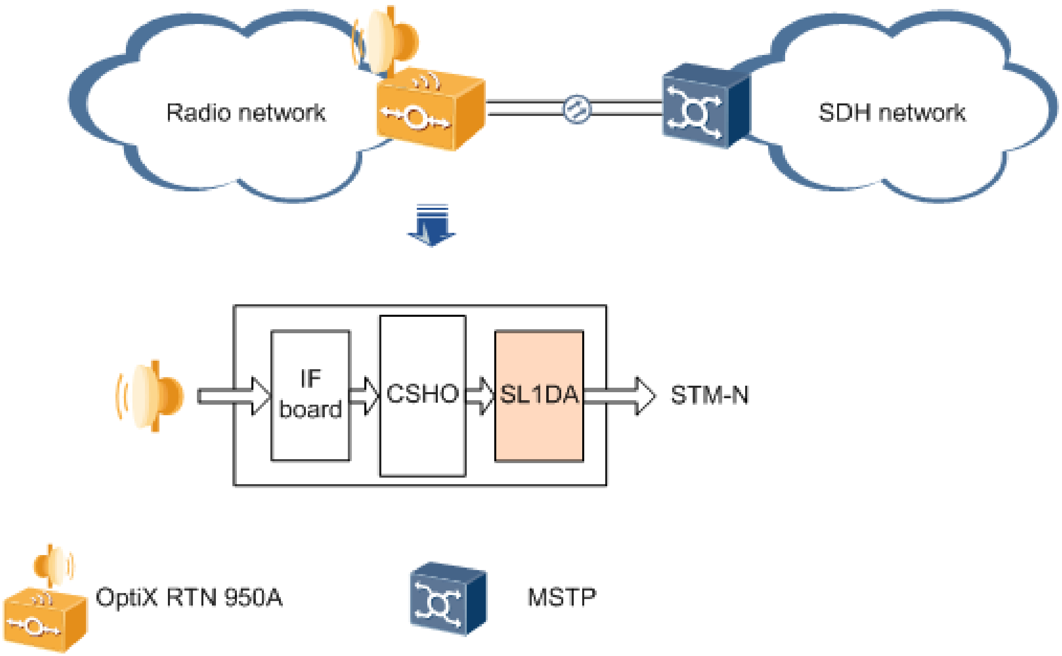
3.18.2 Application

SL1DA boards help OptiX RTN 950A NEs converge TDM services from radio networks before forwarding the services to SDH networks, or help OptiX RTN 950A NEs build SDH networks together with SDH equipment.

Converging TDM Services from Radio Networks

SL1DA boards converge TDM services from radio networks before forwarding the services to SDH networks.

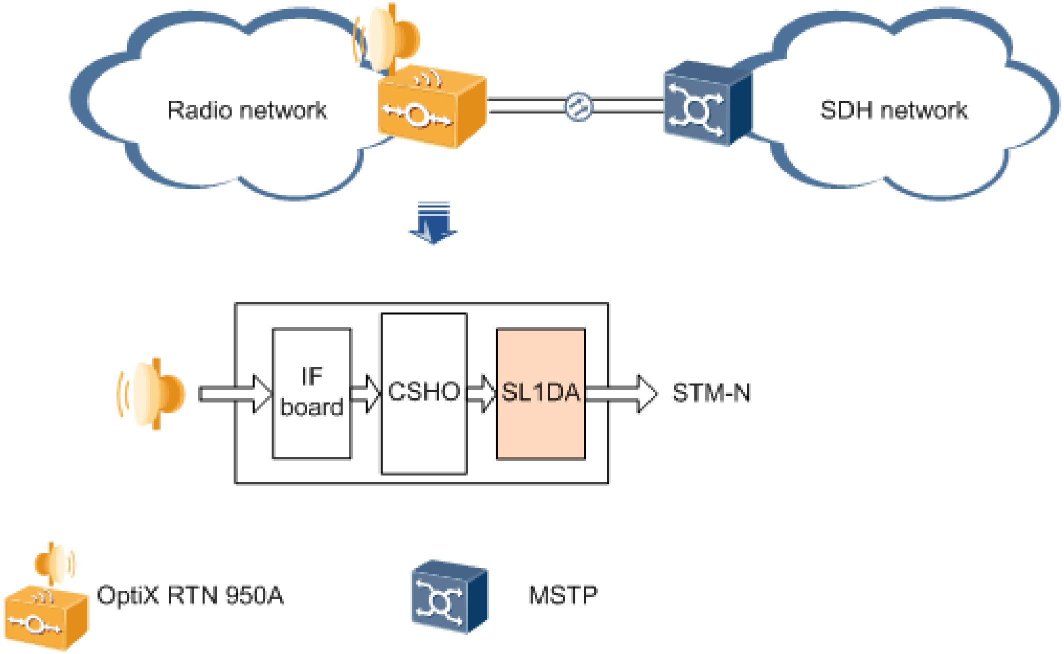
Figure 3-122 Application scenario of SL1DA boards (1)



NOTE

- Converged services shown in the preceding figure can be SDH/PDH services from TDM radio networks or native E1/STM-1 services from IP radio networks.
- Transmission lines between the OptiX RTN equipment and the SDH network can be configured with linear MSP.
- OptiX RTN 950A NEs can work as nodes on SDH rings, as shown in **Figure 3-123**. Services on such SDH rings can be configured with SNCP.

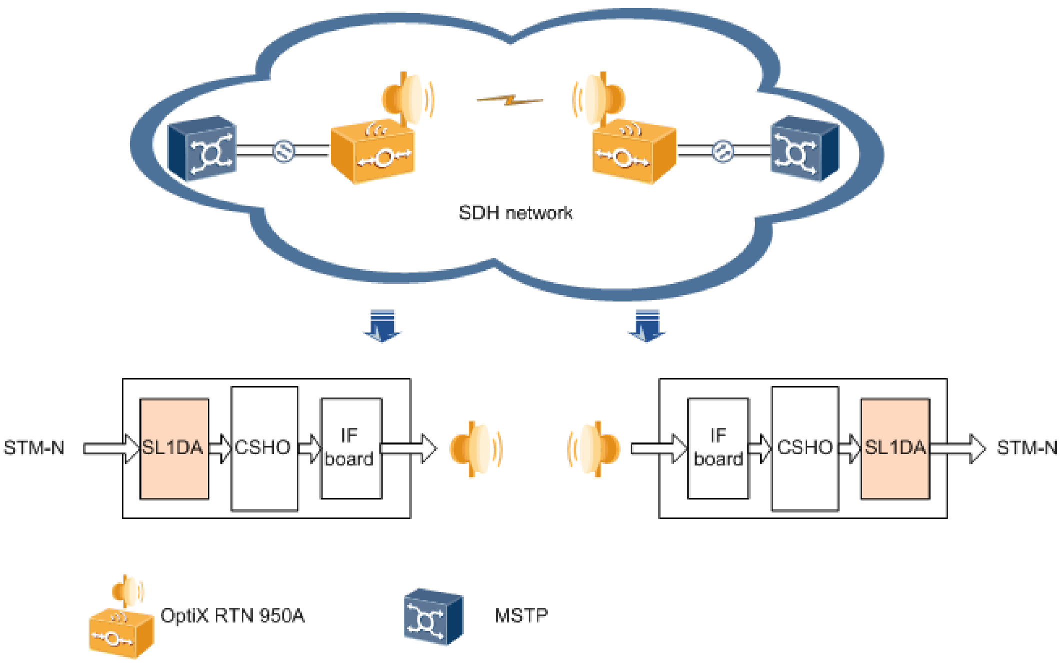
Figure 3-123 Application scenario of SL1DA boards (2)



Helping OptiX RTN 950A NEs Build SDH Networks Together with SDH Equipment

OptiX RTN 950A NEs using SL1DA boards can build SDH networks together with SDH equipment. In this scenario, radio links function as dark fibers.

Figure 3-124 Application scenario of SL1DA boards (3)



NOTE

- IF boards shown in the preceding figure can be TDM IF boards working in SDH radio mode, or general-purpose IF boards or XPIC IF boards working in SDH radio or native STM-1+Ethernet mode.
- Radio links can form SDH rings together with SDH fiber links. Services on such SDH rings can be configured with SNCP.

3.18.3 Functions and Features

An SL1DA receives and transmits 2xSTM-1 optical/electrical signals.

Table 3-507 lists the functions and features that the SL1DA supports.

Table 3-507 Functions and features that the SL1DA supports

Function and Feature		Description
Basic functions		Receives and transmits 2xSTM-1 optical/electrical signals.
Port specifications	Optical ports	● Uses SFP optical modules to provide optical ports of Ie-1, S-1.1, L-1.1, and L-1.2 types. ● Provides ITU-T G.957-compliant optical port specifications.
	Electrical ports	● Adopts SFP electrical modules. ● The performance of the electrical ports complies with ITU-T G.703.
Protection	LMSP	Supported
	SNCP	Supported
Clock	Clock source	Provides one SDH line clock signal over each line port.
	Clock protection	Supports the following clock protection schemes: ● Protection based on clock source priorities ● Protection by running the SSM protocol ● Protection by running the extended SSM protocol
Data communication network (DCN)	Outband DCN	Provides a 3-, 9-, or 12-byte DCC channel over each SDH line port.
K byte pass-through		Supported
OM	Loopback	Supports the following loopback types: ● Outloops at optical/electrical ports ● Inloops at optical/electrical ports ● Outloops on VC-4 paths ● Inloops on VC-4 paths

Function and Feature		Description
	Warm reset and cold reset	Supported
	Setting of the on/off state of a laser	Supported
	ALS function[a]	Supported
	In-service FPGA loading	Supported
	Queries of board manufacturing information	Supported
	Queries of the board power consumption	Supported
	Detection and query of SFP module information	Supported

NOTE

a: The ALS function is implemented as follows:

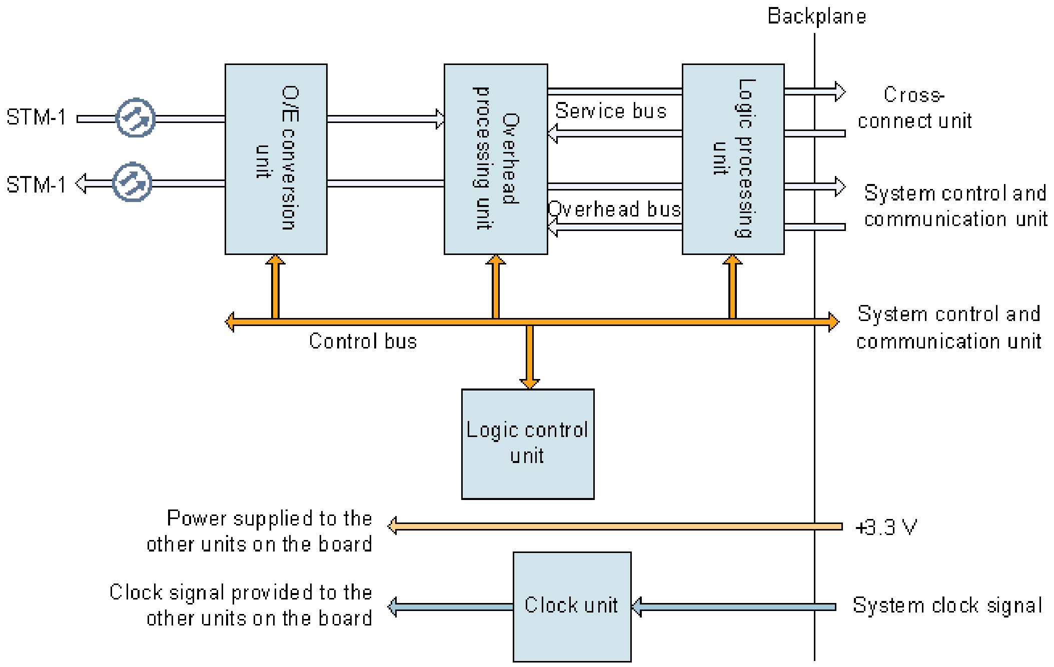
- After an optical module detects an R_LOS alarm at its receive port and the alarm persists for 500 ms, the laser at the specific transmit port is automatically shut down.
- The laser starts to launch laser pulses at a specified interval; that is, the laser emits light for 2s and stops emission for 60s.
- After the R_LOS alarm is cleared, the laser restarts to work properly and emits continuous light.

3.18.4 Working Principle and Signal Flow

This section describes how to process one STM-1 optical signal, and it serves as an example to describe the working principle and signal flow of the SL1DA.

Functional Block Diagram

Figure 3-125 Functional block diagram of the SL1DA



Signal Processing in the Receive Direction

Table 3-508 Signal processing in the receive direction of the SL1DA

Step	Function Unit	Processing Flow
1	O/E conversion unit	● Regenerates STM-1 optical signals. ● Detects R_LOS alarms. ● Converts STM-1 optical signals into electrical signals.

Step	Function Unit	Processing Flow
2	Overhead processing unit	● Restores clock signals. ● Aligns frames and detects R_LOS and R_LOF alarms. ● Performs descrambling. ● Checks B1 and B2 bytes and generates specific alarms and performance events. ● Checks the M1 byte and bits 6-8 of the K2 byte, and generates specific alarms and performance events. ● Detects the changes in the SSM in the S1 byte and reports the SSM status to the system control and communication unit. ● Extracts orderwire bytes, auxiliary channel bytes including F1 and SERIAL bytes, DCC bytes, and K bytes and transmits the overhead signal to the logic processing unit. ● Adjusts AU pointers and generates specific performance events. ● Checks higher order path overheads and generates specific alarms and performance events. ● Transmits VC-4 signals and pointer indication signals to the logic processing unit.
3	Logic processing unit	● Processes clock signals. ● Ttransmits the overhead signals to the system control and communication unit. ● Transmits VC-4 signals and pointer indication signals to the cross-connect unit.

Signal Processing in the Transmit Direction

Table 3-509 Signal processing in the transmit direction of the SL1DA

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Processes overhead signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.

Step	Function Unit	Processing Flow
2	Overhead processing unit	● Sets higher order path overheads. ● Sets AU pointers. ● Sets multiplex section overhead bytes. ● Sets regenerator section overhead bytes. ● Performs scrambling.
3	O/E conversion unit	Converts electrical signals into optical signals.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit and enables FPGA loading.

Clock Unit

This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.18.5 Front Panel

There are indicators, STM-1 ports, and a label on the front panel.

Front Panel Diagram

Figure 3-126 Front panel of the SL1DA (with optical ports)

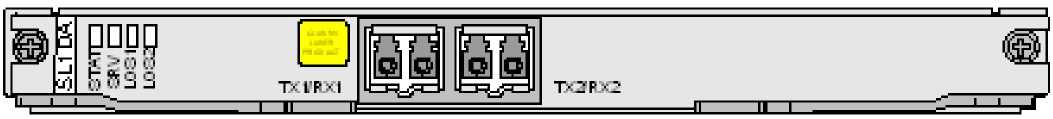
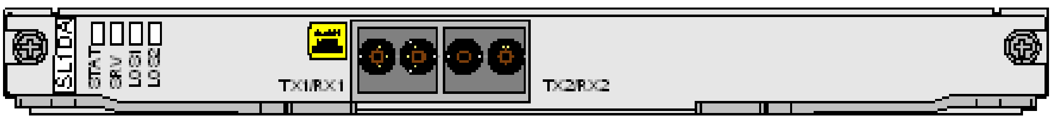


Figure 3-127 Front panel of the SL1DA (with electrical ports)



Indicators

Table 3-510 Status explanation for indicators on the SL1DA

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
	Off	The services are not configured.
LOS1	On (red)	The first port of the SL1DA is reporting the R_LOS alarm.
	Off	The first port of the SL1DA is free of R_LOS alarms.
LOS2	On (red)	The second port of the SL1DA is reporting the R_LOS alarm.
	Off	The second port of the SL1DA is free of R_LOS alarms.

Ports

Table 3-511 Description of the ports

Port	Description	Connector Type	Corresponding Cable
TX1	Transmit port of the first STM-1 port	• SFP optical module: LC • SFP electrical module: SAA straight/female	• SFP optical module: **5.6 Fiber Jumper** • SFP electrical module: **5.7 STM-1 Cable**
RX1	Receive port of the first STM-1 port		
TX2	Transmit port of the second STM-1 port	• SFP optical module: LC • SFP electrical module: SAA straight/female	
RX2	Receive port of the second STM-1 port		

Labels

There is a laser safety class label on the front panel.

The laser safety class label indicates that the laser safety class of the optical port is CLASS 1. That is, the maximum launched optical power of the optical port is lower than 10 dBm (10 mW).

3.18.6 Valid Slots

An SL1DA board can be inserted in Slots 1 to 6, which have consistent logical slot numbers on the NMS.

Figure 3-128 Physical slots for SL1DA boards in an IDU chassis

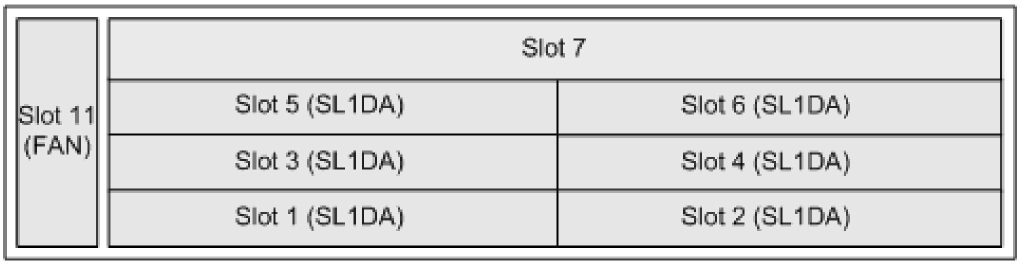


Figure 3-129 Logical slots for SL1DA boards on the NMS

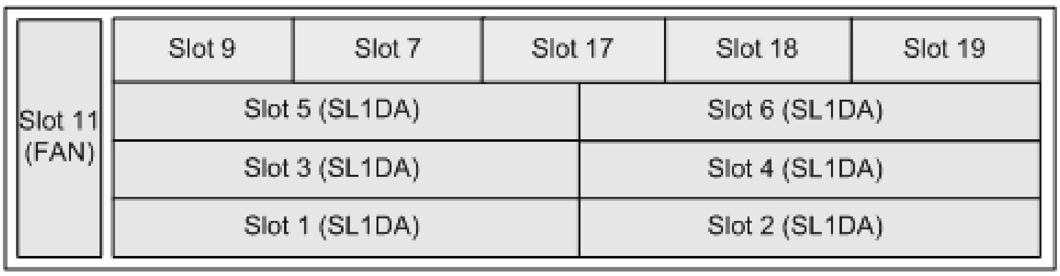


Table 3-512 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.18.7 Board Feature Code

The board feature code of the SL1DA indicates the type of SFP module. The board feature code refers to the number next to the board name in the bar code.

Table 3-513 Board feature code of the SL1DA

Feature Code	Type of Optical Module	Part Number of the Optical Module
01	**Ie-1**	34060287
02	**S-1.1**	34060276
03	**L-1.1**	34060281
04	**L-1.2**	34060282
05	**STM-1e**	34100104

3.18.8 Technical Specifications

This section describes the board specifications, including the STM-1 optical/electrical port performance, board mechanical behavior, and board power consumption.

STM-1 Optical Interface Performance

The performance of the STM-1 optical interface is compliant with ITU-T G.957/G.825. The following table provides the typical performance of the interface.

Table 3-514 STM-1 optical interface performance (two-fiber bidirectional)

Item	Performance			
Nominal bit rate (kbit/s)	155520			
Classification code	Ie-1	S-1.1	L-1.1	L-1.2
Fiber type	Multi-mode fiber	Single-mode fiber	Single-mode fiber	Single-mode fiber
Transmission distance (km)	2	15	40	80

Item	Performance			
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Mean launched power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver minimum sensitivity (dBm)	-30	-28	-34	-34
Minimum overload (dBm)	-14	-8	-10	-10
Minimum extinction ratio (dB)	10	8.2	10	10

NOTE

The OptiX RTN 950A uses SFP optical modules for providing optical interfaces. You can use different types of SFP optical modules to provide optical interfaces with different classification codes and transmission distances.

STM-1 Electrical Interface Performance

The performance of the STM-1 electrical interface is compliant with ITU-T G.703. The following table provides the typical performance of the interface.

Table 3-515 STM-1 electrical interface performance

Item	Performance
Nominal bit rate (kbit/s)	155520
Code type	CMI
Wire pair in each transmission direction	One coaxial wire pair
Impedance (ohm)	75

NOTE

The OptiX RTN 950A uses SFP electrical modules to provide electrical interfaces.

Mechanical Behavior and Power Consumption

Table 3-516 Mechanical behavior and power consumption of SL1DA

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm

Item	Performance
Weight	0.30 kg
Power consumption	< 3.3 W

3.19 ML1/MD1

The ML1 is a 16xSmart E1 service processing board. The MD1 is a 32xSmart E1 service processing board.

3.19.1 Version Description

The functional version of the ML1 is SL92. The functional version of the MD1 is SL91.

3.19.2 Application

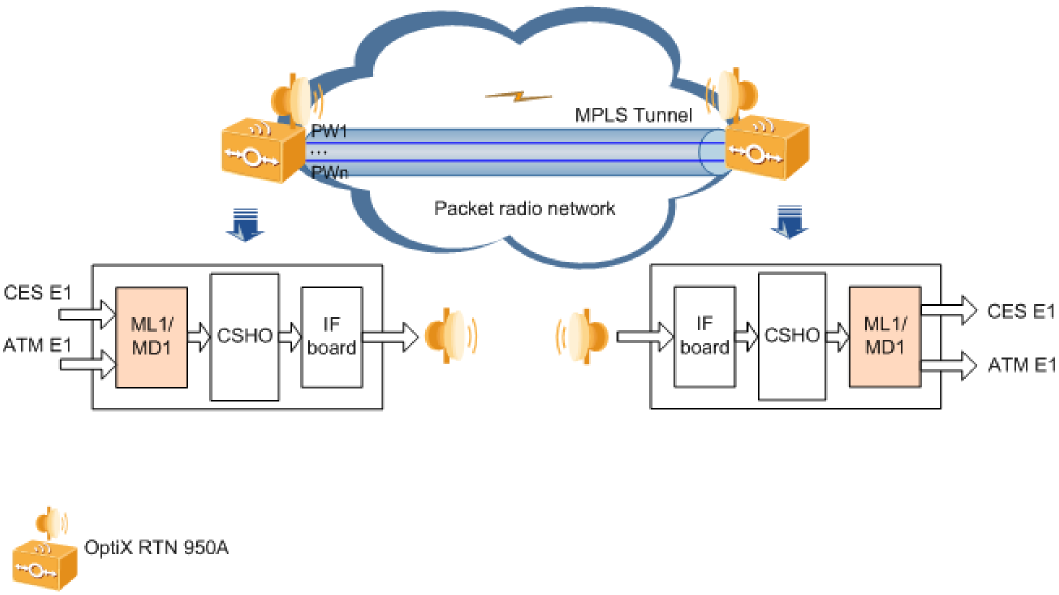
ML1/MD1 boards receive and transmit E1 services on OptiX RTN 950A NEs that transmit E1-carried ATM/CES services in PWE3 mode. The selection of MD1 or ML1 boards depends on desired port quantities.

The ML1/MD1 board is used to:

- Transmit CES/ATM E1 services in PWE3 mode.
- Allow an MPLS tunnel to traverse a TDM network

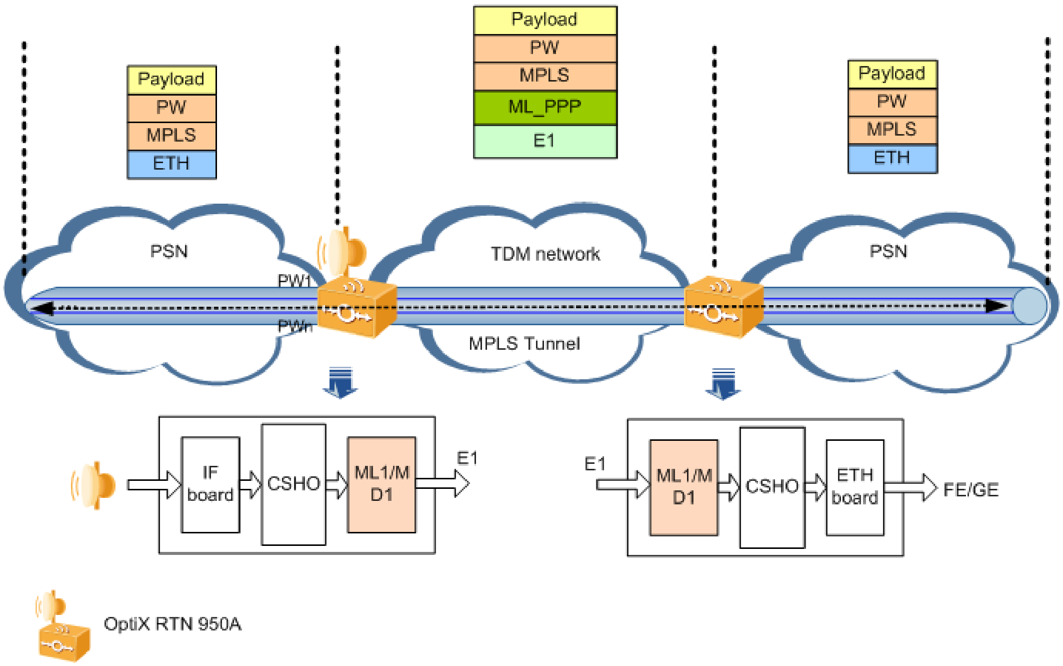
Transmitting CES/ATM E1 Services in PWE3 Mode

Figure 3-130 Transmitting CES/ATM E1 services in PWE3 mode



Allowing an MPLS Tunnel to Traverse a TDM Network

Figure 3-131 Allowing an MPLS tunnel to traverse a TDM network



NOTE

- IF boards shown in **Figure 3-130** and **Figure 3-131** must be general-purpose IF boards or XPIC IF boards working in native E1+Ethernet mode or native STM-1+Ethernet mode.

3.19.3 Functions and Features

An ML1 receives and transmits 16xE1 signals. The MD1 receives and transmits 32xE1 signals.

Table 3-517 lists the functions and features that the ML1/MD1 supports.

Table 3-517 Functions and features that the ML1/MD1 supports

Function and Feature	Description	
	ML1	MD1
Basic functions	Receives and transmits E1 signals, and supports various types of E1 service types.	
E1 service types	Supports the following E1 service types: ● CES E1 ● ATM/IMA E1 ● ML-PPP E1	

<table>
<tr><th colspan="2">Function and Feature</th><th colspan="2">Description</th></tr>
<tr><th colspan="2"></th><th>ML1</th><th>MD1</th></tr>
<tr><td>Port specifications</td><td>75-ohm/120-ohm E1 port</td><td>16</td><td>32</td></tr>
<tr><td colspan="2">Fractional E1</td><td colspan="2">Supports transparent service transmission at the 64 kbit/s level.</td></tr>
<tr><td rowspan="8">ATM/IMA</td><td>Maximum number of ATM services</td><td colspan="2">64</td></tr>
<tr><td>Maximum number of ATM connections</td><td colspan="2">256</td></tr>
<tr><td>ATM traffic management</td><td colspan="2">Supported</td></tr>
<tr><td>ATM encapsulation mode</td><td colspan="2">Supports the following ATM encapsulation modes:
● N-to-one VPC
● N-to-one VCC
● One-to-one VPC
● One-to-one VCC</td></tr>
<tr><td>Maximum number of concatenated ATM cells</td><td colspan="2">31</td></tr>
<tr><td>ATM OAM</td><td colspan="2">Supports F4 OAM (VP level) and F5 OAM (VC level), including the following functions:
● Alarm indication signal (AIS)/Remote defect indication (RDI)
● Continuity check test
● Loopback test</td></tr>
<tr><td>Maximum number of IMA groups</td><td>16</td><td>32</td></tr>
<tr><td>Maximum number of members in an IMA group</td><td colspan="2">16</td></tr>
<tr><td>CES</td><td>Maximum number of services</td><td>16</td><td>32</td></tr>
</table>

Function and Feature		Description	
		ML1	**MD1**
	Encapsulation mode	Supports the following encapsulation modes: ● CESoPSN ● SAToP	
	Service type	Point-to-point services	
	Idle timeslot compression	Supported (applicable to CESoPSN only)	
	Jitter buffering time (µs)	375-16000	
	Packet loading time (µs)	125-5000	
	CES ACR	Supported	
	Retiming	Supported	
MLPPP	MLPPP link type	E1	
	Maximum number of PPP links	16	32
	Maximum number of MLPPP groups	8	16
	Maximum number of links in an MLPPP group	16	
Anti-theft		Supported **NOTE** Supported only when it is used with the CSHOF board.	
Clock	Clock source	Extracts a tributary clock source from the first or fifth E1 signal.	
	Clock protection	Supports clock protection based on clock source priorities.	
	E1 retiming function	Supported	
OM	Loopback	Supports inloops and outloops at E1 tributary ports.	
	Cold reset and warm reset	Supported	

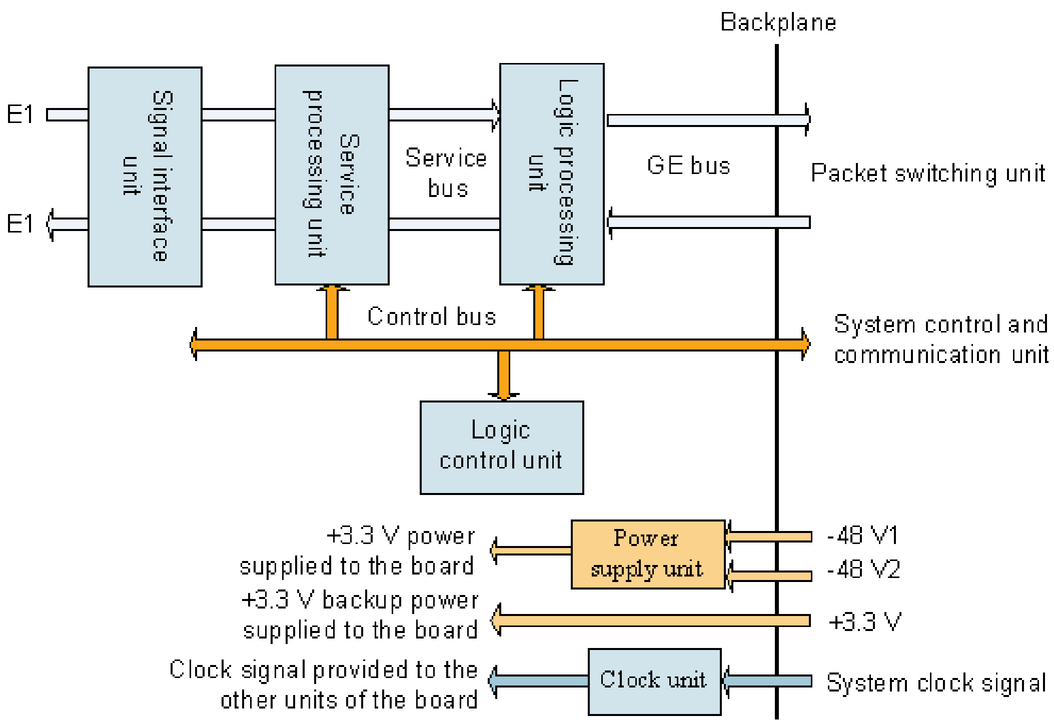
Function and Feature		Description	
		ML1	MD1
	PRBS tests at E1 ports	Supported	
	Queries of board manufacturing information	Supported	
	Queries of the board power consumption	Supported	

3.19.4 Working Principle and Signal Flow

This section describes how to process one E1 signal, and it serves as an example to describe the working principle and signal flow of the ML1/MD1.

Functional Block Diagram

Figure 3-132 Functional block diagram of the ML1/MD1



Signal Processing in the Receive Direction

Table 3-518 Signal processing in the receive direction of the ML1/MD1

Step	Function Unit	Processing Flow
1	Signal interface unit	● Receives external E1 signals. ● Matches the resistance. ● Equalizes signals. ● Converts the level. ● Recovers clock signals. ● Buffers the received data. ● Performs HDB3 decoding.
2	Service processing unit	● Frames E1 signals. ● Performs CES emulation or processes ATM/IMA services. ● Encapsulates PWE3 services and converts the PWE3 services into Ethernet services.
3	Logic processing unit	● Implements the conversion from the internal service bus into the GE bus in the backplane. ● Sends service signals to the packet switching unit.

Signal Processing in the Transmit Direction

Table 3-519 Signal processing in the transmit direction of the ML1/MD1

Step	Function Unit	Processing Flow
1	Logic processing unit	● Receives service signals from the packet switching unit. ● Implements the conversion from the GE bus in the backplane into the internal service bus.
2	Service processing unit	● Decapsulates service signals. ● Re-forms CES packets or processes ATM/IMA services. ● Converts signals into E1 signals and sends the E1 signals to the signal interface unit.
3	Signal interface unit	● Performs HDB3 coding. ● Performs clock re-timing. ● Performs pulse shaping. ● Drives the line. ● Sends E1 signals to a port.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives two -48 V power supplies from the backplane, converts the -48 V power supplies into +3.3 V power, and then supplies the +3.3 V power to the other units on the board.
- Receives one +3.3 V power supply from the backplane, which functions as a +3.3 V power backup for the other units on the board.

Clock Unit

This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.19.5 Front Panel

There are indicators and E1 ports on the front panel.

Front Panel Diagram

Figure 3-133 Front panel of the ML1

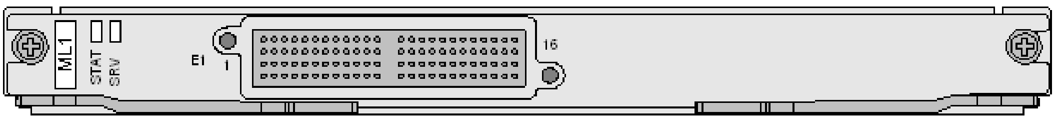
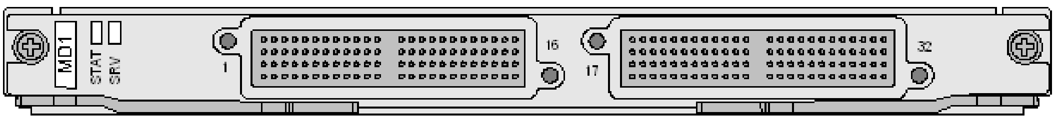


Figure 3-134 Front panel of the MD1



Indicators

Table 3-520 Status explanation for indicators on the ML1/MD1

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
	Off	The services are not configured.

Ports

Table 3-521 Description of the ports on the ML1

Port	Description	Connector Type	Corresponding Cable
1 to 16	The first to sixteenth E1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

Table 3-522 Description of the ports on the MD1

Port	Description	Connector Type	Corresponding Cable
1 to 16	The first to sixteenth E1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

Port	Description	Connector Type	Corresponding Cable
17 to 32	The seventeenth to thirty-second E1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

The ports on the ML1/MD1 use the Anea 96 connector. **Figure 3-135** shows the front view of an Anea 96 connector and **Table 3-523** provides the pin assignments for the Anea 96 connector.

Figure 3-135 Front view of an Anea 96 connector

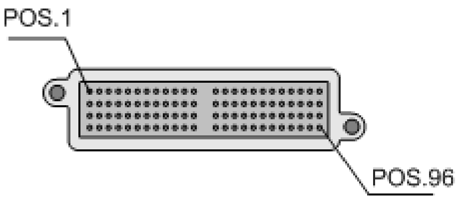


Table 3-523 Pin assignments for the Anea 96 connector

Pin	Signal	Pin	Signal
1	The first received E1 differential signal (+)	25	The first transmitted E1 differential signal (+)
2	The first received E1 differential signal (-)	26	The first transmitted E1 differential signal (-)
3	The second received E1 differential signal (+)	27	The second transmitted E1 differential signal (+)
4	The second received E1 differential signal (-)	28	The second transmitted E1 differential signal (-)
5	The third received E1 differential signal (+)	29	The third transmitted E1 differential signal (+)
6	The third received E1 differential signal (-)	30	The third transmitted E1 differential signal (-)
7	The fourth received E1 differential signal (+)	31	The fourth transmitted E1 differential signal (+)
8	The fourth received E1 differential signal (-)	32	The fourth transmitted E1 differential signal (-)
9	The fifth received E1 differential signal (+)	33	The fifth transmitted E1 differential signal (+)

Pin	Signal	Pin	Signal
10	The fifth received E1 differential signal (-)	34	The fifth transmitted E1 differential signal (-)
11	The sixth received E1 differential signal (+)	35	The sixth transmitted E1 differential signal (+)
12	The sixth received E1 differential signal (-)	36	The sixth transmitted E1 differential signal (-)
13	The seventh received E1 differential signal (+)	37	The seventh transmitted E1 differential signal (+)
14	The seventh received E1 differential signal (-)	38	The seventh transmitted E1 differential signal (-)
15	The eighth received E1 differential signal (+)	39	The eighth transmitted E1 differential signal (+)
16	The eighth received E1 differential signal (-)	40	The eighth transmitted E1 differential signal (-)
17	The ninth received E1 differential signal (+)	41	The ninth transmitted E1 differential signal (+)
18	The ninth received E1 differential signal (-)	42	The ninth transmitted E1 differential signal (-)
19	The tenth received E1 differential signal (+)	43	The tenth transmitted E1 differential signal (+)
20	The tenth received E1 differential signal (-)	44	The tenth transmitted E1 differential signal (-)
21	The eleventh received E1 differential signal (+)	45	The eleventh transmitted E1 differential signal (+)
22	The eleventh received E1 differential signal (-)	46	The eleventh transmitted E1 differential signal (-)
23	The twelfth received E1 differential signal (+)	47	The twelfth transmitted E1 differential signal (+)
24	The twelfth received E1 differential signal (-)	48	The twelfth transmitted E1 differential signal (-)
49	The thirteenth received E1 differential signal (+)	73	The thirteenth transmitted E1 differential signal (+)
50	The thirteenth received E1 differential signal (-)	74	The thirteenth transmitted E1 differential signal (-)
51	The fourteenth received E1 differential signal (+)	75	The fourteenth transmitted E1 differential signal (+)
52	The fourteenth received E1 differential signal (-)	76	The fourteenth transmitted E1 differential signal (-)

Pin	Signal	Pin	Signal
53	The fifteenth received E1 differential signal (+)	77	The fifteenth transmitted E1 differential signal (+)
54	The fifteenth received E1 differential signal (-)	78	The fifteenth transmitted E1 differential signal (-)
55	The sixteenth received E1 differential signal (+)	79	The sixteenth transmitted E1 differential signal (+)
56	The sixteenth received E1 differential signal (-)	80	The sixteenth transmitted E1 differential signal (-)

3.19.6 Valid Slots

The ML1/MD1 can be inserted in Slots 1-6, which have consistent logical slot numbers on the NMS.

Figure 3-136 Physical slots for the ML1/MD1 in the IDU chassis

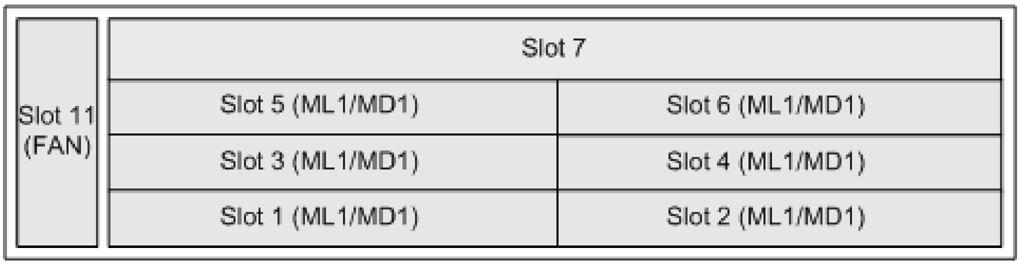


Figure 3-137 Logical slots of the ML1/MD1 on the NMS

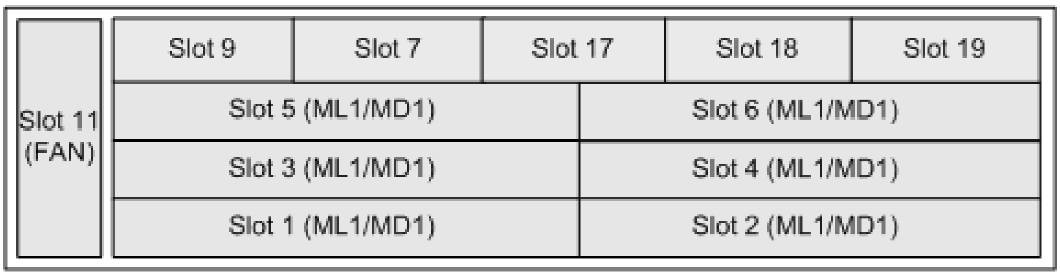


Table 3-524 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.19.7 Board Feature Code

The board feature code of the ML1/MD1 indicates the port impedance. The board feature code refers to the number next to the board name in the bar code.

Table 3-525 Board feature code of the ML1/MD1

Board Feature Code	Port Impedance (Ohm)
A	75
B	120

3.19.8 Technical Specifications

This section describes the board specifications, including the E1 port performance, board mechanical behavior, and board power consumption.

E1 Interface Performance

Table 3-526 E1 interface performance

Item	Performance	
Nominal bit rate (kbit/s)	2048	
Code pattern	HDB3	
Impedance (ohm)	75	120
Wire pair in each transmission direction	One coaxial wire pair	One symmetrical wire pair

Mechanical Behavior and Power Consumption

Table 3-527 Mechanical behavior and power consumption of ML1

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.45 kg
Power consumption	< 7.0 W

Table 3-528 Mechanical behavior and power consumption of MD1

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.50 kg
Power consumption	< 12.2 W

3.20 CQ1

CQ1 boards are 4-port channelized STM-1 processing boards.

3.20.1 Version Description

The functional version of CQ1 boards is SL91.

3.20.2 Application

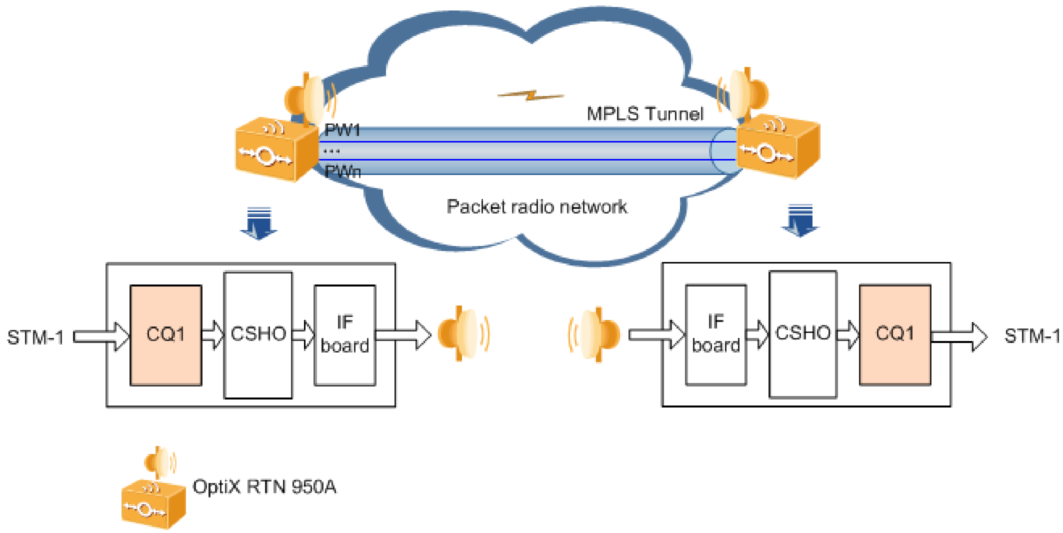
CQ1 boards apply to OptiX RTN 950A NEs to transparently transmit STM-1 services over packet radio networks. CQ1 boards receive/transmit only channelized STM-1 services.

CQ1 boards are used in the following scenarios:

- STM-1 services are transparently transmitted over packet radio networks.
- Multiprotocol Label Switching (MPLS) tunnels traverse a TDM network.
- Circuit emulation service (CES) E1 services are converged to channelized STM-1s.

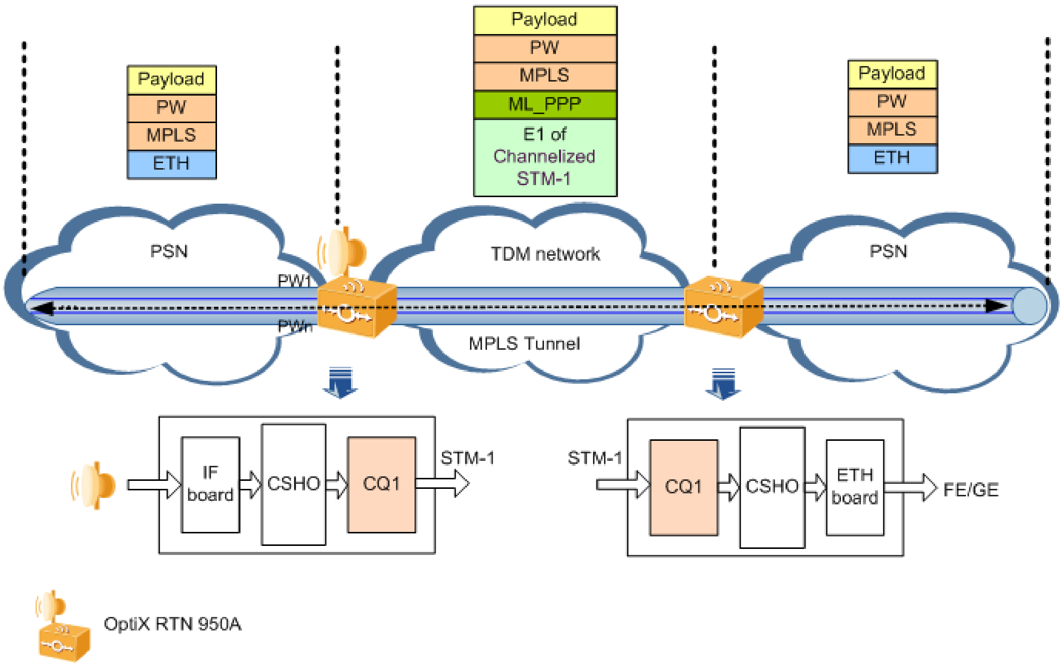
Transparently Transmitting STM-1 Services over Packet Radio Networks

Figure 3-138 Application scenario of CQ1 boards (1)



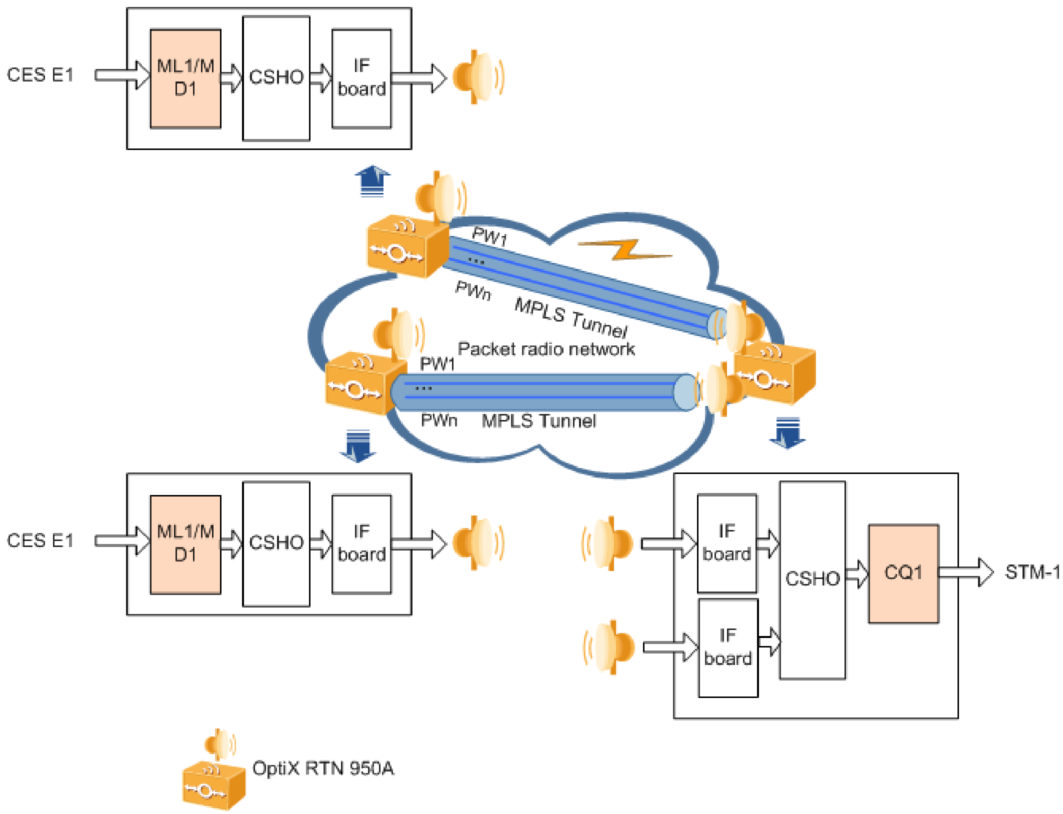
Carrying MPLS Tunnels over a TDM Network

Figure 3-139 Application scenario of CQ1 boards (2)



Converging CES E1 Services to Channelized STM-1s

Figure 3-140 Application scenario of CQ1 boards (3)



NOTE

- The IF boards shown in **Figure 3-138** to **Figure 3-140** must be general-purpose IF boards or cross polarization interference cancellation (XPIC) IF boards working in native E1+Ethernet or native STM-1+Ethernet mode.

3.20.3 Functions and Features

A CQ1 board receives and transmits four channels of channelized STM-1 optical/electrical signals.

Table 3-529 lists the functions and features that the CQ1 board supports.

Table 3-529 Functions and features that CQ1 board supports

Function and Feature	Description
Basic functions	Receives and transmits four channels of channelized STM-1 optical/electrical signals.

Function and Feature		Description
Supported packet service types		• Circuit emulation service (CES) E1 • ML-PPP E1
Port specifications	Optical ports	• Uses small form-factor pluggable (SFP) optical modules to provide optical ports of the Ie-1, S-1.1, L-1.1, and L-1.2 types. • Complies with ITU-T G.957.
	Electrical ports	• Uses SFP electrical modules. • Complies with ITU-T G.703.
Fractional E1		Transparently transmits 64 kbit/s CES services.
CES	Maximum number of services	192
	Encapsulation mode	• CESoPSN (CESoPSN stands for circuit emulation services over packet switch networks) • SAToP (SAToP stands for Structure-Agnostic Time Division Multiplexing over Packet)
	Idle timeslot compression	Supported only in CESoPSN mode
	Jitter buffering time (μs)	875 to 16,000
	Packet loading time (μs)	125 to 5,000
	CES ACR (ACR stands for adaptive clock recovery)	Supported with the NE functioning only as a master node
	Transparent transmission of SDH overheads	Supported
ML-PPP	Type of links carrying ML-PPP links	E1s in channelized STM-1s
	Maximum number of supported PPP links	252
	Maximum number of supported ML-PPP groups	32

Function and Feature		Description
	Maximum number of links in one ML-PPP group	16
Anti-theft		Supported **NOTE** Supported only when it is used with the CSHOF board.
Clock	Clock source	● Provides one SDH line clock signal over each line port. ● Provides two channels of E1 clock signals over two STM-1 ports.
	Clock protection	● Protection implemented based on different clock source priorities ● Protection implemented by running Synchronization Status Message (SSM) protocol ● Protection implemented by running extended SSM protocol
	SDH line clock retiming	Supported
Linear multiplex section protection (LMSP)		1:1 LMSP
Data communication network (DCN)	Outband DCN	Each SDH line port can provide one data communications channel (DCC) that is composed of three DCC bytes, nine DCC bytes, or 12 DCC bytes.
	Inband DCN	Transmits DCN information over ML-PPP links.
Operation and maintenance	Loopback	● Supports inloops at STM-1 ports. ● Supports outloops at STM-1 ports. ● Supports inloops over E1 channels. ● Supports outloops over E1 channels.
	Warm and cold resetting	Supported
	Switching a laser on or off	Supported
	Manufacturer information querying	Supported

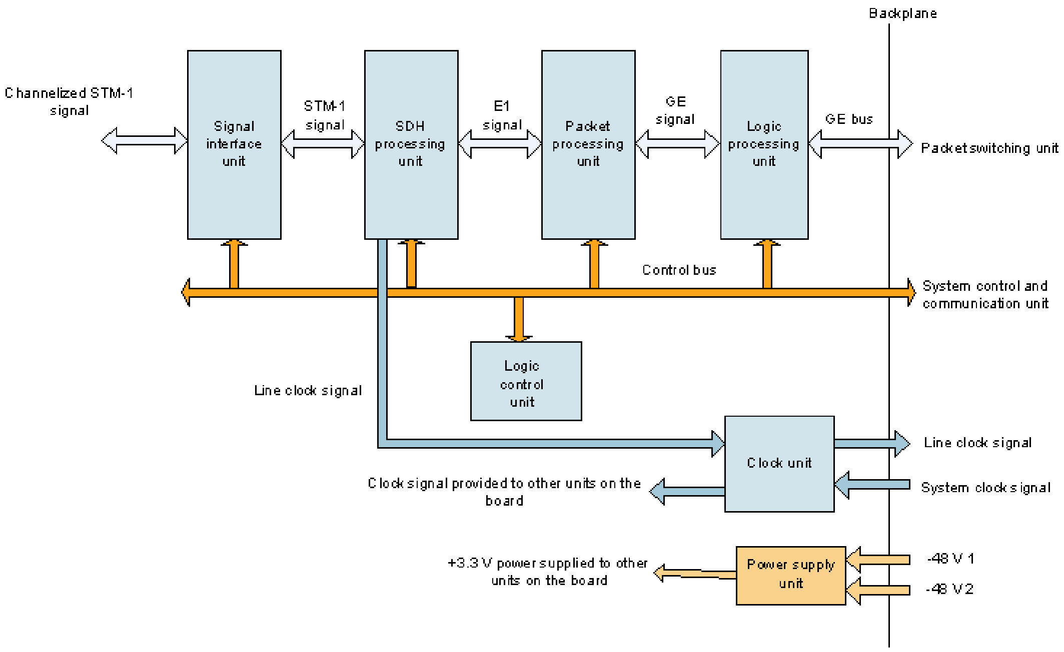
Function and Feature		Description
	Power consumption querying	Supported
	SFP module information detecting and querying	Supported

3.20.4 Working Principle and Signal Flow

This section describes how the function units of a CQ1 board process channelized STM-1 optical signals.

Function Block Diagram

Figure 3-141 CQ1 board function block diagram



Signal Processing in the Receive Direction

Table 3-530 Signal processing in the receive direction of a CQ1 board

Step	Function Unit	Processing Flow
1	Signal interface unit	● Receives channelized STM-1 signals. ● Regenerates STM-1 optical signals. ● Checks for R_LOS alarms. ● Converts STM-1 optical signals into STM-1 electrical signals.
2	SDH processing unit	● Restores clock signals. ● Synchronizes frames and checks for R_LOS and R_LOF alarms. ● Descrambles signals. ● Checks B1 and B2 bytes and generates alarms and performance events, if any. ● Checks the M1 byte and bits 6-8 of the K2 byte, and generates alarms and performance events, if any. ● Checks for changes in Synchronization Status Messages (SSMs) in the S1 byte and reports the SSM status to the system control and communication unit. ● Extracts orderwire bytes, auxiliary channel bytes (including F1 and serial bytes), DCC bytes, and K bytes, and transmits the bytes to the logic processing unit. ● Adjusts AU pointers and generates performance events, if any. ● Checks higher order path overheads and generates alarms and performance events, if any. ● Decapsulates E1 signals from the STM-1 signals.
3	Packet processing unit	● Frames E1 signals. ● Performs CES emulation. ● Performs Multilink Point-to-Point Protocol (MP-PPP) processing. ● Encapsulates PWE3 services and converts them into Ethernet services.
4	Logic processing unit	● Grooms services from service buses to the GE bus on the backplane. ● Sends service signals to the packet switching unit.

Signal Processing in the Transmit Direction

Table 3-531 Signal processing in the transmit direction of a CQ1 board

Step	Function Unit	Processing Flow
1	Logic processing unit	● Receives service signals from the packet switching unit. ● Grooms services from the GE bus on the backplane to service buses.
2	Packet processing unit	● Decapsulates service signals. ● Restructures CES packets. ● Converts signals into E1 signals and sends the E1 signals to the SDH processing unit.
3	SDH processing unit	● Multiplexes E1 signals into STM-1 signals. ● Sets higher order path overheads. ● Sets AU pointers. ● Sets multiplex section overhead bytes. ● Sets regenerator section overhead bytes. ● Scrambles signals.
4	Signal interface unit	Converts electrical signals into optical signals.

Control Signal Processing

The CQ1 board is directly controlled by a CPU on the system control and communication unit. The CPU issues configuration and query commands to the other units of the board over the control bus. These units send command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU.

Power Supply Unit

The power supply unit receives two -48 V power supplies from the backplane. It then converts the -48 V power supplies into +3.3 V power and supplies the +3.3 V power to other units on the board.

Clock Unit

The clock unit performs the following operations:

- Extracts line clock signals or E1 clock signals and transmits them to the system control and communication unit.
- Receives system clock signals from the control bus on the backplane and supplies clock signals to other units on the board.

3.20.5 Front Panel

A CQ1 board has indicators and STM-1 ports on its front panel.

Front Panel Diagram

Figure 3-142 Front panel of a CQ1 board providing optical ports

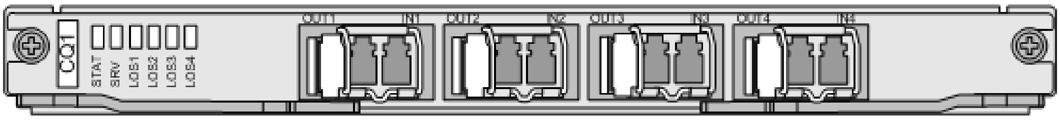
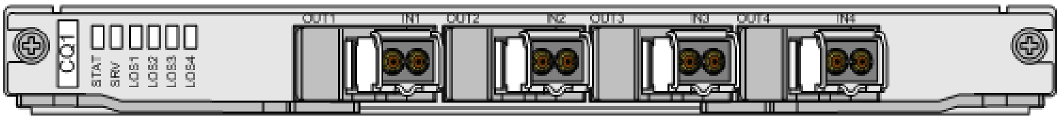


Figure 3-143 Front panel of a CQ1 board providing electrical ports



Indicators

Table 3-532 Status explanation for indicators on a CQ1 board

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	The board is not working, not created, or not powered on.
SRV	On (green)	Services are normal.
	On (red)	A critical or major alarm has been reported.
	On (yellow)	A minor or remote alarm has been reported.
	Off	No service is configured.
LOS1	On (red)	The first port has reported an R_LOS alarm.
	Off	The first port does not report any R_LOS alarms.

Indicator	State	Meaning
LOS2	On (red)	The second port has reported an R_LOS alarm.
	Off	The second port does not report any R_LOS alarms.
LOS3	On (red)	The third port has reported an R_LOS alarm.
	Off	The third port does not report any R_LOS alarms.
LOS4	On (red)	The fourth port has reported an R_LOS alarm.
	Off	The fourth port does not report any R_LOS alarms.

Ports

Table 3-533 Ports on a CQ1 board

Port	Description	Connector Type	Required Cable
OUT1 to OUT4	Transmit ports of the first to fourth STM-1 ports	• LC (with an SFP optical module) • SAA straight female (with an SFP electrical module)	• **5.6 Fiber Jumper** for SFP optical modules • **5.7 STM-1 Cable** for SFP electrical modules
IN1 to IN4	Receive ports of the first to fourth STM-1 ports		

3.20.6 Valid Slots

The CQ1 board can be inserted in Slots 1 – 6, which have consistent logical slot numbers on the NMS.

Figure 3-144 Physical slots for CQ1 boards in a chassis

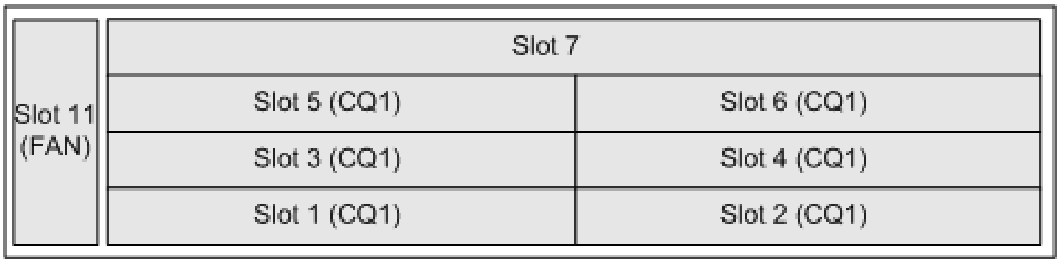


Figure 3-145 Logical slots of CQ1 boards on the NMS

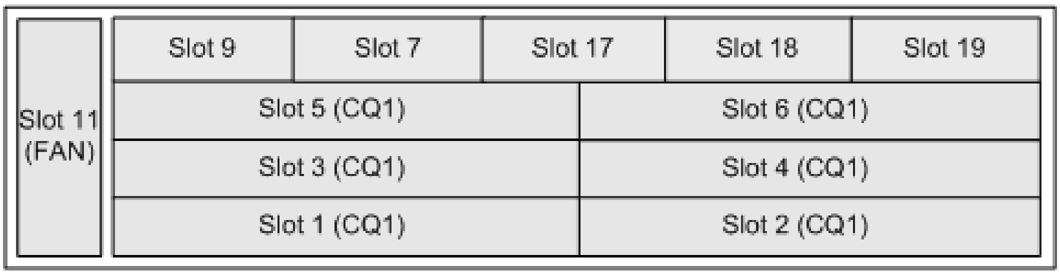


Table 3-534 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.20.7 Types of SFP Modules

STM-1 ports on CQ1 boards support multiple types of small form-factor pluggable (SFP) modules.

NOTE

All optical modules supported by the product are described in this document. For details about their availability, contact the sales personnel of the corresponding product or see *Mainstream Optical Modules for Microwave Products*.

Table 3-535 Types of SFP modules that STM-1 ports support

Category	Part Number	Type	Wavelength and Transmission Distance
Dual-fiber bidirectional STM-1 module	34060287	Ie-1	1310 nm, 2 km
	34060276	S-1.1	1310 nm, 15 km
	34060281	L-1.1	1310 nm, 40 km
	34060282	L-1.2	1550 nm, 80 km
Single-fiber bidirectional STM-1 module	34060363	S-1.1-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1550 nm 15 km

Category	Part Number	Type	Wavelength and Transmission Distance
	34060364	S-1.1-BX-D	Transmit wavelength: 1550 nm; receive wavelength: 1310 nm 15 km
	34060328	L-1.1-BX-U	Transmit wavelength: 1310 nm; receive wavelength: 1550 nm 40 km
	34060329	L-1.1-BX-D	Transmit wavelength: 1550 nm; receive wavelength: 1310 nm 40 km
Electrical STM-1 module	34100104	STM-1e	Transmission distance: 300 m

NOTE

For specifications for each type of SFP module, see **STM-1 Optical Interface Performance** and **STM-1 Electrical Interface Performance** in **3.20.8 Technical Specifications**.

The types of SFP modules listed in the following table can be identified by feature codes in the bar codes of CQ1 boards. A feature code refers to the number next to the board name in a bar code.

Table 3-536 Feature codes of CQ1 boards

Feature Code	Module Type	Part Number of the Module
01	**Ie-1**	34060287
02	**S-1.1**	34060276
03	**L-1.1**	34060281

3.20.8 Technical Specifications

This section describes board specifications, including the STM-1 optical/electrical port performance, mechanical behaviors, and power consumption.

STM-1 Optical Interface Performance

The performance of the STM-1 optical interface is compliant with ITU-T G.957/G.825. The following table provides the typical performance of the interface.

Table 3-537 STM-1 optical interface performance (two-fiber bidirectional)

Item	Performance			
Nominal bit rate (kbit/s)	155520			
Classification code	Ie-1	S-1.1	L-1.1	L-1.2
Fiber type	Multi-mode fiber	Single-mode fiber	Single-mode fiber	Single-mode fiber
Transmission distance (km)	2	15	40	80
Operating wavelength (nm)	1270 to 1380	1261 to 1360	1263 to 1360	1480 to 1580
Mean launched power (dBm)	-19 to -14	-15 to -8	-5 to 0	-5 to 0
Receiver minimum sensitivity (dBm)	-30	-28	-34	-34
Minimum overload (dBm)	-14	-8	-10	-10
Minimum extinction ratio (dB)	10	8.2	10	10

NOTE

The OptiX RTN 950A uses SFP optical modules for providing optical interfaces. You can use different types of SFP optical modules to provide optical interfaces with different classification codes and transmission distances.

Table 3-538 STM-1 optical interface performance (single-fiber bidirectional)

Item	Performance			
Nominal bit rate (kbit/s)	155520			
Classification code	S-1.1-BX-D	S-1.1-BX-U	L-1.1-BX-D	L-1.1-BX-U
Fiber type	Single-mode fiber	Single-mode fiber	Single-mode fiber	Single-mode fiber

Item	Performance			
Transmission distance (km)	15	15	40	40
Nominal wavelength (nm)	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550	Tx: 1550 Rx: 1310	Tx: 1310 Rx: 1550
Operating wavelength (nm)	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580	Tx: 1480 to 1580 Rx: 1260 to 1360	Tx: 1260 to 1360 Rx: 1480 to 1580
Mean launched power (dBm)	-15 to -8	-15 to -8	-5 to 0	-5 to 0
Receiver minimum sensitivity (dBm)	-32	-32	-32	-32
Minimum overload (dBm)	-8	-8	-10	-10
Minimum extinction ratio (dB)	8.5	8.5	10	10

NOTE

The OptiX RTN 950A uses SFP optical modules for providing optical interfaces. You can use different types of SFP optical modules to provide optical interfaces with different classification codes and transmission distances.

STM-1 Electrical Interface Performance

The performance of the STM-1 electrical interface is compliant with ITU-T G.703. The following table provides the typical performance of the interface.

Table 3-539 STM-1 electrical interface performance

Item	Performance
Nominal bit rate (kbit/s)	155520
Code type	CMI
Wire pair in each transmission direction	One coaxial wire pair
Impedance (ohm)	75

NOTE

The OptiX RTN 950A uses SFP electrical modules to provide electrical interfaces.

Mechanical Behaviors and Power Consumption

Table 3-540 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.47 kg
Power consumption	< 11.5 W

3.21 MN1

MN1 boards are multiple-protocol null-port circuit emulation extended boards.

3.21.1 Version Description

The functional version of MN1 boards is SL91.

3.21.2 Application

If an MN1 board works with a CSHO board, an E1 port on the CSHO board can be configured as a Smart E1 port, and an STM-1 port on the CSHO board can be configured as a channelized STM-1 port.

MN1 boards are used to:

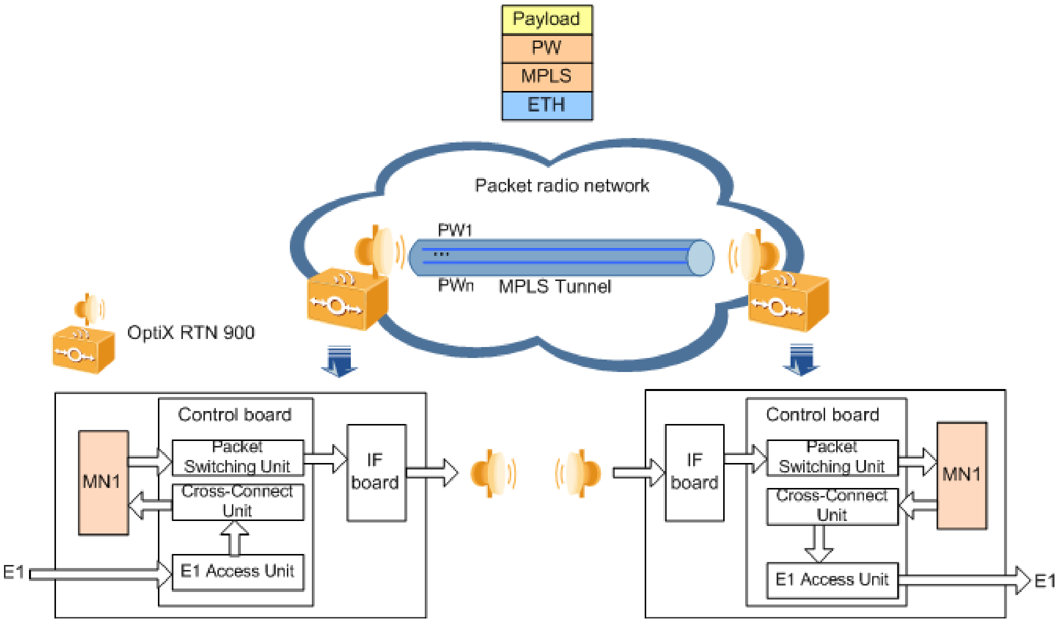
- Transmit E1 services carried by channelized STM-1 and TDM E1 services in CES E1 mode.
- Allow an MPLS tunnel to traverse a TDM network.

NOTE

The application scenarios of SDH services are similar to those of PDH services. The following description takes PDH services as an example.

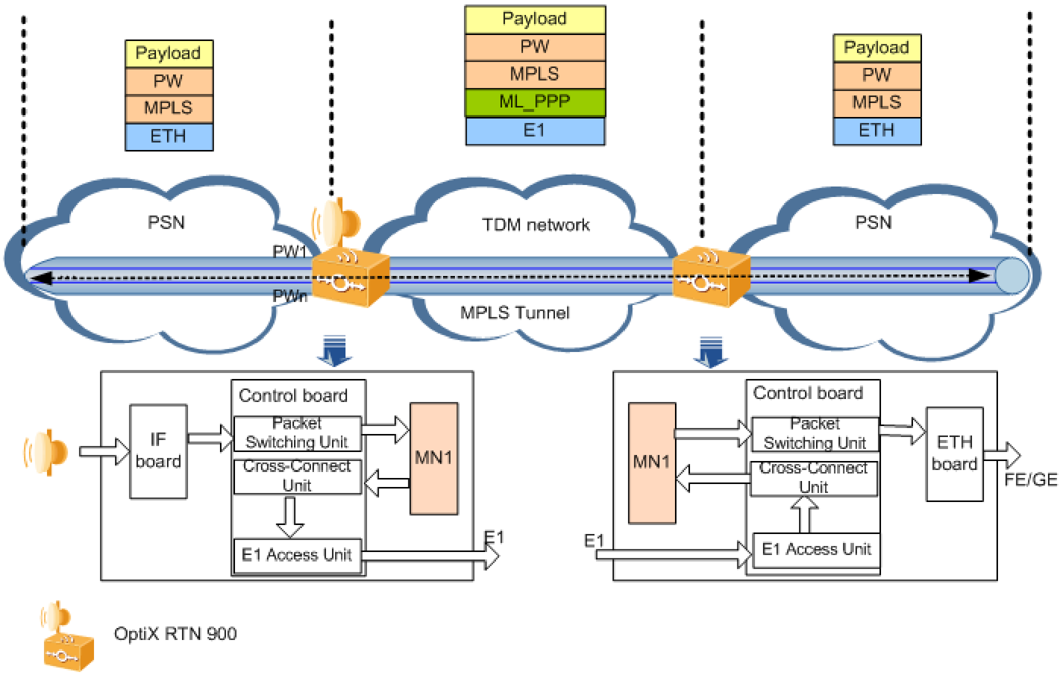
Transmitting TDM E1 Services in CES E1 Mode

Figure 3-146 Transmitting TDM E1 services in CES E1 mode



Allowing an MPLS Tunnel to Traverse a TDM Network

Figure 3-147 Allowing an MPLS tunnel to traverse a TDM network



3.21.3 Functions and Features

MN1 boards provide CES or ML-PPP functions for E1/STM-1 ports on system control boards.

Table 3-541 Functions and features that MN1 boards support

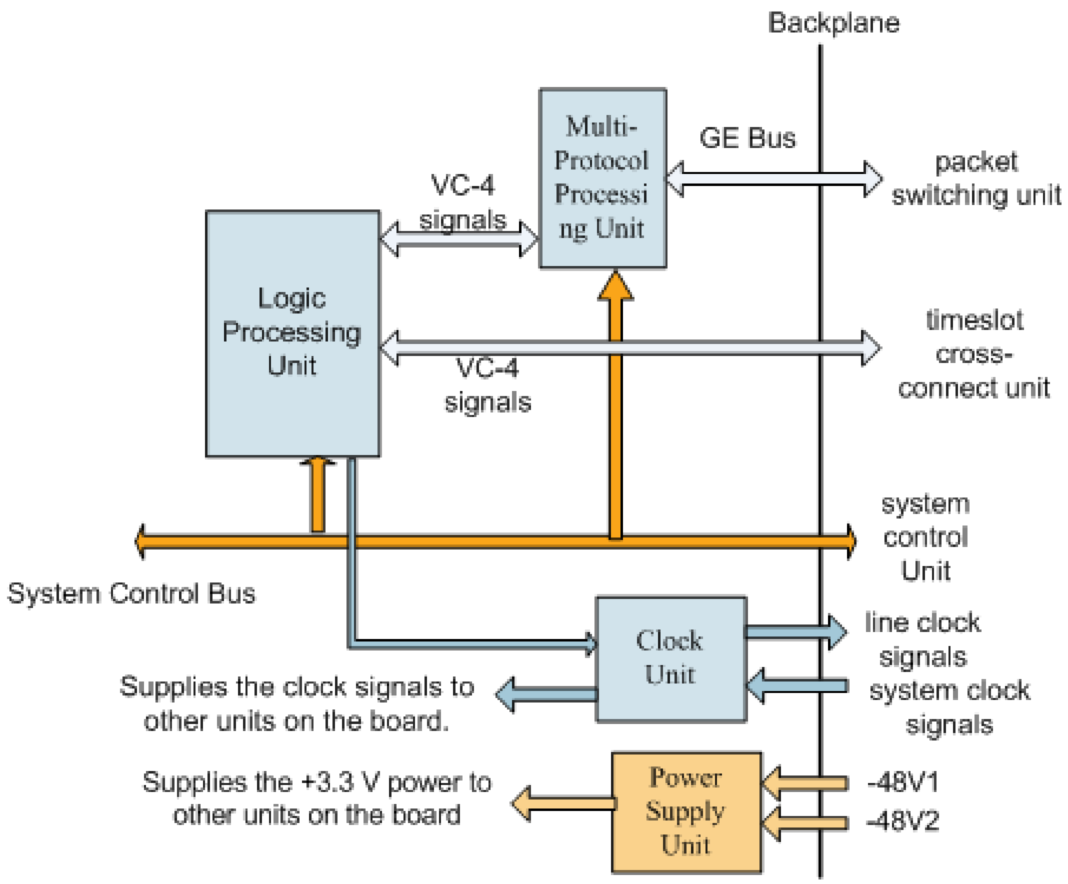
Function and Feature		Description
CES	Maximum number of services	142
	Encapsulation mode	• CESoPSN (CESoPSN stands for circuit emulation services over packet switch networks) • SAToP (SAToP stands for Structure-Agnostic Time Division Multiplexing over Packet)
	Idle timeslot compression	Supported only in CESoPSN mode
	Jitter buffering time (μs)	875 to 16000
	Packet loading time (μs)	125 to 5000
	CES ACR (ACR stands for adaptive clock recovery)	Supports CES ACR for four channels of signals.
	Re-timing	Supported
	PRBS	Supported
ML-PPP	Type of links carrying ML-PPP links	E1/STM-1
	Maximum number of supported PPP links	142
	Maximum number of supported ML-PPP groups	40
	Maximum number of links in one ML-PPP group	16
DCN	Outband DCN	Provides DCC channels.
	Inband DCN	Supports transmission of DCN information using part of bandwidth provided by ML-PPP links.

3.21.4 Working Principle and Signal Flow

This section describes the working principle of MN1 boards.

Function Block Diagram

Figure 3-148 MN1 board function block diagram



Logic Processing Unit

- Receives/Outputs VC-4 signals from/to the timeslot cross-connect unit.
- Provides the re-timing function.
- Processes SDH overheads.
- Obtains DCCs from the system control board.

Multi-Protocol Processing Unit

- Receives/Outputs Ethernet signals from/to the packet switching unit.
- If SDH/PDH services are received from the timeslot cross-connect unit, the multi-protocol processing unit provides the following functions:
  - Frames VC-4 signals.
  - Performs CES simulation.

  - Encapsulates PWE3 services and converts the PWE3 services into Ethernet services.
- If Ethernet services are received from the packet switching unit, the multi-protocol processing unit provides the following functions:
  - Decapsulates service signals.
  - Reassembles CES packets into E1 signals.

Power Supply Unit

The power supply unit receives two -48 V power supplies from the backplane. It then converts the -48 V power supplies into +3.3 V power and supplies the +3.3 V power to other units on the board.

Clock Unit

The clock unit performs the following operations:

- Extracts line clock signals or E1 clock signals and transmits them to the system control and communication unit.
- Receives system clock signals from the control bus on the backplane and supplies clock signals to other units on the board.

3.21.5 Front Panel

There are only indicators on the front panel. There are no ports on the front panel.

Front Panel Diagram

Figure 3-149 Front panel of the MN1

Indicators

Table 3-542 Status explanation for indicators on an MN1

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.

Indicator	State	Meaning
	Off	• The board is not working or created. • There is no power supplied to the board.
SRV	On (green)	• The system/service is normal. • No service is configured.
	On (red)	A critical or major alarm occurs in the system/service.
	On (yellow)	A minor or remote alarm occurs in the system/service.
	Off	No logical board is added on the NMS.

3.21.6 Valid Slots

An MN1 board can be inserted in any of slots 1 to 6. Its logical slot on the network management system (NMS) is the same as its physical slot.

NOTE

One OptiX RTN 950A supports only one MN1 board.

Figure 3-150 Slots for MN1 boards in a chassis

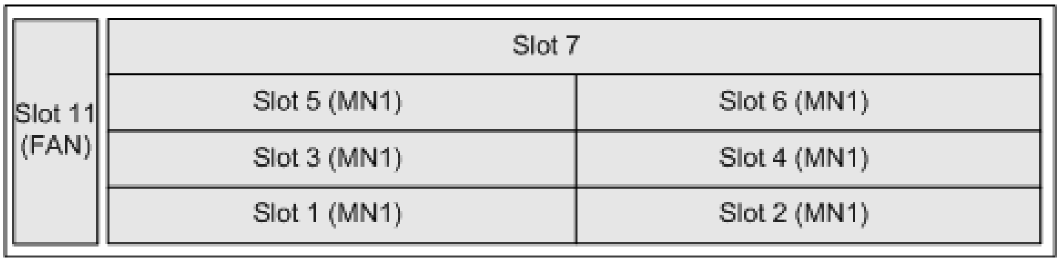


Figure 3-151 Logical slots of MN1 boards on the NMS

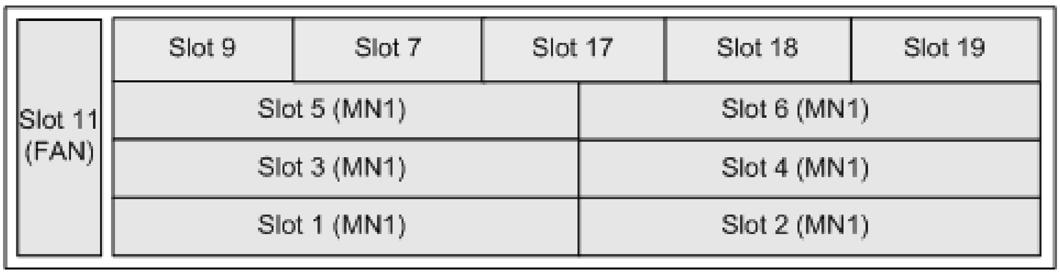


Table 3-543 Slot allocation

Item	Description
Slot allocation	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.21.7 Technical Specifications

This section describes board specifications, including the mechanical behaviors, and power consumption.

Mechanical Behaviors and Power Consumption

Table 3-544 Mechanical behaviors and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.35 kg
Typical power consumption	< 5.3 W

3.22 SP3S/SP3D

The SP3S is a 16xE1 75-ohm/120-ohm tributary board. The SP3D is a 32xE1 75-ohm/120-ohm tributary board. The SP3SA VER.C and SP3DA VER.C can be used as a 16xT1 100-ohm tributary board and a 32xT1 100-ohm tributary board respectively. In the board names, A indicates the feature code and VER.C indicates the board version.

3.22.1 Version Description

The SP3S has two functional versions: SL91SP3S VER.B and SL91SP3S VER.C. The SP3D also has two functional versions: TNH1SP3D VER.B and TNH1SP3D VER.C. The difference between VER.B and VER.C is that path indication on the front panel is optimized and the board power consumption is reduced.

The difference between VER.B and VER.C of SP3S/SP3D whose feature code is A is that VER.C supports the T1 function.

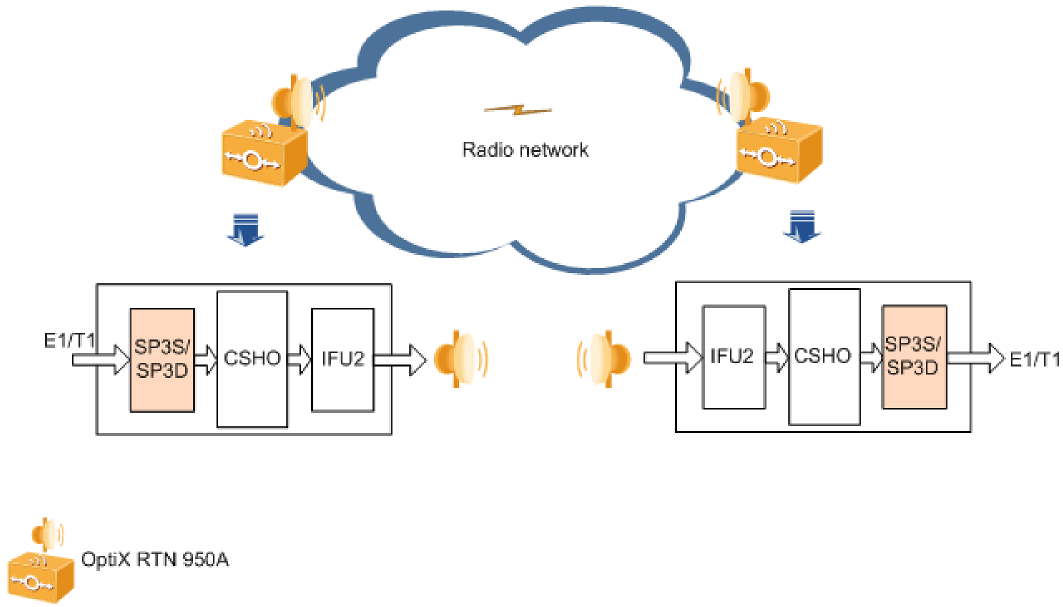
3.22.2 Application

SP3S/SP3D boards receive and transmit E1/T1 services on OptiX RTN 950A NEs that transmit E1/T1 services in native mode. The E1/T1 services come from customer premises or TDM networks.

NOTE

For the OptiX RTN 950A, configure SP3S/SP3D boards only if E1/T1 ports on system control, switching, and timing boards cannot meet customers' requirements.

Figure 3-152 Application scenario of SP3S/SP3D boards



3.22.3 Functions and Features

An SP3S receives and transmits 16xE1/T1 signals. The SP3D receives and transmits 32xE1/T1 signals.

Table 3-545 lists the functions and features that the SP3S/SP3D supports.

Table 3-545 Functions and features that the SP3S/SP3D supports

Function and Feature		Description	
		SP3S	SP3D
Basic functions		Receives and transmits E1/T1 (B8SZ/AMI) signals. You can select the board to receive and transmit E1 or T1 signals by setting the board software correspondingly.	
Port specifications	75-ohm/120-ohm E1 port or 100-ohm T1 port	16	32
Clock	Clock source	Extracts a tributary clock source from the first or fifth E1/T1 signal.	

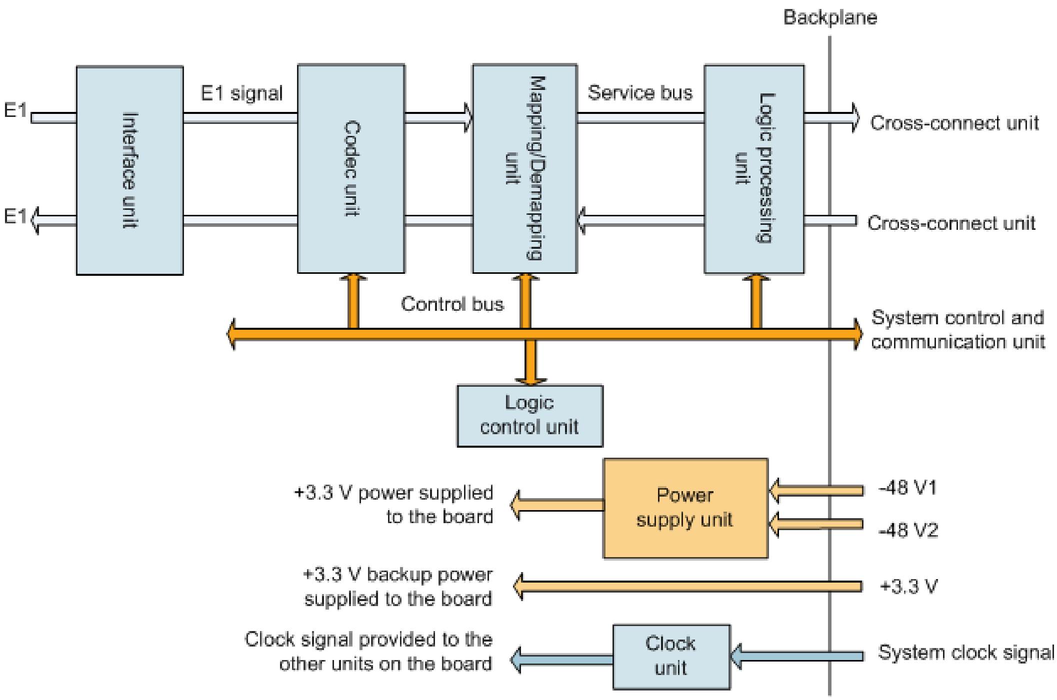
Function and Feature		Description	
		SP3S	**SP3D**
	Clock protection	Supports clock protection based on clock source priorities.	
	E1 retiming function	Supported	
OM	Loopback	Supports inloops and outloops at E1/T1 tributary ports.	
	Cold reset and warm reset	Supported	
	PRBS tests at E1/T1 ports	Supported	
	Queries of board manufacturing information	Supported	
	Queries of the board power consumption	Supported	

3.22.4 Working Principle and Signal Flow

This section describes how to process one E1 signal, and it serves as an example to describe the working principle and signal flow of the SP3S/SP3D. A T1 signal is similar to an E1 signal, except that the T1 code type is B8ZS or AMI.

Functional Block Diagram

Figure 3-153 Functional block diagram of the SP3S/SP3D



NOTE

The power supply units on the SP3S VER.C and SP3D VER.C boards do not support conversion from -48 V power into +3.3 V power.

Signal Processing in the Receive Direction

Table 3-546 Signal processing in the receive direction

Step	Function Unit	Processing Flow
1	Interface unit	External E1 signals are coupled by the transformer and then transmitted to the board.
2	Codec unit	• Equalizes the received signals. • Recovers clock signals. • Detects T_ALOS alarms. • Performs HDB3 decoding.

Step	Function Unit	Processing Flow
3	Mapping/ Demapping unit	● Asynchronously maps signals into C-12s. ● Adds path overhead bytes to C-12s to form VC-12s. ● Processes pointers to form TU-12s. ● Performs byte interleaving for three TU-12s to form one TUG-2. ● Performs byte interleaving for seven TUG-2s to form one TUG-3. ● Performs byte interleaving for three TUG-3s to form one C-4. ● Adds higher order path overhead bytes to one C-4 to form one VC-4.
4	Logic processing unit	● Processes clock signals. ● Transmits VC-4 signals and pointer indication signals to the main and standby cross-connect units.

Signal Processing in the Transmit Direction

Table 3-547 Signal processing in the transmit direction

Step	Function Unit	Processing Flow
1	Logic processing unit	● Processes clock signals. ● Receives VC-4 signals and pointer indication signals from the cross-connect unit.
2	Mapping/ Demapping unit	● Demultiplexes three TUG-3s from one VC-4. ● Demultiplexes seven TUG-2s from one TUG-3. ● Demultiplexes three VC-12s from one TUG-2. ● Processes path overheads and pointers and detects specific alarms and performance events. ● Extracts E1 signals.
3	Codec unit	Performs HDB3 coding.
4	Interface unit	E1 signals are coupled by the transformer and then transmitted to an external cable.

Control Signal Processing

The board is directly controlled by the CPU unit on the system control and communication unit. The CPU unit issues configuration and query commands to the other units of the board over the control bus. These units then report command responses, alarms, and performance events to the CPU unit over the control bus.

The logic control unit decodes the address read/write signals from the CPU unit of the system control and communication unit.

Power Supply Unit

The power supply unit performs the following functions:

- Receives two -48 V power supplies from the backplane, converts the -48 V power into +3.3 V power, and then supplies the +3.3 V power to the other units on the board. The power supply units on the SP3SVER.C and SP3DVER.C boards do not support conversion from -48 V power into +3.3 V power.
- Receives one +3.3 V power supply from the backplane, which functions as a +3.3 V power backup for the other units on the board.

Clock Unit

This unit receives the system clock from the control bus in the backplane and provides clock signals to the other units on the board.

3.22.5 Front Panel

There are indicators and E1/T1 ports on the front panel.

Front Panel Diagram

Figure 3-154 Front panel of the SP3S VER.B

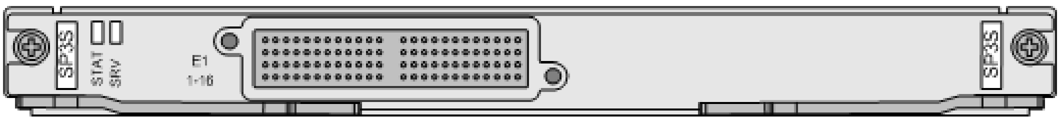


Figure 3-155 Front panel of the SP3S VER.C

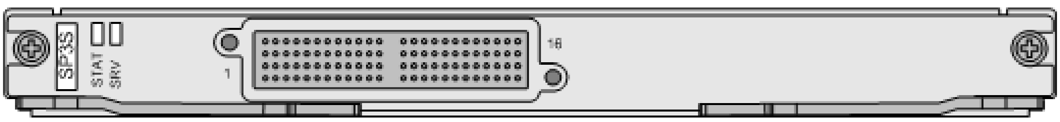


Figure 3-156 Front panel of the SP3D VER.B

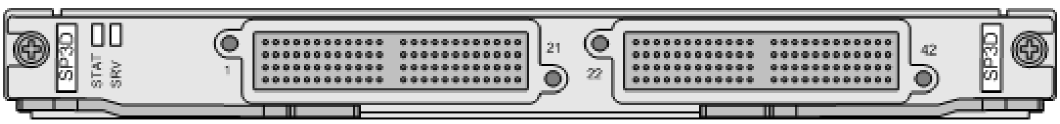
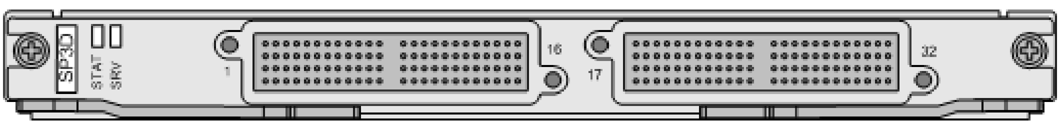


Figure 3-157 Front panel of the SP3D VER.C



Indicators

Table 3-548 Status explanation for indicators on the SP3S/SP3D

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	● The board is not working. ● The board is not created. ● There is no power supplied to the board.
SRV	On (green)	The services are normal.
	On (red)	A critical or major alarm occurs in the services.
	On (yellow)	A minor or remote alarm occurs in the services.
	Off	The services are not configured.

Ports

Table 3-549 Description of the ports on the SP3S (VER.B and VER.C)

Port	Description	Connector Type	Corresponding Cable
1-16	The first to sixteenth E1/T1 ports **NOTE** Only VER.C supports T1 interfaces.	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment**, **5.8.2 E1 Cable Connected to the E1 Panel** or **5.8.3 E1 Transit Cable Terminated with an Anea 96 Connector and a DB44 Connector**

Table 3-550 Description of the ports on the SP3D VER.B

Port	Description	Connector Type	Corresponding Cable
1-21	The first to sixteenth E1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**
22-42	The seventeenth to thirty-second E1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

NOTE

On the OptiX RTN 950A, only ports 1-16 and 22-37 of the SP3D are used. Ports 1-16 correspond to E1 signals 1-16 and ports 22-37 correspond to E1 signals 17-32.

Table 3-551 Description of the ports on the SP3D VER.C

Port	Description	Connector Type	Corresponding Cable
1-16	The first to sixteenth E1/T1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**
17-32	The seventeenth to thirty-second E1/T1 ports	Anea 96	**5.8.1 E1 Cable Connected to the External Equipment** or **5.8.2 E1 Cable Connected to the E1 Panel**

NOTE

- Only twisted pair cables can be used on T1 interfaces, which is the same as on 120-ohm E1 interfaces. The definition of cable connector pins on the two types of interfaces is also the same.
- On SP3S/SP3D, a T1 port can connect to a cable with up to 50 meters long.

The ports on the SP3S/SP3D use Anea 96 connectors. **Figure 3-158** shows the front view of an Anea 96 connector and **Table 3-552** lists the pin assignments for an Anea 96 connector.

Figure 3-158 Front view of an Anea 96 connector

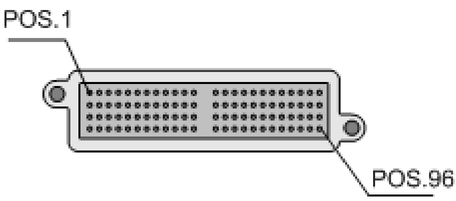


Table 3-552 Pin assignments for an Anea 96 connector

Pin	Signal	Pin	Signal
1	The first received E1 differential signal (+)	25	The first transmitted E1 differential signal (+)
2	The first received E1 differential signal (-)	26	The first transmitted E1 differential signal (-)
3	The second received E1 differential signal (+)	27	The second transmitted E1 differential signal (+)
4	The second received E1 differential signal (-)	28	The second transmitted E1 differential signal (-)
5	The third received E1 differential signal (+)	29	The third transmitted E1 differential signal (+)
6	The third received E1 differential signal (-)	30	The third transmitted E1 differential signal (-)
7	The fourth received E1 differential signal (+)	31	The fourth transmitted E1 differential signal (+)
8	The fourth received E1 differential signal (-)	32	The fourth transmitted E1 differential signal (-)
9	The fifth received E1 differential signal (+)	33	The fifth transmitted E1 differential signal (+)
10	The fifth received E1 differential signal (-)	34	The fifth transmitted E1 differential signal (-)
11	The sixth received E1 differential signal (+)	35	The sixth transmitted E1 differential signal (+)
12	The sixth received E1 differential signal (-)	36	The sixth transmitted E1 differential signal (-)
13	The seventh received E1 differential signal (+)	37	The seventh transmitted E1 differential signal (+)
14	The seventh received E1 differential signal (-)	38	The seventh transmitted E1 differential signal (-)
15	The eighth received E1 differential signal (+)	39	The eighth transmitted E1 differential signal (+)
16	The eighth received E1 differential signal (-)	40	The eighth transmitted E1 differential signal (-)
17	The ninth received E1 differential signal (+)	41	The ninth transmitted E1 differential signal (+)

Pin	Signal	Pin	Signal
18	The ninth received E1 differential signal (-)	42	The ninth transmitted E1 differential signal (-)
19	The tenth received E1 differential signal (+)	43	The tenth transmitted E1 differential signal (+)
20	The tenth received E1 differential signal (-)	44	The tenth transmitted E1 differential signal (-)
21	The eleventh received E1 differential signal (+)	45	The eleventh transmitted E1 differential signal (+)
22	The eleventh received E1 differential signal (-)	46	The eleventh transmitted E1 differential signal (-)
23	The twelfth received E1 differential signal (+)	47	The twelfth transmitted E1 differential signal (+)
24	The twelfth received E1 differential signal (-)	48	The twelfth transmitted E1 differential signal (-)
49	The thirteenth received E1 differential signal (+)	73	The thirteenth transmitted E1 differential signal (+)
50	The thirteenth received E1 differential signal (-)	74	The thirteenth transmitted E1 differential signal (-)
51	The fourteenth received E1 differential signal (+)	75	The fourteenth transmitted E1 differential signal (+)
52	The fourteenth received E1 differential signal (-)	76	The fourteenth transmitted E1 differential signal (-)
53	The fifteenth received E1 differential signal (+)	77	The fifteenth transmitted E1 differential signal (+)
54	The fifteenth received E1 differential signal (-)	78	The fifteenth transmitted E1 differential signal (-)
55	The sixteenth received E1 differential signal (+)	79	The sixteenth transmitted E1 differential signal (+)
56	The sixteenth received E1 differential signal (-)	80	The sixteenth transmitted E1 differential signal (-)
NOTE Pin signals can also be T1 signals. The definition of T1 pin signals is the same as that of E1 pin signals.			

3.22.6 Valid Slots

The SP3S/SP3D can be inserted in Slots 1 to 6, which have consistent logical slot numbers on the NMS.

Figure 3-159 Physical slots for the SP3S/SP3D in the IDU chassis

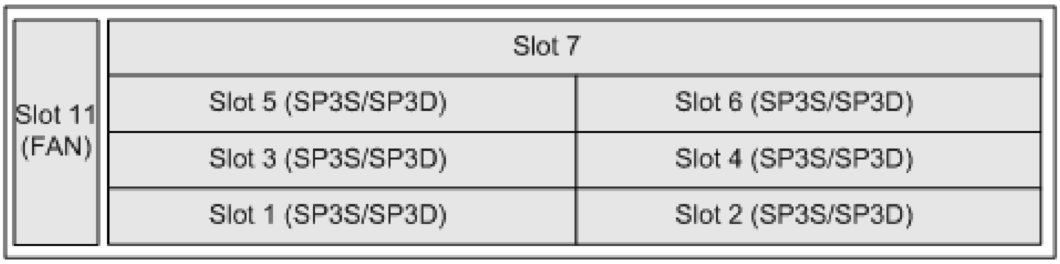


Figure 3-160 Logical slots of the SP3S/SP3D on the NMS

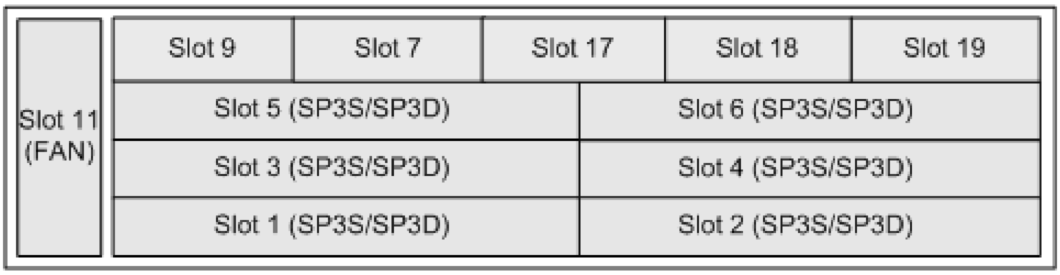


Table 3-553 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.22.7 Board Feature Code

The board feature code of the SP3S/SP3D indicates the E1 port impedance. The board feature code refers to the number next to the board name in the bar code.

NOTE

The SP3S VER.C and SP3D VER.C boards support T1 interfaces only when the feature code is A and the interface impedance is 100 ohm.

Table 3-554 Board feature code of the SP3S/SP3D

Board Feature Code	Port Impedance (Ohm)
A	120
B	75

3.22.8 Technical Specifications

This section describes the board specifications, including the E1/T1 port performance, board mechanical behavior, and board power consumption.

E1 Interface Performance

Table 3-555 E1 interface performance

Item	Performance	
Nominal bit rate (kbit/s)	2048	
Code pattern	HDB3	
Impedance (ohm)	75	120
Wire pair in each transmission direction	One coaxial wire pair	One symmetrical wire pair

T1 Interface Performance

Table 3-556 T1 interface performance

Item	Performance
Nominal bit rate (kbit/s)	1544
Code pattern	B8ZS and AMI
Impedance (ohm)	100
Wire pair in each transmission direction	One symmetrical wire pair

Mechanical Behavior and Power Consumption

Table 3-557 Mechanical behavior and power consumption of SP3S

Item	Performance	
	SP3S VER.B	SP3S VER.C
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm	
Weight	0.54 kg	0.64 kg
Power consumption	< 5.7 W	< 4.8 W

Table 3-558 Mechanical behavior and power consumption of SP3D

Item	Performance	
	SP3D VER.B	SP3D VER.C
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm	
Weight	0.64 kg	
Power consumption	< 9.6 W	< 8.3 W

3.23 AUX

The AUX is an auxiliary management interface board of the OptiX RTN 950A.

3.23.1 Version Description

The functional version of the AUX is SL91.

3.23.2 Functions and Features

The AUX provides the system with one orderwire phone port, one synchronous data port, one asynchronous data port, and one four-input/two-output external alarm port.

Table 3-559 lists the functions and features that the AUX supports.

Table 3-559 Functions and features

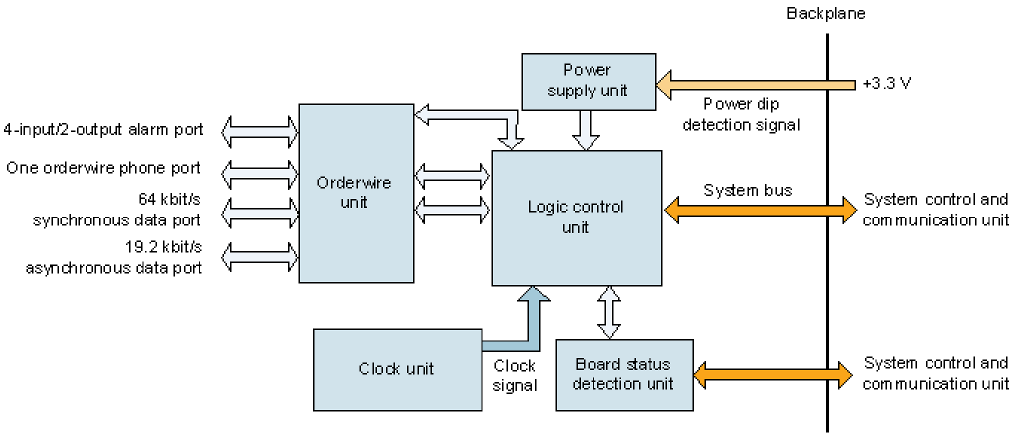
Function and Feature	Description
Orderwire phone port	1
Synchronous data port	1 The port transmission rate is 64 kbit/s and its specifications comply with ITU-T G.703.
Asynchronous data port	1 The transmission rate of the port is equal to or less than 19.2 kbit/s and the interfacing level complies with RS-232.
External alarm port	Four inputs and two outputs
Hot swapping	Supported
Queries of the board power consumption	Supported
Power monitoring	Supported

3.23.3 Working Principle

The AUX consists of the orderwire unit, logic control unit, and clock unit.

Functional Block Diagram

Figure 3-161 Functional block diagram of the AUX



Power Supply Unit

- Receives the +3.3 V power supply from the backplane and supplies it to the other units on the AUX.
- Receives and shuts down control signals.

Orderwire Unit

- Supports the input of four channels of alarms.
- Supports the output of two channels of alarms.
- Provides one orderwire port.
- Provides one 64 kbit/s synchronous transparent data port.
- Provides one 19.2 kbit/s asynchronous transparent data port.

NOTE

The 64 kbit/s synchronous data port can transparently transmit orderwire byte. One port, however, can implement only one of the two functions: 64 kbit/s synchronous data port and transparent transmission of orderwire byte.

Logic Control Unit

- Provides an interface with the CPU unit and works with the CPU unit to implement the board control function.
- Processes orderwire bytes and overhead bytes.
- Processes clock signals.
- Provides board status information.

- Checks the status of the system control, switching, and timing board.
- Checks the status of the clock.
- Supports the switching of system clock reference sources automatically and by running specific commands.
- Supports the detection and reporting of the key clock status of each board in the system.

Board Status Detection Unit

- Detects board performance data such as board voltage.
- Stores board manufacturing information.

Clock Unit

Provides clock signals to the logic control unit.

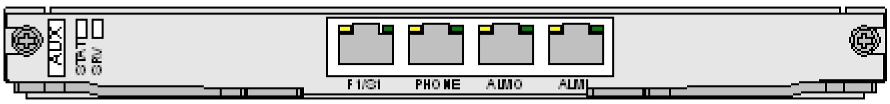
3.23.4 Front Panel

There are indicators, management ports, and auxiliary ports on the front panel.

Front Panel Diagram

Figure 3-162 shows the appearance of the front panel of the AUX.

Figure 3-162 Front panel of the AUX



Indicators

Table 3-560 Status explanation for indicators on the AUX

Indicator	State	Meaning
STAT	On (green)	The board is working properly.
	On (red)	The board hardware is faulty.
	Off	• The board is not working. • The board is not created. • There is no power supplied to the board.
SRV	On (green)	The system is working properly.
	On (red)	A critical or major alarm occurs in the system.

Indicator	State	Meaning
	On (yellow)	A minor or remote alarm occurs in the system.
	Off	There is no power supplied to the system.

Auxiliary Ports and Management Ports

Table 3-561 Description of the auxiliary ports and management ports

Port	Description	Connector Type
F1/S1	Synchronous/Asynchronous data port	RJ45
ALMI	Alarm input port	
ALMO	Alarm output port	
PHONE	Orderwire phone port	

The auxiliary ports and management ports use RJ45 connectors. The pin assignments for the ports, however, are different. **Figure 3-163** shows the front view of an RJ45 connector.

Figure 3-163 Front view of an RJ45 connector

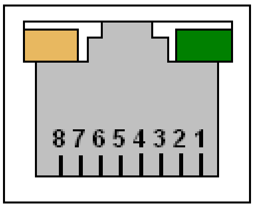


Table 3-562 provides the pin assignments for the F1/S1 port.

Table 3-562 Pin assignments for the F1/S1 port

Port	Pin	Signal
F1/S1	1	Transmitting asynchronous data signals
	2	Grounding end
	3	Receiving asynchronous data signals
	4	Transmitting synchronous data signals (TIP)
	5	Transmitting synchronous data signals (RING)

Port	Pin	Signal
	6	Grounding end
	7	Receiving synchronous data signals (TIP)
	8	Receiving synchronous data signals (RING)

For the pin assignments for the ALMI and ALMO ports, see **Table 3-563** and see **Table 3-564**.

Table 3-563 Pin assignments for the ALMI port

Port	Pin	Signal
ALMI	1	The first external alarm input signal
	2	Grounding end for the first external alarm input signal
	3	The second external alarm input signal
	4	The third external alarm input signal
	5	Grounding end for the third external alarm input signal
	6	Grounding end for the second external alarm input signal
	7	The fourth external alarm input signal
	8	Grounding end for the fourth external alarm input signal

Table 3-564 Pin assignments for the ALMO port

Port	Pin	Signal
ALMO	1	The first external alarm output signal (+)
	2	The first external alarm output signal (-)
	3	The second external alarm output signal (+)
	4	Connected in parallel with pin 1
	5	Connected in parallel with pin 2
	6	The second external alarm output signal (-)
	7	Connected in parallel with pin 3
	8	Connected in parallel with pin 6

External alarms are also called housekeeping alarms or relay alarms. OptiX RTN 950A provides external alarms.

Figure 3-164 shows an interface circuit for external alarm input. When the relay of the external system is switched off, the IDU interface circuit detects a high-level signal. When the relay of the external system is switched on, the IDU interface circuit detects a low-level signal. The board generates corresponding alarms based on the level signals detected by the IDU interface circuit. External alarm input mainly achieves access of the relay alarms generated by the environmental alarm generator.

Figure 3-164 Interface circuit for external alarm input

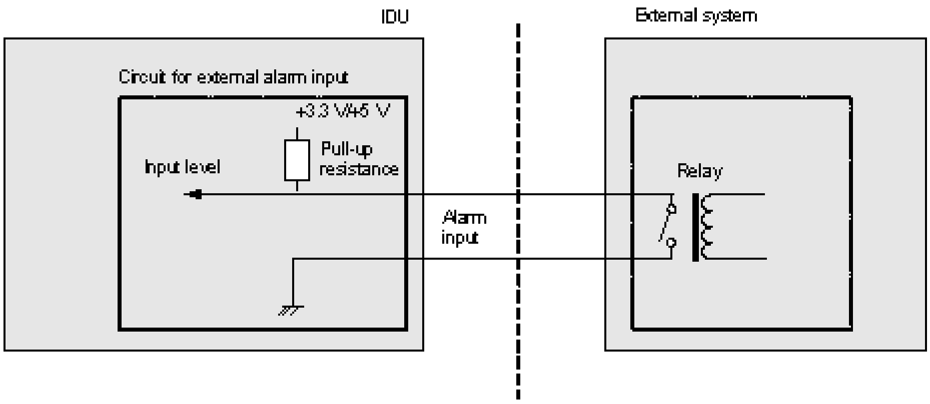
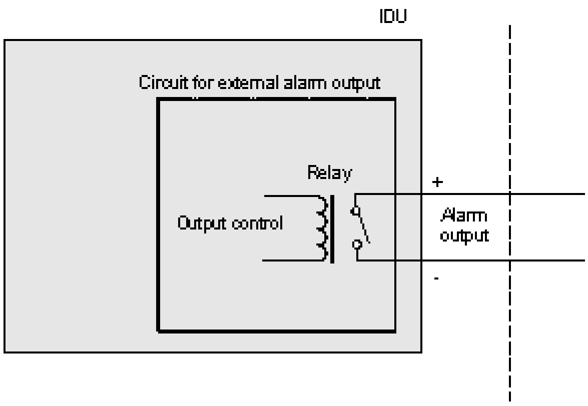


Figure 3-165 shows an interface circuit for external alarm output. When the external alarm output conditions are met, the equipment switches on or off the relay depending on the conditions that result in the alarm. External alarm output helps to provide equipment alarms to the centralized alarming device.

Figure 3-165 Interface circuit for external alarm output



3.23.5 Valid Slots

The AUX can be inserted in Slots 1-6, which have consistent logical slot numbers on the NMS.

NOTE

One NE can house only one AUX.

Figure 3-166 Physical slots for the AUX in the IDU chassis

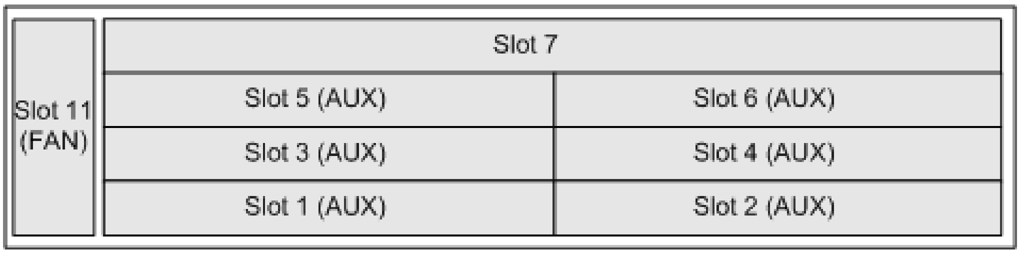


Figure 3-167 Logical slots of the AUX on the NMS

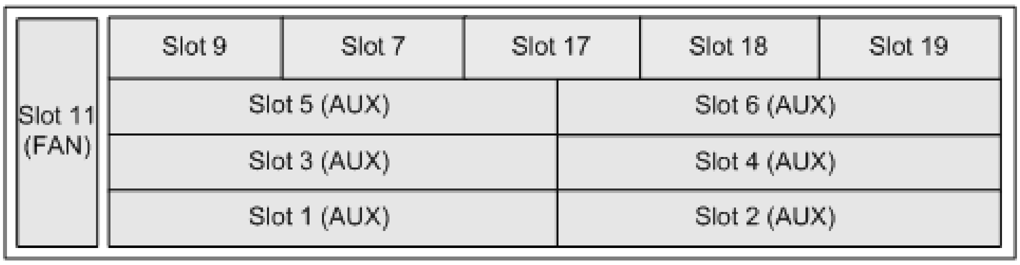


Table 3-565 Slot allocation

Item	Description
Slot allocation priority	Slots 4 and 6 > Slots 1 and 2 > Slots 3 and 5

3.23.6 Technical Specifications

This section describes the board specifications, including auxiliary port performance, board mechanical behavior, and board power consumption.

Orderwire Interface Performance

Table 3-566 Orderwire interface performance

Item	Performance
Transmission path	Uses the E1 and E2 bytes in the SDH overhead or the Huawei-defined byte in the overhead of the microwave frame.
Orderwire type	Addressing call

Item	Performance
Wire pair in each transmission direction	One symmetrical wire pair
Impedance (ohm)	600

Synchronous Data Interface Performance

Table 3-567 Synchronous data interface performance

Item	Performance
Transmission path	Uses the F1 byte in the SDH overhead or the Huawei-defined byte in the overhead of the microwave frame.
Nominal bit rate (kbit/s)	64
Interface type	Codirectional
Interface characteristics	Meets the ITU-T G.703 standard.

Asynchronous Data Interface

Table 3-568 Asynchronous data interface performance

Item	Performance
Transmission path	Uses the Huawei-defined byte in the overhead of the microwave frame.
Nominal bit rate (kbit/s)	≤ 19.2
Interface characteristics	Meets the RS-232 standard.

Mechanical Behavior and Power Consumption

Table 3-569 Mechanical behavior and power consumption

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.27 kg
Power consumption	< 1.3 W

3.24 FAN

The FAN is a fan board that dissipates heat generated in the chassis through air cooling.

3.24.1 Version Description

The functional version of the FAN is SLF1.

3.24.2 Functions and Features

The FAN board adjusts the fan rotating speed, and detects and reports the fan status.

Table 3-570 lists the functions and features that the FAN supports.

Table 3-570 Functions and features

Function and Feature	Description
Power input	Accesses three - 42 V power inputs from the system control, switching, and timing board. One power input provides power supply to one fan.
Number of fans	3
Intelligent fan speed adjustment	Supports two-step speed adjustments by voltage.
Protection	Provides soft-start for the power supply of the fans and protects fans against overcurrent.
O&M	● Reports the information about alarms, version number, and board in-position status. ● Provides alarm indicators.

NOTE

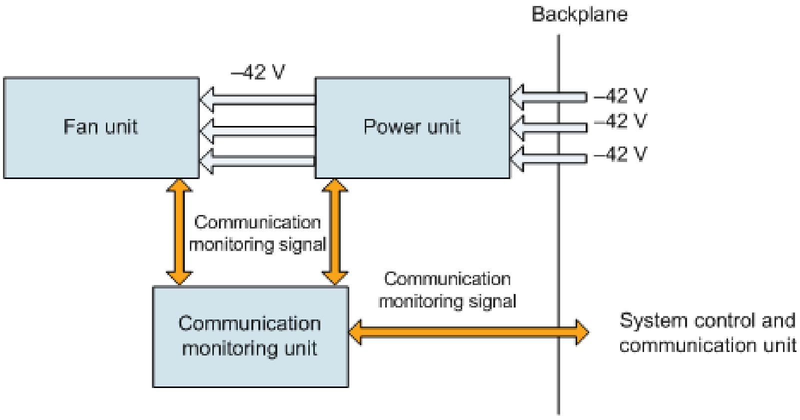
- When one fan fails, it is recommended that you replace it within 96 hours if the ambient temperature reaches 40°C; it is recommended that you replace it within 24 hours if the ambient temperature exceeds 40°C.
- When more than one fan fails, it is recommended that you replace the failed fans immediately.

3.24.3 Working Principle

The FAN consists of the fan unit, power unit, and communication monitoring unit.

shows the functional block diagram of the FAN.

Figure 3-168 Functional block diagram of the FAN



Power Unit

- Receives three -42 V power inputs from the backplane.
- Supports soft-start of the fan unit.

Fan Unit

Three air-cooling fans dissipate the heat generated by the system.

Communication Monitoring Unit

Detects the manufacturing information, PCB version information, and rotating status of the FAN, and reports the information to the system control and communication unit.

Speed Adjustment Mechanism

The system control and communication unit detects the environmental temperature and regulates the input voltage accordingly. The system adjusts the fan rotating speed based on the input voltage, as listed **Table 3-571**.

Table 3-571 Adjustment of the fan rotating speed

Working Temperature	Rotating Speed
≤ 40°C	Low speed
≥ 40°C	Normal speed

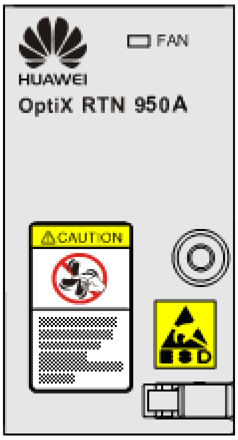
3.24.4 Front Panel

There are indicators, an ESD wrist strap jack, and labels on the front panel.

Front Panel Diagram

Figure 3-169 shows the appearance of the front panel of the FAN.

Figure 3-169 Front panel of the FAN



Indicators

Table 3-572 Status explanation for indicators on the FAN

Indicator	State	Meaning
FAN	On (green)	The fan is working properly.
	On (red)	The fan is faulty.
	Off	The fan is not powered on or is not installed.

ESD Wrist Strap Jack

An ESD wrist strap needs to be connected to the ESD wrist strap jack to achieve the proper grounding of the human body.

Labels

The front panel of the FAN has the following labels:

- ESD protection label: indicates that the equipment is static-sensitive.
- Fan warning label: warns you not to touch fan leaves when a fan is rotating.

3.24.5 Valid Slots

The FAN can be inserted in Slot 11 in the IDU chassis, which has a consistent logical slot number on the NMS.

Figure 3-170 Slot for the FAN in the IDU chassis

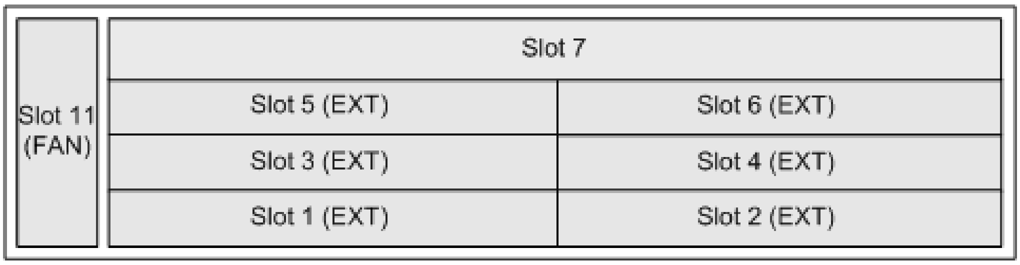
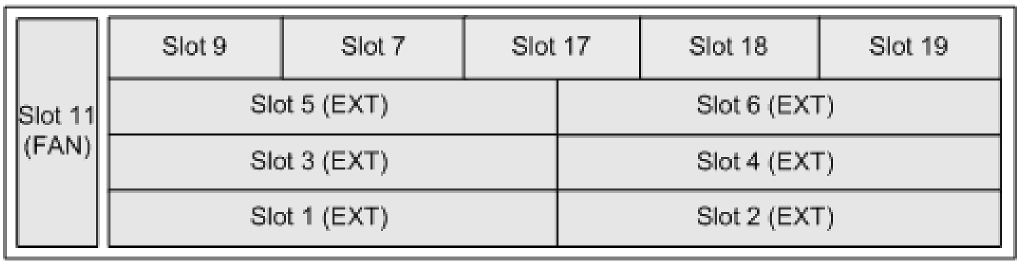


Figure 3-171 Logical slot of the FAN on the NMS



3.24.6 Technical Specifications

This section describes the board specifications, including board mechanical behavior and board power consumption.

Table 3-573 Technical specifications for the FAN

Item	Performance
Dimensions (H x W x D)	89.1 mm × 51.1 mm × 238.58 mm
Weight	● 0.5 kg
Power consumption	● < 9 W (low voltage) ● < 12 W (high voltage)

<table>
<tr><th>Item</th><th>Performance</th></tr>
<tr><td>Life span</td><td>The average life span of a fan tray assembly varies depending on the actual environment. Environments can be classified as follows:
Class A environment: refers to the indoor environment where the ambient temperature and humidity are controlled (including inhabited rooms).
Class B environment: refers to the indoor environment where the ambient temperature and humidity are not controlled or the common outdoor environment where only simple shelter (such as awning) is available and the humidity occasionally reaches 100%.
Class C environment: refers to the marine environment or outdoor land environment near pollution sources and with only simple shelters (such as awning).
The average life spans of fan tray assemblies in different environments are as follows:
Class A environment: 6.5 years
Class B environment: 5 years
Class C environment: 2 years
NOTE
The previous life spans are the average values concluded based on the test data in a lab and the theoretical model, rather than the actual values. They are for reference only. The actual life span must be determined based on the environment conditions of a specific area. In addition, the previous life spans do not indicate that a fan tray assembly becomes unavailable immediately at the end of its life span. They are used to prompt users to replace the fan tray assembly in time.
It is not recommended that IDUs be used in the class C environment.</td></tr>
</table>

3.25 TCU6

The TDM connecting unit (TCU6) is a 6xE1 port conversion board. The TCU6 implements conversion between DB44 ports and RJ45 ports.

3.25.1 Version Description

The functional version of the TCU6 is SL91.

3.25.2 Functions and Features

The TCU6 implements 6xE1 service connection between DB44 ports and RJ45 ports. It usually works with the SP3S (120 ohms). It can also implement connection between Anea 96 ports and RJ45 ports by using another Anea96-DB44 terminated E1 cable.

Table 3-574 lists the functions and features that the TCU6 supports.

Table 3-574 Functions and features

Function and Feature		Description
Basic functions		When connected to an E1 cable terminated with an Anea 96 connector at one end and a DB44 connector at the other end, the TCU6 provides connection between an Anea 96 port and an RJ45 port.
Port specifications	RJ45 port	6
	DB44 port	1 (for receiving/transmitting 6xE1 signals)
Board information query on the NMS		Not supported

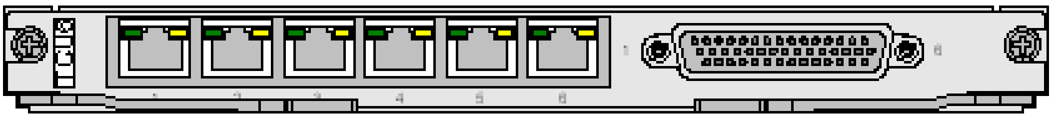
NOTE

The TCU6 is a passive port-convertor board without any software interfaces and ports for connecting to the backplane.

3.25.3 Front Panel

There are six RJ45 ports and one DB44 port on the front panel.

Front Panel Diagram



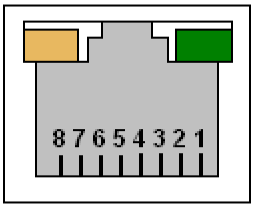
Ports

Table 3-575 Description of the ports on the TCU6

Port	Description	Connector Type	Corresponding Cable
1-6 (RJ45)	The first to sixth E1 RJ45 ports	RJ45	-
1-6 (DB44)	The first to sixth E1 DB44 ports	DB44	**5.8.3 E1 Transit Cable Terminated with an Anea 96 Connector and a DB44 Connector**

Figure 3-172 shows the front view of an RJ45 connector.

Figure 3-172 Front view of an RJ45 connector



NOTE

The two indicators on an RJ45 connector do not indicate port status and are steady off.

Each RJ45 port transmits 1xE1 signals. **Table 3-576** provides the pin assignments for an RJ45 port.

Table 3-576 Pin assignments for an RJ45 port

Port	Pin	Signal
n (n = 1-6)	1	The nth transmitted E1 differential signal (+)
	2	The nth transmitted E1 differential signal (-)
	3	Reserved
	4	The nth received E1 differential signal (+)
	5	The nth received E1 differential signal (-)
	6	Reserved
	7	Reserved
	8	Reserved

Figure 3-173 shows the front view of a DB44 connector.

Figure 3-173 Pin assignments for a DB44 port

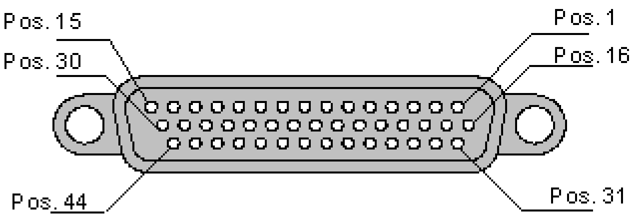


Table 3-577 Pin assignments for a DB44 port

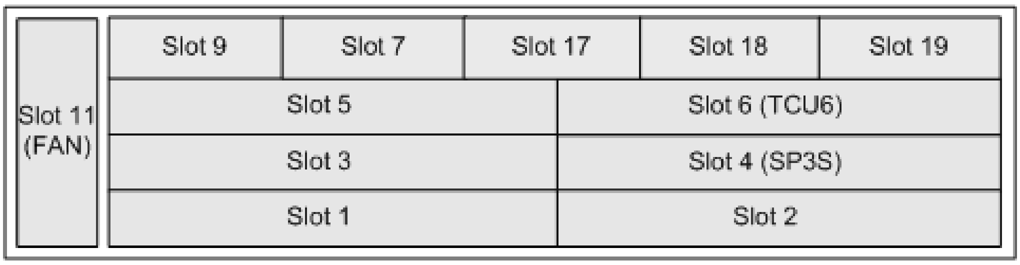
Pin	Signal	Pin	Signal
15	The first received E1 differential signal (-)	38	The first transmitted E1 differential signal (-)
30	The first received E1 differential signal (+)	23	The first transmitted E1 differential signal (+)
14	The second received E1 differential signal (-)	37	The second transmitted E1 differential signal (-)
29	The second received E1 differential signal (+)	22	The second transmitted E1 differential signal (+)
13	The third received E1 differential signal (-)	36	The third transmitted E1 differential signal (-)
28	The third received E1 differential signal (+)	21	The third transmitted E1 differential signal (+)
12	The fourth received E1 differential signal (-)	35	The fourth transmitted E1 differential signal (-)
27	The fourth received E1 differential signal (+)	20	The four transmitted E1 differential signal (+)
11	The fifth received E1 differential signal (-)	34	The fifth transmitted E1 differential signal (-)
26	The fifth received E1 differential signal (+)	19	The fifth transmitted E1 differential signal (+)
10	The sixth received E1 differential signal (-)	33	The sixth transmitted E1 differential signal (-)
25	The sixth received E1 differential signal (+)	18	The sixth transmitted E1 differential signal (+)
1-6 and 39-44	Grounding	Others	Not defined

3.25.4 Valid Slots

The TCU6 can be inserted in Slots 4 and 6 in the IDU chassis, which has a consistent logical slot number on the NMS.

The TCU6 usually works with the SP3S. The TCU6 is inserted in Slot 6 and the SP3S is inserted in Slot 4.

Figure 3-174 Physical slots for the TCU6 in the IDU chassis



Alternatively, the TCU6 can be housed in Slot 4 and the SP3S can be housed in Slot 6.

3.25.5 Technical Specifications

This section describes the board specifications, including only the mechanical behavior.

Mechanical Behavior

Table 3-578 Mechanical behavior

Item	Performance
Dimensions (H x W x D)	19.82 mm x 193.80 mm x 225.80 mm
Weight	0.27 kg

4 Accessories

The accessories of the OptiX RTN 950A include the E1 panel, USB Flash Drives, and the power distribution unit (PDU). Select appropriate accessories based on the requirements.

When an IDU is installed in a 19-inch cabinet, install an E1 panel in the cabinet and this E1 panel functions as a DDF for the IDU.

An SSC6PDU is installed on the top of a 19-inch cabinet to distribute the input power supply to devices in the cabinet.

The DPD80-2-8 power distribution unit (PDU) is a new type of PDU that can be installed on the top of a 19-inch cabinet or an ETSI cabinet and distributes power to devices in the cabinet.

The external power box ETP4830-A1 can be used for AC power supply if an IDU is installed indoors.

Configuring and replacing OptiX RTN 950As is simple with USB flash drives, which store NE data and used to back up configuration data.

By inserting the AE 905S to OptiX RTN 950A, the Atom GPS timing system can be formed. The Atom GPS system is used to receive satellite signals from the GPS antenna, with the frequency of output GPS signals as 1pps.

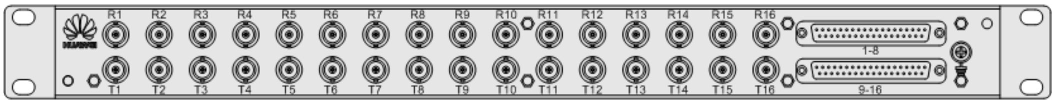
4.1 E1 Panel

When an IDU is installed in a 19-inch cabinet, install an E1 panel in the cabinet and this E1 panel functions as a DDF for the IDU.

The dimensions (H x W x D) of the E1 panel are 42 mm x 483 mm x 33 mm. An E1 panel provides cable distribution for 16 E1s.

Front Panel Diagram

Figure 4-1 Front panel of an E1 panel



Ports

Table 4-1 Port description of an E1 panel

Port	Description	Connector Type
T1-T16	Transmit ports for the first to sixteenth E1 ports (connected to external equipment)	BNC
R1-R16	Receive ports for the first to sixteenth E1 ports (connected to external equipment)	
1-8	The first to eighth E1 ports (connected to an IDU)	DB37
9-16	The ninth to sixteenth E1 ports (connected to an IDU)	
Grounding bolt	Connecting a PGND cable	-

NOTE

The port impedance of each E1 port on an E1 panel is 75 ohms.

Figure 4-2 shows the front view of an E1 port that is connected to an IDU. **Table 4-2** provides the pin assignments for the E1 port.

Figure 4-2 Front view of an E1 port (E1 panel)

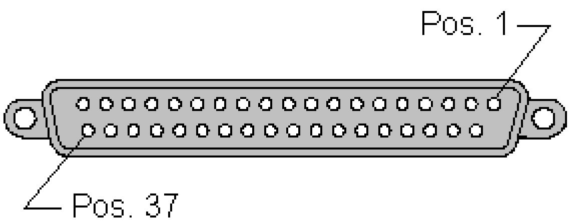


Table 4-2 Pin assignments for an E1 port (E1 panel)

Pin	Signal	Pin	Signal
20	The first E1 received differential signal (+)	21	The first E1 transmitted differential signal (+)
2	The first E1 received differential signal (-)	3	The first E1 transmitted differential signal (-)
22	The second E1 received differential signal (+)	23	The second E1 transmitted differential signal (+)
4	The second E1 received differential signal (-)	5	The second E1 transmitted differential signal (-)
24	The third E1 received differential signal (+)	25	The third E1 transmitted differential signal (+)
6	The third E1 received differential signal (-)	7	The third E1 transmitted differential signal (-)
26	The fourth E1 received differential signal (+)	27	The fourth E1 transmitted differential signal (+)
8	The fourth E1 received differential signal (-)	9	The fourth E1 transmitted differential signal (-)
36	The fifth E1 received differential signal (+)	35	The fifth E1 transmitted differential signal (+)
17	The fifth E1 received differential signal (-)	16	The fifth E1 transmitted differential signal (-)
34	The sixth E1 received differential signal (+)	33	The sixth E1 transmitted differential signal (+)
15	The sixth E1 received differential signal (-)	14	The sixth E1 transmitted differential signal (-)
32	The seventh E1 received differential signal (+)	31	The seventh E1 transmitted differential signal (+)
13	The seventh E1 received differential signal (-)	12	The seventh E1 transmitted differential signal (-)
30	The eighth E1 received differential signal (+)	29	The eighth E1 transmitted differential signal (+)
11	The eighth E1 received differential signal (-)	10	The eighth E1 transmitted differential signal (-)
Others	Reserved	-	-

4.2 SSC6PDU

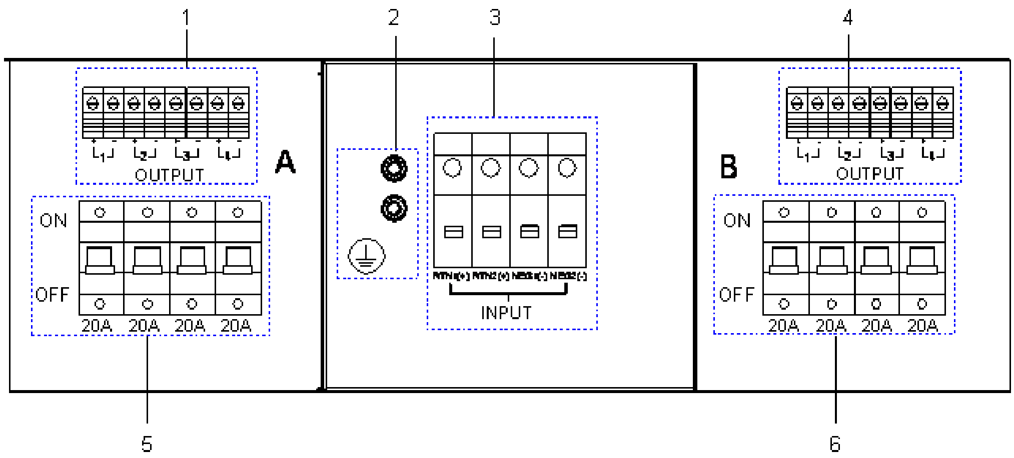
An SSC6PDU is installed on the top of a 19-inch cabinet to distribute the input power supply to devices in the cabinet.

4.2.1 Front Panel

There are power input terminals, PGND terminals, power output terminals, and power switches on the front panel of an SSC6PDU.

Front Panel Diagram

Figure 4-3 Front panel of an SSC6PDU



1. Power output terminals (Side A)
2. PGND terminals
3. Power input terminals
4. Power output terminals (Side B)
5. Power switches (Side A)
6. Power switches (Side B)

Ports

Table 4-3 Ports on the PDU

Position	Port	Description
Power output terminals (Side A)	+	Power output (+)
	-	Power output (-)
PGND terminals	⏚	Wiring terminal for a two-hole OT terminal,For connecting PGND cables
Power input terminals	RTN1(+)	First power input (+)
	RTN2(+)	Second power input (+)

Position	Port	Description
	NEG1(-)	First power input (-)
	NEG2(-)	Second power input (-)
Power output terminals (Side B)	+	Power output (+)
	-	Power output (-)
Power switches (Side A)	20 A	Switches for power outputs The fuse capacity is 20 A. The switches from the left to the right correspond to power output terminals 1 to 4 on Side A.
Power switches (Side B)	20 A	Switches for power outputs The fuse capacity is 20 A. The switches from the left to the right correspond to power output terminals 1 to 4 on Side B.

4.2.2 Functions and Working Principles

An SCC6PDU provides simple power distribution, feeding power to devices in the cabinet on top of which it is installed.

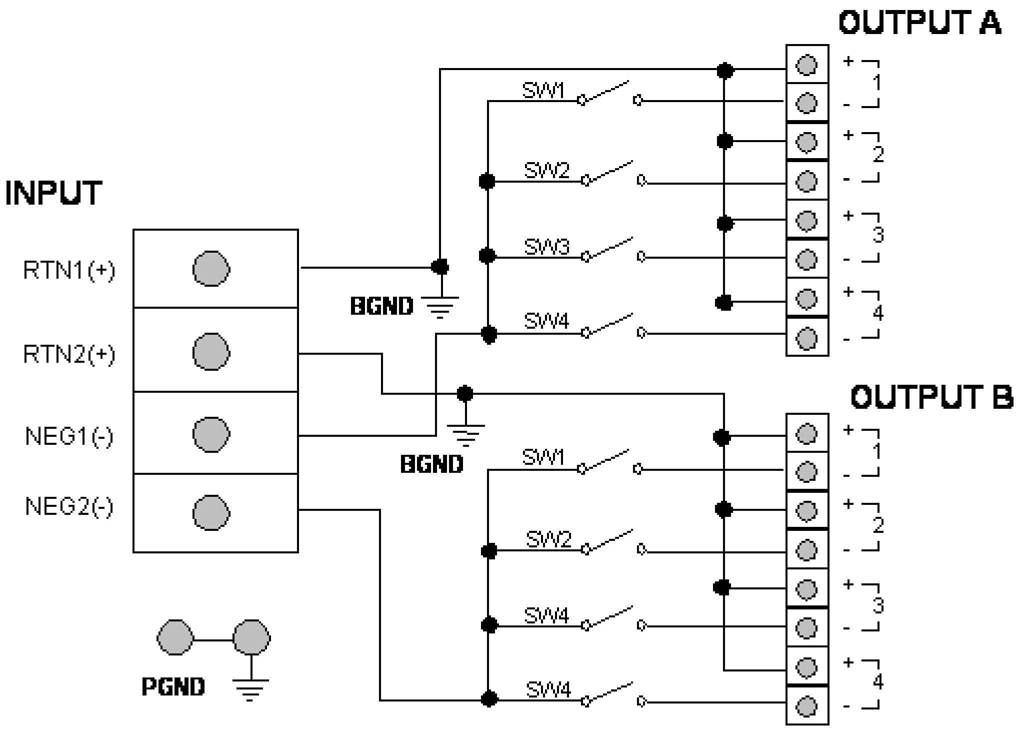
Functions

- Supports two -48 V/-60 V DC power inputs.
- Allows each power input to provide four power outputs.
- Supports a 20 A fuse capacity for each power output switch.
- Supports DC-C and DC-I power distribution.

Working Principle

An SSC6PDU consists of input terminals, output terminals, and circuit breakers and it performs simple distribution operations for the input power.

Figure 4-4 Functional block diagram of the SSC6PDU



4.2.3 Power Distribution Mode

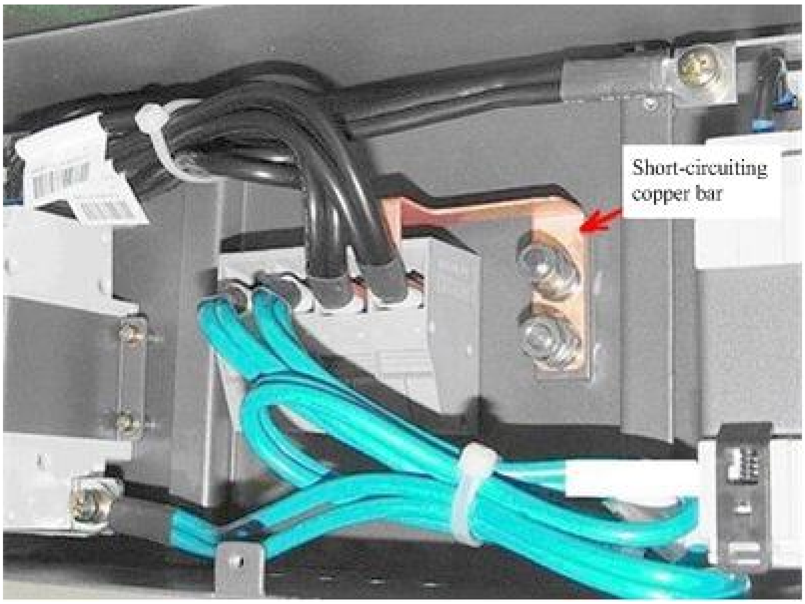
An SSC6PDU supports DC-C and DC-I power distribution. The DC-C power distribution is the default mode.

A short-circuit copper bar inside an SSC6PDU controls the power distribution mode of the SSC6PDU.

DC-C Power Distribution Mode

To use DC-C power distribution, use the short-circuit copper bar to short-circuit terminal RTN1(+), terminal RTN2(+), and PGND terminals.

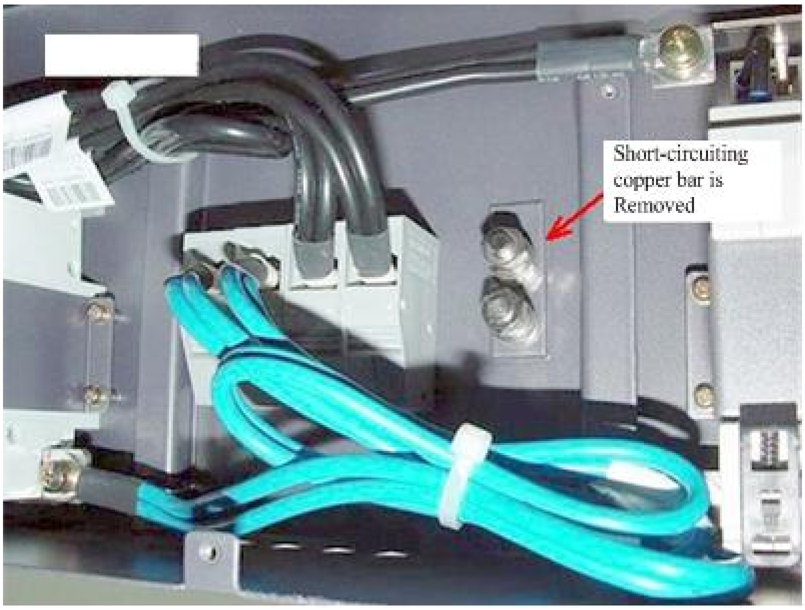
Figure 4-5 Interior of an SSC6PDU in DC-C mode



DC-I Power Distribution Mode

To use DC-I power distribution, remove the short-circuit copper bar.

Figure 4-6 Interior of an SSC6PDU in DC-I mode



4.3 DPD80-2-8 PDU

The DPD80-2-8 power distribution unit (PDU) is a new type of PDU that can be installed on the top of a 19-inch cabinet or an ETSI cabinet and distributes power to devices in the cabinet.

4.3.1 Front Panel and Internal Structure

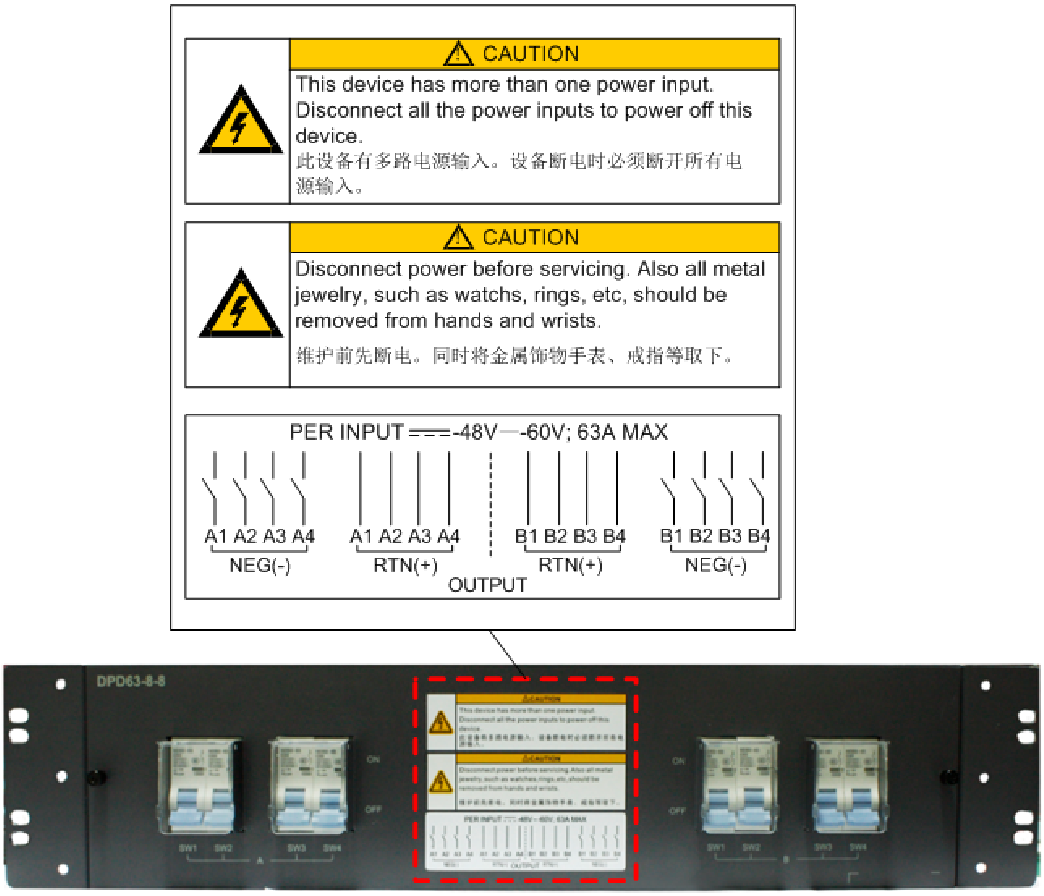
The DPD80-2-8 PDU has two areas (Area A and Area B; each providing four power switches) on its front panel and all cable ports inside it.

Front Panel

Figure 4-7 shows a universal PDU (DPD63-8-8 PDU). Different types of short-circuiting copper bars are used to match different types of power current supplied by the power supply equipment in the equipment room. The DPD80-2-8 PDU is a 2-input and 8-output PDU developed based on the DPD63-8-8 PDU.

On the front panel, Area A and Area B each receives one -48 V/-60 V power input and provides four power outputs to subracks inside the cabinet.

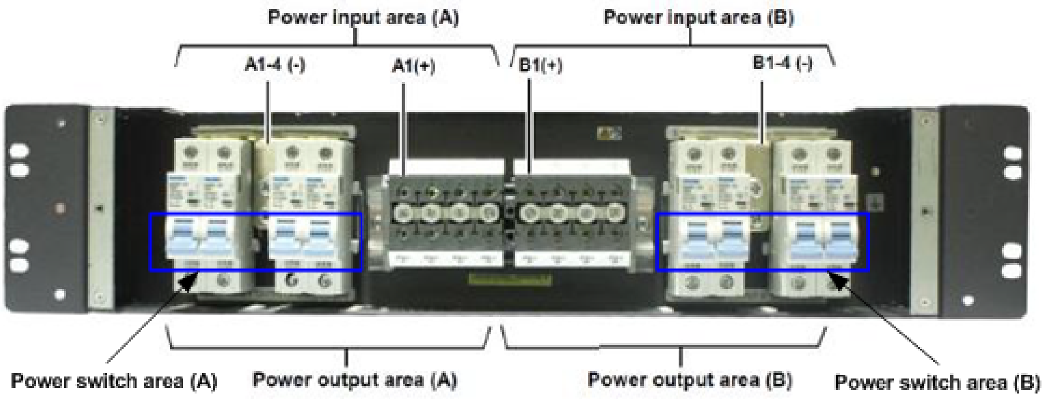
Figure 4-7 Front panel of a DPD80-2-8 PDU



Internal Structure

Figure 4-8 shows the internal structure of a DPD80-2-8 PDU. The power input and output ports are inside the PDU. Input and output power cables are connected to these ports.

Figure 4-8 Internal structure of the DPD80-2-8 PDU



- Power output area: On either side of the DC PDU, there are four output terminal blocks that are used to connect the power cables of subracks.
- Power input area: INPUT A and INPUT B are each connected to one -48 V DC power cable and one power ground cable, that is, two -48 V DC power cables and two power ground cables in total.
- Power switch area: On both sides of the DC PDU, there are respectively four power output switches controlling the corresponding power output terminals. The power output switches control power supply to the corresponding subracks.

4.3.2 Functions and Working Principles

A DPD80-2-8 PDU provides simple distribution functions, feeding power to devices in a cabinet.

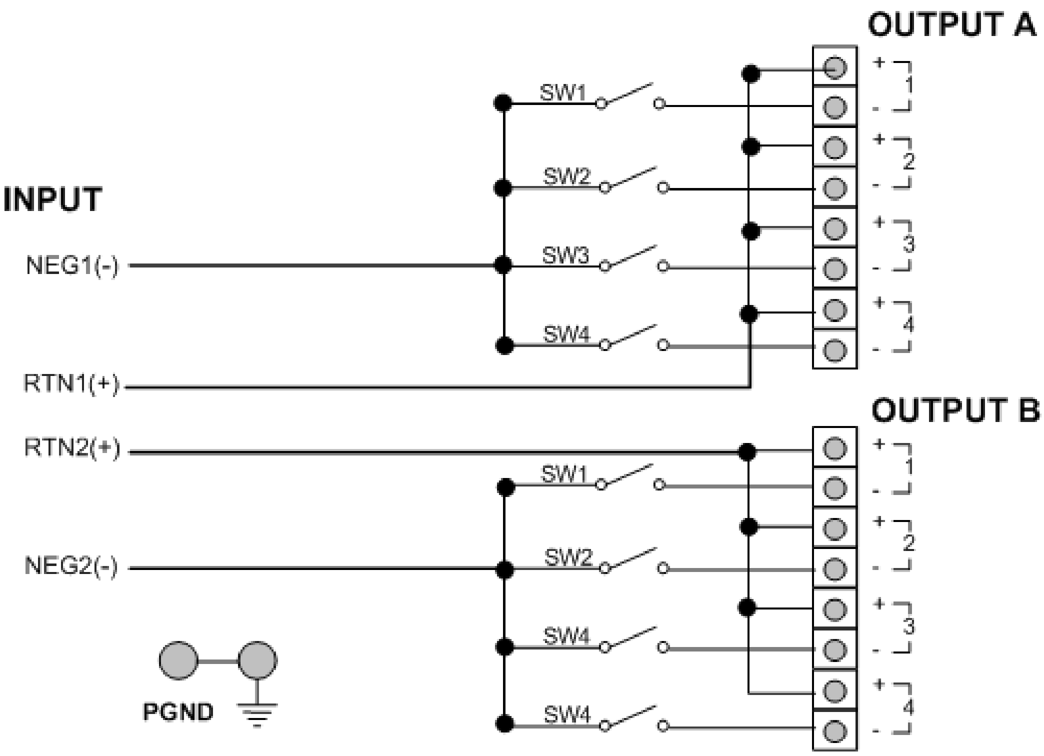
Functions

- Supports two -48 V/-60 V DC power inputs.
- Allows each power input to provide four outputs.
- Supports a 20 A fuse capacity for each power output switch.

Working Principles

The DPD80-2-8 PDU consists of input terminals, output terminals, and circuit breakers. It simply distributes the input power.

Figure 4-9 Functional block diagram of the DPD80-2-8 PDU



4.3.3 Power Distribution Mode

The DPD80-2-8 PDU supports the DC-I power distribution mode.

4.4 AC Power Box

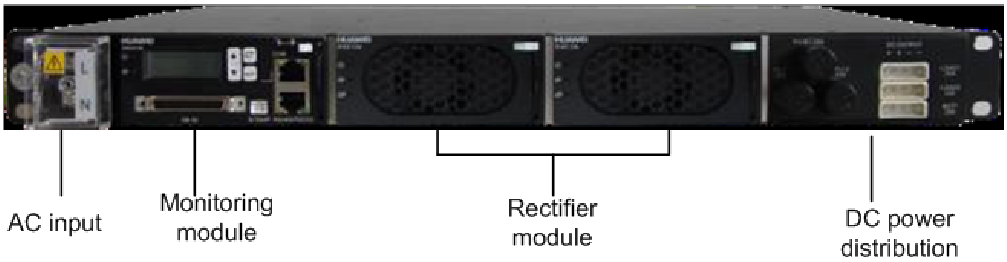
The external power box ETP4830-A1 can be used for AC power supply if an IDU is installed indoors.

4.4.1 Front Panel

An AC power box has power ports, communication ports, indicators, and switches on its front panel.

Front Panel Diagram

Figure 4-10 Front panel of an AC power box



AC/DC Power Distribution Subrack

An AC/DC power distribution subrack has ports and switches for AC power inputs and DC power distribution.

Table 4-4 Ports on an AC/DC power distribution subrack

Location	Mark	Description
AC power input	L	Live wire terminal
	N	Neutral wire terminal
DC distribution	LOAD1-LOAD2	Two 20 A load ports
	BATT	One 20 A battery port
	FU-1 20A and FU-2 20A	20 A load port fuses
	FU-BT 20A	20 A battery port fuse

Rectifier Module

A rectifier module has a power indicator, an alarm indicator, and a fault indicator.

Figure 4-11 Front panel of a rectifier module

Table 4-5 Indicators on a rectifier module

Mark	Indicator Name	Description
	Power indicator	Indicates the power input and running status of a rectifier module.
	Alarm indicator	Indicates the alarm status of a rectifier module.
	Fault indicator	Indicates whether a fault occurs on a rectifier module.

NOTE

For details, see ETP4830-A1 User Manual.

Monitoring Module

A monitoring module has indicators, a liquid crystal display (LCD), buttons, and communication and monitoring ports on its front panel.

Figure 4-12 Front panel of a monitoring module

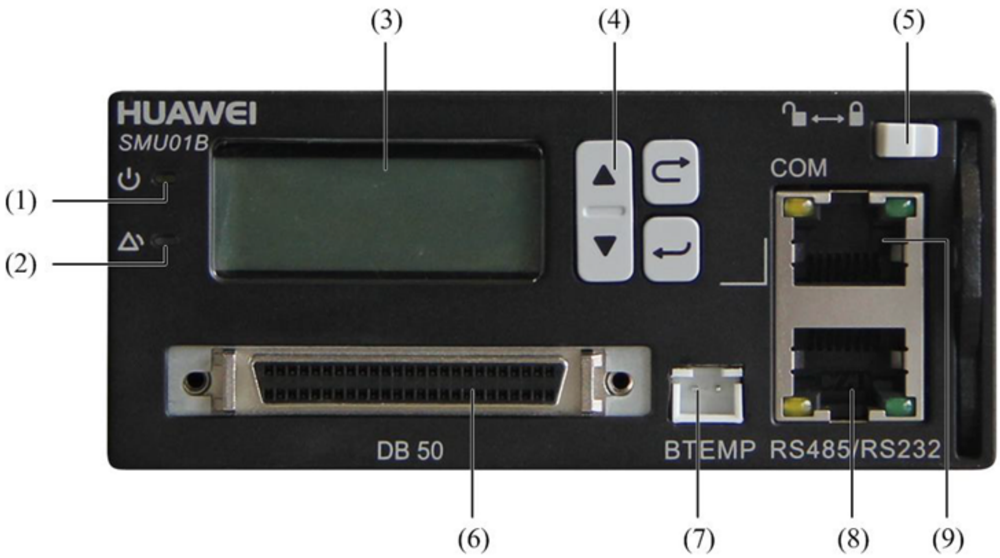


Table 4-6 Front panel of a monitoring module

No.	Name	Description
1	Running status indicator	Indicates the running status of a monitoring module.
2	Alarm indicator	Indicates the alarm status of a monitoring module.
3	LCD	Displays system running information and menu options.
4	Button	Operates menus displayed on the LCD.
5	Locking switch	Locks or unlocks a monitoring module.
6	DB50 port	(Reserved)
7	Battery temperature sensor port	Connects to a battery temperature sensor.
8	RS485/RS232 port	(Reserved)
9	COM port	(Reserved)

NOTE

For details, see ETP4830-A1 User Manual.

4.4.2 Functions and Features

The AC power box converts single-phase 220 V AC power to -48 V DC power required by the OptiX RTN 950A. It can work with a storage battery to provide the DC power supply backup.

Table 4-7 lists the functions and features that the AC power box supports.

Table 4-7 Functions and features

Function and Feature		Description
Basic function		Converts 220 V AC power input to -48 V DC power output.
Power system configuration	AC power distribution	Supports 85 V to 300 V AC input voltages
	Rectifier module	● Supports a maximum of two rectifier modules. ● Supports the 15 A rectifier module type.
	DC power distribution	Provides -42 V DC to -58 V DC power outputs, with -53.5 V DC by default.

Function and Feature		Description
	Power monitoring unit (PMU)	A PMU is a requisite when a storage battery is configured. ● Regulates rectifier module voltages and currents. ● Powers on or off the rectifier module. ● Manages batteries. ● Monitors battery status when being configured with a temperature sensor.
	Storage battery	Provides a valve regulated lead-acid battery (48 V/40 Ah/12 V-cell batteries).
Installation and maintenance		● Supports horizontal and vertical installation in a 19-inch cabinet (default configuration). ● Allows users to perform operations and maintenance using the front panel. ● Supports simple operations on the LCD. ● Provides the hot-swappable rectifier module and monitoring module.

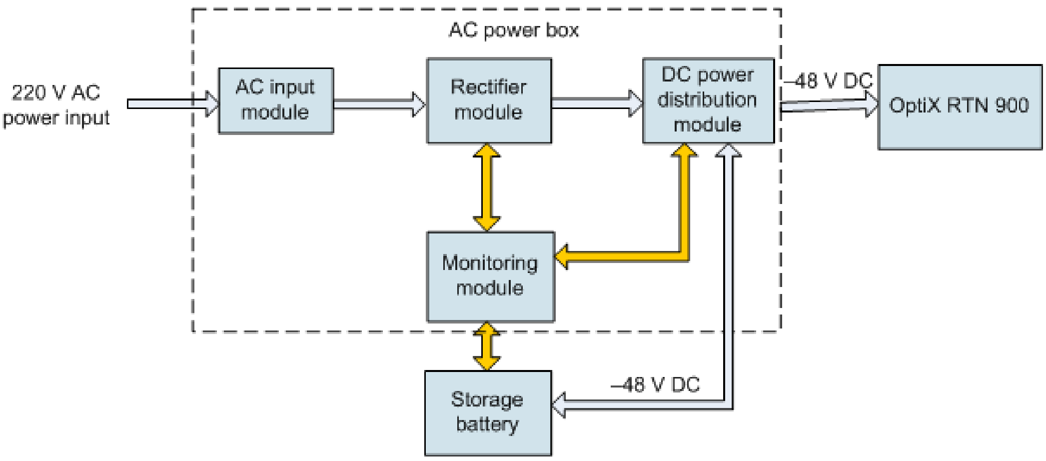
4.4.3 Working Principle

This section describes how the AC power box works with the storage battery to supply power to equipment.

System Architecture

The AC power box consists of an AC input module, a rectifier module, a DC distribution module, and a monitoring module. The storage battery provides the backup power supply.

Figure 4-13 Function block diagram of the AC power box



Working Principle

When receiving a 220 V AC power input, the rectifier module converts the 220 V AC power into -48 V DC power and provides two -48 V DC power outputs to the OptiX RTN 950A and one -48 V DC power output to the storage battery.

When the 220 V AC power input is interrupted, the storage battery discharges to ensure the two -48 V DC power outputs to the OptiX RTN 950A. The monitoring module detects alarms about AC power input interruption. When the storage battery voltage decreases to 45 V, the monitoring module reports DC undervoltage alarms. When the storage battery voltage decreases to 43 V, the power supplied by the storage battery is cut off to protect the storage battery. When the 220 V AC power supply is restored, the power system resumes normal operation.

4.4.4 Technical Specifications

This section describes the technical specifications of the AC power box, including electrical specifications and entire system specifications.

Table 4-8 lists the technical specifications of the AC power box.

Table 4-8 Technical specifications

Item		Specifications
AC input	Input mode	Single-phase three-wire (L, N, and PE)Single-phase, dual-live-wire, and three-phase
	Input voltage	85 V AC to 300 V AC, with 220 V AC by default
	Input frequency	45 Hz to 66 Hz, with 50 Hz or 60 Hz by default
	Power factor	≥ 0.99 (100% load)
DC output	Output voltage	-42 V DC to -58 V DC, with -53.5 V DC by default
	Output power	See the output power of the rectifier module. The maximum output power of the system is the product of the rectifier module count and the output power of a single rectifier module.
	Regulated voltage precision	≤ 1.0%
	Peak-to-peak noise voltage	≤ 200 mV (0 MHz to 20 MHz)
Rectifier module type		● R4815N1 (15 A rectifier of normal efficiency) by default

Item	Specifications
Power monitoring module type	SMU01C
Dimensions (H x W x D)	43.6 mm x 442 mm x 255 mm
Weight	< 10 kg (including modules)

4.4.5 Power Cable

An AC power box (ETP 4830) has three types of power cable: AC input power cables, load power cables, and battery power cables.

AC Input Power Cable

An AC input power cable carries AC power from an AC power supply device to an AC power box.

Figure 4-14 AC input power cable diagram

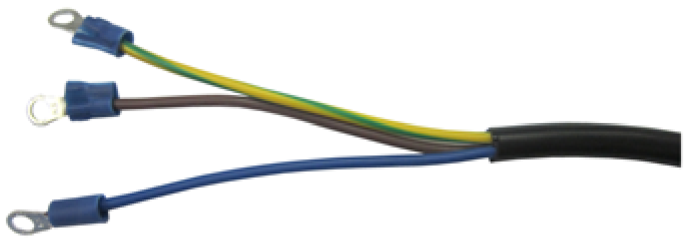


Table 4-9 AC input power cable specifications

Cable	Terminal (AC Power Supply Device)	Terminal (ETP 4830)
Power cable, 300 V/500 V, 60227IEC10 (BVV), 3x2.5 mm^2, black (cores: blue, brown, yellow/green), 27 A, with a package exempted from fumigating	Naked crimping terminal, OT, 2.5 mm^2, M8, tin plating, insulated ring terminal, 16-14 AWG, blue	Naked crimping terminal, OT, 2.5 mm^2, M4, tin plating, insulated ring terminal, 16-14 AWG, blue

Load Power Cable

Load power cables carry DC power from an ETP 4830 to an OptiX RTN 950A.

Figure 4-15 Load power cable diagram

Table 4-10 Load power cable specifications

Model	Cable	Terminal (ETP 4830)	Terminal (OptiX RTN 950A)
Single cable, ESC monitor box -48 V feeder cable, 2.2 m, H4 (5.08), 2x18UL1015BL +2x18UL1015B, 2xT2.0^{2}Y (2x1.0), HONET P3-UA	Power cable, 600 V, UL1015, 0.823 mm^2, 18 AWG, blue +black, 13 A	Ordinary plug - 4PIN - single row / 5.08 mm	Naked crimping terminal, twin cord end terminal, 2 mm^2, insertion depth 8 mm, 23 A, tin plating, yellow, 2x1. 0 mm^2 Termi-blok stacking connector, 2PIN, side screw/side leading wire

Battery Power Cable

A battery power cable connects an AC power box to a storage battery.

Figure 4-16 Battery power cable diagram

Table 4-11 Battery power cable specifications

Model	Cable	Terminal (ETP 4830)	Terminal (Battery)
Single cable, ESC monitor box -48 V feeder cable, 10.0 m, H4 (5.08), 2x18UL1015BL +2x18UL1015B, 2xOT2.5-8	Power cable, 600 V, UL1015, 0.823 mm^2, 18 AWG, blue +black, 13 A	Ordinary plug - 4PIN - single row / 5.08 mm	Naked crimping terminal, OT, 2.5 mm^2, M8, tin plating, insulated ring terminal, 16-14 AWG, blue **NOTE** Replace the terminal with an M6 bare crimp terminal onsite.

Battery Cascade Cable

A battery cascade cable connects four 12 V storage batteries in series to form a 48 V battery group.

Figure 4-17 Battery cascade cable diagram

Table 4-12 Battery cascade cable specifications

Cable	Terminal
Power cable, 600 V, UL3386, 2.5 mm^2, 14 AWG, black, 28.5 A, XLPE	Naked crimping terminal, OT, 2.5 mm^2, M6, tin plating, insulated ring terminal, 16-14 AWG, blue

4.5 USB Flash Drives

Configuring and replacing OptiX RTN 950As is simple with USB flash drives, which store NE data and used to back up configuration data.

Functions and Features

USB flash drives prepared for OptiX RTN 950As store NE software, configuration data (including databases, system parameters, and scripts), and license files.

- Software, patch packages, license files, NE databases, and system parameters are backed up to USB flash drives. This avoids the need to reconfigure data when replacing a OptiX RTN 950A.

Application Scenario

- During OptiX RTN 950A replacement, an empty USB flash drive is inserted into a faulty device, which automatically backs up its data to the drive. After the faulty device is replaced, the drive holding the backup data is inserted into the new device, which automatically downloads the backed up NE data, software, license, and system parameters and restores the NE data.

Data uploading

A USB flash drive contains the following folders:

NOTE

The USB flash drive partition format is FAT32.

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

NOTE

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

- pkg: stores the NE software.

NOTICE

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

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

When a USB flash drive is connected to an OptiX RTN 950A, the OptiX RTN 950A checks the folders on the USB flash drive in the following order:

1. Checks for the **RTN.CER** file in the root directory. If the file exists, the USB flash drive is authenticated. Otherwise, the USB flash drive fails to be identified.
2. Checks the NE software folder **pkg**. If the NE software version is different from that of the local OptiX RTN 950A, the OptiX RTN 950A upgrades its software.
3. Checks the patch software folder **patch**. If the patch software version is different from that of the local OptiX RTN 950A, the OptiX RTN 950A loads the patch software from the folder.
4. Checks the system parameter folder **sysdata**. If the folder contains data, the OptiX RTN 950A imports system parameters from the folder.
5. Checks the script folder **script**. If the folder contains data, the OptiX RTN 950A imports script data from the folder.
6. Checks the database folder **db**. If the folder contains data and the device type under **\Devicetype** is the same as the NE device type, the OptiX RTN 950A loads the database from the folder.
7. Checks the license folder **license**. If the folder contains the license, the OptiX RTN 950A loads the license from the folder.
8. If any of the preceding folders contains no data or does not exist, the OptiX RTN 950A checks the next folder. If the OptiX RTN 950A 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.

The following are working principles of USB flash drives in various scenarios:

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 4-13 lists the types of USB flash drives supported by the OptiX RTN 950A. Not all USB flash drives are supported by the OptiX RTN 950A. If a USB flash drive of another model or capacity is required, confirm with the local Huawei representative office that the USB flash drive is supported by the OptiX RTN 950A. The USB that does not meet the requirement may have the compatibility issue.

Table 4-13 Types of USB flash drives

No.	Manufacturer	Model	Capacity
1	Netac	U208	4 GB

4.6 Atom GPS system

By inserting the AE 905S to OptiX RTN 950A, the Atom GPS timing system can be formed. The Atom GPS system is used to receive satellite signals from the GPS antenna, with the frequency of output GPS signals as 1pps.

AE 905S module

An AE 905S module functions as a lightweight BITS, which provides GPS access for carrier networks. An AE 905S module can receive clock and time signals addressed to the GPS, converts the clock signals into Ethernet signals, and transmits the signals to the local RTN device. In addition, the module converts the time signals into time synchronization signals and transmits them to the RTN device. Then, the signals are synchronized to all base stations on an RTN network using the PTP time of the RTN device, greatly reducing the TCO for clock and time synchronization. **Figure 4-18** shows the appearance of the AE 905S module.

NOTE

Each EG4/EM6 board supports a maximum of one AE 905S module.

Figure 4-18 Appearance of an AE 905S module

An AE 905S module has a STAT indicator that is located at the bottom of the "HUAWEI" logo. **Table 4-14** describes the states of the STAT indicator.

Table 4-14 States of the STAT indicator

Status	Description
On (green)	The AE 905S is working properly.
On (red)	The AE 905S module has a hardware fault or the working temperature exceeds the threshold.
Blinking in green in 1 second	Links over GE interfaces are not established.
Blinking in red in 1 second	The GPS frequency or time is out of lock.
Off	The AE 905S is not running or powered on.

Table 4-15 lists the technical specifications of interfaces on an AE 905S module.

Table 4-15 Technical specifications of interfaces on an AE 905S module

Technical Specification	Value
Interface type	SMA
Encapsulation mode	SFP
Input signal	GPS satellite signals are connected through SMA interfaces.
Output signal	physical-layer clock synchronization and IEEE 1588v2 signals are provided for an ATN device through GE interfaces.

GPS Antenna

NOTE

The appearance and technical specifications of a GPS antenna vary according to vendors.

A GPS antenna is used to receive satellite signals from GPS. **Figure 4-19** shows the appearance of a GPS antenna.

Figure 4-19 Appearance of a GPS antenna

Table 4-16 Technical specifications of a GPS antenna

Technical Specification	Value
Weight	0.4 kg
Working temperature	-40ºC to +80ºC
Frequency range	1575.42±1.023 (MHz)
Gain	38dBi

GPS Surge Protector

NOTE

The appearance and technical specifications of a GPS surge protector vary according to vendors.

A GPS surge protector is used to protect devices from overcurrent or overvoltage due to inducting lightning strokes introduced by feeders. **Figure 4-20** shows the appearance of a GPS surge protector.

Figure 4-20 GPS surge protector

Table 4-17 Technical specifications of a GPS surge protector

Technical Specification	Value
Working temperature	-50ºC to +85ºC
Lightning current	20 KA
Protection voltage	20 V
Frequency range	1200 MHz to 2500 MHz
Connector type	N-F/N-M

GPS Antenna Feeder

A GPS antenna feeder is connected to a GPS antenna system to transmit GPS signals. **Figure 4-21** shows the appearance of a GPS antenna feeder.

Figure 4-21 GPS antenna feeder

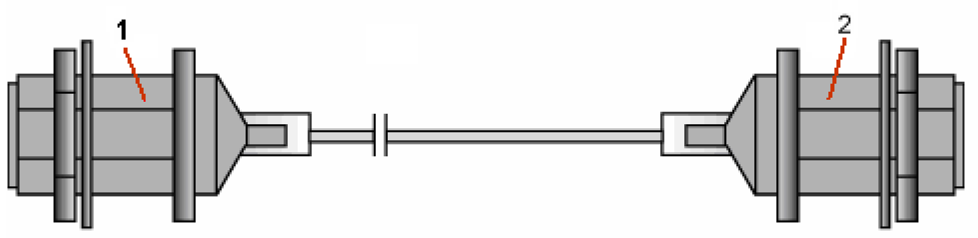


Table 4-18 Technical specifications of a GPS antenna feeder

Technical Specification	Value
Working temperature	-40ºC to +70ºC
Characteristic impedance	50 ohm

5 Cables

This chapter describes the purpose, appearance, and pin assignments of various cables used on the IDU 950A.

A power cable connects the PIU board in the IDU to a power supply device (for example, a PDU on top of the cabinet) for access of the -48 V power to the IDU.

PGND cables are available in two categories: IDU PGND cables and E1 panel PGND cables.

The IF cable connects the ODU and IDU. The IF cable is used to transport the IF signal, O&M signal, and -48 V power between the ODU and the IDU.

An IF jumper connects the IDU to an IF cable. The IF jumper works with the IF cable to transmit IF signals and O&M signals in addition to supplying -48 V power between the ODU and the IDU.

An XPIC cable transmits reference IF signals between the two XPIC boards in an XPIC workgroup to implement the XPIC function.

A fiber jumper transmits optical signals. One end of the fiber jumper has an LC/PC connector that is connected to an SDH optical port or FE/GE optical port on the OptiX RTN 950A. The connector at the other end of the fiber jumper depends on the type of the optical port on the equipment to be connected.

An STM-1 cable transmits/receives STM-1 signals. One end of the STM-1 cable has an SAA connector that is connected to an STM-1 electrical port. The connector at the other end of the STM-1 cable is connected to a DDF and needs to be prepared on site as required.

E1 cables are available in two categories: E1 cable (Anea 96) connected to the external equipment and E1 cable connected to the E1 panel.

An orderwire cable connects an orderwire phone to the equipment. Both ends of the orderwire cable are terminated with an RJ11 connector. One end of the orderwire cable is connected to the PHONE port on the AUX. The other end of the orderwire cable is connected to the port of the orderwire phone.

5.10 Network Cable
A network cable connects two pieces of Ethernet equipment. Both ends of the network cable are terminated with an RJ45 connector.

5.1 Power Cable

A power cable connects the PIU board in the IDU to a power supply device (for example, a PDU on top of the cabinet) for access of the -48 V power to the IDU.

Cable Diagram

Figure 5-1 Power cable

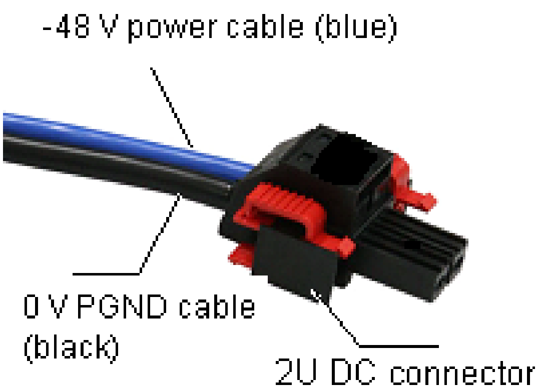


Table 5-1 Power cable specifications

Length	Model	Cable	Terminal
Equal to or shorter than 10 m	4 mm^2 power cable and terminal	Electronic power cable, 450 V/750 V, H07Z-K UL3386, 4 mm^2, Blue/Black, Halogen free and low smoke flame retardant cable	Common terminal, single cord end terminal, conductor cross section 4 mm^2, 20 A, insertion depth 10 mm
Longer th an 10 m	6 mm^2 power cable and terminal	Power cable, 450 V/750 V, H07Z-K, 6 mm^2, blue/ black, low smoke zero halogen cable[a]	Common terminal, single cord end terminal, conductor cross section 6 mm^2, 30 A, insertion depth 12 mm

NOTE

For OptiX RTN 950A, power cables with a 6 mm^2 cross-sectional area can extend for a maximum distance of 43 m.

5.2 PGND Cable

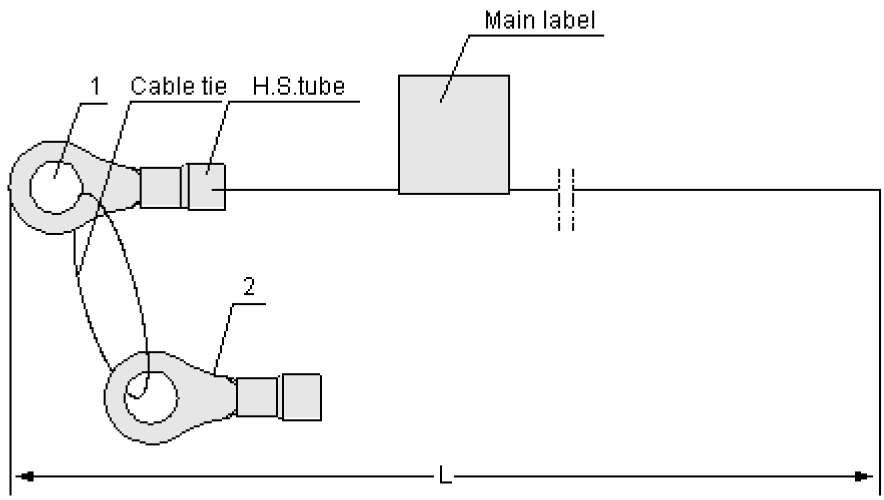
PGND cables are available in two categories: IDU PGND cables and E1 panel PGND cables.

5.2.1 IDU PGND Cable

An IDU PGND cable connects the left ground point of the IDU to the ground point of external equipment (for example, the ground support of a cabinet) so that the IDU and external equipment share the same ground.

Cable Diagram

Figure 5-2 IDU PGND cable



1. Bare crimping terminal, OT

2. Bare crimping terminal, OT

Pin Assignments

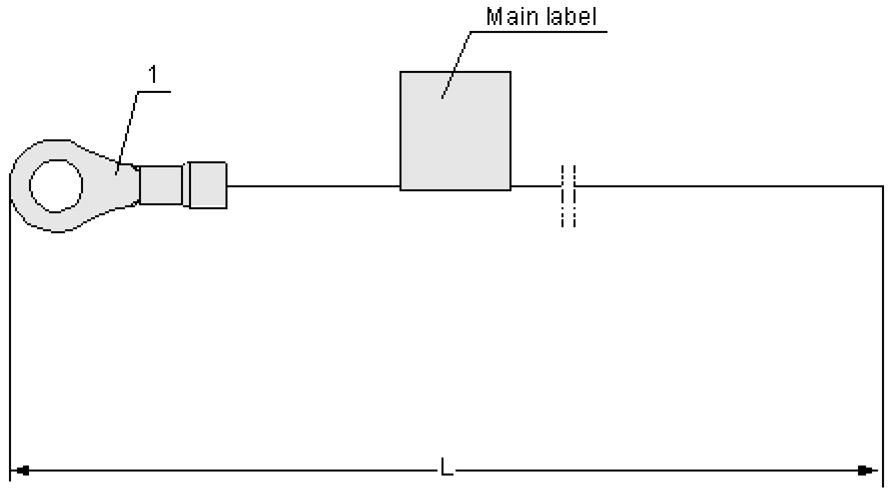
None.

5.2.2 E1 Panel PGND Cable

An E1 panel PGND cable connects the right ground nut of the E1 panel to the ground point of external equipment (for example, the ground support of a cabinet) so that the E1 panel and external equipment share the same ground.

Cable Diagram

Figure 5-3 E1 panel PGND cable



Bare crimping terminal, OT

Pin Assignments

None.

5.3 IF Cable

The IF cable connects the ODU and IDU. The IF cable is used to transport the IF signal, O&M signal, and -48 V power between the ODU and the IDU.

IF cables are of three types, namely, 5D cable, RG-8U cable, and 1/2-inch cable.

Table 5-2 Types of IF cables

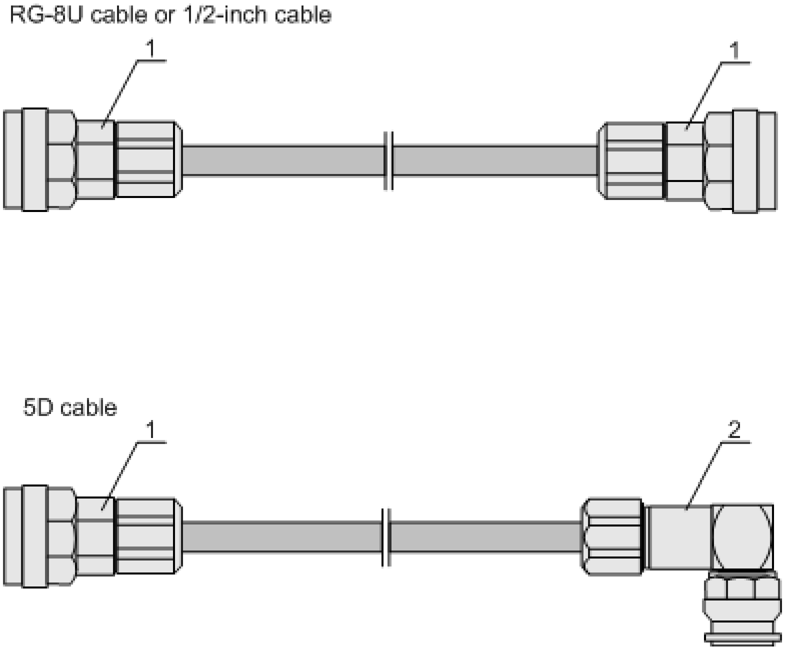
Type	Applicable Distance (Distance Between an IDU and an ODU)	Connector		IF Jumper Required
		ODU Side	IDU Side	
5D cable	< 120 m	Type N, male connector	Type TNC, male connector	No
RG-8U cable	120 m to 180 m	Type N, male connector	Type N, male connector	Yes
1/2-inch cable	180 m to 300 m	Type N, male connector	Type N, male connector	Yes

NOTE

A 5D cable connects the IF interface of an ODU to the IF interface of an IDU. An RG-8U cable or 1/2-inch cable connects the IF interface of an ODU to the IF jumper of an IDU.

Cable Diagram

Figure 5-4 Diagram of the IF cable



1. RF coaxial cable connector, type-N, male	2. RF Coaxial Connector, type TNC, male

Cable Connection Table

None.

Technical Specifications

Table 5-3 Performance of the IF cable

Item	Performance			
	5D Cable	RG-8U Cable	1/2-Inch Super-flexible Cable	1/2-Inch Common Cable
Characteristic impedance (ohm)	50	50	50	50

Item	Performance			
	5D Cable	RG-8U Cable	1/2-Inch Super-flexible Cable	1/2-Inch Common Cable
Attenuation (dB/100 m at 20°C)	≤ 10.0 (140 MHz) ≤ 11.0 (177 MHz) ≤ 15.0 (350 MHz) ≤ 18.0 (550 MHz)	≤ 6.0 (140 MHz) ≤ 7.0 (177 MHz) ≤ 9.0 (350 MHz) ≤ 11.0 (550 MHz)	≤ 5.0 (140MHz) ≤ 6.0 (177MHz) ≤ 6.63 (350MHz) ≤ 8.5 (550MHz)	≤ 2.8 (140MHz) ≤ 3.0 (177MHz) ≤ 4.5 (350MHz) ≤ 5.5 (550MHz)
DC resistance (ohm/km at 20°C)	≤ 11.0	≤ 4.9	≤ 4.3	≤ 2.7
Outside diameter of the cable (mm)	7.60	10.16	13.40	15.7

NOTE

When the ISM8 board works with the XMC-3H ODU, if the distance between the IDU and the ODU is from 220 m to 300 m, the 1/2-inch common cable is used.

5.4 IF Jumper

An IF jumper connects the IDU to an IF cable. The IF jumper works with the IF cable to transmit IF signals and O&M signals in addition to supplying -48 V power between the ODU and the IDU.

An IF jumper is a 2 m RG-223 cable. One end of the IF jumper has a Type N connector that is connected to the IF cable. The other end of the IF jumper has a TNC connector that is connected to the IF board.

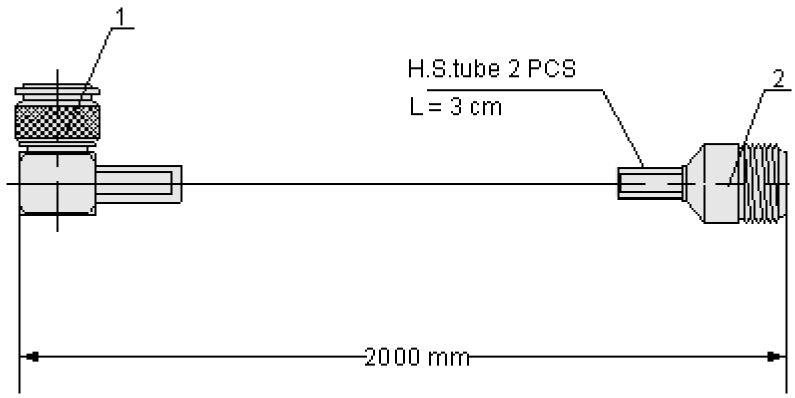
NOTE

For all other IF boards except ISM6,

- If a 5D IF cable is used, you can connect the cable directly to an IF board instead of using an IF jumper.
- If an RG-8U or 1/2-inch IF cable is used, an IF jumper is required to connect the RG-8U or 1/2-inch IF cable to the IF board.

Cable Diagram

Figure 5-5 IF jumper



1. RF coaxial cable connector, TNC, male 2. RF coaxial cable connector, Type N, female

Pin Assignments

None.

5.5 XPIC Cable

An XPIC cable transmits reference IF signals between the two XPIC boards in an XPIC workgroup to implement the XPIC function.

An XPIC cable is an RG316 cable that has SMA connectors at both ends. One end of the XPIC cable is connected to the X-IN port of one XPIC board in an XPIC workgroup, and the other end of the XPIC cable is connected to the X-OUT port of the other XPIC board in the same XPIC workgroup.

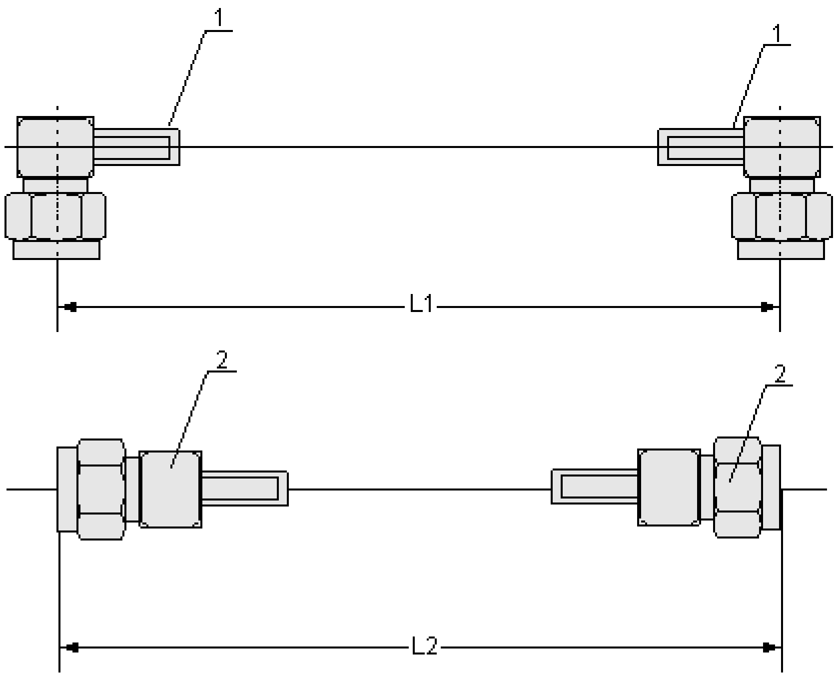
- If the XPIC function is disabled on an ISX2 board, use a short XPIC cable to connect the IN and OUT ports on the board. Otherwise, the board performance will be affected.
- If the XPIC function is disabled on an ISV3 board, do not use a short XPIC cable to connect the IN and OUT ports on the board. Otherwise, the board performance will be affected.

XPIC cables are available in the following types:

- XPIC cables with angle connectors: These XPIC cables are long and used to connect two XPIC boards in the horizontal direction.
- XPIC cables with straight connectors: These XPIC cables are short and used to connect two XPIC boards in the vertical direction. These XPIC cables are also used to connect the X-IN port to the X-OUT port on the same XPIC board to loop back signals.

Cable Diagram

Figure 5-6 XPIC cable



1. Coaxial cable connector, SMA, angle, male 2. Coaxial cable connector, SMA, straight, male

Pin Assignments

None.

5.6 Fiber Jumper

A fiber jumper transmits optical signals. One end of the fiber jumper has an LC/PC connector that is connected to an SDH optical port or FE/GE optical port on the OptiX RTN 950A. The connector at the other end of the fiber jumper depends on the type of the optical port on the equipment to be connected.

Types of Fiber Jumpers

Table 5-4 Types of fiber jumpers

Connector 1	Connector 2	Cable
LC/PC	FC/PC	2 mm single-mode fiber
		2 mm multi-mode fiber
LC/PC	SC/PC	2 mm single-mode fiber

Connector 1	Connector 2	Cable
		2 mm multi-mode fiber
LC/PC	LC/PC	2 mm single-mode fiber
		2 mm multi-mode fiber

NOTE

For the OptiX RTN 950A, multi-mode fibers are required to connect to 1000BASE-SX GE optical ports.

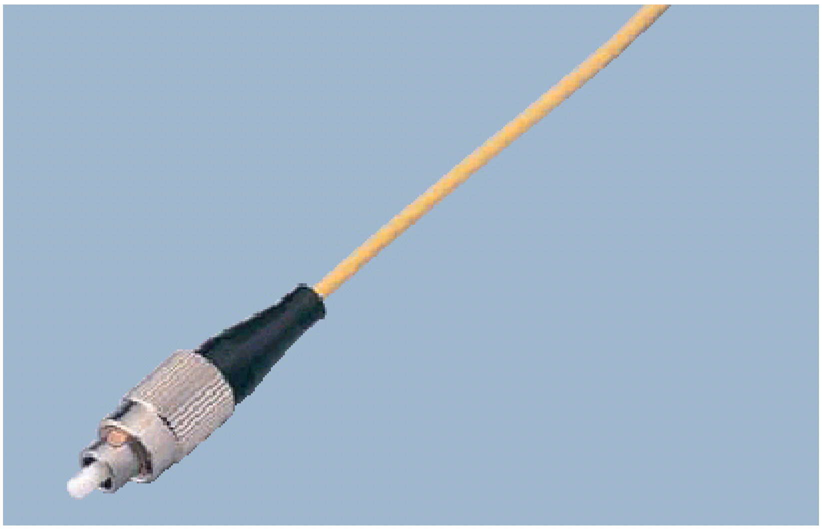
Fiber Connectors

The following figures show three common types of fiber connectors, namely, LC/PC connector, SC/PC connector, and FC/PC connector.

Figure 5-7 LC/PC connector

Figure 5-8 SC/PC connector

Figure 5-9 FC/PC connector

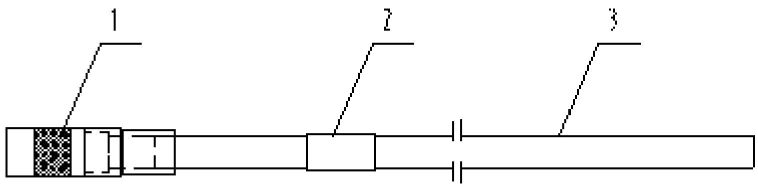


5.7 STM-1 Cable

An STM-1 cable transmits/receives STM-1 signals. One end of the STM-1 cable has an SAA connector that is connected to an STM-1 electrical port. The connector at the other end of the STM-1 cable is connected to a DDF and needs to be prepared on site as required.

Cable Diagram

Figure 5-10 STM-1 cable



1. Coaxial connector, SAA straight/male 2. Main label 3. Coaxial cable

Pin Assignments

None.

Cable Specifications

Item	Description
Connector	Coaxial connector, SAA connector (1.0/2.3), 75-ohm straight/ male
Cable model	Coaxial cable, 75-ohm, 3.9 mm, 2.1 mm, 0.34 mm, shielded
Number of cores	One
Core diameter	Diameter of the shield layer (3.9 mm), diameter of the internal insulation layer (2.1 mm), diameter of the internal conductor (0.34 mm)
Length	10 m
Fireproof class	CM

5.8 E1 Cables

E1 cables are available in two categories: E1 cable (Anea 96) connected to the external equipment and E1 cable connected to the E1 panel.

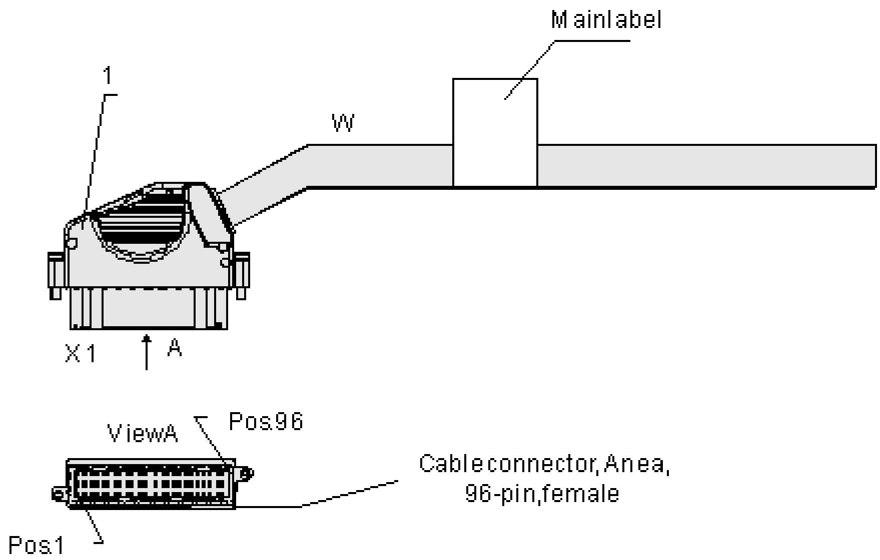
5.8.1 E1 Cable Connected to the External Equipment

An E1 cable that is connected to the external equipment is used when the IDU needs to directly receive E1 signals from or transmits E1 signals to external equipment.

Each E1 cable that is connected to the external equipment can transmit a maximum of 16 E1 signals. There are two types of E1 cables that are connected to the external equipment: 75-ohm coaxial cables and 120-ohm twisted pair cables.

Cable Diagram

Figure 5-11 E1 cable connected to the external equipment



1. Cable connector, Anea 96, female

NOTE

- A 120-ohm E1 cable and a 75-ohm E1 cable have the same appearance.
- The core diameter of a 75-ohm E1 cable is 1.6 mm. Therefore, use a crimping tool with an opening of 2.5 mm (0.098-inch) to attach the end of the 75-ohm E1 cable on the DDF frame with a 75-1-1 coaxial connector.

Pin Assignments

Table 5-5 Pin assignments for a 75-ohm E1 cable

Pin	W		Remarks	Pin	W		Remarks
	Core	Serial No.			Core	Serial No.	
1	Tip	1	R0	25	Tip	2	T0
2	Ring			26	Ring		
3	Tip	3	R1	27	Tip	4	T1
4	Ring			28	Ring		
5	Tip	5	R2	29	Tip	6	T2
6	Ring			30	Ring		
7	Tip	7	R3	31	Tip	8	T3

Pin	W		Remarks	Pin	W		Remarks
	Core	Serial No.			Core	Serial No.	
8	Ring			32	Ring		
9	Tip	9	R4	33	Tip	10	T4
10	Ring			34	Ring		
11	Tip	11	R5	35	Tip	12	T5
12	Ring			36	Ring		
13	Tip	13	R6	37	Tip	14	T6
14	Ring			38	Ring		
15	Tip	15	R7	39	Tip	16	T7
16	Ring			40	Ring		
18	Ring	17	R8	42	Ring	18	T8
17	Tip			41	Tip		
20	Ring	19	R9	44	Ring	20	T9
19	Tip			43	Tip		
22	Ring	21	R10	46	Ring	22	T10
21	Tip			45	Tip		
24	Ring	23	R11	48	Ring	24	T11
23	Tip			47	Tip		
50	Ring	25	R12	74	Ring	26	T12
49	Tip			73	Tip		
52	Ring	27	R13	76	Ring	28	T13
51	Tip			75	Tip		
54	Ring	29	R14	78	Ring	30	T14
53	Tip			75	Tip		
56	Ring	31	R15	80	Ring	32	T15
55	Tip			79	Tip		
Shell	Braid			Shell	Braid		

Table 5-6 Pin assignments for a 120-ohm E1 cable

Pin	W		Remarks	Tape Color	Pin	W		Remarks	Tape Color
	Color of the Core	Relationship				Color of the Core	Relationship		
1	White	Twisted pair	R0	Blue	25	White	Twisted pair	T0	Blue
2	Blue				26	Orange			
3	White	Twisted pair	R1		27	White	Twisted pair	T1	
4	Green				28	Brown			
5	White	Twisted pair	R2		29	Red	Twisted pair	T2	
6	Gray				30	Blue			
7	Red	Twisted pair	R3		31	Red	Twisted pair	T3	
8	Orange				32	Green			
9	Red	Twisted pair	R4		33	Red	Twisted pair	T4	
10	Brown				34	Gray			
11	Black	Twisted pair	R5		35	Black	Twisted pair	T5	
12	Blue				36	Orange			
13	Black	Twisted pair	R6		37	Black	Twisted pair	T6	
14	Green				38	Brown			
15	Black	Twisted pair	R7		39	Yellow	Twisted pair	T7	
16	Gray				40	Blue			
17	White	Twisted pair	R8	Orange	41	White	Twisted pair	T8	Orange
18	Blue				42	Orange			
19	White	Twisted pair	R9		43	White	Twisted pair	T9	
20	Green				44	Brown			
21	White	Twisted pair	R10		45	Red	Twisted pair	T10	
22	Gray				46	Blue			
23	Red	Twisted pair	R11		47	Red	Twisted pair	T11	

Pin	W		Remarks	Tape Color	Pin	W		Remarks	Tape Color
	Color of the Core	Relationship				Color of the Core	Relationship		
24	Orange				48	Green			
49	Red	Twisted pair	R12		73	Red	Twisted pair	T12	
50	Brown				74	Gray			
51	Black	Twisted pair	R13		75	Black	Twisted pair	T13	
52	Blue				76	Orange			
53	Black	Twisted pair	R14		77	Black	Twisted pair	T14	
54	Green				78	Brown			
55	Black	Twisted pair	R15		79	Yellow	Twisted pair	T15	
56	Gray				80	Blue			
Shell	Braid				Shell	Braid			

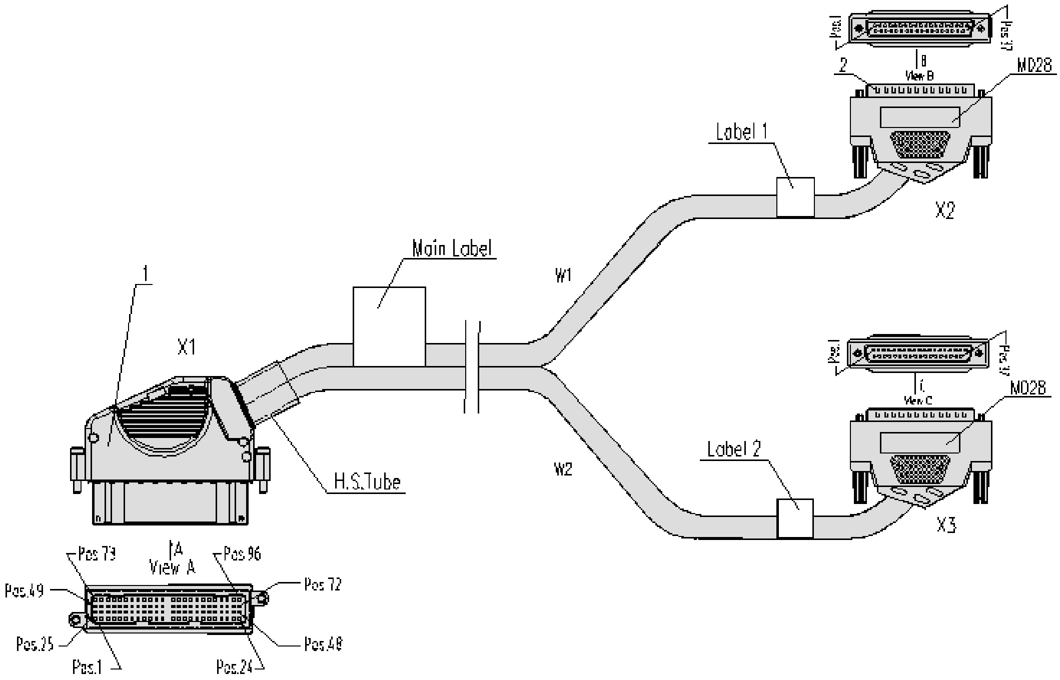
5.8.2 E1 Cable Connected to the E1 Panel

An E1 cable that is connected to the E1 panel is used when the E1 panel functions as a DDF. One end of the E1 cable has an Anea 96 connector that is connected to an E1 port on the IDU. The other end of the E1 cable has a DB37 connector that is connected to the E1 panel.

Each E1 cable can transmit 16 E1 signals. The port impedance of the E1 cable is 75 ohms.

Cable Diagram

Figure 5-12 E1 cable connected to the E1 panel



X1: Cable connector, Anea 96, female

X2/X3: Cable connector, type D, 37 male

Label 1: "CHAN 0-7"

Label 2: "CHAN 8-15"

Pin Assignments

Table 5-7 Pin assignments for the E1 cable terminated with an Anea 96 connector and a DB37 connector

Wire	Connector X1	Connector X2/X3	Remarks	Connector X1	Connector X2/X3	Remarks
W1	X1.2	X2.20	R0	X1.10	X2.36	R4
	X1.1	X2.2		X1.9	X2.17	
	X1.26	X2.21	T0	X1.34	X2.35	T4
	X1.25	X2.3		X1.33	X2.16	
	X1.4	X2.22	R1	X1.12	X2.34	R5
	X1.3	X2.4		X1.11	X2.15	
	X1.28	X2.23	T1	X1.36	X2.33	T5
	X1.27	X2.5		X1.35	X2.14	

Wire	Connector X1	Connector X2/X3	Remarks	Connector X1	Connector X2/X3	Remarks
	X1.6	X2.24	R2	X1.14	X2.32	R6
	X1.5	X2.6		X1.13	X2.13	
	X1.30	X2.25	T2	X1.38	X2.31	T6
	X1.29	X2.7		X1.37	X2.12	
	X1.8	X2.26	R3	X1.16	X2.30	R7
	X1.7	X2.8		X1.15	X2.11	
	X1.32	X2.27	T3	X1.40	X2.29	T7
	X1.31	X2.9		X1.39	X2.10	
W2	X1.18	X3.20	R8	X1.50	X3.36	R12
	X1.17	X3.2		X1.49	X3.17	
	X1.42	X3.21	T8	X1.74	X3.35	T12
	X1.41	X3.3		X1.73	X3.16	
	X1.20	X3.22	R9	X1.52	X3.34	R13
	X1.19	X3.4		X1.51	X3.15	
	X1.44	X3.23	T9	X1.76	X3.33	T13
	X1.43	X3.5		X1.75	X3.14	
	X1.22	X3.24	R10	X1.54	X3.32	R14
	X1.21	X3.6		X1.53	X3.13	
	X1.46	X3.25	T10	X1.78	X3.31	T14
	X1.45	X3.7		X1.77	X3.12	
	X1.24	X3.26	R11	X1.56	X3.30	R15
	X1.23	X3.8		X1.55	X3.11	
	X1.48	X3.27	T11	X1.80	X3.29	T15
	X1.47	X3.9		X1.79	X3.10	
-	Shell	Braid		Shell	Braid	

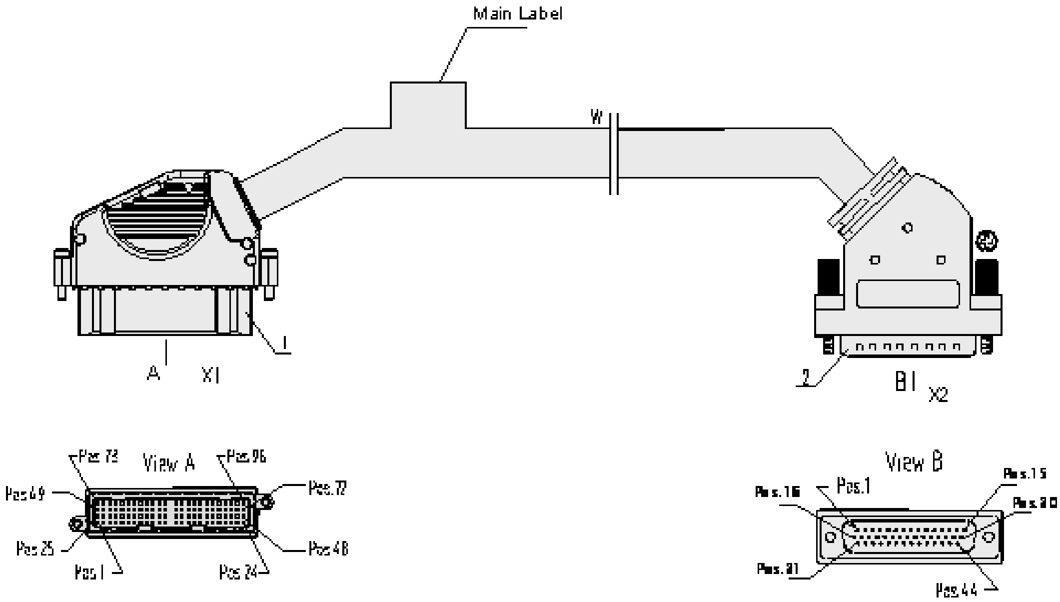
5.8.3 E1 Transit Cable Terminated with an Anea 96 Connector and a DB44 Connector

When the TCU6 works with the SP3S, an E1 transit cable terminated with an Anea 96 connector and a DB44 connector is required for connecting the two boards. For the E1 transit cable, the Anea 96 connector is connected to the E1 port on the SP3S, and the DB44 connector is connected to the DB44 E1 port on the TCU6.

This E1 transit cable can transmit 6xE1 signals. The port impedance of the cable is 120 ohms, and therefore this cable can work only with the 120-ohm SP3S. The cable is 0.6 m long.

Cable Diagram

Figure 5-13 E1 transit cable terminated with an Anea 96 connector and a DB44 connector



X1. Cable connector, Anea 96, female X2. Cable connector, type-D, 44 male

Pin Assignments

Table 5-8 Pin assignments for the E1 transit cable terminated with an Anea 96 connector and a DB44 connector

Wire	Connector X1	Connector X2	Remarks	Connector X1	Connector X2	Remarks
W1	X1.2	X2.15	R0	X1.8	X2.12	R3
	X1.1	X2.30		X1.7	X2.27	
	X1.26	X2.38	T0	X1.32	X2.35	T3
	X1.25	X2.23		X1.31	X2.20	
	X1.4	X2.14	R1	X1.10	X2.11	R4
	X1.3	X2.29		X1.9	X2.26	
	X1.28	X2.37	T1	X1.34	X2.34	T4

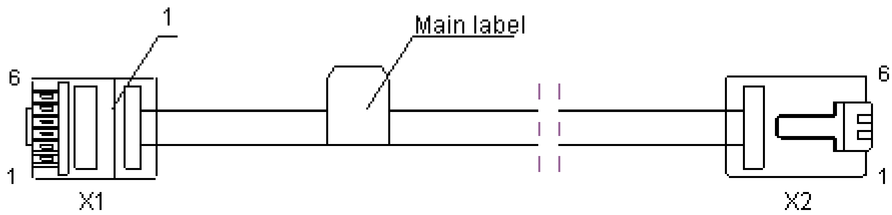
Wire	Connector X1	Connector X2	Remarks	Connector X1	Connector X2	Remarks
	X1.27	X2.22		X1.33	X2.19	
	X1.6	X2.13	R2	X1.12	X2.10	R5
	X1.5	X2.28		X1.11	X2.25	
	X1.30	X2.36	T2	X1.36	X2.33	T5
	X1.29	X2.21		X1.35	X2.18	
-	Shell	Braid		Shell	Braid	

5.9 Orderwire Cable

An orderwire cable connects an orderwire phone to the equipment. Both ends of the orderwire cable are terminated with an RJ11 connector. One end of the orderwire cable is connected to the PHONE port on the AUX. The other end of the orderwire cable is connected to the port of the orderwire phone.

Cable Diagram

Figure 5-14 Orderwire cable



1. Orderwire port, RJ11 connector

Pin Assignments

Table 5-9 Pin assignments for the orderwire cable

Connector X1	Connector X2	Function
X1.3	X2.3	Tip
X1.4	X2.4	Ring

5.10 Network Cable

A network cable connects two pieces of Ethernet equipment. Both ends of the network cable are terminated with an RJ45 connector.

Two types of interfaces use RJ45 connectors, which are medium dependent interfaces (MDIs) and MDI-Xs. MDIs are used by terminal equipment, for example, network card. The pin assignments for MDIs are provided in **Table 5-10**. MDI-Xs are used by network equipment. The pin assignments for MDI-Xs are provided in **Table 5-11**.

Table 5-10 Pin assignments for MDIs

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

Table 5-11 Pin assignments for MDI-Xs

Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	Function	Signal	Function
1	RX+	Receiving data (+)	BIDB+	Bidirectional data wire B (+)
2	RX-	Receiving data (-)	BIDB-	Bidirectional data wire B (-)

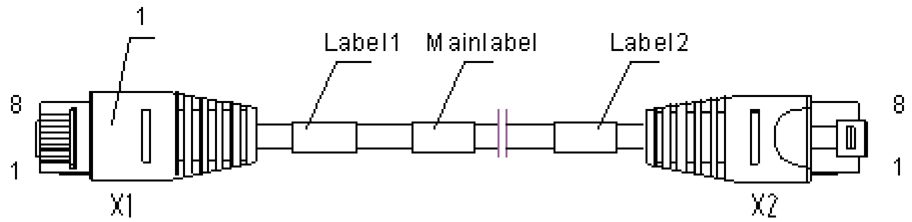
Pin	10/100BASE-T(X)		1000BASE-T	
	Signal	**Function**	**Signal**	**Function**
3	TX+	Transmitting data (+)	BIDA+	Bidirectional data wire A (+)
4	Reserved	-	BIDD+	Bidirectional data wire D (+)
5	Reserved	-	BIDD-	Bidirectional data wire D (-)
6	TX-	Transmitting data (-)	BIDA-	Bidirectional data wire A (-)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

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 the pin assignment.

The NMS/COM port, NE cascading port, and Ethernet electrical service ports of the OptiX RTN 950A support the MDI, MDI-X, and auto-MDI/MDI-X modes. Straight-through cables and crossover cables can be used to connect the NMS/COM port, EXT port, and Ethernet electrical service ports to MDIs or MDI-Xs.

Cable Diagram

Figure 5-15 Network cable



1. Network port connector, RJ45

Pin Assignments

Table 5-12 Pin assignments for the straight-through cable

Connector X1	Connector X2	Color	Relation
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	

Table 5-13 Pin assignments for the crossover cable

Connector X1	Connector X2	Color	Relation
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	

A Glossary

Numerics

3G	See **Third Generation.**
3GPP	3rd Generation Partnership Project
802.1Q in 802.1Q (QinQ)	A VLAN feature that allows the equipment to add a VLAN tag to a tagged frame. The implementation of QinQ is to add a public VLAN tag to a frame with a private VLAN tag to allow the frame with double VLAN tags to be transmitted over the service provider's backbone network based on the public VLAN tag. This provides a layer 2 VPN tunnel for customers and enables transparent transmission of packets over private VLANs.

A

A/D	analog/digit
ABR	See **available bit rate.**
ACAP	See **adjacent channel alternate polarization.**
ACL	See **Access Control List.**
ADC	Analogue-to-Digital Converter
ADM	add/drop multiplexer
AF	See **assured forwarding.**
AIS	alarm indication signal
ALS	See **automatic laser shutdown.**
AM	See **adaptive modulation.**
APS	automatic protection switching
ARP	See **Address Resolution Protocol.**
ASBR	See **autonomous system boundary router.**
ASIC	See **application-specific integrated circuit.**
ATM	Asynchronous Transfer Mode
ATPC	See **automatic transmit power control.**

Access Control List (ACL)	A list of entities, together with their access rights, which are authorized to access a resource.
Address Resolution Protocol (ARP)	An Internet Protocol used to map IP addresses to MAC addresses. The ARP protocol enables hosts and routers to determine link layer addresses through ARP requests and responses. The address resolution is a process by which the host converts the target IP address into a target MAC address before transmitting a frame. The basic function of ARP is to use the target equipment's IP address to query its MAC address.
adaptive modulation (AM)	A technology that is used to automatically adjust the modulation mode according to the channel quality. When the channel quality is favorable, the equipment uses a high-efficiency modulation mode to improve the transmission efficiency and the spectrum utilization of the system. When the channel quality is degraded, the equipment uses the low-efficiency modulation mode to improve the anti-interference capability of the link that carries high-priority services.
adjacent channel alternate polarization (ACAP)	A channel configuration method, which uses two adjacent channels (a horizontal polarization wave and a vertical polarization wave) to transmit two signals.
alarm suppression	A method to suppress alarms for the alarm management purpose. Alarms that are suppressed are no longer reported from NEs.
analog signal	A signal in which information is represented with a continuously variable physical quantity, such as voltage. Because of this constant changing of the wave shape with regard to its passing a given point in time or space, an analog signal might have a virtually indefinite number of states or values. This contrasts with a digital signal that is expressed as a square wave and therefore has a very limited number of discrete states. Analog signals, with complicated structures and narrow bandwidth, are vulnerable to external interference.
application-specific integrated circuit (ASIC)	A special type of chip that starts out as a nonspecific collection of logic gates. Late in the manufacturing process, a layer is added to connect the gates for a specific function. By changing the pattern of connections, the manufacturer can make the chip suitable for many needs.
assured forwarding (AF)	One of the four per-hop behaviors (PHB) defined by the Diff-Serv workgroup of IETF. It is suitable for certain key data services that require assured bandwidth and short delay. For traffic within the bandwidth limit, AF assures quality in forwarding. For traffic that exceeds the bandwidth limit, AF degrades the service class and continues to forward the traffic instead of discarding the packets.
attenuator	A device used to increase the attenuation of an Optical Fiber Link. Generally used to ensure that the signal at the receive end is not too strong.
automatic laser shutdown (ALS)	A technique (procedure) to automatically shutdown the output power of laser transmitters and optical amplifiers to avoid exposure to hazardous levels.
automatic transmit power control (ATPC)	A method of adjusting the transmit power based on fading of the transmit signal detected at the receiver
autonomous system boundary router (ASBR)	A router that exchanges routing information with other autonomous system boundary routers.
available bit rate (ABR)	A kind of service categories defined by the ATM forum. ABR only provides possible forwarding service and applies to the connections that does not require the real-time quality. It does not provide any guarantee in terms of cell loss or delay.

B

B-ISDN	See **broadband integrated services digital network.**
BDI	See **backward defect indication.**
BE	See **best effort.**
BER	bit error rate
BFD	See **Bidirectional Forwarding Detection.**
BGP	Border Gateway Protocol
BIOS	See **basic input/output system.**
BIP	See **bit interleaved parity.**
BPDU	See **bridge protocol data unit.**
BSC	See **base station controller.**
BTS	base transceiver station
Bidirectional Forwarding Detection (BFD)	A fast and independent hello protocol that delivers millisecond-level link failure detection and provides carrier-class availability. After sessions are established between neighboring systems, the systems can periodically send BFD packets to each other. If one system fails to receive a BFD packet within the negotiated period, the system regards that the bidirectional link fails and instructs the upper layer protocol to take actions to recover the faulty link.
backbone network	A network that forms the central interconnection for a connected network. The communication backbone for a country is WAN. The backbone network is an important architectural element for building enterprise networks. It provides a path for the exchange of information between different LANs or subnetworks. A backbone can tie together diverse networks in the same building, in different buildings in a campus environment, or over wide areas. Generally, the backbone network's capacity is greater than the networks connected to it.
backward defect indication (BDI)	A function that the sink node of a LSP, when detecting a defect, uses to inform the upstream end of the LSP of a downstream defect along the return path.
base station controller (BSC)	A logical entity that connects the BTS with the MSC in a GSM/CDMA network. It interworks with the BTS through the Abis interface, the MSC through the A interface. It provides the following functions: radio resource management, base station management, power control, handover control, and traffic measurement. One BSC controls and manages one or more BTSs in an actual network.
basic input/output system (BIOS)	Firmware stored on the computer motherboard that contains basic input/output control programs, power-on self test (POST) programs, bootstraps, and system setting information. The BIOS provides hardware setting and control functions for the computer.
baud rate	The maximum rate of signal state changes per second on a communications circuit. If each signal state change corresponds to a code bit, then the baud rate and the bit rate are the same. It is also possible for signal state changes to correspond to more than one code bit, so the baud rate may be lower than the code bit rate.

best effort (BE)	A traditional IP packet transport service. In this service, the diagrams are forwarded following the sequence of the time they reach. All diagrams share the bandwidth of the network and routers. The amount of resource that a diagram can use depends of the time it reaches. BE service does not ensure any improvement in delay time, jitter, packet loss ratio, and high reliability.
bit interleaved parity (BIP)	A method of error monitoring. With even parity, the transmitting equipment generates an X-bit code over a specified portion of the signal in such a manner that the first bit of the code provides even parity over the first bit of all X-bit sequences in the covered portion of the signal, the second bit provides even parity over the second bit of all X-bit sequences within the specified portion, and so forth. Even parity is generated by setting the BIP-X bits so that an even number of 1s exist in each monitored partition of the signal. A monitored partition comprises all bits in the same bit position within the X-bit sequences in the covered portion of the signal. The covered portion includes the BIP-X.
bridge	A device that connects two or more networks and forwards packets among them. Bridges operate at the physical network level. Bridges differ from repeaters because bridges store and forward complete packets, while repeaters forward all electrical signals. Bridges differ from routers because bridges use physical addresses, while routers use IP addresses.
bridge protocol data unit (BPDU)	Data messages exchanged across switches within an extended LAN that uses a spanning tree protocol (STP) topology. BPDU packets contain information on ports, addresses, priorities, and costs, and they ensure that the data reaches its intended destination. BPDU messages are exchanged across bridges to detect loops in a network topology. These loops are then removed by shutting down selected bridge interfaces and placing redundant switch ports in a backup, or blocked, state.
broadband integrated services digital network (B-ISDN)	A standard defined by the ITU-T to handle high-bandwidth applications, such as voice. It currently uses the ATM technology to transmit data over SONNET-based circuits at 155 to 622 Mbit/s or higher speed.
broadcast	A means of delivering information to all members in a network. The broadcast range is determined by the broadcast address.
broadcast domain	A group of network stations that receives broadcast packets originating from any device within the group. The broadcast domain also refers to the set of ports between which a device forwards a multicast, broadcast, or unknown destination frame.

C

CAD	See **router.**
CAR	committed access rate
CBS	See **committed burst size.**
CC	See **continuity check.**
CCDP	See **co-channel dual polarization.**
CDMA	See **Code Division Multiple Access.**
CE	See **customer edge.**
CES	See **circuit emulation service.**
CGMP	Cisco Group Management Protocol

CIST	See **Common and Internal Spanning Tree.**
CLNP	connectionless network protocol
CM	connection management
CORBA	See **Common Object Request Broker Architecture.**
CPU	See **Central Processing Unit.**
CRC	See **cyclic redundancy check.**
CSES	consecutive severely errored second
CSMA/CD	See **carrier sense multiple access with collision detection.**
CTC	common transmit clock
CW	control word
Central Processing Unit (CPU)	The computational and control unit of a computer. The CPU is the device that interprets and executes instructions. The CPU has the ability to fetch, decode, and execute instructions and to transfer information to and from other resources over the computer's main data-transfer path, the bus.
Code Division Multiple Access (CDMA)	A communication scheme that uses frequency expansion technology to form different code sequences. When the CDMA scheme is used, subscribers with different addresses can use different code sequences for multi-address connection.
Common Object Request Broker Architecture (CORBA)	A specification developed by the Object Management Group in 1992 in which pieces of programs (objects) communicate with other objects in other programs, even if the two programs are written in different programming languages and are running on different platforms. A program makes its request for objects through an object request broker, or ORB, and therefore does not need to know the structure of the program from which the object comes. CORBA is designed to work in object-oriented environments.
Common and Internal Spanning Tree (CIST)	The single spanning tree jointly calculated by STP and RSTP, the logical connectivity using MST bridges and regions, and MSTP. The CIST ensures that all LANs in the bridged local area network are simply and fully connected.
cable tie	A cable tie (also known as a wire tie, hose tie, steggel tie, or zip tie, and by the brand names Ty-Rap) is a type of fastener, for holding items together, primarily electrical cables or wires.
carrier sense multiple access with collision detection (CSMA/CD)	Carrier sense multiple access with collision detection (CSMA/CD) is a computer networking access method in which: a carrier sensing scheme is used. a transmitting data station that detects another signal while transmitting a frame, stops transmitting that frame, transmits a jam signal, and then waits for a random time interval before trying to send that frame again.
channel	A telecommunication path of a specific capacity and/or speed between two or more locations in a network. The channel can be established through wire, radio (microwave), fiber, or any combination of the three. The amount of information transmitted per second in a channel is the information transmission speed, expressed in bits per second. For example, b/s (100 bit/s), kb/s (103 bit/s), Mb/s (106 bit/s), Gb/s (109 bit/s), and Tb/s (1012 bit/s).

circuit emulation service (CES)	A function with which the E1/T1 data can be transmitted through ATM networks. At the transmission end, the interface module packs timeslot data into ATM cells. These ATM cells are sent to the reception end through the ATM network. At the reception end, the interface module re-assigns the data in these ATM cells to E1/T1 timeslots. The CES technology guarantees that the data in E1/T1 timeslots can be recovered to the original sequence at the reception end.
clock tracing	The method of keeping the time on each node synchronized with a clock source in the network.
co-channel dual polarization (CCDP)	A channel configuration method, which uses a horizontal polarization wave and a vertical polarization wave to transmit two signals. The Co-Channel Dual Polarization has twice the transmission capacity of the single polarization.
committed burst size (CBS)	A parameter used to define the capacity of token bucket C, that is, the maximum burst IP packet size when information is transferred at the committed information rate. This parameter must be greater than 0 but should be not less than the maximum length of an IP packet to be forwarded.
continuity check (CC)	An Ethernet connectivity fault management (CFM) method used to detect the connectivity between MEPs by having each MEP periodically transmit a Continuity Check Message (CCM).
cross-polarization interference cancellation (XPIC)	A technology used in the case of the Co-Channel Dual Polarization (CCDP) to eliminate the cross-connect interference between two polarization waves in the CCDP.
customer edge (CE)	A part of the BGP/MPLS IP VPN model that provides interfaces for directly connecting to the Service Provider (SP) network. A CE can be a router, switch, or host.
cyclic redundancy check (CRC)	A mathematical checksum that can be used to detect data corruption in transmitted frames. The CRC is a linear hash function, and should not be used for data security assurance.

D

DC	direct current
DC-C	See **DC-return common (with ground).**
DC-I	See **DC-return isolate (with ground).**
DC-return common (with ground) (DC-C)	A power system, in which the BGND of the DC return conductor is short-circuited with the PGND on the output side of the power supply cabinet and also on the line between the output of the power supply cabinet and the electric equipment.
DC-return isolate (with ground) (DC-I)	A power system, in which the BGND of the DC return conductor is short-circuited with the PGND on the output side of the power supply cabinet and is isolated from the PGND on the line between the output of the power supply cabinet and the electric equipment.
DCN	See **data communication network.**
DDF	digital distribution frame
DDN	See **digital data network.**
DE	discard eligible
DM	See **delay measurement.**

DS boundary node	A DS node that connects one DS domain to a node either in another DS domain or in a domain that is not DS-capable.
DS interior node	A DS node located at the center of a DS domain. It is a non-DS boundary node.
DS node	A DS-compliant node, which is subdivided into DS boundary node and ID interior node.
DSCP	See **differentiated services code point.**
DVMRP	See **Distance Vector Multicast Routing Protocol.**
DiffServ	See **differentiated service.**
Distance Vector Multicast Routing Protocol (DVMRP)	An Internet gateway protocol based primarily on the RIP. The DVMRP protocol implements a typical dense mode IP multicast solution and uses IGMP to exchange routing datagrams with its neighbors.
data communication network (DCN)	A communication network used in a TMN or between TMNs to support the data communication function.
delay measurement (DM)	The time elapsed since the start of transmission of the first bit of the frame by a source node until the reception of the last bit of the loopbacked frame by the same source node, when the loopback is performed at the frame's destination node.
differentiated service (DiffServ)	An IETF standard that defines a mechanism for controlling and forwarding traffic in a differentiated manner based on CoS settings to handle network congestion.
differentiated services code point (DSCP)	According to the QoS classification standard of the Differentiated Service (Diff-Serv), the type of services (ToS) field in the IP header consists of six most significant bits and two currently unused bits, which are used to form codes for priority marking. Differentiated services code point (DSCP) is the six most important bits in the ToS. It is the combination of IP precedence and types of service. The DSCP value is used to ensure that routers supporting only IP precedence can be used because the DSCP value is compatible with IP precedence. Each DSCP maps a per-hop behavior (PHB). Therefore, terminal devices can identify traffic using the DSCP value.
digital data network (DDN)	A data transmission network that is designed to transmit data on digital channels (such as the fiber channel, digital microwave channel, or satellite channel).
digital modulation	A method that controls the changes in amplitude, phase, and frequency of the carrier based on the changes in the baseband digital signal. In this manner, the information can be transmitted by the carrier.
dual-polarized antenna	An antenna intended to simultaneously radiate or receive two independent radio waves orthogonally polarized.

E

E-Aggr	See **Ethernet aggregation.**
E-LAN	See **Ethernet local area network.**
E-Line	See **Ethernet line.**
ECC	See **embedded control channel.**
EMC	See **electromagnetic compatibility.**
EMI	See **electromagnetic interference.**
EPL	See **Ethernet private line.**

EPLAN	See **Ethernet private LAN service.**
EPLD	See **erasable programmable logic device.**
ERPS	Ethernet ring protection switching
ETS	European Telecommunication Standards
ETSI	See **European Telecommunications Standards Institute.**
EVPL	See **Ethernet virtual private line.**
EVPLAN	See **Ethernet virtual private LAN service.**
Ethernet	A LAN technology that uses the carrier sense multiple access with collision detection (CSMA/CD) media access control method. The Ethernet network is highly reliable and easy to maintain. The speed of an Ethernet interface can be 10 Mbit/s, 100 Mbit/s, 1000 Mbit/s, or 10,000 Mbit/s.
Ethernet aggregation (E-Aggr)	A type of Ethernet service that is based on a multipoint-to-point EVC (Ethernet virtual connection).
Ethernet line (E-Line)	A type of Ethernet service that is based on a point-to-point EVC (Ethernet virtual connection).
Ethernet local area network (E-LAN)	A type of Ethernet service that is based on a multipoint-to-multipoint EVC (Ethernet virtual connection).
Ethernet private LAN service (EPLAN)	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over dedicated bandwidth between multipoint-to-multipoint connections.
Ethernet private line (EPL)	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over dedicated bandwidth between point-to-point connections.
Ethernet virtual private LAN service (EVPLAN)	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over shared bandwidth between multipoint-to-multipoint connections.
Ethernet virtual private line (EVPL)	A type of Ethernet service provided by SDH, PDH, ATM, or MPLS server layer networks. This service is carried over shared bandwidth between point-to-point connections.
European Telecommunications Standards Institute (ETSI)	ETSI is a multinational standardization body with regulatory and standardization authority over much of Europe. GSM standardization took place under the auspices of ETSI.
electromagnetic compatibility (EMC)	A condition which prevails when telecommunications equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment.
electromagnetic interference (EMI)	Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the performance of electronics/electrical equipment.
embedded control channel (ECC)	A logical channel that uses a data communications channel (DCC) as its physical layer to enable the transmission of operation, administration, and maintenance (OAM) information between NEs.
engineering label	A mark on a cable, a subrack, or a cabinet for identification.

erasable programmable logic device (EPLD)	A logic array device which can be used to implement the required functions by programming the array. In addition, a user can modify and program the array repeatedly until the program meets the requirement.

F

FD	See **frequency diversity.**
FDDI	See **fiber distributed data interface.**
FDI	See **forward defect indication.**
FEC	See **forward error correction.**
FFD	fast failure detection
FFD packet	A path failure detection method independent from CV. Different from a CV packet, the frequency for generating FFD packets is configurable to satisfy different service requirements. By default, the frequency is 20/s. An FFD packet contains information the same as that in a CV packet. The destination end LSR processes FFD packets in the same way for processing CV packets.
FIFO	See **first in first out.**
FPGA	See **field programmable gate array.**
FTP	File Transfer Protocol
fiber distributed data interface (FDDI)	A standard developed by the American National Standards Institute (ANSI) for high-speed fiber-optic LANs. FDDI provides specifications for transmission rates of 100 megabits per second on token ring networks.
field programmable gate array (FPGA)	A semi-customized circuit that is used in the Application Specific Integrated Circuit (ASIC) field and developed based on programmable components. FPGA remedies many of the deficiencies of customized circuits, and allows the use of many more gate arrays.
first in first out (FIFO)	A stack management method in which data that is stored first in a queue is also read and invoked first.
forward defect indication (FDI)	A packet generated and traced forward to the sink node of the LSP by the node that first detects defects. It includes fields to indicate the nature of the defect and its location. Its primary purpose is to suppress alarms being raised at affected higher level client LSPs and (in turn) their client layers.
forward error correction (FEC)	A bit error correction technology that adds correction information to the payload at the transmit end. Based on the correction information, the bit errors generated during transmission can be corrected at the receive end.
fragmentation	A process of breaking a packet into smaller units when transmitting over a network node that does not support the original size of the packet.
frequency diversity (FD)	The signal is transmitted using several frequency channels or spread over a wide spectrum that is affected by frequency-selective fading.

G

GCRA	generic cell rate algorithm
GFC	generic flow control

GFP	See **Generic Framing Procedure.**
GNE	See **gateway network element.**
GPS	See **Global Positioning System.**
GTS	See **generic traffic shaping.**
GUI	graphical user interface
Generic Framing Procedure (GFP)	A framing and encapsulated method that can be applied to any data type. GFP is defined by ITU-T G.7041.
Global Positioning System (GPS)	A global navigation satellite system that provides reliable positioning, navigation, and timing services to users worldwide.
gateway	A device that receives data via one protocol and transmits it via another.
gateway network element (GNE)	An NE that serves as a gateway for other NEs to communicate with a network management system.
generic traffic shaping (GTS)	A traffic control measure that proactively adjusts the output speed of the traffic. This is to adapt the traffic to network resources that can be provided by the downstream router to avoid packet discarding and congestion.

H

HQoS	See **hierarchical quality of service.**
HSDPA	See **High Speed Downlink Packet Access.**
HSM	hitless switch mode
High Speed Downlink Packet Access (HSDPA)	A modulating-demodulating algorithm put forward in 3GPP R5 to meet the requirement for asymmetric uplink and downlink transmission of data services. It enables the maximum downlink data service rate to reach 14.4 Mbit/s without changing the WCDMA network topology.
hierarchical quality of service (HQoS)	A type of QoS that controls the traffic of users and performs the scheduling according to the priority of user services. HQoS has an advanced traffic statistics function, and the administrator can monitor the usage of bandwidth of each service. Hence, the bandwidth can be allocated reasonably through traffic analysis.

I

I/O	input/output
ICMP	See **Internet Control Message Protocol.**
IDU	See **indoor unit.**
IEEE	See **Institute of Electrical and Electronics Engineers.**
IGMP	See **Internet Group Management Protocol.**
IGP	See **Interior Gateway Protocol.**
IP	Internet Protocol
IPv4	See **Internet Protocol version 4.**
IPv6	See **Internet Protocol version 6.**
ISDN	Integrated Services Digital Network

IST	internal spanning tree
ITU	See **International Telecommunication Union.**
Institute of Electrical and Electronics Engineers (IEEE)	A professional association of electrical and electronics engineers based in the United States, but with membership from numerous other countries. The IEEE focuses on electrical, electronics, and computer engineering, and produces many important technology standards.
Interior Gateway Protocol (IGP)	A routing protocol that is used within an autonomous system. The IGP runs in small-sized and medium-sized networks. The IGPs are RIP, IGRP, EIGRP, OSPF, and IS-IS.
International Telecommunication Union (ITU)	A United Nations agency, one of the most important and influential recommendation bodies, responsible for recommending standards for telecommunication (ITU-T) and radio networks (ITU-R).
Internet Control Message Protocol (ICMP)	A network layer protocol that provides message control and error reporting between a host server and an Internet gateway.
Internet Group Management Protocol (IGMP)	One of the TCP/IP protocols for managing the membership of Internet Protocol multicast groups. It is used by IP hosts and adjacent multicast routers to establish and maintain multicast group memberships.
Internet Protocol version 4 (IPv4)	The current version of the Internet Protocol (IP). IPv4 utilizes a 32bit address which is assigned to hosts. An address belongs to one of five classes (A, B, C, D, or E) and is written as 4 octets separated by periods and may range from 0.0.0.0 through to 255.255.255.255. Each IPv4 address consists of a network number, an optional subnetwork number, and a host number. The network and subnetwork numbers together are used for routing, and the host number is used to address an individual host within the network or subnetwork.
Internet Protocol version 6 (IPv6)	An update version of IPv4, which is designed by the Internet Engineering Task Force (IETF) and is also called IP Next Generation (IPng). It is a new version of the Internet Protocol. The difference between IPv6 and IPv4 is that an IPv4 address has 32 bits while an IPv6 address has 128 bits.
indoor unit (IDU)	The indoor unit of the split-structured radio equipment. It implements accessing, multiplexing/demultiplexing, and intermediate frequency (IF) processing for services.

L

L2VPN	Layer 2 virtual private network
LACP	See **Link Aggregation Control Protocol.**
LAG	See **link aggregation group.**
LAN	See **local area network.**
LAPS	Link Access Protocol-SDH
LB	See **loopback.**
LCAS	See **link capacity adjustment scheme.**
LM	See **loss measurement.**
LOS	See **loss of signal.**
LPT	link-state pass through

LSDB	link state database
LSP tunnel	An LSP over which traffic is transmitted based on labels that are assigned to FECs on the ingress. The traffic is transparent to the intermediate nodes
LSR	See **label switching router.**
LTE	Long Term Evolution
Layer 2 switching	A data forwarding method. In a LAN, a network bridge or 802.3 Ethernet switch transmits and distributes packet data based on the MAC address. Since the MAC address is at the second layer of the OSI model, this data forwarding method is called Layer 2 switching.
Link Aggregation Control Protocol (LACP)	A dynamic link aggregation protocol that improves the transmission speed and reliability. The two ends of the link send LACP packets to inform each other of their parameters and form a logical aggregation link. After the aggregation link is formed, LACP maintains the link status in real time and dynamically adjusts the ports on the aggregation link upon detecting the failure of a physical port.
label switching router (LSR)	Basic element of an MPLS network. All LSRs support the MPLS protocol. The LSR is composed of two parts: control unit and forwarding unit. The former is responsible for allocating the label, selecting the route, creating the label forwarding table, creating and removing the label switch path; the latter forwards the labels according to groups received in the label forwarding table.
laser	A component that generates directional optical waves of narrow wavelengths. The laser light has better coherence than ordinary light. Semi-conductor lasers provide the light used in a fiber system.
line rate	The maximum packet forwarding capacity on a cable. The value of line rate equals the maximum transmission rate capable on a given type of media.
link aggregation group (LAG)	An aggregation that allows one or more links to be aggregated together to form a link aggregation group so that a MAC client can treat the link aggregation group as if it were a single link.
link capacity adjustment scheme (LCAS)	LCAS in the virtual concatenation source and sink adaptation functions provides a control mechanism to hitless increase or decrease the capacity of a link to meet the bandwidth needs of the application. It also provides a means of removing member links that have experienced failure. The LCAS assumes that in cases of capacity initiation, increases or decreases, the construction or destruction of the end-to-end path is the responsibility of the network and element management systems.
local area network (LAN)	A network formed by the computers and workstations within the coverage of a few square kilometers or within a single building, featuring high speed and low error rate. Current LANs are generally based on switched Ethernet or Wi-Fi technology and run at 1,000 Mbit/s (that is, 1 Gbit/s).
loopback (LB)	A troubleshooting technique that returns a transmitted signal to its source so that the signal or message can be analyzed for errors. The loopback can be a inloop or outloop.
loss measurement (LM)	A method used to collect counter values applicable for ingress and egress service frames where the counters maintain a count of transmitted and received data frames between a pair of MEPs.
loss of signal (LOS)	No transitions occurring in the received signal.

M

MA	maintenance association
MAC	See **Media Access Control.**
MADM	multiple add/drop multiplexer
MBS	maximum burst size
MD	See **maintenance domain.**
MD5	See **message digest algorithm 5.**
MDI	medium dependent interface
MEP	maintenance association end point
MIB	See **management information base.**
MLPPP	Multi-Link Point-to-Point Protocol
MP	maintenance point
MPLS	See **Multiprotocol Label Switching.**
MPLS L2VPN	A network that provides the Layer 2 VPN service based on an MPLS network. In this case, on a uniform MPLS network, the carrier is able to provide Layer 2 VPNs of different media types, such as ATM, FR, VLAN, Ethernet, and PPP.
MPLS TE	multiprotocol label switching traffic engineering
MPLS VPN	See **multiprotocol label switching virtual private network.**
MS	multiplex section
MSP	See **multiplex section protection.**
MST region	See **multiple spanning tree region.**
MSTI	See **multiple spanning tree instance.**
MSTP	See **Multiple Spanning Tree Protocol.**
MTBF	See **mean time between failures.**
MTTR	See **Mean Time to Repair.**
MTU	See **maximum transmission unit.**
Mean Time to Repair (MTTR)	The average time that a device will take to recover from a failure.
Media Access Control (MAC)	A protocol at the media access control sublayer. The protocol is at the lower part of the data link layer in the OSI model and is mainly responsible for controlling and connecting the physical media at the physical layer. When transmitting data, the MAC protocol checks whether to be able to transmit data. If the data can be transmitted, certain control information is added to the data, and then the data and the control information are transmitted in a specified format to the physical layer. When receiving data, the MAC protocol checks whether the information is correct and whether the data is transmitted correctly. If the information is correct and the data is transmitted correctly, the control information is removed from the data and then the data is transmitted to the LLC layer.

Multiple Spanning Tree Protocol (MSTP)	A protocol that can be used in a loop network. Using an algorithm, the MSTP blocks redundant paths so that the loop network can be trimmed as a tree network. In this case, the proliferation and endless cycling of packets is avoided in the loop network. The protocol that introduces the mapping between VLANs and multiple spanning trees. This solves the problem that data cannot be normally forwarded in a VLAN because in STP/RSTP, only one spanning tree corresponds to all the VLANs.
Multiprotocol Label Switching (MPLS)	A technology that uses short tags of fixed length to encapsulate packets in different link layers, and provides connection-oriented switching for the network layer on the basis of IP routing and control protocols.
maintenance domain (MD)	The network or the part of the network for which connectivity is managed by connectivity fault management (CFM). The devices in a maintenance domain are managed by a single Internet service provider (ISP).
management information base (MIB)	A type of database used for managing the devices in a communications network. It comprises a collection of objects in a (virtual) database used to manage entities (such as routers and switches) in a network.
maximum transmission unit (MTU)	The largest packet of data that can be transmitted on a network. MTU size varies, depending on the network-576 bytes on X.25 networks, for example, 1500 bytes on Ethernet, and 17,914 bytes on 16 Mbit/s token ring. Responsibility for determining the size of the MTU lies with the link layer of the network. When packets are transmitted across networks, the path MTU, or PMTU, represents the smallest packet size (the one that all networks can transmit without breaking up the packet) among the networks involved.
mean time between failures (MTBF)	The average time between consecutive failures of a piece of equipment. It is a measure of the reliability of the system.
message digest algorithm 5 (MD5)	A hash function that is used in a variety of security applications to check message integrity. MD5 processes a variable-length message into a fixed-length output of 128 bits. It breaks up an input message into 512-bit blocks (sixteen 32-bit little-endian integers). After a series of processing, the output consists of four 32-bit words, which are then cascaded into a 128-bit hash number.
multicast	A process of transmitting data packets from one source to many destinations. The destination address of the multicast packet uses Class D address, that is, the IP address ranges from 224.0.0.0 to 239.255.255.255. Each multicast address represents a multicast group rather than a host.
multiple spanning tree instance (MSTI)	A type of spanning trees calculated by MSTP within an MST Region, to provide a simply and fully connected active topology for frames classified as belonging to a VLAN that is mapped to the MSTI by the MST Configuration. A VLAN cannot be assigned to multiple MSTIs.
multiple spanning tree region (MST region)	A region that consists of switches that support the MSTP in the LAN and links among them. Switches physically and directly connected and configured with the same MST region attributes belong to the same MST region.
multiplex section protection (MSP)	A function, which is performed to provide capability for switching a signal between and including two multiplex section termination (MST) functions, from a "working" to a "protection" channel.

multiprotocol label switching virtual private network (MPLS VPN)	An Internet Protocol (IP) virtual private network (VPN) based on the multiprotocol label switching (MPLS) technology. It applies the MPLS technology for network routers and switches, simplifies the routing mode of core routers, and combines traditional routing technology and label switching technology. It can be used to construct the broadband Intranet and Extranet to meet various service requirements.

N

N+1 protection	A radio link protection system composed of N working channels and one protection channel.
NE	network element
NE Explorer	The main operation interface, which is used to manage the telecommunication equipment. In the NE Explorer, a user can query, manage, and maintain NEs, boards, and ports.
NNI	Network-to-Network Interface
NPE	network provider edge
NSAP	See **network service access point.**
NSF	non-stop forwarding
network service access point (NSAP)	A network address defined by ISO, at which the OSI Network Service is made available to a Network service user by the Network service provider.
network storm	A phenomenon that occurs during data communication. To be specific, mass broadcast packets are transmitted in a short time; the network is congested; transmission quality and availability of the network decrease rapidly. The network storm is caused by network connection or configuration problems.
non-GNE	See **non-gateway network element.**
non-gateway network element (non-GNE)	A network element that communicates with the NM application layer through the gateway NE application layer.

O

OAM	See **operation, administration and maintenance.**
OAMPDU	operation, administration and maintenance protocol data unit
ODF	optical distribution frame
OSPF	See **Open Shortest Path First.**
Open Shortest Path First (OSPF)	A link-state, hierarchical interior gateway protocol (IGP) for network routing that uses cost as its routing metric. A link state database is constructed of the network topology, which is identical on all routers in the area.
operation, administration and maintenance (OAM)	A set of network management functions that cover fault detection, notification, location, and repair.
orderwire	A channel that provides voice communication between operation engineers or maintenance engineers of different stations.

P

PDH	See **plesiochronous digital hierarchy.**
PE	See **provider edge.**
PHB	See **per-hop behavior.**
PLA	See **physical link aggregation.**
PLL	See **phase-locked loop.**
PRBS	See **pseudo random binary sequence.**
PRI	Primary Rate Interface
PSN	See **packet switched network.**
PSTN	See **public switched telephone network.**
PTN	packet transport network
PTP	Precision Time Protocol
PTP clock	See **Precision Time Protocol clock.**
PVP	See **permanent virtual path.**
PW	See **pseudo wire.**
PWE3	See **Pseudowire Emulation Edge-to-Edge.**
Precision Time Protocol clock (PTP clock)	A type of high-decision clock defined by the IEEE 1588 V2 standard. The IEEE 1588 V2 standard specifies the precision time protocol (PTP) in a measurement and control system. The PTP protocol ensures clock synchronization precise to sub-microseconds.
Pseudowire Emulation Edge-to-Edge (PWE3)	An end-to-end Layer 2 transmission technology. It emulates the essential attributes of a telecommunication service such as ATM, FR or Ethernet in a packet switched network (PSN). PWE3 also emulates the essential attributes of low speed time division multiplexing (TDM) circuit and SONET/SDH. The simulation approximates to the real situation.
packet switched network (PSN)	A telecommunications network that works in packet switching mode.
per-hop behavior (PHB)	IETF Diff-Serv workgroup defines forwarding behaviors of network nodes as per-hop behaviors (PHB), such as, traffic scheduling and policing. A device in the network should select the proper PHB behaviors, based on the value of DSCP. At present, the IETF defines four types of PHB. They are class selector (CS), expedited forwarding (EF), assured forwarding (AF), and best-effort (BE).
permanent virtual path (PVP)	Virtual path that consists of PVCs.
phase-locked loop (PLL)	A circuit that consists essentially of a phase detector that compares the frequency of a voltage-controlled oscillator with that of an incoming carrier signal or reference-frequency generator. The output of the phase detector, after passing through a loop filter, is fed back to the voltage-controlled oscillator to keep it exactly in phase with the incoming or reference frequency.
physical link aggregation (PLA)	Being a technology providing load balancing based on physical layer bandwidths, physical link aggregation (PLA) combines Ethernet transmission paths in several Integrated IP radio links into a logical Ethernet link for higher Ethernet bandwidth and Ethernet transmission reliability.

plesiochronous digital hierarchy (PDH)	A multiplexing scheme of bit stuffing and byte interleaving. It multiplexes the minimum rate 64 kit/s into rates of 2 Mbit/s, 34 Mbit/s, 140 Mbit/s, and 565 Mbit/s.
polarization	A kind of electromagnetic wave, the direction of whose electric field vector is fixed or rotates regularly. Specifically, if the electric field vector of the electromagnetic wave is perpendicular to the plane of horizon, this electromagnetic wave is called vertically polarized wave; if the electric field vector of the electromagnetic wave is parallel to the plane of horizon, this electromagnetic wave is called horizontal polarized wave; if the tip of the electric field vector, at a fixed point in space, describes a circle, this electromagnetic wave is called circularly polarized wave.
provider edge (PE)	A device that is located in the backbone network of the MPLS VPN structure. A PE is responsible for managing VPN users, establishing LSPs between PEs, and exchanging routing information between sites of the same VPN. A PE performs the mapping and forwarding of packets between the private network and the public channel. A PE can be a UPE, an SPE, or an NPE.
pseudo random binary sequence (PRBS)	A sequence that is random in the sense that the value of each element is independent of the values of any of the other elements, similar to a real random sequence.
pseudo wire (PW)	An emulated connection between two PEs for transmitting frames. The PW is established and maintained by PEs through signaling protocols. The status information of a PW is maintained by the two end PEs of a PW.
public switched telephone network (PSTN)	A telecommunications network established to perform telephone services for the public subscribers. Sometimes it is called POTS.

Q

QPSK	See **quadrature phase shift keying.**
QinQ	See **802.1Q in 802.1Q.**
QoS	See **quality of service.**
quadrature phase shift keying (QPSK)	A variation of BPSK, and it is also a Double Side Band Suppressed Carrier (DSBSC) modulation scheme, which sends two bits of digital information at a time, called as bigits.
quality of service (QoS)	A commonly-used performance indicator of a telecommunication system or channel. Depending on the specific system and service, it may relate to jitter, delay, packet loss ratio, bit error ratio, and signal-to-noise ratio. It functions to measure the quality of the transmission system and the effectiveness of the services, as well as the capability of a service provider to meet the demands of users.

R

RADIUS accounting	An accounting mode in which the BRAS sends the accounting packets to the RADIUS server. Then the RADIUS server performs accounting.
RDI	remote defect indication
RED	See **random early detection.**
REI	remote error indication
RFC	See **Request For Comments.**
RMEP	remote maintenance association end point

RMON	remote network monitoring
RNC	See **radio network controller.**
RSL	See **received signal level.**
RSTP	See **Rapid Spanning Tree Protocol.**
RSVP	See **Resource Reservation Protocol.**
RTN	radio transmission node
RTSP	Real-Time Streaming Protocol
Rapid Spanning Tree Protocol (RSTP)	An evolution of the Spanning Tree Protocol (STP) that provides faster spanning tree convergence after a topology change. The RSTP protocol is backward compatible with the STP protocol.
Request For Comments (RFC)	A document in which a standard, a protocol, or other information pertaining to the operation of the Internet is published. The RFC is actually issued, under the control of the IAB, after discussion and serves as the standard. RFCs can be obtained from sources such as InterNIC.
Resource Reservation Protocol (RSVP)	A protocol that reserves resources on every node along a path. RSVP is designed for an integrated services Internet.
RoHS	restriction of the use of certain hazardous substances
radio network controller (RNC)	A device in a radio network subsystem that is in charge of controlling the usage and integrity of radio resources.
random early detection (RED)	A packet loss algorithm used in congestion avoidance. It discards the packet according to the specified higher limit and lower limit of a queue so that global TCP synchronization resulting from traditional tail drop can be prevented.
real-time variable bit rate (rt-VBR)	A parameter intended for real-time applications, such as compressed voice over IP (VoIP) and video conferencing. The rt-VBR is characterized by a peak cell rate (PCR), sustained cell rate (SCR), and maximum burst size (MBS). You can expect the source device to transmit in bursts and at a rate that varies with time.
received signal level (RSL)	The signal level at a receiver input terminal.
receiver sensitivity	The minimum acceptable value of mean received power at point Rn (a reference point at an input to a receiver optical connector) to achieve a 1x10-12 BER when the FEC is enabled.
regeneration	The process of receiving and reconstructing a digital signal so that the amplitudes, waveforms and timing of its signal elements are constrained within specified limits.
route	The path that network traffic takes from its source to its destination. On a TCP/IP network, each IP packet is routed independently. Routes can change dynamically.
router (CAD)	A device on the network layer that selects routes in the network. The router selects the optimal route according to the destination address of the received packet through a network and forwards the packet to the next router. The last router is responsible for sending the packet to the destination host. Can be used to connect a LAN to a LAN, a WAN to a WAN, or a LAN to the Internet.
rt-VBR	See **real-time variable bit rate.**

S

SAI	service area identifier
SAToP	Structure-Agnostic Time Division Multiplexing over Packet
SD	See **space diversity.**
SDH	See **synchronous digital hierarchy.**
SES	severely errored second
SETS	SDH equipment timing source
SF	See **signal fail.**
SFP	small form-factor pluggable
SLA	See **Service Level Agreement.**
SNCP	subnetwork connection protection
SNMP	See **Simple Network Management Protocol.**
SNR	See **signal-to-noise ratio.**
SSL	See **Secure Sockets Layer.**
SSM	See **Synchronization Status Message.**
STM	See **synchronous transport module.**
STM-1	See **Synchronous Transport Module level 1.**
STM-4	Synchronous Transport Module level 4
STM-N	Synchronous Transport Module level N
STP	Spanning Tree Protocol
Secure Sockets Layer (SSL)	A security protocol that works at a socket layer. This layer exists between the TCP layer and the application layer to encrypt/decode data and authenticate concerned entities.
Service Level Agreement (SLA)	A service contract between a customer and a (SLA) service provider that specifies the forwarding service a customer should receive. A customer may be a user organization (source domain) or another DS domain (upstream domain). A SLA may include traffic conditioning rules which constitute a TCA in whole or in part.
Simple Network Management Protocol (SNMP)	An IETF protocol for monitoring and managing systems and devices in a network. The data being monitored and managed is defined by a MIB. The functions supported by the protocol are the request and retrieval of data, the setting or writing of data, and traps that signal the occurrence of events.
Synchronization Status Message (SSM)	A message that carries the quality levels of timing signals on a synchronous timing link. SSM messages provide upstream clock information to nodes on an SDH network or synchronization network.
Synchronous Transport Module level 1 (STM-1)	Synchronous transfer mode at 155 Mbit/s.
signal fail (SF)	A signal indicating that associated data has failed in the sense that a near-end defect condition (non-degrade defect) is active.

signal-to-noise ratio (SNR)	The ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time. SNR is expressed as 10 times the logarithm of the power ratio and is usually expressed in dB.
single-polarized antenna	An antenna intended to radiate or receive radio waves with only one specified polarization.
space diversity (SD)	A diversity scheme that enables two or more antennas separated by a specific distance to transmit/receive the same signal and selection is then performed between the two signals to ease the impact of fading. Currently, only receive SD is used.
subnet mask	The subnet mask is a binary pattern that is stored in the device and is matched with the IP address. A subnet mask is used by the IP protocol to determine to which network segment packets are destined. Subnet mask (also known as netmask or address mask) is a 32-bit binary value used over the TCP/IP network.
synchronous digital hierarchy (SDH)	A transmission scheme that follows ITU-T G.707, G.708, and G.709. SDH defines the transmission features of digital signals, such as frame structure, multiplexing mode, transmission rate level, and interface code. SDH is an important part of ISDN and B-ISDN.
synchronous transport module (STM)	An information structure used to support section layer connections in the SDH. It consists of information payload and Section Overhead (SOH) information fields organized in a block frame structure which repeats every 125. The information is suitably conditioned for serial transmission on the selected media at a rate which is synchronized to the network. A basic STM is defined at 155 520 kbit/s. This is termed STM-1. Higher capacity STMs are formed at rates equivalent to N times this basic rate. STM capacities for N = 4, N = 16 and N = 64 are defined; higher values are under consideration.

T

T1	A North American standard for high-speed data transmission at 1.544Mbps. It provides 24 x 64 kbit/s channels.
TCI	tag control information
TCP	See **Transmission Control Protocol.**
TCP/IP	Transmission Control Protocol/Internet Protocol
TD-SCDMA	See **Time Division-Synchronous Code Division Multiple Access.**
TDD	time division duplex
TDM	See **time division multiplexing.**
TDMA	See **Time Division Multiple Access.**
TEDB	See **traffic engineering database.**
TIM	trace identifier mismatch
TMN	See **telecommunications management network.**
TOS	test operation system
TTL	See **time to live.**
TUG	tributary unit group

Telnet	A standard terminal emulation protocol in the TCP/IP protocol stack. Telnet allows users to log in to remote systems and use resources as if they were connected to a local system. Telnet is defined in RFC 854.
Third Generation (3G)	The third generation of digital wireless technology, as defined by the International Telecommunications Union (ITU). Third generation technology is expected to deliver data transmission speeds between 144 kbit/s and 2 Mbit/s, compared to the 9.6 kbit/s to 19.2 kbit/s offered by second generation technology.
Time Division Multiple Access (TDMA)	An approach used for allocating a single channel among many users, by dividing the channel into different timeslots during which each user has access to the medium.
Time Division-Synchronous Code Division Multiple Access (TD-SCDMA)	A 3G mobile communications standard found in UMTS mobile telecommunications networks in China as an alternative to W-CDMA. TD-SCDMA integrates technologies of CDMA, TDMA, and FDMA, and makes use of technologies including intelligent antenna, joint detection, low chip rate (LCR), and adaptive power control. With the flexibility of service processing, a TD-SCDMA network can connect to other networks through the RNC.
Transmission Control Protocol (TCP)	The protocol within TCP/IP that governs the breakup of data messages into packets to be sent using Internet Protocol (IP), and the reassembly and verification of the complete messages from packets received by IP. A connection-oriented, reliable protocol (reliable in the sense of ensuring error-free delivery), TCP corresponds to the transport layer in the ISO/OSI reference model.
tail drop	A congestion management mechanism, in which packets arrive later are discarded when the queue is full. This policy of discarding packets may result in network-wide synchronization due to the TCP slow startup mechanism.
tangent ring	A concept borrowed from geometry. Two tangent rings have a common node between them. The common node often leads to single-point failures.
telecommunications management network (TMN)	A protocol model defined by ITU-T for managing open systems in a communications network. TMN manages the planning, provisioning, installation, and OAM of equipment, networks, and services.
time division multiplexing (TDM)	A multiplexing technology. TDM divides the sampling cycle of a channel into time slots (TSn, n is equal to 0, 1, 2, 3...), and the sampling value codes of multiple signals engross time slots in a certain order, forming multiple multiplexing digital signals to be transmitted over one channel.
time to live (TTL)	A specified period of time for best-effort delivery systems to prevent packets from looping endlessly. When writing data into Redis, there may be a point at which data is no longer needed. We can remove the data explicitly with DEL, or if we want to remove an entire key after a specified timeout, we can use what's known as expiration. When we say that a key has a time to live, or that it'll expire at a given time, we mean that Redis will automatically delete the key when its expiration time has arrived.
traffic engineering database (TEDB)	A type of database that every router generates after collecting the information about TE of every links in its area. TEDB is the base of forming the dynamic TE path in the MPLS TE network.
tributary loopback	A fault can be located for each service path by performing loopback to each path of the tributary board. There are three kinds of loopback modes: no loopback, outloop, and inloop.

tunnel	A channel on the packet switching network that transmits service traffic between PEs. In VPN, a tunnel is an information transmission channel between two entities. The tunnel ensures secure and transparent transmission of VPN information. In most cases, a tunnel is an MPLS tunnel.

U

UART	universal asynchronous receiver/transmitter
UAS	unavailable second
UBR+	Unspecified Bit Rate Plus
UDP	See **user datagram protocol.**
UI	user interface
UNI	See **User-to-Network Interface.**
UPC	See **usage parameter control.**
User-to-Network Interface (UNI)	The interface between user equipment and private or public network equipment (for example, ATM switches).
unicast	The process of sending data from a source to a single recipient.
usage parameter control (UPC)	During communications, UPC is implemented to monitor the actual traffic on each virtual circuit that is input to the network. Once the specified parameter is exceeded, measures will be taken to control. NPC is similar to UPC in function. The difference is that the incoming traffic monitoring function is divided into UPC and NPC according to their positions. UPC locates at the user/network interface, while NPC at the network interface.
user datagram protocol (UDP)	An Internet protocol that provides connectionless datagram delivery service to applications.UDP over IP adds the ability to address multiple endpoints within a single network node.

V

V-NNI	virtual network-network interface
VB	virtual bridge
VC	See **virtual container.**
VCC	See **virtual channel connection.**
VCCV	virtual circuit connectivity verification
VCG	See **virtual concatenation group.**
VCI	virtual channel identifier
VCTRUNK	A virtual concatenation group applied in data service mapping, also called the internal port of a data service processing board.
VLAN	virtual local area network
VPI	See **virtual path identifier.**
VPLS	virtual private LAN segment
VPN	virtual private network

VSWR voltage standing wave ratio

virtual channel connection (VCC) A VC logical trail that carries data between two end points in an ATM network. A point-to-multipoint VCC is a set of ATM virtual connections between two or multiple end points.

virtual circuit A channel or circuit established between two points on a data communications network with packet switching. Virtual circuits can be permanent virtual circuits (PVCs) or switched virtual circuits (SVCs) .

virtual concatenation group (VCG) A group of co-located member trail termination functions that are connected to the same virtual concatenation link.

virtual container (VC) An information structure used to support path layer connections in the SDH. A VC consists of a payload and path overhead (POH), which are organized in a block frame structure that repeats every 125 μs or 500 μs.

virtual path identifier (VPI) The field in the Asynchronous Transfer Mode (ATM) cell header that identifies to which virtual path the cell belongs.

W

WCDMA See **Wideband Code Division Multiple Access.**

WEEE waste electrical and electronic equipment

WFQ See **weighted fair queuing.**

WRR weighted round robin

WTR See **wait to restore.**

Web LCT The local maintenance terminal of a transport network, which is located at the NE management layer of the transport network.

Wideband Code Division Multiple Access (WCDMA) A standard defined by the ITU-T for the third-generation wireless technology derived from the Code Division Multiple Access (CDMA) technology.

wait to restore (WTR) The number of minutes to wait before services are switched back to the working line.

weighted fair queuing (WFQ) A fair queue scheduling algorithm based on bandwidth allocation weights. This scheduling algorithm allocates the total bandwidth of an interface to queues, according to their weights and schedules the queues cyclically. In this manner, packets of all priority queues can be scheduled.

winding pipe A tool for fiber routing, which acts as the corrugated pipe.

X

XPIC See **cross-polarization interference cancellation.**

