PASOLINK NEO
6-52 GHz PDH/SDH DIGITAL RADIO SYSTEM

Section I DESCRIPTION

CONTENTS

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1. GENERAL DESCRIPTION

This section provides descriptive information on the PASOLINK NEO radios which are used for the wide/narrow band point-to-point digital microwave radio links.

The Indoor Unit (IDU) provides digital PDH (5-48 × E1, 1/2 × E3), SDH (1/2 × STM-1) and LAN (2 × 10/100Base-TX) signal transmission by the change of the data signal interface card. It can select the modulation method QPSK/16QAM/32QAM/128QAM, by software selection depending on the transmission capacity that is configured in the modulator/demodulator unit.

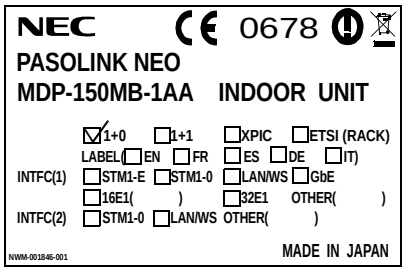
The Outdoor Unit (ODU) can be applied for a wide range of RF frequency bands from 6/7/8/11/13/15/18/23/26/32/38/52 GHz.

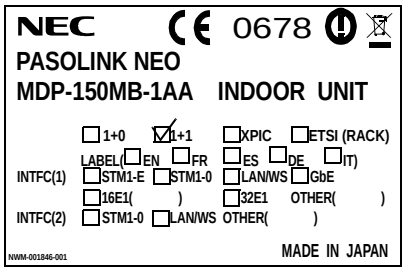
Applications using the following redundancy configurations, Unprotected (1+0), 2 × (1+0)* and Protected (1+1), 2 × (1+1)* are available for PASOLINK NEO radio systems.

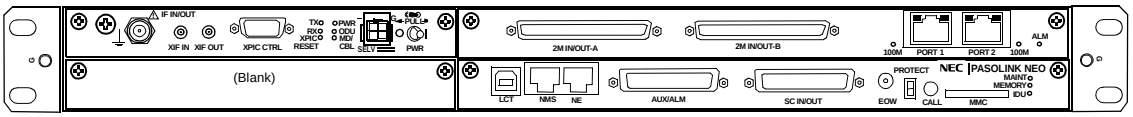
*Note: * XPIC*

Cross Polarization Interference Canceller (XPIC) system is applied for dual polarized systems using the same frequency in 2 × (1+0) and 2 × (1+1) configurations.

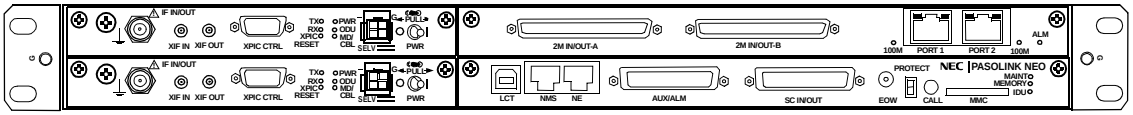
PASOLINK NEO



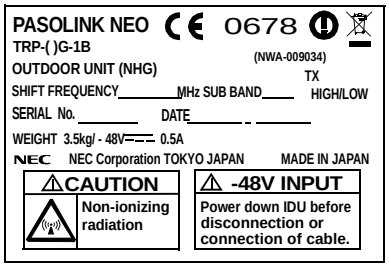


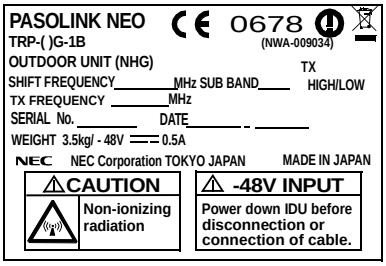


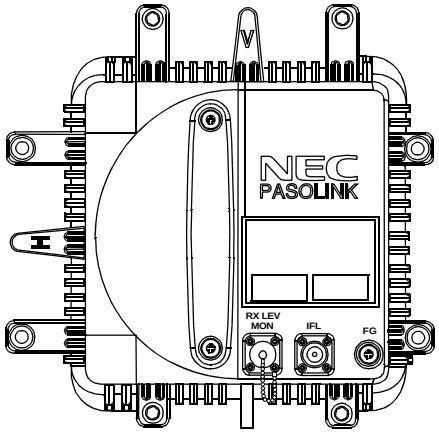
IDU 1+0



IDU 1+1







ODU

2. SYSTEM CONFIGURATION AND CHARACTERISTICS

This section provides outline of the system configuration, system performance, RF channel plan, external alarm items and House keeping input/output, and power supply.

2.1 System Configuration

The system consists of the MDP-150MB-1AA Modulator-Demodulator (Indoor Unit (IDU)) and TRP-(*1)G-1B Transmitter-Receiver (Outdoor Unit (ODU)), Hybrid Combiner/Devider*2 or Orthogonal Mode Transducer (OMT)*3 and the antenna.

The TRP-( )G-1B is available with frequency bands of 6 GHz to 52 GHz. band.

Notes: *1:ODU Type depends on the frequency band used, such as TRP-(13)G-1B is applied for 13 GHz band.

*2:The Combiner/Divider is used in (1+1) single antenna configuration for antenna direct mount type ODUs.

*3:The OMT is used in XPIC systems with antenna direct mounting ODUs.

Refer to

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Fig. 2-2 Signal Interface/Capacity (1/2)
Fig. 2-3 IDU e/w Standard and Optional Interface (1/2)
Fig. 2-4 Configuration of the ODU (1/3)
Fig. 2-5 System Block Diagram (1/4)
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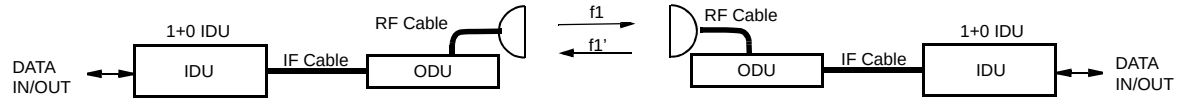
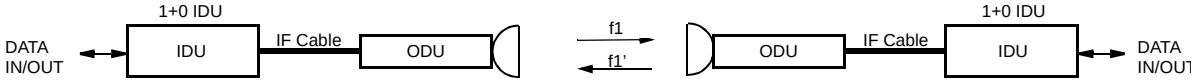
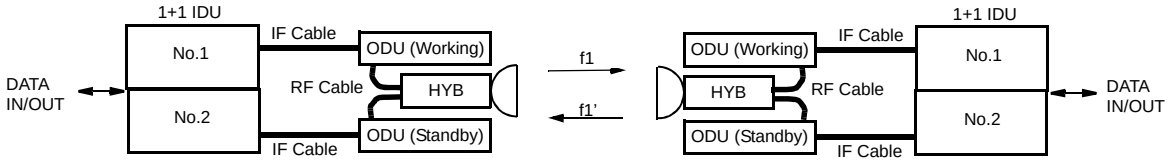


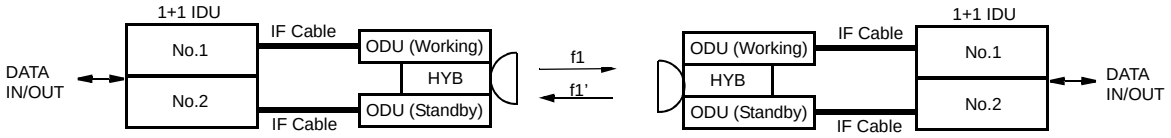
1+0 with Waveguide/Coaxial Cable Connection



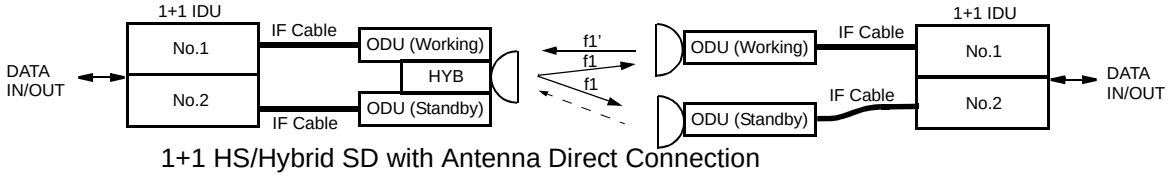
1+0 with Antenna Direct Connection



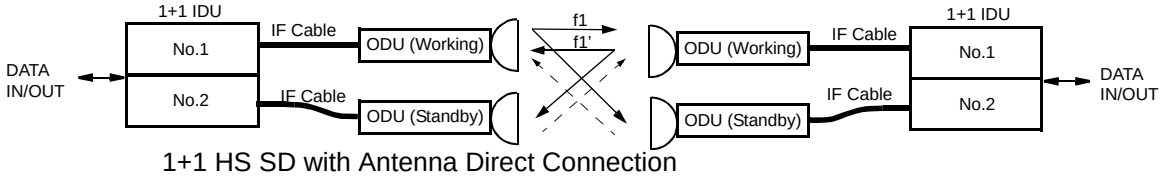
1+1HS/HS with Coaxial Cable Connection



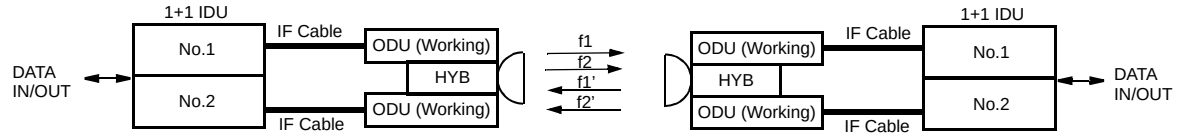
1+1 HS/HS with Antenna Direct Connection



1+1 HS/Hybrid SD with Antenna Direct Connection

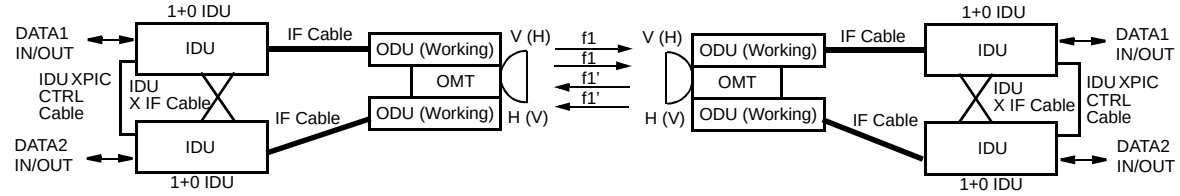


1+1 HS SD with Antenna Direct Connection

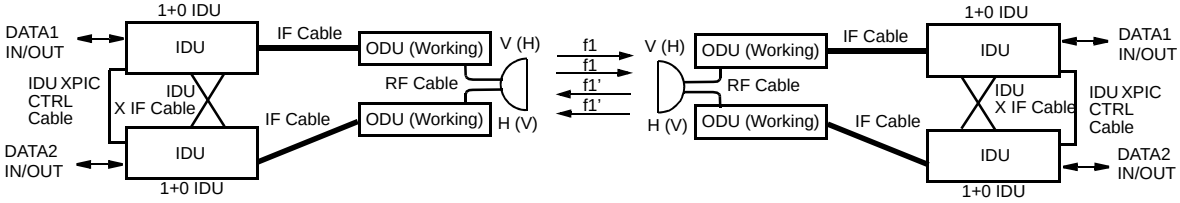


1+1 Twin-path FD with Antenna Direct Connection

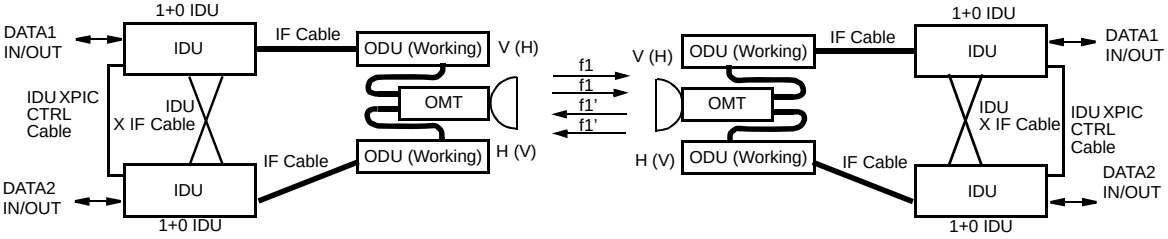
Fig. 2-1 Protected/Unprotected System Configuration (1/2)



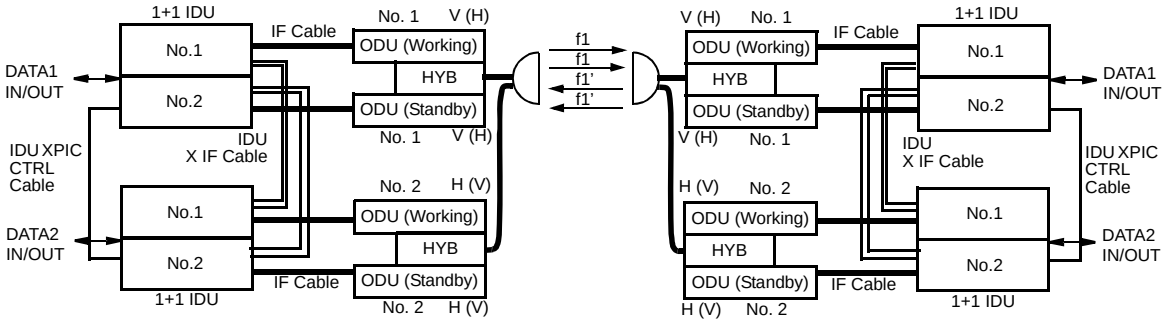
2(1+0) XPIC with Antenna Direct Connection



2(1+0) XPIC with Waveguide/Coaxial Cable Connection

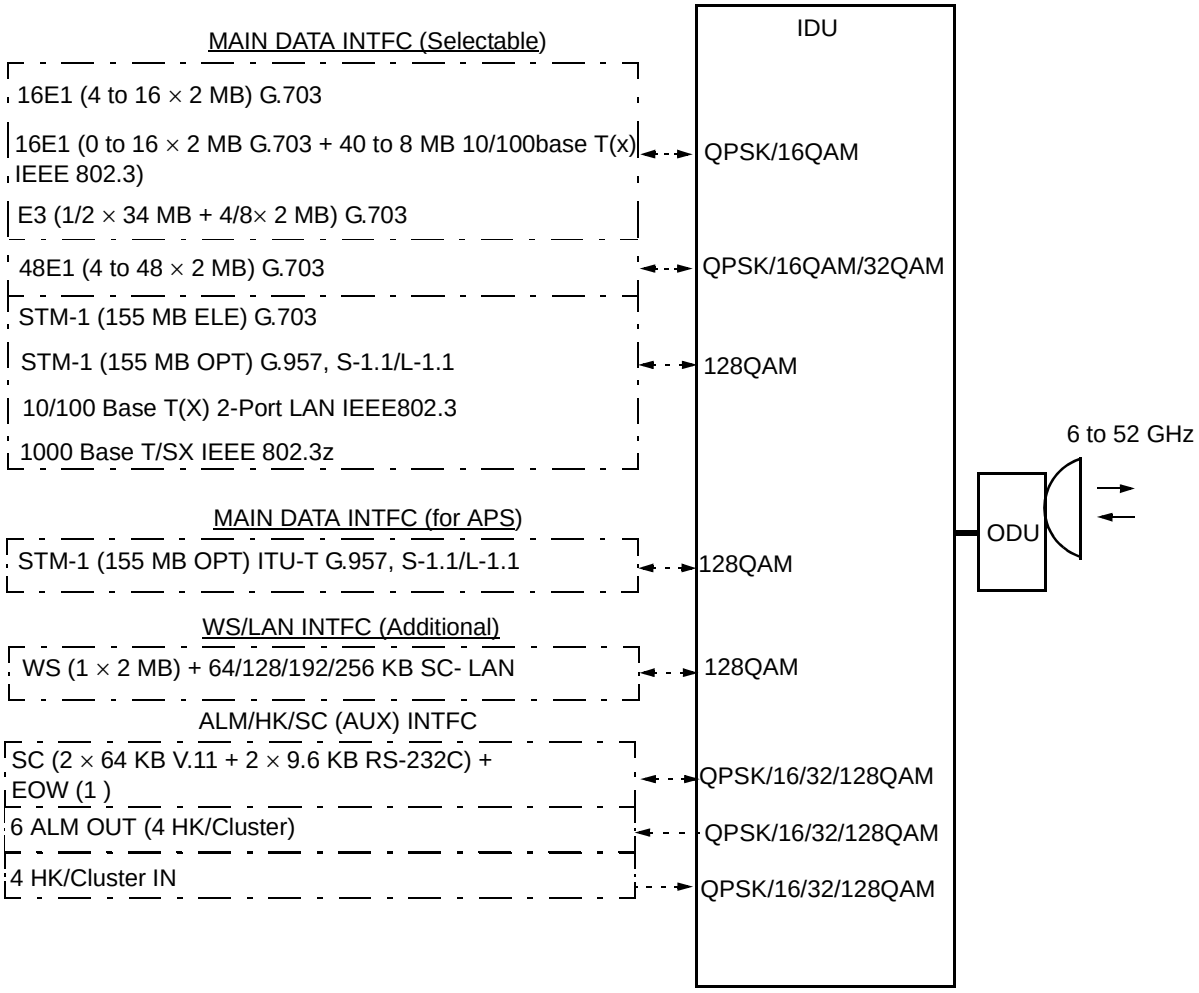


2(1+0) XPIC with Waveguide/Coaxial Cable Connection



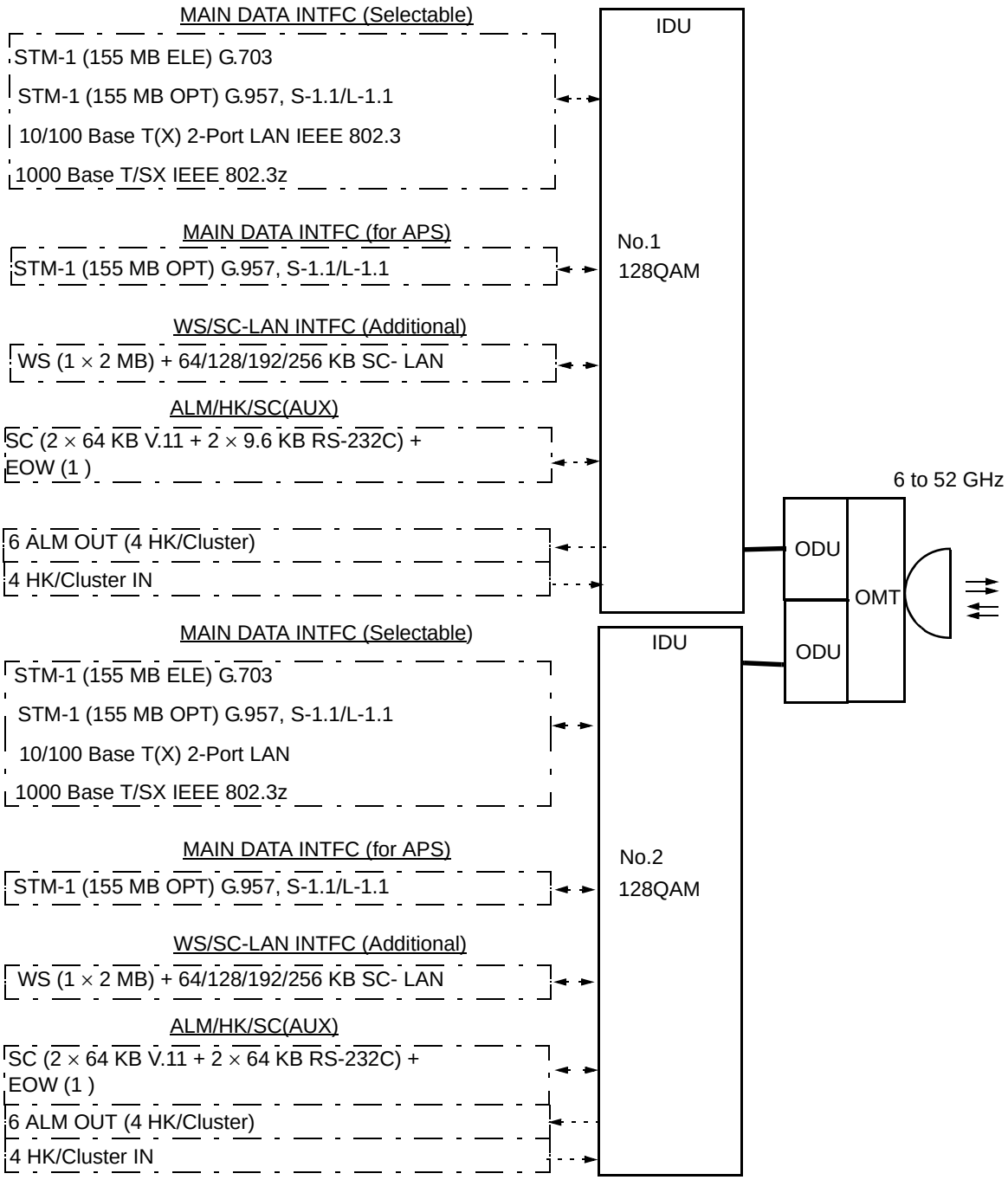
2(1+1) XPIC with Waveguide/Coaxial Cable Connection

Fig. 2-1 Protected/Unprotected System Configuration (2/2)



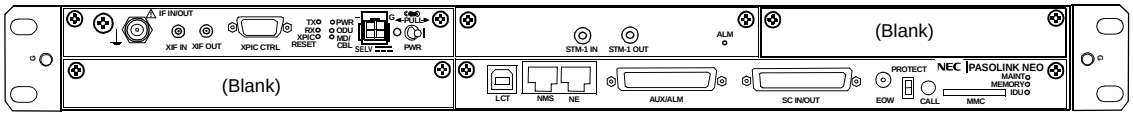
1+0/1+1 Configuration

Fig. 2-2 Signal Interface/Capacity (1/2)

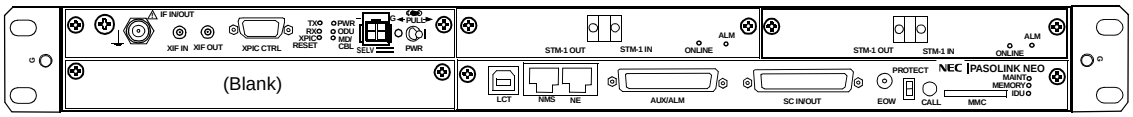


XPIC Configuration

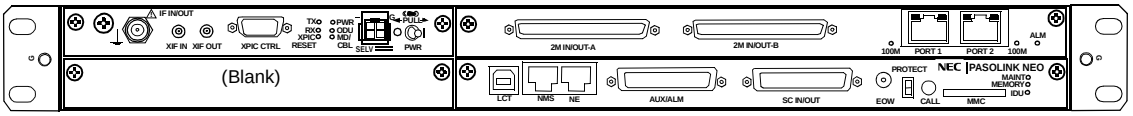
Fig. 2-2 Signal Interface/Capacity (2/2)



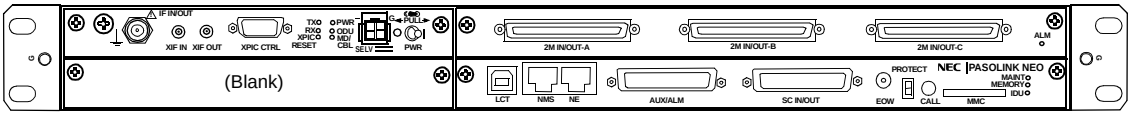
Equipped with STM-1 Electrical Interface



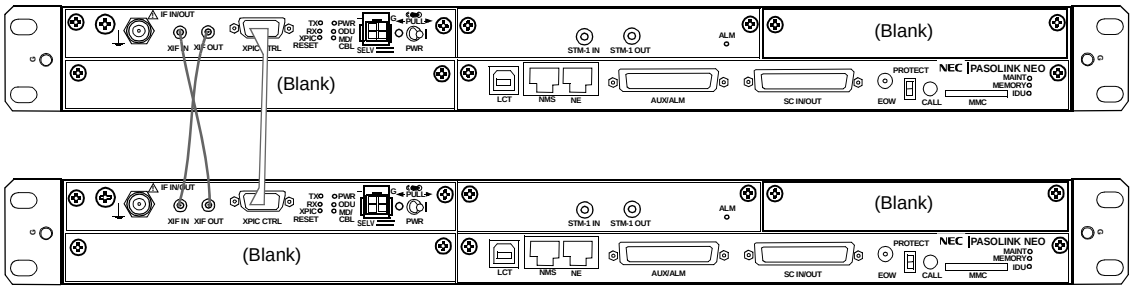
Equipped with STM-1 Optical Interface for APS



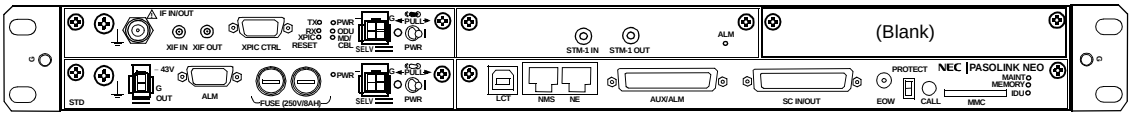
Equipped with 16E1 Interface with 2 Port LAN



Equipped with 48E1 Interface



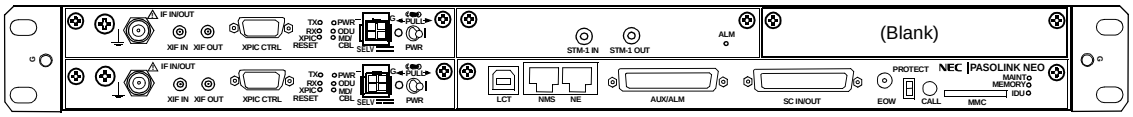
Equipped with STM-1 Electrical Interface in XPIC



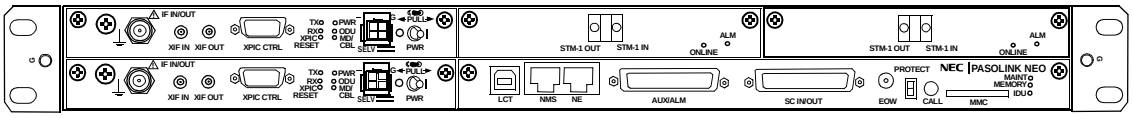
Equipped with DC-DC CONV

Unprotected System (IDU)

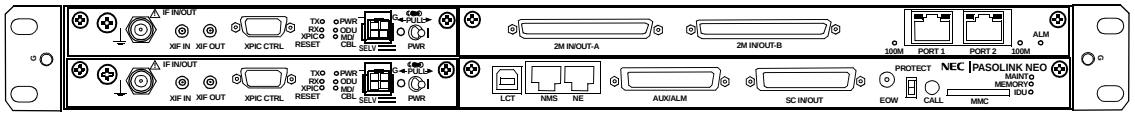
Fig. 2-3 IDU e/w Standard and Optional Interface (1/2)



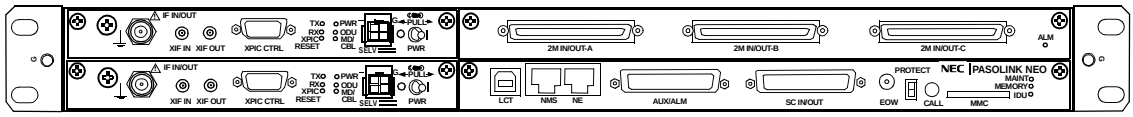
Equipped with STM-1 Electrical Interface



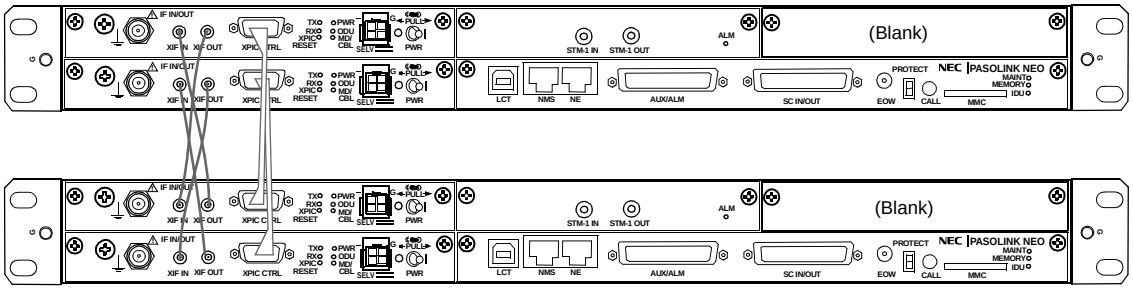
Equipped with STM-1 Optical Interface in APS



Equipped with 16E1 Interface with 2 Port LAN



Equipped with 48E1 Interface



Equipped with STM-1 Electrical Interface in XPIC

Protected System (IDU)

Fig. 2-3 IDU e/w Standard and Optional Interface (2/2)

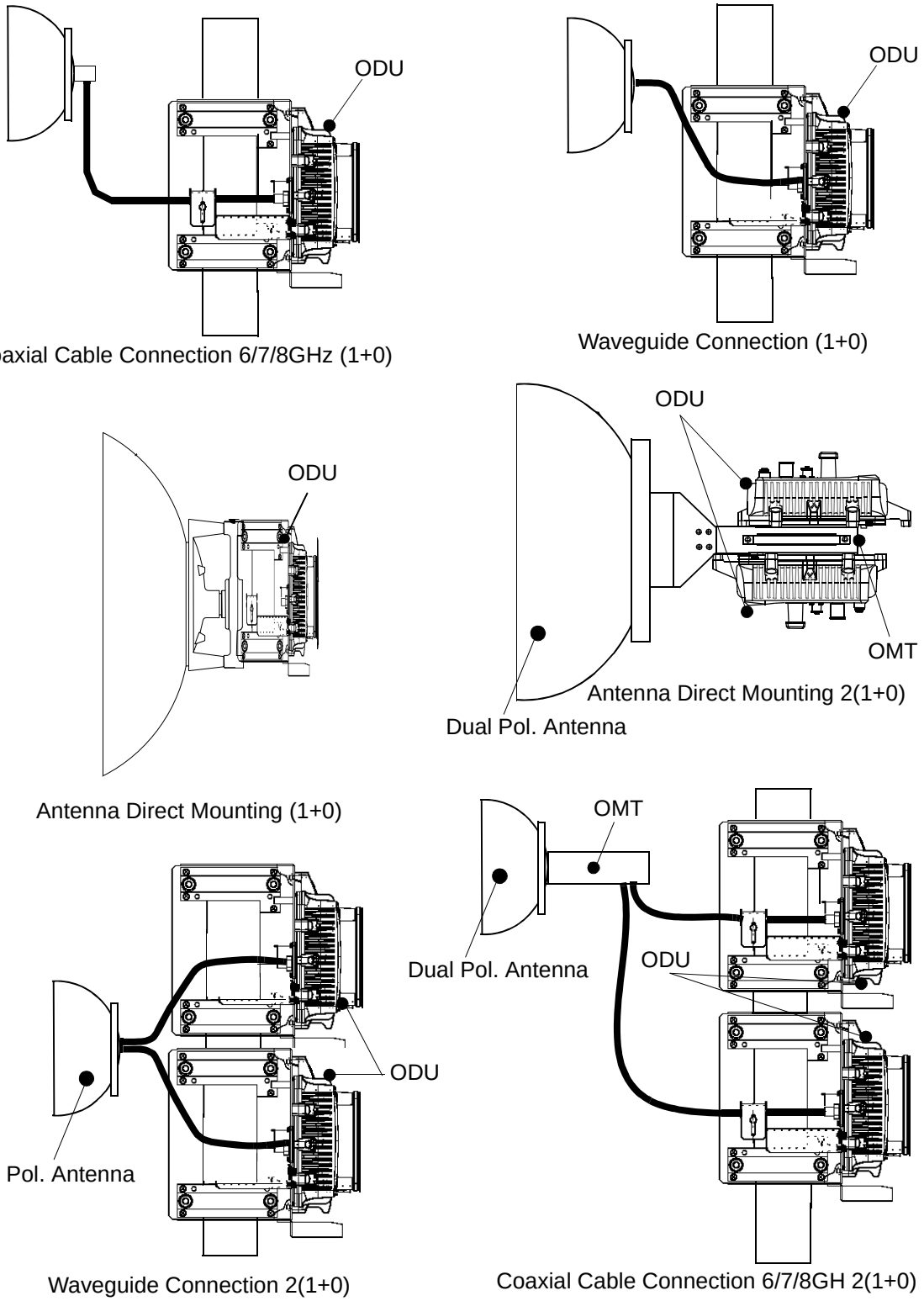
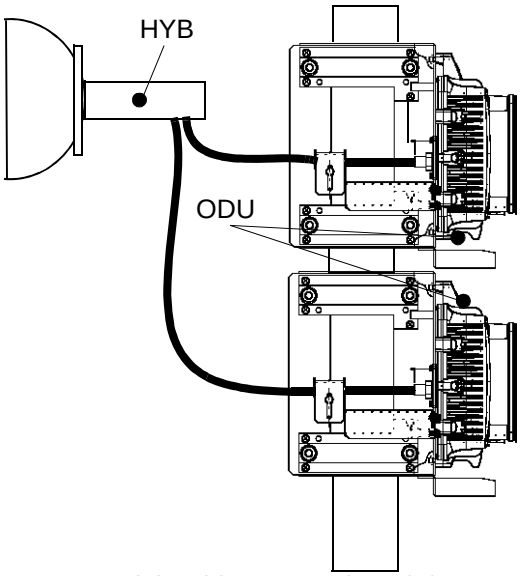
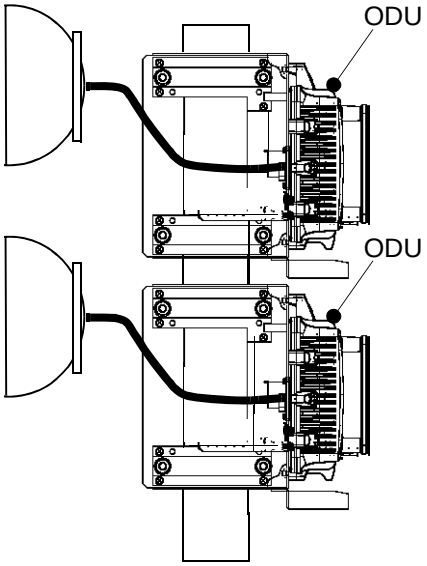


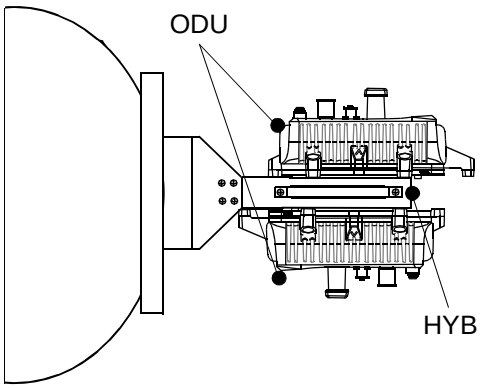
Fig. 2-4 Configuration of the ODU (1/3)



Coaxial Cable Connection 6/7/8 GHz (1+1)

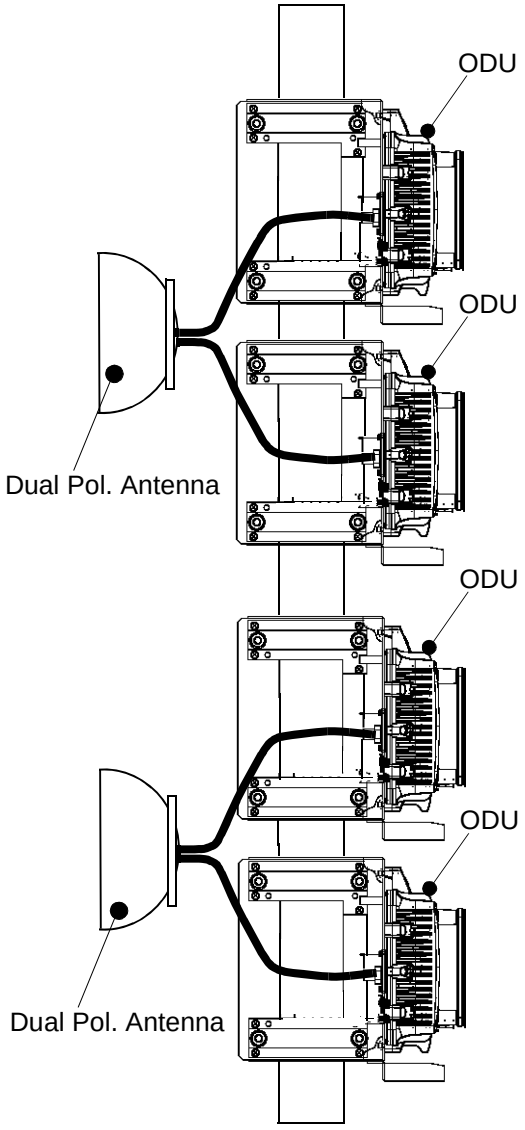


Waveguide Connection (1+1 SD)



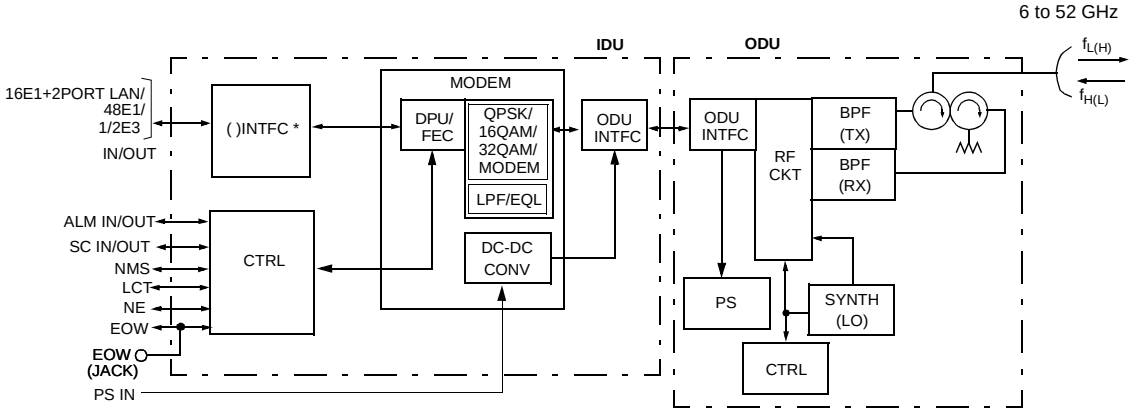
Antenna Direct Mounting (1+1)

Fig. 2-4 Configuration of the ODU (2/3)



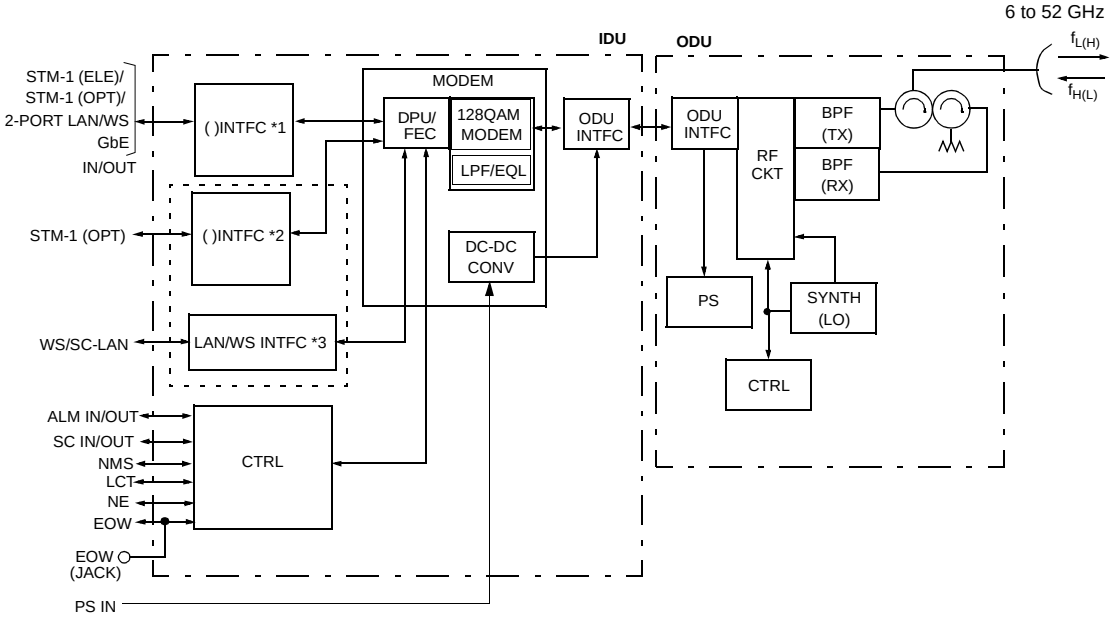
Waveguide Connection 2(1+1) XPIC SD

Fig. 2-4 Configuration of the ODU (3/3)



*Note: * Optional*

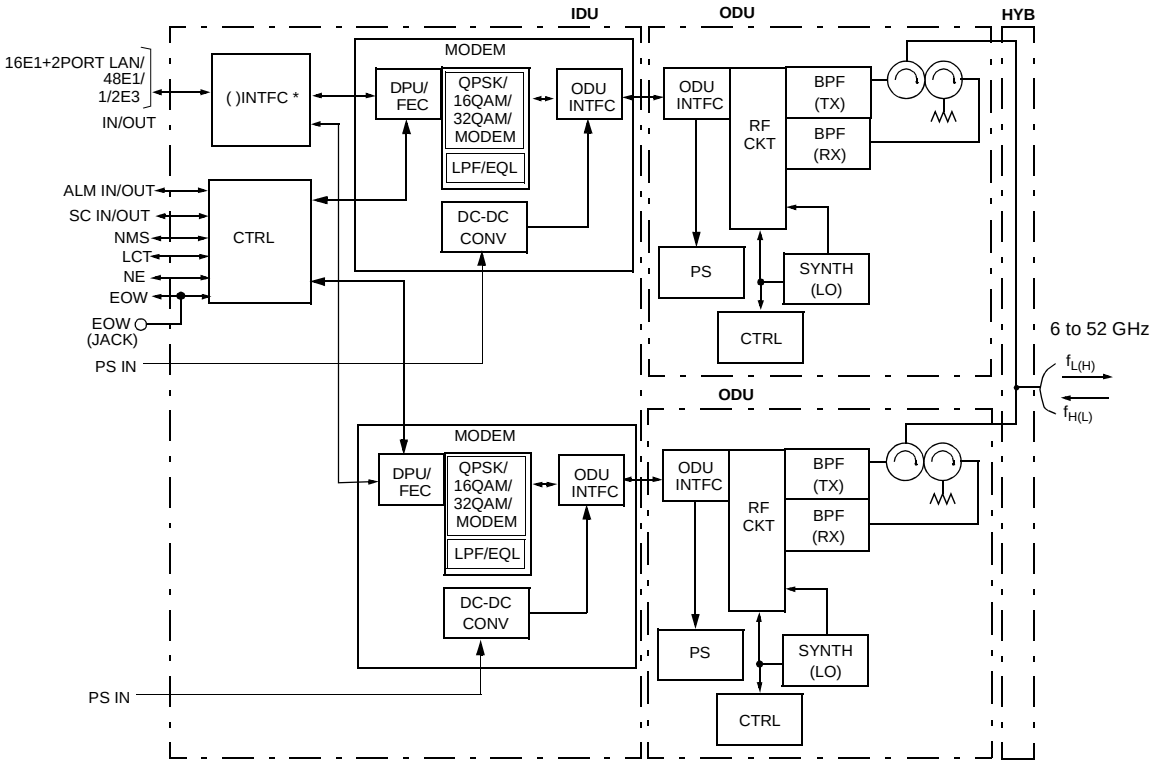
1+0 CONFIGURATION FOR PDH



*Notes: *1 :Optional*
**2:Provides for APS*
**3:Provides for auxiliary signals*

1+0 CONFIGURATION FOR SDH

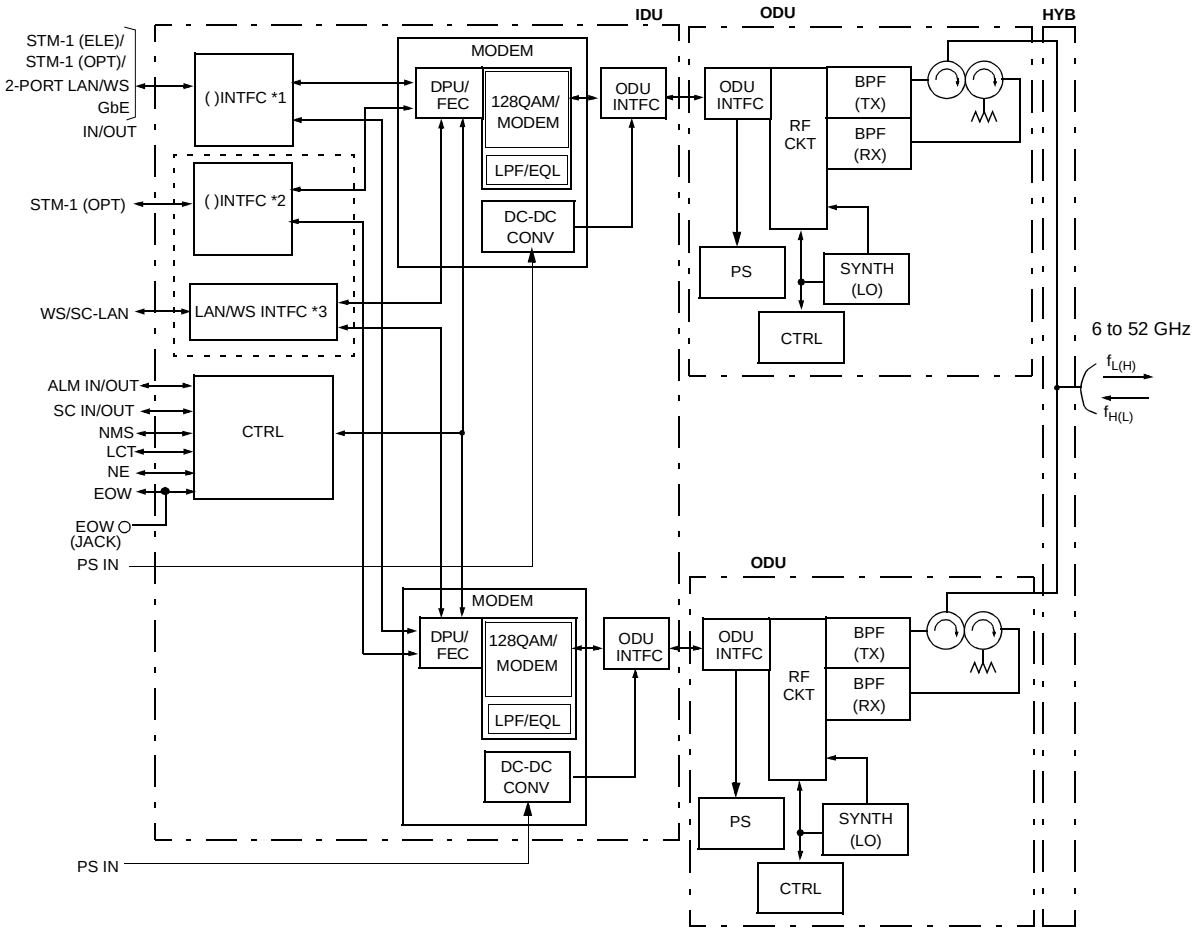
Fig. 2-5 System Block Diagram (1/4)



*Note: * :Optional*

1+1 CONFIGURATION FOR PDH

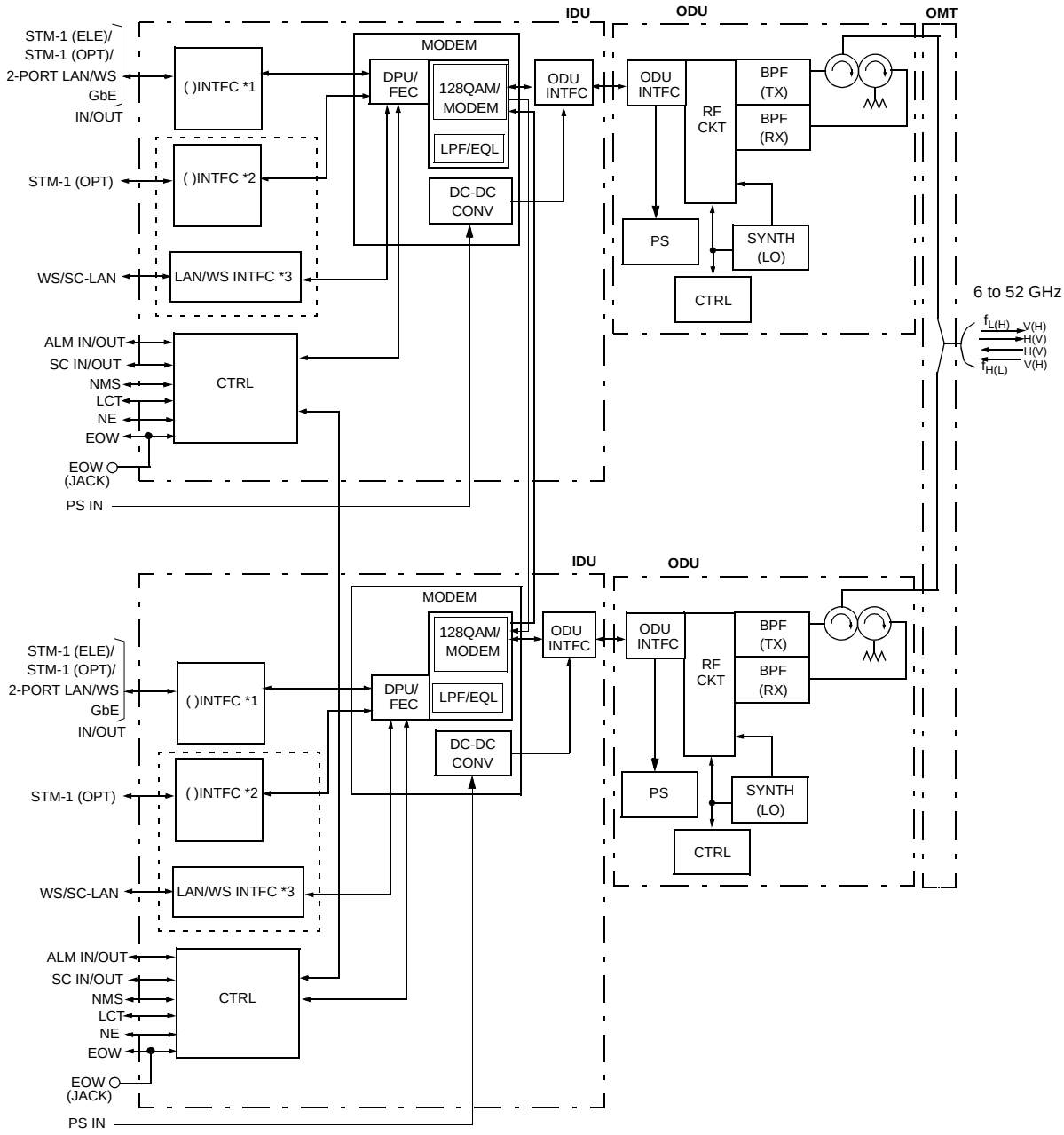
Fig. 2-5 System Block Diagram (2/4)



*Notes: *1 :Optional*
**2:Provides for APS*
**3:Provides for auxiliary signals*

1+1 CONFIGURATION FOR SDH

Fig. 2-5 System Block Diagram (3/4)



*Notes: *1 :Optional*
**2:Provides for APS*
**3:Provides for auxiliary signals*

1+0 CONFIGURATION FOR XPIC SDH

Fig. 2-5 System Block Diagram (4/4)

2.2 Performance Characteristics

2.2.1 General System

Table 2-1 System General Performance (1/2)

		STANDARD (STD)	
ITEM		**PDH**	**LAN**
Capacity		Up to 100 Mbps	
Interface		D-sub 37/MDR 68 16 × E1/48 × E1	RJ-45 10/100 Base-T(X)
Interconnecting Connector, Cable impedance and Cable length (IDU-ODU)		ODU side: N type female, 50 ohms (Coaxial) IDU side: TNC type female, 50 ohms (Coaxial) 300m (in case 8D-FB cable or equivalent cable)	
Channel Spacing *1	QPSK	7 MHz, 14 (13.75) MHz, 28 (27.5) MHz	
	16 QAM	3.5 MHz, 7 MHz, 14 (13.75) MHz, 28 (27.5) MHz	
	32 QAM	28 (27.5) MHz	
	128 QAM	Not Applicable	
Environmental Requirement	Guaranteed Operation	ODU: –33 to +50°C IDU: –5 to +50°C	
	Workable Operation	ODU: –40 to +55°C IDU: –10 to +55°C	
	Transportation/ Storage	ODU, IDU: –40 to +70°C	
	Relative humidity	ODU: 100% applicable IDU: Less than 90% at +50°C (Non-codensing)	
EMC		Conforms to EN301 489-4	
Safety		Conforms to EN60950	
Power Requirement		–48 VDC (–40.5 to –57 VDC), Conforms to EN300 132-2	
Power Consumption (Typical)			
ODU/Unit		30 W (6 to 11 GHz), 23 W (13 to 52 GHz)	
IDU Card/Unit			
MODEM		10 W	
48E1 INTFC (for 48 × E1)		8 W	
16E1 INTFC (for 16 × E1)		8 W	
E3 INTFC		8 W	
CTRL		7 W	
Weight/Card		MODEM: 0.5 kg, 48E1 INTFC (for 48 × E1): 0.4 kg, 16E1 INTFC (for 16 × E1): 0.4 kg, E3 INTFC (for E3): 0.4 kg, CTRL: 0.4 kg	
Mechanical Dimension	ODU	237(W) × 237(H) × 101(D): Approx. 3.5 kg/Unit	
	IDU	482(W) × 44(H) × 240(D): Approx.4 kg	

Note *1: 13.75 or 27.5 MHz is applied for 18 GHz.

Table 2-1 System Performance Characteristics (2/2)

		STANDARD (STD)	
ITEM		**SDH**	**LAN**
Capacity		155/ 2 × 155 Mbps*	Up to 150 Mbps
Interface		Optical: LC Electrical: IEC 169-13(1.0/2.3) Up to 2 × STM-1	RJ-45 10/100/1000 Base-T(X) LC: 1000 Base-SX
Interconnecting Connector, Cable impedance and Cable length (IDU-ODU)		ODU side: N type female, 50 ohms (Coaxial) IDU side: TNC type female, 50 ohms (Coaxial) 300m (in case 8D-FB cable or equivalent cable)	
Channel Spacing *1	QPSK (PDH)	Not Applicable	
	16QAM (PDH)		
	32QAM (PDH)		
	128QAM	28 (27.5) MHz	28 (27.5) MHz
Environmental Requirement	Guaranteed Operation	ODU: –33 to +50°C IDU: –5 to +50°C	
	Workable Operation	ODU: –40 to +55°C IDU: –10 to +55°C	
	Transportation/ Storage	ODU, IDU: –40 to +70°C	
	Relative humidity	ODU: 100% applicable IDU: Less than 90% at +50°C (Non-codensing)	
EMC		Conforms to EN301 489-4	
Safety		Conforms to EN60950	
Power Requirement		–48 VDC (–40.5 to –57 VDC), Conforms to EN300 132-2	
Power Consumption (Typical)			
ODU/Unit		30 W (6 to 11GHz), 23 W (13 to 52 GHz)	
IDU Card/Unit			
MODEM		10 W	
STM-1O INTFC		5 W	-
STM-1E INTFC		5 W	-
LAN/WS INTFC		-	5 W
CTRL		7 W	
Weight/Card		MODEM: 0.5 kg, STM-1O INTFC: 0.3 kg, STM-1E INTFC: 0.3 kg, LAN/WS INTFC: 0.3 kg, CTRL: 0.4 kg	
Mechanical Dimension	ODU	237(W) × 237(H) × 101(D): Approx. 3.5 kg/Unit	
	IDU	482(W) × 44(H) × 240(D): Approx.4 kg	

Note *1: 27.5 MHz is applied for 18 GHz.

2.2.2 LAN Interface (10/100 Base-T(X))

- Type : 10 Base-T/100 Base-TX (Auto-sensing or fixed)
- Port Number and Interface
  : 2 (Each port is separated) × RJ-45
- Transmission Rate: Selectable and rest E1 channels
- Flow control : Full duplex or Half duplex (Backpressure)
- Forwarding Mode : Store-and-Forwarding

  (This interface card is worked as "LAN Bridge" and compliant with IEEE802.3)

Note: In case of employing main traffic LAN interface, LAN ports and E1 ports can be used at the same time. However, the numbers of E1 port are limited depending on the selected LAN transmission rate as shown in the following tables.

(1) 2 Port LAN with WS INTFC

Table 2-2 2 Port LAN 150 Mbps (128QAM)

LAN Setting		LAN capacity [Mbps]
Port 1	**Port 2**	
P1 & P2 = 150 M Best effort (separated)		150
P1 = 75 M separated	P2 = 75 M separated	150
P1 = 100 M separated	P2 = 50 M separated	150
P1 = 100 M separated	Disabled	100

(2) 2 Port LAN with PDH INTFC

Table 2-3 2 Port LAN 40 Mbps (16QAM/QPSK)

LAN Setting		LAN capacity [Mbps]	E1 capacity [channels]
Port 1	Port 2		
P1 & P2 = 40 M shared *1		40	0
P1 & P2=shared from 40M to 8M		(2 Mbps step)	(1 channel step)
P1 & P2 = 8M shared		8	16
P1 = 20M separated	P2 = 20M separated	40	0
P1 = 10M separated	P2 = 10M separated	20	10
P1 = 4M separated	P2 = 4M separated	8	16
Disabled	Disabled	0	16

*1 LAN capacity can be set in 2 Mbps step. (P1 & P2 Shared mode)

Table 2-4 2 Port LAN 20 Mbps (16QAM/QPSK)

LAN Setting		LAN capacity [Mbps]	E1 capacity [channels]
Port 1	Port 2		
P1 & P2 = 20M shared		20	0
P1 & P2= shared from 20M to 4M		(2 Mbps step)	(1 channel step)
P1 & P2 = 4M shared		4	8
P1 = 10M separated	P2 = 10M separated	20	0
Disabled	Disabled	0	10

Table 2-5 2 Port LAN 10 Mbps (16QAM/QPSK)

LAN Setting		LAN capacity [Mbps]	E1 capacity [channels]
Port 1	Port 2		
P1 & P2 = 10M shared		10	0
P1 & P2 = shared from 10M to 2M		(2 Mbps step)	(1 channel step)
P1 & P2 = 2M shared		2	4
Disabled	Disabled	0	5

2.2.3 LAN Interface (GbE)

Table 2-6 GbE LAN

Type	1000 Base-SX (IEEE 802.3z)	1000 Base-T (IEEE 802.3ab)
Throughput	150 Mbps	150 Mbps
Connector type	LC	RJ-45
Port Number	1 port	1 port

2.2.4 Service Channel (SC)

- Port SC1 and SC2 : V.11, 64 kbps (Contra/Co-directional: Selectable)
- Port SC3 and SC4 : RS-232C, 9.6 kbps
- Port SC5 : EOW 1 channel
- Connector : High Density D-sub 44 ways
- LAN Interface : SC LAN Interface

  (in case of using SC LAN sub interface)
  (Only for 155 Mbps capacity, throughput: 64/128/192/256 kbps or 2 Mbps)

2.2.5 LCT (PNMT) Interface

- Serial Interface : Connector type USB-B

2.2.6 PNMS Interface

- 10 Base T : Connector RJ-45

2.2.6.1 RF I/O Port

- Interface Port Type:

  Antenna direct mount interface:exclusive NEC flange (11-52 GHz)

  Coaxial cable interface : 6/7/8 GHz: N (Female)

  Waveguide feeder interface* (Remote mount):
  6 GHz: PDR70
  7/8 GHz: PDR84
  10/11 GHz: PDR100
  13 GHz: PBR120
  15 GHz: PBR140
  18/23 GHz: PBR220
  26 GHz: PBR260
  28/32/38 GHz: PBR320
  52 GHz: N/A

  Polarization : Field changeable (Vertical or Horizontal)

Note: For the ODU of waveguide connection type, flange adapter is attached to the RF IN/OUT port in standard.

2.2.6.2 Parallel Alarm Interface

- Output port : Relay Contact (Form-C); 6 outputs max. (assignable 4 outputs for multiple items)
- Input port : Photo coupler; 6 items max.
- Cluster ALM

  IN/OUT : 4 items (max.)
  (4 bi-directional circuit provide. It can be assigned each as IN or OUT. Then, *Cluster can be used* $4 \geq IN + OUT$.)
- Connector : High Density D-sub 44 ways

2.2.6.3 Wayside

In case of 155 Mbps capacity, one wayside channel can be used as E1 or LAN interface.

2.2.7 ODU (Outdoor Unit) and System performance

Table 2-7 System Performance for QPSK/ODU

Frequency Band (GHz)		6	7-8	10-11	13	15	18	23	26	28	32	38	52	Guaranteed
Range [GHz]		5.925-7.11	7.12-8.5	10.15-11.7	12.75-13.25	14.25-15.35	17.7-19.7	21.3-23.6	24.25-27.5	27.5-29.5	31.8-33.4	37.0-40.0	51.4-52.6	–
Interface type	Direct Mount	N/A	N/A	NEC Original										–
	Remote mount *2	N type or PDR 70	N type or PDR 84	PDR 100	PBR 120	PBR 140	PBR 220	PBR 220	PBR 260	PBR 320	PBR 320	PBR 320	N/A	–
Output Power, nominal (dBm) (Measured at ODU output port)		+29		+25	+25	+23	+24	+24	+22	+22	+22	+18	+3	6-26G:±1.5 dB 28-52G:+1.5/–2.5 dB
Power Control (1 dB step, variable)		0 to 30 dB *3								0 to 25 dB *4			0 to 10 dB	±1.0 dB
ATPC (1 dB step)		0 to 30 dB *3								0 to 25 dB *4			0 to 10 dB	–
Frequency Stability		± 6 ppm												±10 ppm
Threshold Level		(dBm), (Measured at ODU input port) at BER = 10^{-6}												+3.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		–84		–83	–83	–83.5	–83.5	–83.5	–83	–83	–81.5	–81.5	–78	
14 (13.75) *1 MHz		–87		–86	–86	–86.5	–86.5	–86.5	–86	–86	–84.5	–84.5	–81	
7 MHz		–90		–89	–89	–89.5	–89.5	–89.5	–89	–89	–87.5	–87.5	–84	
BER = 10^{-3}		Above value –1.5 dB												
System Gain		(dB), (Measured at ODU input port) at BER = 10^{-6}												6-26G:–3.0 dB 28-52G:–4.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		113		108	108	106.5	107.5	107.5	105	105	103.5	99.5	81	
14 (13.75) *1 MHz		116		111	111	109.5	110.5	110.5	108	108	106.5	102.5	84	
7 MHz		119		114	114	112.5	113.5	113.5	111	111	109.5	105.5	87	
BER = 10^{-3}		Above value +1.5 dB												
Maximum Input Level		–15 dBm (No Error)												–
Residual BER		Less than 10^{-12} at RSL=–30 dBm												–

**1 13.75 MHz and 27.5 MHz are applied for 18 GHz.*

**2 For the ODU of waveguide connection type, flange adapter is attached to the RF IN/OUT port in standard.*

**3 When additional 5 dB (maximum) attenuation is added.*

**4 Additional attenuation is unavailable.*

Table 2-8 System Performance for 16QAM/ODU

Frequency Band (GHz)		6	7-8	10-11	13	15	18	23	26	28	32	38	Guaranteed
Range [GHz]		5.925-7.11	7.12-8.5	10.15-11.7	12.75-13.25	14.25-15.35	17.7-19.7	21.3-23.6	24.25-27.5	27.5-29.5	31.8-33.4	37.0-40.0	–
Interface type	Direct Mount	N/A	N/A	NEC Original									–
	Remote mount *2	N type or PDR 70	N type or PDR 84	PDR 100	PBR 120	PBR 140	PBR 220	PBR 220	PBR 260	PBR 320	PBR 320	PBR 320	–
Output Power, nominal (dBm) (Measured at ODU output port)		+26		+21.5	+22.5	+22.5	+22	+22	+20	+18	+17	+14.5	6-26G:±1.5 dB 28-38G:+1.5/–2.5 dB
Power Control (1 dB step, variable)		0 to 24 dB *3											±1.0 dB
ATPC range		0 to 24 dB *3											–
Frequency Stability		± 6 ppm											±10 ppm
Threshold Level		(dBm), (Measured at ODU input port) at BER = 10^{-6}											+3.0 dB
Channel Separation (CS) = 28 (27.5) *1 MHz		–77		–76	–76	–76.5	–76.5	–76.5	–76	–76	–74.5	–74.5	
14 (13.75) *1 MHz		–80		–79	–79	–79.5	–79.5	–79.5	–79	–79	–77.5	–77.5	
7 MHz		–83		–82	–82	–82.5	–82.5	–82.5	–82	–82	–80.5	–80.5	
3.5 MHz		–86		–85	–85	–85.5	–85.5	–85.5	–85	–85	–83.5	–83.5	
BER = 10^{-3}		Above value –1.5 dB											
System Gain		(dB) , (Measured at ODU input port) at BER = 10^{-6}											–3.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		103		97.5	98.5	99	98.5	98.5	96	94	91.5	89	
14 (13.75) *1 MHz		106		100.5	101.5	102	101.5	101.5	99	97	94.5	92	
7 MHz		109		103.5	104.5	105	104.5	104.5	102	100	97.5	95	
3.5 MHz		112		106.5	107.5	108	107.5	107.5	105	103	10.5	98	
BER = 10^{-3}		Above value +1.5 dB											
Maximum Input Level		–20 dBm for the BER less than 10^{-3}											–
Residual BER		Less than 10^{-12} at RSL = –30 dBm											–

**1 13.75 MHz and 27.5 MHz are applied for 18 GHz.*

**2 For the ODU of waveguide connection type, flange adapter is attached to the RF IN/OUT port in standard.*

**3 Additional attenuation is unavailable.*

Table 2-9 System Performance for 32QAM/ODU

Frequency Band (GHz)		6	7-8	10-11	13	15	18	23	26	28	32	38	52	Guaranteed
Range [GHz]		5.925-7.11	7.12-8.5	10.15-11.7	12.75-13.25	14.25-15.35	17.7-19.7	21.3-23.6	24.25-27.5	27.5-29.5	31.8-33.4	37.0-40.0	51.4-52.6	–
Interface type	Direct Mount	N/A	N/A	NEC Original										–
	Remote mount *2	N type or PDR 70	N type or PDR 84	PDR 100	PBR 120	PBR 140	PBR 220	PBR 220	PBR 260	PBR 320	PBR 320	PBR 320	N/A	–
Output Power, nominal (dBm) (Measured at ODU output port)		+25		+21	+21	+21	+19	+19	+18	+18	+17	+14.5	–3	6-26G:±1.5 dB 28-52G:+1.5/–2.5 dB
Power Control (1 dB step, variable)		0 to 28 dB *3											0 to 6 dB	±1.0 dB
ATPC (1 dB step)		0 to 28 dB *3											0 to 6 dB	–
Frequency Stability		± 6 ppm												±10 ppm
Threshold Level		(dBm), (Measured at ODU input port) at BER = 10^{-6}												+3.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		–75.5		–74.5	–74.5	–75	–75	–74.5	–74.5	–73	–73	73	–69.5	
BER = 10^{-3}		Above value –1.5 dB												
System Gain		(dB), (Measured at ODU input port) at BER = 10^{-6}												–3.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		100.5	95.5	95.5	96	94	94	92.5	92.5	92.5	90	87.5	66.5	
BER = 10^{-3}		Above value +1.5 dB												
Maximum Input Level		–20 dBm for the BER less than 10^{-3}												–
Residual BER		Less than 10^{-12} at RSL=–30 dBm												–

**1 27.5 MHz is applied for 18 GHz.*

**2 For the ODU of waveguide connection type, flange adapter is attached to the RF IN/OUT port in standard.*

**3 When additional 5 dB (maximum) attenuation is added.*

Table 2-10 System Performance for 128QAM/ODU

Frequency Band (GHz)		6	7-8	10-11	13	15	18	23	26	28	32	38	Guaranteed
Range [GHz]		5.925-7.11	7.12-8.5	10.15-11.7	12.75-13.25	14.25-15.35	17.7-19.7	21.3-23.6	24.25-27.5	27.5-29.5	31.8-33.4	37.0-40.0	–
Interface type	Direct Mount	N/A	N/A	NEC Original									–
	Remote mount *2	N type or PDR 70	N type or PDR 84	PDR 100	PBR 120	PBR 140	PBR 220	PBR 220	PBR 260	PBR 320	PBR 320	PBR 320	–
Output Power, nominal (dBm) (Measured at ODU output port)		+25		+21	+21	+21	+19	+19	+18	+18	+17	+14.5	6-26G:±1.5 dB 28-38G:+1.5/–2.5 dB
Power Control (1 dB step, variable)		0 to 25 dB *3								0 to 20 dB *4			±1.0 dB
ATPC range)		0 to 25 dB *3								0 to 20 dB *4			–
Frequency Stability		± 6 ppm											±10 ppm
Threshold Level		(dBm), (Measured at ODU input port) at BER = 10^{-6}											+3.0 dB
Channel Separation (CS)= 28 (27.5) *1 MHz		–69.5		–68.5	–68.5	–69	–69	–69	–68.5	–68.5	–67	–67	
BER = 10^{-3}		Above value –1.5 dB											
System Gain		(dB), (Measured at ODU input port) at BER = 10^{-6}											–3.0 dB
Channel Separation = 28 (27.5) *1 MHz		94.5		89.5	89.5	90	88	88	86.5	86.5	84	81.5	
BER = 10^{-3}		Above value +1.5 dB											
Maximum Input Level		–20 dBm for the BER less than 10^{-3}											–
Residual BER		Less than 10^{-12} at RSL=–30 dBm											–

**1 27.5 MHz is applied for 18 GHz.*

**2 For the ODU of waveguide connection type, flange adapter is attached to the RF IN/OUT port in standard.*

**3 When additional 5 dB (maximum) attenuation is added.*

**4 Additional attenuation is unavailable.*

Note: XPIC system has the same condition as above.

2.2.8 IDU (Indoor Unit) and System performance

Table 2-11 System Performance for IDU

No.	Item	Specification			
		PDH		SDH	LAN
1	IDU type	Expandable/1+1			
2	Modulation Type	QPSK/16/32QAM		128QAM	QPSK/16/32/128QAM
3	Baseband Interface	E1: 2.048 Mbps ±50 ppm	E3: 34.368 Mbps ±20 ppm	155.52 Mbps ±20 ppm	10/100 Base-T(X) 1000 Base-SX 1000 Base-T
		75 ohm/120 ohm	75 ohm	75 ohm/S-1.1/L-1.1	
		D-sub37/MDR68	IEC 169-13 (1.0/2.3)	IEC 169-13 (1.0/2.3)	RJ-45 (10/100/1000 Base-T(X)) LC (1000 Base-SX)
	Channel Number	5/10/16/20/40/48	1/2	1/2*	1/2
	Total Capacity	10/20/32/40/80/96 Mbps	34/68 Mbps	155 Mbps	10/20/40/80/100/100+50, 75+75 Mbps
4	Service Channels	V.11 (Contra/Co-directional) × 2 channels, RS-232C × 2 channels			
5	EOW	IDU-IDU			
6	External alarm & House keeping	See below table			
7	Security level by LCT	2 levels			
8	Control &Setting by LCT/PNMT	Serial Interface (USB connector)			
	Loop Back	a) Far End Baseband Loop Back b) Near End Baseband Loop Back c) IF Loop back			
	BER Alarm	Adjustable 10^{-3}/ 10^{-4}/ 10^{-5} (High BER) 10^{-6}/ 10^{-7}/ 10^{-8}/ 10^{-9} (Low BER)			
	Frequency changing	Direct entry or Table Download entry: Available when using PNMx (optional)			
	TX output Control	Manual control, Automatic control, Mute control			
9	Performance monitoring (PMON) /Metering	PMON Items; a) OFS, b) BBE, c) ES, d) SES, e) SEP, f) UAS			
		Metering Items a) Output power level (TX PWR), b) Received signal level (AGC V) c) Bit error rate (BER MON)			
		LAN monitoring Items; a) RX Unicast, b) RX Broadcast, c) RX Multicast, d) RX Pause, e) RX CRC error			
10	LED Display	CTRL		IDU Alarm (Red) Maintenance (Amber) Memory Access (Amber)	
		MODEM		Operating PWR (Green) ODU Alarm (Red) MD/CBL Alarm (Red) TX status (Green) RX status (Green) XPIC Reset (Amber)*	
		PDH INTFC		Module alarm (Red)	
		SDH INTFC		Module alarm (Red) Online (Green)**	
		LAN/WS INTFC		Module alarm (Red)	

** This value is available with 2 IDUs per 1 RF CH with XPIC system.*

*** This indicates the online status which is selected from Working/Standby in APS system or Warking in w/o APS system.*

Table 2-12 Alarm & House Keeping Output Items

#	Alarm Item displayed on LCT/PNMT	Condition	ALM LED Indication (IDU's front)	Summarized Alarm Output (Form-C) <Note 3,4,5>					
				RL1	RL2	RL3	RL4	RL5	RL6
1	MAINT	System under maintenance	MAINT	●	—	MASK	MASK	MASK	MASK
2	IDU CPU ALM	IDU CPU failure	-	—	●	—	—	—	—
3	PS ALM1	PS1 failure (only1+1)	PWR	—	●	—	—	—	—
4	PS ALM2	PS2 failure (only1+1)	-	—	●	—	—	—	—
5	ODU ALM1	ODU1 total alarm	ODU	—	—	√	○	○	○
6	ODU ALM2	ODU2 total alarm		—	—	√	○	○	○
7	ODU CPU ALM1	ODU1 CPU failure	ODU Blinking	—	—	○	√	○	○
8	ODU CPU ALM2	ODU2 CPU failure		—	—	○	√	○	○
9	TX PWR ALM1	ODU1 output power decrease	ODU	—	—	○	○	○	○
10	TX PWR ALM2	ODU2 output power decrease		—	—	○	○	○	○
11	TX INPUT ALM1	ODU1 TX IF input level decrease	ODU	—	—	○	○	○	○
12	TX INPUT ALM2	ODU2 TX IF input level decrease		—	—	○	○	○	○
13	APC ALM1	ODU1 LO OSC APC loop out of lock	ODU	—	—	○	○	○	○
14	APC ALM2	ODU2 LO OSC APC loop out of lock		—	—	○	○	○	○
15	RX LEV ALM1	ODU1 Receiving level decrease	ODU	—	—	○	○	○	○
16	RX LEV ALM2	ODU2 Receiving level decrease		—	—	○	○	○	○
17	IF CABLE SHORT ALM1	IF Cable connected to ODU1 short	IDU MD/CBL Blinking	—	—	○	○	○	○
18	IF CABLE SHORT ALM2	IF Cable connected to ODU2 short		—	—	○	○	○	○
19	IDU ALM	IDU total alarm	IDU	—	—	○	○	√	○
20	MOD ALM1	MOD PLL APC loop out of lock, MOD output level down or TX DPU CLK loss in MODEM1	IDU MD/CBL	—	—	○	○	○	○
21	MOD ALM2	MOD PLL APC loop out of lock, MOD output level down or TX DPU CLK loss in MODEM2		—	—	○	○	○	○
22	DEM ALM1	Carrier Asynchronous, Frame Asynchronous at DPU in MODEM1	IDU MD/CBL	—	—	○	○	○	○
23	DEM ALM2	Carrier Asynchronous, Frame Asynchronous at DPU in MODEM2		—	—	○	○	○	○
24	HIGH BER ALM1	BER > 10E-3 to -5 (selectable) in MODEM1	IDU MD/CBL	—	—	○	○	○	√
25	HIGH BER ALM2	BER > 10E-3 to -5 (selectable) in MODEM2		—	—	○	○	○	√
26	LOW BER ALM1	BER > 10E-6 to -9 (selectable) in MODEM1	IDU MD/CBL	—	—	○	○	○	○
27	LOW BER ALM2	BER > 10E-6 to -9 (selectable) in MODEM2		—	—	○	○	○	○
28	LOF1	Loss of Radio frame synchronization in MODEM1	IDU MD/CBL	—	—	○	○	○	○
29	LOF2	Loss of Radio frame synchronization in MODEM2		—	—	○	○	○	○
30	INPUT LOSS CH 1-48	Loss of input data stream from DTE <Note 1>	IDU INTFC <Note7>	—	—	○	○	○	○
31	AIS RCVD CH 1-48	AIS (all "1") is received from DTE <Note 1>	IDU INTFC <Note7>	—	—	○	○	○	○
32	AIS GENERATED CH 1-48	AIS (all "1") is sent to DTE <Note 1>	IDU INTFC <Note7>	—	—	○	○	○	○
33	CH USAGE ERROR CH 1-48	Miss of usage (E1 channel) <Note 2>	IDU INTFC <Note7>	—	—	○	○	○	○

Table 2-12 Alarm & House Keeping Output Items (Cont'd)

#	Alarm Item displayed on LCT/PNMT	Condition	ALM LED Indication (IDU's front)	Summarized Alarm Output (Form-C) <Note 3,4,5>					
				RL1	RL2	RL3	RL4	RL5	RL6
34	LAN LINK PORT 1-4	Loss of Main LAN Link <Note 3>	IDU INTFC	—	—	○	○	○	○
35	STM-1(1/2) LOS (MUX)	Loss of input data stream from MUX <Note 3>	IDU INTFC <Note8>	—	—	○	○	○	○
36	STM-1(1/2) LOS (DMR)	Loss of input data stream from DMR <Note 3>	IDU INTFC <Note8>	—	—	○	○	○	○
37	STM-1(1/2) TF ALM	Loss of STM-1 signal output to MUX <Note 3>	IDU INTFC <Note8>	—	—	○	○	○	○
38	WS INPUT LOSS	Loss of Wayside signal input	IDU INTFC <Note8>	—	—	○	○	○	○
39	INTFC (2) LAN LINK PORT	Loss of SC LAN Link	IDU INTFC <Note9>	—	—	○	○	○	○
40	XCTRL ALM1	Control failure or REF Signal failure	IDU INTFC <Note9>	—	—	○	○	○	○
41	XCTRL ALM2	Control failure or REF Signal failure	IDU INTFC <Note9>	—	—	○	○	○	○
42	XREF ALM1	Control failure or REF Signal failure	IDU INTFC <Note9>	—	—	○	○	○	○
43	XREF ALM2	Control failure or REF Signal failure	IDU INTFC <Note9>	—	—	○	○	○	○
44	HK-OUT1	House keeping Event outport1	Only show PNMT	—	—	—	—	—	○
45	HK-OUT2	House keeping Event outport2	Only show PNMT	—	—	—	—	○	—
46	HK-OUT3	House keeping Event outport3	Only show PNMT	—	—	—	○	—	—
47	HK-OUT4	House keeping Event outport4	Only show PNMT	—	—	○	—	—	—
48	Cluster ALM1	This item received from opposite site. Item 1	Only show PNMT	—	—	—	—	—	○
49	Cluster ALM2	This item received from opposite site. Item 2	Only show PNMT	—	—	—	—	○	—
50	Cluster ALM3	This item received from opposite site. Item 3	Only show PNMT	—	—	—	○	—	—
51	Cluster ALM4	This item received from opposite site. Item 4	Only show PNMT	—	—	○	—	—	—

Note 1: Apply to each channel of E1/E3.

Note 2: Unused channel/interface is masked according to the bit rate.

Note 3: It is possible to change capacity between E1 and Ethernet under working condition.

Note 4: In MAINT status, excepting HK-OUT and Cluster ALM, alarm outputs are masked to normal condition.

Note 5: The summarization of alarm outputs is fully user programmable; The sign ● in above table shows fixed item and can not be changed. The sign √ only shows the factory settings. The sign ○ output can be assigned for plural items. The sign — input/output can not be assigned. Either HK output or Cluster ALM output in each channel can be assigned.

Note 6: Above Table shows Alarm output matrix considerable 1+1 configuration

Note 7: Only apply to PDH system.

Note 8: Only apply to SDH system.

Note 9: Only apply to XPIC system.

Output Port condition

Interface circuit: Relay Form C
Maximum Current: 0.2 A
Maximum Voltage: 100 V (AC+DC)

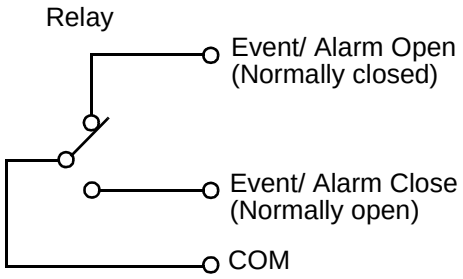


Table 2-13 House keeping input Items

#	House keeping Item displayed on LCT/PNMT	Condition	Event Indication	Summarized Alarm Input (Photo coupler) <Note 2,3>					
				IN1	IN2	IN3	IN4	IN5	IN6
1	HK-IN1	House keeping Event inport1	Only show PNMT	●	—	—	—	—	—
2	HK-IN2	House keeping Event inport2	Only show PNMT	—	●	—	—	—	—
3	HK-IN3	House keeping Event inport3	Only show PNMT	—	—	●	—	—	—
4	HK-IN4	House keeping Event inport4	Only show PNMT	—	—	—	●	—	—
5	HK-IN5	House keeping Event inport5	Only show PNMT	—	—	—	—	●	—
6	HK-IN6	House keeping Event inport6	Only show PNMT	—	—	—	—	—	●
7	Cluster ALM1	This item transmits to opposite site. Item 1	Only show PNMT	—	—	—	—	—	○
8	Cluster ALM2	This item transmits to opposite site. Item 2	Only show PNMT	—	—	—	—	○	—
9	Cluster ALM3	This item transmits to opposite site. Item 3	Only show PNMT	—	—	—	○	—	—
10	Cluster ALM4	This item transmits to opposite site. Item 4	Only show PNMT	—	—	○	—	—	—

Note 1: Unused channel/interface is masked according to the bit rate.

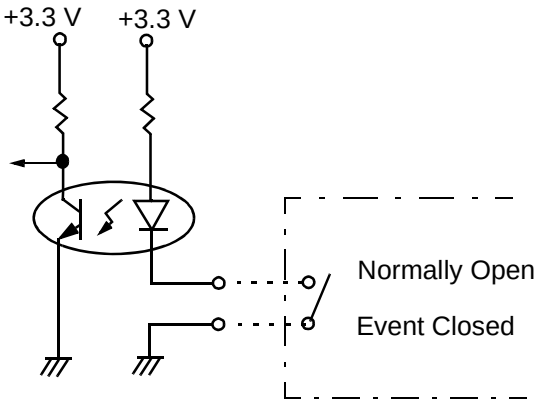
Note 2: It is possible to change capacity between E1 and Ethernet under working condition.

Note 3: The summarization of alarm outputs is fully user programmable. The sign ● in above table only shows the factory settings. The sign ○ in above table can be changed to set for input/output items.

Note 4: Table 1 shows Alarm output matrix considerable 1+1 configuration.

Input Port condition

Normal OPEN (> 200 k ohms)
Event CLOSE (< 50 ohms)
Interface circuit: photo coupler with bias circuit



2.3 Interconnection between ODU and IDU

Table 2-14 IF Cable

No.	Item	Specification
1	Interconnection	Single coaxial cable (per channel)/50 ohms
2	Standard Type of Cable - IF cable adapter	5D-FB, 8D-FB (standard), 10D-FB
3	Signals	IF signal, alarms, control, monitoring and power source
4	Maximum Cable Length	150 m (5D-FB) 300 m (8D-FB) 350 m (10D-FB)
5	Cable Equalization	Automatic level equalization
6	Guaranteed temperature range	–33°C to +50°C (workable : –40°C to +55°C)

Note 1 : In case of employing hitless protection, set each length of two IF cables same or the difference of their cable length shall be less than 100 meters.

Note 2 : Salt damage (custom order)
In case of operating in the sea or around the coast area (within 3 km from coastline), measure must be taken for the ODU against salt damage. Please contact NEC for the countermeasure.

Note 3 : Water Proof N type connector
The waterproof N type connectors must be used for IF cable of ODU side, because DC voltage power is supplied in it.

Note 4 : IDU IF connector = TNC (Female),
ODU IF connector = N (Female)

Note 5 : TNC (Male) L-angle connector for the 8D-FB IF cable is used to connect it to the IDU. When the N (Male) straight connector is attached to the 5D-FB or 10D-FB IF cable, the TNC (Male) - N (Female) L-angle adapter is used.

2.4 Hybrid Combiner/Divider

There are two types of hybrid combiner/divider are used in 1+1 protected systems, one is coaxial cable connection type for 6/7/8 GHz Bands and the other is WG connection type for 11 - 52 GHz Bands. The following NEC Hybrid Combiner/Divider is suited for Andrew or RFS Antenna, and all NEC ODUs.

6/7/8 GHz Hybrid

11 - 52 GHz Hybrid

Fig. 2-6 Hybrid

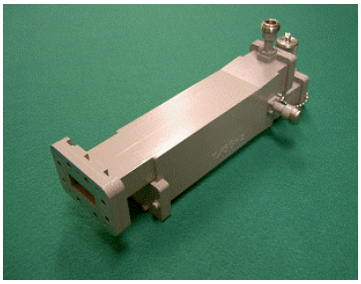
Table 2-15 Characteristics

Frequency Band [GHz]	Frequency Range [GHz]	1-2 PORT Variation Max.(dB)	Loss Max. (dB)	Isolation Min.(dB)	VSWR Max.	Interface	
						(ANT Side)	(ODU Side)
L6	5.925 - 6.425	0.5	3.7	20	1.3	UDR70	N Connector
U6	6.43 - 7.11	0.5	3.7	20	1.3	UDR70	N Connector
7	7.125 - 7.9	0.5	3.7	20	1.3	UDR84	N Connector
8	7.7 - 8.5	0.5	3.7	20	1.3	UDR84	N Connector
11	10.5 - 11.7	0.5	3.5	20	1.2	NEC original	NEC original
13	12.75 - 13.25	0.5	3.5	20	1.2		
15	14.5 - 15.35	0.5	3.5	20	1.2		
18	17.7 - 19.7	0.5	3.5	20	1.2		
23	21.2 - 23.6	0.5	3.5	20	1.2		
26	24.5 - 26.5	0.5	3.8	20	1.2		
32	31.8 - 33.4	0.5	3.8	20	1.2		
38	37 - 39.5	0.5	3.8	20	1.2		
52	51.4 - 52.6	0.5	4.5	20	1.3		

** Custom ordered for 28 GHz.*

2.4.1 10 dB Coupler

There are two types of NEC 10 dB Coupler; one is coaxial cable connection type for 6/7/8 GHz bands and the other is WG connection type for 11 - 38 GHz Bands. The following 10 dB Coupler is suited for Andrew or RFS Antenna, and all NEC ODUs.



6/7/8 GHz Coupler (N-Type)

11 - 38 GHz Coupler

Fig. 2-7 10 dB Coupler

Table 2-16 Characteristics

Frequency Band [GHz]	Frequency Range [GHz]	1-2 PORT Variation Max.(dB)	Loss Max. (dB)	Isolation Min.(dB)	VSWR Max.	Interface	
						(ANT Side)	(ODU Side)
L6/U6	5.925 - 7.125	0.5	1.2	20	1.3	UDR70	N Connector
7/8	7.125 - 8.5	0.5	1.2	20	1.3	UDR84	N Connector
11	10.5 - 11.7	0.5	1.2	20	1.2	NEC original	NEC original
13	12.75 - 13.25	0.5	1.2	20	1.2		
15	14.5 - 15.35	0.5	1.2	20	1.2		
18	17.7 - 19.7	0.5	1.2	20	1.2		
23	21.2 - 23.6	0.5	1.2	20	1.2		
26	24.5 - 26.5	0.5	1.2	20	1.2		
32	31.8 - 33.4	0.5	1.2	20	1.2		
38	37 - 39.5	0.5	1.2	20	1.2		

* *ODU for 6/7/8 GHz: Separate Type*
* *ODU for 11 - 38 GHz: Direct Mount Type*
* *Custom ordered for 28 GHz.*

2.4.2 OMT (Ortho-Mode Transducer)

The OMT enables dual polarization feature to double the transmission capacity for the PASOLINK system using the same frequency. The following NEC OMT has Wave Guide connection type for 11-38 GHz Bands, which is suited for RFS Antenna and all NEC ODUs.

Fig. 2-8 OMT Transducer

Table 2-17 Characteristics

Frequency Band [GHz]	Frequency Range [GHz]	XPD Min. [dB]	LOSS Max. [dB]	P-P ISOLATION Min.[dB]	VSWR Max.	INTERFACE WG INNER DIA. (mm) (ANT Side)	INTERFACE (ODU Side)
11	10.5 - 11.7	35	0.6	38	1.3	18.0	NEC original
13	12.75 - 13.25	35	0.6	38	1.3	15.0	
15	14.5 - 15.35	35	0.6	38	1.3	13.5	
18	17.7 - 19.7	35	0.6	38	1.3	10.5	
23	21.2 - 23.6	35	0.6	38	1.3	9.0	
26	24.5 - 26.5	35	0.8	38	1.3	8.0	
32	31.8 - 33.4	35	1.0	38	1.3	6.5	
38	37 - 39.5	35	1.0	38	1.3	5.5	

2.5 RF Channel Plan

Radio frequencies in 6 to 52 GHz applicable to PASOLINK NEO are shown in the following Table:
For details of frequency range in each Sub Band of below RF frequency, refer to the Appendix attached in this Section 1.

Table 2-18 RF Frequencies

RF BAND [GHz]	Tx-Rx Shift Frequency [MHz]
L6 GHz : 5.925 - 6.425	252.04/ 266
U6 GHz : 6.43 - 7.11	340
7 GHz : 7.125 - 7.9	154/ 161/ 196/ 245
8 GHz : 7.7 - 8.5	119/ 126/ 151.614/ 154/ 266/ 294.44/ 305.56/ 311.32
10-11 GHz : 10.15 - 11.7	530
13 GHz : 12.75 - 13.25	266
15 GHz : 14.5 - 15.35	315/ 420/ 470/ 490/ 644/ 728
18 GHz : 17.7 - 19.7	340/ 750/ 1008/ 1010/ 1092.5/ 1120/ 1250/ 1560
23 GHz : 21.2 - 23.6	600/ 1008/ 1200/ 1232
26 GHz : 24.5 - 26.5	855/ 1008/ 1123.5
28 GHz : 27.5 - 29.5	1008
32 GHz : 31.8 - 33.4	812
38 GHz : 37 - 39.5	700/ 1000/ 1260/
52 GHz : 51.4 - 52.6	616

2.6 Power Supply

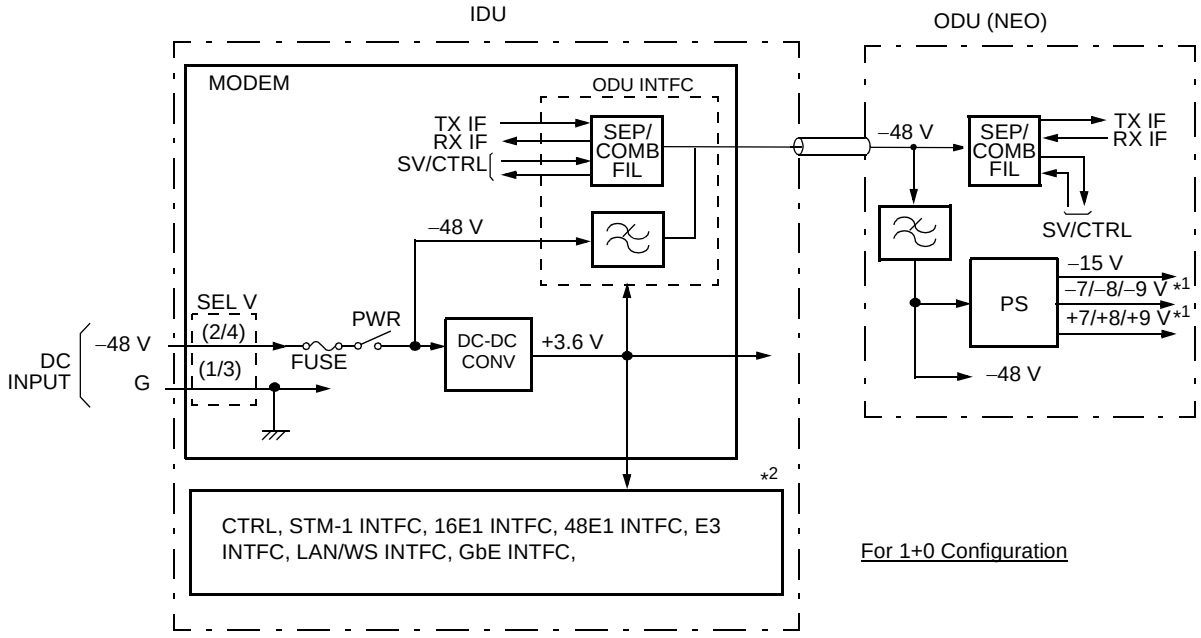
The power supply systems are shown in Fig. 2-10 (1/3) to (3/3). The DC-DC CONV module in the MODEM module produces regulated +3.6 V DC from –48 V *1 DC input for the component modules on the IDU. Also, this module supplies a –48 V DC to the ODU.

Caution: * 1 The –48 V power supply system for the PASOLINK NEO must be separated from existing power supply system. The PASOLINK, PASOLINK+, PASOLINK Mx, etc. that are used in –43 V and floating polarities.

****2 When the ODU which is not NEO is connected to the IDU NEO, it is recommended to install optional DC-DC CONV module into the IDU as shown in Fig. 2-9 (3/3). The ODU will be shorten ODUs life or may be damaged if not used optional DC-DC CONV module.***

The DC V to the ODU is supplied through the coaxial cable which is also used for the IF and other signals. The PS circuit on the ODU produces +7/+8/+9/–7/–8/–9 * and –15 V DC for the component modules from the –48 V DC supplied from the IDU.

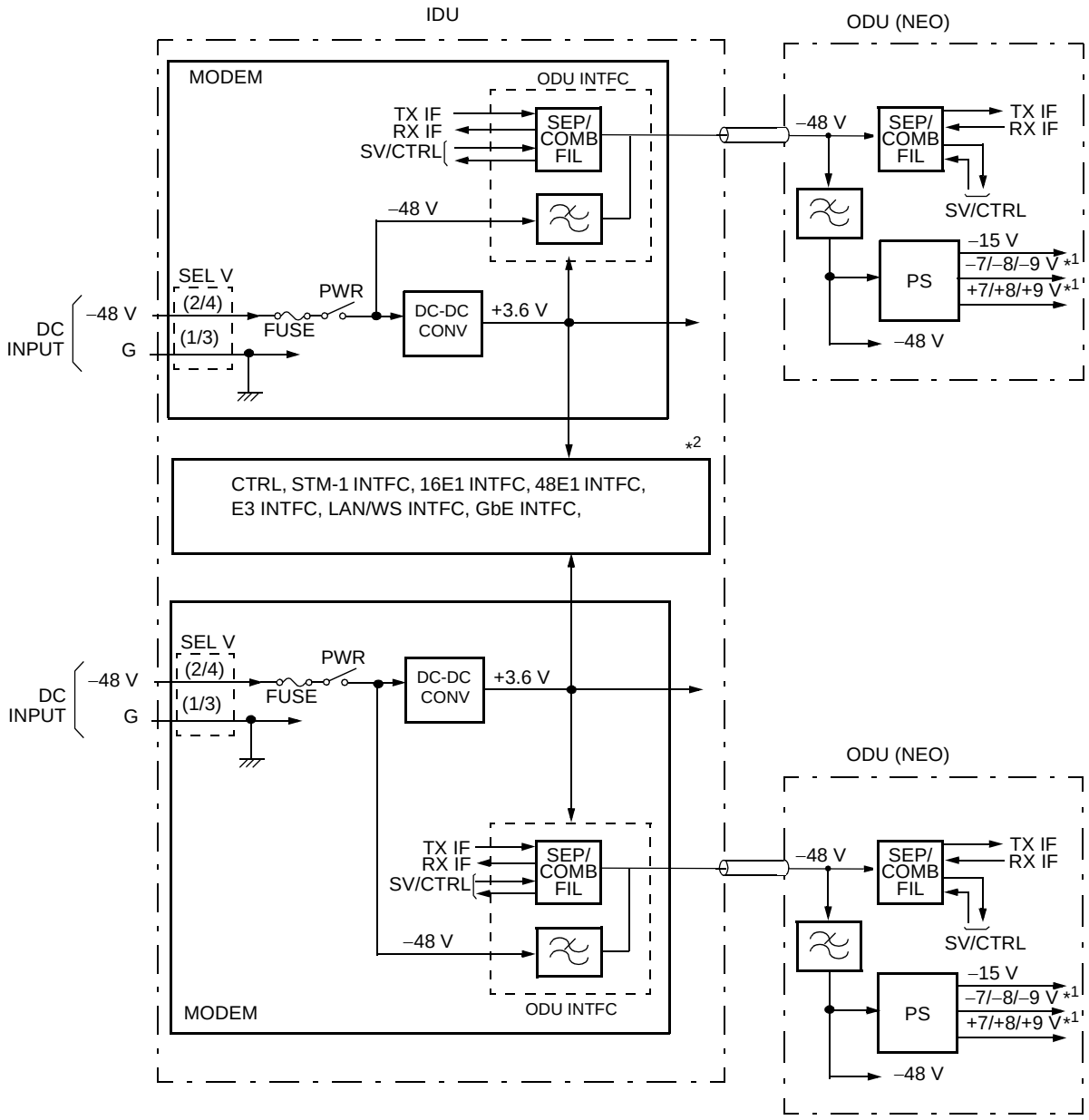
*Note: *: Necessary voltages in the ODU vary depending on the ODU type.*



*Notes: *1: The inner voltages vary depending on the ODU type.*
**2: Optional*

For 1+0 Configuration

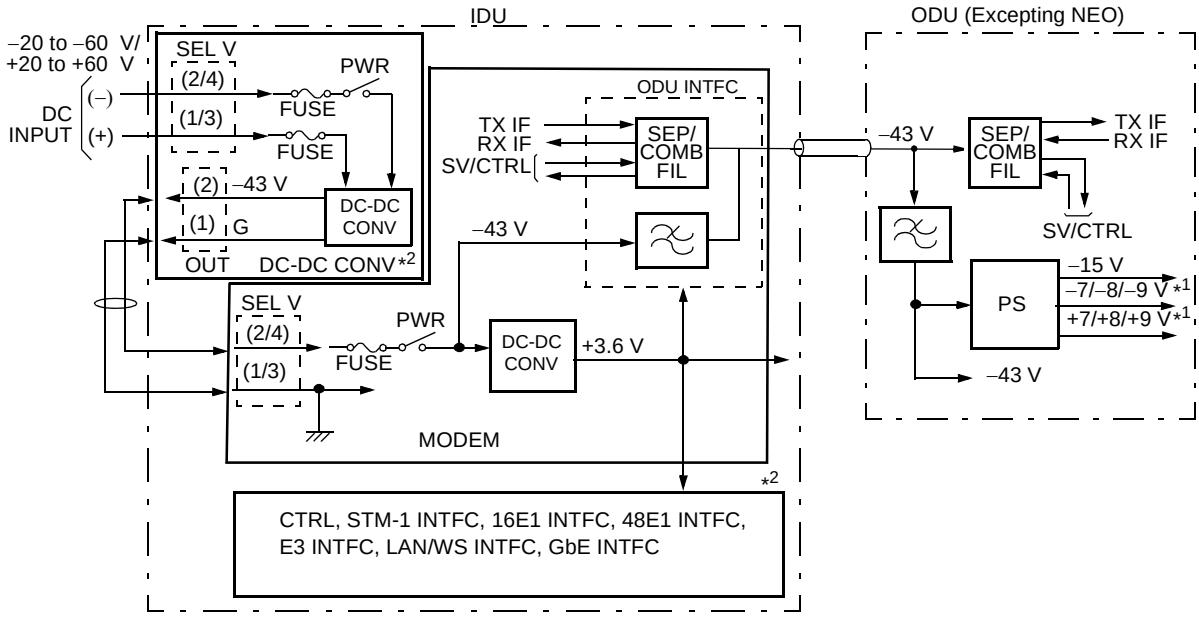
Fig. 2-9 Power Supply System Block Diagram (1/3)



*Notes: *1: The inner voltages vary depending on the ODU type.*
**2: Optional*

For 1+1 Configuration

Fig. 2-9 Power Supply System Block Diagram (2/3)



*Notes: *1: The inner voltages vary depending on the ODU type.*
**2: Optional*

For 1+0 Configuration

Connecting Other Type Pasolink ODU

Fig. 2-9 Power Supply System Block Diagram (3/3)