OptiX RTN 620 Radio Transmission System

V100R003

# Product Description

**Issue** 07

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HUAWEI TECHNOLOGIES CO., LTD.

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### Notice



## Huawei Technologies Co., Ltd.

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

Website: http://www.huawei.com

Email: support@huawei.com

# About This Document

## Purpose

This document describes the features, structure, configuration, networking and application, network management system (NMS), and performance indexes of the OptiX RTN 620 radio transmission system, thus providing comprehensive information of the OptiX RTN 620 product for readers.

## Related Versions

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

| Product Name | Product Version |
|---|---|
| OptiX RTN 620 | V100R003 |
| OptiX iManager T2000 | V200R007C03 |

## Intended Audience

This document is intended for network planning engineers.

Before you read this document, ensure that you have acquired the basic knowledge of digital microwave communication.

## Conventions

### 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 or low level of risk, which if not avoided, could result in minor or moderate injury. |
| CAUTION | Indicates a potentially hazardous situation, which if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results. |
| TIP | Indicates a tip that may help you solve a problem or save time. |
| NOTE | Provides additional information to emphasize or supplement important points of the main text. |

## 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`. |

# Update History

Updates between document issues are cumulative. Therefore, the latest document issue contains all updates made in previous issues.

## Updates in Issue 07 (2010-05-25)

Seventh release.

The descriptions of XMC ODU are added.

The descriptions of IF1A/IF1B/IF0A/IF0B are updated according to the changes about power distribute mode.

## Updates in Issue 06 (2009-06-15)

Sixth release.

The specifications of the product are updated.

## Updates in Issue 05 (2009-04-25)

Fifth release.

The *OptiX RTN 600 Product Description* is divided into the *OptiX RTN 620 Product Description* and the *OptiX RTN 605 Product Description*.

The specifications of the product are updated.

## Updates in Issue 04 (2009-02-25)

Fourth release.

The radio work modes of Hybrid microwave are updated.

## Updates in Issue 03 (2009-01-10)

Third release.

The frequency information of the LPA ODU is updated.

## Updates in Issue 02 (2008-10-30)

Second release.

The specifications of the product are updated.

## Updates in Issue 01 (2008-09-20)

Initial release.

# Contents

# Figures

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# 1 Introduction

## About This Chapter

The OptiX RTN 620 is one of the series products of the OptiX RTN 600 radio transmission system.

The OptiX RTN 600 V100R003 radio transmission system product series are classified into the OptiX RTN 620 and the OptiX RTN 605. The OptiX RTN 620 and the OptiX RTN 605 share one set of ODUs.

- The OptiX RTN 620 adopts 2U-high IDU (namely, IDU 620), supports one to four microwave directions, and provides the TDM microwave and Hybrid microwave integrated solution.
- The OptiX RTN 605 adopts 1U-high IDU (namely, IDU 605), supports one microwave direction, and provides the TDM microwave and Hybrid microwave terminal access solution.

This manual describes the OptiX RTN 620 only. For the description of the OptiX RTN 605, see the corresponding *OptiX RTN 605 Product Description*.

**NOTE**

For the description of the OptiX RTN 610, see the *OptiX RTN 600 V100R002 Product Description*.

1.1 Network Application
The OptiX RTN 620 is a split microwave transmission system developed by Huawei. It can provide a seamless microwave transmission solution for the mobile communication network or other private networks.

1.2 Components
The OptiX RTN 620 is of a split structure, consisting of the IDU 620 and the ODU. Each ODU is connected to the IDU 620 through a coaxial cable.

1.3 Radio Link Form
The OptiX RTN 620 provides the radio links of different forms by flexibly configuring different IF boards and ODUs to meet the requirements of different microwave application scenarios.

# 1.1 Network Application

The OptiX RTN 620 is a split microwave transmission system developed by Huawei. It can provide a seamless microwave transmission solution for the mobile communication network or other private networks.

The OptiX RTN 620 provides several types of service interfaces and features flexible configuration and easy installation. In addition, the OptiX RTN 620 can provide a TDM microwave and Hybrid microwave integrated solution according to the network requirements.

**Figure 1-1** TDM microwave transmission solution provided by the OptiX RTN 620

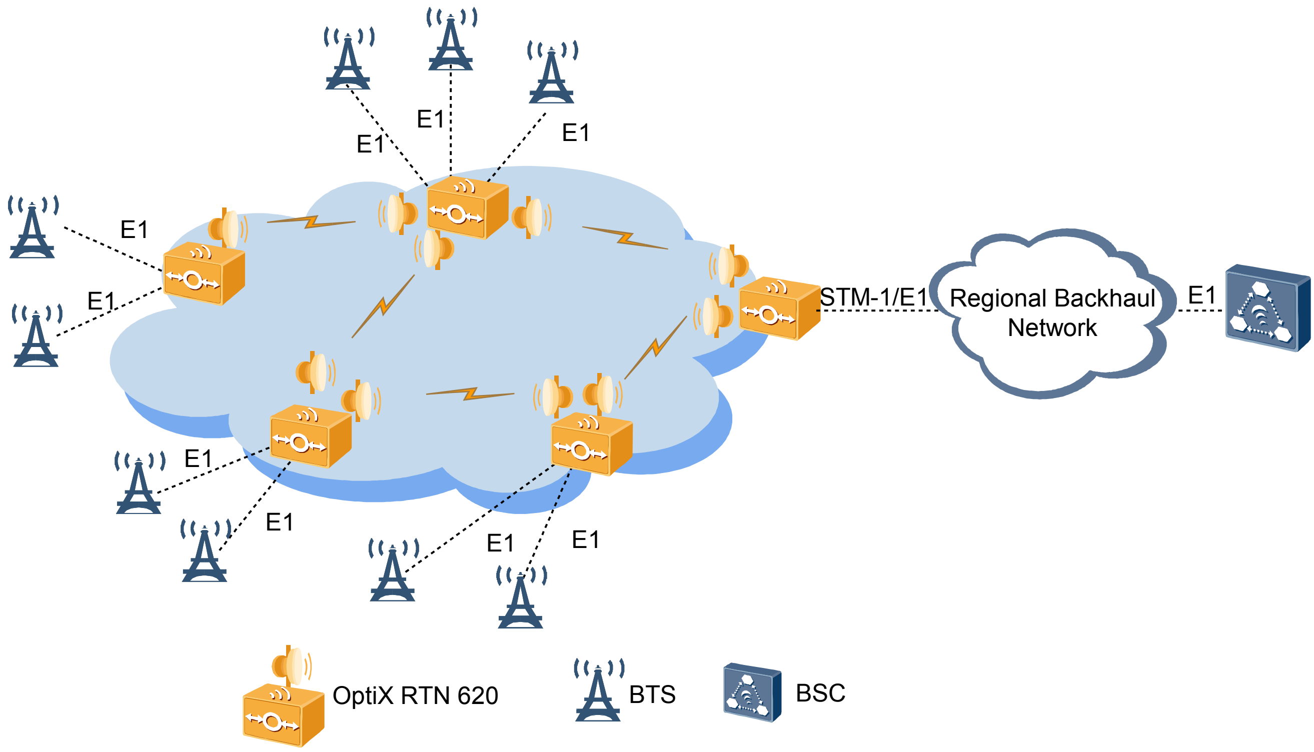
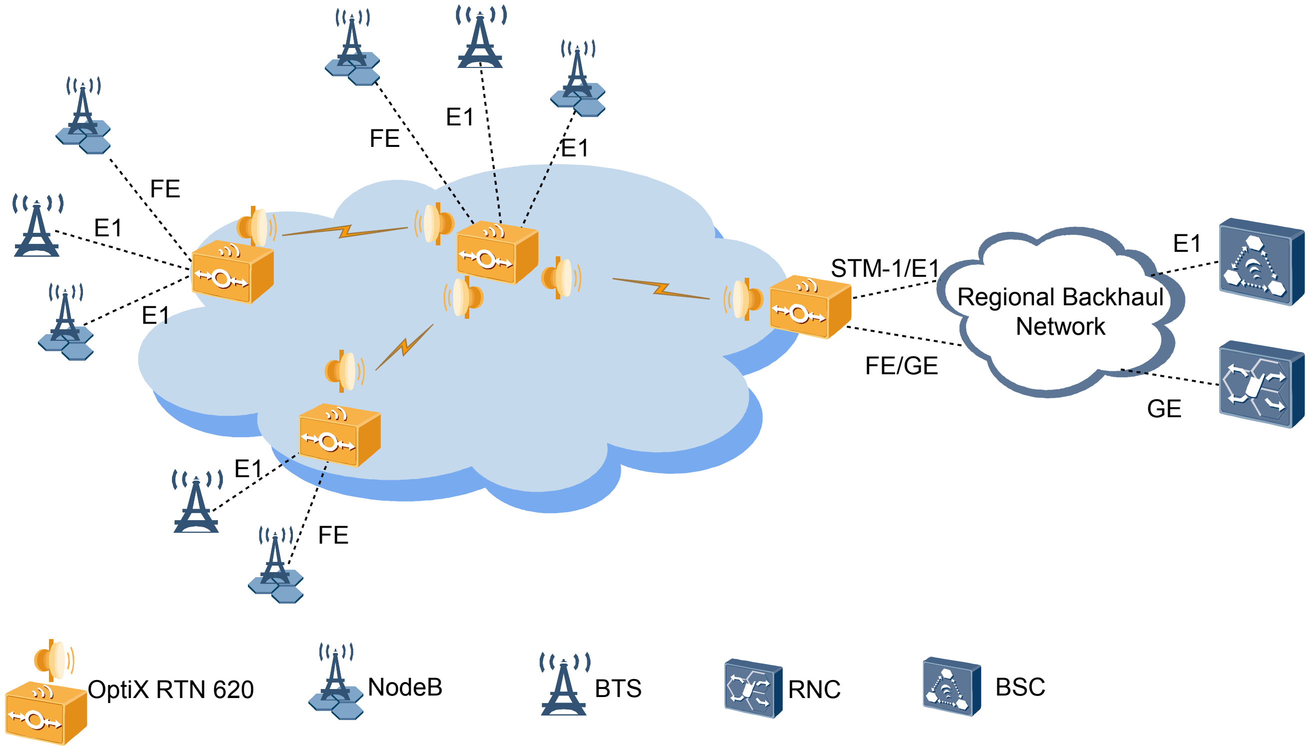
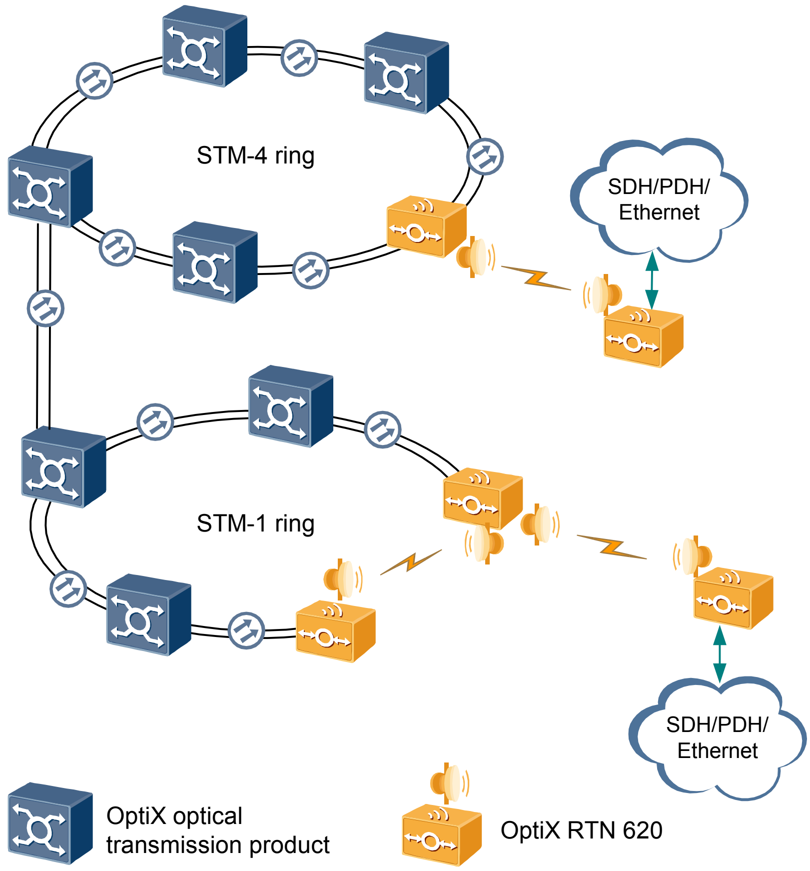


**Figure 1-2** Hybrid microwave transmission solution provided by the OptiX RTN 620




The OptiX RTN 620 can be networked with other OptiX transmission products. Thus, it can provide an optical transmission and radio transmission seamlessly integrated solution to transmit SDH, PDH, and Ethernet services.

**Figure 1-3** Hybrid transmission network of the OptiX RTN 620 and other OptiX transmission products




# 1.2 Components

The OptiX RTN 620 is of a split structure, consisting of the IDU 620 and the ODU. Each ODU is connected to the IDU 620 through a coaxial cable.

## IDU 620

The IDU 620 is the indoor unit of the OptiX RTN 620. It accesses services, performs multiplexing/demultiplexing and IF processing of the services, and provide system control and communication function.

**Table 1-1** provides the brief introduction to the IDU 620.

**Table 1-1** Introduction to the IDU 620

| Item | Performance |
|---|---|
| Chassis height | 2U |
| Pluggable | Supported |

| Item | Performance |
|---|---|
| Number of microwave directions | 1 to 4 |
| RF configuration mode | 1+0 non-protection configuration<br>1+1 protection configuration<br>N+1 protection configuration (N = 2 or N = 3)<br>XPIC configuration |

**Figure 1-4** IDU 620

# ODU

The ODU is the outdoor unit of the OptiX RTN 620. It performs frequency conversion and amplification of signals.

The OptiX RTN 620 provide a complete ODU solution, and support an entire frequency band from 6 GHz to 38 GHz. OptiX RTN 620 supports the RTN 600 ODU and RTN XMC ODU. The ODU is available in three series: standard power, high power, and low capacity for PDH to meet the requirements of different scenarios.

**NOTE**

Unlike the other frequency bands that use 14 MHz, 28 MHz, or 56 MHz channel spacing, the 18 GHz frequency band uses 13.75 MHz, 27.5 MHz, or 55 MHz channel spacing correspondingly.

**Table 1-2** RTN 600 ODUs supported by the OptiX RTN 620

| Item | Description | | |
|---|---|---|---|
| | Standard Power ODU | High Power ODU | Low Capacity for PDH ODU |
| ODU type | SP and SPA | HP | LP and LPA |

| Item | Description | | |
|---|---|---|---|
| | Standard Power ODU | High Power ODU | Low Capacity for PDH ODU |
| Frequency band | 7/8/11/13/15/18/23/26/38 GHz (SP ODU)<br>6/7/8/11/13/15/18/23 GHz (SPA ODU) | 7/8/11/13/15/18/23/26/32/38 GHz | 7/8/11/13/15/18/23 GHz (LP ODU)<br>7/8/11/13/15/18/23/26/32/38 GHz (LPA ODU) |
| Microwave modulation mode | QPSK/16QAM/32QAM/64QAM/128QAM/256QAM (SP ODU)<br>QPSK/16QAM/32QAM/64QAM/128QAM (SPA ODU) | QPSK/16QAM/32QAM/64QAM/128QAM/256QAM | QPSK/16QAM |
| Channel spacing | 3.5/7/14/28 MHz | 7/14/28/40/56 MHz | 3.5/7/14/28 MHz |

**Table 1-3** RTN XMC ODUs supported by the OptiX RTN 620

| Item | Description | |
|---|---|---|
| | High Power ODU | Low Capacity for PDH ODU |
| ODU type | XMC-2 | XMC-1 |
| Frequency band | 7/8/13/15/18/23 GHz | 7/8/13/15/18/23 GHz |
| Microwave modulation mode | QPSK/16QAM/32QAM/64QAM/128QAM/256QAM | QPSK/16QAM |
| Channel spacing | 7/14/28/56 MHz, (7/13/15/18/23 GHz)<br>7/14/28/40/56 MHz, (8 GHz) | 3.5/7/14/28 MHz |

There are two methods of mounting the ODU and the antenna: direct mounting and split mounting.

- The direct mounting method is normally adopted when a small-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 (hereinafter referred to as a hybrid coupler) must be mounted to connect the ODUs to the antenna. **Figure 1-5** shows the direct mounting.

**Figure 1-5** Direct mounting

- The separate mounting method is adopted when a double-polarized antenna or big-diameter and single-polarized antenna is used. **Figure 1-6** shows the split mounting. In this situation, a hybrid coupler can be mounted to enable two ODUs to share one feed boom.

**Figure 1-6** Separate mounting

# 1.3 Radio Link Form

The OptiX RTN 620 provides the radio links of different forms by flexibly configuring different IF boards and ODUs to meet the requirements of different microwave application scenarios.

**Table 1-4** Radio link forms of the OptiX RTN 620

| Radio Link Form | Type of the IF Board | Type of ODU |
|---|---|---|
| PDH radio link [a] | IF0A/IF0B | Low capacity for PDH ODU |
| SDH/PDH radio link | IF1A/IF1B | The standard power ODU or the high power ODU |
| XPIC SDH radio link | IFX | The standard power ODU or the high power ODU |
| Hybrid radio link | IFH2 | The standard power ODU or the high power ODU |

NOTE

a: This radio link form applies to the scenario wherein the OptiX RTN 600 is interconnected with the OptiX RTN 605.

# 2 Functions and Features

## About This Chapter

The OptiX RTN 620 provides plentiful functions and features to ensure the quality and efficiency of service transmission.

2.1 Frequency Band
The OptiX RTN 620 provides the products of full frequency bands.

2.2 Microwave Type
The OptiX RTN 620 supports several microwave types.

2.3 Modulation Strategy
The SDH microwave and the PDH microwave support the fixed modulation. The Hybrid microwave supports the fixed modulation and adaptive modulation.

2.4 RF Configuration Modes
The OptiX RTN 620 supports the 1+0 protection configuration, 1+1 protection configuration, N+1 protection configuration, and XPIC configuration.

2.5 Interfaces
The OptiX RTN 620 has several interface types.

2.6 Cross-Polarization Interference Cancellation
The cross-polarization interference cancellation (XPIC) is a technology used together with co-channel dual-polarization (CCDP). The application of the two technologies doubles the wireless link capacity over the same channel.

2.7 Automatic Transmit Power Control
The automatic transmit power control (ATPC) function enables the output power of the transmitter to automatically trace the level fluctuation at the receive end. This technology reduces the interference with neighboring systems and residual BER rate.

2.8 Ethernet Processing Capability
The OptiX RTN 620 provides powerful Ethernet service processing capability.

2.9 Clock Features
The following clock features of the OptiX RTN 620 meet the requirements for transporting the clock of the mobile communication network.

[2.10 Protection Capability](#)
The OptiX RTN 620 provides comprehensive protection schemes.

[2.11 Network Management](#)
The OptiX RTN 620 supports multiple network management (NM) modes, and provides complete NM information exchange schemes.

[2.12 Easy Installation](#)
The OptiX RTN 620 supports several installation modes. Therefore, the installation is flexible and convenient.

[2.13 Easy Maintenance](#)
The OptiX RTN 620 provides several maintenance features. Therefore, it can effectively reduce the cost of equipment maintenance.

# 2.1 Frequency Band

The OptiX RTN 620 provides the products of full frequency bands.

- When the OptiX RTN 620 uses the standard power ODU, the 6, 7, 8, 11, 13, 15, 18, 23, 26, and 38 GHz frequency bands are supported.
- When the OptiX RTN 620 uses the high power ODU, the 7, 8, 11, 13, 15, 18, 23, 26, 32, and 38 GHz frequency bands are supported.
- When the OptiX RTN 620 uses the low capacity for PDH ODU , the 7, 8, 11, 13, 15, 18, 23, 26, 32, and 38 GHz frequency bands are supported.

# 2.2 Microwave Type

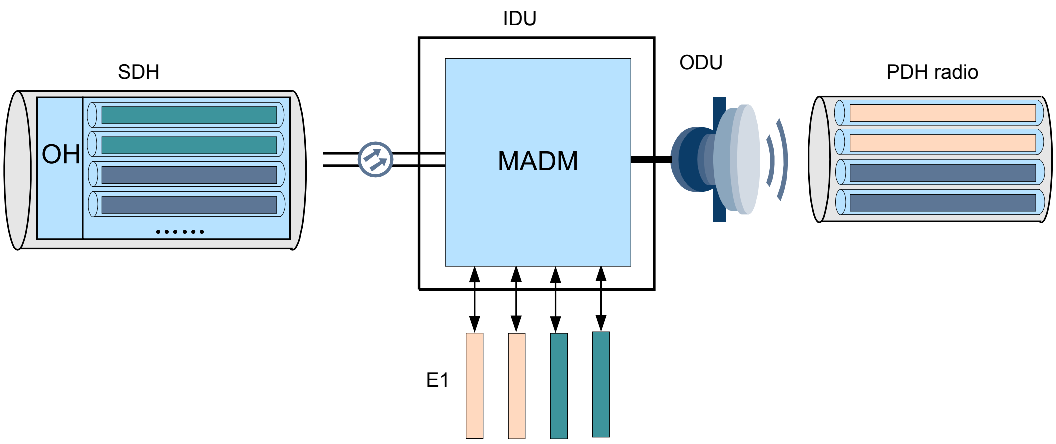
The OptiX RTN 620 supports several microwave types.

## 2.2.1 PDH Microwave

The PDH microwave refers to the microwave that transmits only the PDH services (mainly, the E1 services). During the transmission, the PDH microwave does not change the features of the PDH services.

Different from the traditional PDH microwave equipment, the OptiX RTN 620 embeds the MADM, which grooms E1 services and E1 signals of the SDH line to the microwave port through the cross-connect matrix, and then transmits the signals over the PDH microwave. In this manner, the free grooming of services and the seamless convergence with the optical transmission network are implemented.

**Figure 2-1** PDH microwave

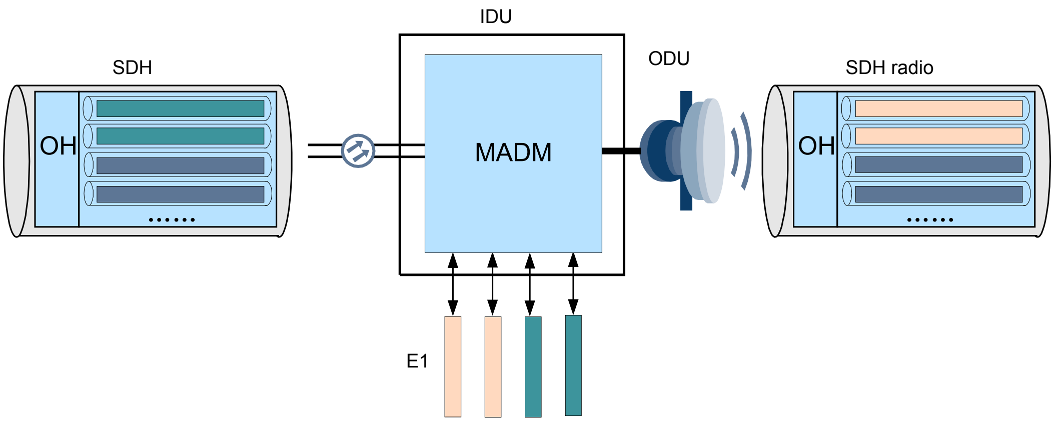



## 2.2.2 SDH Microwave

The SDH microwave refers to the microwave that transmits SDH services. During the transmission, the SDH microwave does not change the features of the SDH services.

The OptiX RTN 620 embeds the MADM, which grooms services to the microwave port through cross-connections, maps the services into the STM-1-based microwave frames, and then transmits the STM-1-based microwave frames. In this manner, the free grooming of services and the seamless convergence with the optical transmission network are implemented.

**Figure 2-2** SDH microwave

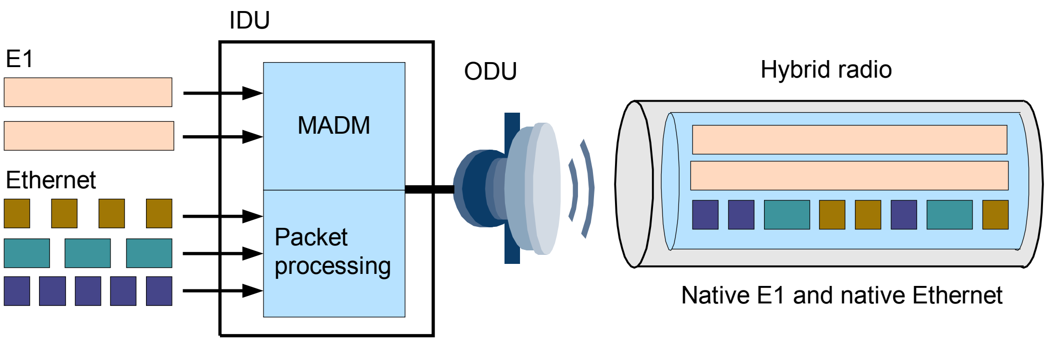



## 2.2.3 Hybrid Microwave

The Hybrid microwave refers to the microwave that transmits native E1 services and native Ethernet services in hybrid mode. The hybrid microwave can support AM function.

The OptiX RTN 620 embeds the MADM and the packet processing platform. The MADM transmits E1 services that are accessed locally or extracted from the SDH to the microwave port. After processing the accessed Ethernet services in the unified manner, the packet processing platform transmits the Ethernet services to the microwave port. The microwave port maps the E1 services and the Ethernet services into Hybrid microwave frames and then transmits the Hybrid microwave frames.

**Figure 2-3** Hybrid microwave



# 2.3 Modulation Strategy

The SDH microwave and the PDH microwave support the fixed modulation. The Hybrid microwave supports the fixed modulation and adaptive modulation.

## 2.3.1 Fixed Modulation

The fixed modulation refers to a modulation strategy wherein a modulation mode is adopted invariably when the radio link is running.

When the OptiX RTN 620 uses the fixed modulation, you can set the modulation mode by using the software.

## 2.3.2 Adaptive Modulation

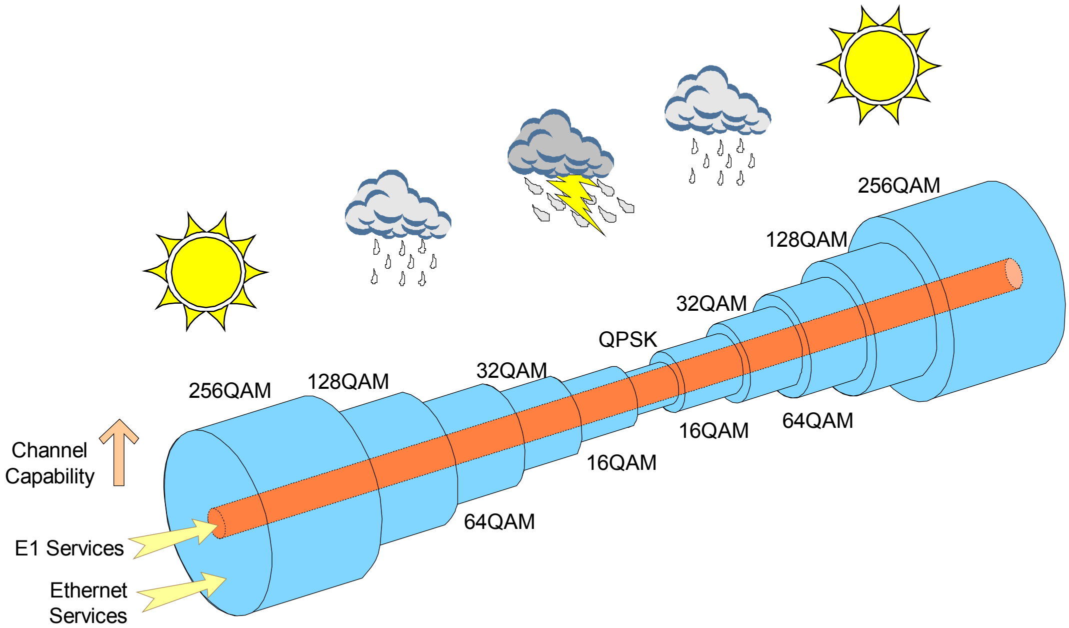
The adaptive modulation (AM) is a technology wherein the modulation mode can be adjusted automatically according to the channel quality.

In the case of the same channel spacing, the microwave service bandwidth varies with the modulation mode. The higher the modulation efficiency, the higher is the bandwidth of the transmitted services but the poorer is the anti-interference capability of the link. When the channel quality is favorable (such as on days when the weather is favorable), the equipment adopts a higher modulation mode to transmit more user services. In this manner, the transmission efficiency and the spectrum utilization of the system are improved. When the channel quality is degraded (such as on days when the weather is stormy and foggy), the equipment adopts a lower modulation mode to transmit only the services with a higher priority within the available bandwidth and to discard the services with a lower priority. In this manner, the anti-interference capability of a link is improved and the link availability of the services with a higher priority is ensured.

When the Hybrid microwave equipment adopts the AM technology, it controls service transmission based on the service bandwidth and QoS policy corresponding to the current modulation mode. The E1 services have the highest priority. By adopting the CoS technology, the equipment schedule the Ethernet services of different types to the queues of different priorities. The services in the queues with different priorities are transmitted to the microwave port through the SP or WRR algorithm. When the queues of certain priorities are congested because of insufficient microwave bandwidth, the queues of these priorities discard certain or all services. When the Hybrid microwave works in the lowest modulation mode, the equipment transmits only the E1 services. If there is extra bandwidth, the equipment can also transmits the services with a high priority. When the Hybrid microwave works in any other modulation modes, all the additional bandwidth is used to transmit the Ethernet services. In this manner, the availability of the links that carry the E1 services and the Ethernet services with a high priority is ensured, and the Ethernet service capacity is increased.

**Figure 2-4** shows the service change caused by the AM. The orange part indicates the E1 services. The blue part indicates the Ethernet services. The closer to the edge of the blue part, the lower is the priority of the Ethernet service. Under all channel conditions, the E1 services occupy the specific bandwidth that is permanently available. Thus, the availability of the E1 services is ensured. The bandwidth for the Ethernet services varies with the channel conditions. When the channel is in bad conditions, the Ethernet services with a low priority are discarded.

**Figure 2-4** Adaptive modulation




The AM technology adopted by the OptiX RTN 620 has the following features:

- The AM technology can use the QPSK, 16QAM, 32QAM, 64QAM, 128QAM, and 256QAM modulation modes.
- The lowest modulation mode (also called "reference mode") and the highest modulation mode (also called "nominal mode") actually used by the AM can be set.
- When the modulation modes of the AM are switched, the transmit frequency, receive frequency, and channel spacing do not change.
- When the modulation modes of the AM are switched, the step-by-step switching method is adopted.
- When the AM switches the modulation mode, the services with a low priority are discarded but no bit errors or slips occur in the services with a high priority. The speed of switching the modulation mode meets the requirement for no bit error in the case of 100 dB/s fast fading.

# 2.4 RF Configuration Modes

The OptiX RTN 620 supports the 1+0 protection configuration, 1+1 protection configuration, N+1 protection configuration, and XPIC configuration.

Table 2-1 provides the RF configuration modes that are supported by the OptiX RTN 620.

**Table 2-1** RF configuration modes

| Configuration Mode | Maximum Number of Directions |
|---|---|
| 1+0 non-protection configuration | 4 |

| Configuration Mode | | Maximum Number of Directions |
|---|---|---|
| 1+1 protection configuration (1+1 HSB/FD/SD) | | 2 |
| N+1 protection configuration | 2+1 (for one NE) | 1 |
| | 3+1 (for two NEs) | 1 |
| XPIC configuration | | 2 |

NOTE

The Hybrid microwave and the PDH microwave do not support the N+1 protection configuration and the XPIC configuration.

# 2.5 Interfaces

The OptiX RTN 620 has several interface types.

## 2.5.1 Microwave Interfaces

The OptiX RTN 620 provides the microwave interface through the IF board and the ODU. Each microwave interface transmits one channel of microwave service. In addition, each microwave interface transmits various auxiliary services or paths through the microwave overheads.

**Table 2-2** provides the auxiliary services or paths transmitted by each microwave interface.

**Table 2-2** Auxiliary services or paths transmitted by each microwave interface

| Service/Path Type | Quantity | Rate |
|---|---|---|
| Asynchronous data service | 1 | ≤ 19.2 Kbit/s |
| Synchronous data service | 1 | 64 Kbit/s |
| Orderwire phone service | 1 | 64 Kbit/s |
| Wayside E1 service | 1 | 2048 Kbit/s |

| Service/Path Type | Quantity | Rate |
|---|---|---|
| DCC channel | 1 | 64 kbit/s (the PDH microwave provided by the IF1 board and the capacity is less than 16xE1.)<br>192 kbit/s (the SDH/PDH microwave provided by the IF1 board and the capacity is not less than 16xE1.)<br>192 kbit/s (the PDH microwave provided by the IF0 board.)<br>192 kbit/s (the Hybrid microwave) |

## 2.5.2 Service Interfaces

The OptiX RTN 620 provides different types of service interfaces by housing different types of service interface boards.

**Table 2-3** Service interfaces provided by different types of service interface boards

| Type of the service interface board | Service Interface | Number of Interfaces Provided by One Board | Maximum Number of Boards |
|---|---|---|---|
| PO1 | 75/120-ohm E1 interface | 8 | 4 |
| PH1 | 75/120-ohm E1 interface | 16 | 4 |
| PD1 | 75/120-ohm E1 interface | 32 | 4 |
| PL3 | 75-ohm E3/T3 interface | 3 | 4 |
| SL4 | STM-4 optical interfaces: S-4.1, L-4.1, and L-4.2 | 1 | 2 |
| SL1 | STM-1 optical interface: Ie-1, S-1.1, L-1.1, and L-1.2 | 1 | 4 |
| SD1 | STM-1 optical interface: Ie-1, S-1.1, L-1.1, and L-1.2 | 2 | 4 |
| SLE | 75-ohm STM-1 electrical interface | 1 | 4 |
| SDE | 75-ohm STM-1 electrical interface | 2 | 4 |

| Type of the service interface board | Service Interface | Number of Interfaces Provided by One Board | Maximum Number of Boards |
|---|---|---|---|
| EFT4 | FE electrical interface: 10/100BASE-T(X) | 4 | 4 |
| EMS6 | FE electrical interface: 10/100BASE-T(X) | 4 | 4 |
| | GE electrical interface: 10/100/1000BASE-T(X) or<br>GE optical interface: 1000Base-SX, 1000Base-LX | 2 | |

NOTE

- The IFH2 board provides a 10/100/1000BASE-T(X) GE electrical interface, which can access Ethernet services directly.
- "Maximum Number of Boards" in **Table 2-3** is the maximum number calculated when at least one IF board is configured.

## 2.5.3 Management and Auxiliary Interfaces

The OptiX RTN 620 provides several types of management and auxiliary interfaces.

**Table 2-4** Management and auxiliary interfaces

| Interface | Specifications | Quantity |
|---|---|---|
| External clock interface | Combined 75-ohm 2048 kbit/s or 2048 kHz clock input/output interface | 1 |
| Management interface | 10/100BASE-T(X) Ethernet NM interface | 1 |
| | NM serial interface | 1 |
| | 10/100BASE-T(X) NE cascade interface | 1 |
| Auxiliary interface | Orderwire interface | 1 |
| | RS-232 asynchronous data interface | 1 |
| | 64 kbit/s synchronous data interface | 1 |
| | Wayside E1 interface | 1 |
| Alarm interface | Alarm input/output interface | Six inputs + two outputs |

NOTE

- The external clock interface and wayside E1 interface are combined into one interface. This interface can also transparently transmit the overhead byte, including the DCC byte, synchronous/asynchronous data overhead byte, and orderwire overhead byte). This interface, however, can realize only one function at one time.
- The synchronous data interface can also transparently transmit one orderwire overhead byte. This interface, however, can realize only one function at one time.

# 2.6 Cross-Polarization Interference Cancellation

The cross-polarization interference cancellation (XPIC) is a technology used together with co-channel dual-polarization (CCDP). The application of the two technologies doubles the wireless link capacity over the same channel.

The CCDP transmission adopts both the horizontally polarized wave and the vertically polarized wave over one channel to transmit two channels of signals. The ideal situation of the CCDP transmission is that no interference occurs between the two orthogonal signals though they are with the same frequency, and thus the receiver can easily recover the two signals. In actual engineering conditions, however, despite the orthogonality of the two signals, certain interference between the signals inevitably occurs, due to cross-polarization discrimination (XPD) of the antenna and channel degradation. To cancel the interference, the XPIC technology is adopted. In XPIC technology, the signals are received in the horizontal and vertical directions. The signals in the two directions are then processed and the original signals are recovered.

# 2.7 Automatic Transmit Power Control

The automatic transmit power control (ATPC) function enables the output power of the transmitter to automatically trace the level fluctuation at the receive end. This technology reduces the interference with neighboring systems and residual BER rate.

# 2.8 Ethernet Processing Capability

The OptiX RTN 620 provides powerful Ethernet service processing capability.

The OptiX RTN 620 transmits Ethernet services by using the following two methods. One method involves using the Ethernet over SDH technology to encapsulate and map the Ethernet service into a VC channel, and then to transmit the SDH/PDH microwave frames in the TU or STM-1 mode. The other method involves using the Hybrid microwave to transmit Ethernet services. The OptiX RTN 620 supports two types of Ethernet processing boards to realize access and processing of Ethernet services. When the Ethernet over SDH technology is used to transmit Ethernet services, the EFT4 board or EMS6 board can be used to process Ethernet services. When the Hybrid microwave is used to transmit Ethernet services, the EMS6 board can be used to process Ethernet services.

**Table 2-5** Principle functions of Ethernet service processing boards

| Feature | Board | |
|---|---|---|
| | **EFT4** | **EMS6** |
| Interfaces | 4xFE | 2xGE/FE + 4xFE |
| Format of service frames | Ethernet II, IEEE 802.3, IEEE 802.1q/p | |
| Jumbo frame | Supports the jumbo frame with a maximum length of 9600 bytes. | |
| Uplink bandwidth | 2 x VC-4 | |
| Mapping mode | VC-12, VC-3, VC-12-xv (x≤63), and VC-3-xv (x≤6) | |
| Number of VCTRUNKs | 4 | 8 |
| Transparent transmission of Ethernet services | Supported | Supported |
| Layer 2 switching of Ethernet services | Not supported | Supported |
| VLAN | Supports the transparent transmission. | Supports the VLAN and QinQ. Supports addition, deletion, and exchange of VLAN tags that comply with IEEE 802.1q/p. |
| QoS | Not supported | Supported |
| STP/RSTP | Not supported | Supported |
| IGMP snooping | Not supported | Supported |
| Encapsulation format | GFP, LAPS, and HDLC | |
| LCAS | Supported | |
| Flow control | IEEE 802.3x | |
| Test frames | Supported | |
| Ethernet performance monitoring | Supports the RMON performance monitoring that complies with IETF RFC 2819. | |
| ETH-OAM | Not supported | IEEE 802.1ag and IEEE 802.3ah |
| Link aggregation | Not supported | Supported |
| LPT | Supported | |

**NOTE**

The IFH2 board provides the simple Ethernet service processing functions, including the flow control, QoS, and the synchronous Ethernet. Thus, the IFH2 board can process the directly accessed Ethernet services.

# 2.9 Clock Features

The following clock features of the OptiX RTN 620 meet the requirements for transporting the clock of the mobile communication network.

- Supports extraction of the clock sources from the line, tributary, microwave, Ethernet, and external clock signals.
- Supports the SSM protocol and extended SSM protocol. The SSM information can be transmitted over the SDH line and STM-1 microwave.
- Supports the re-timing function of the tributary.
- Supports the synchronous Ethernet.

# 2.10 Protection Capability

The OptiX RTN 620 provides comprehensive protection schemes.

- The OptiX RTN 620 supports 1+1 backup of the input power supply. The OptiX RTN 620 provides two internal power modules that work in 1+1 backup mode.
- The OptiX RTN 620 supports 1+1 backup of the cross-connect units and clock units.
- The OptiX RTN 620 supports 1+1 protection configuration and N+1 protection configuration.
- The OptiX RTN 620 supports the SNCP configuration between the optical transmission links, between the wireless links, and between the optical transmission link and the wireless link.
- The OptiX RTN 620 supports the linear MSP for the optical transmission link and the STM-le link.
- The OptiX RTN 620 supports the two-fiber bidirectional MSP between the STM-4 optical transmission links.
- The OptiX RTN 620 supports the STP/RSTP or the LAG to protect Ethernet services.

# 2.11 Network Management

The OptiX RTN 620 supports multiple network management (NM) modes, and provides complete NM information exchange schemes.

## NM Mode

The OptiX RTN 620 supports the following functions:

- Accessing the iManager T2000 Web LCT (hereinafter referred to as the Web LCT) directly at the near end of the NE to perform the single-point management over the NE
- Using the iManager T2000 Web LCT to manage multiple OptiX RTN NEs in the centralized manner
- Using the OptiX iManager T2000 to manage all OptiX RTN NEs on the transmission network and the NEs of Huawei optical transmission products in the centralized manner and to manage the transmission networks in the unified manner

- Using the SNMP agent to query alarms and performance events

### NM Information Exchange Schemes

At the physical layer, the OptiX RTN 620 supports the following NM information exchange schemes:

- Using one or three Huawei-defined DCC bytes in the PDH microwave frame to transmit NM information
- Using the D1–D3 and D4–D12 bytes or D1–D12 bytes in the SDH microwave frame and the SDH frame to transmit NM information
- Using three Huawei-defined bytes in the Hybrid microwave frame to transmit NM information
- Using the Ethernet NM interface to transmit NM information
- Using the DCC bytes that are transmitted by the external clock interface to transmit NM information over an SDH/PDH network

At the network layer, the OptiX RTN 620 supports the following NM information exchange schemes:

- Using the HW ECC protocol to carry the NM information
- Using the IP over DCC technology to carry the NM information
- Using the OSI over DCC technology to carry the NM information

## 2.12 Easy Installation

The OptiX RTN 620 supports several installation modes. Therefore, the installation is flexible and convenient.

The IDU can be installed in the following modes:

- In a 300 mm ETSI cabinet
- In a 600 mm ETSI cabinet
- In a 450 mm 19-inch cabinet
- In a 600 mm 19-inch cabinet
- In an open cabinet
- On a wall
- On a desk

The ODU supports two installation modes: direct mounting and separate mounting.

## 2.13 Easy Maintenance

The OptiX RTN 620 provides several maintenance features. Therefore, it can effectively reduce the cost of equipment maintenance.

- Provides SDH alarms and performance events that comply with ITU-T G.783.
- Supports various loopback functions of service ports and IF ports.

- Embeds a test system, which can be used to perform the following tests when no special test tools are available:
  - Supports the pseudo-random binary sequence (PRBS) test on the PDH port and IF port.
  - Receives and transmits Ethernet test frames.
- Supports the monitoring and the graphic display of key radio transmission performance specifications such as the microwave transmit power and the received signal strength indicator (RSSI).
- Supports the RMON performance events and ETH-OAM.
- Supports removal of the memory card that saves the data configuration files. Thus, you can restore the data of the SCC board by replacing the memory card.
- Supports remote loading of the NE software and data by using the NMS.
- Supports the hot patch loading function. Thus, you can upgrade the software that is running without interrupting services.
- Support the software version rollback function. When a software upgrade fails, the original services of the system can be restored.

# 3 Product Structure

## About This Chapter

This topic describes the system structure, hardware structure, and software structure of the product, and the process for processing service signals.



 Huawei Proprietary and Confidential 

# 3.1 System Architecture

The OptiX RTN 620 consists of a series of functional units, including the service interface unit, cross-connect unit, IF unit, control unit, clock unit, auxiliary interface unit, fan unit, power unit, and ODU.

**Figure 3-1** System architecture

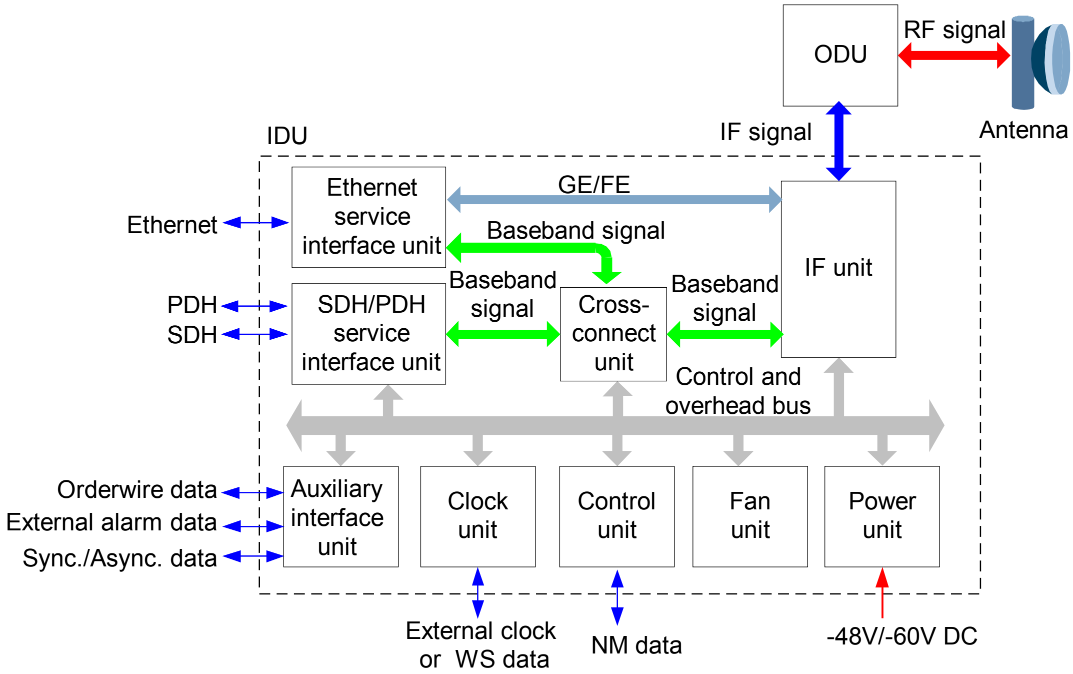



**Table 3-1** Functional units

| Functional Unit | Function Description |
|---|---|
| SDH/PDH Service interface unit | ● Accesses SDH signals.<br>● Accesses PDH signals. |
| Ethernet Service interface unit | Accesses Ethernet signals. |
| Cross-connect unit | ● Cross-connects and grooms services.<br>● Supports 1+1 standby. |

| Functional Unit | Function Description |
| --- | --- |
| IF unit | ● Maps service signals to microwave frame signals and demaps microwave frame signals to service signals.<br>● Performs conversion between microwave frame signals and IF analog signals.<br>● Provides the O&M channel between the IDU and the ODU.<br>● Supports FEC. |
| Control unit | ● System communications and control.<br>● System configuration and management.<br>● Collects alarms and monitors performance.<br>● Cross-connects overheads. |
| Clock unit | ● Traces the clock source signal and provides various clock signals for the system.<br>● Supports input and output of one external clock signal. |
| Auxiliary interface unit | ● Provides the orderwire interface.<br>● Provides the synchronous/asynchronous data interface.<br>● Provides the external alarm input/output interface. |
| Power unit | ● Accesses –48 V/–60 V DC power.<br>● Provides –48 V/+3.3 V power for the IDU.<br>● Provides –48 V power for the ODU. |
| Fan unit | ● Provides wind cooling for the IDU. |
| ODU | ● Converses between the IF analog signal and the RF signal.<br>● Provides the O&M channel that is connected to the IDU. |

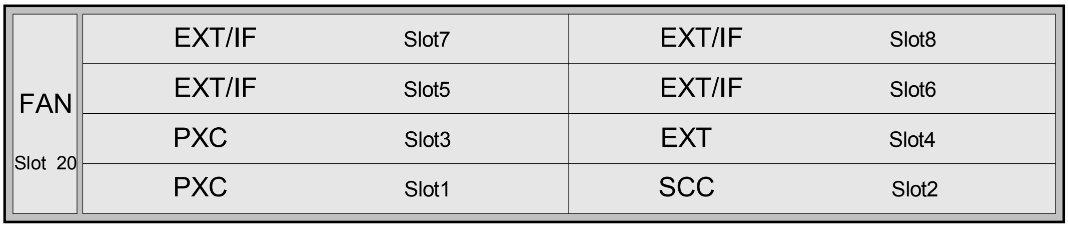
# 3.2 Hardware Structure

The OptiX RTN 620 is of a split structure, consisting of the IDU and the ODU. Each ODU is connected to the IDU through a coaxial cable. The coaxial cable transmits IF service signals and the O&M signals of the ODU. In addition, the coaxial cable supplies –48 V power supply to the ODU.

## 3.2.1 IDU

The IDU 620 can realize different functions by configuring different types of boards.

**Figure 3-2** IDU 620 configuration




NOTE

EXT refers to the extended slot for a service board. IF refers to the slot for an IF board.

**Table 3-2** List of IDU 620 boards

| Board Name | Full Name | Valid Slot | Description |
|---|---|---|---|
| PXC | Integrated power cross-connect clock board | Slot 1/3 | Accesses one input of –48 V/–60 V DC power<br>Provides a full timeslot cross-connection for VC-12/VC-3/VC-4 services equivalent to 16x16 VC-4.<br>Supports the input and output of one external clock signal. |
| SCC | System control and communication board | Slot 2 | Integrates an EOW subboard, occupying the logical slot 21.<br>Provides the NM interface, external alarm interface, synchronous/asynchronous data interface, and orderwire phone interface. |
| IF1A | SDH intermediate frequency board | Slot 5/6/7/8 | Provides one IF interface. The logical slot number of the ODU that is connected to the IF board is 10 plus the slot number of the IF board.<br>The IF1A and IF1B boards support the TU-based and STM-1 based microwave frame structures for establishing microwave links between two sets of IDU 610 or IDU 620. The IF0A and IF0B boards support the E1-based microwave frame structure for establishing microwave links with the IDU 605 1A/1B/2B. |
| IF1B | SDH intermediate frequency board | | |
| IF0A | PDH intermediate frequency board | Slot 5/6/7/8 | |
| IF0B | PDH intermediate frequency board | | |

| Board Name | Full Name | Valid Slot | Description |
|---|---|---|---|
| IFX | XPIC intermediate frequency board | Slot 5/6/7/8 | Provides one IF interface. The logical slot number of the ODU that is connected to the IF board is 10 plus the slot number of the IF board.<br>Provides the XPIC function.<br>Provides the STM-1 based microwave frame structure.<br>Supports only the DC-C power distribution mode. |
| IFH2 | Hybrid intermediate frequency board | Slot 5/6/7/8 | ● Provides one IF interface. The logical slot number of the ODU that is connected to the IF board is 10 plus the slot number of the IF board.<br>● Provides one FE/GE electrical interface for accessing Ethernet services.<br>● Supports the AM function. |
| SL4 | SDH single-port STM-4 board | Slot 6/8 | Uses the SFP optical module to provide one STM-4 optical interface. |
| SL1 | SDH single-port STM-1 board | Slot 4/5/6/7/8 | Uses the SFP optical module to provide one STM-1 optical interface. |
| SD1 | SDH dual-port STM-1 board | | Uses the SFP optical module to provide two STM-1 optical interfaces. |
| SLE | SDH single-port STM-1 electrical board | | Provides one 75-ohm STM-1 electrical interface. |
| SDE | SDH dual-port STM-1 electrical board | | Provides two 75-ohm STM-1 electrical interfaces. |
| PL3 | 3xE3/T3 tributary board | Slot 4/5/6/7/8 | Provides three 75-ohm E3/T3 electrical interfaces. |
| PO1 | 8xE1 tributary board | | Provides eight 75/120-ohm E1 interfaces. |
| PH1 | 16xE1 tributary board | | Provides 16 75/120-ohm E1 interfaces. |
| PD1 | 32xE1 tributary board | | Provides 32 75/120-ohm E1 interfaces. |

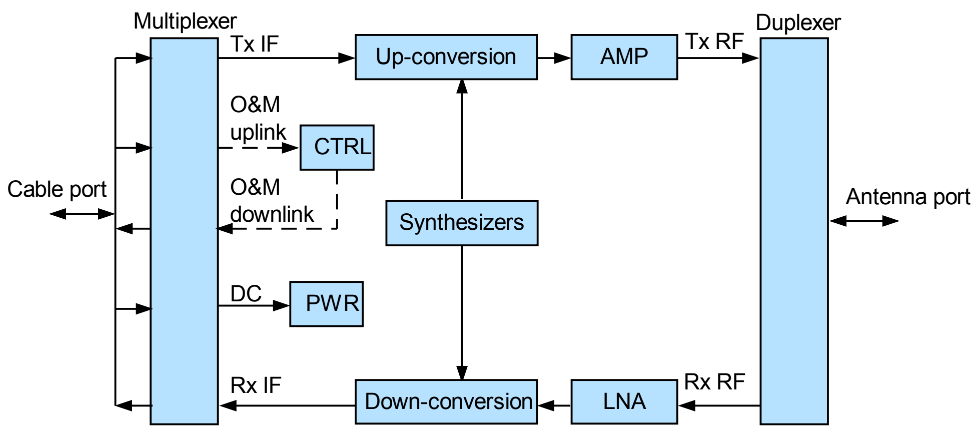
| Board Name | Full Name | Valid Slot | Description |
|---|---|---|---|
| EFT4 | 4-port 10M/100M Ethernet transparent transmission processing board | Slot 4/5/6/7/8 | Provides a 4x10/100BASE-T(X) interface for processing Ethernet transparent transmission services. The maximum uplink bandwidth of the board is 2xVC-4. |
| EMS6 | 4-port RJ45 + 2-port SFP Fast Ethernet / Gigabit Ethernet Switching Processing Board | | Provides four FE electrical interfaces. The other two ports use SFP optical/electrical modules for providing two GE optical/electrical interfaces. The GE electrical interface is compatible with the FE electrical interface.<br>Supports the transparently transmitted Ethernet transparent transmission services and Layer 2 switching services. The maximum uplink bandwidth of the board is 2xVC-4. |
| FAN | Fan board | Slot 20 | Provides wind cooling for the IDU 620. |

## 3.2.2 ODU

The ODU is an integrated system and is of various types. The structures and working principles of various types of ODUs are the same.

### Block Diagram

**Figure 3-3** Block diagram of the ODU



### Signal Processing in the Transmit Direction

The multiplexer splits the signal coming from the IF cable into a 350 MHz IF signal, an O&M uplink signal, and a –48 V DC power signal.

In the transmit direction, the IF signal is processed as follows:

1. Through the up-conversion, filtering, and amplification, the IF signal is converted into the RF signal and then sent to the AMP amplifier unit.
2. The AMP amplifies the RF signal (the output power of the signal can be controlled by the IDU software).
3. After the amplification, the RF signal is sent to the antenna through the diplexer.

The O&M uplink signal is a 5.5 MHz ASK-modulated signal and is demodulated in the CTRL control unit.

The –48 V DC power signal is sent to the PWR power unit where the secondary power supply of a different voltage is generated and provided to the modules of the ODU.

### Signal Processing in the Receive Direction

In the diplexer, the receive RF signal is separated from the antenna signal. The RF signal is amplified in the low noise amplifier (LNA). Through the down-conversion, filtering, and amplification, the RF signal is converted into the 140 MHz IF signal and then sent to the multiplexer.

The O&M downlink signal is modulated under the ASK mode in the CTRL unit. The 10 MHz signal is generated through the modulation and sent to the multiplexer. The CTRL unit also detects the receive signal level through the RSSI detection circuit and provides the RSSI interface.

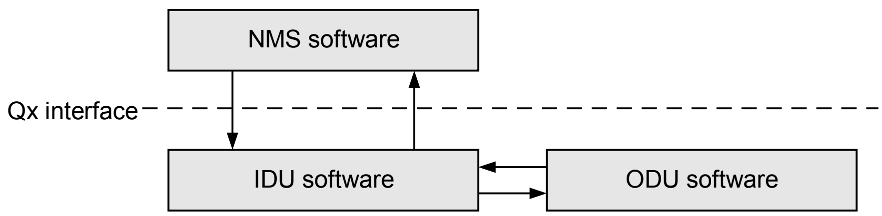
The IF signal and the O&M downlink signal are combined in the multiplexer and then sent to the IDU through the IF cable.

## 3.3 Software Architecture

The software package of the OptiX RTN 600 contains the NMS software, IDU software, and ODU software.

For the software architecture of the OptiX RTN 600, see **Figure 3-4**. The NMS software communicates with the IDU software through the Qx interface. The Qx interface uses the OptiX private management protocol.

**Figure 3-4** Software architecture of the OptiX RTN 600



## 3.3.1 NMS Software

Huawei provides a transport network management solution that meets the requirements of the telecommunication management network (TMN) for managing all the OptiX RTN 600 products and OptiX series optical transmission products in the network.

For details, refer to section **5 Network Management System**.

## 3.3.2 IDU Software

The IDU software consists of the NE software and the board software.

The NE software manages, monitors, and controls the running status of the IDU. Through the NE software, the NMS communicates with the boards, and controls and manages the NE. In addition, the NE software communicates with the ODU software to manage and control the ODU running.

The board software manages and controls the running status of other boards of the IDU except the SCC board. Currently, the IDU does not have the independent board software except the software of the EMS6 board. The board software of the IDU, in the form of modules, is integrated into the NE software and runs in the CPU of the SCC board.

## 3.3.3 ODU Software

The ODU software manages and controls the running status of the ODU. The ODU software controls the running status of the ODU according to the parameter delivered by the IDU software. In addition, the running status of the ODU is reported to the IDU software.

# 3.4 Service Signal Processing Flow

The flow for transmitting the SDH/PDH microwave signals is different from the flow for transmitting the Hybrid microwave signals.

## 3.4.1 SDH/PDH Microwave

This topic considers the STM-1 optical signal as an example to describe the processing flow of the SDH/PDH microwave signals on the OptiX RTN 620.

**Figure 3-5** Signal processing flow

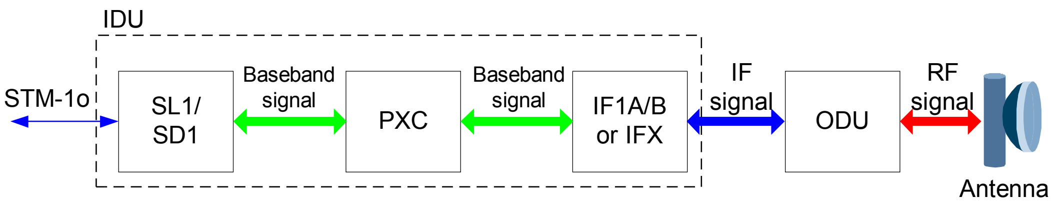


**Table 3-3** Transmit direction

| No. | Logical Board | Signal Processing Description |
| --- | --- | --- |
| 1 | SL1/SD1 (IDU) | ● Converts the STM-1 optical signals into STM-1 electrical signals.<br>● Synchronizes and descrambles the frames.<br>● Extracts the overheads from the STM-1 frames.<br>● Transmits the VC-4 signals in the STM-1 frames to the cross-connect unit through the service bus. |
| 2 | PXC (IDU) | ● Cross-connects the VC-4 signals to the service bus of the IF board. |
| 3 | IF1A/IF1B or IFX (IDU) | ● Multiplexes the VC-4 signals, microwave frame overheads, and pointers into STM-1 microwave frames.<br>● Scrambling.<br>● FEC coding.<br>● Digital modulation.<br>● D/A conversion.<br>● Analog modulation.<br>● Combines the analog IF signals and ODU O&M signals. The ODU O&M signals have been modulated by the auxiliary modem.<br>● Transmits the combined signals and –48 V power to the ODU through the coaxial cable. |
| 4 | ODU | ● Splits the analog IF signals, ODU O&M signals, and –48 V power.<br>● Converts the analog IF signals into RF signals through up conversions and amplifications.<br>● Transmits the RF signals to the antenna through the waveguide. |

**Table 3-4** Receive direction

| No. | Logical Board | Signal Processing Description |
| --- | --- | --- |
| 1 | ODU | ● Isolates and filters RF signals.<br>● Converts the RF signals into analog IF signals through down conversions and amplifications.<br>● Combines the IF signals and the ODU O&M signals. The O&M signals have been modulated by an auxiliary modem.<br>● Transmits the combined signals to the IF board. |

| No. | Logical Board | Signal Processing Description |
|---|---|---|
| 2 | IF1A/IF1B or IFX (IDU) | ● Splits the received analog IF signals and ODU O&M signals.<br>● Performs A/D conversion for the IF signals.<br>● Digital demodulation.<br>● Time domain adaptive equalization.<br>● FEC decoding.<br>● Synchronizes and descrambles the frames.<br>● Extracts overheads from microwave frames.<br>● Extracts VC-4 signals from microwave frames, and transmits the VC-4 signals to the cross-connect unit. |
| 3 | PXC (IDU) | ● Cross-connects the VC-4 signals to the service bus of the SL1/SD1 board. |
| 4 | SL1/SD1 (IDU) | ● Multiplexes the VC-4 signals, overheads, and pointers into STM-1 signals.<br>● Scrambles the signals.<br>● Converts the signals into STM-1 optical signals. |

## 3.4.2 Hybrid Microwave

This topic considers the transmission of the E1 services and Ethernet services over the Hybrid microwave as an example and describes the processing flow of the Hybrid microwave services in the OptiX RTN 620.

**Figure 3-6** Service signal processing flow

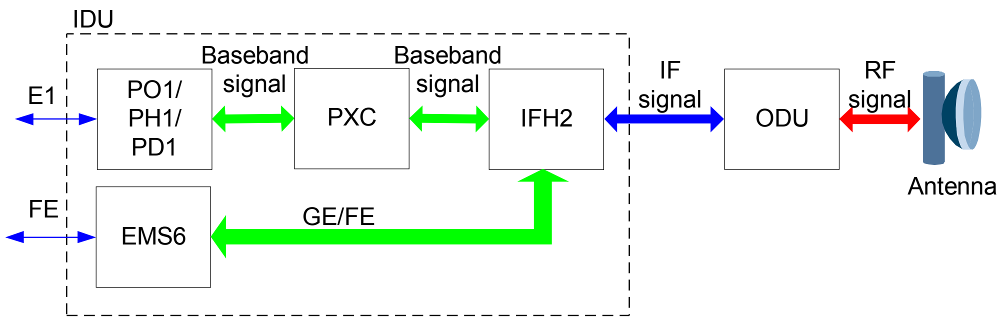


**Table 3-5** Transmit direction

| No. | Logical Board | Signal Processing Description |
|---|---|---|
| 1 | PO1/PH1/PD1 (IDU) | ● Accesses E1 signals.<br>● Performs HDB3 decoding.<br>● Maps the E1 signals into the VC-4 signal.<br>● Transmits the VC-4 signal to the PXC board through the service bus. |
| | EMS6 (IDU) | ● Accesses FE signals.<br>● Performs decoding.<br>● Delimits the FE frames, strips the preamble code, and processes the cyclic redundancy check (CRC) code.<br>● Processes the data packets according to the QoS.<br>● Processes the VLAN tags according to the data configuration and forwards the data frames to the GE internal interface.<br>● Delimits the GE frames and adds the preamble code and the CRC code.<br>● Performs coding.<br>● Transmits the GE signals to the IFH2 board through the network cable. |
| 2 | PXC (IDU) | Cross-connects the VC-4 signals to the service bus of the IFH2 board. |

| No. | Logical Board | Signal Processing Description |
|---|---|---|
| 3 | IFH2(IDU) | ● Selects the proper coding and modulation mode according to the quality of the received signal.<br>● Accesses GE signals and decodes the GE signals.<br>● Delimits the GE frames, strips the preamble code, and processes the (CRC) code.<br>● Performs the flow control and QoS-based packet processing according to the data configuration and the bandwidth of the air interface that is allocated to the Ethernet service.<br>● Demaps the E1 signals from the VC-4 signal.<br>● Constructs the E1 service signal, microwave frame overheads, and Ethernet data frame into the microwave frame.<br>● FEC coding.<br>● Digital modulation.<br>● D/A conversion.<br>● Analog modulation<br>● Combines the analog IF signals and ODU O&M signals. The ODU O&M signals are already modulated by the auxiliary modem.<br>● Transmits the combined signals and –48 V power to the ODU through the coaxial cable. |
| 4 | ODU | ● Splits the analog IF signals, ODU O&M signals, and –48 V power.<br>● Converts the analog IF signals into RF signals through up conversions and amplifications.<br>● Transmits the RF signals to the antenna through the waveguide. |

**Table 3-6** Receive direction

| No. | Logical Board | Signal Processing Description |
|---|---|---|
| 1 | ODU | ● Isolates and filters RF signals.<br>● Converts the RF signals into analog IF signals through down conversions and amplifications.<br>● Combines the IF signals and the ODU O&M signals. The O&M signals are already modulated by an auxiliary modem.<br>● Transmits the combined signals to the IF boards. |

| No. | Logical Board | Signal Processing Description |
|---|---|---|
| 2 | IFH2 (IDU) | ● Splits the received analog IF signals and ODU O&M signals.<br>● A/D conversion.<br>● Digital demodulation.<br>● Select<br>● Time domain adaptive equalization.<br>● FEC decoding.<br>● Synchronizes and descrambles the frames.<br>● Extracts overheads from microwave frames.<br>● Extracts The E1 signals from the microwave frames and transmits the E1 signals to the tributary boards.<br>● Maps the E1 signals into the VC-4 signal.<br>● Transmits the VC-4 signal to the cross-connect unit through the service bus.<br>● Extracts the Ethernet data frames from the microwave frames.<br>● Decapsulation.<br>● Delimits the GE frames, strips the preamble code, and processes the CRC code.<br>● Codes the GEsignals.<br>● Transmits the GE signals to the EMS6 board. |
| 3 | PXC (IDU) | ● Cross-connects the VC-4 signals to the service bus of the PO1/PH1/PD1 board. |
| 4 | PF1/PO1/PH1 (IDU) | ● Demaps the E1 signals from the VC-4 signal.<br>● Performs HDB3 coding.<br>● Outputs the E1 signals. |
| 4 | EMS6 | ● Accesses GE signals.<br>● Decoding.<br>● Delimits the GE frames, strips the preamble code, and processes the CRC code.<br>● Processes the data packets according to the QoS.<br>● Processes the VLAN tags according to the data configuration and forwards the data frames to the FE external interface.<br>● Delimits the FE frames and adds the preamble code and the CRC code.<br>● Performs coding.<br>● Outputs the FE signal. |

# 4 Networking

## About This Chapter

The OptiX RTN 620 supports several types of networking modes to meet different requirements of the customers.

# 4.1 SDH/PDH Microwave

The SDH/PDH microwave has two networking modes: chain networking and ring networking.

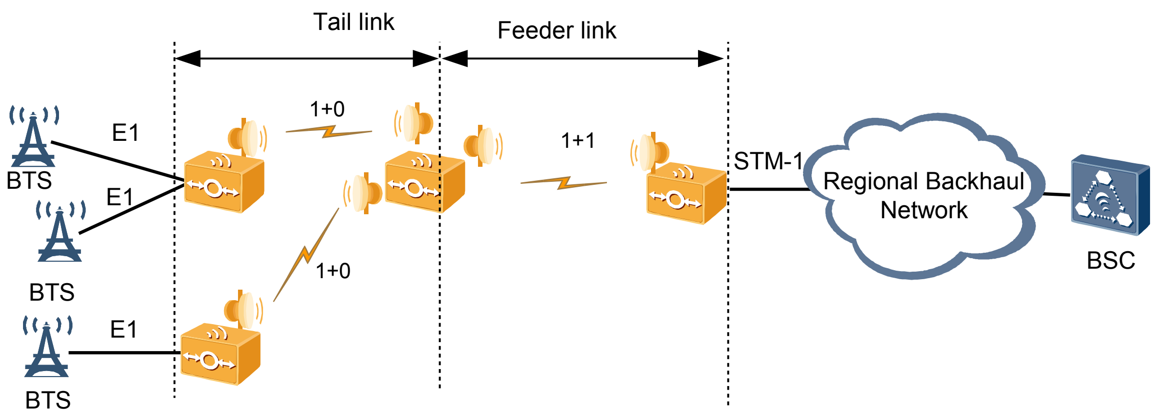
## 4.1.1 Chain Networking

In the TDM microwave transmission solution wherein the chain networking is the basic networking form, a hop of radio link is the basic networking unit.

The **Figure 4-1** shows the TDM microwave transmission solution wherein the chain networking is the basic form of networking. In this solution:

- The PDH radio link of the corresponding air-interface capacity can be created based on the capacity of the access link. An ordinary link adopts 1+0 non-protection configuration. An important link adopts 1+1 protection configuration.
- The SDH/PDH radio link of the corresponding air-interface capacity can be created based on the capacity of the aggregation link. The SDH/PDH aggregation link can adopt the protection configuration. In this situation, the maximum air-interface capacity can be improved to 2xSTM-1s or 3xSTM-1s by configuring 1+1 protection of an XPIC SDH link or N+1 protection of an SDH link.
- Multiple microwave hops of a key station are implemented by using the multi-direction microwave convergence capability of the OptiX RTN 620.

**Figure 4-1** TDM microwave transmission solution (chain networking)




## 4.1.2 Ring Networking

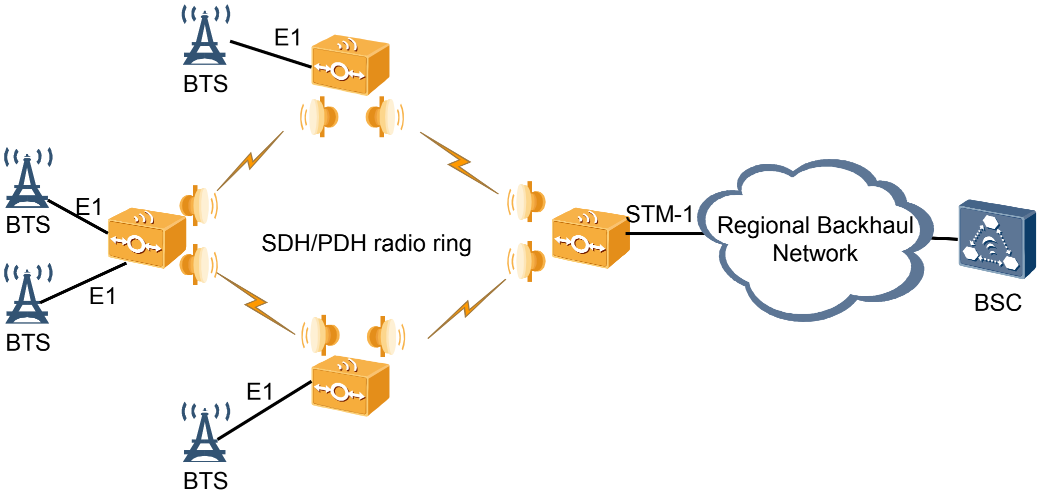
In the TDM microwave transmission solution wherein the ring networking is the basic networking form, the SNCP is used to protect SDH/PDH services on the microwave ring.

**Figure 4-2** shows the TDM microwave transmission solution wherein the ring networking is the basic networking form. In this solution, the SNCP is used to protect SDH/PDH microwave transmission services.

**NOTE**

The SDH/PDH microwave that is provided only by the IF1A, IF1B, or IFX board supports the ring networking mode.

**Figure 4-2** TDM microwave transmission solution (ring networking)




# 4.2 Hybrid Microwave

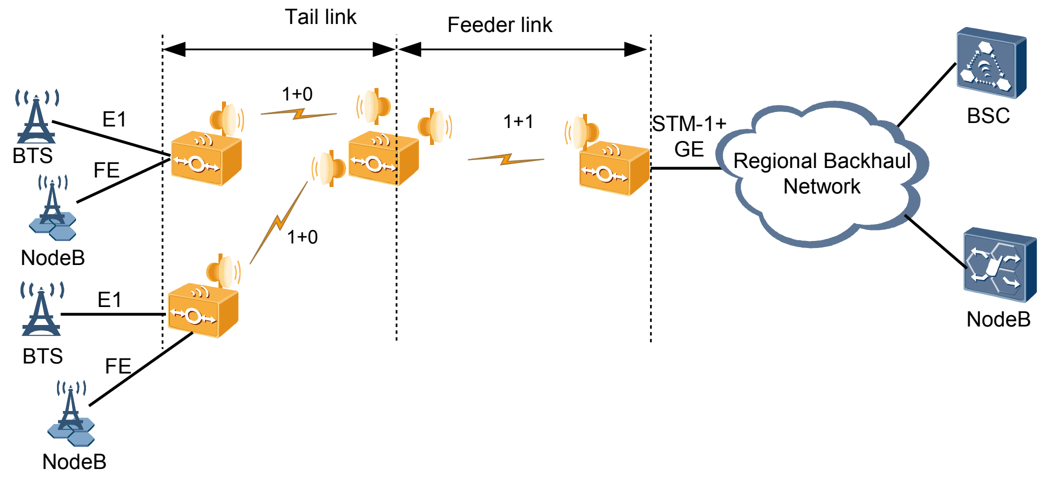
The Hybrid microwave adopts the chain networking as the basic networking mode.

In the Hybrid microwave transmission solution wherein the chain networking is the basic networking form, a hop of radio link is the basic networking unit.

In the Hybrid microwave transmission solution as shown in **Figure 4-3**:

- The hybrid radio link of the corresponding air-interface capacity can be created based on the capacity of the access link. An ordinary link adopts 1+0 non-protection configuration. An important link adopts 1+1 protection configuration.
- The hybrid radio link of the corresponding air-interface capacity can be created based on the capacity of the aggregation link. The hybrid radio link adopts 1+1 protection configuration.
- Multiple microwave hops of a key station are implemented by using the multi-direction microwave convergence capability of the OptiX RTN 620.

**Figure 4-3** Hybrid microwave transmission solution



# 5 Network Management System

## About This Chapter

This topic describes the network management system solution and several types of NMS software required by this solution.

5.1 Network Management Solution
Huawei provides a complete transport network management solution compliant with TMN for different function domains and customers in telecommunication networks.

5.2 Web LCT
The Web LCT is a local maintenance terminal. A user can access the Web LCT server by using the IE explorer to manage a single NE. The Web LCT provides the following NE-level management functions: NE management, alarm management, performance management, configuration management, communication management, and security management.

5.3 T2000
The T2000 is a subnetwork-level network management system. A user can access the T2000 server through a T2000 client to manage Huawei transport subnets in the unified manner. The T2000 can provide not only the NE-level management function, but also the network-level management function.

5.4 T2100
The T2100 is a network-level network management system. A user can access the T2100 server through a T2100 client to manage Huawei transport subnets in the unified manner.

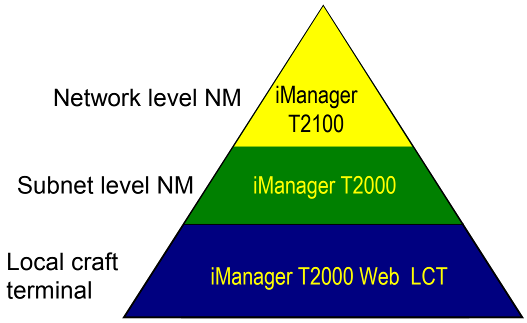
# 5.1 Network Management Solution

Huawei provides a complete transport network management solution compliant with TMN for different function domains and customers in telecommunication networks.

The NM solutions include the following:

- **iManager Web LCT**
- **iManager T2000**
- **iManager T2100**

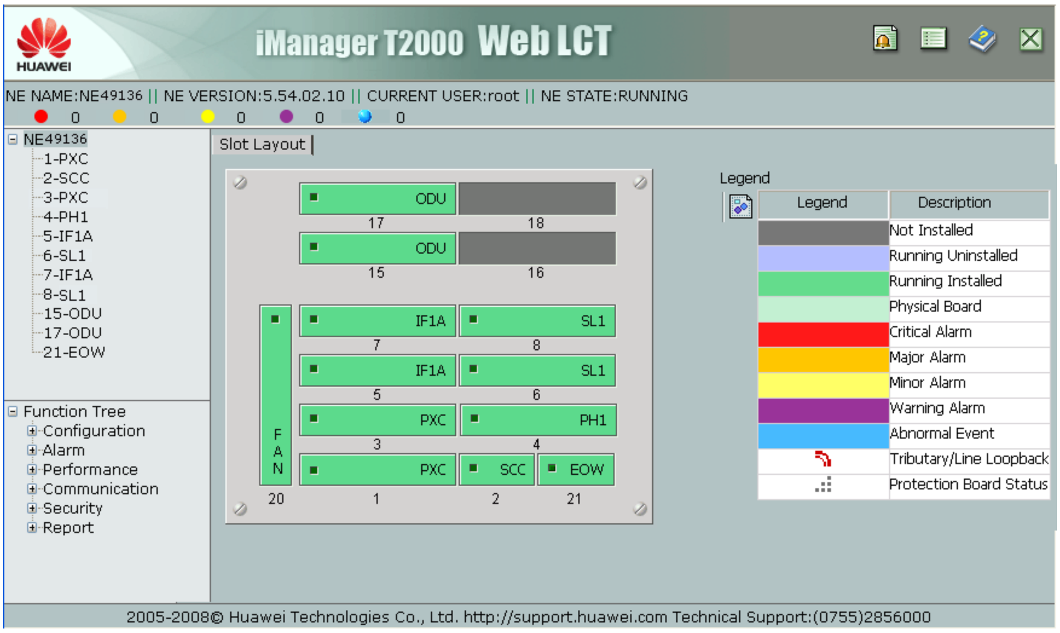
**Figure 5-1** NM solution of a transport network




# 5.2 Web LCT

The Web LCT is a local maintenance terminal. A user can access the Web LCT server by using the IE explorer to manage a single NE. The Web LCT provides the following NE-level management functions: NE management, alarm management, performance management, configuration management, communication management, and security management.

**Figure 5-2** User interface of the Web LCT




NOTE

The Web LCT supports the end-to-end management over one microwave hop. Thus, it can manage the opposite NE in the NE Explorer of the local end of the microwave link.

## NE Management

- Searching for NEs
- Adding/Deleting NEs
- Logging in to/Logging out of NEs
- Managing NE time

## Alarm Management

- Setting alarm monitoring strategies
- Viewing alarms
- Deleting alarms

## Performance Management

- Setting performance monitoring strategies
- Viewing performance events
- Resetting performance registers

## Configuration Management

- Configuring basic NE information
- Configuring radio links

- Configuring protection schemes
- Configuring interfaces
- Configuring services
- Configuring clock

### Communication Management

- Managing communication parameters
- Managing the DCC
- Managing the HW ECC protocol
- Managing the IP protocol
- Configuring the OSI protocol

### Security Management

- Managing NE users
- Managing NE user groups
- Managing LCT access control
- Managing online users
- Managing NE security parameters
- Managing NE security logs
- Managing NM users
- Managing NM logs

## 5.3 T2000

The T2000 is a subnetwork-level network management system. A user can access the T2000 server through a T2000 client to manage Huawei transport subnets in the unified manner. The T2000 can provide not only the NE-level management function, but also the network-level management function.

### NE-Level Management Function

- NE Management
- NE-level alarm management
- NE-level performance management
- NE-level configuration management
- NE-level communication management
- NE-level security management

### Network-Level Management Function

- Topology management
- Network-level alarm management

- Network-level performance management
- Network-level configuration management
- Network-level communication management
- Network-level security management
- Network-wide clock management

### Others

- Report function
- Northbound SNMP interface

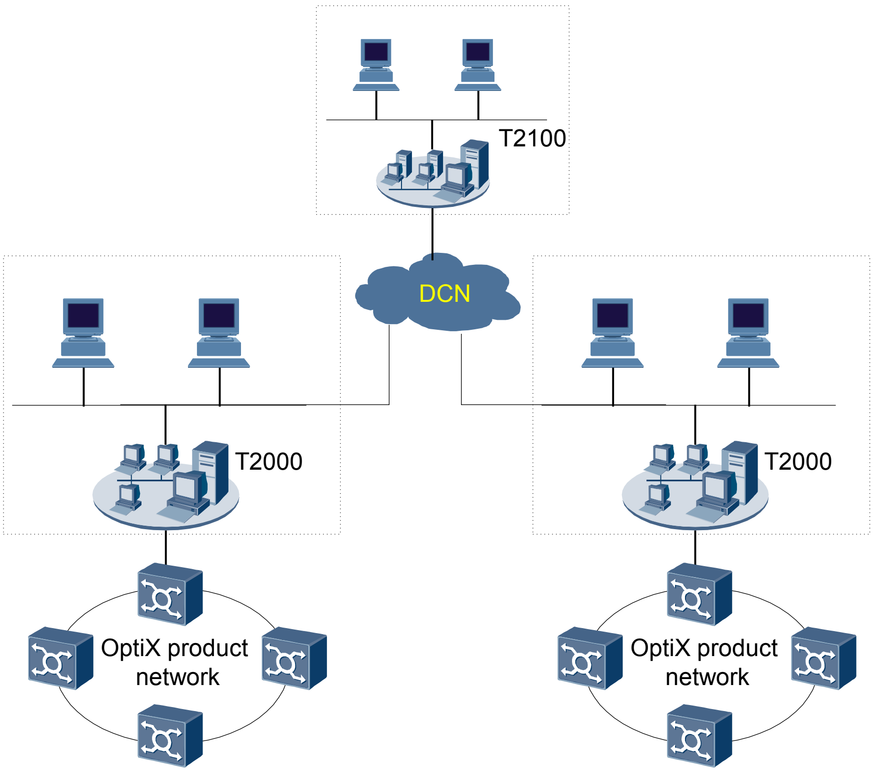
## 5.4 T2100

The T2100 is a network-level network management system. A user can access the T2100 server through a T2100 client to manage Huawei transport subnets in the unified manner.

The T2100 and T2000 can form a multi-layer management network to manage large transmission networks. This management system has the following features:

- Strengthens the network management ability.
- Realizes unified network management.
- Separates NE management from network management.
- Meets the operator requirements for the O&M mechanism.

**Figure 5-3** Multi-layer management network



# 6 Technical Specifications

## About This Chapter

This topic describes the technical specifications of the OptiX RTN 620.

6.1 RF Performance
The RF performance includes all the technical specifications related to the microwave.

6.2 Equipment Reliability
Equipment reliability includes the IDU and ODU reliability and the link reliability.

6.3 Interface Performance
Interface performance consists of the performance of service interfaces and the performance of auxiliary interfaces.

6.4 Jitter Performance
The output jitter performance at the SDH and PDH interface complies with relevant ITU-T recommendations.

6.5 Clock Timing and Synchronization Performance
The clock timing performance and synchronization performance of the OptiX RTN 600 meet relevant ITU-T recommendations.

6.6 Integrated System Performance
Integrated system performance includes the dimensions, weight, power consumption, power supply, EMC, lightning protection, safety, and environment.

# 6.1 RF Performance

The RF performance includes all the technical specifications related to the microwave.

## 6.1.1 Microwave Working Modes

This topic describes the microwave working modes supported by the OptiX RTN 620.

### Working Modes of the PDH Microwave

**Table 6-1** Working modes of the PDH microwave

| Service Capacity | Modulation Mode | Channel Spacing (MHz) |
|---|---|---|
| 2xE1 | QPSK | 3.5 |
| 5xE1 | QPSK | 7 |
| 10xE1 | QPSK | 14 (13.75) |
| 16xE1 | QPSK | 28 (27.5) |

**NOTE**

- The channel spacings 13.75 MHz and 27.5 MHz are applied to the 18 GHz frequency band.
- The channel spacings listed in the table are the minimum channel spacings supported by the OptiX RTN 620. The channel spacings larger than the values are also supported.
- The IF0 board supports all the microwave working modes provided in the table.
- The 2xE1 working mode does not support 1+1 protection configuration.

### Working Modes of the SDH/PDH Microwave

**Table 6-2** Working modes of the SDH/PDH microwave

| Service Capacity | Modulation Mode | Channel Spacing (MHz) |
|---|---|---|
| 4xE1 | QPSK | 7 |
| 4xE1 | 16QAM | 3.5 |
| 8xE1 | QPSK | 14 (13.75) |
| 8xE1 | 16QAM | 7 |
| 16xE1 | QPSK | 28 (27.5) |
| 16xE1 | 16QAM | 14 (13.75) |
| 22xE1 | 32QAM | 14 (13.75) |

| Service Capacity | Modulation Mode | Channel Spacing (MHz) |
|---|---|---|
| 26xE1 | 64QAM | 14 (13.75) |
| 35xE1 | 16QAM | 28 (27.5) |
| 44xE1 | 32QAM | 28 (27.5) |
| 53xE1 | 64QAM | 28 (27.5) |
| E3 | QPSK | 28 (27.5) |
| E3 | 16QAM | 14 (13.75) |
| STM-1 | 128QAM | 28 (27.5) |

**NOTE**

- The channel spacings 13.75 MHz and 27.5 MHz are applied to the 18 GHz frequency band.
- The channel spacings listed in the table are the minimum channel spacings supported by the OptiX RTN 600. The channel spacings larger than the values are also supported.
- The IF1 board supports all the microwave working modes provided in the table. The IFX board supports STM-1 microwave working mode.

## Working Modes of the Hybrid Microwave

**Table 6-3** Working modes of the Hybrid microwave

| Channel Spacing (MHz) | Modulation Mode | Service Capacity (Mbit/s) | Maximum Number of E1s in service |
|---|---|---|---|
| 7 | QPSK | 10 | 5 |
| 7 | 16QAM | 20 | 10 |
| 7 | 32QAM | 25 | 12 |
| 7 | 64QAM | 32 | 15 |
| 7 | 128QAM | 38 | 18 |
| 7 | 256QAM | 44 | 21 |
| 14 (13.75) | QPSK | 20 | 10 |
| 14 (13.75) | 16QAM | 42 | 20 |
| 14 (13.75) | 32QAM | 51 | 24 |
| 14 (13.75) | 64QAM | 66 | 31 |
| 14 (13.75) | 128QAM | 78 | 37 |
| 14 (13.75) | 256QAM | 90 | 43 |

| Channel Spacing (MHz) | Modulation Mode | Service Capacity (Mbit/s) | Maximum Number of E1s in service |
|---|---|---|---|
| 28 (27.5) | QPSK | 42 | 20 |
| 28 (27.5) | 16QAM | 84 | 40 |
| 28 (27.5) | 32QAM | 105 | 50 |
| 28 (27.5) | 64QAM | 133 | 64 |
| 28 (27.5) | 128QAM | 158 | 75 |
| 28 (27.5) | 256QAM | 183 | 75 |
| 56 (55) | QPSK | 84 | 40 |
| 56 (55) | 16QAM | 168 | 75 |
| 56 (55) | 32QAM | 208 | 75 |
| 56 (55) | 64QAM | 265 | 75 |
| 56 (55) | 128QAM | 313 | 75 |
| 56 (55) | 256QAM | 363 | 75 |
| 40 | 64QAM | - | 75 |

**NOTE**

- The channel spacings 13.75 MHz 27.5 MHz and 55 MHz are applied to the 18 GHz frequency band.
- The channel spacings listed in the table are the minimum channel spacings supported by the OptiX RTN 600. The channel spacings larger than the values are also supported.
- The E1 services consume the corresponding bandwidth of the service capacity. After the E1 service capacity is deducted from the service capacity, the remaining bandwidth of the service capacity can be used for the Ethernet services.
- The 64QAM/40MHz mode that is the super PDH mode does not support the transmission of Ethernet services.
- The IFH2 board supports all the microwave working modes provided in the table.

## 6.1.2 Frequency Band

The ODUs of the different series and different types support different operating frequency bands.

**NOTE**

For information of a specific frequency band, see *ODU Hardware Description*.

## Frequency Bands (Standard Power ODU)

**Table 6-4** Frequency Band (SP ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7 GHz | 7.093-7.897 | 154, 161, 168, 196, 245 |
| 8 GHz | 7.731-8.496 | 119, 126, 266, 311.32 |
| 11 GHz | 10.675-11.745 | 490, 500, 530 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.403-15.348 | 315, 322, 420, 490, 728 |
| 18 GHz | 17.685-19.710 | 1008, 1010, 1560 |
| 23 GHz | 21.200-23.618 | 1008, 1200, 1232 |
| 26 GHz | 24.549-26.453 | 1008 |
| 38 GHz | 37.044-40,105 | 700, 1260 |

**Table 6-5** Frequency band (SPA ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 6 GHz | 5.915-6.425 (L6)<br>6.425-7.125 (U6) | 252.04 (L6)<br>340 (U6) |
| 7 GHz | 7.093-7.897 | 154, 161, 168, 196, 245 |
| 8 GHz | 7.731-8.496 | 119, 126, 266, 311.32 |
| 11 GHz | 10.675-11.745 | 490, 500, 530 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.403-15.348 | 420, 490 |
| 18 GHz | 17.685-19.710 | 1008, 1010 |
| 23 GHz | 21.200-23.618 | 1008, 1232 |

## Frequency Bands (High Power ODU)

**Table 6-6** Frequency band (HP ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7 GHz | 7.093-7.897 | 154, 161, 168, 196, 245 |
| 8 GHz | 7.731-8.497 | 119, 126, 151.614, 208, 266, 311.32 |
| 11 GHz | 10.675-11.745 | 490, 500, 530 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.400-15.353 | 315, 322, 420, 490, 644, 728 |
| 18 GHz | 17.685-19.710 | 1008, 1010, 1560 |
| 23 GHz | 21.200-23.618 | 1008, 1200, 1232 |
| 26 GHz | 24.549-26.453 | 1008 |
| 32 GHz | 31.815-33.383 | 812 |
| 38 GHz | 37.044-40.105 | 700, 1260 |

**Table 6-7** Frequency band (XMC-2 ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7GHz | 7.093-7.897 | 154, 160, 161, 168, 196, 245 |
| 8GHz | 7.731-8.497 | 119/126, 151.614, 208, 266, 311.32 |
| 13 GHz | 12.751-13.248 | 266 |
| 15GHz | 14.400-15.358 | 315/322, 420, 475, 490, 640, 644, 728 |
| 18 GHz | 17.685-19.710 | 1010/1008, 1092.5, 1560 |
| 23GHz | 21.200-23.618 | 1008, 1200, 1232 |

## Frequency Bands (Low Capacity for PDH ODU)

**Table 6-8** Frequency band (LP ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7 GHz | 7.093-7.897 | 154, 161, 168, 196, 245 |

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 8 GHz | 7.718-8.496 | 119, 126, 266, 311.32 |
| 11 GHz | 10.675-11.745 | 490, 500, 530 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.403-15.348 | 420, 490 |
| 18 GHz | 17.685-19.710 | 1008, 1010 |
| 23 GHz | 21.200-23.618 | 1008, 1232 |

**Table 6-9** Frequency band (LPA ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7 GHz | 7.093-7.897 | 154, 161, 168, 196, 245 |
| 8 GHz | 7.718-8.496 | 119, 126, 151.614, 208, 266, 311.32 |
| 11 GHz | 10.675-11.745 | 490, 500, 530 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.400-15.353 | 315, 322, 420, 490, 644, 728 |
| 18 GHz | 17.685-19.710 | 1008, 1010, 1560 |
| 23 GHz | 21.200-23.618 | 1008, 1200, 1232 |
| 26 GHz | 24.549-26.453 | 1008 |
| 32 GHz | 31.815-33.383 | 812 |
| 38 GHz | 37.044-40.105 | 700, 1260 |

**Table 6-10** Frequency band (XMC-1 ODU)

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 7 GHz | 7.093-7.897 | 154, 160, 161, 168, 196, and 245 |
| 8 GHz | 7.731-8.497 | 119/126, 151.614, 208, 266, and 311.32 |
| 13 GHz | 12.751-13.248 | 266 |
| 15 GHz | 14.400-15.358 | 315/322, 420, 475, 490, 640, 644, 728 |
| 18 GHz | 17.685-19.710 | 1010/1008, 1092.5, 1560 |

| Frequency Band | Frequency Range (GHz) | T/R Spacing (MHz) |
|---|---|---|
| 23 GHz | 21.200-23.618 | 1008, 1200, 1232 |

# 6.1.3 Receiver Sensitivity

The receiver sensitivity reflects the anti-fading capability of the microwave equipment.

**NOTE**

For a guaranteed value, remove 3 dB from the typical value.

## Receiver Sensitivity of the PDH Microwave

**Table 6-11** Typical values of the receiver sensitivity of the PDH microwave

| Item | Performance | | | |
|---|---|---|---|---|
| | 2xE1 | 5xE1 | 10xE1 | 16xE1 |
| | QPSK | QPSK | QPSK | QPSK |
| RSL@ BER=$10^{-6}$ (dBm) | | | | |
| @6 GHz | –94.5 | –90.0 | –87.0 | –85.5 |
| @7 GHz | –94.5 | –90.0 | –87.0 | –85.5 |
| @8 GHz | –94.5 | –90.0 | –87.0 | –85.5 |
| @11 GHz | –94.0 | –89.5 | –86.5 | –85.0 |
| @13 GHz | –94.0 | –89.5 | –86.5 | –85.0 |
| @15 GHz | –94.0 | –89.5 | –86.5 | –85.0 |
| @18 GHz | –94.0 | –89.5 | –86.5 | –85.0 |
| @23 GHz | –93.5 | –89.0 | –86.0 | –84.5 |
| @26 GHz | –93.0 | –88.5 | –85.5 | –84.0 |
| @32 GHz | –92.0 | –87.5 | –84.5 | –83.0 |
| @38 GHz | –91.5 | –87.0 | –84.0 | –82.5 |

## Receiver Sensitivity of the SDH/PDH Microwave

**Table 6-12** Typical values of the receiver sensitivity of the SDH/PDH microwave

| Item | Performance | | | | | |
|---|---|---|---|---|---|---|
| | 4xE1 | | 8xE1 | | 16xE1 | |
| | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM |
| RSL@BER=$10^{-6}$ (dBm) | | | | | | |
| @6 GHz | –91.5 | –87.5 | –88.5 | –84.5 | –85.5 | –81.5 |
| @7 GHz | –91.5 | –87.5 | –88.5 | –84.5 | –85.5 | –81.5 |
| @8 GHz | –91.5 | –87.5 | –88.5 | –84.5 | –85.5 | –81.5 |
| @11 GHz | –91.0 | –87.0 | –88.0 | –84.0 | –85.0 | –81.0 |
| @13 GHz | –91.0 | –87.0 | –88.0 | –84.0 | –85.0 | –81.0 |
| @15 GHz | –91.0 | –87.0 | –88.0 | –84.0 | –85.0 | –81.0 |
| @18 GHz | –91.0 | –87.0 | –88.0 | –84.0 | –85.0 | –81.0 |
| @23 GHz | –90.5 | –86.5 | –87.5 | –83.5 | –84.5 | –80.5 |
| @26 GHz | –90.0 | –86.0 | –87.0 | –83.0 | –84.0 | –80.0 |
| @32 GHz | –89.0 | –85.0 | –86.0 | –82.0 | –83.0 | –79.0 |
| @38 GHz | –88.5 | –84.5 | –85.5 | –81.5 | –82.5 | –78.5 |

**Table 6-13** Typical values of the receiver sensitivity (ii) of the SDH/PDH microwave

| Item | Performance | | | | |
|---|---|---|---|---|---|
| | 22xE1 | 26xE1 | 35xE1 | 44xE1 | 53xE1 |
| | 32QAM | 64QAM | 16QAM | 32QAM | 64QAM |
| RSL@BER=$10^{-6}$ (dBm) | | | | | |
| @6 GHz | –80.5 | –76.5 | –79.0 | –77.5 | –73.5 |
| @7 GHz | –80.5 | –76.5 | –79.0 | –77.5 | –73.5 |
| @8 GHz | –80.5 | –76.5 | –79.0 | –77.5 | –73.5 |
| @11 GHz | –80.0 | –76.0 | –78.5 | –77.0 | –73.0 |
| @13 GHz | –80.0 | –76.0 | –78.5 | –77.0 | –73.0 |
| @15 GHz | –80.0 | –76.0 | –78.5 | –77.0 | –73.0 |
| @18 GHz | –80.0 | –76.0 | –78.5 | –77.0 | –73.0 |

| Item | Performance | | | | |
|---|---|---|---|---|---|
| | 22xE1 | 26xE1 | 35xE1 | 44xE1 | 53xE1 |
| | 32QAM | 64QAM | 16QAM | 32QAM | 64QAM |
| @23 GHz | –79.5 | –75.5 | –78.0 | –76.5 | –72.5 |
| @26 GHz | –79.0 | –75.0 | –77.5 | –76.0 | –72.0 |
| @32 GHz | –78.0 | –74.0 | –76.5 | –75.0 | –71.0 |
| @38 GHz | –77.5 | –73.5 | –76.0 | –74.5 | –70.5 |

**Table 6-14** Typical values of the receiver sensitivity (iii) of the SDH/PDH microwave

| Item | Performance | | |
|---|---|---|---|
| | E3 | | STM-1 |
| | QPSK | 16QAM | 128QAM |
| RSL@BER=$10^{-6}$ (dBm) | | | |
| @6 GHz | –86.5 | –82.5 | –70.5 |
| @7 GHz | –86.5 | –82.5 | –70.5 |
| @8 GHz | –86.5 | –82.5 | –70.5 |
| @11 GHz | –86.0 | –82.0 | –70.0 |
| @13 GHz | –86.0 | –82.0 | –70.0 |
| @15 GHz | –86.0 | –82.0 | –70.0 |
| @18 GHz | –86.0 | –82.0 | –70.0 |
| @23 GHz | –85.5 | –81.5 | –69.5 |
| @26 GHz | –85.0 | –81.0 | –69.0 |
| @32 GHz | –84.0 | –80.0 | –68.0 |
| @38 GHz | –83.5 | –79.5 | –67.5 |

## Receiver Sensitivity of the Hybrid Microwave

NOTE

The 6 GHz ODU does not support the modulation mode of 256QAM and the channel spacing of 40/56 MHz. The receiver sensitivity is not available (NA).

**Table 6-15** Typical values of the receiver sensitivity (i) of the Hybrid microwave

| 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 | –76.5 | NA |
| @7 GHz | –92.5 | –86.5 | –82.5 | -79.5 | –76.5 | –73.5 |
| @8 GHz | –92.5 | –86.5 | –82.5 | -79.5 | –76.5 | –73.5 |
| @11 GHz | –92 | –86 | –82 | -79 | –76 | –73 |
| @13 GHz | –92 | –86 | –82 | -79 | –76 | –73 |
| @15 GHz | –92 | –86 | –82 | -79 | –76 | –73 |
| @18 GHz | –92 | –86 | –82 | -79 | –76 | –73 |
| @23 GHz | –91.5 | –85.5 | –81.5 | -78.5 | –75.5 | –72.5 |
| @26 GHz | –91 | –85 | –81 | -78 | –75 | –72 |
| @32 GHz | –90 | –84 | –80 | -77 | –74 | –71 |
| @38 GHz | –89.5 | –83.5 | –79.5 | -76.5 | –73.5 | –70.5 |

**Table 6-16** Typical values of the receiver sensitivity (ii) of the Hybrid microwave

| 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 | NA |
| @7 GHz | –90.5 | –83.5 | –79.5 | -76.5 | –73.5 | –70.5 |
| @8 GHz | –90.5 | –83.5 | –79.5 | -76.5 | –73.5 | –70.5 |
| @11 GHz | –90 | –83 | –79 | -76 | –73 | –70 |
| @13 GHz | –90 | –83 | –79 | -76 | –73 | –70 |
| @15 GHz | –90 | –83 | –79 | -76 | –73 | –70 |
| @18 GHz | –90 | –83 | –79 | -76 | –73 | –70 |
| @23 GHz | –89.5 | –82.5 | –78.5 | -75.5 | –72.5 | –69.5 |
| @26 GHz | –89 | –82 | –78 | -75 | –72 | –69 |
| @32 GHz | –88 | –81 | –77 | -74 | –71 | –68 |
| @38 GHz | –87.5 | –80.5 | –76.5 | -73.5 | –70.5 | –67.5 |

**Table 6-17** Typical values of the receiver sensitivity (iii) of the Hybrid microwave

| 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 | -73.5 | –70.5 | NA |
| @7 GHz | –87.5 | –80.5 | –76.5 | -73.5 | –70.5 | –67.5 |
| @8 GHz | –87.5 | –80.5 | –76.5 | -73.5 | –70.5 | –67.5 |
| @11 GHz | –87 | –80 | –76 | -73 | –70 | –67 |
| @13 GHz | –87 | –80 | –76 | -73 | –70 | –67 |
| @15 GHz | –87 | –80 | –76 | -73 | –70 | –67 |
| @18 GHz | –87 | –80 | –76 | -73 | –70 | –67 |
| @23 GHz | –86.5 | –79.5 | –75.5 | -72.5 | –69.5 | –66.5 |
| @26 GHz | –86 | –79 | –75 | -72 | –69 | –66 |
| @32 GHz | –85 | –78 | –74 | -71 | –68 | –65 |
| @38 GHz | –84.5 | –77.5 | –73.5 | -70.5 | –67.5 | –64.5 |

**Table 6-18** Typical values of the receiver sensitivity (iv) of the Hybrid microwave

| Item | Performance (Channel Spacing: 56 MHz) | | | | | |
|---|---|---|---|---|---|---|
| | QPSK | 16QAM | 32QAM | 64QAM | 128QAM | 256QAM |
| RSL@ BER=$10^{-6}$ (dBm) | | | | | | |
| @6 GHz | NA | NA | NA | NA | NA | NA |
| @7 GHz | –84.5 | –77.5 | –73.5 | -70.5 | –67.5 | –64.5 |
| @8 GHz | –84.5 | –77.5 | –73.5 | -70.5 | –67.5 | –64.5 |
| @11 GHz | –84 | –77 | –73 | -70 | –67 | –64 |
| @13 GHz | –84 | –77 | –73 | -70 | –67 | –64 |
| @15 GHz | –84 | –77 | –73 | -70 | –67 | –64 |
| @18 GHz | –84 | –77 | –73 | -70 | –67 | –64 |
| @23 GHz | –83.5 | –76.5 | –72.5 | -69.5 | –66.5 | –63.5 |
| @26 GHz | –83 | –76 | –72 | -69 | –66 | –63 |

| Item | Performance (Channel Spacing: 56 MHz) | | | | | |
|---|---|---|---|---|---|---|
| | QPSK | 16QAM | 32QAM | 64QAM | 128QAM | 256QAM |
| @32 GHz | –82 | –75 | –71 | -68 | –65 | –62 |
| @38 GHz | –81.5 | –74.5 | –70.5 | -67.5 | –64.5 | –61.5 |

**Table 6-19** Typical values of the receiver sensitivity (v) of the Hybrid microwave

| Item | Performance (Channel Spacing: 40 MHz) |
|---|---|
| | 64QAM |
| RSL@ BER=$10^{-6}$ (dBm) | |
| @6 GHz | NA |
| @7 GHz | –72.5 |
| @8 GHz | –72.5 |
| @11 GHz | –72.0 |
| @13 GHz | –72.0 |
| @15 GHz | –72.0 |
| @18 GHz | –72.0 |
| @23 GHz | –71.5 |
| @26 GHz | –71.0 |
| @32 GHz | –70.0 |
| @38 GHz | –69.5 |

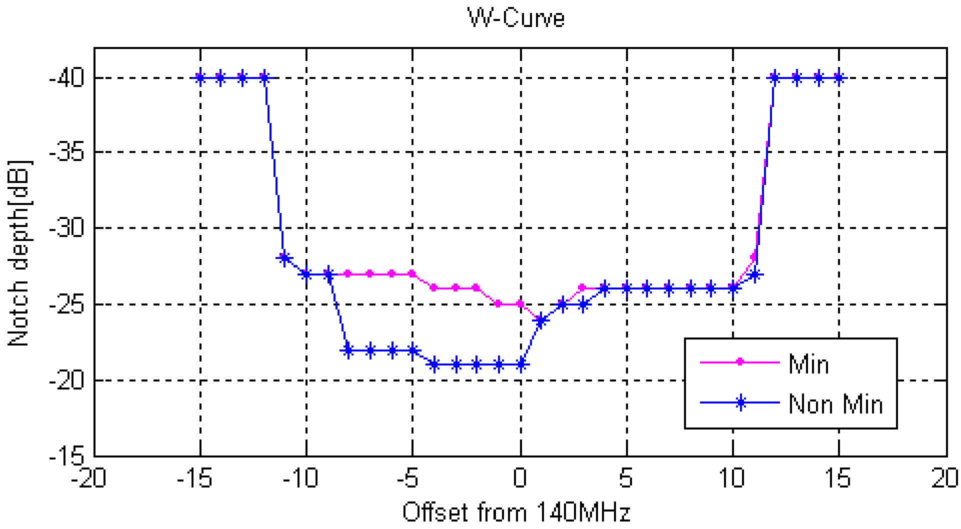
## 6.1.4 Distortion Sensitivity

The distortion sensitivity reflects the anti-multipath fading capability of the OptiX RTN 600.

**Table 6-20** Anti-multipath fading performance

| Item | Performance |
|---|---|
| STM-1/128QAM W-curve | See **Figure 6-1**. |
| STM-1/128QAM dispersion fading margin | 51 dB |

**Figure 6-1** W-curve




## 6.1.5 Transceiver Performance

The performance of the transceiver includes the nominal maximum/minimum transmit power, nominal maximum receive power, and frequency stability.

### Transceiver Performance (Standard Power ODU)

**Table 6-21** Transceiver Performance (SP ODU)

| Item | Performance | | | |
|---|---|---|---|---|
| | QPSK | 16QAM/ 32QAM | 64QAM/ 128QAM | 256QAM |
| Nominal maximum transmit power (dBm) | | | | |
| @7 GHz | 27 | 22.5 | 18.5 | 16.5 |
| @8 GHz | 27 | 22.5 | 18.5 | 16.5 |
| @11 GHz | 26 | 21.5 | 17.5 | 15.5 |
| @13 GHz | 26 | 21.5 | 17.5 | 15.5 |
| @15 GHz | 26 | 21.5 | 17.5 | 15.5 |
| @18 GHz | 25.5 | 21.5 | 17.5 | 15.5 |
| @23 GHz | 24 | 20.5 | 16.5 | 14.5 |
| @26 GHz | 23.5 | 19.5 | 15.5 | 13.5 |
| @38 GHz | 22 | 17.5 | 13.5 | 11.5 |

| Item | Performance | | | |
|---|---|---|---|---|
| | QPSK | 16QAM/ 32QAM | 64QAM/ 128QAM | 256QAM |
| Nominal minimum transmit power (dBm) | -6 | | | |
| Nominal maximum receive power (dBm) | -20 | | | -25 |
| Frequency stability (ppm) | ±5 | | | |

**Table 6-22** Transceiver performance (SPA ODU)

| Item | Performance | | |
|---|---|---|---|
| | QPSK | 16QAM/32QAM | 64QAM/128QAM |
| Nominal maximum transmit power (dBm) | | | |
| @6 GHz | 26.5 | 24 | 23 |
| @7 GHz | 25.5 | 21.5 | 20 |
| @8 GHz | 25.5 | 21.5 | 20 |
| @11 GHz | 24.5 | 20.5 | 18 |
| @13 GHz | 24.5 | 20 | 18 |
| @15 GHz | 24.5 | 20 | 18 |
| @18 GHz | 22.5 | 19 | 17 |
| @23 GHz | 22.5 | 19 | 16 |
| Nominal minimum transmit power (dBm) | 0 | | |
| Nominal maximum receive power (dBm) | -20 | | |
| Frequency stability (ppm) | ±5 | | |

## Transceiver Performance (High Power ODU)

**Table 6-23** Transceiver performance (HP ODU)

| Item | Performance | | | |
|---|---|---|---|---|
| | QPSK | 16QAM/ 32QAM | 64QAM/ 128QAM | 256QAM |
| Nominal maximum transmit power (dBm) | | | | |
| @7 GHz | 30 | 28 | 25 | 23 |
| @8 GHz | 30 | 28 | 25 | 23 |
| @11 GHz | 28 | 26 | 22 | 20 |
| @13 GHz | 26 | 24 | 20 | 18 |
| @15 GHz | 26 | 24 | 20 | 18 |
| @18 GHz | 25.5 | 23 | 19 | 17 |
| @23 GHz | 25 | 23 | 19 | 17 |
| @26 GHz | 25 | 22 | 19 | 17 |
| @32 GHz | 23 | 21 | 17 | 15 |
| @38 GHz | 23 | 20 | 17 | 15 |
| Nominal minimum transmit power (dBm) | | | | |
| @7 GHz | 9 | | | |
| @8 GHz | 9 | | | |
| @11 GHz | 6 | | | |
| @13 GHz | 3 | | | |
| @15 GHz | 3 | | | |
| @18 GHz | 2 | | | |
| @23 GHz | 2 | | | |
| @26 GHz | 2 | | | |
| @32 GHz | 1 | | | |
| @38 GHz | 1 | | | |
| Nominal maximum receive power (dBm) | -20 | | | -25 |
| Frequency stability (ppm) | ±5 | | | |

**Table 6-24** Transceiver performance (XMC-2 ODU)

| Item | Performance | | | |
|---|---|---|---|---|
| | QPSK | 16QAM/ 32QAM | 64QAM/ 128QAM | 256QAM |
| Nominal maximum transmit power (dBm)<br>**NOTE**<br>When the working frequency is 7 GHz and the channel spacing is 56 MHz, the value of this counter in each modulation format reduces by 3 dBm.<br>When the working frequency is 8 GHz and the channel spacing is 40 MHz or 56 MHz, the value of this counter in each modulation format reduces by 3 dBm. | | | | |
| @7 GHz | 26.5 dBm | 25.5 dBm | 25 dBm | 22 dBm |
| @8 GHz | 26.5 dBm | 25.5 dBm | 25 dBm | 22 dBm |
| @13 GHz | 25 | 22 | 20.5 | 17.5 |
| @15 GHz | 25 | 22 | 20.5 | 17.5 |
| @18 GHz | 24 | 21 | 19.5 | 16.5 |
| @23 GHz | 24 | 21 | 19.5 | 16.5 |
| Nominal minimum transmit power (dBm) | | | | |
| @7 GHz | 6.5 dBm | | | |
| @8 GHz | 6.5 dBm | | | |
| @13 GHz | 5 | | | |
| @15 GHz | 5 | | | |
| @18 GHz | 4 | | | |
| @23 GHz | 4 | | | |
| Nominal maximum receive power (dBm) | -20 | | | -25 |
| Frequency stability (ppm) | ±5 | | | |

## Transceiver Performance (Low Capacity for PDH ODU)

**Table 6-25** Transceiver performance (LP ODU)

| Item | Performance | |
|---|---|---|
| | QPSK | 16QAM |
| Nominal maximum transmit power (dBm) | | |
| @7 GHz | 27 | 21 |
| @8 GHz | 27 | 21 |
| @11 GHz | 25 | 19 |
| @13 GHz | 25 | 19 |
| @15 GHz | 23.5 | 17.5 |
| @18 GHz | 23 | 17 |
| @23 GHz | 23 | 17 |
| Nominal minimum transmit power (dBm) | 0 | |
| Nominal maximum receive power (dBm) | -20 | |
| Frequency stability (ppm) | ±5 | |

**Table 6-26** Transceiver performance (LPA ODU)

| Item | Performance | |
|---|---|---|
| | QPSK | 16QAM |
| Nominal maximum transmit power (dBm) | | |
| @7 GHz | 27 | 21 |
| @8 GHz | 27 | 21 |
| @11 GHz | 25 | 19 |
| @13 GHz | 25 | 19 |
| @15 GHz | 23.5 | 17.5 |
| @18 GHz | 23 | 17 |
| @23 GHz | 23 | 17 |
| @26 GHz | 22 | 19 |
| @32 GHz | 21 | 18 |

| Item | Performance | |
|---|---|---|
| | QPSK | 16QAM |
| @38 GHz | 18 | 16 |
| Nominal minimum transmit power (dBm) | 0 | |
| Nominal maximum receive power (dBm) | -20 | |
| Frequency stability (ppm) | ±5 | |

**Table 6-27** Transceiver performance (XMC-1 ODU)

| Item | Performance | |
|---|---|---|
| | QPSK | 16QAM |
| Nominal maximum transmit power (dBm) | | |
| @7 GHz | 26.5 | 21 |
| @8 GHz | 26.5 | 21 |
| @13 GHz | 25 | 19 |
| @15 GHz | 23.5 | 17.5 |
| @18 GHz | 23 | 17 |
| @23 GHz | 23 | 17 |
| Nominal minimum transmit power (dBm) | | |
| @7 GHz | 6.5 | |
| @8 GHz | 6.5 | |
| @13 GHz | 5 | |
| @15 GHz | 5 | |
| @18 GHz | 4 | |
| @23 GHz | 4 | |
| Nominal maximum receive power (dBm) | -20 | |
| Frequency stability (ppm) | ±5 | |

## 6.1.6 IF Performance

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

**Table 6-28** IF performance

| Item | Performance |
|---|---|
| IF signal | |
| Transmit frequency of the IF board (MHz) | 350 |
| Receive frequency of the IF board (MHz) | 140 |
| Impedance (ohm) | 50 |
| ODU O&M signal | |
| Modulation mode | ASK |
| Transmit frequency of the IF board (MHz) | 5.5 |
| Receive frequency of the IF board (MHz) | 10 |

## 6.1.7 Baseband Signal Processing Performance of the Modem

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

**Table 6-29** Baseband signal processing performance of the modem

| Item | Performance |
|---|---|
| Encoding mode | ● Reed-Solomon (RS) encoding for PDH signals<br>● Trellis-coded modulation (TCM) and RS two-level encoding for SDH signals<br>● Low-density parity check code (LDPC) encoding for Hybrid microwave. |
| Adaptive time-domain equalizer for baseband signals | Supported. |

# 6.2 Equipment Reliability

Equipment reliability includes the IDU and ODU reliability and the link reliability.

# 6.2.1 Component Reliability

The component reliability reflects the reliability of a single component.

## SDH/PDH Microwave

**Table 6-30** Component reliability of SDH/PDH microwave

| Item | Performance | | |
|---|---|---|---|
| | **IDU (1+0 Non-protection Configuration)** | **IDU (1+1 Protection Configuration)** | **ODU** |
| MTBF (h) | $75.8 \times 10^4$ | $212.2 \times 0^4$ | $48.18 \times 10^4$ |
| MTTR (h) | 1 | 1 | 1 |
| Availability | 99.99987% | 99.99995% | 99.99979% |

## Hybrid Microwave

**Table 6-31** Component reliability of Hybrid microwave

| Item | Performance | | |
|---|---|---|---|
| | **IDU (1+0 Non-protection Configuration)** | **IDU (1+1 Protection Configuration)** | **ODU** |
| MTBF (h) | $46.97 \times 10^4$ | $81.49 \times 10^4$ | $48.18 \times 10^4$ |
| MTTR (h) | 1 | 1 | 1 |
| Availability | 99.99979% | 99.99988% | 99.99979% |

# 6.2.2 Link Reliability

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

### SDH/PDH Microwave

**Table 6-32** Link reliability per hop of SDH/PDH microwave

| Item | Performance | |
|---|---|---|
| | 1+0 Non-protection Configuration | 1+1 Protection Configuration |
| MTBF (h) | $14.71x10^4$ | $71.43x10^4$ |
| MTTR (h) | 1 | 1 |
| Availability | 99.99932% | 99.99986% |

### Hybrid Microwave

**Table 6-33** Link reliability per hop of Hybrid microwave

| Item | Performance | |
|---|---|---|
| | 1+0 Non-protection Configuration | 1+1 Protection Configuration |
| MTBF (h) | $11.89x10^4$ | $34.85x10^4$ |
| MTTR (h) | 1 | 1 |
| Availability | 99.99916% | 99.99971% |

# 6.3 Interface Performance

Interface performance consists of the performance of service interfaces and the performance of auxiliary interfaces.

## 6.3.1 SDH Interface Performance

Interface performance consists of the performance of service interfaces and the performance of auxiliary interfaces.

### STM-4 Optical Interface Performance

The performance of the STM-4 optical interface is compliant with ITU-T G.957. The following table provides the primary performance.

**Table 6-34** STM-4 optical interface performance

| Item | Performance | | |
|---|---|---|---|
| Nominal bit rate (kbit/s) | 622080 | | |
| Classification code | S-4.1 | L-4.1 | L-4.2 |
| Fiber type | Single-mode fiber | Single-mode fiber | Single-mode fiber |
| Transmission distance (km) | 15 | 40 | 80 |
| Operating wavelength (nm) | 1274 to 1356 | 1280 to 1335 | 1480 to 1580 |
| Mean launched power (dBm) | –15 to –8 | –3 to 2 | -3 to 2 |
| Minimum receiver sensitivity (dBm) | –28 | –28 | –28 |
| Minimum overload (dBm) | –8 | –8 | –8 |
| Minimum extinction ratio (dB) | 8.2 | 10 | 10 |

NOTE

SDH optical interface boards use SFP modules for providing optical interfaces. You can use different types of SFP modules to provide optical interfaces with different classification codes and transmission distances.

## STM-1 Optical Interface Performance

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

**Table 6-35** STM-1 optical interface performance

| 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 | 1280 to 1335 | 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 |

| Item | Performance | | | |
|---|---|---|---|---|
| Minimum overload (dBm) | –14 | –8 | –10 | –10 |
| Minimum extinction ratio (dB) | 10 | 8.2 | 10 | 10 |

NOTE

SDH optical interface boards use SFP modules for providing optical interfaces. You can use different types of SFP 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 primary performance.

**Table 6-36** STM-1 electrical interface performance

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

## 6.3.2 PDH Interface Performance

The performance of the PDH interface is compliant with ITU-T G.703.

### E3/T3 Interface Performance

The performance of the E3/T3 interface is compliant with ITU-T G.703. The following table provides the primary performance.

**Table 6-37** E3/T3 interface performance

| Item | Performance | |
|---|---|---|
| | E3 | T3 |
| Nominal bit rate (kbit/s) | 34368 | 44736 |
| Code pattern | HDB3 | B3ZS |
| Wire pair in each transmission direction | One coaxial wire pair | |

| Item | Performance | |
|---|---|---|
| | E3 | T3 |
| Impedance (ohm) | 75 | |

## E1 Interface Performance

The performance of the E1 interface is compliant with ITU-T G.703. The following table provides the primary performance.

**Table 6-38** E1 interface performance

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

# 6.3.3 Ethernet Interface Performance

The performance of the Ethernet interface is compliant with IEEE 802.3.

## GE Optical Interface Performance

The performance of the GE optical interface is compliant with IEEE 802.3. The following table provides the primary performance.

**Table 6-39** GE optical interface performance

| Item | Performance | |
|---|---|---|
| Nominal bit rate (kbit/s) | 1000 | |
| Classification code | 1000Base-SX | 1000Base-LX |
| Fiber type | Multi-mode fiber | Single-mode fiber |
| Transmission distance (km) | 0.55 | 10 |
| Operating wavelength (nm) | 770 to 860 | 1270 to 1355 |
| Mean launched power (dBm) | –9.5 to 0 | –9 to –3 |
| Minimum receiver sensitivity (dBm) | –17 | –19 |
| Minimum overload (dBm) | 0 | –3 |

| Item | Performance | |
|---|---|---|
| Minimum extinction ratio (dB) | 9 | 9 |

NOTE

Ethernet service processing boards use SFP modules for providing GE optical interfaces. You can use different types of SFP modules to provide GE optical interfaces with different classification codes and transmission distances.

## 10/100/1000BASE-T(X) Interface Performance

The 10/100/1000BASE-T(X) interface is compliant with IEEE 802.3. The following table provides the primary performance.

**Table 6-40** 10/100/1000BASE-T(X) interface performance

| Item | Performance |
|---|---|
| Nominal bit rate (Mbit/s) | 10 (10BASE-T)<br>100 (100BASE-TX)<br>1000 (1000BASE-T) |
| Code pattern | Manchester encoding signal (10BASE-T)<br>MLT-3 encoding signal (100BASE-TX)<br>4D-PAM5 encoding signal (1000BASE-T) |
| Interface type | RJ-45 |

NOTE

Ethernet service processing boards use SFP modules to provide 10/100/1000BASE-T(X) interfaces.

## 10/100BASE-T(X) Interface Performance

The 10/100BASE-T(X) interface is compliant with IEEE 802.3. The following table provides the primary performance.

**Table 6-41** 10/100BASE-T(X) interface performance

| Item | Performance |
|---|---|
| Nominal bit rate (Mbit/s) | 10 (10BASE-T)<br>100 (100BASE-TX) |
| Code pattern | Manchester encoding signal (10BASE-T)<br>MLT-3 encoding signal (100BASE-TX) |
| Interface type | RJ-45 |

## 6.3.4 Auxiliary Interface Performance

The performance of the auxiliary interfaces includes the performance of the order interface, wayside service interface, synchronous data interface, and asynchronous data interface.

### Orderwire Interface Performance

**Table 6-42** 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 |
| Wire pair in each transmission direction | One symmetrical wire pair |
| Impedance (ohm) | 600 |

NOTE

The OptiX RTN equipment supports the orderwire group call function. For example, when an OptiX RTN equipment calls the number of 888, the orderwire group call number, the orderwire phones of all the OptiX RTN equipment in the orderwire subnet ring until a phone is answered. Then, a point-to-point orderwire phone call is established.

### Wayside Service Interface Performance

**Table 6-43** Wayside service interface performance

| Item | Performance |
|---|---|
| Transmission path | Uses the Huawei-defined byte in the overhead of the microwave frame. |
| Nominal bit rate (kbit/s) | 2048 |
| Wire pair in each transmission direction | One coaxial wire pair |
| Impedance (ohm) | 75 |

### Synchronous Data Interface Performance

**Table 6-44** 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 6-45** Asynchronous data interface performance

| Item | Performance |
|---|---|
| Transmission path | Uses the user-defined byte of the SDH overhead or 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. |

# 6.4 Jitter Performance

The output jitter performance at the SDH and PDH interface complies with relevant ITU-T recommendations.

**Table 6-46** Jitter performance

| Item | Performance |
|---|---|
| Output jitter tolerance at SDH interface | Compliant with ITU-T G.813/ITU-T G.825 |
| Input jitter tolerance at SDH interface | |
| Output jitter tolerance at PDH interface | Compliant with ITU-T G.823/ITU-T G.783 |
| Input jitter tolerance at PDH interface | |

# 6.5 Clock Timing and Synchronization Performance

The clock timing performance and synchronization performance of the OptiX RTN 600 meet relevant ITU-T recommendations.

**Table 6-47** 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, hold-in, and pull-out ranges | |
| Noise generation | |
| Noise tolerance | |
| Noise transfer | |
| Transient response and holdover performance | |

# 6.6 Integrated System Performance

Integrated system performance includes the dimensions, weight, power consumption, power supply, EMC, lightning protection, safety, and environment.

## Dimensions

**Table 6-48** Dimensions

| Component | Dimensions |
|---|---|
| IDU | 442 mm x 220 mm x 87 mm (width x depth x height) |
| ODU | < 280 mm x 92 mm x 280 mm (width x depth x height) |

## Weight and Power Consumption

**Table 6-49** Typical weight

| Component | Typical Weight |
|---|---|
| IDU | 6.2 kg, (1+0 non-protection)<br>6.7 kg, (1+1 protection) |
| ODU | 4.2 kg, (LP/SPA ODU)<br>4.6 kg, (SP/LPA ODU)<br>4.6 kg, (HP ODU) |

**Table 6-50** Typical power consumption

| No. | Radio Link Form | Configuration | Typical Power Consumption (IDU+ODU) |
|---|---|---|---|
| 1 | PDH radio link | 16xE1, 1+0 non-protection | 47.5 W |
| 2 | | 16xE1, 1+1 HSB protection | 72.4 W |
| 3 | PDH radio link | 1xSTM-1, 1+0 non-protection | 54.0 W |
| 4 | | 1xSTM-1, 1+1 HSB protection | 87.5 W |
| 5 | Hybrid radio link | 4xFE+16xE1, 1+0 non-protection | 87 W |
| 6 | | 4xFE+16xE1, 1+1 HSB protection | 123.7 W |

## Power Supply

**Table 6-51** Power supply

| Component | Performance |
|---|---|
| IDU | ● Complies with ETSI EN300 132-2.<br>● Supports two –48 V/–60 V (–38.4 V to –72 V) DC power inputs (mutual backup).<br>● Supports 1+1 protection of 3.3 V power units |
| ODU | ● Complies with ETSI EN300 132-2.<br>● The IDU provides one –48 V (–38.4 V to –72 V) DC power input. |

## EMC

- Passes CE authentication.
- Complies with ETSI EN 301 489-1.
- Complies with ETSI EN 301 489-4.
- Complies with CISPR 22.
- Complies with EN 55022 CLASS B (when an IDU is installed in a outdoor BTS cabinet).

## Lightning Protection

- Complies with ITU-T K.27.
- Complies with ETSI EN 300 253.

## Safety

- Passes CE authentication.
- Complies with ETSI EN 60215.
- Complies with ETSI EN 60950.
- Complies with IEC 60825.

## Environment

The IDU is a unit used in a place that has weather protection and where the temperature can be controlled. The ODU is an outdoor unit.

**Table 6-52** Environment

| **Item** | | **Component** | |
|---|---|---|---|
| | | **IDU** | **ODU** |
| Major reference standards | Operation | Complies with ETSI EN 300 019-1-3 class 3.2 | Complies with ETSI EN 300 019-1-4 class 4.1 |
| | Transportation | Complies with ETSI EN 300 019-1-2 class 2.3 | |
| | Storage | Complies with ETSI EN 300 019-1-1 class 1.2 | |
| Air temperature | Operation | –5°C to +55°C | –35°C to +55°C |
| | Transportation and storage | –40°C to +70°C | |
| Relative humidity | | 5% to 95% | 5% to 100% |
| Noise | | < 7.2 bel, compliant with ETSI EN 300 753 class 3.2 attended | - |
| Earthquake | | Complies with Bellcore GR-63-CORE ZONE 4 | |
| Mechanical stress | | Complies with ETSI EN 300 019 | |

# 7 Compliance Standards

## About This Chapter

# 7.1 ITU-R Standards

The OptiX RTN 620 complies with the ITU-R standards designed for microwave equipment.

**Table 7-1** ITU-R standard

| Standard | Description |
| --- | --- |
| ITU-R F.384-7 | Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the upper 6 GHz band |
| ITU-R F.383-6 | Radio-frequency channel arrangements for high capacity radio-relay systems operating in the lower 6 GHz band |
| ITU-R F.385-8 | Radio-frequency channel arrangements for fixed radio systems operating in the 7 GHz band |
| ITU-R F.386-6 | Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the 8 GHz band |
| ITU-R F.387-9 | Radio-frequency channel arrangements for radio-relay systems operating in the 11 GHz band |
| ITU-R F.497-6 | Radio-frequency channel arrangements for radio-relay systems operating in the 13 GHz frequency band |
| ITU-R F.636-3 | Radio-frequency channel arrangements for radio-relay systems operating in the 15 GHz band |
| ITU-R F.595-8 | Radio-frequency channel arrangements for fixed radio systems operating in the 18 GHz frequency band |
| ITU-R F.637-3 | Radio-frequency channel arrangements for radio-relay systems operating in the 23 GHz band |
| ITU-R F.748-3 | Radio-frequency channel arrangements for radio-relay systems operating in the 25, 26 and 28 GHz bands |
| ITU-R F.749-2 | Radio-frequency arrangements for systems of the fixed service operating in the 38 GHz band |
| ITU-R F.1191-1 1 | Bandwidths and unwanted emissions of digital radio-relay systems |
| ITU-R SM.329-10 | Unwanted emissions in the spurious domain |

# 7.2 ETSI Standards

The OptiX RTN 620 complies with the ETSI standards designed for microwave equipment.

**Table 7-2** ETSI standard

| Standard | Description |
|---|---|
| ETSI EN 302 217-1 V1.1.4 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 1: Overview and system-independent common characteristics |
| ETSI EN 302 217-2-1 V1.1.3 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-1: System-dependent requirements for digital systems operating in frequency bands where frequency co-ordination is applied |
| ETSI EN 302 217-2-2 V1.1.3 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 2-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for digital systems operating in frequency bands where frequency co-ordination is applied |
| ETSI EN 302 217-3 V1.1.3 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for equipment operating in frequency bands where no frequency co-ordination is applied |
| ETSI EN 302 217-4-1 V1.1.3 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-1: System-dependent requirements for antennas |
| ETSI EN 302 217-4-2 V1.2.1 | Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas |
| ETSI EN 301 126-1 V1.1.2 | Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment - Definitions, general requirements and test procedures |
| ETSI EN 301 126-3-1 V1.1.2 | Fixed Radio Systems; Conformance testing; Part 3-1: Point-to-Point antennas; Definitions, general requirements and test procedures |
| ETSI EN 301 390 V1.2.1 | Fixed Radio Systems; Point-to-point and Multipoint Systems; Spurious emissions and receiver immunity limits at equipment/ antenna port of Digital Fixed Radio Systems |

# 7.3 Relevant IEC Standards

The OptiX RTN 620 is compliant with the IEC standards related to the waveguide.

**Table 7-3** Relevant IEC standards

| Standard | Description |
|---|---|
| IEC 60153-2-1974 | Hollow metallic waveguides Part 2: Relevant specifications for ordinary rectangular waveguides |
| IEC 60154-2-1980 | Flanges for waveguides Part 2: Relevant specifications for flanges for ordinary rectangular waveguides |

# 7.4 ITU-T Standards

The OptiX RTN 620 complies with the ITU-T standards designed for SDH/PDH equipment.

**Table 7-4** ITU-T standard

| Standard | Description |
|---|---|
| ITU-T G.702 | Digital hierarchy bit rates |
| ITU-T G.703 | Physical/electrical characteristics of hierarchical digital interfaces |
| ITU-T G.704 | Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44,736 kbit/s hierarchical levels |
| ITU-T G.706 | Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in Recommendation G.704 |
| ITU-T G.775 | Loss of Signal (LOS), Alarm Indication Signal (AIS) and Remote Defect Indication (RDI) defect detection and clearance criteria for PDH signals |
| ITU-T G.707 | Network node interface for the synchronous digital hierarchy (SDH) |
| ITU-T G.831 | Management capabilities of transport networks based on the synchronous digital hierarchy (SDH) |
| ITU-T G.832 | Transport of SDH elements on PDH networks - Frame and multiplexing structures |
| ITU-T G.773 | Protocol suites for Q-interfaces for management of transmission systems |
| ITU-T G.774 | Synchronous digital hierarchy (SDH) management information model for the network element view |
| ITU-T G.774.1 | Synchronous Digital Hierarchy(SDH) performance monitoring for the network element view |
| ITU-T G.774.2 | Synchronous digital hierarchy (SDH) configuration of the payload structure for the network element view |
| ITU-T G.774.3 | Synchronous digital hierarchy (SDH) management of multiplex-section protection for the network element view |

| Standard | Description |
|---|---|
| ITU-T G.774.4 | Synchronous digital hierarchy (SDH) management of the sub-network connection protection for the network element view |
| ITU-T G.774.5 | Synchronous digital hierarchy (SDH) management of connection supervision functionality (HCS/LCS) for the network element view |
| ITU-T G.774.6 | Synchronous digital hierarchy (SDH) unidirectional performance monitoring for the network element view |
| ITU-T G.774.7 | Synchronous digital hierarchy (SDH) management of lower order path trace and interface labeling for the network element view |
| ITU-T G.774.9 | Synchronous digital hierarchy (SDH) configuration of linear multiplex section protection for the network element view |
| ITU-T G.774.10 | Synchronous digital hierarchy (SDH) configuration of linear multiplex section protection for the network element view |
| ITU-T G.784 | Synchronous digital hierarchy (SDH) management |
| ITU-T G.780 | Vocabulary of terms for synchronous digital hierarchy (SDH) networks and equipment |
| ITU-T G.781 | Synchronization layer functions |
| ITU-T G.783 | Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks |
| ITU-T G.803 | Architecture of transport networks based on the synchronous digital hierarchy (SDH) |
| ITU-T G.805 | Generic functional architecture of transport networks |
| ITU-T G.806 | Characteristics of transport equipment – Description methodology and generic functionality |
| ITU-T G.810 | Definitions and terminology for synchronization networks |
| ITU-T G.811 | Timing characteristics of primary reference clocks |
| ITU-T G.812 | Timing requirements of slave clocks suitable for use as node clocks in synchronization networks |
| ITU-T G.813 | Timing characteristics of SDH equipment slave clocks (SEC) |
| ITU-T G.821 | Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network |
| ITU-T G.822 | Controlled slip rate objectives on an international digital connection |
| ITU-T G.823 | The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy |
| ITU-T G.825 | The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH) |

| Standard | Description |
|---|---|
| ITU-T G.826 | Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate |
| ITU-T G.828 | Error performance parameters and objectives for international, constant bit rate synchronous digital paths |
| ITU-T G.829 | Error performance events for SDH multiplex and regenerator sections |
| ITU-T G.957 | Optical interfaces for equipments and systems relating to the synchronous digital hierarchy |
| ITU-T G.958 | Digital line systems based on the synchronous digital hierarchy for use on optical fiber cables. |
| ITU-T G.841 | Types and characteristics of SDH network protection architectures |
| ITU-T G.842 | Inter-working of SDH network protection architectures |
| ITU-T G.7041/Y. 1303 | Generic framing procedure (GFP) |
| ITU-T G.7042/Y. 1305 | Link capacity adjustment scheme (LCAS) for virtual concatenated signals |
| ITU-T X.86/Y.1323 | Ethernet over LAPS |
| ITU-T G.8011 | Ethernet over Transport - Ethernet services framework |

# 7.5 IETF Standards

The OptiX RTN 620 complies with IETF standards.

**Table 7-5** IETF standard

| Standard | Description |
|---|---|
| RFC 2819 | Remote Network Monitoring Management Information Base |
| RFC 1662 | PPP in HDLC-like Framing |
| RFC 2615 | PPP over SONET/SDH |

# 7.6 IEEE Standards

The OptiX RTN 620 complies with the IEEE standards designed for Ethernet networks.

**Table 7-6** IEEE standard

| Standard | Description |
|---|---|
| IEEE Std 802.3 | Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specification |
| IEEE 802.3x | Full Duplex Operation and Type 100BASE-T2 |
| IEEE 802.3u | Media Access Control (MAC) parameters, physical Layer, medium attachment units, and repeater for 100 Mb/s operation, type 100Base-T |
| IEEE 802.3z | Media Access Control (MAC) parameters, physical Layer, repeater and management parameters for 1000 Mb/s operation |
| IEEE 802.3ah | Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks |
| IEEE 802.1d | Media Access Control (MAC) Bridges |
| IEEE 802.1q | Virtual bridged local area networks |
| IEEE 802.1ad | Virtual Bridged Local Area Networks Amendment 4: Provider Bridges |
| IEEE 802.1ag | Virtual Bridged Local Area Networks — Amendment 5: Connectivity Fault Management |

# 7.7 Environmental Standards

The OptiX RTN 620 complies with the environmental standards designed for split-mount microwave equipment.

**Table 7-7** environmental standard

| Standard | Description |
|---|---|
| EN 55022 | Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment |
| CISPR 22 | Limits and methods of measurement of radio disturbance characteristics of information |
| ETSI EN 301 489-1 | Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements |
| ETSI EN 301 489-4 | Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services |
| NEBS GR-63-CORE | Network Equipment-Building System (NEBS) Requirements: Physical Protection |

| Standard | Description |
|---|---|
| EN 60950-1 | Information technology equipment–Safety–Part 1: General requirements |
| UL 60950-1 | Information technology equipment–Safety–Part 1: General requirements |
| IEC 60825-1 | Safety of laser products-Part 1: Equipment classification, requirements and user's guide |
| IEC 60825-2 | Safety of laser products-Part 2: Safety of optical fiber communication systems (OFCS) |
| IEC 60950-1 | Information technology equipment–Safety–Part 1: General requirements |
| IEC 60950-22 (Outdoor Unit) | Information technology equipment-Safety-Part 22: Equipment to be installed outdoors |
| IEC 61000-4-2 | Electromagnetic compatibility (EMC) Part 2: Testing and measurement techniques Section 2: Electrostatic discharge immunity test Basic EMC Publication |
| IEC 61000-4-3 | Electromagnetic compatibility; Part 3: Testing and measurement techniques Section 3 radio frequency electromagnetic fields; immunity test. |
| IEC 61000-4-4 | Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 4: Electrical fast transient/burst immunity test Basic EMC publication |
| IEC 61000-4-5 | Electromagnetic compatibility (EMC) Part 5: Testing and measurement techniques Section 5: Sruge immunity test |
| IEC 61000-4-6 | Electromagnetic compatibility: Part 6: Testing and measurement techniques: Section 6 conducted disturbances induced by radio-frequency fields; immunity test |
| IEC721-3-1 Classes 1K4/1Z2/1Z3/1Z5/1B2/1C2/1S3/1M2 | Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 1: Storage Classes 1K4/1Z2/1Z3/1Z5/1B2/1C2/1S3/1M2 |
| IEC721-3-2 Classes 2K4/2B2/2C2/2S2/2M2 | Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation Classes 2K4/2B2/2C2/2S2/2M2 |
| IEC721-3-3 Classes 3K5/3Z2/3Z4/3B2/3C2(3C1)/3S2/3M2 (Indoor Unit) | Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weatherprotected locations Classes 3K5/3Z2/3Z4/3B2/3C2(3C1)/3S2/3M2 |
| IEC721-3-4 Classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5 (Outdoor Unit) | Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 4: Stationary use at non-weatherprotected locations. Classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5 |

| Standard | Description |
| --- | --- |
| ETSI EN 300 019-1-1 Class 1.2 | Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage Class 1.2 |
| ETSI EN 300 019-1-2 Class 2.3 | Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of environmental conditions; Transportation Class 2.3 |
| ETSI EN 300 019-1-3 Class 3.2 (Indoor Unit) | Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations; Class 3.2 |
| ETSI EN 300 019-1-4 Class 4.1 (Outdoor Unit) | Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations Class 4.1 |

# A Glossary

Terms are listed in an alphabetical order.



# A.1 0-9

This section provides the terms starting with numbers.

**1+1 protection**
An architecture that has one normal traffic signal, one working SNC/trail, one protection SNC/trail and a permanent bridge. At the source end, the normal traffic signal is permanently bridged to both the working and protection SNC/trail. At the sink end, the normal traffic signal is selected from the better of the two SNCs/trails. Due to the permanent bridging, the 1+1 architecture does not allow an extra unprotected traffic signal to be provided.

**1U**
The standard electronics industries association (EIA) rack unit (44 mm/1.75 in.)

**802.1Q in 802.1Q**
802.1Q in 802.1Q (QinQ) is 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, making the frame encapsulated with two layers of VLAN tags. The frame is forwarded over the service provider's backbone network based on the public VLAN tag. By this, a layer 2 VPN tunnel is provided to customers.The QinQ feature enables the transmission of the private VLANs to the peer end transparently.

# A.2 A-E

This section provides the terms starting with letters A to E.

## A

**ACAP**
See **adjacent channel alternate polarization**

**adaptive modulation**
A technology that is used to automatically adjust the modulation mode according to the channel quality. When the channel quality is favorable, the equipment adopts 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 adopts the low-efficiency modulation mode to improve the anti-interference capability of the link that carries high-priority services.

**ADC**
See **Analog to Digital Converter**

**add/drop multiplexer**
Add/Drop Multiplexing. Network elements that provide access to all or some subset of the constituent signals contained within an STM-N signal. The constituent signals are added to (inserted), and/or dropped from (extracted) the STM-N signal as it passed through the ADM.

**Address Resolution Protocol**
Address Resolution Protocol (ARP) is an Internet Protocol used to map IP addresses to MAC addresses. It allows hosts and routers to determine the link layer addresses through ARP requests and ARP responses. The address resolution is a process in which the host converts the target IP address into a target MAC address before transmitting a frame. The basic function of the ARP is to query the MAC address of the target equipment through its IP address.

**adjacent channel alternate polarization**
A channel configuration method, which uses two adjacent channels (a horizontal polarization wave and a vertical polarization wave) to transmit two signals.

**ADM**
See **add/drop multiplexer**

| | |
|---|---|
| **Administrative Unit** | The information structure which provides adaptation between the higher order path layer and the multiplex section layer. It consists of an information payload (the higher order VC) and an AU pointer which indicates the offset of the payload frame start relative to the multiplex section frame start. |
| **AGC** | See **Automatic Gain Control** |
| **AM** | See **adaptive modulation** |
| **Analog to Digital Converter** | An electronic circuit that converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (DAC). |
| **APS** | See **Automatic Protection Switching** |
| **ARP** | See **Address Resolution Protocol** |
| **ASK** | amplitude shift keying |
| **ATPC** | See **automatic transmit power control** |
| **AU** | See **Administrative Unit** |
| **Automatic Gain Control** | A process or means by which gain is automatically adjusted in a specified manner as a function of a specified parameter, such as received signal level. |
| **Automatic Protection Switching** | Automatic Protection Switching (APS) is the capability of a transmission system to detect a failure on a working facility and to switch to a standby facility to recover the traffic. |
| **automatic transmit power control** | A method of adjusting the transmit power based on fading of the transmit signal detected at the receiver |

## B

| | |
|---|---|
| **Base Station Controller** | A logical entity that connects the BTS with the MSC in a GSM 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. |
| **BER** | See **Bit Error Rate** |
| **BIOS** | Basic Input Output System |
| **BIP** | Bit-Interleaved Parity |
| **bit error** | An incompatibility between a bit in a transmitted digital signal and the corresponding bit in the received digital signal. |
| **Bit Error Rate** | Bit error rate. Ratio of received bits that contain errors. BER is an important index used to measure the communications quality of a network. |
| **BPDU** | See **Bridge Protocol Data Unit** |
| **Bridge Protocol Data Unit** | The data messages that are exchanged across the switches within an extended LAN that uses a spanning tree protocol (STP) topology. BPDU packets contain information on ports, addresses, priorities and costs and ensure that the data ends up where it was intended to go. BPDU messages are exchanged across bridges to detect loops in a network topology. The loops are then removed by shutting down selected bridges interfaces and placing redundant switch ports in a backup, or blocked, state. |
| **BSC** | See **Base Station Controller** |

# C

| | |
|---|---|
| **C-VLAN** | Customer VLAN |
| **CAR** | See **committed access rate** |
| **CBS** | See **Committed Burst Size** |
| **CCDP** | See **Co-Channel Dual Polarization** |
| **Central Processing Unit** | The CPU is the brains of the computer. Sometimes referred to simply as the processor or central processor, the CPU is where most calculations take place. |
| **CF** | See **compact flash** |
| **CGMP** | Cisco Group Management Protocol |
| **CIR** | See **Committed Information Rate** |
| **CIST** | See **Common and Internal Spanning Tree** |
| **Class of Service** | A class object that stores the priority mapping rules. When network congestion occurs, the class of service (CoS) first processes services by different priority levels from high to low. If the bandwidth is insufficient to support all services, the CoS dumps the services of low priority. |
| **Co-Channel Dual Polarization** | A channel configuration method, which uses a horizontal polarization wave and a vertical polarization wave to transmit two signals. The Co-Channel Dual Polarization is twice the transmission capacity of the single polarization. |
| **committed access rate** | A traffic control method that uses a set of rate limits to be applied to a router interface. CAR is a configurable method by which incoming and outgoing packets can be classified into QoS (Quality of Service) groups, and by which the input or output transmission rate can be defined. |
| **Committed Burst Size** | committed burst size. A parameter used to define the capacity of token bucket C, that is, the maximum burst IP packet size when the information is transferred at the committed information rate. This parameter must be larger than 0. It is recommended that this parameter should be not less than the maximum length of the IP packet that might be forwarded. |
| **Committed Information Rate** | The rate at which a frame relay network agrees to transfer information in normal conditions. Namely, it is the rate, measured in bit/s, at which the token is transferred to the leaky bucket. |
| **Common and Internal Spanning Tree** | Common and Internal Spanning Tree. The single Spanning Tree calculated by STP and RSTP together with the logical continuation of that connectivity through MST Bridges and regions, calculatedby MSTP to ensure that all LANs in the Bridged Local Area Network are simply and fully connected. |
| **compact flash** | Compact flash (CF) was originally developed as a type of data storage device used in portable electronic devices. For storage, CompactFlash typically uses flash memory in a standardized enclosure. |
| **CoS** | See **Class of Service** |
| **CPU** | See **Central Processing Unit** |
| **CRC** | See **Cyclic Redundancy Check** |

| | |
|---|---|
| **cross polarization interference cancellation** | 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. |
| **Cyclic Redundancy Check** | A procedure used in checking for errors in data transmission. CRC error checking uses a complex calculation to generate a number based on the data transmitted. The sending device performs the calculation before transmission and includes it in the packet that it sends to the receiving device. The receiving device repeats the same calculation after transmission. If both devices obtain the same result, it is assumed that the transmission was error free. The procedure is known as a redundancy check because each transmission includes not only data but extra (redundant) error-checking values. |

# D

| | |
|---|---|
| **Data Communication Network** | A communication network used in a TMN or between TMNs to support the Data Communication Function (DCF). |
| **Data Communications Channel** | The data channel that uses the D1-D12 bytes in the overhead of an STM-N signal to transmit information on operation, management, maintenance and provision (OAM&P) between NEs. The DCC channels that are composed of bytes D1-D3 is referred to as the 192 kbit/s DCC-R channel. The other DCC channel that are composed of bytes D4-D12 is referred to as the 576 kbit/s DCC-M channel. |
| **DC** | See **Direct Current** |
| **DC-C** | See **DC-Return Common (with Ground)** |
| **DC-I** | See **DC-Return Isolate (with Ground)** |
| **DC-Return Common (with Ground)** | 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)** | 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. |
| **DCC** | See **Data Communications Channel** |
| **DCN** | See **Data Communication Network** |
| **Differentiated Services Code Point** | Differentiated Services CodePoint. A marker in the header of each IP packet using bits 0-6 in the DS field. Routers provide differentiated classes of services to various service streams/flows based on this marker. In other words, routers select corresponding PHB according to the DSCP value. |
| **digital modulation** | A digital modulation 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. |
| **Direct Current** | Electrical current whose direction of flow does not reverse. The current may stop or change amplitude, but it always flows in the same direction. |
| **Distance Vector Multicast Routing Protocol** | Distance Vector Multicast Routing Protocol. The DVMRP protocol is an Internet gateway protocol mainly based on the RIP. The protocol implements a typical dense mode IP multicast solution. The DVMRP protocol uses IGMP to exchange routing datagrams with its neighbors. |
| **DSCP** | See **Differentiated Services Code Point** |

| | |
|---|---|
| **dual-polarized antenna** | An antenna intended to radiate or receive simultaneously two independent radio waves orthogonally polarized. |
| **DVMRP** | See **Distance Vector Multicast Routing Protocol** |

## E

| | |
|---|---|
| **E-LAN** | Ethernet-LAN |
| **ECC** | See **Embedded Control Channel** |
| **Electro Magnetic Interference** | Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. |
| **electromagnetic compatibility** | Electromagnetic compatibility is the 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. [NTIA] |
| **Embedded Control Channel** | An ECC provides a logical operations channel between SDH NEs, utilizing a data communications channel (DCC) as its physical layer. |
| **EMC** | See **electromagnetic compatibility** |
| **EMI** | See **Electro Magnetic Interference** |
| **EPL** | See **Ethernet Private Line** |
| **EPLAN** | See **ethernet private lan service** |
| **equalization** | A method of avoiding selective fading of frequencies. Equalization can compensate for the changes of amplitude frequency caused by frequency selective fading. |
| **ERPS** | See **ethernet ring protection switching** |
| **ES-IS** | End System to Intermediate System |
| **ethernet private lan service** | An Ethernet service type, which carries Ethernet characteristic information over a dedocated bridge, point-to-multipoint connections, provided by SDH, PDH, ATM, or MPLS server layer networks. |
| **Ethernet Private Line** | A point-to-point interconnection between two UNIs without SDH bandwidth sharing. Transport bandwidth is never shared between different customers. |
| **ethernet ring protection switching** | protection switching mechanisms for ETH layer Ethernet ring topologies. |
| **ethernet virtual private lan service** | An Ethernet service type, which carries Ethernet characteristic information over a shared bridge, point-to-multipoint connections, provided by SDH, PDH, ATM, or MPLS server layer networks. |
| **ethernet virtual private line service** | An Ethernet service type, which carries Ethernet characteristic information over shared bandwidth, point-to-point connections, provided by SDH, PDH, ATM, or MPLS server layer networks. |
| **ETSI** | See **European Telecommunications Standards Institute** |
| **European Telecommunications Standards Institute** | A standards-setting body in Europe. Also the standards body responsible for GSM. |

| | |
|---|---|
| **EVPL** | See **ethernet virtual private line service** |
| **EVPLAN** | See **ethernet virtual private lan service** |

# A.3 F-J

This section provides the terms starting with letters F to J.

## F

| | |
|---|---|
| **Fast Ethernet** | A type of Ethernet with a maximum transmission rate of 100 Mbit/s. It complies with the IEEE 802.3u standard and extends the traditional media-sharing Ethernet standard. |
| **fast link pulse** | The likn pulse that is used to encode information during automatic negotiation. |
| **FCS** | Frame Check Sequence |
| **FD** | See **frequency diversity** |
| **FE** | See **Fast Ethernet** |
| **FEC** | See **Forward Error Correction** |
| **Field Programmable Gate Array** | A type of semi-customized circuit used in the Application Specific Integrated Circuit (ASIC) field. It is developed on the basis of the programmable components, such as the PAL, GAL, and EPLD. It not only remedies the defects of customized circuits, but also overcomes the disadvantage of the original programmable components in terms of the limited number of gate arraies. |
| **FIFO** | See **First in First out** |
| **File Transfer Protocol** | A member of the TCP/IP suite of protocols, used to copy files between two computers on the Internet. Both computers must support their respective FTP roles: one must be an FTP client and the other an FTP server. |
| **First in First out** | A stack management mechanism. The first saved data is first read and invoked. |
| **FLP** | See **fast link pulse** |
| **Forward Error Correction** | A bit error correction technology that adds the correction information to the payload at the transmit end. Based on the correction information, the bit errors generated during transmission are corrected at the receive end. |
| **FPGA** | See **Field Programmable Gate Array** |
| **frequency diversity** | A diversity scheme that enables two or more microwave frequencies with a certain frequency interval are used to transmit/receive the same signal and selection is then performed between the two signals to ease the impact of fading. |
| **FTP** | See **File Transfer Protocol** |

## G

| | |
|---|---|
| **gateway network element** | A network element that is used for communication between the NE application layer and the NM application layer |
| **GE** | See **Gigabit Ethernet** |

**Generic traffic shaping** A traffic control measure that initiatively 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.

**GFP** Generic Framing Procedure

**Gigabit Ethernet** GE adopts the IEEE 802.3z. GE is compatible with 10 Mbit/s and 100 Mbit/s Ethernet.It runs at 1000Mbit/s. Gigabit Ethernet uses a private medium, and it does not support coaxial cables or other cables. It also supports the channels in the bandwidth mode. If Gigabit Ethernet is, however, deployed to be the private bandwidth system with a bridge (switch) or a router as the center, it gives full play to the performance and the bandwidth. In the network structure, Gigabit Ethernet uses full duplex links that are private, causing the length of the links to be sufficient for backbone applications in a building and campus.

**GNE** See **gateway network element**

**Graphical User Interface** A visual computer enviroment that represents programs, files, and options with graphical images, such as icons, menus, and dialog boxes, on the screen.

**GTS** See **Generic traffic shaping**

**GUI** See **Graphical User Interface**

## H

**HDB3** High Density Bipolar Code 3

**HDLC** See **High level Data Link Control procedure**

**High level Data Link Control procedure** A data link protocol from ISO for point-to-point communications over serial links. Derived from IBM's SDLC protocol, HDLC has been the basis for numerous protocols including X.25, ISDN, T1, SS7, GSM, CDPD, PPP and others. Various subsets of HDLC have been developed under the name of Link Access Procedure (LAP).

**hot standby** A mechanism of ensuring device running security. The environment variables and storage information of each running device are synchronized to the standby device. When the faults occur on the running device, the standby device can take over the services in the faulty device in automatic or manual way to ensure the normal running of the entire system.

**HSM** Hitless Switch Mode

**hybrid radio** The hybrid transmission of Native E1 and Native Ethernet signals. Hybrid radio supports the AM function.

## I

**ICMP** See **Internet Control Messages Protocol**

**IDU** See **indoor unit**

**IEC** See **International Electrotechnical Commission**

**IEEE** See **Institute of Electrical and Electronics Engineers**

**IETF** The Internet Engineering Task Force

**IF** See **intermediate frequency**

**IGMP** See **Internet Group Management Protocol**

| | |
|---|---|
| **IGMP snooping** | A multicast constraint mechanism running on a layer 2 device. This protocol manages and controls the multicast group by listening to and analyze the Internet Group Management Protocol (IGMP) packet between hosts and layer 3 devices. In this manner, the spread of the multicast data on layer 2 network can be prevented efficiently. |
| **indoor unit** | The indoor unit of the split-structured radio equipment. It implements accessing, multiplexing/demultiplexing, and IF processing for services. |
| **Institute of Electrical and Electronics Engineers** | A society of engineering and electronics professionals based in the United States but boasting membership from numerous other countries. The IEEE focuses on electrical, electronics, computer engineering, and science-related matters. |
| **intermediate frequency** | The transitional frequency between the frequencies of a modulated signal and an RF signal. |
| **intermediate frequency** | The transitional frequency between the frequencies of a modulated signal and an RF signal. |
| **Intermediate System to Intermediate System** | A protocol used by network devices (routers) .IS-IS is a kind of Interior Gateway Protocol (IGP), used within the ASs. It is a link status protocol using Shortest Path First (SPF) algorithm to calculate the route. |
| **International Electrotechnical Commission** | The International Electrotechnical Commission (IEC) is an international and non-governmental standards organization dealing with electrical and electronical standards. |
| **International Organization for Standardization** | ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards. |
| **Internet Control Messages Protocol** | ICMP belongs to the TCP/IP protocol suite. It is used to send error and control messages during the transmission of IP-type data packets. |
| **Internet Group Management Protocol** | The protocol for managing the membership of Internet Protocol multicast groups among the TCP/IP protocols. It is used by IP hosts and adjacent multicast routers to establish and maintain multicast group memberships. |
| **Internet Protocol** | The TCP/IP standard protocol that defines the IP packet as the unit of information sent across an internet and provides the basis for connectionless, best-effort packet delivery service. IP includes the ICMP control and error message protocol as an integral part. The entire protocol suite is often referred to as TCP/IP because TCP and IP are the two fundamental protocols. IP is standardized in RFC 791. |
| **Internet Protocol Version 6** | A update version of IPv4. It is also called IP Next Generation (IPng). The specifications and standardizations provided by it are consistent with the Internet Engineering Task Force (IETF).Internet Protocol Version 6 (IPv6) is also called. It is a new version of the Internet Protocol, designed as the successor to IPv4. The specifications and standardizations provided by it are consistent with the Internet Engineering Task Force (IETF).The difference between IPv6 and IPv4 is that an IPv4 address has 32 bits while an IPv6 address has 128 bits. |
| **IP** | See **Internet Protocol** |
| **IPv6** | See **Internet Protocol Version 6** |
| **IS-IS** | See **Intermediate System to Intermediate System** |
| **ISO** | See **International Organization for Standardization** |
| **ITU-T** | International Telecommunication Union - Telecommunication Standardization Sector |

| | |
|---|---|
| **IVL** | Independence VLAN learning |

# A.4 K-O

This section provides the terms starting with letters K to O.

## L

| | |
|---|---|
| **LAG** | See **link aggregation group** |
| **LAN** | See **Local Area Network** |
| **LAPD** | Link Access Procedure on the D channel |
| **LAPS** | Link Access Procedure-SDH |
| **layer 2 switch** | A data forwarding method. In LAN, a network bridge or 802.3 Ethernet switch transmits and distributes packet data based on the MAC address. Since the MAC address is the second layer of the OSI model, this data forwarding method is called layer 2 switch. |
| **LB** | See **Loopback** |
| **LCAS** | See **Link Capacity Adjustment Scheme** |
| **LDPC** | Low-Density Parity Check code |
| **link aggregation group** | An aggregation that allows one or more links to be aggregated together to form a link aggregation group so that a MAC clientcan treat the link aggregation group as if it were a single link. |
| **Link Capacity Adjustment Scheme** | The Link Capacity Adjustment Scheme (LCAS) is designed to allow the dynamic provisioning of bandwidth, using VCAT, to meet customer requirements. |
| **LMSP** | Linear Multiplex Section Protection |
| **Local Area Network** | A network formed by the computers and workstations within the coverage of a few square kilometers or within a single building. It features high speed and low error rate. Ethernet, FDDI, and Token Ring are three technologies used to implement a LAN. Current LANs are generally based on switched Ethernet or Wi-Fi technology and running at 1,000 Mbit/s (that is, 1 Gbit/s). |
| **Loopback** | A troubleshooting technique that returns a transmitted signal to its source so that the signal or message can be analyzed for errors. |
| **LPT** | Link State Path Through |

## M

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|---|---|
| **MA** | See **Maintenance Association** |
| **MAC** | See **Medium Access Control** |
| **MADM** | Multi Add-Drop Multiplexer |
| **Maintenance Association** | That portion of a Service Instance, preferably all of it or as much as possible, the connectivity of which is maintained by CFM. It is also a full mesh of Maintenance Entities. |

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| **Maintenance Domain** | The Maintenance Domain (MD) refers to the network or the part of the network for which connectivity is managed by CFM. The devices in an MD are managed by a single ISP. |
| **Maintenance Point** | Maintenance Point (MP) is one of either a MEP or a MIP. |
| **Management Information Base** | 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 Transfer Unit** | The MTU (Maximum Transmission Unit) is the size of the largest datagram that can be sent over a network. |
| **MBS** | Maximum Burst Size |
| **MD** | See **Maintenance Domain** |
| **MDI** | See **Medium Dependent Interface** |
| **Mean Time To Repair** | The average time that a device will take to recover from a failure. |
| **Medium Access Control** | A general reference to the low-level hardware protocols used to access a particular network. The term MAC address is often used as a synonym for physical addresses. |
| **Medium Dependent Interface** | The electrical and mechanical interface between the equipment and the media transmission. |
| **MEP** | Maintenance End Point |
| **MIB** | See **Management Information Base** |
| **MP** | See **Maintenance Point** |
| **MSP** | See **multiplex section protection** |
| **MSTP** | See **Multiple Spanning Tree Protocol** |
| **MTBF** | Mean Time Between Failure |
| **MTTR** | See **Mean Time To Repair** |
| **MTU** | See **Maximum Transfer Unit** |
| **Multiple Spanning Tree Protocol** | Multiple spanning tree protocol. The MSTP 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. |
| **multiplex section protection** | 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. |

## N

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| **N+1 protection** | A radio link protection system composed of N working channels and one protection channel. |
| **NE** | See **Network Element** |
| **Network Element** | A network element (NE) contains both the hardware and the software running on it. One NE is at least equipped with one system control board which manages and monitors the entire network element. The NE software runs on the system control board. |

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| **network management system** | The network management system in charge of the operation, administration, and maintenance of a network. |
| **Network Service Access Point** | A network address defined by ISO, through which entities on the network layer can access OSI network services. |
| **NLP** | Normal Link Pulse |
| **NMS** | See **network management system** |
| **NNI** | Network-to-Network Interface or Network Node Interface |
| **non-gateway network element** | A network element whose communication with the NM application layer must be transferred by the gateway network element application layer. |
| **non-GNE** | See **non-gateway network element** |
| **NSAP** | See **Network Service Access Point** |

### O

| | |
|---|---|
| **OAM** | Operations, Administration and Maintenance |
| **ODU** | See **outdoor unit** |
| **Open Shortest Path First** | A link-state, hierarchical interior gateway protocol (IGP) for network routing. Dijkstra's algorithm is used to calculate the shortest path tree. It 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. |
| **Open Systems Interconnection** | A standard or "reference model" (officially defined by the International Organization of Standards (ISO)) for how messages should be transmitted between any two points in a telecommunication network. The reference model defines seven layers of functions that take place at each end of a communication. |
| **orderwire** | A channel that provides voice communication between operation engineers or maintenance engineers of different stations. |
| **OSI** | See **Open Systems Interconnection** |
| **OSPF** | See **Open Shortest Path First** |
| **outdoor unit** | The outdoor unit of the split-structured radio equipment. It implements frequency conversion and amplification for RF signals. |

## A.5 P-T

This section provides the terms starting with letters P to T.

### P

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|---|---|
| **PDH** | See **Plesiochronous Digital Hierarchy** |
| **Peak Information Rate** | Peak Information Rate . A traffic parameter, expressed in bit/s, whose value should be not less than the committed information rate. |
| **PIM-DM** | Protocol Independent Multicast-Dense Mode |
| **PIM-SM** | See **Protocol Independent Multicast-Sparse Mode** |

**PIR** See **Peak Information Rate**

**Plesiochronous Digital Hierarchy** A multiplexing scheme of bit stuffing and byte interleaving. It multiplexes the minimum rate 64 kit/s into the 2 Mbit/s, 34 Mbit/s, 140 Mbit/s, and 565 Mbit/s rates.

**Point-to-Point Protocol** A protocol on the data link layer, provides point-to-point transmission and encapsulates data packets on the network layer. It is located in layer 2 of the IP protocol stack.

**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.

**PPP** See **Point-to-Point Protocol**

**PRBS** Pseudo-Random Binary Sequence

**Protocol Independent Multicast-Sparse Mode** A protocol for efficiently routing to multicast groups that may span wide-area (and inter-domain) internets. This protocol is named protocol independent because it is not dependent on any particular unicast routing protocol for topology discovery, and sparse-mode because it is suitable for groups where a very low percentage of the nodes (and their routers) will subscribe to the multicast session. Unlike earlier dense-mode multicast routing protocols such as DVMRP and PIM-DM which flooded packets everywhere and then pruned off branches where there were no receivers, PIM-SM explicitly constructs a tree from each sender to the receivers in the multicast group. Multicast packets from the sender then follow this tree.

# Q

**QoS** See **Quality of Service**

**QPSK** See **Quadrature Phase Shift Keying**

**Quadrature Phase Shift Keying** Quadrature Phase Shift Keying (QPSK) is a modulation method of data transmission through the conversion or modulation and the phase determination of the reference signals (carrier). It is also called the fourth period or 4-phase PSK or 4-PSK. QPSK uses four dots in the star diagram. The four dots are evenly distributed on a circle. On these phases, each QPSK character can perform two-bit coding and display the codes in Gray code on graph with the minimum BER.

**Quality of Service** Quality of Service, which determines the satisfaction of a subscriber for a service. QoS is influenced by the following factors applicable to all services: service operability, service accessibility, service maintainability, and service integrity.

# R

**Radio Freqency** A type of electric current in the wireless network using AC antennas to create an electromagnetic field. It is the abbreviation of high-frequency AC electromagnetic wave. The AC with the frequency lower than 1 kHz is called low-frequency current. The AC with frequency higher than 10 kHz is called high-frequency current. RF can be classified into such high-frequency current.

**Radio Network Controller** A device used in the RNS to control the usage and integrity of radio resources.

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| **Rapid Spanning Tree Protocol** | An evolution of the Spanning Tree Protocol, providing for faster spanning tree convergence after a topology change. The RSTP protocol is backward compatible with the STP protocol. |
| **Received signal level** | The signal level at a receiver input terminal. |
| **Received Signal Strength Indicator** | The received wide band power, including thermal noise and noise generated in the receiver, within the bandwidth defined by the receiver pulse shaping filter, for TDD within a specified timeslot. The reference point for the measurement shall be the antenna |
| **RF** | See **Radio Freqency** |
| **RFC** | Request For Comment |
| **RIP** | See **Routing Information Protocol** |
| **RMON** | Remote Monitoring |
| **RNC** | See **Radio Network Controller** |
| **Routing Information Protocol** | Routing Information Protocol: A simple routing protocol that is part of the TCP/IP protocol suite. It determines a route based on the smallest hop count between source and destination. RIP is a distance vector protocol that routinely broadcasts routing information to its neighboring routers and is known to waste bandwidth. |
| **RS** | Reed-Solomon encoding |
| **RSL** | Received Signal Level |
| **RSSI** | See **Received Signal Strength Indicator** |
| **RSTP** | See **Rapid Spanning Tree Protocol** |
| **RTN** | Radio Transmission Node |

## S

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|---|---|
| **SD** | See **space diversity** |
| **SDH** | See **Synchronous Digital Hierarchy** |
| **SFP** | See **Small Form-Factor Pluggable** |
| **Signal Noise Ratio** | The SNR or S/N (Signal to Noise 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 (Decibel). |
| **Simple Network Management Protocol** | A network management protocol of TCP/IP. It enables remote users to view and modify the management information of a network element. This protocol ensures the transmission of management information between any two points. The polling mechanism is adopted to provide basic function sets. According to SNMP, agents, which can be hardware as well as software, can monitor the activities of various devices on the network and report these activities to the network console workstation. Control information about each device is maintained by a management information block. |
| **Small Form-Factor Pluggable** | A specification for a new generation of optical modular transceivers. |
| **SNC** | See **SubNetwork Connection** |
| **SNCP** | See **SubNetwork Connection Protection** |
| **SNMP** | See **Simple Network Management Protocol** |

| | |
|---|---|
| **SNR** | See **Signal Noise Ratio** |
| **SP** | Strict Priority |
| **space diversity** | 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. |
| **Spanning Tree Protocol** | Spanning Tree Protocol. STP is a protocol that is used in the LAN to remove the loop. STP applies to the redundant network to block some undesirable redundant paths through certain algorithms and prune a loop network into a loop-free tree network. |
| **SSM** | See **Synchronization Status Message** |
| **STM** | See **synchronous transport module** |
| **STM-1** | SDH Transport Module -1 |
| **STM-1e** | STM-1 Electrical Interface |
| **STM-1o** | STM-1 Optical Interface |
| **STM-N** | SDH Transport Module -N |
| **STP** | See **Spanning Tree Protocol** |
| **sub-network** | Sub-network is the logical entity in the transmission network and comprises a group of network management objects. The network that consists of a group of interconnected or correlated NEs, according to different functions. For example, protection subnet, clock subnet and so on. A sub-network can contain NEs and other sub-networks. Generally, a sub-network is used to contain the equipments which are located in adjacent regions and closely related with one another, and it is indicated with a sub-network icon on a topological view. The U2000 supports multilevels of sub-networks. A sub-network planning can better the organization of a network view. On the one hand, the view space can be saved, on the other hand, it helps the network management personnel focus on the equipments under their management. |
| **SubNetwork Connection** | A "transport entity" that transfers information across a subnetwork, it is formed by the association of "ports" on the boundary of the subnetwork. |
| **SubNetwork Connection Protection** | A working subnetwork connection is replaced by a protection subnetwork connection if the working subnetwork connection fails, or if its performance falls below a required level. |
| **SVL** | Shared VLAN Learning |
| **Synchronization Status Message** | A message that is used to transmit the quality levels of timing signals on the synchronous timing link. Through this message, the node clocks of the SDH network and the synchronization network can aquire upper stream clock information, and the two perform operations on the corresponding clocks, such as tracing, switchover, or converting hold), and then forward the synchronization information of this node to down stream. |
| **Synchronous Digital Hierarchy** | SDH is a transmission scheme that follows ITU-T G.707, G.708, and G.709. It 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. It interleaves the bytes of low-speed signals to multiplex the signals to high-speed counterparts, and the line coding of scrambling is only used only for signals. SDH is suitable for the fiber communication system with high speed and a large capacity since it uses synchronous multiplexing and flexible mapping structure. |

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| **synchronous transport module** | An STM is the 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

| | |
|---|---|
| **TCI** | Tag Control Information |
| **TCP** | See **TransmissionControl Protocol** |
| **TDM** | See **Time Division Multiplexing** |
| **Telecommunication Management Network** | The Telecommunications Management Network is a protocol model defined by ITU-T for managing open systems in a communications network.An architecture for management, including planning, provisioning, installation, maintenance, operation and administration of telecommunications equipment, networks and services. |
| **Time Division Multiplexing** | It is a multiplexing technology. TDM divides the sampling cycle of a channel into time slots (TSn, n=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. |
| **TMN** | See **Telecommunication Management Network** |
| **trail** | A type of transport entity, mainly engaged in transferring signals from the input of the trail source to the output of the trail sink, and monitoring the integrality of the transferred signals. |
| **TransmissionControl Protocol** | The protocol within TCP/IP that governs the breakup of data messages into packets to be sent via IP (Internet Protocol), 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. |
| **TU** | Tributary Unit |

# A.6 U-Z

This section provides the terms starting with letters U to Z.

## U

| | |
|---|---|
| **UDP** | See **User Datagram Protocol** |
| **UNI** | See **User Network Interface** |

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|---|---|
| **User Datagram Protocol** | A TCP/IP standard protocol that allows an application program on one device to send a datagram to an application program on another. User Datagram Protocol (UDP) uses IP to deliver datagrams. UDP provides application programs with the unreliable connectionless packet delivery service. Thus, UDP messages can be lost, duplicated, delayed, or delivered out of order.UDP is used to try to transmit the data packet, that is, the destination device does not actively confirm whether the correct data packet is received. |
| **User Network Interface** | A type of ATM Forum specification that defines an interoperability standard for the interface between ATM-based products (a router or an ATM switch) located in a private network and the ATM switches located within the public carrier networks. Also used to describe similar connections in Frame Relay networks. |

## V

| | |
|---|---|
| **VC** | See **Virtual Container** |
| **VC-12** | Virtual Container -12 |
| **VC-3** | Virtual Container -3 |
| **VC-4** | Virtual Container -4 |
| **VCG** | See **virtual concatenation group** |
| **VCTRUNK** | A virtual concatenation group applied in data service mapping, also called the internal port of a data service processing board |
| **virtual concatenation group** | A group of co-located member trail termination functions that are connected to the same virtual concatenation link |
| **Virtual Container** | A Virtual Container is the information structure used to support path layer connections in the SDH. It consists of information payload and path Overhead (POH) information fields organized in a block frame structure which repeats every 125 or 500 μs. |
| **Virtual Local Area Network** | A logical grouping of two or more nodes which are not necessarily on the same physical network segment but which share the same IP network number. This is often associated with switched Ethernet. |
| **Virtual Private Network** | The extension of a private network that encompasses encapsulated, encrypted, and authenticated links across shared or public networks. VPN connections can provide remote access and routed connections to private networks over the Internet. |
| **VLAN** | See **Virtual Local Area Network** |
| **Voice over IP** | An IP telephony term for a set of facilities used to manage the delivery of voice information over the Internet. VoIP involves sending voice information in a digital form in discrete packets rather than by using the traditional circuit-committed protocols of the public switched telephone network (PSTN). |
| **VoIP** | See **Voice over IP** |
| **VPN** | See **Virtual Private Network** |

## W

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|---|---|
| **Wait to Restore Time** | A period of time that must elapse before a - from a fault recovered - trail/connection can be used again to transport the normal traffic signal and/or to select the normal traffic signal from. |

| | |
|---|---|
| **WAN** | See **Wide Area Network** |
| **Web LCT** | The local maintenance terminal of a transport network, which is located on the NE management layer of the transport network |
| **Wide Area Network** | A network composed of computers which are far away from each other which are physically connected through specific protocols. WAN covers a broad area, such as a province, a state or even a country. |
| **WRR** | Weighted Round Robin |
| **WTR** | See **Wait to Restore Time** |

## X

| | |
|---|---|
| **XPD** | Cross-Polarization Discrimination |
| **XPIC** | See **cross polarization interference cancellation** |