4.4 ROU (Remote Optic Unit)

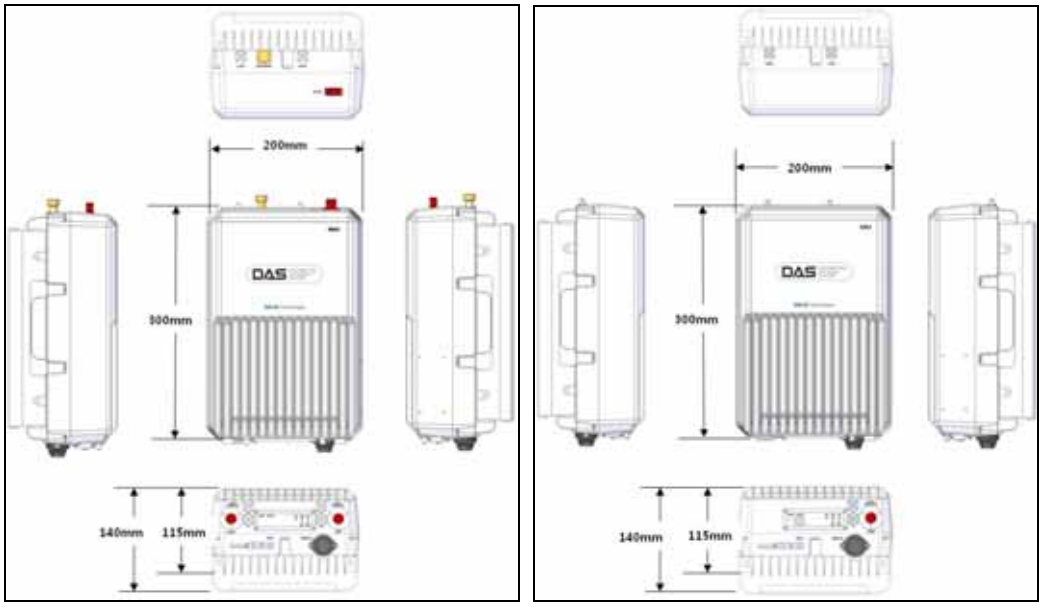
ROU consist of two unit which one is MRU(Main Remote Unit) and the other is ARU(Add on Remote Unit). We simply called as ROU combination of MRU and ARU

MRU receives TX optical signals from ODU or OEU and converts them into RF signals. The converted RF signals are amplified through High Power Amp in a corresponding RU, combined with Multiplexer and then radiated to the antenna port.

When receiving RX signals through the antenna port, this unit filters out-of-band signals in a corresponding RU and sends the results to Remote Optic Module to make electronic-optical conversion of them. After converted, the signals are sent to a upper device of ODU or OEU.

MRU and ARU are composed of maximal dual band

The most difference of MRU an ARU is whether existence of optical module is in it or not



(a)MRU (b)ARU

Figure 4.30 – ROU Outer Look

4.4.1 Specifications of ROU

Item	MRU Spec	ARU Spec.	Remark
Size(mm)	300 x 200 x 140	300 x 200 x 140	mm
Weight	6.6kg	6.8 Kg	Full load
Power consumption	50W	40W	

4.4.2 Block Diagram of ROU

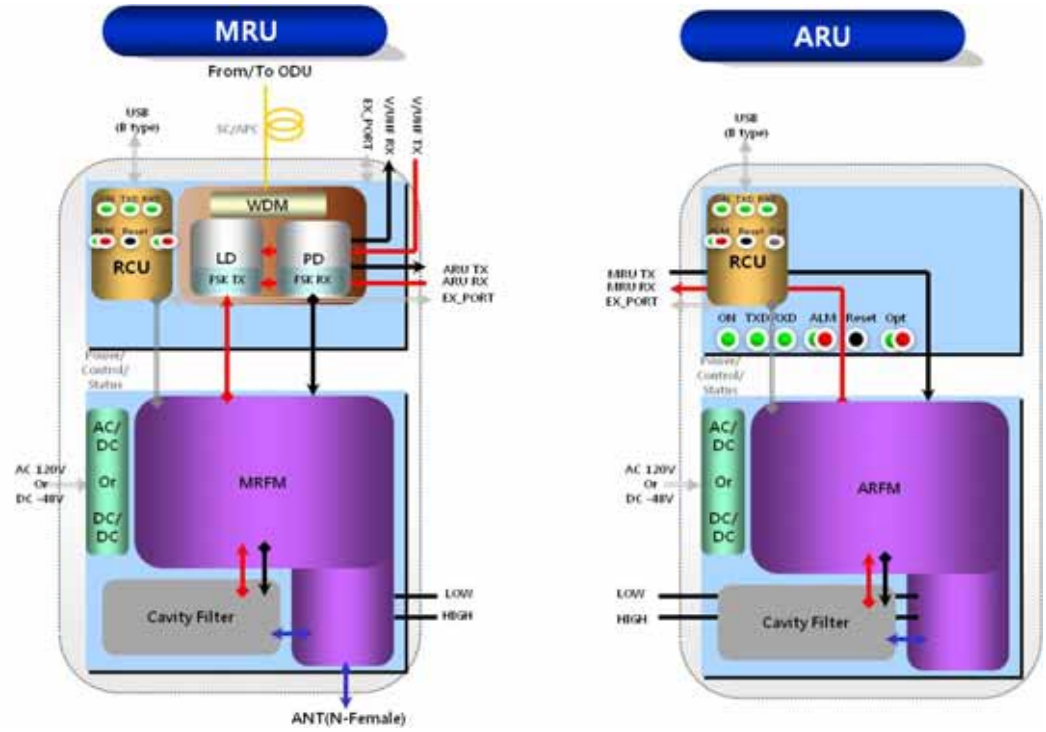
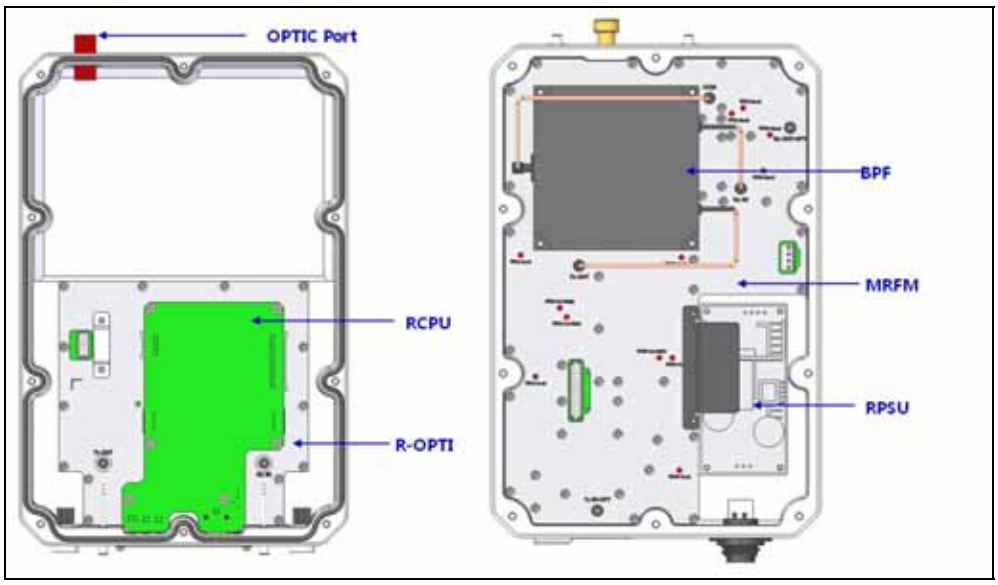
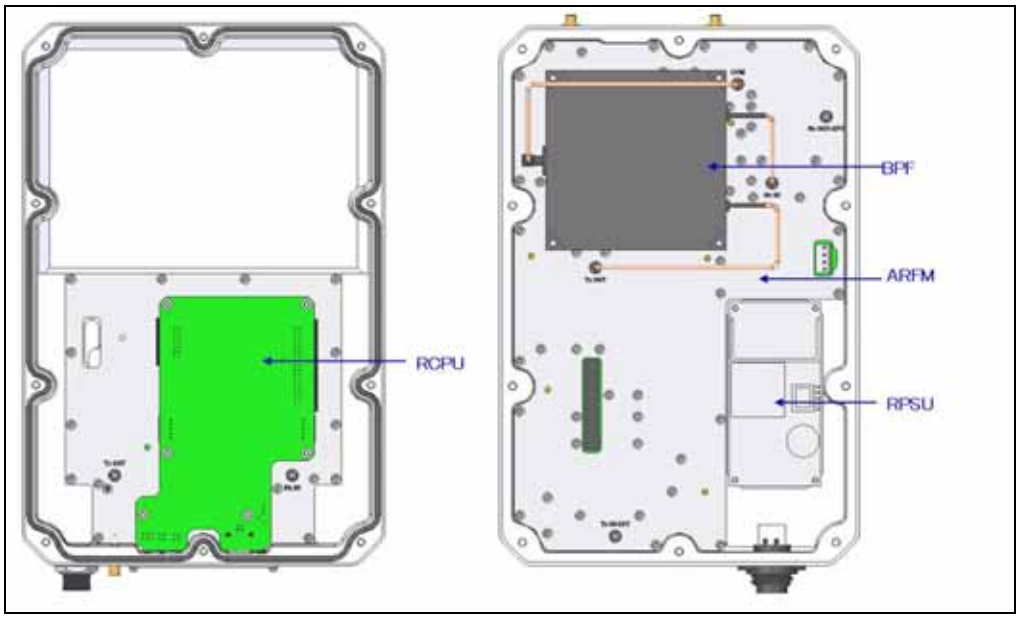


Figure 4.31 – ROU block diagram

4.4.3 ROU parts



(a)MRU



(b)ARU

Figure 4.32 – ROU Inner Look

No.	Unit	Description	Remark
1	MRFM/ARFM +BPF	**Main/Add on RF Module** Filter and high amplify TX signals; Filter and amplify RX signals; Remove other signals through BPF	
2	RPSU	**Remote Power Supply Unit** Input power: DC –48V or AC120V, Output power: 25V For 120V input of AC/DC; For –48V input of DC/DC	
3	R-OPT	**Remote Optic** Make RF conversion of TX optical signals; Convert RX RF signals into optical signals; Compensates optical loss interval Communicates with BIU or OEU though the FSK modem	
4	RCPU	**Remote Central Processor Unit** Controls signal of each unit Monitors BIU/ODU/OEU status through FSK modem communication	

5	Enclosure	Enable Wall Mount; Check if the system is normal, through the bottom panel LED	

4.4.4 Function by unit

1) **Main RF Module/Add on RF Module (MRFM/ARFM)+BPF**

When receiving TX signals from each band through R-Opt, MRFM/AFRM filters the signals and amplifies them with High Power Ampifier. The unit also filters RX signals given through antenna and amplifies them as low noise to send the signals to R-Opt.

In the unit, there is ATT to adjust gain. This devices are varied for each frequency band, including the following:

No	Unit naming	Description	BPF	
			Cavity Filter	Ceramic Filter
1	MRFM 1900P+850C	Dual.	1900P	850C
2	ARFM 700LTE+AWS-1	Dual.	700LTE	AWS-1
3	To be Developed			

2) Remote Power Supply Unit (RPSU)

RPSU receives -48V of input. This unit is divided into DC/DC type to output +25V of DC power and AC/DC type to receive 120V of AC input and to output +25V of DC power.

Upon order, either of the two types should be decided. MS Connector, which uses ports to receive inputs, is designed to different type of AC and DC. The input cable is different as power input conditions.

RPSU don't have switch to turn the power ON/OFF. If power receives, power is automatically operated

Here, you should check for rang of input power as following:

No.	Unit	Range of input power	Remark
1	AC/DC	90 ~ 264VAC	
2	DC/DC	-42V ~ -56VDC	

(a)AC/DC (b)DC/DC

Figure 4.33 – PSU Outer Look

3) Remote Optic(R-OPT)

Remote Optic converts optical signals into RF signals and performs vice versa. With an FSK modem in it, the unit communicates with upper devices.

It also has internal ATT to compensate for optical cable loss. Optical wavelength for TX path is 1310nm, for Rx path is 1550nm. It can be transported by a optical strand using WDM(Wavelength Division Multiplexing) technique

4) Remote Central Processor Unit (RCPU)

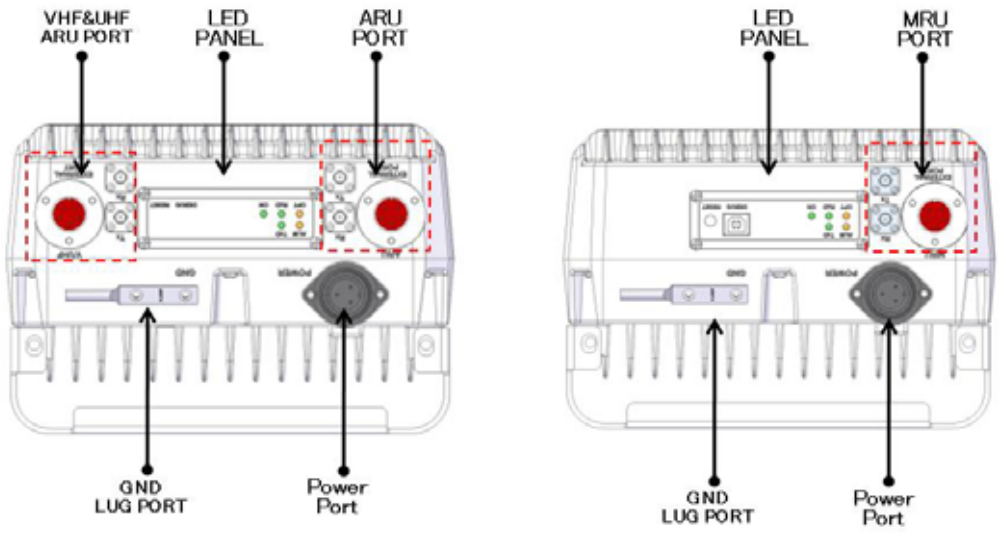
RCPU can monitor and control RU. This unit receives and analyzes upper communication data from Remote Optic and reports the unit's own value to upper devices. At the bottom of the module, it has LED indicator to show system status, letting you check any abnormalities at a time. At the same pannel, it also has communication LED Indicators to show communication status with upper devices. Through USB Port, the unit enables you to check and control device status through PC and laptop. This equipment is indoor use and all the communication wirings are limited to inside of the building.

RCPU of MRU have two port to connect exteranl devices which one is for ARU and the other is for VHF&UHF ARU. Using external interface cable, MRU can communicate with ARU/VHF&UHF ARU.

MRU collects status information from ARU/VHF&UHF ARU and then communicate with upper device

4.4.5 Bottom of ROU

1) Functions



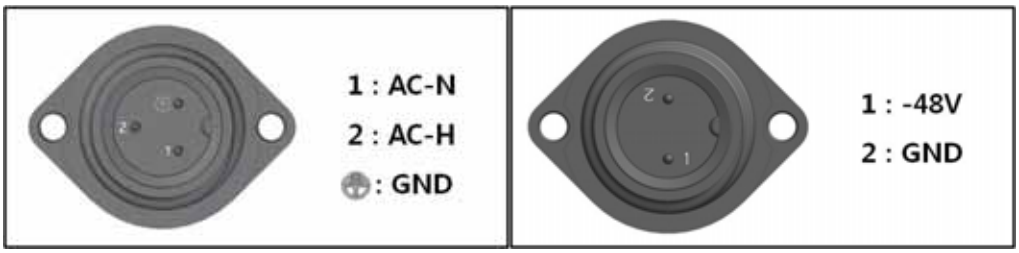
(a)MRU (b)ARU

Figure 4.34 – ROU Bottom Look

Item	Description	Remark
1. VHF/UHF ARU Port	Terminal for TX and RX RF ports of VHF and UHF Terminal for signal port to interface with VHF and UHF	
2.LED PANEL	Visible LED indicator panel for checking if status is abnormal USB Port for check and control device status through PC and laptop	
3. Power Port	AC 120V input port or DC-48V input port	
4.ARU/MRU Port	Terminal for TX and RX RF ports of MRU/ARU Terminal for signal port to interface with MRU/ARU	
5.GND LUG PORT	Terminal for system ground	

Power Port

A different type of power ports are used for power-supplying of -48V DC or 120V AC, and specific power cable should be applied to each different types of ROU power supply (AC/DC or DC/DC). Below figure is naming of the power supply by type.

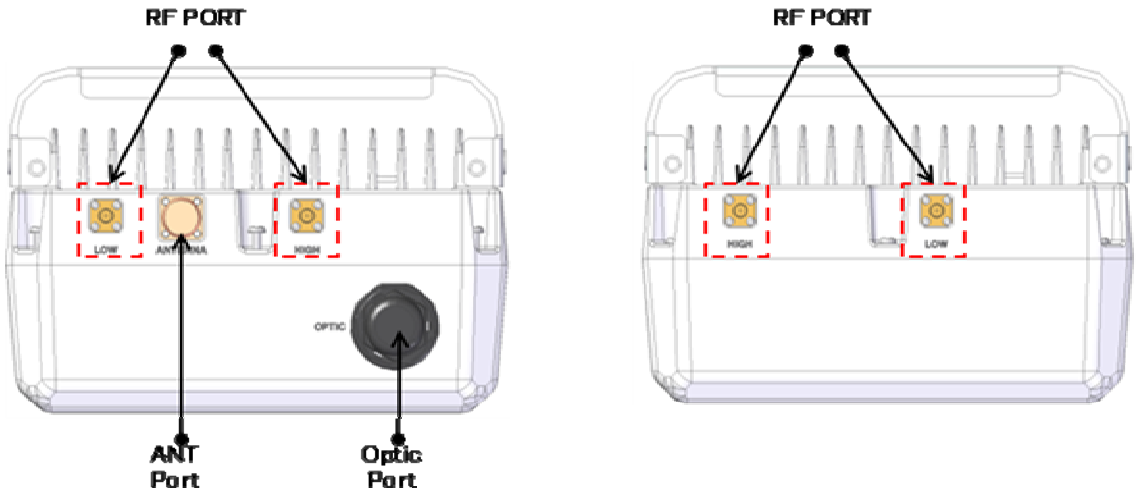


(a)AC/DC (b)DC/DC

Figure 4.35 – ROU Power Port Look

4.4.6 Top of ROU

1) Functions



(a)MRU (b)ARU

Figure 4.36 – ROU Bottom Look

Item	Description	Remark
1. RF Port	Terminal for Low RF port to connect between MRU and ARU RF Terminal for HIGH RF port to connect between MRU and ARU RF	
2. ANT Port	Terminal for RF port to connect with antenna	
3. Optic Port	Termnial for Optical port to connect with optical cable The supported optical connector type is SC/APC	

Section5

System Installation & Operation

This chapter describes how to install each unit and optical cables, along with power cabling method. In detail, the chapter describes how to install shelves or enclosuers of each unit, Power Cabling method and Optic Cabling and RF Interface. Furthermore, by showing power consumption of modules to be installed in each unit, it presents Power Cabling budget in a simple way. Then, it describes the quantity of components of modules to be installed in each unit and expansion method.

5.1 BIU Installation

5.1.1 BIU Shelf Installation

Generally, BIU is installed at a 19" standard rack. As this unit has handler at each side for easy movement. With two fixing holes at each side, you can tightly fix the unit into a 19" rack.

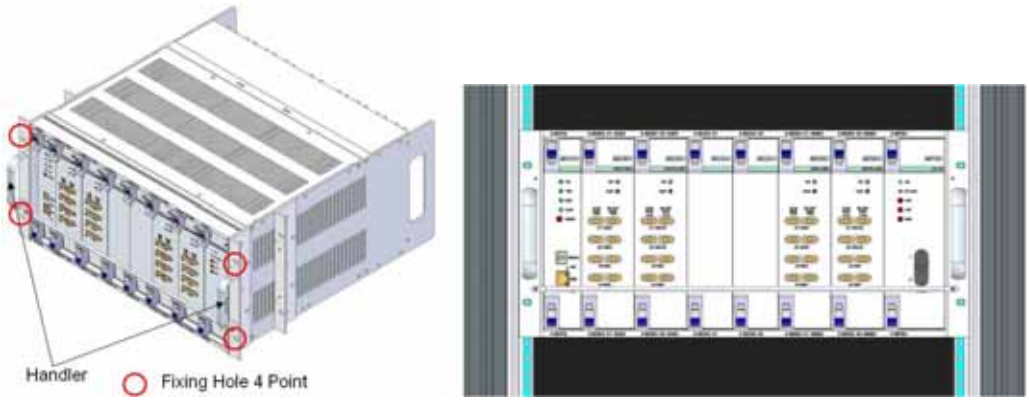


Figure 5.1 – RACK Installation

BIU has the following components:

No.	Unit	Description	Remark
Common Part	Shelf	Including Main Board, 19",5U	1EA
	MPSU	Operate –48Vdc Input	1EA
	MCPU	With Ethernet Port and USB Port	1EA
	Power Cable	–48Vdc Input with two lug terminal	1EA
SISO Slot	MCDU	–	1EA
	MDBU	Two among MDBU	Up to 2EA
MIMO Slot	MCDU	–	1EA
	MDBU	Two among MDBU	Up to 2EA

Basically, the common part of BIU should have shelves and it should be equipped with MPSU to supply devices with power, MCPU to inquire and control state of each module and Power Cable to

supply power from external rectifiers.

In addition, MDBU can be inserted and removed to provide services for desired band (Optional) and MCDU to combine and divide TX/RX signals each SISO and MIMO slots

5.1.2 BIU Power Cabling

BIU has –48V of input power. This unit should connect DC cable with the Terminal Block seen at the rear of BIU.

Terminal	Color of cable	Description	Remark
–48V	Blue color	–	
GND	Black color	–	
NC	Not Connected	–	

Before connecting the power terminal, you need to connect "+" terminal of Multi Voltage Meter probe with the GND terminal and then connect "–" terminal with –48V to see if "–48Vdc" voltage is measured. After the check, you need to connect the power terminal with the terminal of the terminal block seen below.

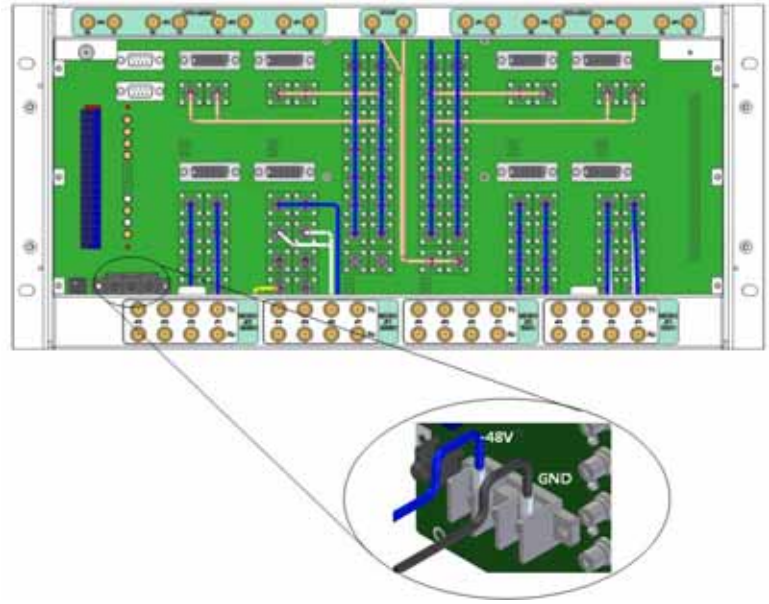
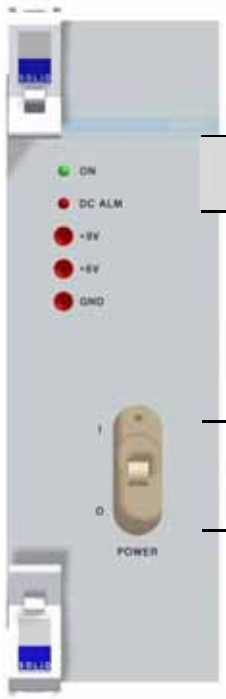


Figure 5.2 – Power interface diagrm

 Note that BIU does not operate if the "+" terminal and the "–" terminal of the –48V power are not inserted into the accurate polarity.

When you connect –48V power with BIU, use the ON/OFF switch of MPSU located at the front of BIU to check the power.



Power Switch	LED		Description
O	ON		Abnormal, Not supply Power –48Vdc
			Normal supply power –48Vdc
	DC ALM		Normal Status
			Failure of output Power
I	ON		Normal Status
	DC ALM		

Figure 5.3 – PSU LED indicator information

5.1.3 RF Interface at BIU

BIU can be connected with Bi-Directional Amplifier and Base Station Tranceiver.

To connect BIU with BDA, you need to use a duplexer or a circulator to separate TX/RX signals from each other.

BIU can feed external TX/RX signals from the Back Plane.

Using MDBU separated from each carrier band, BIU can easily expand and interface with bands. As seen in the table below, MDBU is divided into Single and Dual Bands. The unit can be connected with two carrier signals per band. At the rear, #1~4 marks are seen in order per MDBU. The following table shows signals to be fed to corresponding ports:

No	Unit naming	Description		In/out RF Port	
				TX	RX
1	1900P+850C MDBU	Dual Band 1900P:2Port 850C:2Port	Port#1	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
			Port#2	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
			Port#3	850C TX(869~894MHz)	850C RX(824~849MHz)
			Port#4	850C TX(869~894MHz)	850C RX(824~849MHz)
2	700LTE+AWS-1 MDBU	Dual Band 700LTE:2Port AWS-1:2Port	Port#1	700LTE TX(728~756MHz)	700LTE RX(698~716MHz, 777~787MHz)
			Port#2	700LTE TX(728~756MHz)	700LTE RX(698~716MHz, 777~787MHz)
			Port#3	AWS-1 TX(2110~2155MHz)	AWS-1 RX(1710~1755MHz)
			Port#4	AWS-1 TX(2110~2155MHz)	AWS-1 RX(1710~1755MHz)
3	1900P MDBU	Single Band 1900P:2Port	Port#1	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
			Port#2	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
4	1900P+AWS-1 MDBU	Dual Band 1900P:2Port AWS-1:2Port	Port#1	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
			Port#2	1900P TX(1930~1995MHz)	1900P RX(1850~1915MHz)
			Port#3	AWS-1 TX(2110~2155MHz)	AWS-1 RX(1710~1755MHz)
			Port#4	AWS-1 TX(2110~2155MHz)	AWS-1 RX(1710~1755MHz)
5	700PS+800PS	Dual Band	Port#1	700PS TX(764~776MHz)	700PS RX(794~806MHz)

		700PS:2Port 800PS:2Port	Port#2	700PS TX(764~776MHz)	700PS RX(794~806MHz)
			Port#3	800PS TX(851~869MHz)	800PS RX(806~869MHz)
			Port#4	800PS TX(851~869MHz)	800PS RX(806~869MHz)
6	900I+800I MDBU	Dual Band 900I:2Port 800I:2Port	Port#1	900I TX(929~941MHz)	900I RX(896~902MHz)
			Port#2	900I TX(929~941MHz)	900I RX(896~902MHz)
			Port#3	800PS TX(851~869MHz)	800PS RX(806~869MHz)
			Port#4	800PS TX(851~869MHz)	800PS RX(806~869MHz)
7	900I MDBU	Single Band 900I:2Port	Port#1	900I TX(929~941MHz)	900I RX(896~902MHz)
			Port#2	900I TX(929~941MHz)	900I RX(896~902MHz)
8	VHF+UHF MCDU	Dual Band VHF+UHF : 1Port	Port#1	VHF Tx(136~174MHz)	VHF Rx(136~174MHz)
				UHF Tx(380~512MHz)	UHF Rx(380~512MHz)

At the rear of BIU, Tx input and Rx output ports are seen for each MDBU. The name of all the ports are silk printed as "#1, #2, #3 and #4." Referring to the table above, you need to feed correct signals to input and output ports of corresponding MDBU.

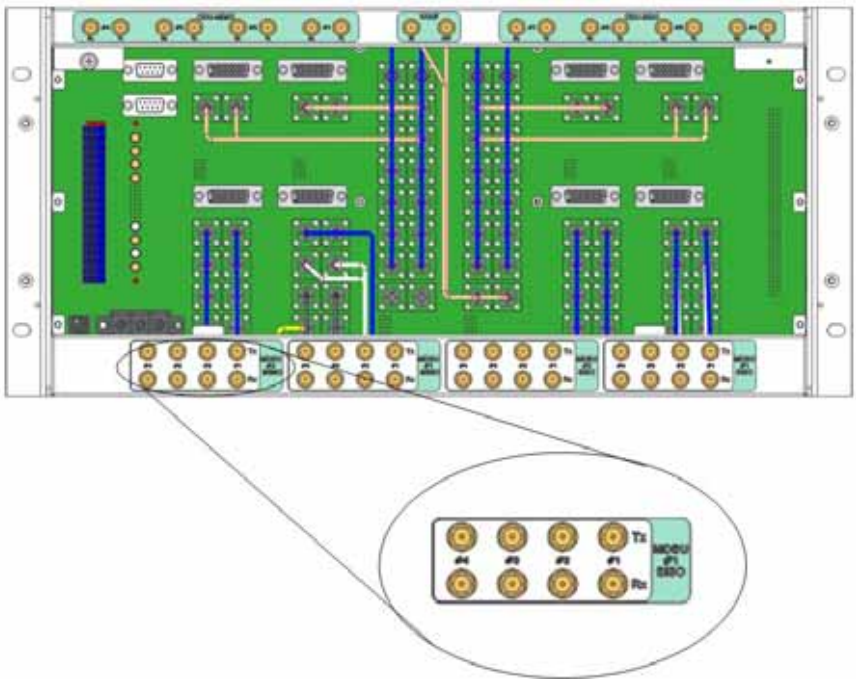


Figure 5.4 – BIU RF interface diagram

For each port, TX signals and RX signals are separated from each other. You don't need to terminate

unused ports unless you want to.

BIU interface with Base station Transceiver

Basically, BIU has different TX and RX ports, and so, you have only to connect input and output ports.

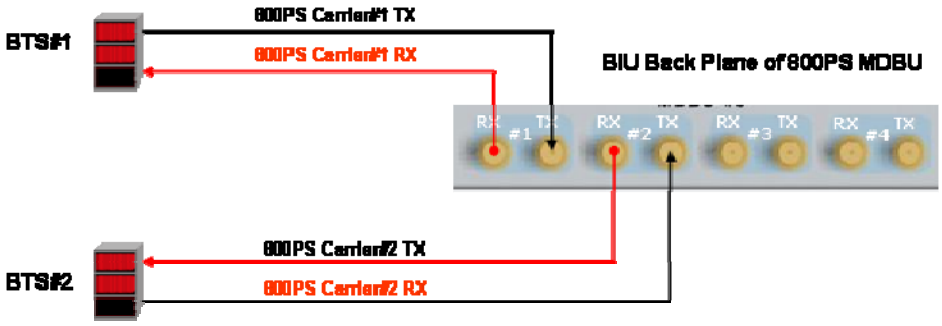


Figure 5.5 – BTS interface directly

Through spectrum, you need to check signals sent from BTS TX. If the signals exceed input range (–20dBm~+10dBm), you can connect an attenuator ahead of the input port to put the signals in the input range.

BIU interface with Bi-Directional Amplifier

Basically, BIU is in Simplexer type; when you use BDA, you need to separate BDA signals from TX and RX type.

Using either duplexer or a circulator, you can separate TX/RX signals of an external device from each other.

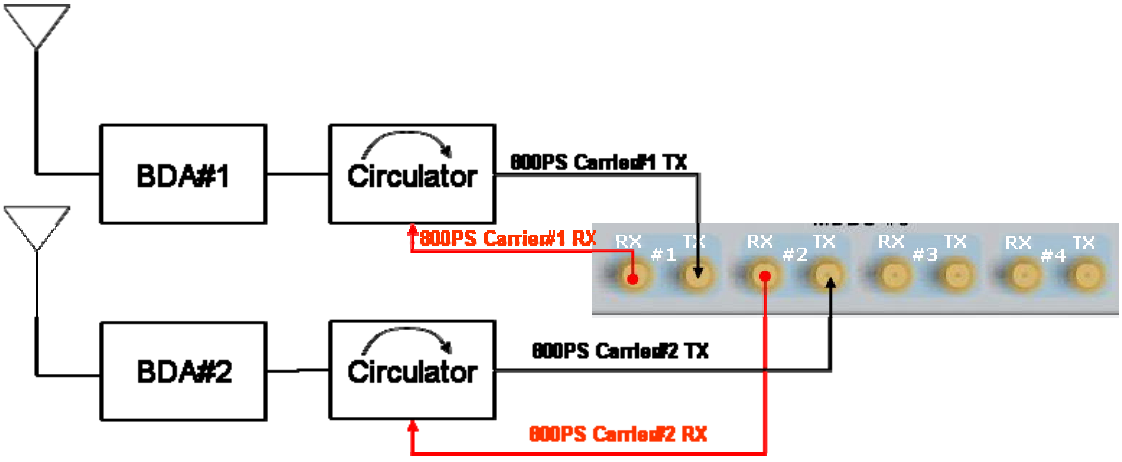


Figure 5.6 –BDA Interface using Circulator

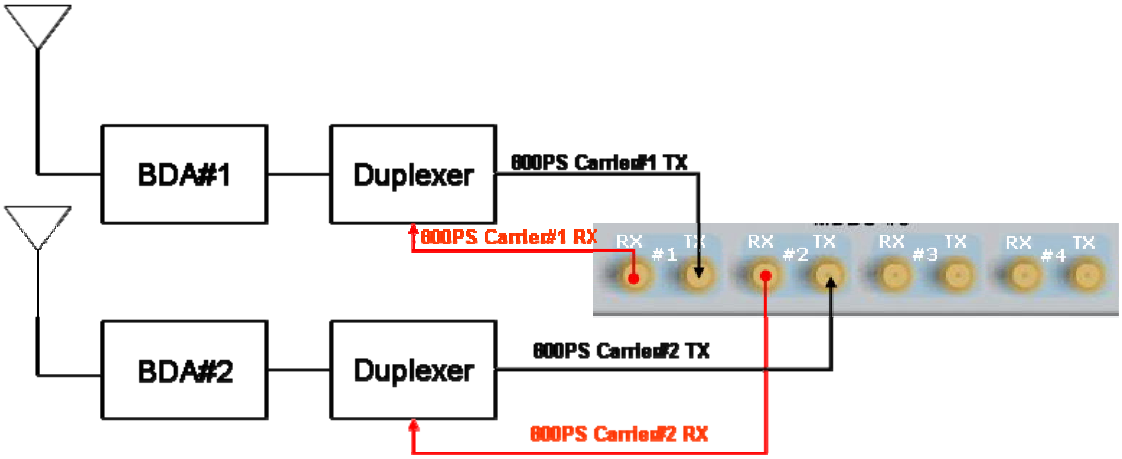


Figure 5.7 -BDA Interface using Duplexer

BIU interfaces with BDA in either of the methods above. In this case, you need to check TX input range as well.

Given the TX input range (-20dBm~+10dBm/Total per port), make sure to see if the value is in the input range, using Spectrum Analyzer, when you connect input ports.

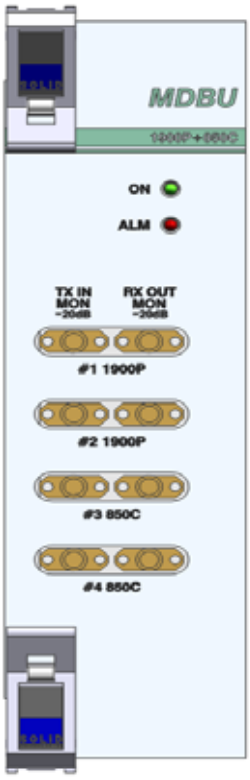
5.1.4 MDBU insertion

MDBU is designed to let a MDBU be inserted into any slot.

BIU can be equipped with a total of four MDBUs. If only one MDBU is inserted into a slot with the other slots reserved, you need to insert BLANK cards into the other slots.

 If you do not terminate input and output ports of MCDU, which combines TX signals and divides RX signals, it will cause loss and generation of spurious signals at the other party's band. Given this, make sure to insert MDBU BLANK into slots of MDBU.

When MDBU is inserted into BIU, LED at the front panel will show the following information:



LED		Description
ON		Power is not supplied.
		Power is supplied.
ALM		Normal Operation
		Abnormal Operation

Figure 5.8 –MDBU LED indicator information

MONITOR SMA port seen at the front panel of MDBU enables you to check current level of TX input and RX output signals in current service without affecting main signals.

TX MON is –20dB compared with TX Input power and RX MON is –20dB as well compared with RX Output power.

5.1.5 ODU Interface

BIU supports up to four ODUs per paths. At the rear of BIU, eight RF input and output ports for ODU and four power ports for power supply and communication are provided. As you connect ODUs, BIU recognizes ODU that is connected with BIU automatically

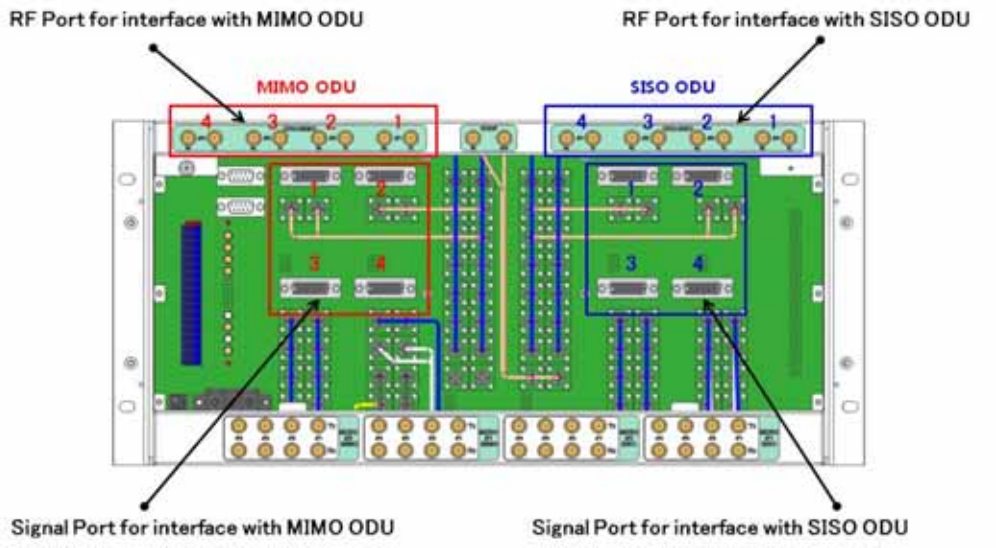


Figure 5.9 –Interface port between BIU and ODU

At the rear part of ODU, the number of RF Ports and Signal Ports are printed in order. Therefore, you need to be careful in case of expansion of ODU.

ODU Numbering		RF Port		Signal Port
		TX	RX	
ODU SISO	ODU 1	#1		SISO_ODU#1
	ODU 2	#2		SISO_ODU#2
	ODU 3	#3		SISO_ODU#3
	ODU 4	#4		SISO_ODU#4
ODU MIMO	ODU 1	#1		MIMO_ODU#1

	ODU 2	#2	MIMO_ODU#2
	ODU 3	#3	MIMO_ODU#3
	ODU 4	#4	MIMO_ODU#4

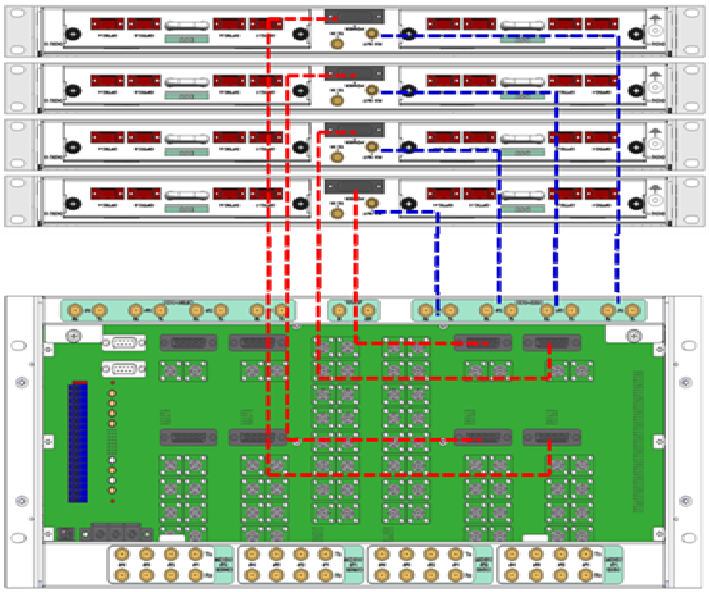


Figure 5.10 –Cabling interface diagram between BIU and ODU

For unused RF Ports for ODU expansion, make sure to terminate them using SMA Term.

When you put ODU on the top of BIU, it is recommended to install the unit at least 1U apart from BIU. Heat from BIU climbes up to reach ODU.

5.1.6 Consumption Power of BIU

The table below shows power consumption of BIU:

Part	Unit	Consumption Power	Remark
Common Part	Shelf	4.8 W	
	MCPU		
	MPSU		
MCDU	–	2.4W	
MDBU	1900P+850C	16W	
	700LTE+AWS-1	16W	
	1900P	–	
	1900P+AWS-1	–	
	700PS+800PS	–	
	900I+800I	–	
	900I	–	

BIU supplies power for ODU. Therefore, when you want to calculate total power consumption of BIU, you need to add power consumption of ODU to the total value.

Power consumption of ODU is given in the later paragraph describing ODU.

5.2 ODU Installation

ODU should be, in any case, put on the top of BIU. This unit gets required power and RF signals from BIU. The following table shows components of ODU:

No.	Unit	Description	Remark
Common Part	Shelf	Including Main Board, 19",1U	1EA
	RF Cable	SMA(F) to SMA(F), 400mm	2EA
	Signal Cable	3Row(26P_F) to 3Row(26P_M),650mm	1EA
Optional Part	DOU	Optical Module with 4 Optic Port	Up to 2EA to be inserted

5.2.1 ODU Shelf Installation

ODU is a shelf in around 1U size. Its width is 19" and so this unit should be inserted into a 19" Standard Rack. ODU should be, in any case, put on the top of BIU. BIU should have interval around 1U when the unit is installed.

5.2.2 ODU Power Cabling

ODU does not operate independently. The unit should get power from BIU.
When you connect 3-Row, 26-pin D-SUB Signal cable from BIU and install DOU, LED on the front panel is lit. Through this LED, you can check state values of LD and PD of DOU.

5.2.3 ODU Optic Cabling

As optical module shelf, ODU makes electronic-optical conversion of TX signals and then makes optical-electronic conversion of RX signals. ODU can be equipped with up to two DOUs. One DOU supports four optical ports and one optical port can be connected with ROU. Optionally, only optical port 4 can be connected with OEU for ODU1 and ODU2. ODU3 and ODU4 can not connect with OEU
As WDM is installed in DOU, the unit can concurrently send and receive two pieces of wavelength (TX:1310nm, RX:1550nm) through one optical core. DOU has SC/APC of optical adaptor type.

Figure 5.11 – Optical cable of SC/ACP Type

For optical adaptor, SC/APC type should be used. To prevent the optical access part from being marred with dirt, it should be covered with a cap during move. When devices are connected through optical cables, you need to clean them using alcohocol to remove dirt.

5.2.4 Insert DOU to ODU

In an ODU Shelf, up to two DOUs can be installed. DOU module is in Plug in Play type.

When you insert DOU in ODU, insert the unit into the left DOU1 slot first. You can be careful as the number is silk printed at the left.

The following figure shows installation diagram of ODU with one DOU inserted in it.

The following figure shows installation diagram of ODU with two DOUs inserted in it.

Figure 5.12 – ODU outlook according to inserted DOUs

When you insert DOU into ODU, insert the unit into the left DOU1 slot first. Into unused slot, you need to insert BLANK UNIT in any case.

5.2.5 Consumption Power of ODU

ODU gets power from BIU. One ODU can be equipped with up to two DOUs. Depending on how many DOUs are installed, power consumption varies. The table below shows power consumption of ODU:

Part	Unit	Consumption Power	Remark
ODU_4	DOU 1 EA	14W	
ODU_8	DOU 2 EA	28W	

5.3 ROU Installation

5.3.1 ROU Enclosure installation

ROU enclosure have two optional. One meets with NEMA4 standard and the other does not meet with NEMA4 which is water- and dirt-proof. ROU can be mounted on a Wall basically. Rack mounting is also possible to use extra unit. Extra units have three type and those will be explained on later chapter. ROU consist of MRU and ARU, their dimension is exactly same.

The following shows dimension of the fixing point for the Wall Mount Bracket.

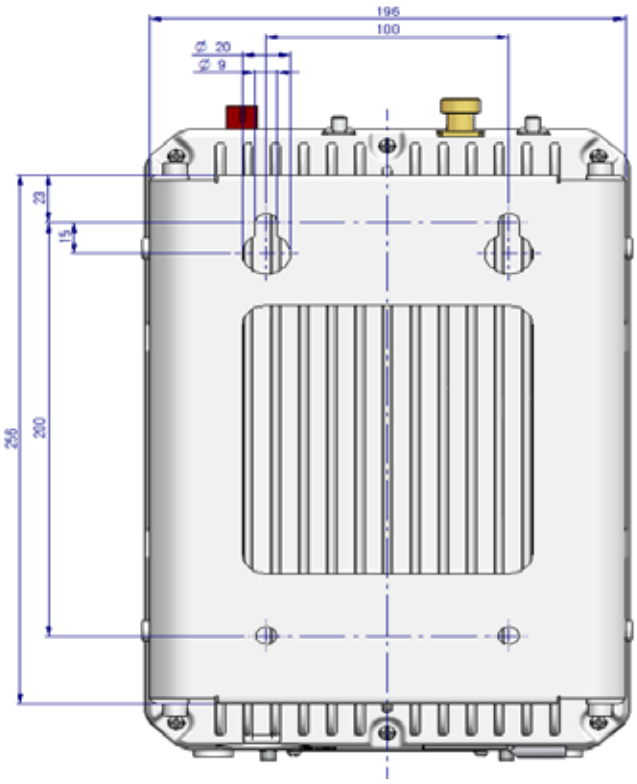


Figure 5.13 – Dimension used to install ROU on the WALL

ROU Wall Mount Installation

There are two way to install ROU on the wall. One is to install ROUs on the wall side by side, the other is 2layer installation that ARU install above MROU directly

Type1 : Side by Side installation

Turn M8 Fixing Screws by half on the wall and fully fix the screw with a Wall Mount Bracket on it.

For convenience, the Wall Mount Bracket has fixing holes to let you easily mount an enclosure.

Turn the M6 Wrench Bolt by half at each side of the Heatsink of the enclosure.

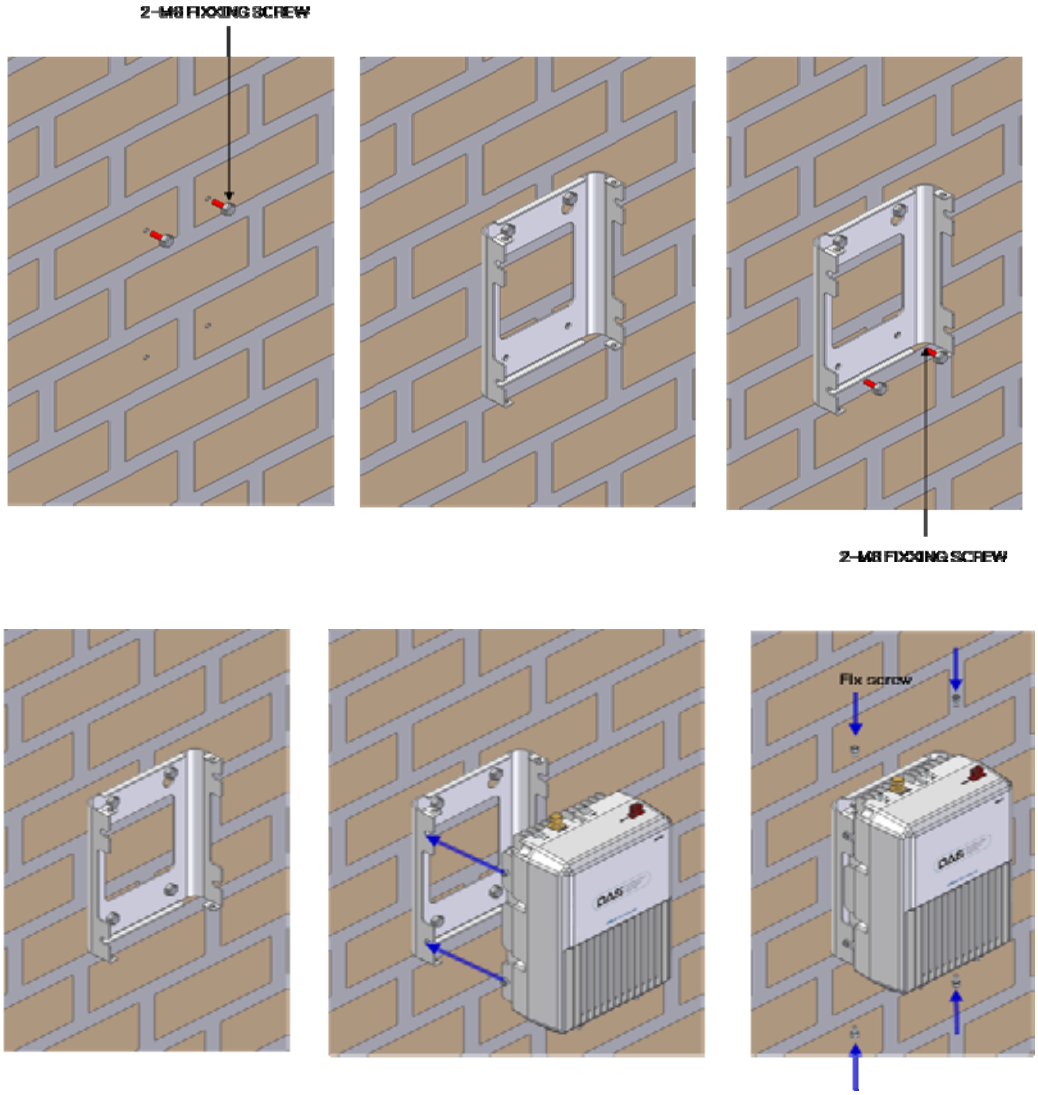


Figure 5.14 – ROU installation procedure side by side

Put the enclosure with the M6 Wrench Bolt fixed on the fixing groove and fix the M6 Wrench Bolts into the remaining fixing holes.

In this case, you will use 4 M6 Wrench Bolts in total except bolts used for the fixing groove.

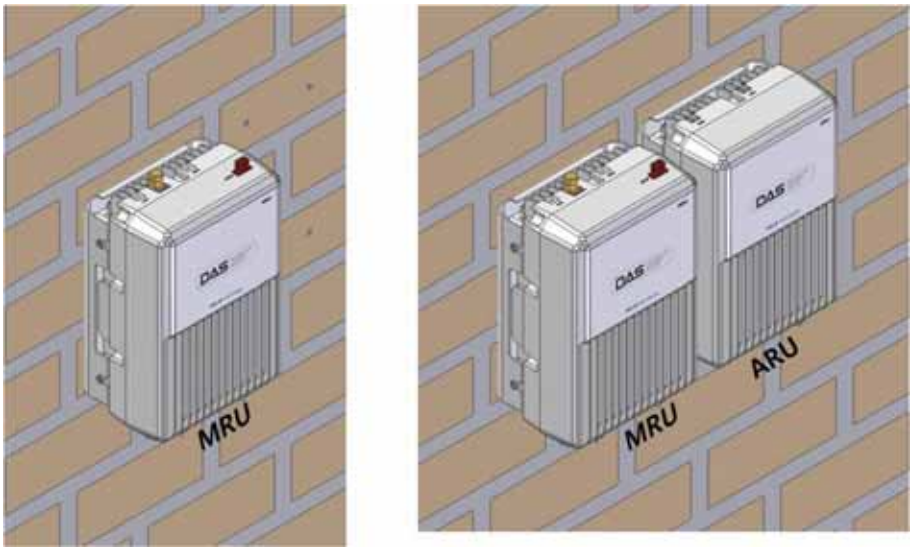


Figure 5.15 – ROU installation diagram side by side

For connecting cables between MRU and ARU conveniently, MRU should install on left side of ARU.

Type2 : 2Layer installation

In case of the narrow space to not install MRU and ARU side by side, we can install RUs into 2layer

To install into 2layer, it need baracket for 2layer installation

First, after installing MRU on the wall and then install the bracket for 2layer installation on the MRU

Second, on top of the installed bracket, install ARU

Completed installation diagram is as follows

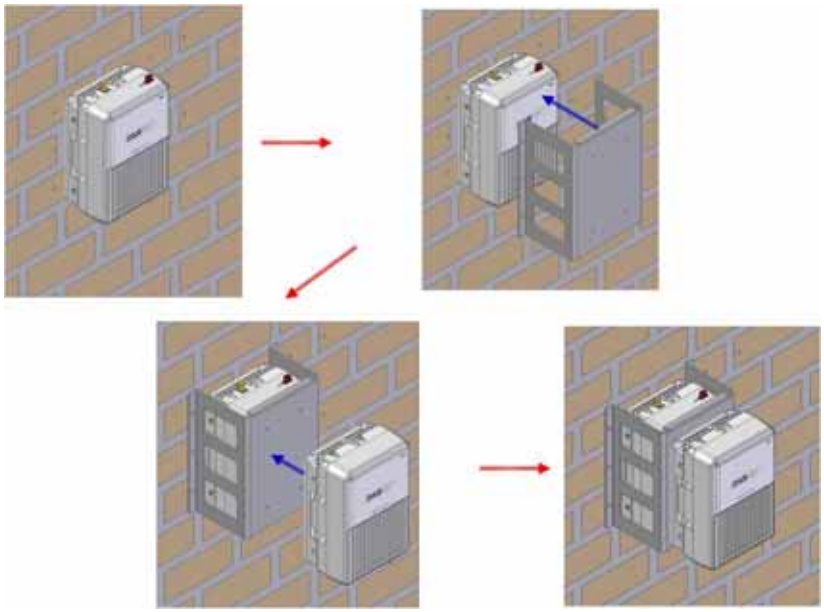


Figure 5.16 – ROU installation procedure for 2layer

The following shows dimension of the fixing point for the 2layer bracket.

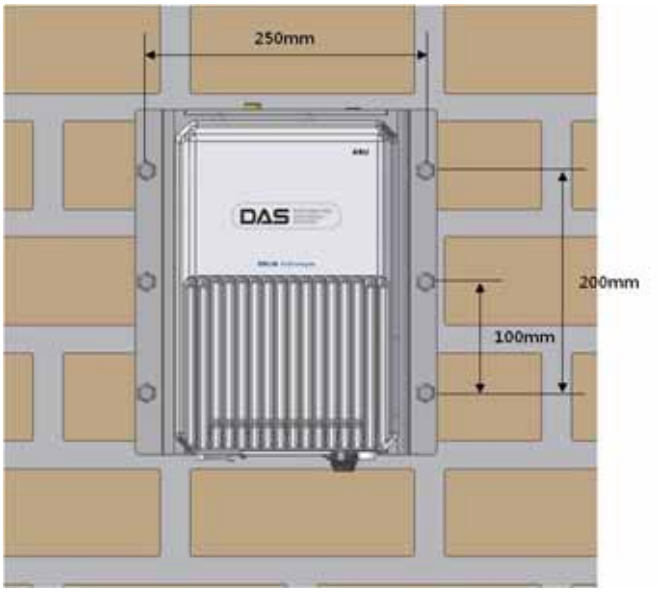


Figure 5.17 – ROU installation diagram for 2layer

ROU Rack Mount Installation

There are two way to install on a rack. One is to install ROUs on the rack vertically, the other is to install ROUs on the rack horizontally

Type1 : Vertical installation on the rack

For vertcal installation, vertical bracket needs.

First, install bracket for vertical installation on the rack

Second, mount MRU on the left side of the installed bracket

Third, mount ARU on the right side of the installed bracket

Completed installation diagram is as follows

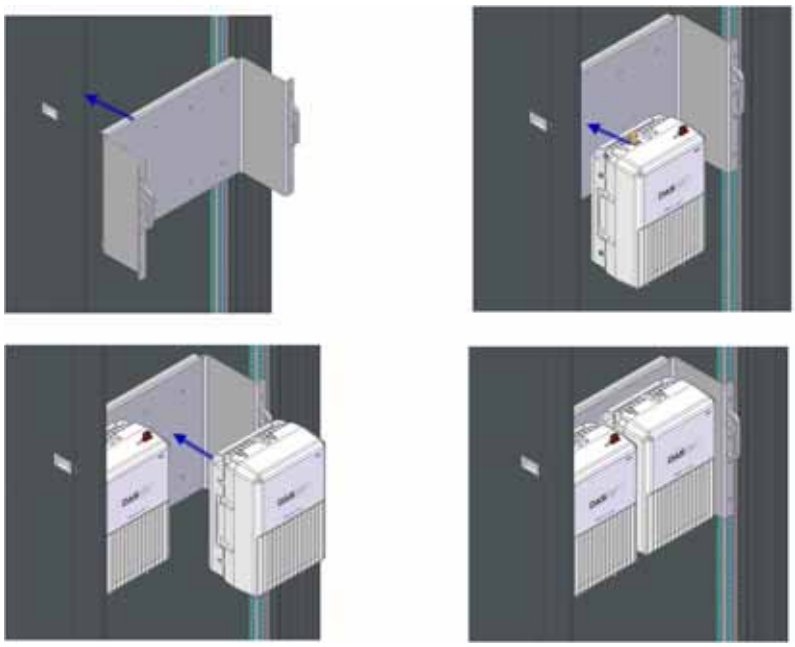


Figure 5.18 – ROU installation procedure for vertical rack

The following shows dimension of the fixing point for vertical installation

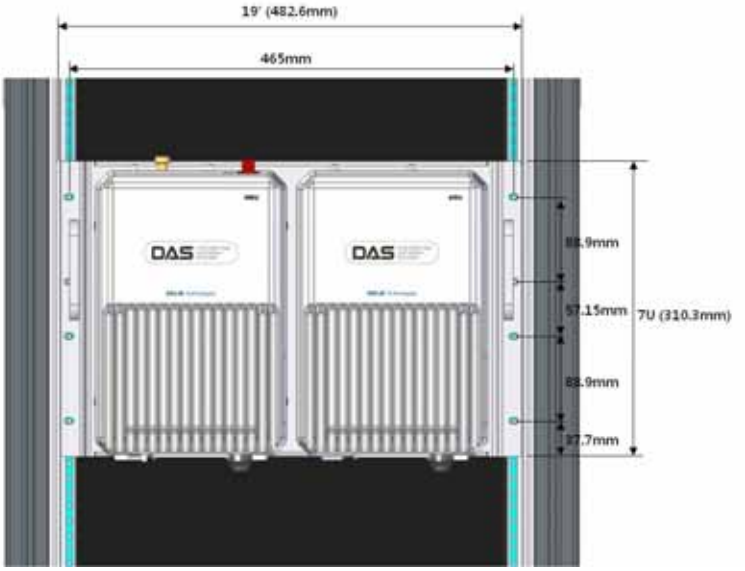


Figure 5.19 – ROU installation diagram for vertical rack

Type2 : Horizontal installation on the rack

For Horizontal installation, horizontal bracket needs. Unlike vertical installation, MRU is mounted on the right of installed bracket first and then ARU is installed on ther left of MRU

First, install bracket for horizontal installation on the rack

Second, open the front cover of horizontal bracket

Third, mount MRU on the right side of the installed bracket

Fourth, mount ARU on the right side of the installed bracket

Fifthly, close the front cover of horizontal bracket

Completed installation diagram is as follows

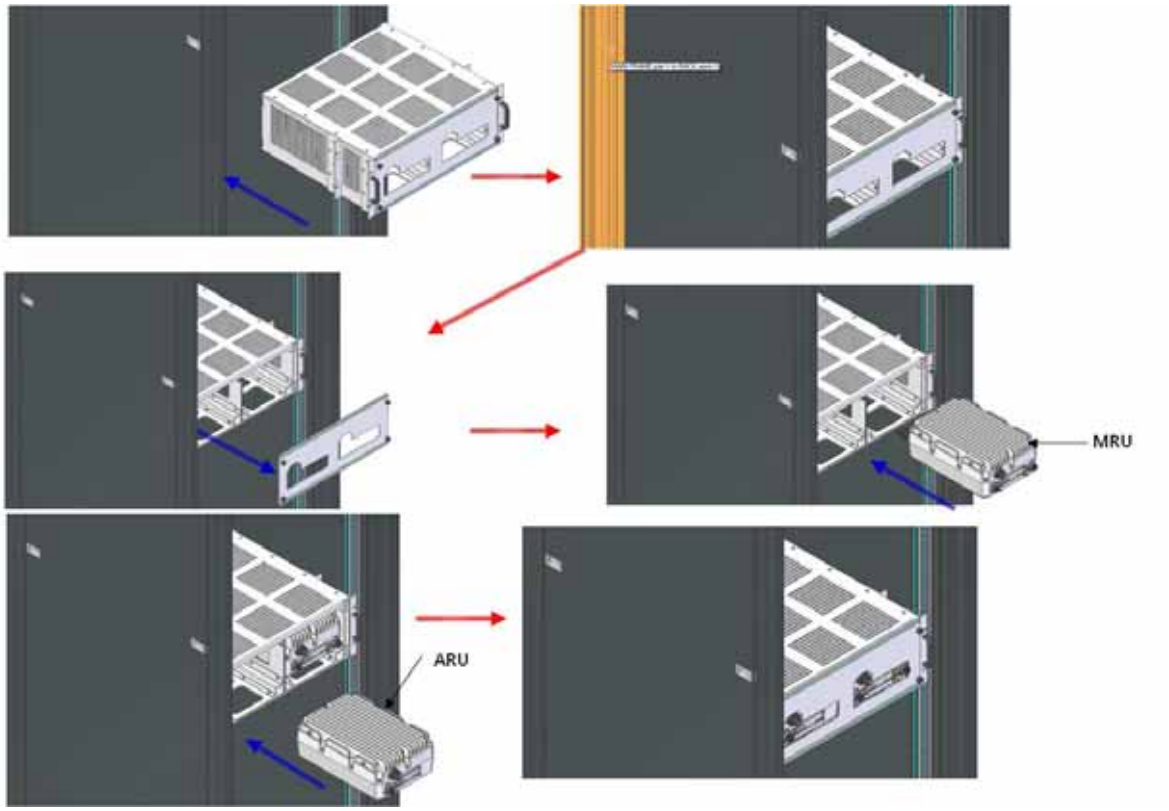


Figure 5.20 – ROU installation procedure for horizontal rack

The following shows dimension of the fixing point for vertical installation

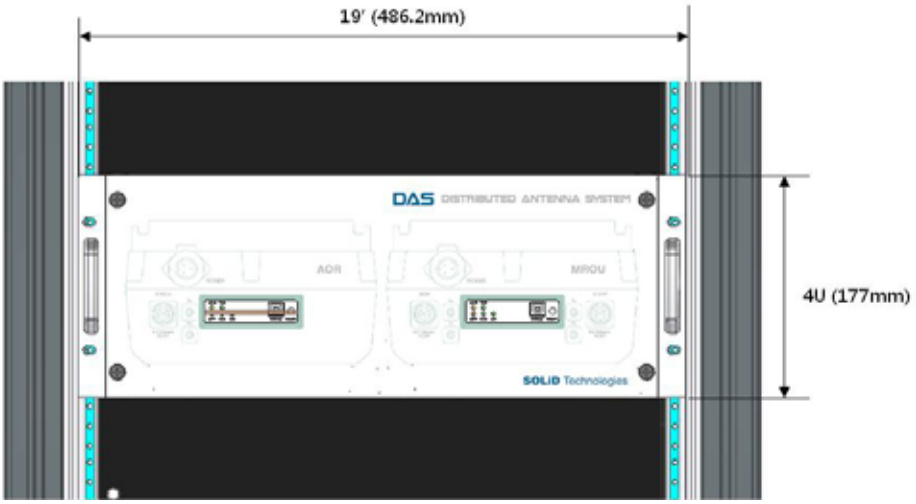


Figure 5.21 – ROU installation diagram for horizontal rack

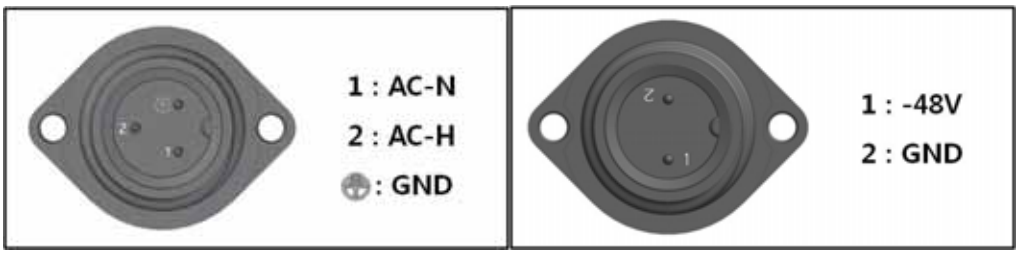
ROU components

ROU has the following components:

No.	Unit	Description	Remark
MRU	Enclosure	Including Wall cradle	1EA
	Power Cable	– Connector with 3 hole to AC 120 plug(AC) – Connector with 2 lug termination(DC)	1EA(Optical for AC or DC)
ARU	Enclosure	Including Wall cradle	1EA
	Power Cable	– Connector with 3 hole to AC 120 plug(AC) – Connector with 2 lug termination(DC)	1EA(Optical for AC or DC)
	RF cable for optical	– Two RF cables and one signal cable	
	RF cable for antenna	– Two RF cables	

5.3.2 ROU Power Cabling

ROU supports both of DC-48V and AC120V of input power. The type of input power of ROU is already determined when ROU produce. Therefore, the ROU has correct power cable in the package box. See the UL name plate of ROU to distinguish the input power type of ROU easily or see the power connector as blow picture. You should order the type of input power as your application.



(a)AC/DC (b)DC/DC

Figure 5.22 – ROU Power Port Look

Check if the connection is the same as one seen in the table above. ROU does not have power switch to power on/off. If you power plug into concent of power, power supply is operated automatically.

5.3.3 Optical Cabling

MRU makes optical-electronic conversion of TX signals from upper ODU and OEU and makes electronic- optical conversion of RX signals. MRU has one optical module in it. As WDM is installed in the R_OPT module, two pieces of wavelength (TX:1310nm, RX:1550nm) can be sent/received with one optical strand at the same time. MRU has SC/APC of optical adaptor type.

For optical adaptor, SC/APC type can be used. To prevent the optical access part from being marred with dirt, it should be covered with a cap during move. When devices are connected through optical cables, you are recommended to clear them using alcohocol to remove dirt.

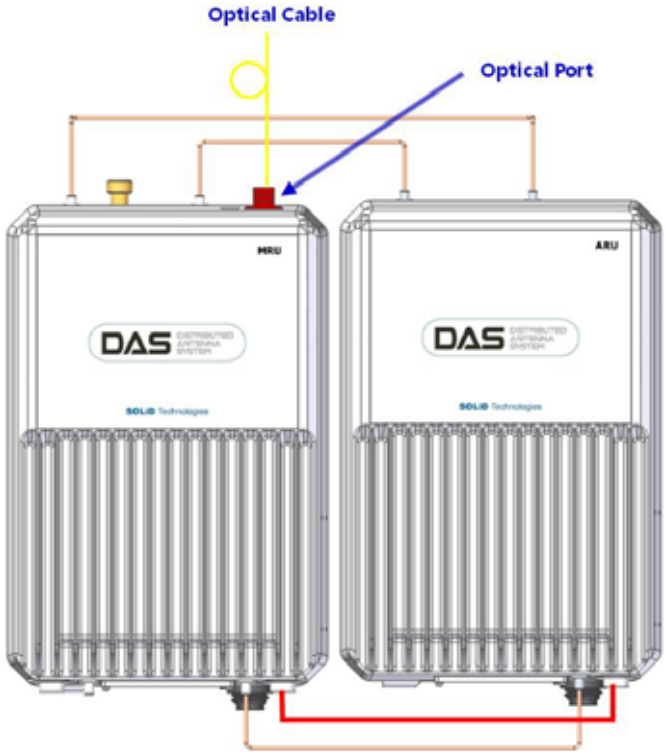


Figure 5.23 – ROU optical Port Look

Only MRU has optical port but ARU don't have optical port

5.3.4 GND Terminal Connection

ROU has one GND terminal port where is on bottom side, like below

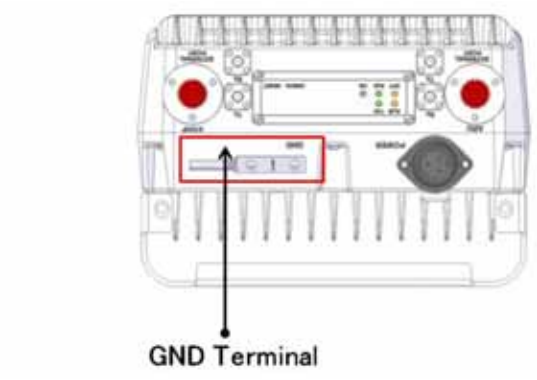


Figure 5.24 – ROU GND Port Look

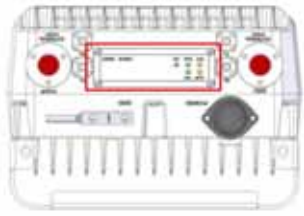
- Take off the GND terminal port from enclosure and connect to ground cable, then fix it the position of enclosure again
- The opposite end of the ground cable should connect to the communication GND of building
- The ground lug is designed meeting the SQ5.5 standard

5.3.5 Coaxial cable and Antenna Connection

- The coaxial cables which are connected to antenna distribued network connect to antenna port of ROU. Before connection, check the VSWR value of coaxial cable whether it is within specification using SITEMASTER .
- At this time, check if the Return loss have above 15Db or VSWR have below 1.5
- The part of antenna connection fasten to port not to be loosed and not to be injected the dusty and insects
- The antenna connected to ROU is only serviced in inbuilding
- The ROU which have antenna port is only MRU, ARU transport their signal through RF cable connected both MRU and ARU

5.3.6 Information of LED of ROU

ROU has LED pannel at the bottom of ROU. The LED indicator is as below



LED		Description
ON		Power is not supplied
		Power is supplied.
ALM		Normal Operation
		Abnormal Operation
OPT		R-OPT is normal operation
		R-OPT is abnormal Operation
TXD		Twinkle when data send to upper unit
RXD		Twinkle when data receive from upper unit

Figure 5.25 – ROU LED indicator information

5.3.7 Consumption of RDU

The following table shows power consumption of ROU

Part	Unit	Consumption Power	Remark
MRU	1900P+850C	50W	Dual Band
	TBD	-	
ARU	700LTE+AWS-1	40W	Dual Band
	TBD	-	

5.4 OEU Installation

OEU is used to expand ROU in Campus Site.

OEU is located at a Remote Closet. As it can be equipped with up to two DOUs, you can expand a total of eight ROUs.

5.4.1 OEU Shelf installation

OEU is a shelf in around 2U size. Its width is 19" and so this unit should be inserted into a 19" Standard Rack. OEU is in a Remote Closet, providing optical ports of ROU.

The following table shows power consumption of OEU:

No.	Unit	Description	Remark
Common Part	Shelf	Including EWDM,ERF,EPSU,ECPU, 19",2U	1EA
	Power Cable	-48Vdc Input with two lug terminal	1EA
Optional Part	DOU	Optical Module with 4 Optic Port	Up to 2EA to be inserted

5.4.2 OEU Power Cabling

The input power of OEU is DC -48V. You need to connect DC cable with the Terminal Block seen at the rear of OEU.

Terminal	Color of cable	Description	Remark
-48V	Blue color	Input range: -42 ~ -56Vdc	
NC	Not Connected		
GND	Black color		

Before connecting the power terminal, you need to connect "+" terminal of Multi Voltage Meter probe with the GND terminal and then connect "-" terminal with -48V to see if "-48Vdc" voltage is measured. After the check, connect the power terminal through the terminal seen below.

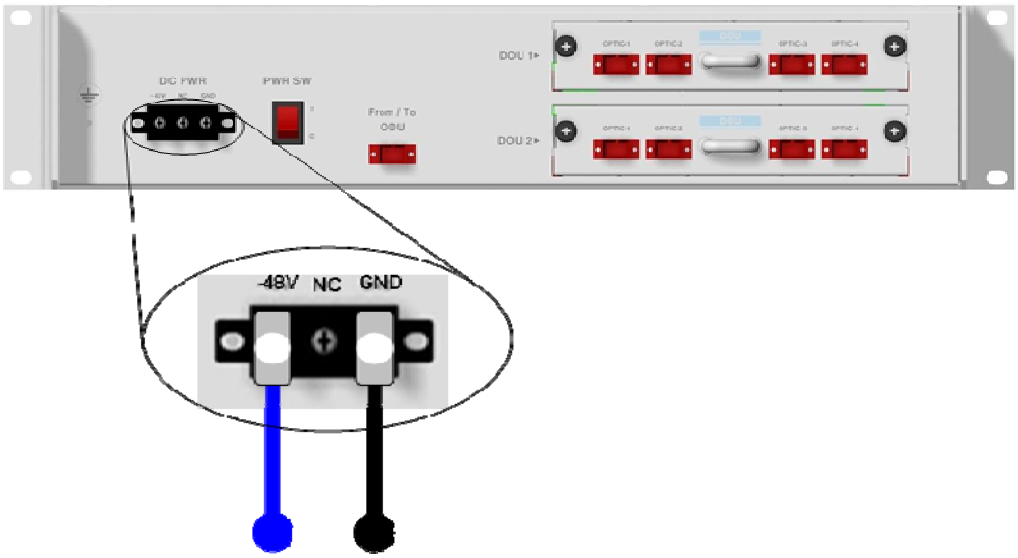


Figure 5.26 – OEU Power interface diagram

Note that OEU does not operate if the "+" terminal and the "–" terminal of the –48V power are not inserted into the accurate polarity.

5.4.3 OEU Optic Cabling

OEU is connected with upper ODU. With DOU inserted in it, the unit is connected with ROU.

As OEU has a shelf with EWDM in it, the unit makes electronic-optical conversion of TX signals from ODU and makes optical-electronic conversion of RX signals. In addition, OEU can be equipped with up to two DOUs. One DOU supports four optical ports and one optical port can be connected with ROU. With WDM in DOU, the unit can concurrently send/receive two pieces of wavelength (TX:1310nm, RX:1550nm) through one optical core. DOU has SC/APC of optical adaptor type.

Figure 5.27 – Optical cable of SC/ACP Type

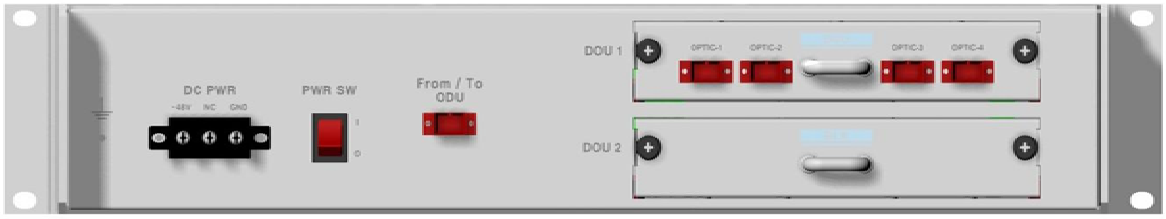
For optical adaptor, SC/APC type should be used. To prevent the optical access part from being marred with dirt, it should be covered with a cap during move. When devices are connected through optical cables, you need to clear them using alcohocol to remove dirt.

5.4.4 Insert DOU to OEU

Into OEU Shelf, up to two DOUs can be inserted. DOU module is in Plug in Play type.

When you insert DOU in OEU, insert the unit into the top DOU1 slot first. You can be careful as the number is silk printed at the left.

The following figure shows installation diagram of OEU with one DOU inserted in it.



The following figure shows installation diagram of OEU with two DOUs inserted in it.

Figure 5.28 – OEU outlook according to inserted DOU

When you insert DOU into OEU, insert the unit into the top DOU1 first. For unused slots, you

nedd to install BLANK UNIT into them.

5.4.5 Consumption Power of OEU

OEU has –48V DC Power supply in it. ODU can be equipped with up to two DOUs. Depending on the quantity of DOU, power consumption is varied.

The following table shows power consumption of OEU:

Part	Unit	Consumption Power	Remark
Common Part	Shelf	12W	
	EWDM		
	ERF		
	EPSU		
OEU_4	DOU 1 EA	23W	
OEU_8	DOU 2 EA	33W	

Section6

Operation

This chapter describes operation of SC-DAS. It deals with procedures and operations for normal system operation after installation. It also describes operations per unit and interworking methods.

6.1 BIU Operation

6.1.1 BIU

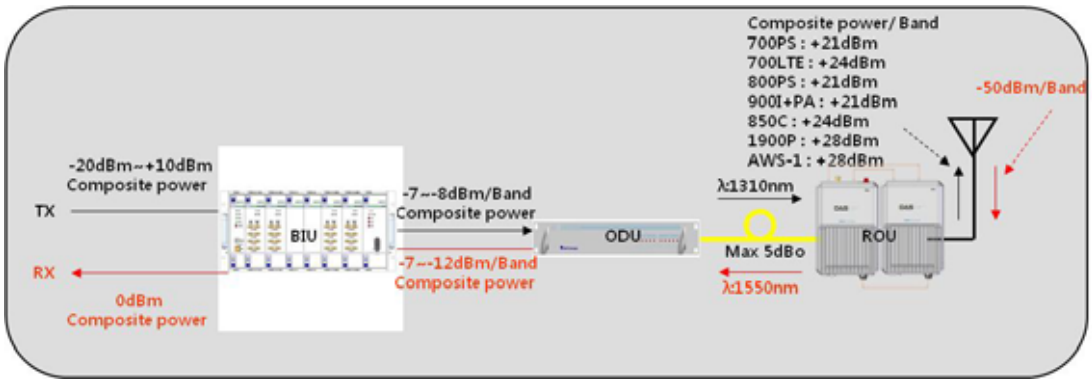


Figure 6.1 – SC-DAS Link budget for BIU

6.1.2 TX Operation at BIU

TX level to be sent to BIU should be in the range of –20dBm ~ + 10dBm. If the level exceeds the range, you need to connect an attenuator with the front end of BIU input and adjust the level in the corresponding range. Out of the range, maximal power cannot be outputted and so you need to increase output power of BDA or adjust attenuation amount of BTS's coupler or ATT to adjust the level.

For signals of all bands, you need to check, using spectrum, if they are in an appropriate level before making connection with input port of BIU and then check if there are spurious signals.

You need MDBU of a band you want to use. Insert the unit into BIU and check if it works normally. For MDBU, up to two TX inputs are provided. Input level per port is –20dBm~+10dBm.

Checking the status of the system's LED Indicator

After turning on the switch of the power supply in BIU, check information on each module's LED of the system. The table below shows normal/abnormal cases depending on the status of each module's LED.

LED information

Unit	LED		Indicates
MDBU	ON		Green: MDBU is normally power-supplied.
	ALM		Green: MDBU is normal.
			Red: MDBU is abnormal; check the alarm through RS-232C.
MCPU	ON		Green: MCPU is normally power-supplied.
	TXD		Green flicker: TX signals are transmitted to communicate with ROU.
	RXD		Green flicker: RX signals are received from ROU.
	ALM		Green: BIU system is normal.
			Red: BIU system is abnormal; check the alarm through RS-232C.
MPSU	ON		Green: BIU is connected with power and MPSU works normally.
	ALM		Green: DC output is normal.
			Red: DC output is abnormal.

MDBU Setting

Insert MDBU into BIU. Check if the "ON" LED Indicator at the front panel of MDBU is lit green.
Make connection with DEBUG port of MCPU through USB Cable
Check if the ID of MDBU module is searched for in those SISO MDBU#1~2,MIMO MDBU#1~2 slots of MDBU through GUI. When you select the tab of a corresponding slot from the main window, you can inquire and set the status of a corresponding MDBU module.

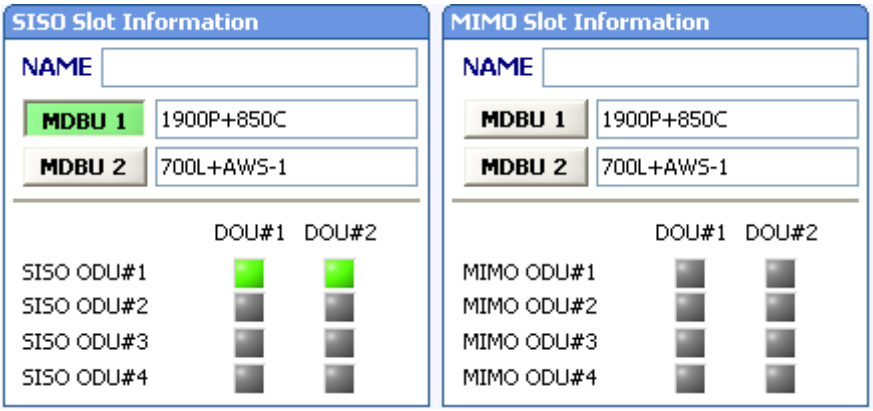


Figure 6.2 –Inserted MDBU information at BIU

Check if MDBU is inserted into a corresponding slot of BIU. The ID screen shows the following:

A. MDBU ID: Show MDBU ID inserted into slot
B. Not Insert: This status value appears when MDBU has not been set.
C. Link Fail: This status value appears when MDBU has been set but it fails to communicate with modules.

SC-DAS is classfied according to path that is as SISO and MIMO. Each path can be inserted up to two MDBU. This MDBU can be different combination as your application

Use the ON/OFF (Activation/de-activation) function for a port you want to use and turn it ON.

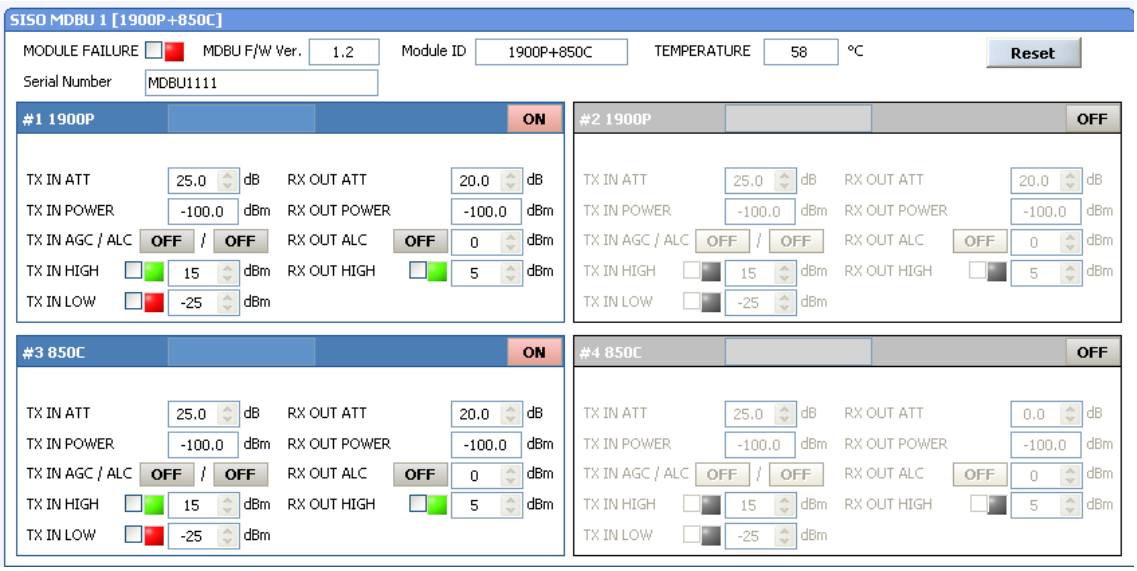


Figure 6.3 –MDBU menu information at BIU

 Depending on whether to use a port, output is subject to change. Thus, make sure to turn

OFF unused port

The table below shows output power depending on whether to use a port:

MDBU Band	Output level (Composite power)	No. of Max port (N)
700PS	23dBm-10*LOG(N)	2
700LTEC	23dBm-10*LOG(N)	2
700LTEF	23dBm-10*LOG(N)	2
800PS	23dBm-10*LOG(N)	2
850Cellular	23dBm-10*LOG(N)	2
900I+Paging	23dBm-10*LOG(N)	2

1900PCS	26dBm-10*LOG(N)	2
AWS-1	26dBm-10*LOG(N)	2
VHF	24dBm-10*LOG(N)	1
UHF	24dBm-10*LOG(N)	1

Check if the level of TX IN POWER is the same as the value measured through spectrum (Within ±3dB). Use TX IN AGC function and automatically set internal ATT depending on input level. ATT is automatically set based on -20dBm of input . The table below shows TX IN ATT depending on TX IN POWER. For manual setting, you can set ATT depending on input according to the table.

TX IN POWER	TX IN ATT	TX IN POWER	TX IN ATT	TX IN POWER	TX IN ATT
-20dBm	0dB	-9dBm	11dB	+1dBm	21dB
-19dBm	1dB	-8dBm	12dB	+2dBm	22dB
-18dBm	2dB	-7dBm	13dB	+3dBm	23dB
-17dBm	3dB	-6dBm	14dB	+4dBm	24dB
-16dBm	4dB	-5dBm	15dB	+5dBm	25dB
-15dBm	5dB	-4dBm	16dB	+6dBm	26dB
-14dBm	6dB	-3dBm	17dB	+7dBm	27dB
-13dBm	7dB	-2dBm	18dB	+8dBm	28dB
-12dBm	8dB	-1dBm	19dB	+9dBm	29dB
-11dBm	9dB	0dBm	20dB	+10dBm	30dB
-10dBm	10dB				

MDBU TX has function of ALC which limit below already determinated level(-20dBm) per ports Here, after operate the input AGC and then should turn on ALC function.

Edit Naming of a port and set it as a desired character string (up to 12 characters).For example, the figure below shows a screen when you set “VzW” for port 1 and “AT&T” for port 2.

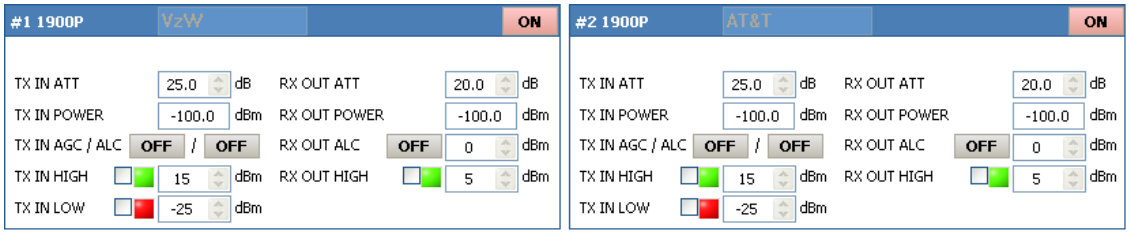


Figure 6.4 –MDBU naming information at BIU

This naming is reflected at tree as follows

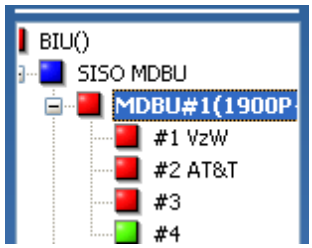


Figure 6.5 –MDBU naming information at the tree

Use various upper/lower limits. The following table shows recommended limit settings:

Item	Recommended Limit	Remark
TX IN HIGH ALM	15dBm	Alarm
TX IN LOW ALM	–25dBm	Alarm
RX OUT ALC	0dBm	Auto Level control
RX OUT HIGH ALM	5dBm	Alarm

As such, when you finish setting normal input levels and alarm limits, check if the value of MODULE FAILUER LED Indicator is lit green (Normal case).

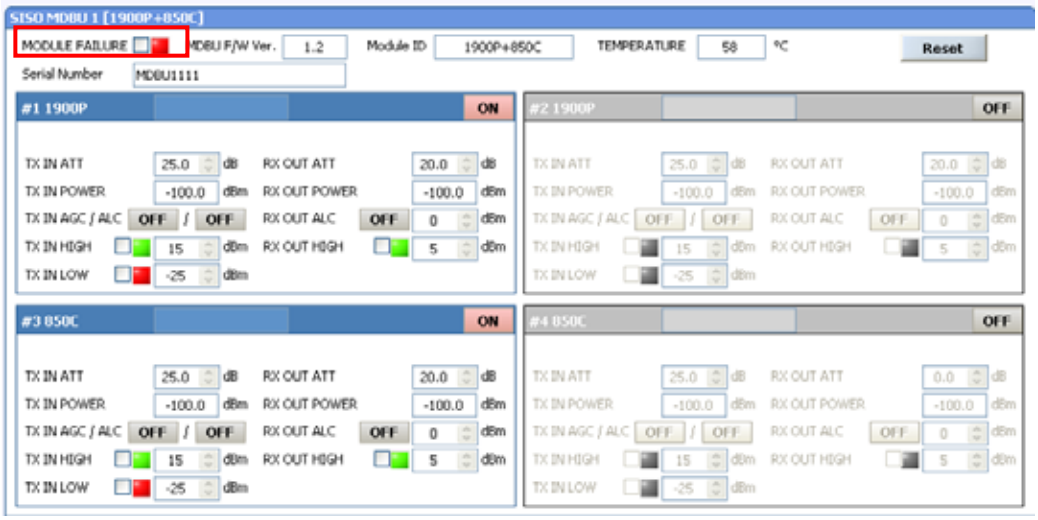


Figure 6.6 –MDBU Module Failure information at BIU

6.1.3 RX Operation at BIU

For RX operation at BIU, you need to set RX gain to prevent BTS or BDA from being affected. There is an ATT setting window to let you adjust gain per band and port.

Total RX gain is 50dB per band. To adjust a desired gain, you need to do the following. For RX gain of a desired gain, you can set it as 50dB-RX ATT. Use the terminal and check if TX Adjust value and Ec/Io value is appropriate.

To block high signals from entering BTS or BDA, keep ALC mode activated (ON).

6.1.4 Tree window at BIU

BIU controls overall system, working as common part in any equipment. Connect BIU with such units as ODU, OEU and ROU to be interfaced with the BIU

The tree hierarchy displays according to connected ODU/OEU/ROU automatically.

BIU actually try to communicate with lower units while collecting the status value of units.

The menu below shows topology for overall units at a tree display

Basic topology for SC-DAS

Configuration of BIU-ODU-ROU

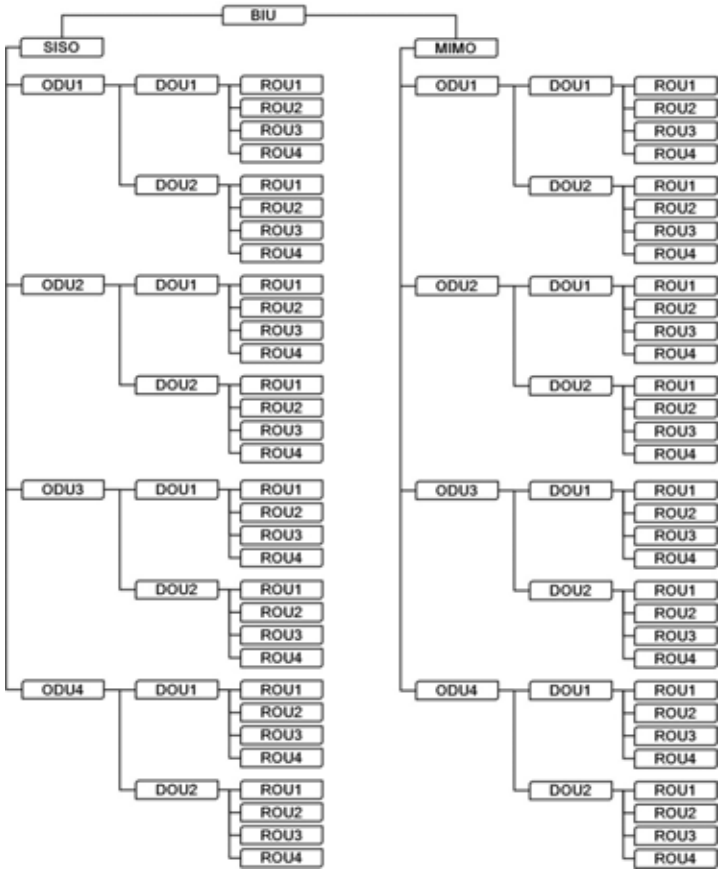


Figure 6.7 -Configuration of BIU-ODU-ROU for basic topology

BIU has two path which is SISO and MIMO. Each path has capability to connect up to 4ODUs, one ODU can be connected up to 8ROUs.Therefore, the number of ROU per path is 32ROUs. If it considering MIMO path, One BIU can connect up to 64 ROUs

Expansion topology for SC-DAS

Configuration of BIU-ODU-OEU-ROU

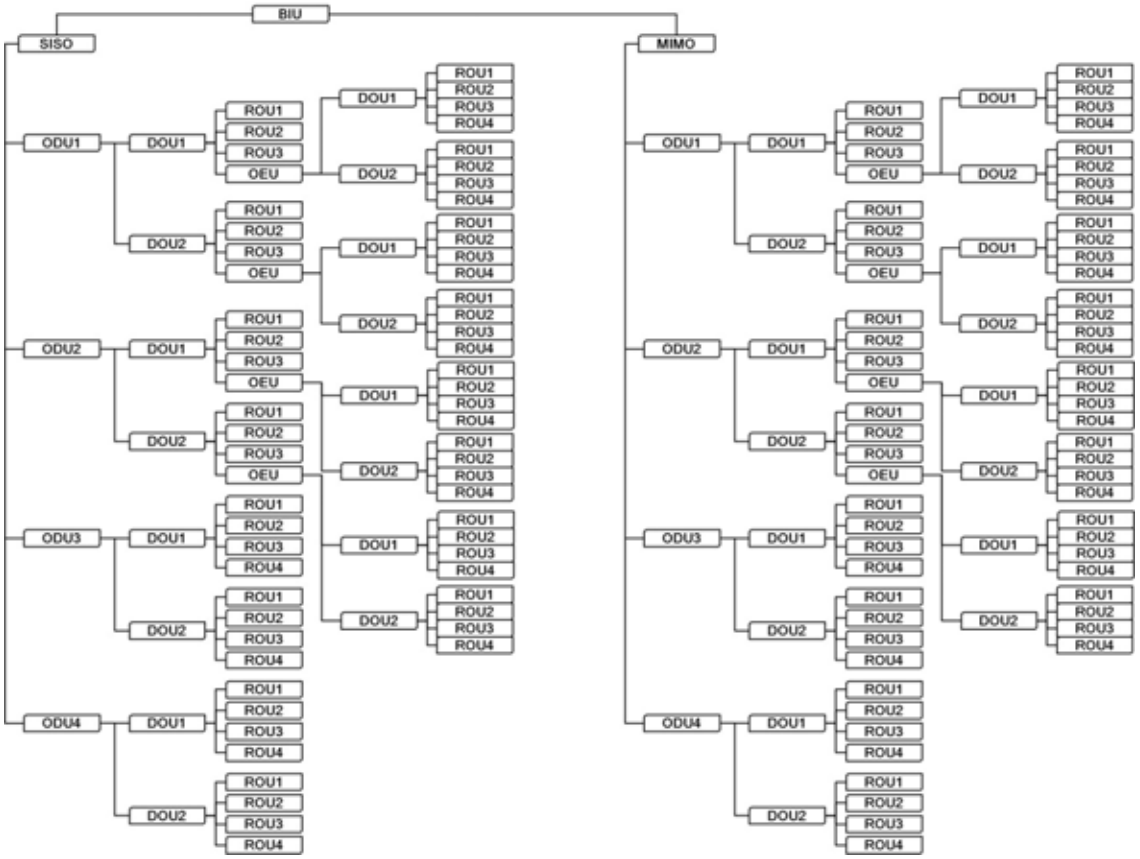


Figure 6.8 -Configuration of BIU-ODU-ROU for expansion topology

Using OEU, this configuration can expand the ROU like above tree structures. As seeing above tree hierarchy, OEU can be connected with ODU1~2 only and among optical port of DOU, OEU can connect at fourth optical port. If you connect the OEU at 1~3 optical port at DOU, BIU don't communicate with OEU.

Therefore, you should connect OEU at the fourth optical port of DOU in the ODU1~2.

This tree hierarchy is generated automatically as ROU/OEU is connected at ODU optical port

6.1.5 ODU Operation at BIU

BIU can be equipped with up to four ODUs per path. One ODU can have two DOUs in it. For information on insertion/deletion of DOU in ODU, you can see at the main window of BIU as below

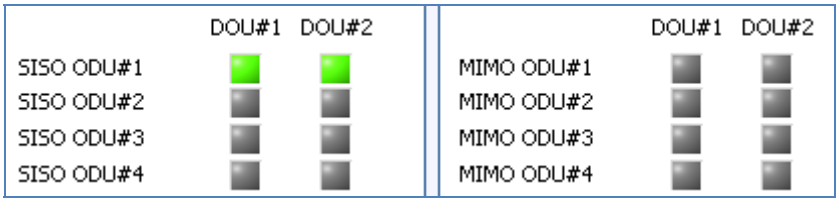


Figure 6.9 –Inserted DOU information at BIU

When you select ODU screen from the left TREE panel, you can see DOU1 or DOU2 menu actiavted depending on whether DOU has been inserted. Then, the optical port set at the INSTALL menu is also actiavted to let you check PD value of the optical port. Any optical port at unused optical port is seen de-activated in grey.

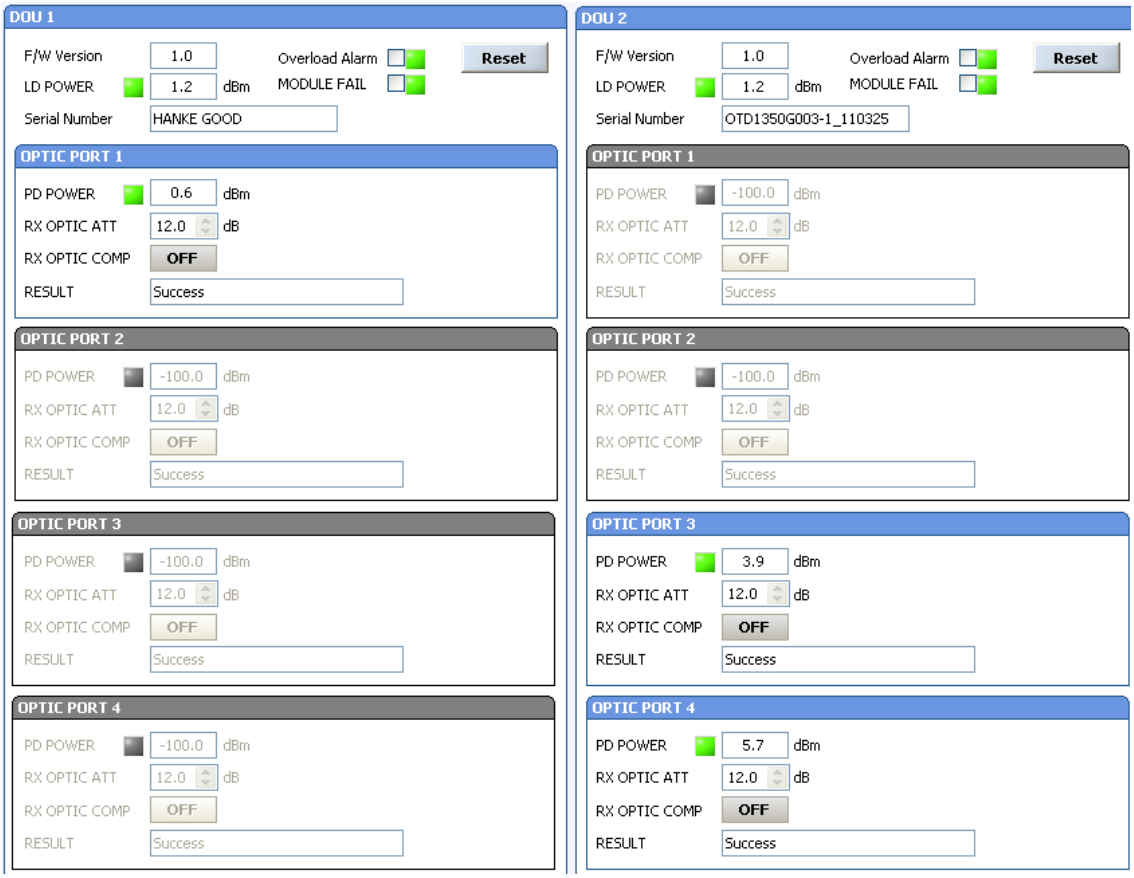


Figure 6.10 –ODU Menu information

The level of DOU's Laser didoe is typically +1.5±1dBm. DOU have various alarm such as LD Power

alarm, Overload Alarm and PD alarms.

The level of Laser diode received from ROU/OEU is +7dBm±0.5dB. The level of Photo diode will be displayed with losses related to the length of optical cables and insertion loss of optical connecters.

In general, the level of optical PD POWER should be +6dBm~ +2dBm±1.5dB.

What is more, ODU has the function of automatically compensating for optical cables loss.

In the first, if BIU communicate with the lower Unit(OEU,ROU), the optical loss compensation is operated automatically

During optical compensation, the Result window shows "Processing" and then a result value. There are three types of results as follows:

A. Success: The optical compensation is normally completed
B. Over Optic Loss: Generated optical loss is 5dBo or more.
C. Communication Fail: Communication with ROU is in poor conditin.

ATT of optical compensation can work based on the numerical expression of 12-2*(LD POWER-PD POWER). Optical compensation can be made not only in ODU but also in ROU.

6.2 ROU Operation

The figure below shows the level of the system link of SC-DAS (BIU-ODU-ROU). This section describes ROU-related information. ROU receives various signals through optical modules. The signals are filtered only for corresponding signal band from MFR/ARF module and amplified with a High Power Amplifier. Then, the multiplexer combines the signals with others and sends them with an antenna.

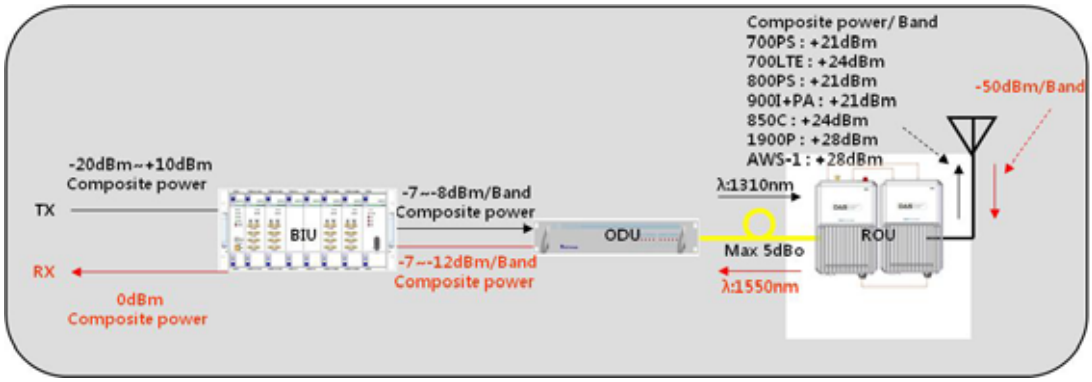


Figure 6.11 -SC-DAS Link budget for ROU

6.2.1 ROU Operation

ROU is in one-body enclosure type. ROU is located at a remote closet in a building. And it

can be installed on a wall or into a rack.

Basically, one antenna is provided. To install a variety of antennas, you need such devices as a divider and a coupler. ROU can work with a DC Feeder and an Optic Cable Feeder. For power supply of ROU, a power supply in AC-DC and DC-DC type is provided to let you select a power supply suitable as an application.

For upper level, ROU can be connected with ODU and OEU. It has AGC function for 5dBo of optical cable loss.

The following show operational procedures after installation of ROU.

Checking the status of ROU's LED Indicator

When power cable is plugged into an outlet, power is provided for ROU. Check information on each module's LED of the system. The table below shows normal/abnormal cases depending on the status of each module's LED.

LED		Description
ON	⚪	Power is not supplied
	🟢	Power is supplied.
ALM	🟢	Normal Operation
	🔴	Abnormal Operation
OPT	🟢	R-OPT is normal operation
	🔴	R-OPT is abnormal Operation
TXD	🟢	Twinkle when data send to upper unit
RXD	🟢	Twinkle when data receive from upper unit

Checking Communication LED of ROU

Check if TXD and RXD LEDs in MRU make communication. Receiving FSK signals from BIU, ROU sends requested status value to BIU. During reception, RXD LED flicks. During tramsmission, on the other hand, TXD LED flicks. At this time, you need to check if whether to use a corresponding ROU is checked on

When ARU is connected with MRU, check if TXD and RXD LEDs at ARU flicks. At this time, check whether external cable is connected MRU and ARU

ROU Optic Comp Operation

ROU has the function of automatically compensating for optical loss. It can do the work for up to 5dBo of optical loss. Set "TX OPTIC COMP" of MRU as "ON." Optical compensation of ROU can not be made without communication with such units in upper level as ODU or OEU. For 1dBo of optical loss, basic TX OPTIC ATT is 12dB; for 5dBo of optical loss, TX OPTIC ATT is 4dB. OPTIC COMP works only one time before it stays dormant.

The figure below shows a screen for OPTIC Information in ROU GUI.

LD POWER means output level of ROU Laser Diode, which is sent to a upper unit by ROU. PD POWER means input level of Photo Diode to be received from a upper unit.

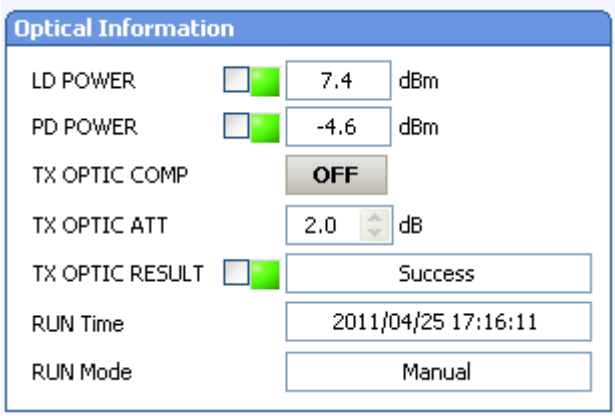


Figure 6.12 –Optical information at ROU

Initially, When ROU is communicated with upper device(ODU/OEU), optical loss compensation is operated automatically. During optical loss compensation, the result window shows "Processing" and then a result value. There are three types of results as follows:

1. Success: The optical compensation is normally completed.
2. Over Optic Loss: Generated optical loss is 5dBo or more.
3. Communication Fail: Communication with ROU is in poor conditin.

Check if TX optic results is success. If the results are over optic Loss, clean optical connector face using clear cloth, and then operate TX OPTIC COMP again.

Also, you can operate optical loss compensation manually. Here, RUN Mode displaies two type as blow

1. Auto : CPU of MRU is operated automatically when is commnincated with upper device
2. Manual : when user operate manually. This result display it

If ROU does not make optical compensation, there will be erors in the budget of system link.

It can cause lower output level or make Spurious Emission not satisfying for a standard.

ROU Setting

MRU can be interfaced with two RU. One is ARU which is provided with additve carrier band. The other is VHF+UHF RU which is provided with public safety service required in the building by compulsion

Through GUI at the MRU, it inquries status and control of MRU itself , ARU and VHF+UHF

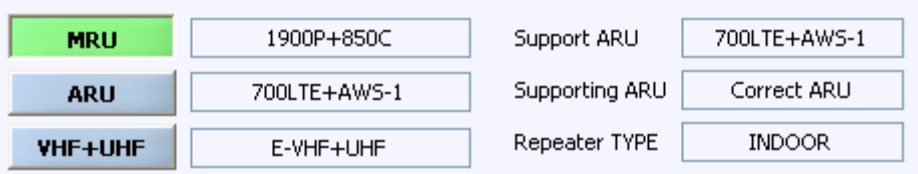


Figure 6.12 –Inserted ROU information at ROU

Clicking the main menu which is MRU,ARU and VHF+UHF, you can inqury and control these units

Set HPA of a corresponding RDU as "ON." Use TX OUTPUT AGS function and set it as a desired output level.

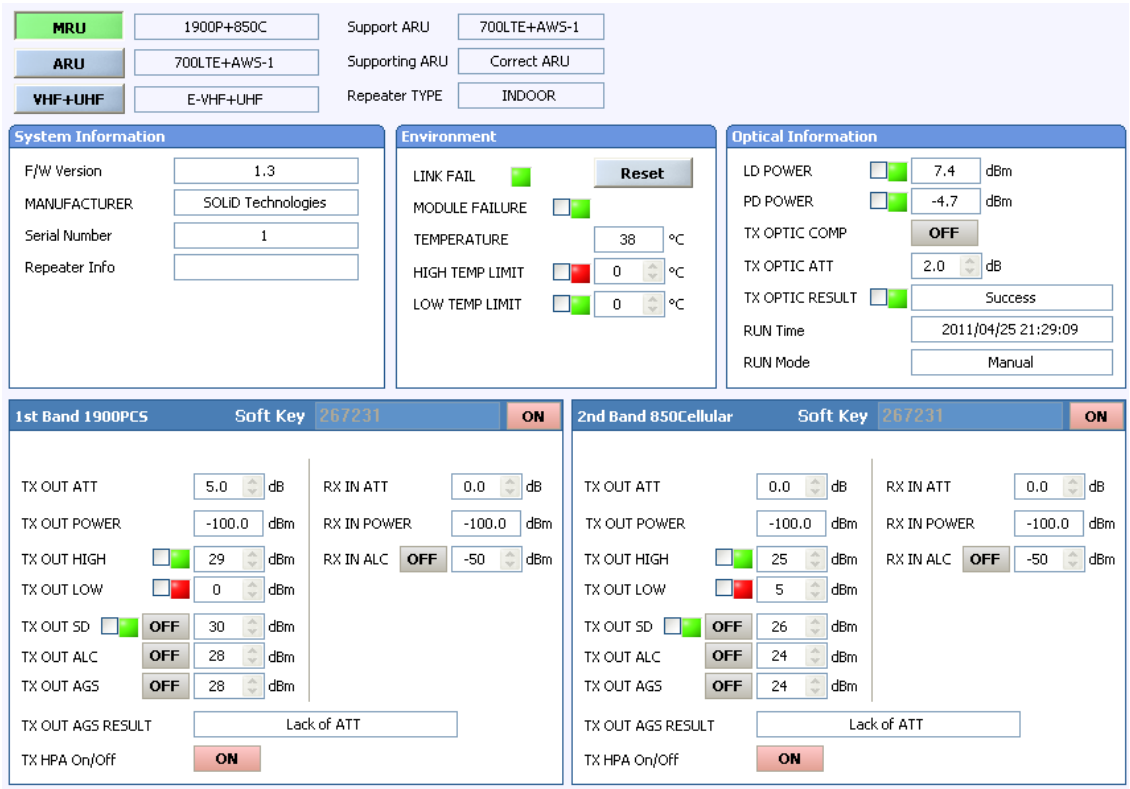


Figure 6.13 –ROU Menu information

The table below shows maximally available Composit Powerlevels that can be set per band:

RDU Band	Power that can be maximally set	Setting range
700LTE	24dBm	0 ~ 24dBm
850Cellular	24dBm	0 ~ 24dBm
1900PCS	28dBm	0 ~ 28dBm
AWS-1	28dBm	0 ~ 28dBm
VHF	24dBm	0~24dBm

UHF	24dBm	0~24dBm

AGS function enables you to adjust output power as you like. While the AGS function is being executed, the Result window shows "Processing" and then a result value. There are three types of results as follows:

A. Success: The AGS function is normally completed.

B. Not Opterate OPTIC Comp: Optic Comp is not executed.

C. Lack of ATT: There is no attenuation available.

Use various upper/lower limits. The following table shows recommended limit settings:

Item	Recommended Limit	Remark
TX OUTPUT HIGH ALM	Max Composit Power+1dB	Alarm
TX OUTPUT LOW ALM	0dBm	Alarm
TX OUTPUT ALC	Max Composit Power	Auto Level control
TX OUTPUT SD	Max Composit Power+2dB	Shutdown
RX ALC	-45dBm	

If TX OUTPUT HIGH ALM is higher than a setting value, alarms will be generated.

If TX OUTPUT LOW ALM is lower than a setting value, alarms will be generated. TX OUTPUT HIGH ALM/LOW ALM tends to work only as warning.

When you activate ("ON") TX OUTPUT ALC, outputs will be restricted depending on a setting output value.

When you activate ("ON") TX OUTPUT SD, output will be turned OFF once output power level reaches the same as SD setting value. Upon SD operation, check output level after 10 minutes and then check the status again.

When you activate ("ON") RX ALC, inputs will be restricted depending on a setting value.

As described above, when normal output level and alarm limit values are set, you need to check if the value of MODULE FAILUER LED Indicator is normally seen green.

For unused bands, you need to use band turning-ON/-OFF function to turn them off.

ROU has softkey function, when softkey is identified with serial number, the band can be activated.

If softkey do not identify with serial number, you can not use these band. The softkey has unique value according to serial number. To use two bands simulatanously, you should enter softkey value.

Figure 6.14 -ROU softkey information

Therefore, ROU has unique serial number and also unique softkey.

6.3 OEU Operation

The figure below shows the level of the system link of SC-DAS (BIU-ODU-OEU-ROU). This section describes OEU-related information. OEU receives various signals through optical modules. The optical signals are converted to RF signal and the RF signal also is amplified to moderate signal level. To transmit to ROU, the signal is converted to optical signal

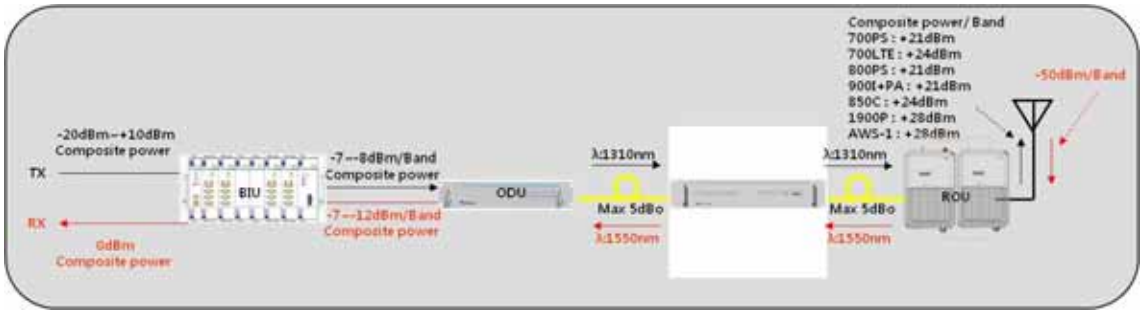


Figure 6.15 -SC-DAS Link Budget for OEU

6.3.1 OEU Operation

OEU is in shelf enclosure type. OEU is located at a remote closet in a building. And it can be installed into a rack.

OEU is for role as hub. It is to expand toward campus cluster, it is only one optical cable to expand 8ROU.This is reason why OEU supports up to 2DOU. The DOU supports up to 4optical port to connect ROU

ROU can work with a DC Feeder and an Optic Cable Feeder. For power supply of OEU, a power supply in DC-DC type is provided

For upper level, OEU can be connected with ODU. It has optical loss compensation function for 5dBo of optical cable loss. The following show operational procedures after installation of OEU.

Checking the status of OEU's LED Indicator

After turning on the switch of the power supply in OEU, check information on each module's LED of the system. The table below shows normal/abnormal cases depending on the status of each module's LED.

Unit	LED		Indicates
EWDM	LD		Green : Laser Diode normal status
			Red :Laser Diode abnormal status
	PD		Green : Photo Diode normal status
			Red : Photo Diode abnormal status, input optic power low alarm
DOU1,2	LD		Green : Laser Diode normal status
			Red :Laser Diode abnormal status
	PD1		Green : Photo Diode(PD) of optic port1 is normal
			Red : PD of optic port1 is abnormal or input optic power low
	PD2		Green : Photo Diode(PD) of optic port2 is normal
			Red : PD of optic port2 is abnormal or input optic power low
	PD3		Green : Photo Diode(PD) of optic port3 is normal
			Red : PD of optic port3 is abnormal or input optic power low
	PD4		Green : Photo Diode(PD) of optic port4 is normal
			Red : PD of optic port4 is abnormal or input optic power low
System	ON		Green : Power on
	TXD1		Green flicker : ECPU send NMS Tx data to BIU
	RXD1		Green flicker : ECPU receive NMS Rx data from BIU
	TXD2		Green flicker : ECPU send NMS Tx data to ROU
	RXD2		Green flicker : ECPU receive NMS Rx data from ROU
	ALM		Green : OEU system normal (no alarm)

		●	Red :OEU system abnormal (alarm)

Checking Communication LED of OEU

Step1 : checking whether communicate with BIU(ODU)

Check if TXD1 and RXD2 LEDs in OEU front LED make communication. Receiving FSK signals from BIU, OEU sends requessted status value to BIU. During reception, RXD1 LED flicks. During tramsmission, on the other hand, TXD1 LED flicks.

Step2 : Checking whether communicate with ROU

OEU do as Hub. OEU has two optical port. One is connected to upper ODU and the others is connected to ROU. Communication with ODU was checked at above step1

Step2 is checking stage whether OEU communicate with ROU. OEU request status to ROU and then TXD2 is flicked and if respones data received from ROU RXD2 LED is flicked

OEU Optic Comp Operation

OEU has the function of automatically compensating for optical calbe loss. It can do the work for up to 5dBo of optical loss. Set "TX OPTIC COMP" of OEU's Eoptic as "ON." Optical compensation of OEU can not be made without communication with such units in upper level as ODU. For 1dBo of optical loss, basic TX OPTIC ATT is 12dB; for 5dBo of optical loss, TX OPTIC ATT is 4dB. OPTIC COMP works only one time before it stays dormant.

The figure below shows a screen for OPTIC Information in OEU GUI.

LD POWER means output level of OEU Laser Diode, which is sent to a upper unit by OEU. PD POWER means input level of Photo Diode to be received from a upper unit.

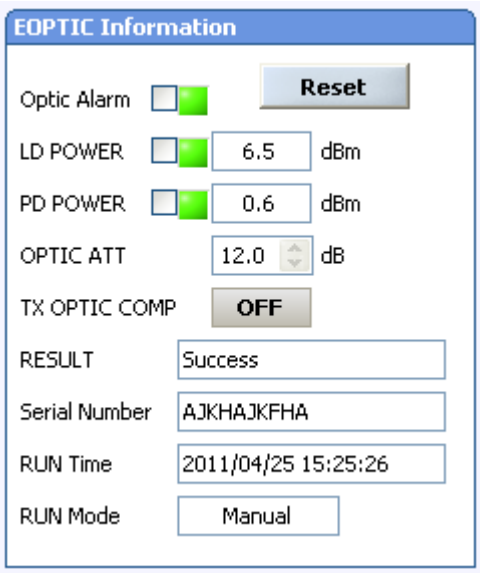


Figure 6.16 –OEU Optical information

Normal LD power level is typically +7dBm±1dBm, PD power is range of +1dBm ~ -5dBm. The results value is same to ROU's optical loss compensation(see the ROU mor detail)

Like ROU, OEU operate optical loss compensation automatically when OEU communicated with upper ODU firstly

During optical compensation, the Result window shows "Processing" and then a result value. There are three types of results as follows:

1. Success: The optical compensation is normally made.
2. Over Optic Loss: Generated optical loss is 5dBo or more.
3. Communication Fail: Communication with ROU is in poor conditin.

OEU can be inserted with two DOU, DOU's behavior is exactly same to ODU(See the ODU more detail)

 If OEU does not make optical compensation, there will be errors in the budget of system link. It can cause lower output level or make Spurious Emission not satisfying for a standard.

Section 7

Additive functions

This chapter describes additive functions of SC-DAS

7.1 Shutdown function (TX output shutdown)

The DAS has an automatic shutdown function to protect the DAS itself and the wireless network when the normal operational conditions cannot be maintained

The DAS shut down automatically when the composite power downlink output power is above the values defined as average for the device for a period not to exceed 5seconds. Criterion level is set through GUI

After automatic shutdown, the DAS may automatically turn-on in order to assess whether the temporary condition has changed. If the condition is still detected, the DAS shall shutdown again. These actions will be repeated 5 times

After 5time repetition, if the condition is still detected, the DAS will be shutdown permanently. The following diagram shows the shutdown logic

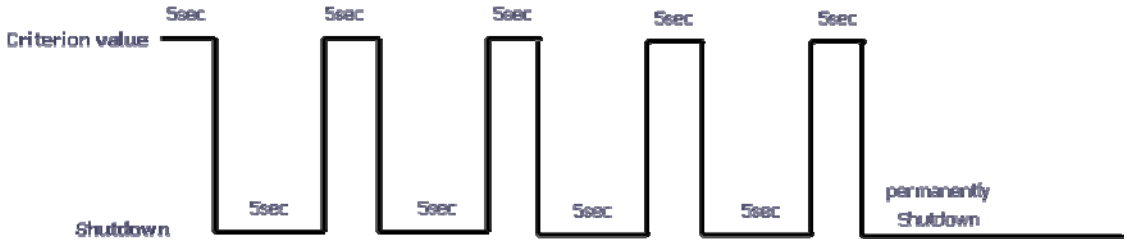


Figure 7.1 -Shutdown logic diagram

After the retry logic exhausts itself, if the DAS still detected a fault status then the DAS will shutdown permanently and illuminate the fault via visual fault indicator

Permanent shutdowns of the DAS will also be reported to the NOC through the NMS

7.2 Total Power Limit function (TX Output ALC)

In order to protect HPA and not to radiate spurious emission, output power don't radiate above defined value which operator set in advance. To execute this function, operator should turn-on the ALC function and set limit level through GUI. If the output power exceed above the defined value, output attenuator is adjusted to operate within defined value. The output attenuator's adjustment range is above 25dB. If output power decease, applied ATT by AGC function return to initial ATT

7.3 Output power automatic setting function (TX Output AGC)

To provide convenience of setting output power at initial setup automatically, operator set to wanting output level and turn-on the AGC function and then output power is automatically set to defined level.

If AGC logic finished, logic operation results show on the result window of GUI. There are three types of results as follows

1. Success: The AGS function is normally completed.
2. Not Opterate OPTIC Comp: Optic Comp is not executed.
3. Lack of ATT: There is no attenuation available.

If normal logic don't executed, changed ATT return to initial ATT

Through output AGC function, can be checked whether optic compensation is executed or not

7.4 Input power AGC function (TX Input AGC)

This function is to give convenience to operator when setting intial installation

Without spectrum analyzer, we can know input power value through power display window of GUI. Use TX IN AGC function and automatically set internal ATT depending on input level. ATT is automatically set based on -20dBm of input . The table below shows TX IN ATT depending on TX IN POWER. For manual setting, you can set ATT depending on input according to the table.

TX IN POWER	TX IN ATT	TX IN POWER	TX IN ATT	TX IN POWER	TX IN ATT
-20dBm	0dB	-9dBm	11dB	+1dBm	21dB
-19dBm	1dB	-8dBm	12dB	+2dBm	22dB
-18dBm	2dB	-7dBm	13dB	+3dBm	23dB
-17dBm	3dB	-6dBm	14dB	+4dBm	24dB
-16dBm	4dB	-5dBm	15dB	+5dBm	25dB
-15dBm	5dB	-4dBm	16dB	+6dBm	26dB
-14dBm	6dB	-3dBm	17dB	+7dBm	27dB
-13dBm	7dB	-2dBm	18dB	+8dBm	28dB

−12dBm	8dB	−1dBm	19dB	+9dBm	29dB
−11dBm	9dB	0dBm	20dB	+10dBm	30dB
−10dBm	10dB				

7.5 Input power limit function (TX Input ALC)

The DAS has TX input ALC function at the BIU to limit level when input power is increased above level by operated input AGC function

Normally, there are more than two input port in the MDBU of BIU

For example, 850cellular band has two input port to support both VzW and AT&T

Two input power may be different each other. The DAS have input attenuator in first stage of MDBU. Through input AGC function, input ATT is adjusted according to input power. If input power increase, input ATT is adjusted again to limit increased input power. Also, if input power decrease input ATT return to initial ATT

7.6 Optical loss compensation

The DAS has the function of automatically compensating for optical loss. It can do the work for up to 5dBo of optical loss. Set "TX OPTIC COMP" of ROU as "ON." Optical compensation of ROU can not be made without communication with such units in upper level as ODU or OEU. For 1dBo of optical loss, basic TX OPTIC ATT is 12dB; for 5dBo of optical loss, TX OPTIC ATT is 4dB. OPTIC COMP works only one time before it stays dormant.

The figure below shows a screen for OPTIC Information in ROU GUI.

LD POWER means output level of ROU Laser Diode, which is sent to a upper unit by ROU.

PD POWER means input level of Photo Diode to be received from a upper unit.

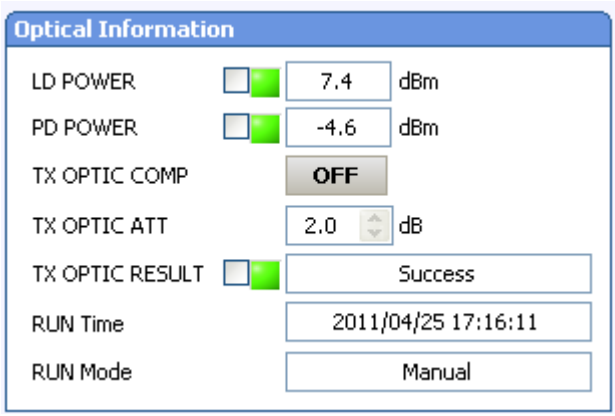


Figure 7.2 –Optical loss information

During optical compensation, the Result window shows "Processing" and then a result value. There are three types of results as follows:

1. Success: The optical compensation is normally competed
2. Over Optic Loss: Generated optical loss exceed 5dBo or more.
3. Communication Fail: Communication with ROU is under poor condition.