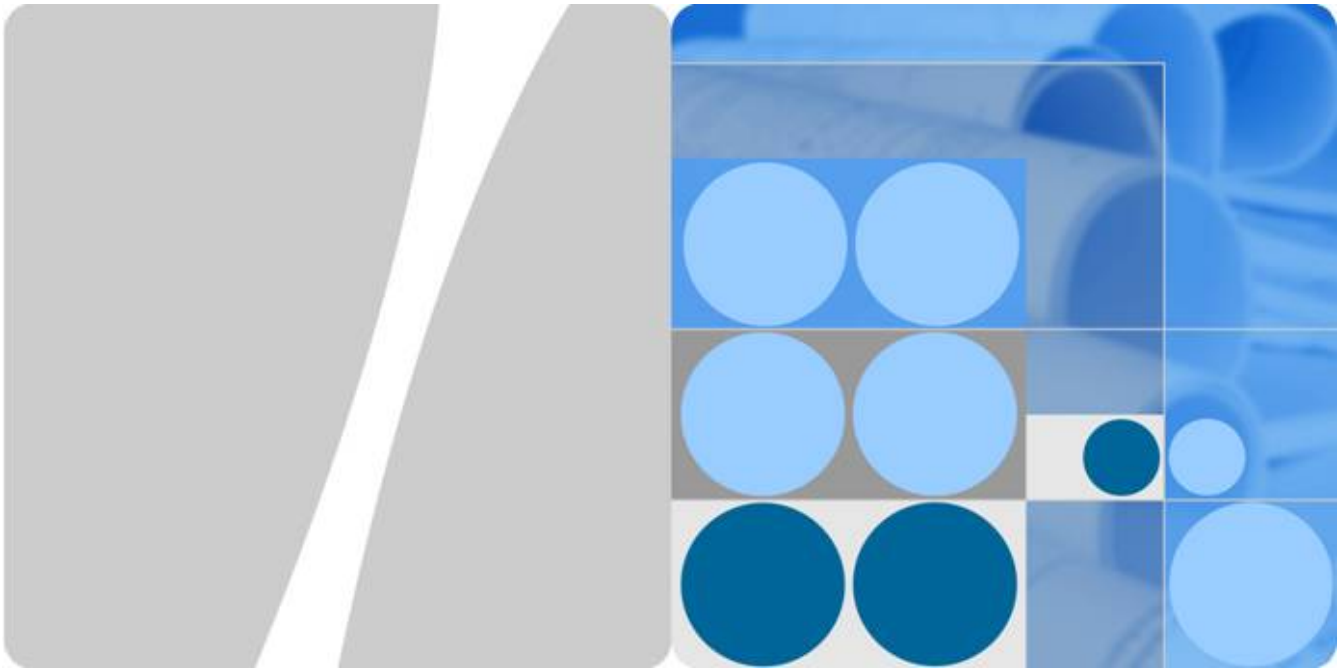

OptiX RTN 600 ODU
V100

Hardware Description

Issue 06

Date 2010-05-30

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About This Document

Purpose

The microwave equipment that adopt split structure consists of the indoor unit (IDU) and outdoor unit (ODU). The OptiX RTN 600 ODU is an outdoor unit of the microwave equipment. It performs frequency conversion and amplification for signals. This document describes the ODU and attached devices including hybrid coupler, separate mount parts and cables. Through this document, readers can have a comprehensive understanding of the OptiX RTN 600 ODU hardware.

Related Versions

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

Product Name	Version
OptiX RTN 600 ODU	V100

Intended Audience

The intended audiences of this document are:

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

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

- Basics of digital microwave communication

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 to previous issues.

Updates in Issue 06 (2010-05-30) Based on Product Version V100

This document is the sixth release of the V100 version.

The updated contents are as follows:

Update	Description
4.5 Antenna Diameter	The specifications of the antennas are updated.

Updates in Issue 05 (2010-05-15) Based on Product Version V100

This document is the fifth release of the V100 version.

The updated contents are as follows:

Update	Description
1 ODU	The specifications of the ODU are updated.

Updates in Issue 04 (2010-03-30) Based on Product Version V100

This document is the fourth release of the V100 version.

The updated contents are as follows:

Update	Description
1 ODU	The specifications of the ODU are updated.
2 Hybrid Coupler	The specifications of the hybrid coupler are updated.
4 Antenna	The specifications of the antennas are updated.
5.1 Lightening Surge Protector	The descriptions of the lightening surge protector are added.

Updates in Issue 03 (2009-10-30) Based on Product Version V100

This document is the third release of the V100 version.

The updated contents are as follows:

Update	Description
1.7 Technical Specifications	The specifications of the ODU are updated.

Update	Description
4 Antenna	The descriptions of antennas adaptive to the OptiX RTN 600 ODU are added.

Updates in Issue 02 (2009-06-30) Based on Product Version V100

This document is the second release of the V100 version.

The updated contents are as follows:

Update	Description
5.2 IF Cable	The description of the 5D IF cable is added.

Updates in Issue 01 (2009-04-30) Based on Product Version V100

This document is the first release of the V100 version.

Contents

Figures

Tables

1 ODU

About This Chapter

The ODU is the outdoor unit of the microwave system. The ODU is mainly used to convert the frequency or amplify the power of the signals. The ODUs that are described in this document are the OptiX RTN 600 SP/SPA/HP/LP/LPA ODUs.

1.1 Equipment Type

The ODU is available in three series: standard power, high power, and low capacity for PDH.

Table 1-1 ODU types

Item	Description		
	Standard Power ODU	**High Power ODU**	**Low Capacity for PDH ODU**
ODU type	SP and SPA	HP	LP and LPA
Frequency band	7/8/11/13/15/18/23/26/38 GHz (SP ODU) 6/7/8/11/13/15/18/23 GHz (SPA ODU)	7/8/10/10.5/11/13/15/18/23/26/28/32/38 GHz	7/8/11/13/15/18/23 GHz (LP ODU) 7/8/11/13/15/18/23/26/32/38 GHz (LPA ODU)
Microwave modulation mode	QPSK/16QAM/32QAM/64QAM/128QAM/256QAM (SP ODU) 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

1.2 Installation Mode

Different installation modes are available for an ODU, depending on the type of antenna configuration.

There are two methods of mounting the ODU and the antenna: direct mounting and separate 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 1-1** shows the direct mounting method.

Figure 1-1 Direct mounting

- The separate mounting method is adopted when a double-polarized antenna or big-diameter and single-polarized antenna is used. **Figure 1-2** shows the separate method. In this situation, a hybrid coupler can be mounted. That is, two ODUs share one feed boom.

Figure 1-2 Separate mounting

NOTE

The ODU with the coaxial interface supports only the separate mounting mode.

1.3 Functions and Features

The ODU is used for the frequency conversion and amplification of signals.

The ODU implements the following functions:

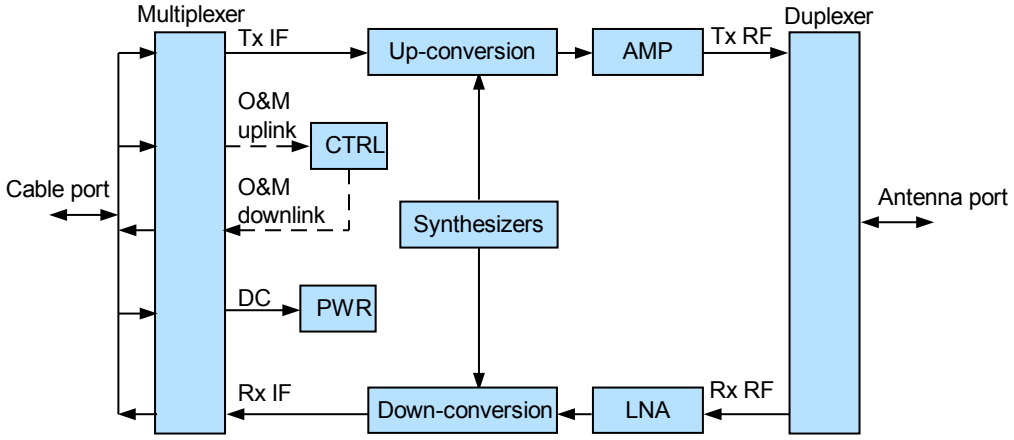
- In the transmit direction, the ODU performs up-conversions and amplifications for the analog IF signal coming from the IDU. After the IF signal is converted into the RF signal with a specific frequency, the ODU transmits the RF signal to the antenna.
- In the receive direction, the ODU performs down-conversions and amplifications for the RF signal coming from the antenna. After the RF signal is converted into the analog IF signal, the ODU transmits the IF signal to the IDU.
- The ODU provides the control channel to receive control and management from the IDU.
- The ODU provides the ATPC function.
- The ODU provides rich alarms and performance events.
- The ODU supports the detection of the ODU transmit power and the received signal strength indicator (RSSI).
- The ODU supports the detection of the ODU temperature.
- The ODU supports the querying of the manufacturing information of the ODU.
- The ODU supports the setting of mute/unmute.

1.4 Working Principle

The structures of various types of ODUs are basically the same. All of the ODUs work by the same principle.

Block Diagram

Figure 1-3 Block diagram of the ODU system



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 scheme 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 power 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.

1.5 Interface

The ODU has the antenna interface, IF interface, RSSI interface, and grounding bolts.

The ODUs are classified into the ODU with the waveguide interface and the ODU with the coaxial interface according to the type of the antenna interface of the ODU. The antenna interfaces of the 7-38 GHz ODUs are waveguide interfaces, and the antenna interfaces of the 6 GHz SPA ODUs are coaxial interfaces.

Figure 1-4 Interfaces of the ODU with the waveguide interface

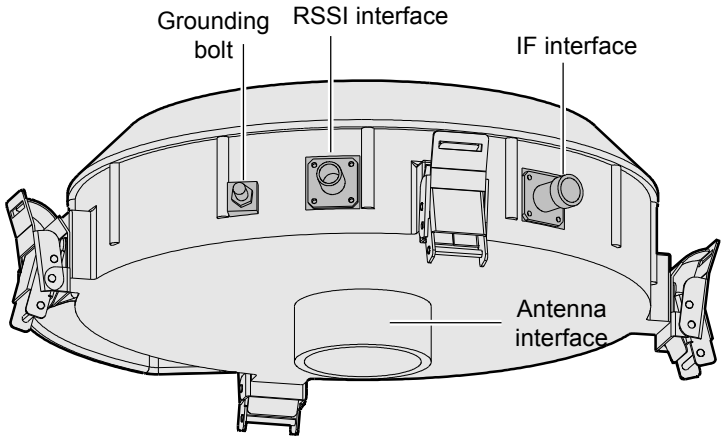


Figure 1-5 Interfaces of the ODU with the coaxial interface

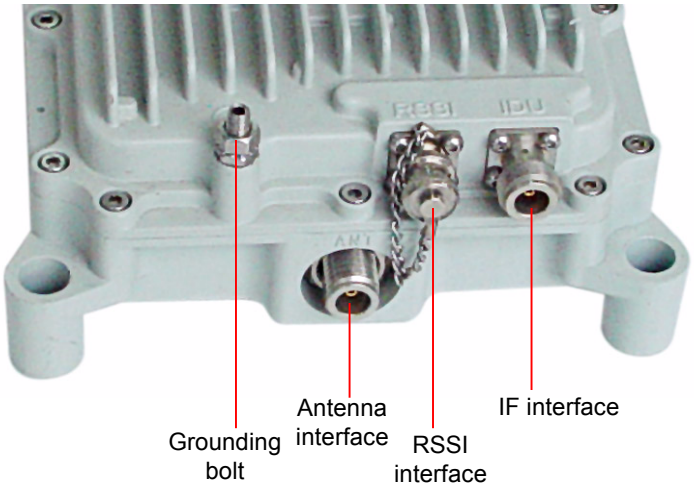


Table 1-2 ODU interface description

Interface	Function	Type of Connector
Antenna interface[a]	Connects the antenna or the hybrid coupler.	Type-N, female (6 GHz frequency band) 1.025" dia (7/8 GHz frequency band) 153IEC-R100 (10/10.5 GHz frequency band) 153IEC-R120 (11/13 GHz frequency band) 153IEC-R140 (15 GHz frequency band) 153IEC-R220 (18/23/26 GHz frequency band) 153IEC-R320 (28/32 GHz frequency band) 0.219" dia (38 GHz frequency band)
IF interface	Connects the IF cable.	Type-N (female)
RSSI interface	Connects the multimeter during the RSSI test.	BNC (female)
Grounding bolt	Connects the protection ground cable.	5 mm bolt

NOTE

a: The coaxial interface of an ODU must be connected to the antenna or hybrid coupler through an RF cable.

1.6 Label

ODU labels are attached to both ODUs and the packing boxes of the ODUs. The ODU label is used to provide the basic information of the ODU.

Figure 1-6 ODU label

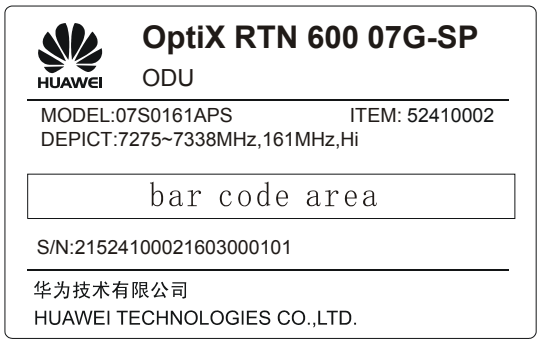


Table 1-3 Description of the ODU label

Label Information	Sample Label	Parameter	Meaning of the Parameter
ODU name	OptiX RTN 600 07G-SP ① ②	(1): Frequency band	Indicates the operating frequency band (GHz) of the ODU, which can be 06/07/08/10/11/13/15/18/23/26/28/32/38. **NOTE** The number 10 represents the 10 GHz and 10.5 GHz frequency bands.
		(2): Type of ODU	SP: SP ODU SPA: SPA ODU HP: HP ODU LP: LP ODU LPA: LPA ODU
Model of ODU (MODEL)	07 S 0161 A P S ① ② ③ ④ ⑤ ⑥	(1): Frequency band	Indicates the operating frequency band (GHz) of the ODU, which can be 06/07/08/10/11/13/15/18/23/26/28/32/38.
		(2): Type of equipment	S: SDH/PDH ODU P: PDH ODU

Label Information	Sample Label	Parameter	Meaning of the Parameter
		(3): T/R spacing	Indicates the T/R spacing (MHz) of the ODU. Some ODUs support two T/R spacings, refer to **1.7 Technical Specifications** for detail.
		(4): Sub-band	Indicates the sub-band of the ODU, which is expressed in letter.
		(5): Tx high/low station	P: Tx high station N: Tx low station
		(6): Level of the output power	S: standard power H: high power
ODU code (ITEM)	52410002	-	Indicates the code of the ODU.
Description of the ODU (DEPICT)	7275~7338MHz,161MHz,Hi ① ② ③	(1): Transmit frequency range	Indicates the transmit frequency range (MHz) of the ODU.
		(2): T/R spacing	Indicates the T/R spacing (MHz) of the ODU. Some ODUs support two T/R spacings, refer to **1.7 Technical Specifications** for detail.
		(3): Tx high/low station	Hi: Tx high station Lo: Tx low station
Serial number of the ODU (S/N)	21524100021603000101	-	Identifies the ODU uniquely.
Bar code area	bar code area	-	Indicates the bar code of the serial number of the ODU.

1.7 Technical Specifications

This technical specifications of the ODU include modulation mode, frequency band, transceiver performance, IF performance, mechanical behavior and power consumption, and frequency information.

NOTE

Huawei is always committing itself to providing consummate ODUs to clients, and thus the categories and technical specifications of the ODUs may be updated irregularly. This document provides only the ODU information that is available before the release of this document. For the latest documents, contact Huawei engineers.

The SP ODU is a type of the standard power ODU.

1.7.2 SPA ODU
The SPA ODU is a type of the standard power ODU.

1.7.3 HP ODU
The HP ODU is a type of the high power ODU.

1.7.4 LP ODU
The LP ODU is a type of the low capacity for PDH ODU.

1.7.5 LPA ODU
The LPA ODU is a type of the low capacity for PDH ODU.

1.7.1 SP ODU

The SP ODU is a type of the standard power ODU.

Modulation Mode

Table 1-4 Modulation Mode (SP ODU)

Item	Performance
Modulation mode	QPSK/16QAM/32QAM/64QAM/128QAM/256QAM
Channel Spacing	3.5/7/14/28 MHz

Frequency Band

Table 1-5 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

Transceiver Performance

NOTE

- The maximum error between the actual transmit power of the ODU and the preset transmit power on the NMS is ±2 dB.
- When the receive power of the ODU is between -70 dBm and -30 dBm, the maximum error between the actual receive power of the ODU and the receive power displayed on the NMS is ±2 dB.

Table 1-6 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
Nominal minimum transmit power (dBm)	-6			
Nominal maximum receive power (dBm)	-20			-25
Frequency stability (ppm)	±5			

IF Performance

Table 1-7 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

Mechanical Behavior and Power Consumption

Table 1-8 Mechanical Behavior and Power Consumption (SP ODU)

Item	Performance
Dimensions	< 280 mm x 92 mm x 280 mm (width x depth x height)
Typical Weight (kg)	4.6
Typical Power Consumption (W)	35

Frequency information

NOTE

Frequency ranges shown are Tx signal frequencies lower / upper limits, that is, not the channel center frequencies. The lowest available channel center frequency is at least the lowest frequency shown plus one half of the selected channel spacing. The highest available channel center frequency is at most the maximum frequency shown minus one half of the selected channel spacing.

Table 1-9 Frequency information of the 7 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	A	7,428.00	7,484.00	7,582.00	7,638.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	B	7,470.00	7,526.00	7,624.00	7,680.00
154	C	7,512.00	7,568.00	7,666.00	7,722.00
161	A	7,114.00	7,177.00	7,275.00	7,338.00
161	B	7,149.00	7,212.00	7,310.00	7,373.00
161	C	7,184.00	7,247.00	7,345.00	7,408.00
161	D	7,219.00	7,282.00	7,380.00	7,443.00
161	E	7,239.00	7,302.00	7,400.00	7,463.00
161	F	7,274.00	7,337.00	7,435.00	7,498.00
161	G	7,309.00	7,372.00	7,470.00	7,533.00
161	H	7,344.00	7,407.00	7,505.00	7,568.00
161	I	7,414.00	7,477.00	7,575.00	7,638.00
161	J	7,449.00	7,512.00	7,610.00	7,673.00
161	K	7,484.00	7,547.00	7,645.00	7,708.00
161	L	7,519.00	7,582.00	7,680.00	7,743.00
161	M	7,539.00	7,602.00	7,700.00	7,763.00
161	N	7,574.00	7,637.00	7,735.00	7,798.00
161	O	7,609.00	7,672.00	7,770.00	7,833.00
161	P	7,644.00	7,707.00	7,805.00	7,868.00
168	A	7,443.00	7,499.00	7,611.00	7,667.00
168	B	7,485.00	7,541.00	7,653.00	7,709.00
168	C	7,527.00	7,583.00	7,695.00	7,751.00
196	A	7,093.00	7,149.00	7,289.00	7,345.00
196	B	7,121.00	7,177.00	7,317.00	7,373.00
196	C	7,149.00	7,205.00	7,345.00	7,401.00
196	D	7,177.00	7,233.00	7,373.00	7,429.00
196	E	7,205.00	7,261.00	7,401.00	7,457.00
245	A	7,400.00	7,484.00	7,645.00	7,729.00
245	B	7,484.00	7,568.00	7,729.00	7,813.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
245	C	7,568.00	7,652.00	7,813.00	7,897.00

Table 1-10 Frequency information of the 8 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
119/126	A	8,279.00	8,307.00	8,398.00	8,426.00
119/126	B	8,293.00	8,321.00	8,412.00	8,440.00
119/126	C	8,307.00	8,335.00	8,426.00	8,454.00
119/126	D	8,321.00	8,349.00	8,440.00	8,468.00
119/126	E	8,335.00	8,363.00	8,454.00	8,482.00
119/126	F	8,349.00	8,377.00	8,468.00	8,496.00
266	A	7,905.00	8,024.00	8,171.00	8,290.00
266	B	8,017.00	8,136.00	8,283.00	8,402.00
311.32	A	7,731.00	7,867.00	8,042.00	8,178.00
311.32	B	7,835.00	7,971.00	8,146.00	8,282.00

Table 1-11 Frequency information of the 11 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490/500	A	10,700.00	10,890.00	11,200.00	11,390.00
490/500	B	10,855.00	11,045.00	11,355.00	11,545.00
490/500	C	11,010.00	11,200.00	11,510.00	11,700.00
530	A	10,675.00	10,855.00	11,205.00	11,385.00
530	B	10,795.00	10,975.00	11,325.00	11,505.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
530	C	10,915.00	11,135.00	11,445.00	11,665.00
530	D	11,035.00	11,215.00	11,565.00	11,745.00

Table 1-12 Frequency information of the 13 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	12,751.00	12,814.00	13,017.00	13,080.00
266	B	12,807.00	12,870.00	13,073.00	13,136.00
266	C	12,863.00	12,926.00	13,129.00	13,192.00
266	D	12,919.00	12,982.00	13,185.00	13,248.00

Table 1-13 Frequency information of the 15 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
315/322	A	14,627.00	14,746.00	14,942.00	15,061.00
315/322	B	14,725.00	14,844.00	15,040.00	15,159.00
315/322	C	14,823.00	14,942.00	15,138.00	15,257.00
420	A	14,501.00	14,613.00	14,921.00	15,033.00
420	B	14,606.00	14,725.00	15,026.00	15,145.00
420	C	14,718.00	14,837.00	15,138.00	15,257.00
420	D	14,816.00	14,928.00	15,236.00	15,348.00
490	A	14,403.00	14,522.00	14,893.00	15,012.00
490	B	14,515.00	14,634.00	15,005.00	15,124.00
490	C	14,627.00	14,746.00	15,117.00	15,236.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490	D	14,739.00	14,858.00	15,229.00	15,348.00
728	B	14,500.00	14,625.00	15,228.00	15,353.00

Table 1-14 Frequency information of the 18 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1010/1008	A	17,685.00	17,985.00	18,695.00	18,995.00
1010/1008	B	17,930.00	18,230.00	18,940.00	19,240.00
1010/1008	C	18,180.00	18,480.00	19,190.00	19,490.00
1010/1008	D	18,400.00	18,700.00	19,410.00	19,710.00
1560	C	17,700.00	18,140.00	19,260.00	19,700.00

Table 1-15 Frequency information of the 23 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1,008	A	21,994.00	22,330.00	23,002.00	23,338.00
1,008	B	22,274.00	22,610.00	23,282.00	23,618.00
1,200	A	21,200.00	21,600.00	22,400.00	22,800.00
1,200	B	21,600.00	22,000.00	22,800.00	23,200.00
1,200	C	22,000.00	22,400.00	23,200.00	23,600.00
1,232	A	21,200.00	21,500.00	22,432.00	22,732.00
1,232	B	21,472.00	21,786.00	22,704.00	23,018.00
1,232	C	21,779.00	22,093.00	23,011.00	23,325.00
1,232	D	22,086.00	22,386.00	23,318.00	23,618.00

Table 1-16 Frequency information of the 26 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	24,549.00	24,885.00	25,557.00	25,893.00
1008	B	24,829.00	25,165.00	25,837.00	26,173.00
1008	C	25,109.00	25,445.00	26,117.00	26,453.00

Table 1-17 Frequency information of the 38 GHz frequency band (SP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
700	A	38,595.00	38,805.00	39,295.00	39,505.00
700	B	38,795.00	39,005.00	39,495.00	39,705.00
700	C	38,995.00	39,205.00	39,695.00	39,905.00
700	D	39,195.00	39,405.00	39,895.00	40,105.00
1260	A	37,044.00	37,632.00	38,304.00	38,892.00
1260	B	37,604.00	38,192.00	38,864.00	39,452.00

1.7.2 SPA ODU

The SPA ODU is a type of the standard power ODU.

Modulation Mode

Table 1-18 Modulation Mode (SPA ODU)

Item	Performance
Modulation mode	QPSK/16QAM/32QAM/64QAM/128QAM
Channel Spacing	3.5/7/14/28 MHz

Frequency Band

Table 1-19 Frequency band (SPA ODU)

Frequency Band	Frequency Range (GHz)	T/R Spacing (MHz)
6 GHz	5.915-6.425 (L6) 6.425-7.125 (U6)	252.04 (L6) 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

Transceiver Performance

NOTE

- The maximum error between the actual transmit power of the ODU and the preset transmit power on the NMS is ±2 dB.
- When the receive power of the ODU is between -70 dBm and -30 dBm, the maximum error between the actual receive power of the ODU and the receive power displayed on the NMS is ±2 dB.

Table 1-20 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

Item	Performance		
	QPSK	16QAM/32QAM	64QAM/128QAM
Nominal minimum transmit power (dBm)	0		
Nominal maximum receive power (dBm)	-20		
Frequency stability (ppm)	±5		

IF Performance

Table 1-21 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

Mechanical Behavior and Power Consumption

Table 1-22 Mechanical Behavior and Power Consumption (SPA ODU)

Item	Performance
Dimensions	< 280 mm x 92 mm x 280 mm (width x depth x height)
Typical Weight (kg)	4.2
Typical Power Consumption (W)	25

Frequency information

NOTE

Frequency ranges shown are Tx signal frequencies lower / upper limits, that is, not the channel center frequencies. The lowest available channel center frequency is at least the lowest frequency shown plus one half of the selected channel spacing. The highest available channel center frequency is at most the maximum frequency shown minus one half of the selected channel spacing.

Table 1-23 Frequency information of the 6 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
252.04	A	5,915.00	5,990.00	6,167.00	6,242.00
252.04	B	5,974.00	6,049.00	6,226.00	6,301.00
252.04	C	6,034.00	6,109.00	6,286.00	6,361.00
252.04	D	6,093.00	6,173.00	6,345.00	6,425.00
340	A	6,425.00	6,509.00	6,765.00	6,849.00
340	B	6,481.00	6,564.00	6,821.00	6,904.00
340	C	6,536.00	6,619.00	6,876.00	6,959.00
340	D	6,591.00	6,674.00	6,931.00	7,014.00
340	E	6,646.00	6,729.00	6,986.00	7,069.00
340	F	6,701.00	6,785.00	7,041.00	7,125.00

Table 1-24 Frequency information of the 7 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	A	7,428.00	7,484.00	7,582.00	7,638.00
154	B	7,470.00	7,526.00	7,624.00	7,680.00
154	C	7,512.00	7,568.00	7,666.00	7,722.00
161	A	7,114.00	7,177.00	7,275.00	7,338.00
161	B	7,149.00	7,212.00	7,310.00	7,373.00
161	C	7,184.00	7,247.00	7,345.00	7,408.00
161	D	7,219.00	7,282.00	7,380.00	7,443.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
161	E	7,239.00	7,302.00	7,400.00	7,463.00
161	F	7,274.00	7,337.00	7,435.00	7,498.00
161	G	7,309.00	7,372.00	7,470.00	7,533.00
161	H	7,344.00	7,407.00	7,505.00	7,568.00
161	I	7,414.00	7,477.00	7,575.00	7,638.00
161	J	7,449.00	7,512.00	7,610.00	7,673.00
161	K	7,484.00	7,547.00	7,645.00	7,708.00
161	L	7,519.00	7,582.00	7,680.00	7,743.00
161	M	7,539.00	7,602.00	7,700.00	7,763.00
161	N	7,574.00	7,637.00	7,735.00	7,798.00
161	O	7,609.00	7,672.00	7,770.00	7,833.00
161	P	7,644.00	7,707.00	7,805.00	7,868.00
168	A	7,443.00	7,499.00	7,611.00	7,667.00
168	B	7,485.00	7,541.00	7,653.00	7,709.00
168	C	7,527.00	7,583.00	7,695.00	7,751.00
196	A	7,093.00	7,149.00	7,289.00	7,345.00
196	B	7,121.00	7,177.00	7,317.00	7,373.00
196	C	7,149.00	7,205.00	7,345.00	7,401.00
196	D	7,177.00	7,233.00	7,373.00	7,429.00
196	E	7,205.00	7,261.00	7,401.00	7,457.00
245	A	7,400.00	7,484.00	7,645.00	7,729.00
245	B	7,484.00	7,568.00	7,729.00	7,813.00
245	C	7,568.00	7,652.00	7,813.00	7,897.00

Table 1-25 Frequency information of the 8 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
119/126	A	8,279.00	8,307.00	8,398.00	8,426.00
119/126	B	8,293.00	8,321.00	8,412.00	8,440.00
119/126	C	8,307.00	8,335.00	8,426.00	8,454.00
119/126	D	8,321.00	8,349.00	8,440.00	8,468.00
119/126	E	8,335.00	8,363.00	8,454.00	8,482.00
119/126	F	8,349.00	8,377.00	8,468.00	8,496.00
266	A	7,905.00	8,024.00	8,171.00	8,290.00
266	B	8,017.00	8,136.00	8,283.00	8,402.00
311.32	A	7,731.00	7,867.00	8,042.00	8,178.00
311.32	B	7,835.00	7,971.00	8,146.00	8,282.00

Table 1-26 Frequency information of the 11 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490/500	A	10,700.00	10,890.00	11,200.00	11,390.00
490/500	B	10,855.00	11,045.00	11,355.00	11,545.00
490/500	C	11,010.00	11,200.00	11,510.00	11,700.00
530	A	10,675.00	10,855.00	11,205.00	11,385.00
530	B	10,795.00	10,975.00	11,325.00	11,505.00
530	C	10,915.00	11,135.00	11,445.00	11,665.00
530	D	11,035.00	11,215.00	11,565.00	11,745.00

Table 1-27 Frequency information of the 13 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	12,751.00	12,814.00	13,017.00	13,080.00
266	B	12,807.00	12,870.00	13,073.00	13,136.00
266	C	12,863.00	12,926.00	13,129.00	13,192.00
266	D	12,919.00	12,982.00	13,185.00	13,248.00

Table 1-28 Frequency information of the 15 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
420	A	14,501.00	14,613.00	14,921.00	15,033.00
420	B	14,606.00	14,725.00	15,026.00	15,145.00
420	C	14,718.00	14,837.00	15,138.00	15,257.00
420	D	14,816.00	14,928.00	15,236.00	15,348.00
490	A	14,403.00	14,522.00	14,893.00	15,012.00
490	B	14,515.00	14,634.00	15,005.00	15,124.00
490	C	14,627.00	14,746.00	15,117.00	15,236.00
490	D	14,739.00	14,858.00	15,229.00	15,348.00

Table 1-29 Frequency information of the 18 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1010/1008	A	17,685.00	17,985.00	18,695.00	18,995.00
1010/1008	B	17,930.00	18,230.00	18,940.00	19,240.00
1010/1008	C	18,180.00	18,480.00	19,190.00	19,490.00
1010/1008	D	18,400.00	18,700.00	19,410.00	19,710.00

Table 1-30 Frequency information of the 23 GHz frequency band (SPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1,008	A	21,994.00	22,330.00	23,002.00	23,338.00
1,008	B	22,274.00	22,610.00	23,282.00	23,618.00
1,232	A	21,200.00	21,500.00	22,432.00	22,732.00
1,232	B	21,472.00	21,786.00	22,704.00	23,018.00
1,232	C	21,779.00	22,093.00	23,011.00	23,325.00
1,232	D	22,086.00	22,386.00	23,318.00	23,618.00

1.7.3 HP ODU

The HP ODU is a type of the high power ODU.

Modulation Mode

Table 1-31 Modulation Mode (HP ODU)

Item	Performance
Modulation mode	QPSK/16QAM/32QAM/64QAM/128QAM/256QAM
Channel Spacing	7/14/28/40/56MHz

NOTE

The ODU with the T/R spacing of 91 MHz does not support the channel spacing of 40/56 MHz.

The ODU with the T/R spacing of 119/126 MHz does not support the channel spacing of 40/56 MHz.

Frequency Band

Table 1-32 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
10 GHz	10.150-10.650	350
10.5 GHz	10.500-10.678	91
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
28 GHz	27.520-29.481	1008
32 GHz	31.815-33.383	812
38 GHz	37.044-40.105	700, 1260

Transceiver Performance

NOTE

- The maximum error between the actual transmit power of the ODU and the preset transmit power on the NMS is ±2 dB.
- When the receive power of the ODU is between -70 dBm and -30 dBm, the maximum error between the actual receive power of the ODU and the receive power displayed on the NMS is ±2 dB.

Table 1-33 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
@10 GHz	26.5	22.5	20.5	18.5

Item	Performance			
	QPSK	16QAM/ 32QAM	64QAM/ 128QAM	256QAM
@10.5 GHz	24	20.5	18	16
@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
@28GHz	25	22	17	15
@32 GHz	23	21	17	15
@38 GHz	23	20	17	15
Nominal minimum transmit power (dBm)				
@7 GHz	9			
@8 GHz	9			
@10 GHz	2			
@10.5 GHz	0			
@11 GHz	6			
@13 GHz	3			
@15 GHz	3			
@18 GHz	2			
@23 GHz	2			
@26 GHz	2			
@28GHz	2			
@32 GHz	1			
@38 GHz	1			
Nominal maximum receive power (dBm)	-20			-25
Frequency stability (ppm)	±5			

IF Performance

Table 1-34 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

Mechanical Behavior and Power Consumption

Table 1-35 Mechanical Behavior and Power Consumption (HP ODU)

Item	Performance
Dimensions	< 280 mm x 92 mm x 280 mm (width x depth x height)
Typical Weight (kg)	4.6
Typical Power Consumption (W)	30 (10/10.5 GHz) 40 (13/15/18/23/26/28/32/38GHz) 52 (7/8/11GHz)

Frequency information

NOTE

Frequency ranges shown are Tx signal frequencies lower / upper limits, that is, not the channel center frequencies. The lowest available channel center frequency is at least the lowest frequency shown plus one half of the selected channel spacing. The highest available channel center frequency is at most the maximum frequency shown minus one half of the selected channel spacing.

Table 1-36 Frequency information of the 7 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	A	7,428.00	7,484.00	7,582.00	7,638.00
154	B	7,470.00	7,526.00	7,624.00	7,680.00
154	C	7,512.00	7,568.00	7,666.00	7,722.00
161	A	7,114.00	7,177.00	7,275.00	7,338.00
161	B	7,149.00	7,212.00	7,310.00	7,373.00
161	C	7,184.00	7,247.00	7,345.00	7,408.00
161	D	7,219.00	7,282.00	7,380.00	7,443.00
161	E	7,239.00	7,302.00	7,400.00	7,463.00
161	F	7,274.00	7,337.00	7,435.00	7,498.00
161	G	7,309.00	7,372.00	7,470.00	7,533.00
161	H	7,344.00	7,407.00	7,505.00	7,568.00
161	I	7,414.00	7,477.00	7,575.00	7,638.00
161	J	7,449.00	7,512.00	7,610.00	7,673.00
161	K	7,484.00	7,547.00	7,645.00	7,708.00
161	L	7,519.00	7,582.00	7,680.00	7,743.00
161	M	7,539.00	7,602.00	7,700.00	7,763.00
161	N	7,574.00	7,637.00	7,735.00	7,798.00
161	O	7,609.00	7,672.00	7,770.00	7,833.00
161	P	7,644.00	7,707.00	7,805.00	7,868.00
168	A	7,443.00	7,499.00	7,611.00	7,667.00
168	B	7,485.00	7,541.00	7,653.00	7,709.00
168	C	7,527.00	7,583.00	7,695.00	7,751.00
196	A	7,093.00	7,149.00	7,289.00	7,345.00
196	B	7,121.00	7,177.00	7,317.00	7,373.00
196	C	7,149.00	7,205.00	7,345.00	7,401.00
196	D	7,177.00	7,233.00	7,373.00	7,429.00
196	E	7,205.00	7,261.00	7,401.00	7,457.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
245	A	7,400.00	7,484.00	7,645.00	7,729.00
245	B	7,484.00	7,568.00	7,729.00	7,813.00
245	C	7,568.00	7,652.00	7,813.00	7,897.00

Table 1-37 Frequency information of the 8 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
119/126	A	8,279.00	8,307.00	8,398.00	8,426.00
119/126	B	8,293.00	8,321.00	8,412.00	8,440.00
119/126	C	8,307.00	8,335.00	8,426.00	8,454.00
119/126	D	8,321.00	8,349.00	8,440.00	8,468.00
119/126	E	8,335.00	8,363.00	8,454.00	8,482.00
119/126	F	8,349.00	8,377.00	8,468.00	8,496.00
151.614	A	8,203.00	8,271.00	8,355.00	8,423.00
151.614	B	8,240.00	8,308.00	8,392.00	8,460.00
151.614	C	8,277.00	8,345.00	8,429.00	8,497.00
208	A	8,043.00	8,113.00	8,251.00	8,321.00
208	B	8,099.00	8,169.00	8,307.00	8,377.00
208	C	8,155.00	8,225.00	8,363.00	8,433.00
208	D	8,211.00	8,281.00	8,419.00	8,489.00
266	A	7,905.00	8,024.00	8,171.00	8,290.00
266	B	8,017.00	8,136.00	8,283.00	8,402.00
311.32	A	7,731.00	7,867.00	8,042.00	8,178.00
311.32	B	7,835.00	7,971.00	8,146.00	8,282.00

Table 1-38 Frequency information of the 10 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
350	A	10,150	10,300	10,500	10,650

Table 1-39 Frequency information of the 10.5 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
91	A	10,500	10,531	10,591	10,622
91	B	10,528	10,559	10,619	10,650
91	C	10,556	10,587	10,647	10,678

Table 1-40 Frequency information of the 11 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490/500	A	10,700.00	10,890.00	11,200.00	11,390.00
490/500	B	10,855.00	11,045.00	11,355.00	11,545.00
490/500	C	11,010.00	11,200.00	11,510.00	11,700.00
530	A	10,675.00	10,855.00	11,205.00	11,385.00
530	B	10,795.00	10,975.00	11,325.00	11,505.00
530	C	10,915.00	11,135.00	11,445.00	11,665.00
530	D	11,035.00	11,215.00	11,565.00	11,745.00

Table 1-41 Frequency information of the 13 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	12,751.00	12,814.00	13,017.00	13,080.00
266	B	12,807.00	12,870.00	13,073.00	13,136.00
266	C	12,863.00	12,926.00	13,129.00	13,192.00
266	D	12,919.00	12,982.00	13,185.00	13,248.00

Table 1-42 Frequency information of the 15 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
315/322	A	14,627.00	14,746.00	14,942.00	15,061.00
315/322	B	14,725.00	14,844.00	15,040.00	15,159.00
315/322	C	14,823.00	14,942.00	15,138.00	15,257.00
420	A	14,501.00	14,613.00	14,921.00	15,033.00
420	B	14,606.00	14,725.00	15,026.00	15,145.00
420	C	14,718.00	14,837.00	15,138.00	15,257.00
420	D	14,816.00	14,928.00	15,236.00	15,348.00
490	A	14,403.00	14,522.00	14,893.00	15,012.00
490	B	14,515.00	14,634.00	15,005.00	15,124.00
490	C	14,627.00	14,746.00	15,117.00	15,236.00
490	D	14,739.00	14,858.00	15,229.00	15,348.00
644	A	14,400.00	14,512.00	15,044.00	15,156.00
644	B	14,498.00	14,610.00	15,142.00	15,254.00
644	C	14,596.00	14,708.00	15,240.00	15,352.00
728	A	14,500.00	14,615.00	15,228.00	15,343.00
728	B	14,500.00	14,625.00	15,228.00	15,353.00

Table 1-43 Frequency information of the 18 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1010/1008	A	17,685.00	17,985.00	18,695.00	18,995.00
1010/1008	B	17,930.00	18,230.00	18,940.00	19,240.00
1010/1008	C	18,180.00	18,480.00	19,190.00	19,490.00
1010/1008	D	18,400.00	18,700.00	19,410.00	19,710.00
1560	C	17,700.00	18,140.00	19,260.00	19,700.00

Table 1-44 Frequency information of the 23 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	21,994.00	22,330.00	23,002.00	23,338.00
1008	B	22,274.00	22,610.00	23,282.00	23,618.00
1200	A	21,200.00	21,600.00	22,400.00	22,800.00
1200	B	21,600.00	22,000.00	22,800.00	23,200.00
1200	C	22,000.00	22,400.00	23,200.00	23,600.00
1232	A	21,200.00	21,500.00	22,432.00	22,732.00
1232	B	21,472.00	21,786.00	22,704.00	23,018.00
1232	C	21,779.00	22,093.00	23,011.00	23,325.00
1232	D	22,086.00	22,386.00	23,318.00	23,618.00

Table 1-45 Frequency information of the 26 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	24,549.00	24,885.00	25,557.00	25,893.00
1008	B	24,829.00	25,165.00	25,837.00	26,173.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	C	25,109.00	25,445.00	26,117.00	26,453.00

Table 1-46 Frequency information of the 28 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	27,520.00	28,025.00	28,528.00	29,033.00
1008	B	27,968.00	28,473.00	28,976.00	29,481.00

Table 1-47 Frequency information of the 32 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
812	A	31,815.00	32,207.00	32,627.00	33,019.00
812	B	32,179.00	32,571.00	32,991.00	33,383.00

Table 1-48 Frequency information of the 38 GHz frequency band (HP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
700	A	38,595.00	38,805.00	39,295.00	39,505.00
700	B	38,795.00	39,005.00	39,495.00	39,705.00
700	C	38,995.00	39,205.00	39,695.00	39,905.00
700	D	39,195.00	39,405.00	39,895.00	40,105.00
1260	A	37,044.00	37,632.00	38,304.00	38,892.00
1260	B	37,604.00	38,192.00	38,864.00	39,452.00

1.7.4 LP ODU

The LP ODU is a type of the low capacity for PDH ODU.

Modulation Mode

Table 1-49 Modulation Mode (LP ODU)

Item	Performance
Modulation mode	QPSK/16QAM
Channel Spacing	3.5/7/14/28 MHz

Frequency Band

Table 1-50 Frequency band (LP 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, 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

Transceiver Performance

NOTE

- The maximum error between the actual transmit power of the ODU and the preset transmit power on the NMS is ±2 dB.
- When the receive power of the ODU is between -70 dBm and -40 dBm, the maximum error between the actual receive power of the ODU and the receive power displayed on the NMS is ±2 dB.

Table 1-51 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	

IF Performance

Table 1-52 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

Mechanical Behavior and Power Consumption

Table 1-53 Mechanical Behavior and Power Consumption (LP ODU)

Item	Performance
Dimensions	< 280 mm x 92 mm x 280 mm (width x depth x height)
Typical Weight (kg)	4.2
Typical Power Consumption (W)	25

Frequency information

NOTE

Frequency ranges shown are Tx signal frequencies lower / upper limits, that is, not the channel center frequencies. The lowest available channel center frequency is at least the lowest frequency shown plus one half of the selected channel spacing. The highest available channel center frequency is at most the maximum frequency shown minus one half of the selected channel spacing.

Table 1-54 Frequency information of the 7 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	A	7,428.00	7,484.00	7,582.00	7,638.00
154	B	7,470.00	7,526.00	7,624.00	7,680.00
154	C	7,512.00	7,568.00	7,666.00	7,722.00
161	A	7,114.00	7,177.00	7,275.00	7,338.00
161	B	7,149.00	7,212.00	7,310.00	7,373.00
161	C	7,184.00	7,247.00	7,345.00	7,408.00
161	D	7,219.00	7,282.00	7,380.00	7,443.00
161	E	7,239.00	7,302.00	7,400.00	7,463.00
161	F	7,274.00	7,337.00	7,435.00	7,498.00
161	G	7,309.00	7,372.00	7,470.00	7,533.00
161	H	7,344.00	7,407.00	7,505.00	7,568.00
161	I	7,414.00	7,477.00	7,575.00	7,638.00
161	J	7,449.00	7,512.00	7,610.00	7,673.00
161	K	7,484.00	7,547.00	7,645.00	7,708.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
161	L	7,519.00	7,582.00	7,680.00	7,743.00
161	M	7,539.00	7,602.00	7,700.00	7,763.00
161	N	7,574.00	7,637.00	7,735.00	7,798.00
161	O	7,609.00	7,672.00	7,770.00	7,833.00
161	P	7,644.00	7,707.00	7,805.00	7,868.00
168	A	7,443.00	7,499.00	7,611.00	7,667.00
168	B	7,485.00	7,541.00	7,653.00	7,709.00
168	C	7,527.00	7,583.00	7,695.00	7,751.00
196	A	7,093.00	7,149.00	7,289.00	7,345.00
196	B	7,121.00	7,177.00	7,317.00	7,373.00
196	C	7,149.00	7,205.00	7,345.00	7,401.00
196	D	7,177.00	7,233.00	7,373.00	7,429.00
196	E	7,205.00	7,261.00	7,401.00	7,457.00
245	A	7,400.00	7,484.00	7,645.00	7,729.00
245	B	7,484.00	7,568.00	7,729.00	7,813.00
245	C	7,568.00	7,652.00	7,813.00	7,897.00

Table 1-55 Frequency information of the 8 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
119/126	A	8,279.00	8,307.00	8,398.00	8,426.00
119/126	B	8,293.00	8,321.00	8,412.00	8,440.00
119/126	C	8,307.00	8,335.00	8,426.00	8,454.00
119/126	D	8,321.00	8,349.00	8,440.00	8,468.00
119/126	E	8,335.00	8,363.00	8,454.00	8,482.00
119/126	F	8,349.00	8,377.00	8,468.00	8,496.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	7,905.00	8,024.00	8,171.00	8,290.00
266	B	8,017.00	8,136.00	8,283.00	8,402.00
311.32	A	7,718.00	7,854.00	8,029.00	8,165.00
311.32	B	7,835.00	7,971.00	8,146.00	8,282.00

Table 1-56 Frequency information of the 11 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490/500	A	10,700.00	10,890.00	11,200.00	11,390.00
490/500	B	10,855.00	11,045.00	11,355.00	11,545.00
490/500	C	11,010.00	11,200.00	11,510.00	11,700.00
530	A	10,675.00	10,855.00	11,205.00	11,385.00
530	B	10,795.00	10,975.00	11,325.00	11,505.00
530	C	10,915.00	11,135.00	11,445.00	11,665.00
530	D	11,035.00	11,215.00	11,565.00	11,745.00

Table 1-57 Frequency information of the 13 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	12,751.00	12,814.00	13,017.00	13,080.00
266	B	12,807.00	12,870.00	13,073.00	13,136.00
266	C	12,863.00	12,926.00	13,129.00	13,192.00
266	D	12,919.00	12,982.00	13,185.00	13,248.00

Table 1-58 Frequency information of the 15 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
420	A	14,501.00	14,613.00	14,921.00	15,033.00
420	B	14,606.00	14,725.00	15,026.00	15,145.00
420	C	14,718.00	14,837.00	15,138.00	15,257.00
420	D	14,816.00	14,928.00	15,236.00	15,348.00
490	A	14,403.00	14,522.00	14,893.00	15,012.00
490	B	14,515.00	14,634.00	15,005.00	15,124.00
490	C	14,627.00	14,746.00	15,117.00	15,236.00
490	D	14,739.00	14,858.00	15,229.00	15,348.00

Table 1-59 Frequency information of the 18 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1010/1008	A	17,685.00	17,985.00	18,695.00	18,995.00
1010/1008	B	17,930.00	18,230.00	18,940.00	19,240.00
1010/1008	C	18,180.00	18,480.00	19,190.00	19,490.00
1010/1008	D	18,400.00	18,700.00	19,410.00	19,710.00

Table 1-60 Frequency information of the 23 GHz frequency band (LP ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	21,994.00	22,330.00	23,002.00	23,338.00
1008	B	22,274.00	22,610.00	23,282.00	23,618.00
1232	A	21,200.00	21,500.00	22,432.00	22,732.00
1232	B	21,472.00	21,786.00	22,704.00	23,018.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1232	C	21,779.00	22,093.00	23,011.00	23,325.00
1232	D	22,086.00	22,386.00	23,318.00	23,618.00

1.7.5 LPA ODU

The LPA ODU is a type of the low capacity for PDH ODU.

Modulation Mode

Table 1-61 Modulation Mode (LPA ODU)

Item	Performance
Modulation mode	QPSK/16QAM
Channel Spacing	3.5/7/14/28 MHz

Frequency Band

Table 1-62 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

Transceiver Performance

NOTE

- The maximum error between the actual transmit power of the ODU and the preset transmit power on the NMS is ±2 dB.
- When the receive power of the ODU is between -70 dBm and -40 dBm, the maximum error between the actual receive power of the ODU and the receive power displayed on the NMS is ±2 dB.

Table 1-63 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
@38 GHz	18	16
Nominal minimum transmit power (dBm)	0	
Nominal maximum receive power (dBm)	-20	
Frequency stability (ppm)	±5	

IF Performance

Table 1-64 IF Performance

Item		Performance
IF signal	Transmit frequency of the IF board (MHz)	350

Item		Performance
	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

Mechanical Behavior and Power Consumption

Table 1-65 Mechanical Behavior and Power Consumption (LPA ODU)

Item	Performance
Dimensions	< 280 mm x 92 mm x 280 mm (width x depth x height)
Typical Weight (kg)	4.6
Typical Power Consumption (W)	35

Frequency information

NOTE

Frequency ranges shown are Tx signal frequencies lower / upper limits, that is, not the channel center frequencies. The lowest available channel center frequency is at least the lowest frequency shown plus one half of the selected channel spacing. The highest available channel center frequency is at most the maximum frequency shown minus one half of the selected channel spacing.

Table 1-66 Frequency information of the 7 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
154	A	7,428.00	7,484.00	7,582.00	7,638.00
154	B	7,470.00	7,526.00	7,624.00	7,680.00
154	C	7,512.00	7,568.00	7,666.00	7,722.00
161	A	7,114.00	7,177.00	7,275.00	7,338.00
161	B	7,149.00	7,212.00	7,310.00	7,373.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
161	C	7,184.00	7,247.00	7,345.00	7,408.00
161	D	7,219.00	7,282.00	7,380.00	7,443.00
161	E	7,239.00	7,302.00	7,400.00	7,463.00
161	F	7,274.00	7,337.00	7,435.00	7,498.00
161	G	7,309.00	7,372.00	7,470.00	7,533.00
161	H	7,344.00	7,407.00	7,505.00	7,568.00
161	I	7,414.00	7,477.00	7,575.00	7,638.00
161	J	7,449.00	7,512.00	7,610.00	7,673.00
161	K	7,484.00	7,547.00	7,645.00	7,708.00
161	L	7,519.00	7,582.00	7,680.00	7,743.00
161	M	7,539.00	7,602.00	7,700.00	7,763.00
161	N	7,574.00	7,637.00	7,735.00	7,798.00
161	O	7,609.00	7,672.00	7,770.00	7,833.00
161	P	7,644.00	7,707.00	7,805.00	7,868.00
168	A	7,443.00	7,499.00	7,611.00	7,667.00
168	B	7,485.00	7,541.00	7,653.00	7,709.00
168	C	7,527.00	7,583.00	7,695.00	7,751.00
196	A	7,093.00	7,149.00	7,289.00	7,345.00
196	B	7,121.00	7,177.00	7,317.00	7,373.00
196	C	7,149.00	7,205.00	7,345.00	7,401.00
196	D	7,177.00	7,233.00	7,373.00	7,429.00
196	E	7,205.00	7,261.00	7,401.00	7,457.00
245	A	7,400.00	7,484.00	7,645.00	7,729.00
245	B	7,484.00	7,568.00	7,729.00	7,813.00
245	C	7,568.00	7,652.00	7,813.00	7,897.00

Table 1-67 Frequency information of the 8 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
119/126	A	8,279.00	8,307.00	8,398.00	8,426.00
119/126	B	8,293.00	8,321.00	8,412.00	8,440.00
119/126	C	8,307.00	8,335.00	8,426.00	8,454.00
119/126	D	8,321.00	8,349.00	8,440.00	8,468.00
119/126	E	8,335.00	8,363.00	8,454.00	8,482.00
119/126	F	8,349.00	8,377.00	8,468.00	8,496.00
151.614	A	8,203.00	8,271.00	8,355.00	8,423.00
151.614	B	8,240.00	8,308.00	8,392.00	8,460.00
151.614	C	8,277.00	8,345.00	8,429.00	8,497.00
208	A	8,043.00	8,113.00	8,251.00	8,321.00
208	B	8,099.00	8,169.00	8,307.00	8,377.00
208	C	8,155.00	8,225.00	8,363.00	8,433.00
208	D	8,211.00	8,281.00	8,419.00	8,489.00
266	A	7,905.00	8,024.00	8,171.00	8,290.00
266	B	8,017.00	8,136.00	8,283.00	8,402.00
311.32	A	7,718.00	7,854.00	8,029.00	8,165.00
311.32	B	7,835.00	7,971.00	8,146.00	8,282.00

Table 1-68 Frequency information of the 11 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490/500	A	10,700.00	10,890.00	11,200.00	11,390.00
490/500	B	10,855.00	11,045.00	11,355.00	11,545.00
490/500	C	11,010.00	11,200.00	11,510.00	11,700.00
530	A	10,675.00	10,855.00	11,205.00	11,385.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
530	B	10,795.00	10,975.00	11,325.00	11,505.00
530	C	10,915.00	11,135.00	11,445.00	11,665.00
530	D	11,035.00	11,215.00	11,565.00	11,745.00

Table 1-69 Frequency information of the 13 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
266	A	12,751.00	12,814.00	13,017.00	13,080.00
266	B	12,807.00	12,870.00	13,073.00	13,136.00
266	C	12,863.00	12,926.00	13,129.00	13,192.00
266	D	12,919.00	12,982.00	13,185.00	13,248.00

Table 1-70 Frequency information of the 15 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
315/322	A	14,627.00	14,746.00	14,942.00	15,061.00
315/322	B	14,725.00	14,844.00	15,040.00	15,159.00
315/322	C	14,823.00	14,942.00	15,138.00	15,257.00
420	A	14,501.00	14,613.00	14,921.00	15,033.00
420	B	14,606.00	14,725.00	15,026.00	15,145.00
420	C	14,718.00	14,837.00	15,138.00	15,257.00
420	D	14,816.00	14,928.00	15,236.00	15,348.00
490	A	14,403.00	14,522.00	14,893.00	15,012.00
490	B	14,515.00	14,634.00	15,005.00	15,124.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
490	C	14,627.00	14,746.00	15,117.00	15,236.00
490	D	14,739.00	14,858.00	15,229.00	15,348.00
644	A	14,400.00	14,512.00	15,044.00	15,156.00
644	B	14,498.00	14,610.00	15,142.00	15,254.00
644	C	14,596.00	14,708.00	15,240.00	15,352.00
728	B	14,500.00	14,625.00	15,228.00	15,353.00

Table 1-71 Frequency information of the 18 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1010/1008	A	17,685.00	17,985.00	18,695.00	18,995.00
1010/1008	B	17,930.00	18,230.00	18,940.00	19,240.00
1010/1008	C	18,180.00	18,480.00	19,190.00	19,490.00
1010/1008	D	18,400.00	18,700.00	19,410.00	19,710.00
1560	C	17,700.00	18,140.00	19,260.00	19,700.00

Table 1-72 Frequency information of the 23 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	21,994.00	22,330.00	23,002.00	23,338.00
1008	B	22,274.00	22,610.00	23,282.00	23,618.00
1200	A	21,200.00	21,600.00	22,400.00	22,800.00
1200	B	21,600.00	22,000.00	22,800.00	23,200.00
1200	C	22,000.00	22,400.00	23,200.00	23,600.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1232	A	21,200.00	21,500.00	22,432.00	22,732.00
1232	B	21,472.00	21,786.00	22,704.00	23,018.00
1232	C	21,779.00	22,093.00	23,011.00	23,325.00
1232	D	22,086.00	22,386.00	23,318.00	23,618.00

Table 1-73 Frequency information of the 26 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
1008	A	24,549.00	24,885.00	25,557.00	25,893.00
1008	B	24,829.00	25,165.00	25,837.00	26,173.00
1008	C	25,109.00	25,445.00	26,117.00	26,453.00

Table 1-74 Frequency information of the 32 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
812	A	31,815.00	32,207.00	32,627.00	33,019.00
812	B	32,179.00	32,571.00	32,991.00	33,383.00

Table 1-75 Frequency information of the 38 GHz frequency band (LPA ODU)

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
700	A	38,595.00	38,805.00	39,295.00	39,505.00
700	B	38,795.00	39,005.00	39,495.00	39,705.00

T/R Spacing (MHz)	Sub-band	Lower Sub-band Tx Frequency (MHz)		Higher Sub-band Tx Frequency (MHz)	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
700	C	38,995.00	39,205.00	39,695.00	39,905.00
700	D	39,195.00	39,405.00	39,895.00	40,105.00
1260	A	37,044.00	37,632.00	38,304.00	38,892.00
1260	B	37,604.00	38,192.00	38,864.00	39,452.00

2 Hybrid Coupler

About This Chapter

The hybrid coupler is the short name for the RF signal combiner/divider. The hybrid coupler is used when two ODUs need to be installed on the same antenna. The ODUs that are described in this document are the OptiX RTN 600 SP/SPA/HP/LP/LPA ODUs of the OptiX RTN 600.

2.1 Equipment Type

The hybrid coupler is classified into two types, namely, 3 dB balanced hybrid coupler and 6 dB unbalanced hybrid coupler.

- A 3 dB balanced hybrid coupler can split one RF signal into two RF signals that have almost the same power. In other words, each of the two RF signals is attenuated about 3 dB, compared with the original RF signal.
- A 6 dB unbalanced hybrid coupler can split one RF signal into two RF signals that have different power. The RF signal that has the smaller power is attenuated about 6 dB, compared with the original RF signal.

2.2 Functions and Features

The hybrid coupler is used to combine and split RF signals.

- In the transmit direction, the hybrid coupler combines two ODU RF signals into one RF signal which is then transmitted to the antenna.
- In the receive direction, the hybrid coupler divides the RF signal received from the antenna into two RF signals which are then transmitted to the ODU.

2.3 Working Principle

A hybrid coupler consists of a waveguide cavity-.

The waveguide cavity is the major part of a hybrid coupler. It has three ports. They are the common interface, primary branch interface, and secondary branch interface.

- In the transmit direction, the RF signals received by the two branch interfaces are combined into one in the waveguide cavity, which is then output through the common interface.
- In the receive direction, the RF signal received by the common interface are divided into two RF signals in the waveguide cavity, which are then output through the two branch interfaces.

2.4 Interfaces

The hybrid coupler has three types of interfaces: antenna interface, primary branch interface, and secondary branch interface.

The hybrid couplers are classified into the hybrid coupler with waveguide interfaces and the hybrid coupler with coaxial interfaces according to the type of the branch interfaces of the hybrid coupler. The ODUs with waveguide interfaces use the hybrid couplers with waveguide interfaces, and the ODUs with coaxial interfaces use the hybrid couplers with coaxial interfaces. The antenna interfaces of the 7-38 GHz ODUs are waveguide interfaces, and the antenna interfaces of the 6 GHz SPA ODUs are coaxial interfaces.

Figure 2-1 Interfaces of the hybrid coupler with waveguide interfaces

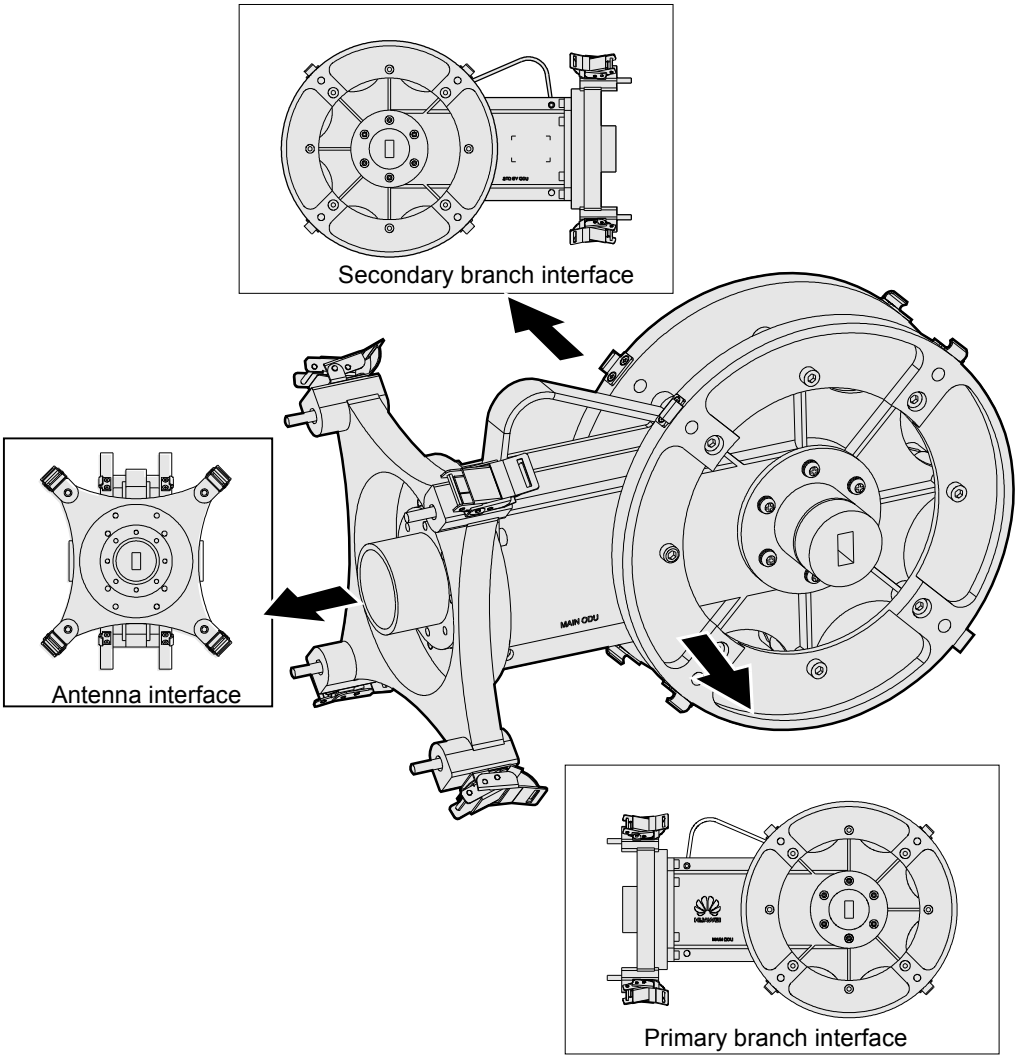


Table 2-1 Description of the interfaces of the hybrid coupler with waveguide interfaces

Interface	Mark	Function	Type of Connector
Antenna interface	-	Connects to the antenna.	1.025" dia (7/8 GHz frequency band) 153IEC-R100 (10/10.5 GHz frequency band) 153IEC-R120 (11/13 GHz frequency band) 153IEC-R140 (15 GHz frequency band) 153IEC-R220 (18/23/26 GHz frequency band)
Primary branch interface	MAIN	Connects to the active ODU.	

Interface	Mark	Function	Type of Connector
Secondary branch interface	STD BY	Connects to the standby ODU.	153IEC-R320 (28/32 GHz frequency band) 0.219" dia (38 GHz frequency band)

Figure 2-2 Interfaces of the hybrid coupler with coaxial interfaces

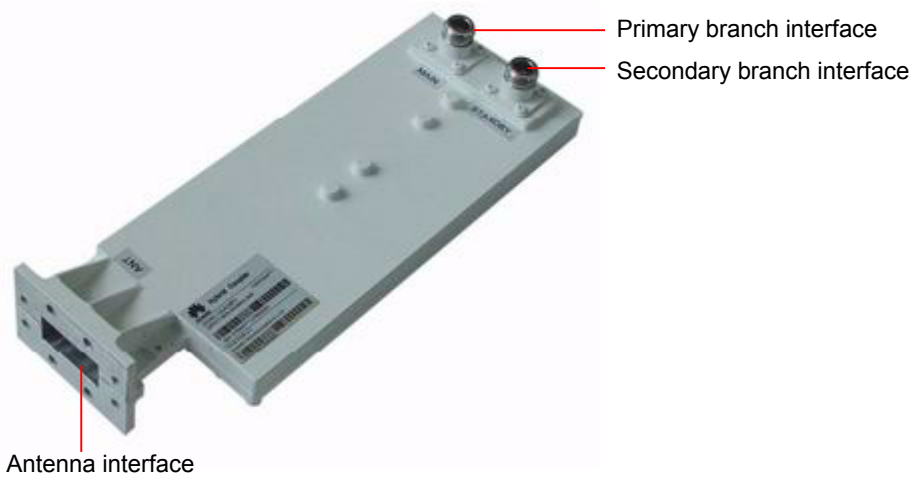


Table 2-2 Description of the interfaces of the hybrid coupler with coaxial interfaces

Interface	Mark	Function	Type of Connector
Antenna interface	-	Connects to the antenna.	UDR70
Primary branch interface[a]	MAIN	Connects to the active ODU.	Type-N (female)
Secondary branch interface[a]	STANDBY	Connects to the standby ODU.	

NOTE

a: The primary branch interface or secondary branch interface of a hybrid coupler that has coaxial interfaces is connected to ODUs through an RF cable.

2.5 Label

Hybrid coupler labels are attached to both hybrid couplers and the packing boxes of the hybrid couplers. The hybrid coupler label is used to provide the basic information of the hybrid coupler.

Figure 2-3 Hybrid coupler label

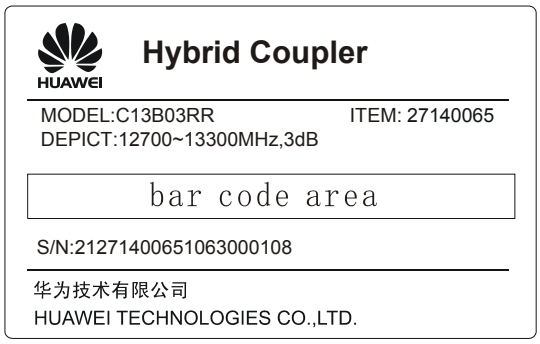


Table 2-3 Description of the hybrid coupler label

Label Information	Sample Label	Parameter	Meaning of the Parameter
Component name	**Hybrid Coupler**	-	Indicates that the component is a hybrid coupler.
Model of hybrid coupler (MODEL)	C 13 B 03 R R ① ② ③ ④ ⑤ ⑥	(1): Type of component	C: Indicates a hybrid coupler.
		(2): Frequency band	Indicates the operating frequency band (GHz) of the hybrid coupler, which can be 0L6/0U6/07/08/10/11/13/15/18/23/26/28/32/38. **NOTE** The number 10 represents the 10 GHz and 10.5 GHz frequency bands.
		(3): Branch characteristics	B: balanced U: unbalanced
		(4): Coupling	03: The coupling between the primary branch and the secondary branch is 3 dB. 06: The coupling between the primary branch and the secondary branch is 6 dB.

Label Information	Sample Label	Parameter	Meaning of the Parameter
		(5): Type of antenna interface	C: round waveguide R: rectangular waveguide F: flange
		(6): Type of ODU interface	C: round waveguide R: rectangular waveguide N: type-N, female
Code of the hybrid coupler (ITEM)	27140065	-	Indicates the code of the hybrid coupler.
Description of the hybrid coupler (DEPICT)	1270-1330MHz,3dB ① ②	(1): Operating frequency range	Indicates the operating frequency range (MHz) of the hybrid coupler.
		(2): Coupling	Indicates the coupling (dB) between the primary branch and the secondary branch.
Serial number of the hybrid coupler (S/N)	21271400651603000108	-	Identifies the hybrid coupler uniquely.
Bar code area	bar code area	-	Indicates the bar code of the serial number of the hybrid coupler.

2.6 Technical Specifications

The technical specifications of the hybrid coupler include electrical and mechanical specifications.

Table 2-4 Performance of the hybrid coupler

Item	Performance
Loss of the main path (dB)	3.3±0.3 (3 dB balanced hybrid coupler) ≤ 1.7 (6 dB unbalanced hybrid coupler with waveguide interfaces) ≤ 1.9 (6 dB unbalanced hybrid coupler with coaxial interfaces)
Ripple of loss (dB)	≤ 0.5
Loss of the standby path (dB)	3.3±0.3 (3 dB balanced hybrid coupler) 6.5±0.6 (6 dB unbalanced hybrid coupler)

Item	Performance
Isolation between the main path and the standby path(dB)	≥ 20
Voltage standing wave ratio (VSWR)	≤ 1.2
Power capacity (W)	8
Dimensions	< 220 mm x 334 mm x 252 mm (width x depth x height) (hybrid coupler with waveguide interfaces) < 100 mm x 300 mm x 120 mm (width x depth x height) (hybrid coupler with coaxial interfaces)
Weight (kg)	≤ 6 (hybrid coupler with waveguide interfaces) ≤ 3 (hybrid coupler with coaxial interfaces)

3 Separate Mount Parts

About This Chapter

When an ODU applies the separate mount mode, you need to use separate mount parts to connect an antenna to the ODU or hybrid coupler. The separate mount parts described in this documents are the separate mount parts applicable to the OptiX RTN 600 SP/SPA/HP/LP/LPA ODU.

3.1 Separate Mount Parts for an ODU with the Waveguide Interface

When an ODU with the waveguide interface adopts the separate mount mode, the installation parts include an ODU adapter and a flexible waveguide.

When you install an ODU or a hybrid coupler on a pole, an ODU adapter is used to convert the feed boom interface on the ODU or hybrid coupler into a standard flange interface, for the connection of a flexible waveguide.

A flexible waveguide is in rectangular form. It is used to connect the flange interface on an antenna to the flange interface on an ODU adapter.

When the flange interface of an antenna or ODU adapter cannot be directly interconnected with the flange interface of a separately separate mount part such as flexible waveguide, a waveguide-to-coaxial converter, or a coaxial hybrid coupler, due to a mismatch between the specifications, a flange converter is used to convert the interfaces.

3.1.1 ODU Adapter

When you install an ODU or a hybrid coupler on a pole, an ODU adapter is used to convert the feed boom interface on the ODU or hybrid coupler into a standard flange interface, for the connection of a flexible waveguide.

Appearance

Figure 3-1 Appearance of an ODU adapter

Performance

Table 3-1 Performance of an ODU adapter

Item		Performance
Attenuation (dB)		≤ 0.2 (7/8/11/13/15/18/23/26 GHz frequency band) ≤ 0.3 (28/32/38 GHz frequency band)
Flatness (dB)		≤ 0.2
Standing wave ratio		≤ 1.2
Interface	At the side of the ODU or hybrid coupler	1.025" dia (7/8 GHz frequency band) 153IEC-R120 (11/13 GHz frequency band) 153IEC-R140 (15 GHz frequency band) 153IEC-R220 (18/23/26 GHz frequency band) 153IEC-R320 (28/32 GHz frequency band) 0.219" dia (38 GHz frequency band)
	At the side of the flexible waveguide	154IEC-UBR84 (7/8 GHz frequency band) 154IEC-UBR100 (11GHz frequency band) 154IEC-UBR120 (13 GHz frequency band) 154IEC-UBR140 (15 GHz frequency band) 154IEC-UBR220 (18/23/26 GHz frequency band) 154IEC-UBR320 (28/32/38 GHz frequency band)

Label

ODU adapter labels are attached to both ODU adapters and the packing boxes of the ODU adapters. The ODU adapter label is used to provide the basic information of the ODU adapter.

Figure 3-2 ODU adapter label

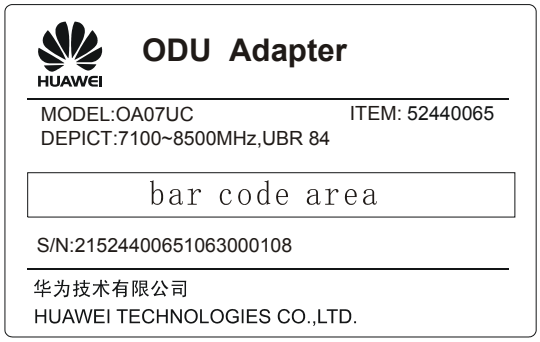


Table 3-2 Description of the ODU adapter label

Label Information	Sample Label	Parameter	Meaning of the Parameter
Component name	**ODU Adapter**	-	Indicates that the component is an ODU adapter.
Model of ODU adapter (MODEL)	OA 07 U C ① ② ③ ④	(1): Type of component	OA: Indicates an ODU adapter.
		(2): Frequency band	Indicates the operating frequency band (GHz) of the ODU adapter, which can be 07/08/11/13/15/18/23/26/28/32/38.
		(3): Type of interface at the side of the flexible waveguide	U: UBR flange interface
		(4): Type of interface at the side of the ODU	C: round waveguide R: rectangular waveguide
Code of the ODU adapter (ITEM)	52440065	-	Indicates the code of the ODU adapter.
Description of the ODU adapter (DEPICT)	7100-8500MHz,UBR84 ① ②	(1): Operating frequency range	Indicates the operating frequency range (MHz) of the ODU adapter.
		(2): Interface specification	Indicates the specification of the flange interface at the side of the flexible waveguide.
Serial number of the ODU adapter (S/N)	21524400651603000108	-	Identifies the ODU adapter uniquely.
Bar code area	bar code area	-	Indicates the bar code of the serial number of the ODU adapter.

3.1.2 Flexible Waveguide

A flexible waveguide is in rectangular form. It is used to connect the flange interface on an antenna to the flange interface on an ODU adapter.

Appearance

Figure 3-3 Appearance of a flexible waveguide

Performance

Table 3-3 Performance of a flexible waveguide

Item		Performance
Attenuation (dB)		≤ 0.4 (7/8/11 GHz frequency band) ≤ 0.6 (13 GHz frequency band) ≤ 0.9 (15 GHz frequency band) ≤ 2.4 (18/23/26 GHz frequency band) ≤ 3.0 (28/32/38 GHz frequency band)
Flatness (dB)		≤ 0.2 (7/8/11/13 GHz frequency band) ≤ 0.3 (15 GHz frequency band) ≤ 0.5 (18/23/26 GHz frequency band) ≤ 0.5 (28/32/38 GHz frequency band)
Standing wave ratio		≤ 1.1 (7/8/11/13/15 GHz frequency band) ≤ 1.2 (18/23/26/28/32/38 GHz frequency band)
Length (m)		0.9
Interface	At the side of the ODU adapter	154IEC-PBR84 (7/8 GHz frequency band) 154IEC-PBR100 (11GHz frequency band) 154IEC-PBR120 (13 GHz frequency band)

Item		Performance
	At the side of the antenna adapter	154IEC-PBR140 (15 GHz frequency band) 154IEC-PBR220 (18/23/26 GHz frequency band) 154IEC-PBR320 (28/32/38 GHz frequency band)
Maximum twist degree (the whole flexible waveguide, unifirmly twisting)		249°(7/8 GHz frequency band) 280°(11 GHz frequency band) 330°(13 GHz frequency band) 405°(15 GHz frequency band) 465°(18/23/26/28/32/38 GHz frequency band)
Minimum E-bend radius		76 mm (7/8 GHz frequency band) 64 mm (11/13GHz frequency band) 52 mm (15 GHz frequency band) 38 mm (18/23/26/28/32/38 GHz frequency band)
Minimum H-bend radius		152 mm (7/8 GHz frequency band) 127 mm (11 GHz frequency band) 115 mm (13GHz frequency band) 102 mm (15 GHz frequency band) 76 mm (18/23/26/28/32/38 GHz frequency band)

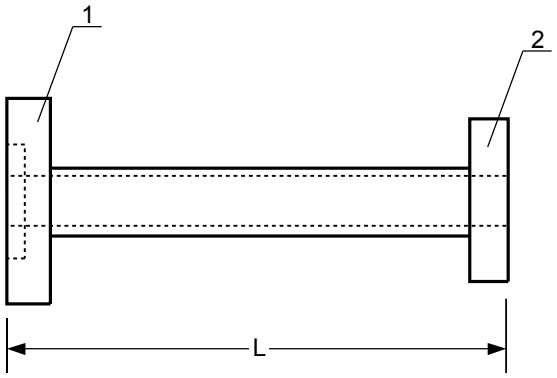
3.1.3 Flange Converter

When the flange interface of an antenna or ODU adapter cannot be directly interconnected with the flange interface of a separately separate mount part such as flexible waveguide, a waveguide-to-coaxial converter, or a coaxial hybrid coupler, due to a mismatch between the specifications, a flange converter is used to convert the interfaces.

Appearance

A flange converter consists of the flange interface on the antenna side, flange interface on the flexible waveguide side, and waveguide body.

Figure 3-4 Appearance of a flange converter



1. Flange interface on the antenna side
2. Flange interface on the flexible waveguide side

Performance

Table 3-4 Performance of a flange converter

Frequency Band	Frequency Range (GHz)	Flange Type (Antenna Side/ Flexible Waveguide Side)	Length (mm)	Standing Wave Ratio
6GHz	5.38-8.17	PDR70/PDR70	100	1.02
7/8 GHz	6.57-9.99	UDR84/UBR84	50	1.02
	6.57-9.99	PDR84/UBR84	50	1.02
	7.050-8.6	PDR70/UBR84	100	1.05
11 GHz	8.2-12.5	UDR100/UBR100	50	1.02
	8.2-12.5	UBR100/UBR100	100	1.02
	8.2-12.5	PDR100/UBR100	50	1.02
	10.0-12.4	PBR120/UBR100	100	1.05
13 GHz	9.84-15.0	UBR120/UBR120	100	1.02
	9.84-15.0	PDR120/UBR120	50	1.02
	9.84-15.0	PBR140/UBR120	50	1.02
15 GHz	11.9-18.0	UBR140/UBR140	100	1.02
18/23/26 GHz	17.6-26.7	UBR220/UBR220	100	1.02
	24.0-26.5	PBR260/UBR220	100	1.05
	24.0-26.5	UBR260/UBR220	100	1.05

Frequency Band	Frequency Range (GHz)	Flange Type (Antenna Side/ Flexible Waveguide Side)	Length (mm)	Standing Wave Ratio
28/32/38 GHz	26.3-40.0	UBR320/UBR320	100	1.02

3.2 Separate Mount Parts for an ODU with the Coaxial Interface

When an ODU with the coaxial interface adopts the separate mount mode, the installation parts include a waveguide-to-coaxial converter and an RF cable.

A waveguide-to-coaxial converter is used to convert the waveguide interface (standard flange interface) on an antenna into an RF cable interface (type-N interface), for connecting an antenna and an RF cable.

An RF cable is an FSJ1-50A coaxial cable. It is used to connect a waveguide-to-coaxial converter to an ODU or to connect a hybrid coupler to an ODU.

3.2.1 Waveguide-to-Coaxial Converter

A waveguide-to-coaxial converter is used to convert the waveguide interface (standard flange interface) on an antenna into an RF cable interface (type-N interface), for connecting an antenna and an RF cable.

Appearance

Figure 3-5 Appearance of a waveguide-to-coaxial converter

Performance

Table 3-5 Performance of a waveguide-to-coaxial converter

Item		Performance
Attenuation (dB)		≤ 0.2
Flatness (dB)		≤ 0.2
Standing wave ratio		≤ 1.15
Interface	At the side of the antenna	UDR70
	At the side of the RF cable	Type N, female

3.2.2 RF Cable

An RF cable is an FSJ1-50A coaxial cable. It is used to connect a waveguide-to-coaxial converter to an ODU or to connect a hybrid coupler to an ODU.

Appearance

Figure 3-6 Appearance of an RF cable

Performance

Table 3-6 Performance of an RF cable

Item	Performance
Attenuation (dB)	≤ 0.6
Standing wave ratio (dB)	≤ 1.2

Item	Performance
Length (m)	1
Interface	Type N, male
Interface impedance (ohm)	50

4 Antenna

About This Chapter

The microwave equipment uses the parabolic antennas to radiate and receive the electromagnetic waves. The antennas that are described in this document are the parabolic antennas adaptive to the OptiX RTN 600 SP/SPA/HP/LP/LPA ODU.

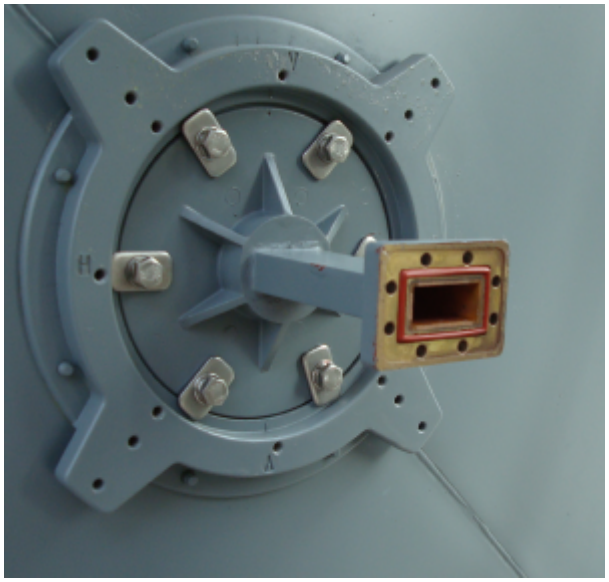
4.1 Equipment Type

The antennas are classified into two types, namely, the single-polarized antenna and dual-polarized antenna.

- The single-polarized antenna radiates or receives the electromagnetic waves in a specific polarization direction. The single-polarized antenna provides a feed boom interface. The feed boom interface can be set to be vertically polarized or horizontally polarized. According to the mode of installing the ODU to the antenna, the single-polarized antenna is classified into two types, namely, direct-mount antenna and separate-mount antenna. **Figure 4-1** and **Figure 4-2** show the feed booms of the direct-mount single-polarized antenna and the separate-mount single-polarized antenna.

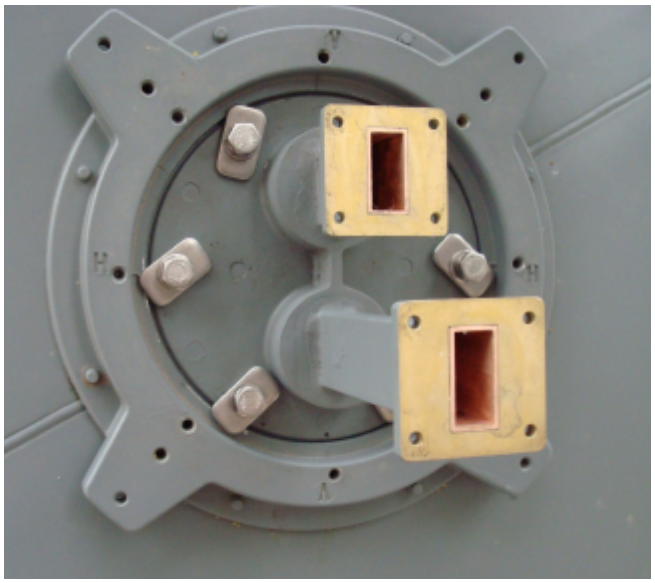
Figure 4-1 Feed boom of the direct-mount single-polarized antenna

Figure 4-2 Feed boom of the separate-mount single-polarized antenna



- The dual-polarized antenna radiates and receives vertically polarized electromagnetic waves and horizontally polarized electromagnetic waves at the same time. The dual-polarized antenna provides two feed boom interfaces, which are vertically and horizontally polarized. The ODU can be installed on the dual-polarized antenna only in separate mounting mode. **Figure 4-3** shows the feed booms of the dual-polarized antenna.

Figure 4-3 Feed boom of the dual-polarized antenna



4.2 Functions and Features

The antenna is used to convert between the RF signals transmitted from the ODU and the electromagnetic waves radiated in the air.

- In the transmit direction, the antenna converts the RF signals transmitted from the ODU into the directional electromagnetic waves and then radiates the electromagnetic waves in the air.
- In the receive direction, the antenna receives and assembles the electromagnetic waves from the air, converts the electromagnetic waves into the RF signals, and then transmits the RF signals to the ODU.

4.3 Working Principle

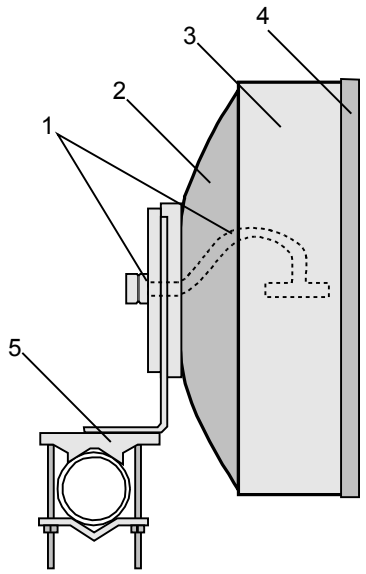
An antenna comprises the reflector, feed boom, radome, shield, and mounting brackets.

Figure 4-4 shows the structure of the antenna.

NOTE

This topic considers the single-polarized antenna as an example to describe the working principle of antennas. The dual-polarized antenna has two feed boom interfaces and thus can transmit the electromagnetic waves in the vertical and horizontal polarization directions at the same time. The working principles of each component of the dual-polarized antenna are similar to the working principles of each component of the single-polarized antenna.

Figure 4-4 Structure of the antenna



1. Feed boom
2. Reflector
3. Shield
4. Radome
5. Mounting brackets

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

- Feed boom

  The input port of the feed boom accesses the RF signals transmitted from the ODU. The accessed RF signals are transmitted through the waveguide to the output port of the feed boom, which is located at the focal spot of the reflector. The output port of the feed boom is equivalent to a preliminary horn antenna and radiates electromagnetic waves towards the antenna reflector.

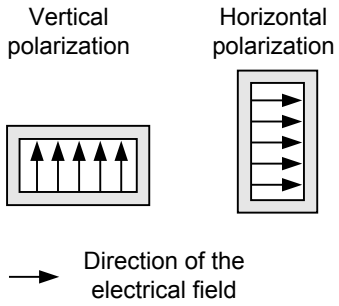
  You can change the polarization direction of the antenna by rotating the feed boom. The polarization direction of the antenna is the polarization of the electromagnetic waves

radiated by the antenna. The polarization direction of the electromagnetic waves is the direction of the electrical field. **Figure 4-5** shows the polarization directions supported by the rectangular waveguide.

NOTE

The polarization direction of the antenna must be the same as the polarization direction of the ODU or hybrid coupler. The feed booms of certain types use the round waveguide. In this case, see installation instruction of the antenna to adjust the polarization direction of an antenna according to the polarization mark.

Figure 4-5 Polarization directions supported by the rectangular waveguide



- Reflector

  Normally, the reflector of the antenna is a rotatable paraboloid. The reflector is mainly used for determining the direction and providing the directive gain.

  - In the transmit direction, the reflector reflects the electromagnetic waves radiated from the feed boom so that the electromagnetic waves are directional.
  - In the receive direction, the reflector assembles the electromagnetic waves from the space to the output port of the feed boom.

- Radome

  The radome protects the antenna from being damaged due to the wind, rain, and ice. The electromagnetic waves can be radiated through the radome.

- Shield

  The shield is installed on the HP antenna. The shield is mainly used for suppressing the radiation of the side lobes.

- Mounting brackets

  The mounting brackets are used for fixing the antenna onto the pole and for adjusting the azimuth and elevation slightly. In addition to the mounting brackets, a reinforcing rod is required for fixing the antenna with the diameter of not less than 1.2 meters.

4.4 Interface

The feed boom interface of the direct-mount single-polarized antenna is a waveguide interface. The feed boom interfaces of the separate-mount single-polarized antenna and the dual-polarized antenna are flange interfaces.

Table 4-1 Specifications for the feed boom interface of an antenna

Frequency Band	Interface Type	
	Direct-Mount Single-Polarized Antenna	Separate-Mount Single-Polarized Antenna or Dual-Polarized Antenna
6 GHz	Not supported	154IEC-PDR70
7/8 GHz	1.025" dia	154IEC-UBR84
10/10.5 GHz	153IEC-R100	154IEC-UBR100
11 GHz	153IEC-R120	154IEC-UBR100
13 GHz	153IEC-R120	154IEC-UBR120
15 GHz	153IEC-R140	154IEC-UBR140
18 GHz	153IEC-R220	154IEC-UBR220
23 GHz	153IEC-R220	154IEC-UBR220
26 GHz	153IEC-R220	154IEC-UBR220
28 GHz	153IEC-R320	154IEC-UBR320
32 GHz	153IEC-R320	154IEC-UBR320
38 GHz	0.219" dia	154IEC-UBR320

4.5 Antenna Diameter

Antennas that are of different types or operate on different frequency bands support various diameters.

Table 4-2 to Table 4-4 list the diameters that different types of antennas support. "Y" indicates that the corresponding antenna diameter is supported. "NA" indicates that the corresponding antenna diameter is Not supported

Table 4-2 Diameter of the direct-mount single-polarized antenna

Operating Frequency Band	Antenna Diameter				
	0.3 m	0.6 m	0.9 m	1.2 m	1.8 m
7/8 GHz	NA	Y	Y	Y	Y
10/10.5 GHz	NA	Y	NA	Y	Y
11 GHz	Y	Y	Y	Y	Y
13 GHz	Y	Y	Y	Y	Y
15 GHz	Y	Y	Y	Y	Y

Operating Frequency Band	Antenna Diameter				
	0.3 m	0.6 m	0.9 m	1.2 m	1.8 m
18 GHz	Y	Y	Y	Y	Y
23 GHz	Y	Y	Y	Y	Y
26 GHz	Y	Y	Y	Y	NA
28 GHz	Y	Y	NA	NA	NA
32 GHz	Y	Y	NA	NA	NA
38 GHz	Y	Y	NA	NA	NA

Table 4-3 Diameter of the separate-mount single-polarized antenna

Operating Frequency Band	Antenna Diameter						
	0.6 m	0.9 m	1.2 m	1.8 m	2.4 m	3.0 m	3.7 m
L6 GHz	NA	Y	Y	Y	Y	Y	Y
U6 GHz	NA	Y	Y	Y	Y	Y	Y
7/8 GHz	Y	NA	Y	Y	Y	Y	Y
11 GHz	Y	NA	Y	Y	Y	Y	NA
13 GHz	Y	NA	Y	Y	Y	Y	NA
15 GHz	Y	NA	Y	Y	NA	NA	NA
18 GHz	Y	NA	Y	Y	NA	NA	NA
23 GHz	Y	NA	Y	Y	NA	NA	NA
26 GHz	Y	NA	Y	NA	NA	NA	NA
32 GHz	Y	NA	NA	NA	NA	NA	NA
38 GHz	Y	NA	NA	NA	NA	NA	NA

Table 4-4 Diameter of the dual-polarized antenna

Operating Frequency Band	Antenna Diameter							
	0.3 m	0.6 m	0.9 m	1.2 m	1.8 m	2.4 m	3.0 m	3.7 m
L6 GHz	NA	NA	Y	Y	Y	Y	Y	Y

Operating Frequency Band	Antenna Diameter							
	0.3 m	0.6 m	0.9 m	1.2 m	1.8 m	2.4 m	3.0 m	3.7 m
U6 GHz	NA	NA	Y	Y	Y	Y	Y	Y
7/8 GHz	NA	Y	Y	Y	Y	Y	Y	Y
11 GHz	NA	Y	Y	Y	Y	Y	Y	Y
13 GHz	NA	Y	NA	Y	Y	Y	Y	Y
15 GHz	NA	Y	NA	Y	Y	NA	NA	NA
18 GHz	NA	Y	NA	Y	Y	NA	NA	NA
23 GHz	NA	Y	NA	Y	Y	NA	NA	NA
26 GHz	Y	Y	NA	Y	NA	NA	NA	NA
28 GHz	Y	Y	NA	NA	NA	NA	NA	NA
32 GHz	Y	Y	NA	NA	NA	NA	NA	NA
38 GHz	Y	Y	NA	NA	NA	NA	NA	NA

4.6 Specifications

The technical specifications for the antenna include electrical indexes and mechanical indexes. The electrical indexes of the antenna include the antenna gain, half-power beamwidth, standing wave ratio, and front-to-back ratio. The mechanical indexes of the antenna include the size, weight, wind-protective feature, and ice/snow-protective feature.

Huawei provides a complete series antennas. To obtain the technical documents about the specifications of a specific antenna, contact Huawei.

5 Accessories and Cables

About This Chapter

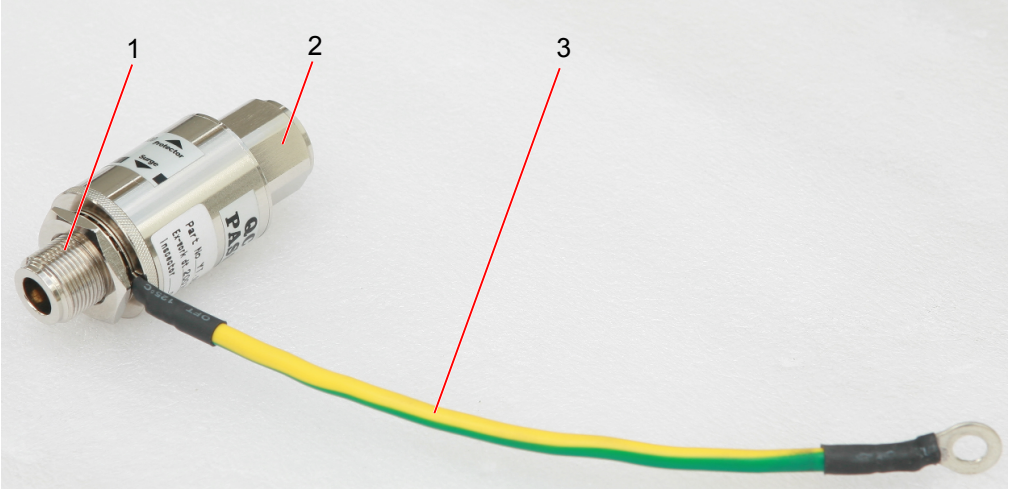
The ODU accessories include the lightening surge protector. The ODU cables include IF cables and ODU protection ground cables.

5.1 Lightening Surge Protector

A lightening surge protector is used to protect an ODU, preventing the ODU from being damaged due to overvoltage caused by induction lightning strokes from an IF cable.

Appearance

Figure 5-1 Appearance of a lightening surge protector



1. Type-N female at the Surge end 2. Type-N male at the Protect end 3. Protection ground cable, OT6-5 terminal

Installation Method

- Connect the Protect end (type-N male connector) of a lightening surge protector to the IF interface of the ODU, and the Surge end (type-N female connector) of the lightening surge protector to the type-N connector of the IF cable.
- Connect one end of the protection ground cable of a lightening surge protector to the Surge end (type-N female connector) of the lightening surge protector, and the other end of the protection ground cable to the grounding stud of the ODU.

Performance

Table 5-1 Performance of the ODU adapter

Item	Performance
Characteristic impedance	50 ohms
Working voltage	DC -48 V (-30 V to -72 V)
Working current	≤ 2 A
Nominal discharge capacity	5 kA (8/20 us)
Residual voltage	≤ 150 V (5 kA, 8/20 us)

Item	Performance
Response time	100 ns
DC resistance	0.75 ohms ±20%
Insertion loss	≤ 0.2 dB (4-430 MHz)
Voltage standing wave ratio (VSWR)	≤ 1.1 (4-430 MHz)
Flatness	≤ 0.2 dB (140/350 MHz)
Connector type	Type-N male (Protect end) Type-N female (Surge end)

5.2 IF Cable

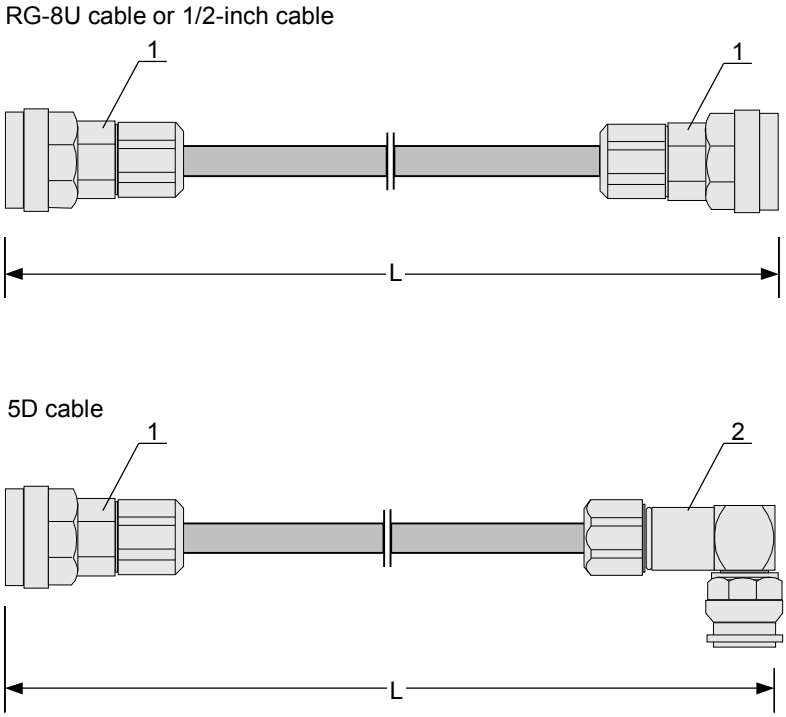
The IF cable connects the ODU and IDU. The IF cable is used to transport the IF signal, O&M signal, and -48 V power between the ODU and the IDU.

IF cables are of three types, namely, 5D cable, 1/2-inch cable, and RG-8U cable.

- If the distance between the IDU and the ODU is less than 120 meters, use the 5D cable. One end of the 5D cable needs to be terminated with a type-N connector for connecting to the IF interface of the ODU. The other end of the 5D cable needs to be terminated with a TNC connector for connecting to the IF interface of the IDU.
- If the distance between the IDU and the ODU is within 120 meters to 180 meters, use the RG-8U cable. Both ends of the RG-8U cable need to be terminated with the type-N connectors for connecting to the IF interface of the ODU and the IF jumper of the IDU, respectively.
- If the distance between the IDU and the ODU is within 180 meters to 300 meters, use the 1/2-inch cable. Both ends of the 1/2-inch cable need to be terminated with the type-N connectors for connecting to the IF interface of the ODU and the IF jumper of the IDU, respectively.

Cable Diagram

Figure 5-2 Diagram of the IF cable



1. RF coaxial cable connector, type-N, male
2. RF Coaxial Connector, type TNC, male

Cable Connection Table

None.

Technical Specifications

Table 5-2 Technical specifications of the IF cable

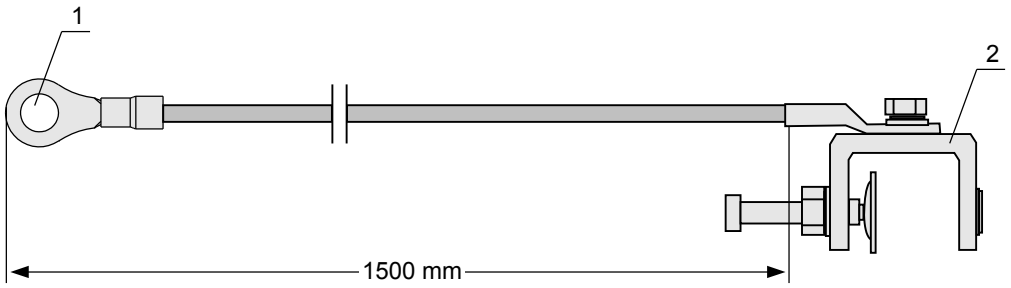
Item	Performance		
	5D Cable	RG-8U Cable	1/2-Inch Cable
Characteristic impedance (ohm)	50	50	50
Attenuation (dB/100 meters)	≤ 10.0 (140 MHz) ≤ 15.0 (350 MHz)	≤ 6.0 (140 MHz) ≤ 9.0 (350 MHz)	≤ 5.0 (140 MHz) ≤ 7.8 (350 MHz)
DC resistance (ohm/km at 20°C)	≤ 11.0	≤ 4.9	≤ 4.3
Cable diameter (mm)	7.60	10.16	13.40

5.3 ODU Protection Ground Cable

The ODU protection ground cable is used to connect the left grounding screw of the ODU and the outdoor ground point such as the ground point on the tower, so that the ODU is connected to the outdoor ground counterpoise.

Cable Diagram

Figure 5-3 View of the ODU protection ground cable



1. Naked crimping connector, OT
2. Grounding clip base

Cable Connection Table

None.

A Glossary

A

ATPC Automatic Transmit Power Control. A method of adjusting the transmit power based on fading of the transmit signal detected at the receiver.

I

IDU Indoor Unit. The indoor unit implements accessing, multiplexing/ demultiplexing, and IF processing for services.

IF Intermediate Frequency. IF is the transitional frequency between the frequencies of a modulated signal and an RF signal.

N

Non-primary station The RTN microwave station on which the transmitted frequency is lower than the received frequency.

O

ODU Outdoor Unit. The outdoor unit implements frequency conversion and amplification for RF signals.

P

PDH Plesiosynchronous 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.

Primary station The RTN microwave station on which the transmitted frequency is higher than the received frequency.

S

SDH Synchronous Digital Hierarchy. A hierarchical set of digital transport structures, standardized for the transport of suitably adapted payloads over physical transmission networks.

B Acronyms and Abbreviations

A

ASK	Amplitude Shift Keying

B

BER	Bit Error Rate

D

DC	Direct Current

I

IDU	Indoor Unit
IF	Intermediate Frequency

L

LNA	Low Noise Amplifier

M

MODEM	MOdulator-DEModulator

O

ODU	Outdoor Unit

P

PDH	Plesiochronous Digital Hierarchy
Q	
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
R	
RF	Radio Frequency
RSL	Received Signal Level
RSSI	Received Signal Strength Indicator
RTN	Radio Transmission System
S	
SDH	Synchronous Digital Hierarchy
V	
VGA	Variable Gain Amplifier