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

# *Section5*

## System Installation & Operation

This chapter describes how to install each unit and corresponding fiber cables, along with power cabling method.

In detail, the chapter describes how to install shelves or enclosures of each unit, Power Cabling method , Optic Cabling and RF Interface. Furthermore, by showing power consumption of modules installed in each unit, a the Power Cabling budget is easily determined. Last, it describes the quantity of components of modules to be installed in each unit along with an expansion method.

## 5.1 BIU Installation

### 5.1.1 BIU Shelf Installation

Generally, the BIU is installed in a 19" standard rack. This unit has handles on each side for easy placement. With two mounting holes on each side, you can firmly fix the unit into a 19" rack.

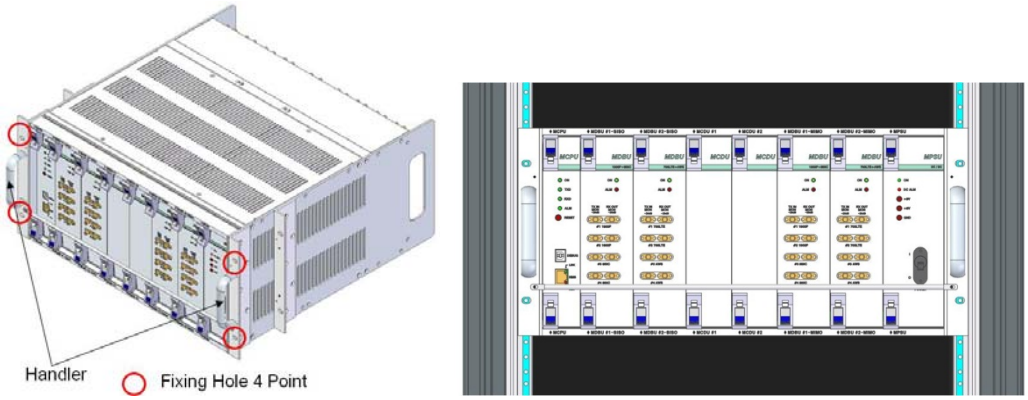



**Figure 5.1 – RACK Installation**

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 frame of the BIU has slots equipped with an MPSU to supply devices with poweran

MCPU to query and control state of each module and a Power Cable to supply power from external rectifiers.

In addition, ther are slots for the MDBUs which provide services for desired band (Optional) and the MCDU to combine and divide TX/RX signals for each SISO and MIMO slots

### 5.1.2 BIU Power Cabling

BIU requires -48VDC input power. Connect DC cable from the power supply to 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 the DVM probe with the GND terminal and then connect "–" terminal with -48V to see if "-48Vdc" voltage is present. After confirming this, connect the power terminal with the terminal of the terminal block seen below.

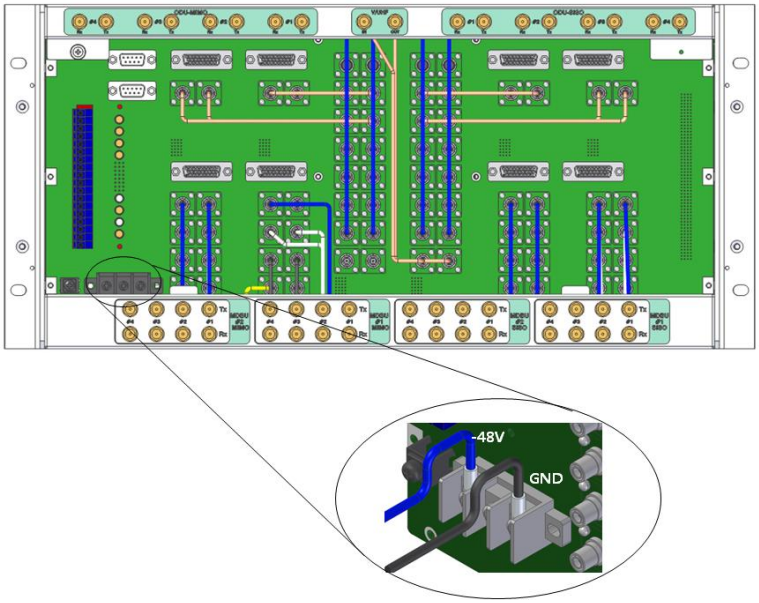
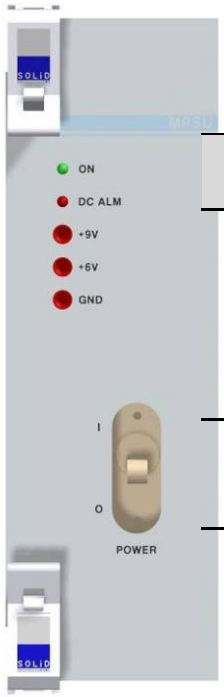



**Figure 5.2 – Power interface diagrm**

Note that BIU does not operate if the "+" terminal and the "–" terminal of the -48V power are reversed.

When you connect -48V power to the BIU, use the ON/OFF switch of the 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 BIU/RF interface

The BIU can be connected with a Bi-Directional Amplifier or Base Station Tranceiver.

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

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

Using a dual band MDBU, the BIU can easily accomodate all frequency bands. As seen in the table below, the MDBU is divided into Single and Dual Bandmodules and each unit can be connected with two carrier signals per band. At the rear of the MDBU, 4 ports represent the inputs for the frequency bands. 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 | 900I+800I MDBU | Dual Band 900I:2Port 800I:2Port | Port#1 | 900I TX(935~940MHz) | 900I RX(896~901MHz) |
| | | | Port#2 | 900I TX(925~940MHz) | 900I RX(896~901MHz) |
| | | | Port#3 | 800PS TX(851~869MHz) | 800PS RX(806~869MHz) |
| | | | Port#4 | 800PS TX(851~869MHz) | 800PS RX(806~869MHz) |
| 5 | 1900P+AWS-1 MDBU | Dual Band 1900P: AWS-1: | Port#1 | 1900P TX(1930~1995MHz) | 1900P RX(1850~1915MHz) |
| | | | | ~1995MHz) | 1900P RX(1850~1915MHz) |
| | | | | ~2155MHz) | AWS-1 RX(1710~1755MHz) |
| | | | Port#4 | AWS-1 TX(2110~2155MHz) | AWS-1 RX(1710~1755MHz) |
| 6 | 700PS+800PS | Dual Band | Port#1 | 700PS TX(763~775MHz) | 700PS RX(793~805MHz) |

On the loadmap

| | | | | | |
|---|---|---|---|---|---|
| | MDBU | 700PS:2Port<br>800PS:2Port | Port#2 | 700PS TX(763~775MHz) | 700PS RX(793~805MHz) |
| | | | Port#3 | 800PS TX(851~869MHz) | 800PS RX(806~869MHz) |
| | | | Port#4 | 800PS TX(851~869MHz) | 800PS RX(806~869MHz) |
| 7 | 900I<br>MDBU | Single Band<br>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<br>MCDU | Dual Band<br>VHF+UHF : 1Port | Port#1 | VHF<br>Tx(136~174MHz) | VHF<br>Rx(136~174MHz) |
| | | | | UHF<br>Tx(380~512MHz) | UHF<br>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 screened as "#1, #2, #3 and #4." From the table above, you need to feed correct signals tothe input and output ports of the corresponding MDBU.

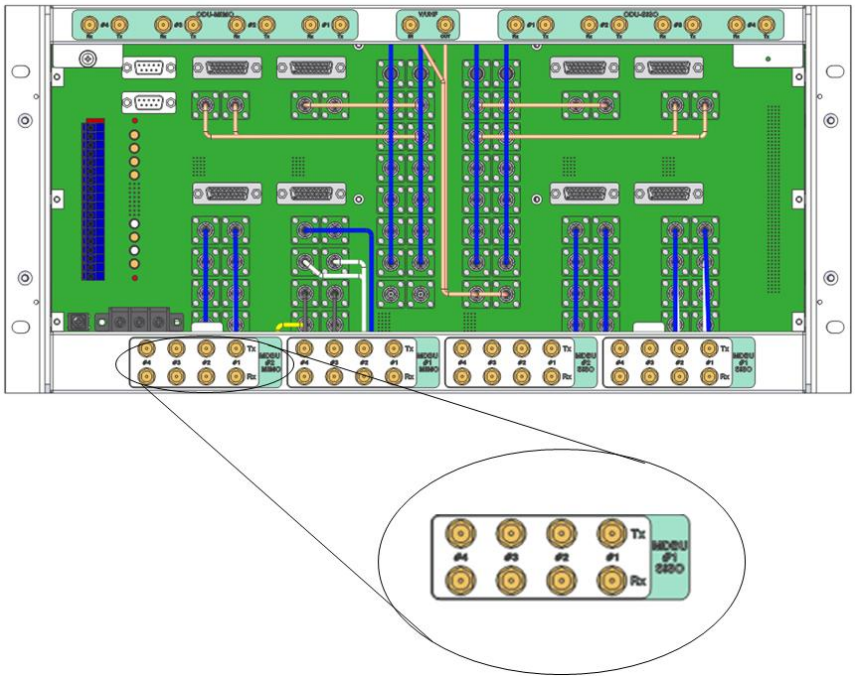


**Figure 5.4 – BIU RF interface diagram**

For each port, TX and RX signals are separated from each other. It is not necessary to terminate unused ports unless you want to.

### BIU interface with Base station Transceiver

Basically, the BIU has separate TX and RX portsso you have only to connect the input and output

ports.

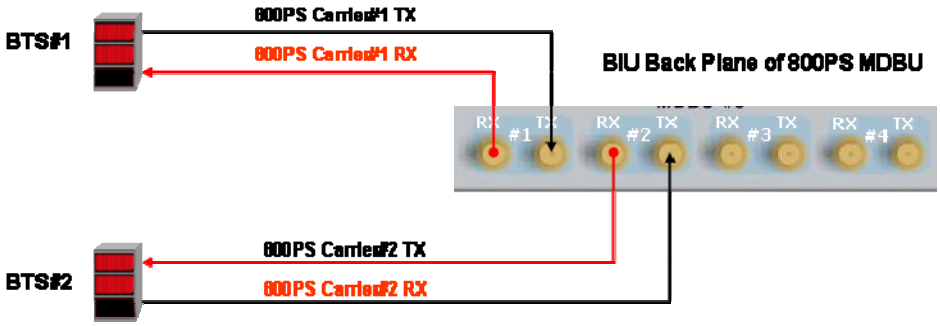



**Figure 5.5 – BTS /BIU connections**

Using a spectrum analyzer or power meter, you need to check signals sent from BTS TX. If the signals exceed input range (-20dBm~+10dBm), you can connect an attenuator between the BTS and BIU to bring the signal level into range.

### BIU interface with Bi-Directional Amplifier

Since the BIU is Simplex format; you need to un-duplex the BDA signal to properly connect it to the BIU.

Using either duplexer or a circulator, you can separate TX/RX signals coming from the BDA

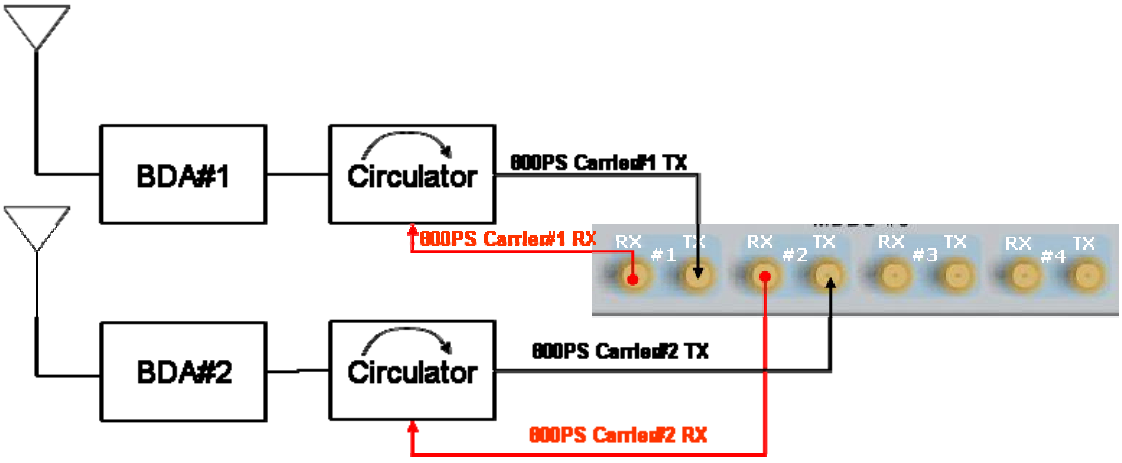



**Figure 5.6 –BDA Interface using Circulator**

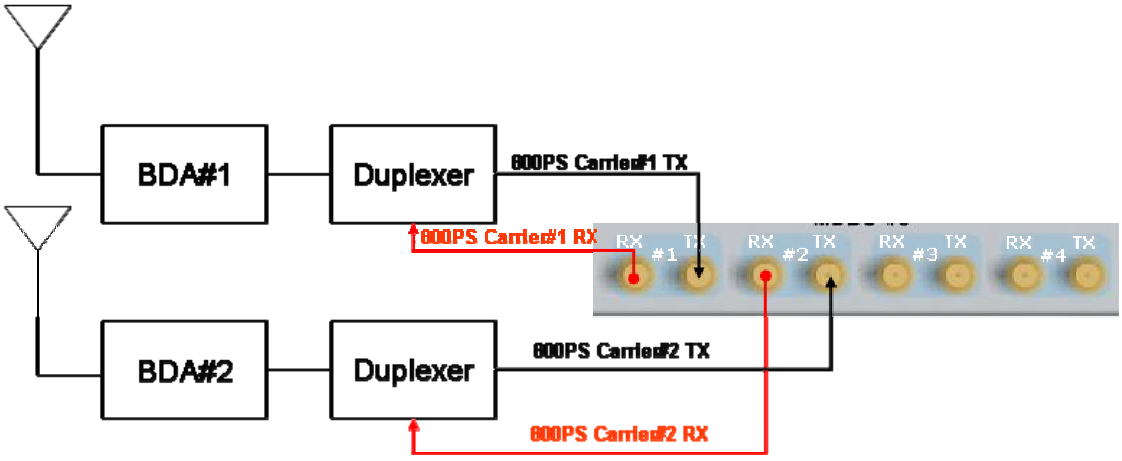



**Figure 5.7 –BDA Interface using Duplexer**

The BIU will work with the BDA in either of the methods above. TX signal level from the BDA must be verified that it is within range of the BIU.

---

Given the BIU TX input range (-20dBm~+10dBm/Total per port), verify it is within the input range, before connecting the ports.

---

### 5.1.4 MDBU installation

MDBU is designed to be inserted into any slot.

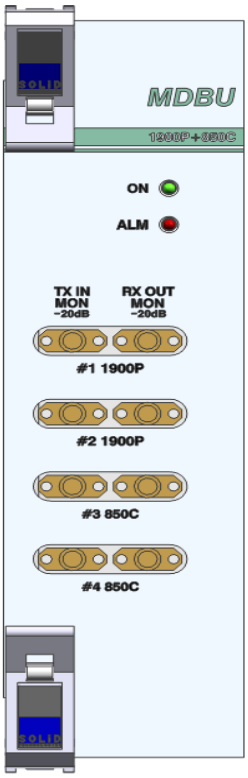
A BIU can be equipped with a total of four MDBUs. If only one MDBU is inserted, you need to insert BLANK cards into the other slots.

---

If you do not terminate input and output ports of the MCDU, which combines TX signals and divides RX signals, it will cause out of band spurious signals. Make sure to insert MDBU BLANK cards into the MDBU slots.

---

When an MDBU is inserted into the BIU, LEDs 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 the MDBU allows you to check the current level of TX input and RX output signals in service without affecting main signals.

TX MON is -20dB below TX Input power and RX MON is -20dB below RX Output power as well.

### 5.1.5 ODU Interface

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

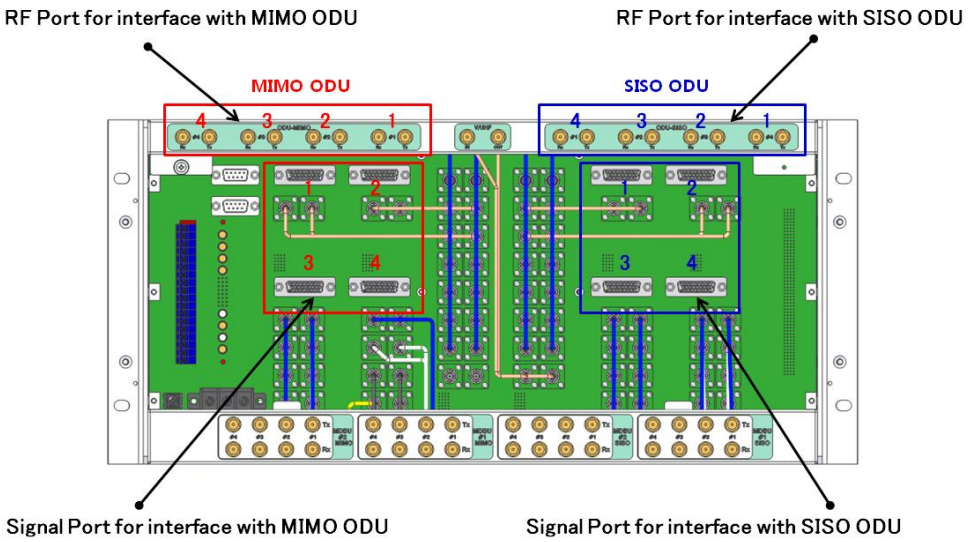



**Figure 5.9 –Interface port between BIU and ODU**

At the rear part of the ODU, the number of RF Ports and Signal Ports are printed in order. Its a good idea to label these in case additional ODUs are needed.

| 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 |

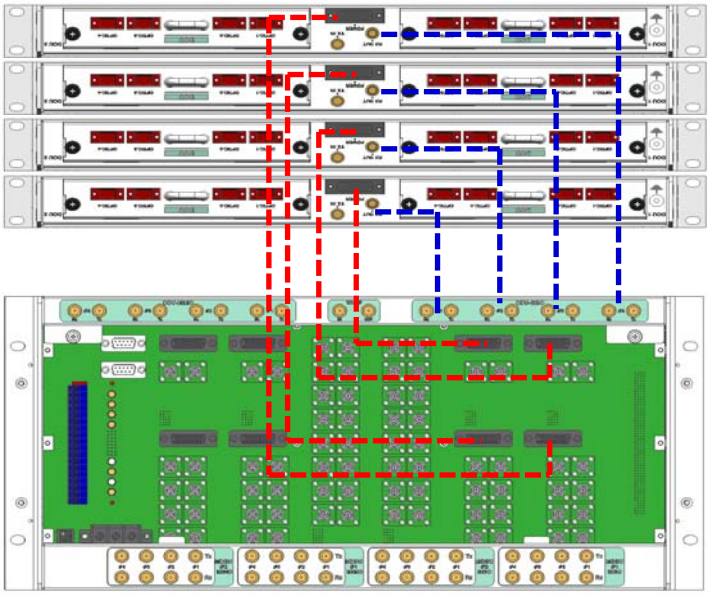


**Figure 5.10 –Cabling interface diagram between BIU and ODU**

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

When installing an ODU above the BIU, it is recommended to leave at least 1RU of space between the two. Heat from BIU rises and could damage the ODU.

### 5.1.6 BIU power consumption

The table below shows power consumption of the 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 | 12W | |
| | 900I+800I | 16W | |
| | 1900P+AWS-1 | - | |
| | 700PS+800PS | On the loadmap | |
| | 900I | - | |

The BIU supplies power for ODU. When you want to calculate total power consumption of the BIU, you need to add power consumption of the 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

The ODU chassis is 1RU in height and 19" wide. It should be inserted into a 19" standard rack and placed above the BIU leaving a 1RU gap between the ODU and the BIU.

### 5.2.2 ODU Power Cabling

The ODU gets power from the BIU.
When you connect a 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

The ODU makes RF-optical conversion of TX signals as well as optical-RF conversion of RX signals. TheODU can be equipped with up to two DOUs. One DOU supports four optical ports and one

optical port can be connected with an ROU. Optionally, only optical port 4 can be connected with OEU for ODU1 and ODU2. ODU3. ODU4 can not connect with OEU.

As WDM is used in the DOU, the unit can concurrently send and receive two different wavelengths (TX:1310nm, RX:1550nm) through one strand of fiber. The DOU has SC/APC fiber connectors.

**Figure 5.11 –SC/APC fiber termination**

For optical adaptor, SC/APC type should be used. To preventcontamination of the fiber end, it should be covered with a cap when not installed. The SC/APC connectors should be cleaned with alcohol prior to installation.

### 5.2.4 DOU installation

Up to two DOUs can be installed in an ODU chassis. The DOU module is a Plug in Play type.

When you insert a DOU in the ODU, insert the unit into the left DOU1 slot first. The slot number is silk screened at the left.

The following figure shows installation diagram of the 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 rear view with DOUs inserted**

 When you insert DOU into ODU, insert the unit into the left DOU1 slot first. Insert a BLANK UNIT in the unused slot.

### 5.2.5 ODU Power consumption

The ODU gets power from the 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 the 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

The ROU enclosure has two options. One meets NEMA4 standard and the other is not waterproof or dirtproof. The ROU can be mounted on a Wall easily. Rack mounting is also possibleusing special frame. There are 3 different types and they will be explained later in this chapter. The ROU consists of anMRU and anARU. Their dimensions are thesame.

The following shows the dimension of the mounting holes for the Wall Mount Bracket.

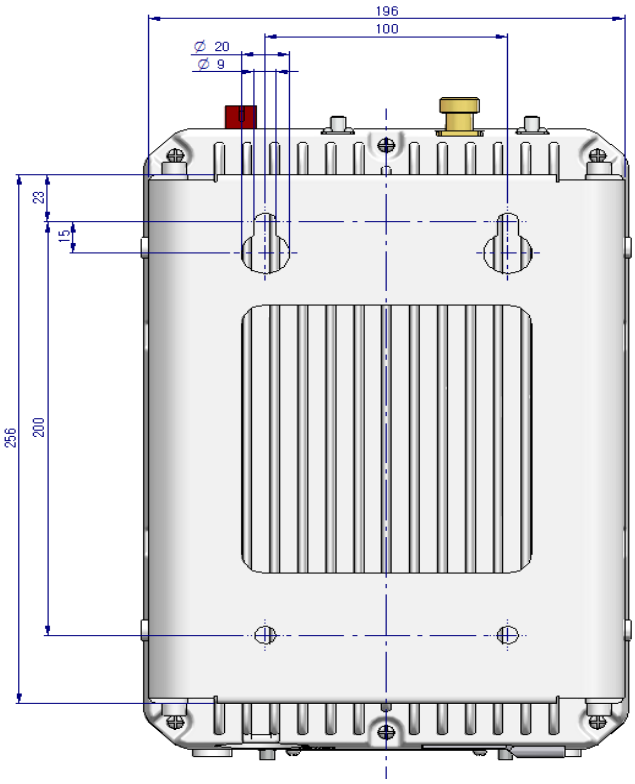



**Figure 5.13 – Wall mount dimensions for the ROU**

### ROU Wall Mount Installation

There are two way to install the ROU on the wall. One is to install ROUs on the wall side by side, the other is stack the ARU above the MRU.

**Type1 : Side by Side installation**

Install M8 mounting Screws roughly half way in, insert the wall mount bracket over the 2 screws and secure it with the last 2 screws.

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

Screw the M6 Wrench Bolts by half at each side of the Heatsink enclosure.

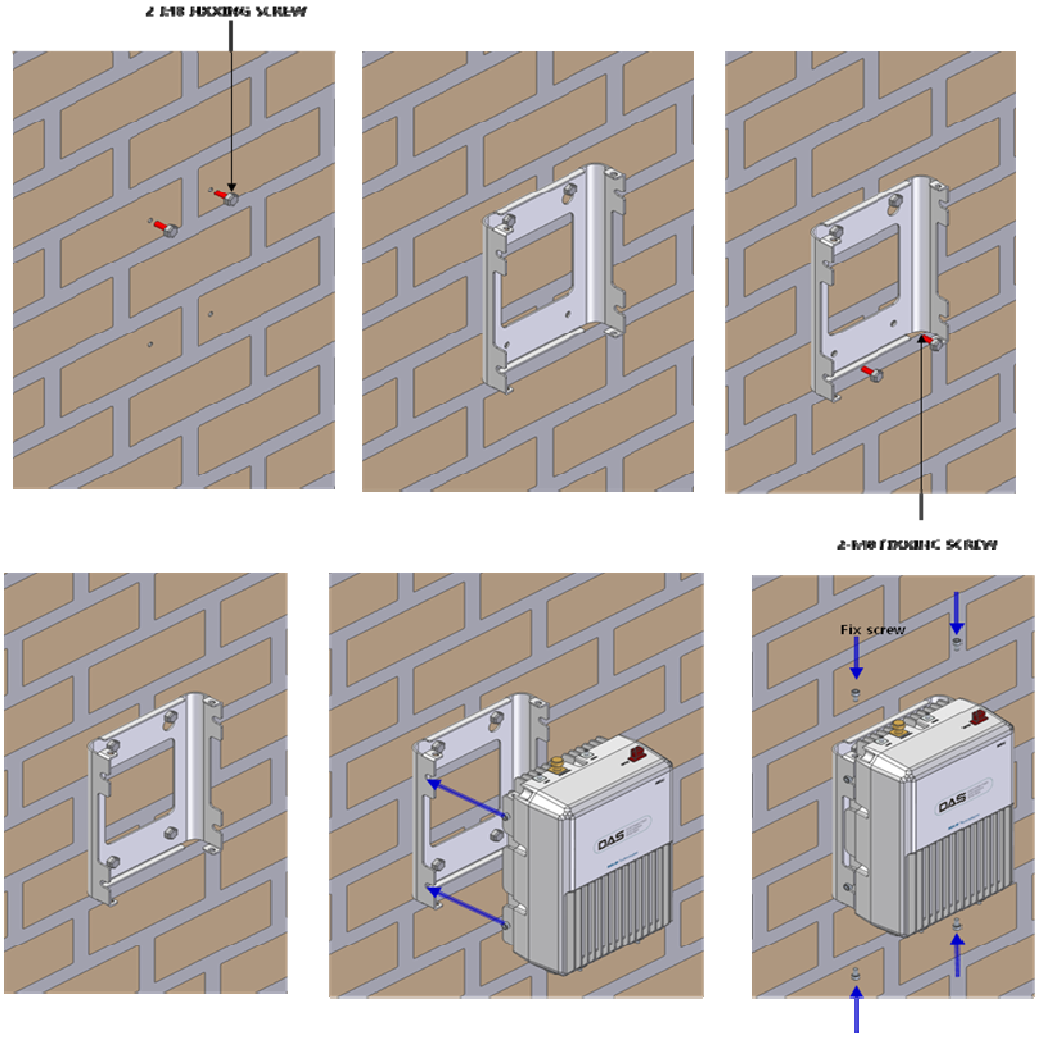



**Figure 5.14 – ROU installation procedure side by side**

Place the enclosure with the M6 Bolt on the mounting groove and mount the M6 Wrench Bolts into the remaining mounting holes.

In this case, you will use 4 M6 Wrench Bolts.

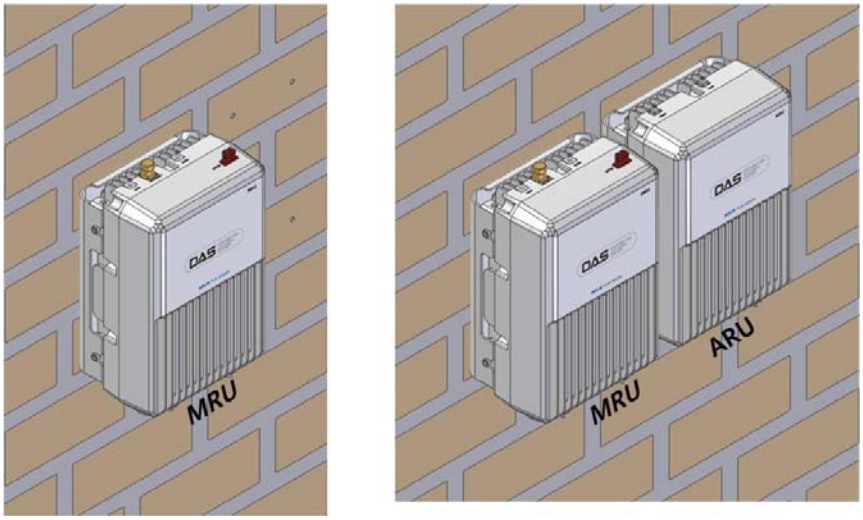



**Figure 5.15 – ROU installation diagram side by side**

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

**Type2 : stacked installation**

If space prohibits the MRU and ARU from being mounted side by side, the units can be installed in a stacked configuration.

Stacking the unit requires a special baracket for stacked installation

First, install the MRU on the wall , then install the bracket for stacked installation on the MRU. Finally install the ARU on the bracket.

Completed installation diagram is as follows

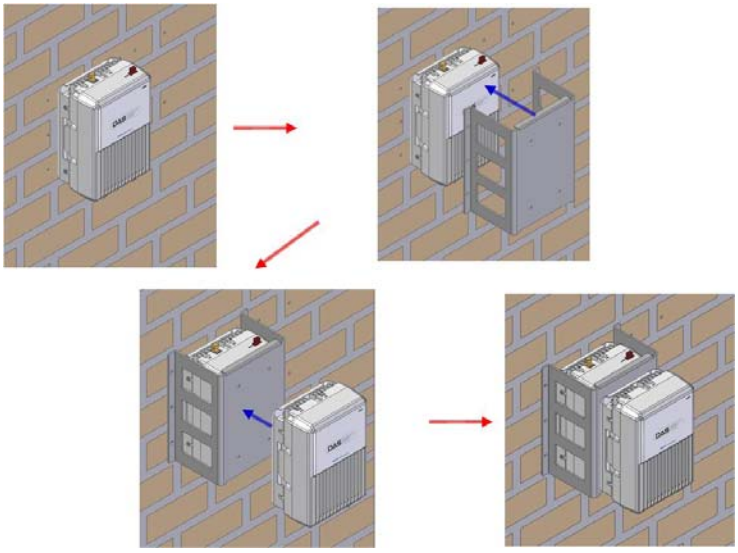


**Figure 5.16 – ROU installation procedure for stacked mounting**

The following shows dimension of the mounting point for the stacked bracket.

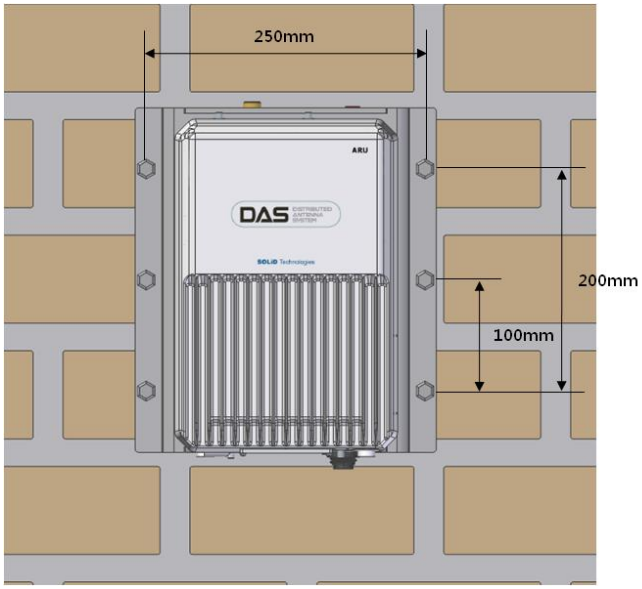



**Figure 5.17 – ROU installation diagram for stacked mounting**

## ROU Rack Mount Installation

There are two ways to install rack mount. 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, a vertical bracket is needed.

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

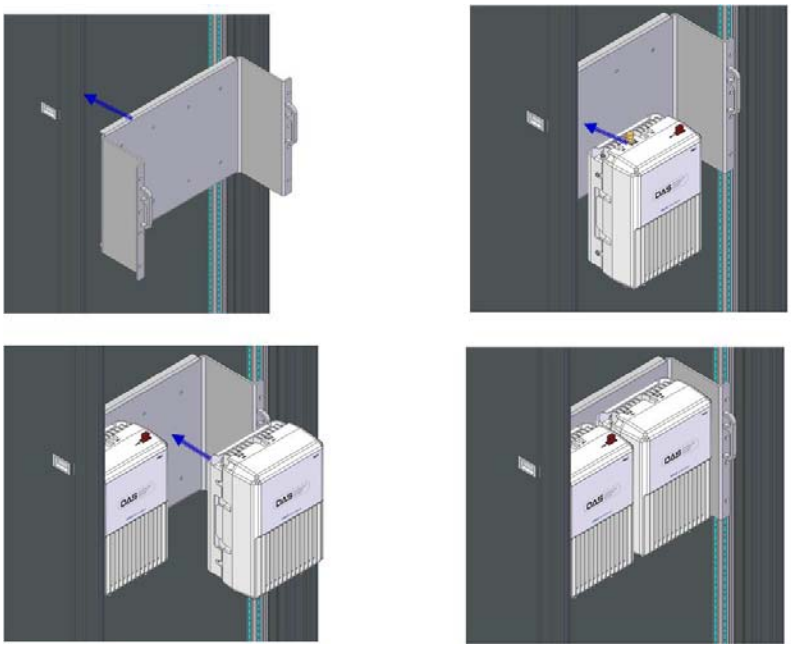


**Figure 5.18 – ROU installation procedure for vertical rack**

The following shows dimension of the mounting point for vertical installation

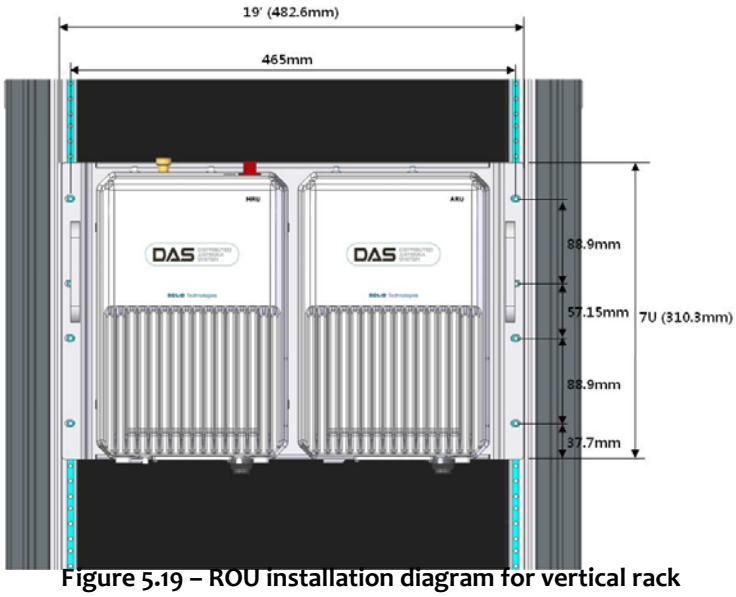



**Figure 5.19 – ROU installation diagram for vertical rack**

**Type2 : Horizontal installation on the rack**

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

Finally, close the front cover of horizontal bracket

Completed installation diagram is as follows

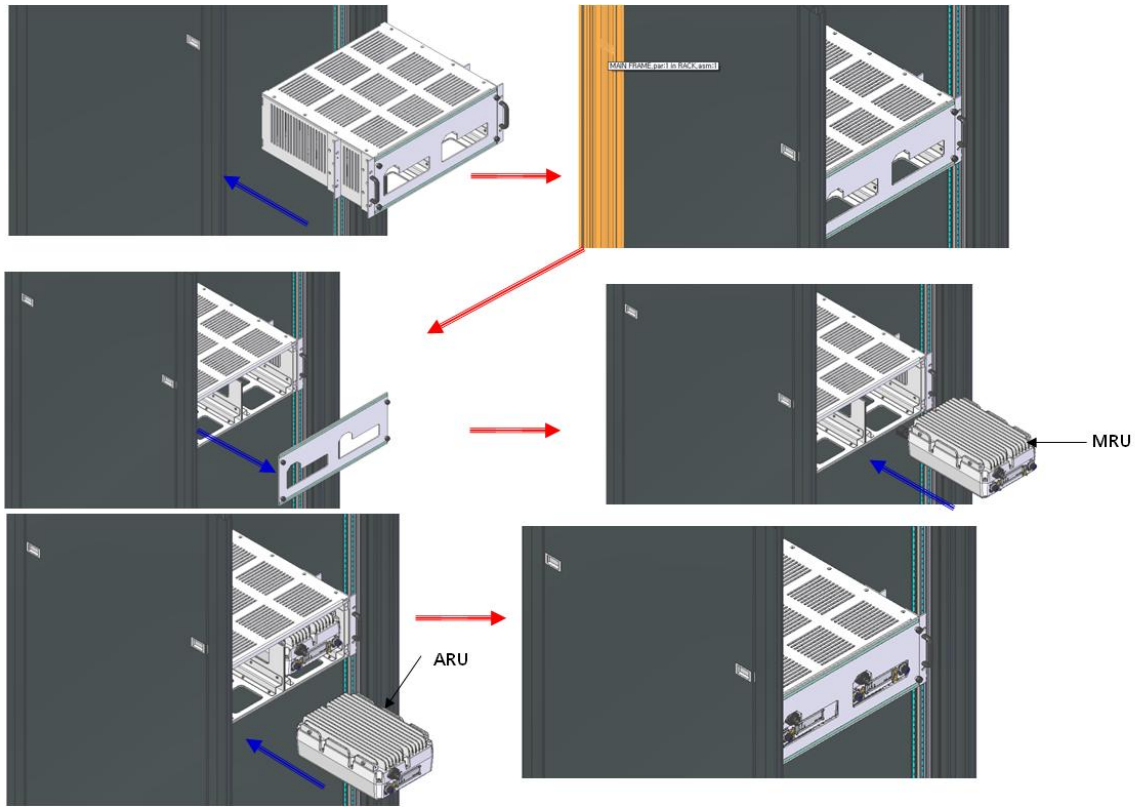



**Figure 5.20 – ROU installation procedure for horizontal rack**

The following shows dimensions of the mounting point for horizontal installation

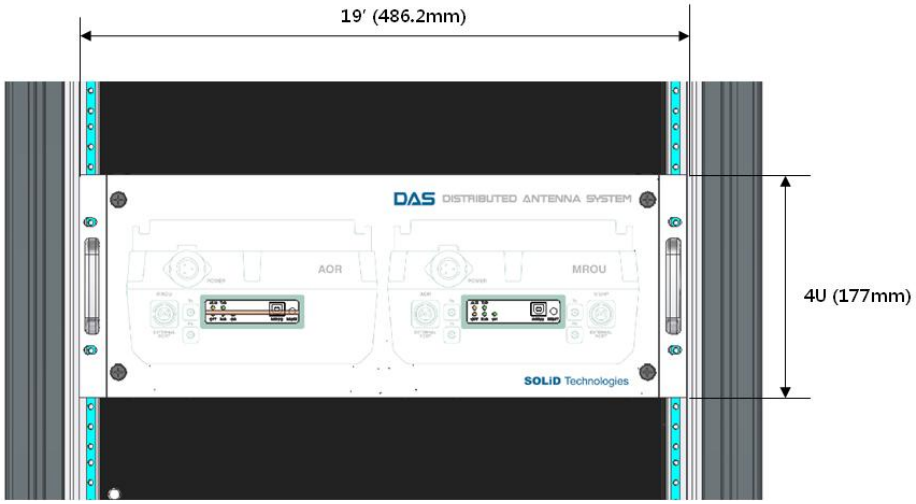



**Figure 5.21 – ROU installation diagram for horizontal rack**

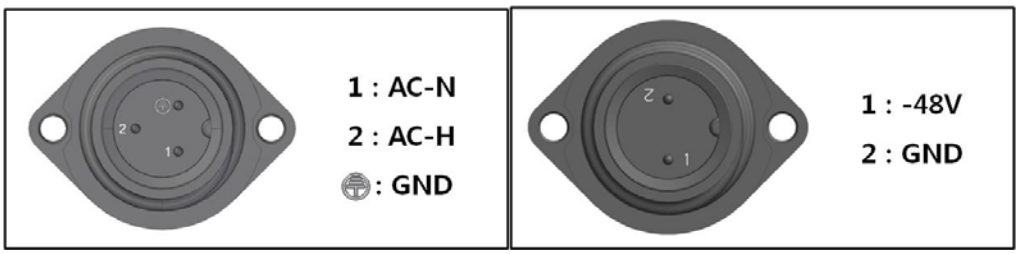
### ROU components

The 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)<br>- 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)<br>- 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

The ROU supports both of DC-48V and AC120V input power. The type of input power for the ROU is already determined at the factory. The ROU is shipped with the correct power cable in the package box. See the UL name plate of the ROU to determine the input power type of the ROU or see the power connector in the below picture. You should order the type of input power as your application.




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

**Figure 5.22 – ROU Power Port view**

Check if your power cord connector is the same as one seen in the table above. The ROU does not have power switch to power on/off. Power supply is on when cord is plugged into the AC source.

### 5.3.3 Optical Cabling

The MRU makes the optical-RF conversion of TX signals from upper the ODU and OEU as well as the RF- optical conversion of RX signals. The MRU has one optical module in it. As WDM is used in the R_OPT module, two separate wavelengths (TX:1310nm, RX:1550nm) can be sent/received with one fiber strand at the same time. The MRU has SC/APC connectors.

To prevent the fiber interface from being marred with dirt, it should be covered with a cap when not installed. Fiber connectors should be cleaned alcohocol to remove dirt before installation .

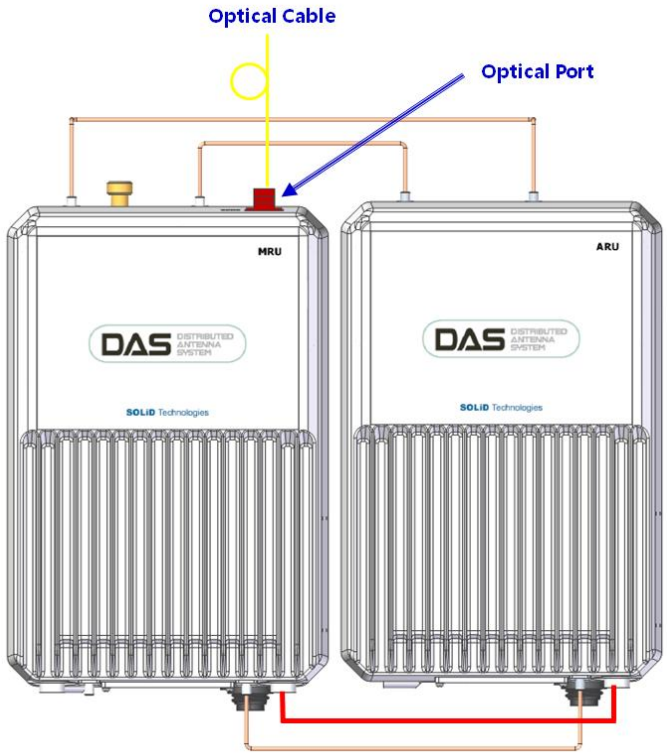



**Figure 5.23 – ROU optical Port view**

Only the MRU has optical port; there is no optical port on the ARU

### 5.3.4 GND Terminal Connection

TheROU has one GND terminal port on bottom side, as shown below

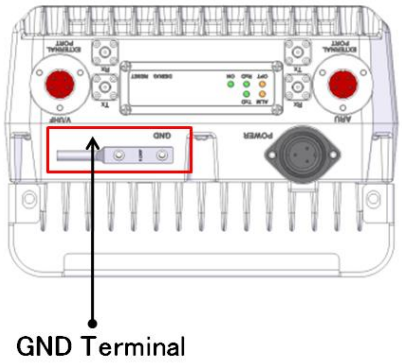



**Figure 5.24 – ROU GND Port view**

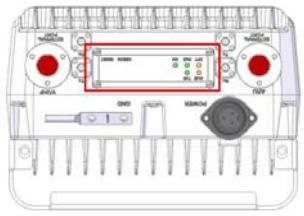
- Take off the GND terminal port from the enclosure and connect to the ground cable. Then reconnect it to the enclosure
- The opposite end of the ground cable should connect to the communication GND of building
- The ground lug is designed meeting the SQ5.5 standard

### 5.3.5 Coaxial cable and Antenna Connection

- The coaxial cables which are connected to DAS connect to antenna port of the ROU. Before connection, check the VSWR of the coaxial cable using a SiteMaster to verify whether it is within tolerance.
- The Return loss should be better than 15dB or VSWR should be below 1.5: 1.
- Make sure the antenna connector is tightened properly and free of any dirt or insects.
- The antenna connected to the ROU is only for inbuilding use.
- Only the MRU has an antenna port. The ARU transmits its signal through RF cable connected to both the MRU and ARU

### 5.3.6 LED explanation on ROU

The ROU has an LED panel at the bottom of ROU. The LED indicator is explained 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 | | Flashing when data send to upper unit |
| RXD | | Flashing when data receive from upper unit |

**Figure 5.25 – ROU LED indicator information**

### 5.3.7 ROU Power consumption

The following table shows power consumption of the ROU

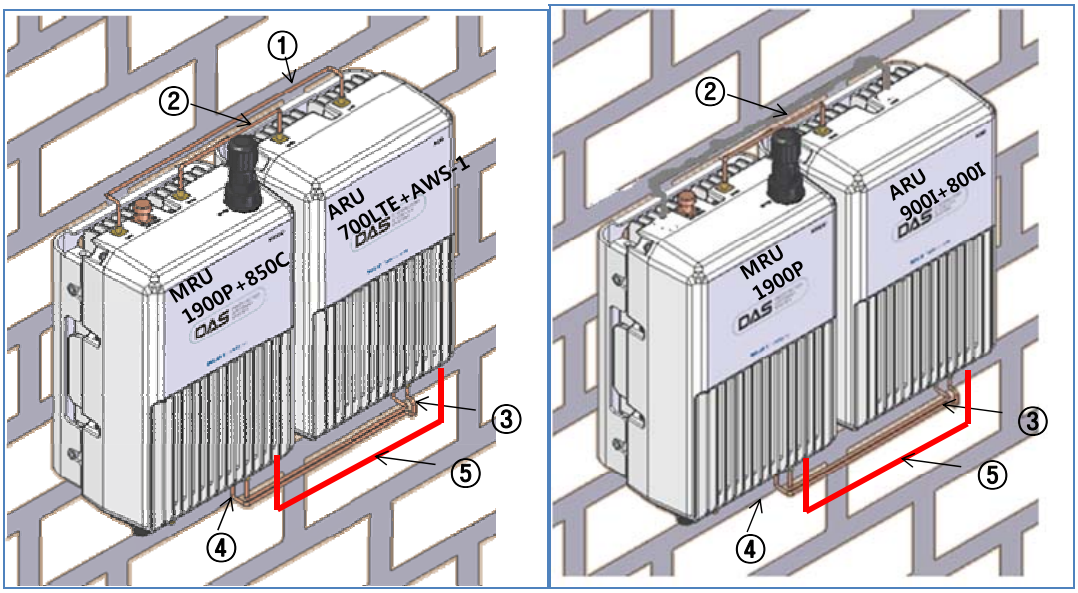
| Part | Unit | Consumption Power | Remark |
|---|---|---|---|
| MRU | 1900P+850C supporting ARU 700LTE+AWS-1 | 50W | Dual Band |
| | 1900P supporting ARU 900I+800I | 45W | Single Band |
| | MRU 700LTE+AWS-1 | 50W | Dual Band |
| ARU | 700LTE+AWS-1 | 40W | Dual Band |

| | | | |
|---|---|---|---|
| | 900I+800I | 44W | Dual Band |

### 5.3.8 Cable connection between MRU and ARU

MRU has only antenna port, ARU output port should be connected with MRU. MRU transmit all frequency band into one antenna after combining with ARU signal

Figure below shows connection diagram between MRU and ARU




(a)MRU1900P+850C/ARU700LTE/AWS-1 (b)MRU1900P/ARU900I/800I

Figure 5.26 – Cable connection between MRU and ARU

| Cable | Description | MRU Name | ARU Name | Remark |
|---|---|---|---|---|
| ① | Coaxial cable | High | High | |
| ② | Coaxial cable | Low | Low | |
| ③ | Coaxial cable | TX | TX | |
| ④ | Caaxial cable | RX | RX | |
| ⑤ | Signal cable | External port | External port | |

## 5.4 OEU Installation

OEU is used to expand the ROU in a multi building environment.

The 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 chassis installation

The OEU chassis is 2RU in sizeand can be inserted into a 19" Standard Rack. The OEU is in a Remote Closet, providing optical ports for the ROU.

The following table shows power consumption of OEU:

| No. | Unit | Description | Remark |
|---|---|---|---|
| Common Part | Chassis | 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 Ports | Up to 2EA to be inserted |

### 5.4.2 OEU Power Cabling

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

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

Before connecting the power terminal, Verify that -48VDC is present by connecting the power supply to a DVM with "-" terminal to positive and "+" terminal to GND of the DVM. If voltage is correct, connect the power terminal through the terminal seen below.

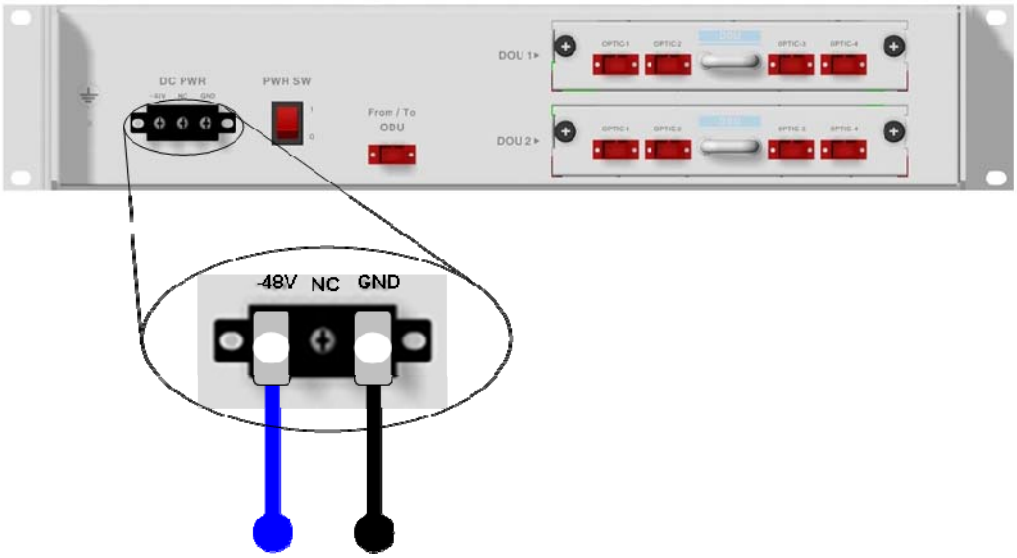



**Figure 5.26 – OEU Power interface diagram**

Note that OEU does not operate if the "+" terminal and the "–" terminal of the -48V power supply are reversed.

### 5.4.3 OEU Optic Cabling

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

Having EWDM built in the OEU, it makes the RF-optical conversion of TX signals from ODU as well as the optical-RF conversion of RX signals. In addition, the OEU can be equipped with up to two DOUs. One DOU supports four optical ports and one optical port can be connected with the ROU. With WDM in the DOU, the unit can concurrently send/receive two different wavelengths (TX:1310nm, RX:1550nm) through one strand of fiber. The DOU has SC/APC connectors.

**Figure 5.27 – Optical cable with SC/ACP Type Connectors**

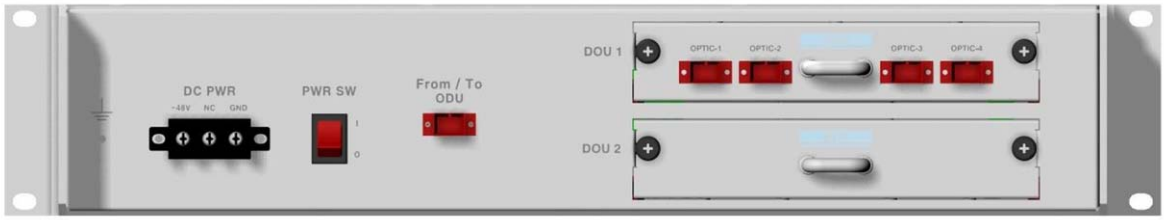
SC/APC type connectors must be used. To prevent the optical access part from being marred with dirt, it should be covered with a cap when not installed. Connectors should be cleaned with alcohol before they are installed.

### 5.4.4 DOU installation with an OEU

Up to two DOUs can be inserted into an OEU chassis. The DOU module is a Plug in Play type.

When you insert the DOU into the OEU, insert it into the top DOU 1 slot first. Slot numbers are silkscreened on the left.

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




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

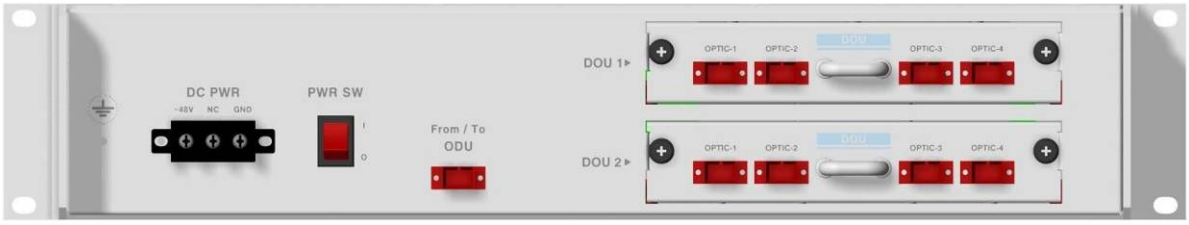



**Figure 5.28 – OEU with DOUs inserted**

When you insert a DOU into OEU, use the DOU 1slot first. For unused slots, you nedd to install

BLANK UNIT into them.

### 5.4.5 OEU Power Consumption

The OEU has a -48V DC Power supply in it. The OEU can be equipped with up to two DOUs. Depending on the number of DOUs, power consumption will vary.

The following table shows power consumption of the OEU:

| Part | Unit | Consumption Power | Remark |
|---|---|---|---|
| Common Part | Shelf | 12W | |
| | EWDM | | |
| | ERF | | |
| | EPSU | | |
| OEU_4 | DOU 1 EA | 23W | |
| OEU_8 | DOU 2 EA | 39W | |

# *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 Overview

### 6.1.1 BIU

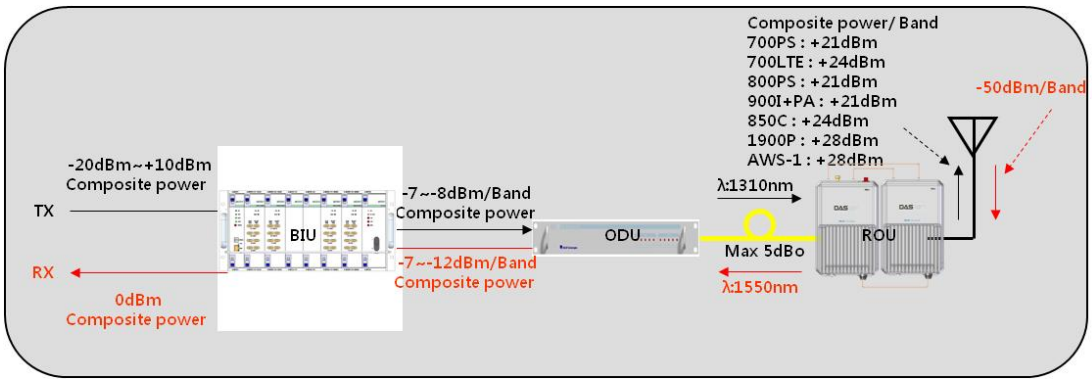



**Figure 6.1 – SC-DAS Link budget for the BIU**

### 6.1.2 BIU TX parameters

The TX level to be sent to the BIU should be in the range of -20dBm to + 10dBm. If the level exceeds the range, you need to connect an attenuator to the front end of the BIU input and adjust the level in the corresponding range. If TX input is too low, maximum power cannot be achieved so you need to increase the output power of BDA or adjust attenuation amount of BTS's coupler adjust the level of the ATT.

Using a spectrum analyzer, check all bands and verify if they are in an appropriate level before making connection with input port of the BIU. Last, check to see if there are spurious signals.

Select an MDBU with the desired frequency bands and . insert it into the BIU and check to see if it works normally. For the MDBU, up to two TX inputs are provided. Input level per port is -20dBm to+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 the MDBU into the BIU. Check if the "ON" LED Indicator at the front panel of MDBU is lit green. Make a connection with DEBUG port of the MCPU through USB Cable

Check if the ID of MDBU module is located in those SISO MDBU#1& 2,MIMO MDBU#1& 2 slots of the MDBU through the 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.

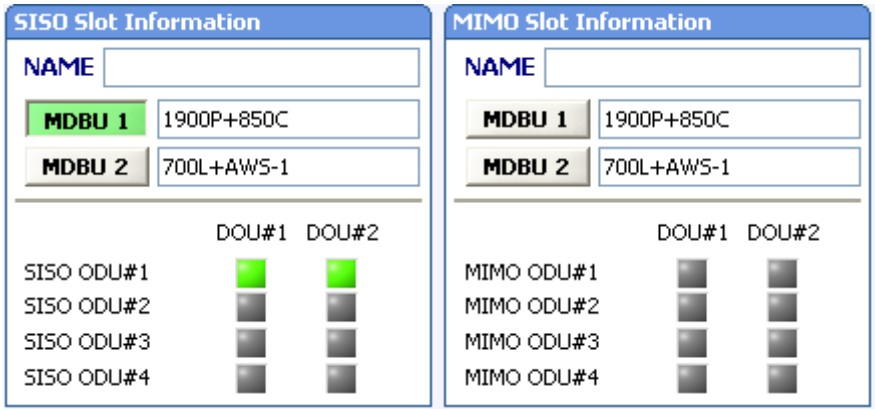



**Figure 6.2 –MDBU information assigned at theBIU**

Check if the MDBU is inserted into a corresponding slot of theBIU. 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 have up to two MDBUs. These MDBUs can be different combinations as per your application

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

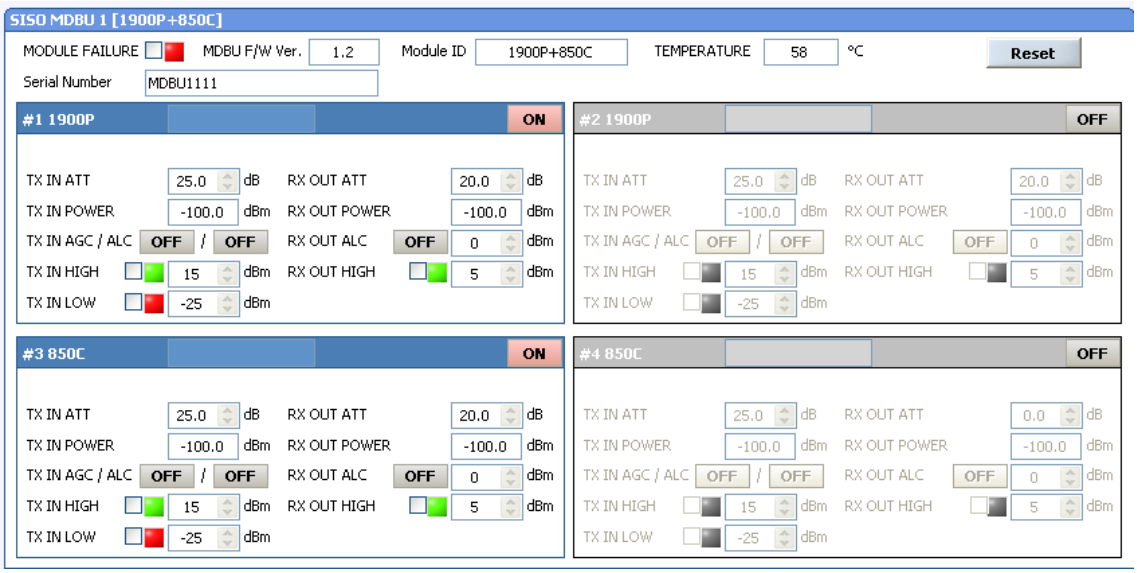



**Figure 6.3 –MDBU menu information at the BIU**

⚠. Make sure to turn OFF unused ports.

The table below shows output power vs number of ports

| MDBU Band | Output level (Composite power) | No. of Max port (N) |
|---|---|---|
| 700LTE | 24dBm-10*LOG(N) | 2 |
| 850Cellular | 24dBm-10*LOG(N) | 2 |
| 1900PCS | 28dBm-10*LOG(N) | 2 |
| AWS-1 | 28dBm-10*LOG(N) | 2 |
| 900I | 26dBm-10*LOG(N) | 2 |
| 800I | 26dBm-10*LOG(N) | 2 |
| 700PS | On the loadmap | 2 |
| VHF | | 1 |
| UHF | 24dBm-10*LOG(N) | 1 |

Check if the level of TX IN POWER is the same as the value measured with spectrum analyzer(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 | | | | |

The MDBU cards in the BIU provide ALC (Auto Level Control) functionality for each of the inputs to limit the maximum power output per carrier input. The input level starts activating ALC at -20dBm when turning the ALC on. For correct parameter settings, first, perform the input AGC and then turn the ALC function on.

Edit the port name 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.

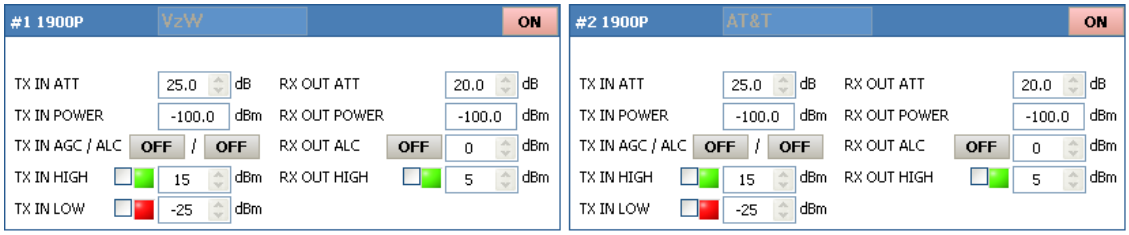



**Figure 6.4 –MDBU name assignment at theBIU**

This naming is reflected at the tree as follows

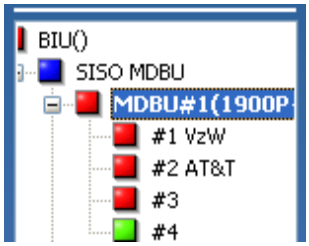



**Figure 6.5 –MDBU name assignment at the tree**

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 |

After you finish setting normal input levels and alarm limits, check to see if the MODULE FAILURE LED Indicator is lit green (Normal case).

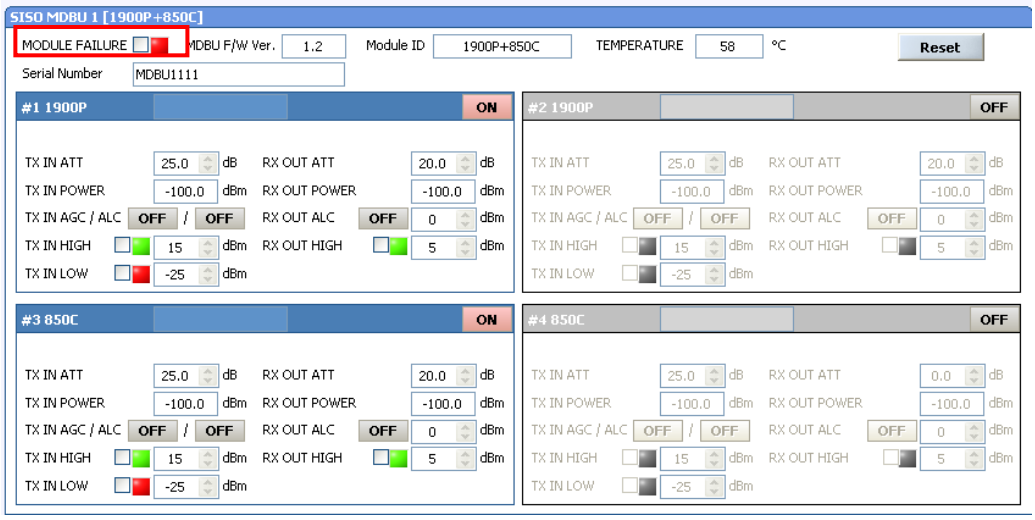



**Figure 6.6 –MDBU Module Failure information at the BIU**

### 6.1.3 BIU RX parameters

For RX operation at BIU, you need to set RX gain to prevent the 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 a desired RX 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 prevent high level signals from entering the BTS or BDA, keep ALC mode activated (ON).

### 6.1.4 BIU Logic Sequence Diagram

The BIU controls the overall system, working as as the head end unit of any system. The BIU connects with units such as ODU, OEU and ROU.

The tree hierarchy automatically displays the components connected to the system and communicate with lower units while collecting the status of the units.

The menu below shows topology for overall units.

**Basic topology for SC-DAS**

**Configuration of BIU-ODU-ROU**

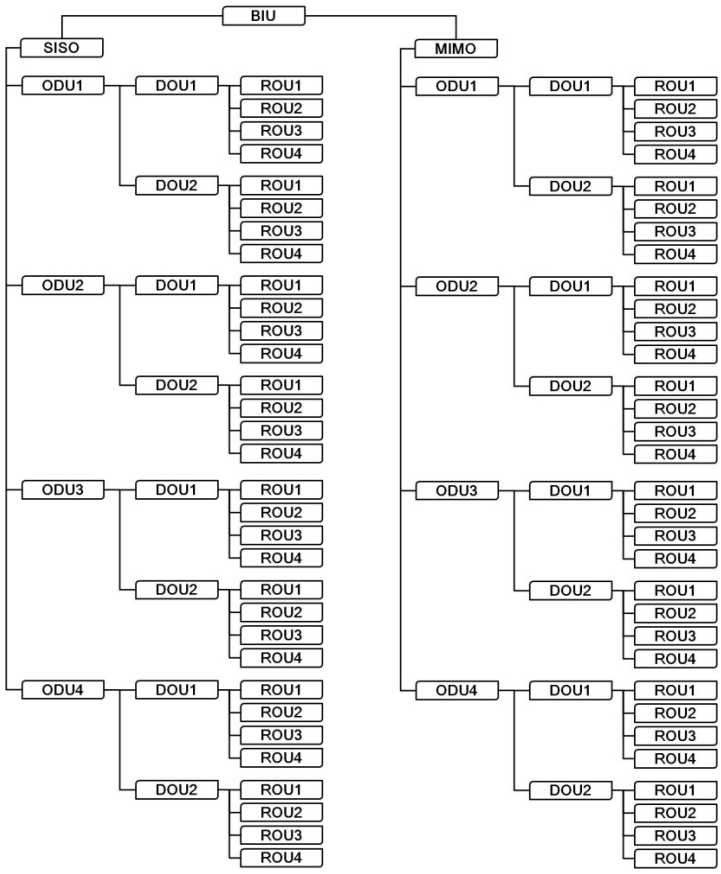



**Figure 6.7 –Configuration of BIU-ODU-ROU for basic topology**

The BIU has two paths : SISO and MIMO. Each path has capability to connect up to 4ODUs, one ODU can be connected up to 8ROUs.Therefore, the number of ROUs per path is 32. Regarding the MIMO path, One BIU can connect up to 64 ROUs

## Expansion topology for SC-DAS

## Configuration of BIU-ODU-OEU-ROU

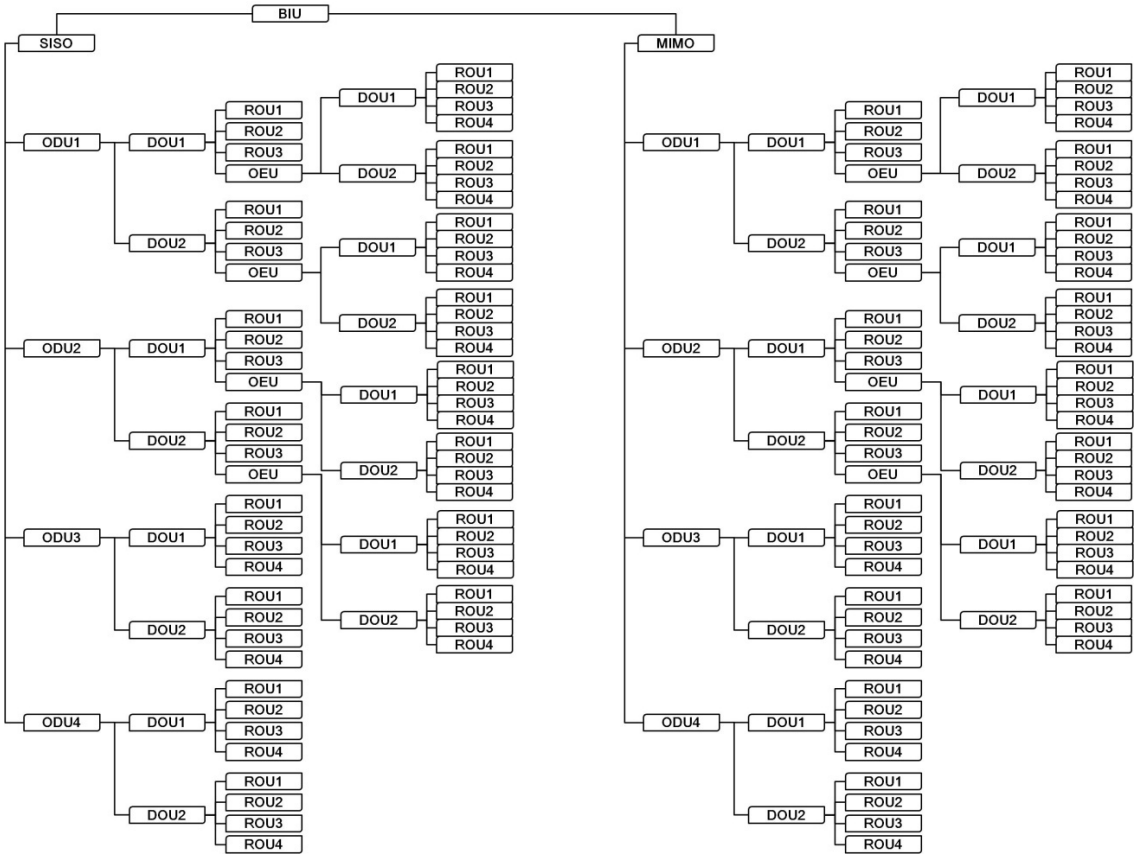



**Figure 6.8 –Configuration of BIU-ODU-ROU for expansion topology**

Using an OEU allows you to expand for additional ROUs as shown in the tree structures. Looking at the above tree hierarchy, an OEU can be connected with ODU1and2 only and regarding the optical port of a DOU, the OEU can only connect to the fourth optical port. If you try to connect the OEU ports 1 thru 3 of the DOU, the BIU won't communicate with it. This tree hierarchy is generated automatically as the ROU/OEU is connected at the ODU optical port

### 6.1.5 Interaction with the BIU

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

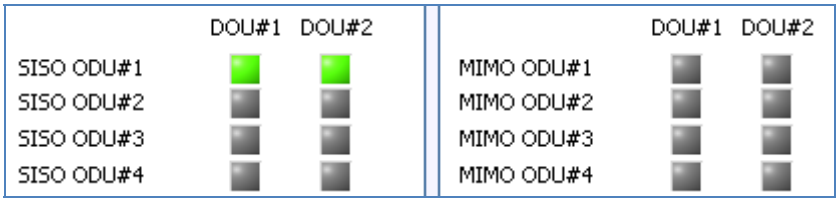



**Figure 6.9 –DOU assignment at the BIU**

When you select the ODU screen from the left TREE panel, you can see the DOU 1 or DOU 2 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 unused optical port is seen de-activated in grey.

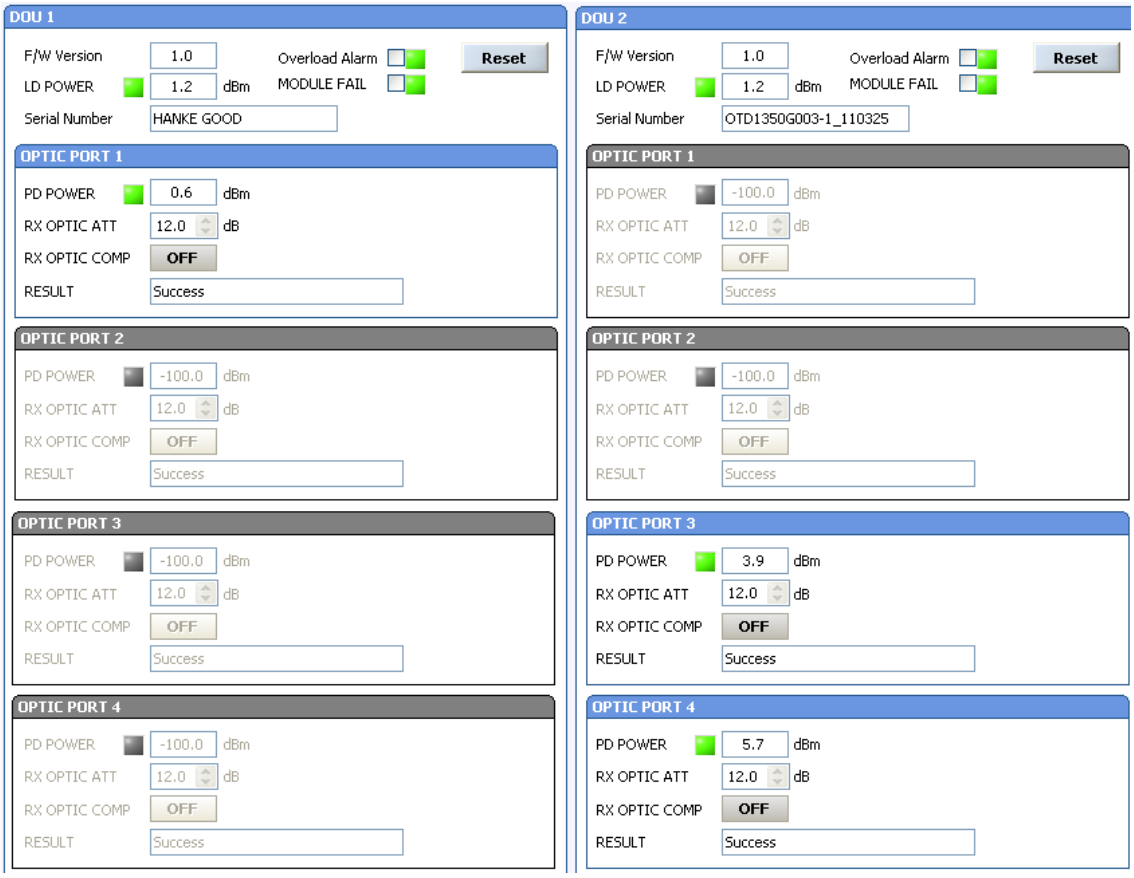



**Figure 6.10 –ODU Menu information**

The level of DOU's Laser didoe is typically +1.5±1dBm. DOUs 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 connectors.

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

Furthermore, the ODU has the function of automatically compensating for optical cable loss.

Initially, if BIU communicates with the lower Unit(OEU,ROU), the optical loss compensation is automatically affected.

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.

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

## 6.2 ROU Overview

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

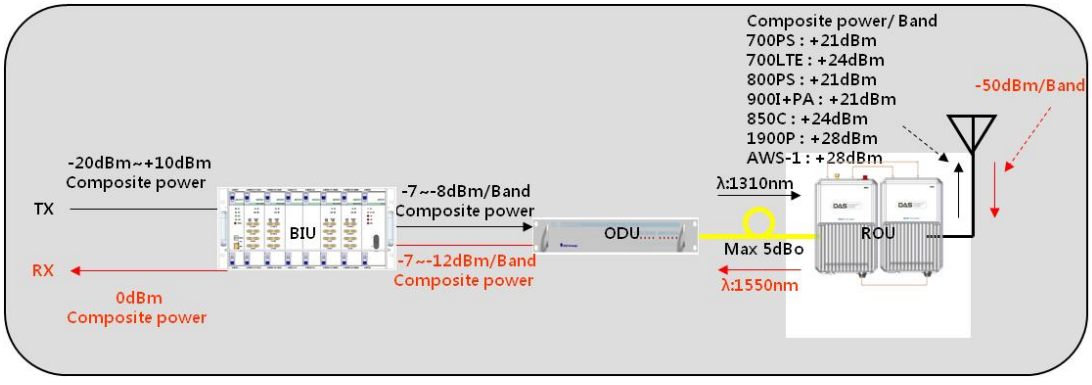



**Figure 6.11 –SC-DAS Link budget for ROU**

### 6.2.1 ROU Operation

The ROU is a one-body enclosure type and is located at a remote closet in the building. It can be installed on a wall or into a rack.

Basically, only one antenna port is provided. To install multiple antennas, you need dividers and/or couplers. The ROU can work with a DC Feeder and an Optic Cable Feeder. To power the ROU, a power supply of either AC-DC or DC-DC can be selected depending on the application.

For upper level, the ROU can be connected with the ODU and OEU. It has an AGC function for 5dBo of optical cable loss.
The following shows operational procedures after installation ofthe ROU.

#### Checking the status of ROU's LED Indicator

When power cable is plugged into an outlet, power is provided for the 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 | | Flashing when data send to upper unit |
| RXD | | Flashing when data receive from upper unit |

#### Checking Communication LED of ROU

Check if TXD and RXD LEDs in the MRU make communication. Receiving FSK signals from the BIU,

the ROU sends requested status value to the BIU. During reception, RXD LED blinks. During tramsmission, , TXD LED blinks. At this time, you need to see if whether to use a corresponding ROU is checked on

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

## ROU Optic Comp Operation

The 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 the MRU to "ON." Optical compensation of ROU can not be made without communication to the ODU or OEU. For 1dBo of optical loss, basic TX OPTIC ATT is 1dB; 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 references the output level of ROU Laser Diode which is sent to a upper unit by the ROU.

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

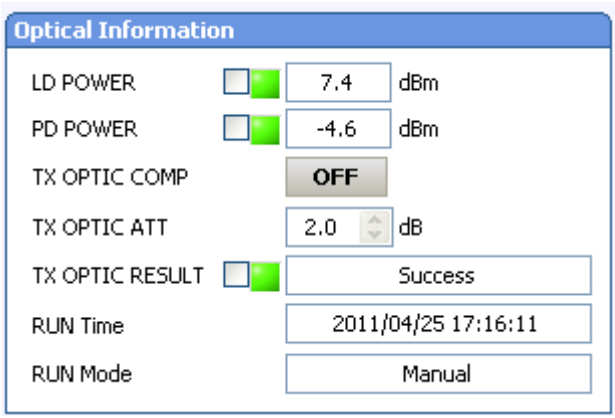



**Figure 6.12 –Optical information at the ROU**

Initially, When the ROU communicates with the upper device(ODU/OEU), optical loss compensation is done automatically. During optical loss compensation, the result window shows "Processing" and then a result valueis displayed. 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 condition.

Continue if TX optic result is successful. If the results are “over optic Loss”, clean optical connector face using clear cloth, and then operate TX OPTIC COMP again.

Also, you can perform optical loss compensation manually. Here, RUN Mode displays two types as shown below

1. Auto : CPU of MRU is performed automatically when is commnincated with upper device
2. Manual : when user performs manually. This result willdisplay

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If ROU does not make optical compensation, there will be erors in the system link budget . It can cause lower output levels or make Spurious Emissions detrimental to the system.

## ROU Setting

The MRU can be interfaced with two RUs. One is an ARU which is provided with an extra carrier band. The other is a VHF+UHF RU which is provided with public safety service required in the building code.

Through the GUI at the MRU, it queries the status and control of the MRU, the ARU and the VHF+UHF RU

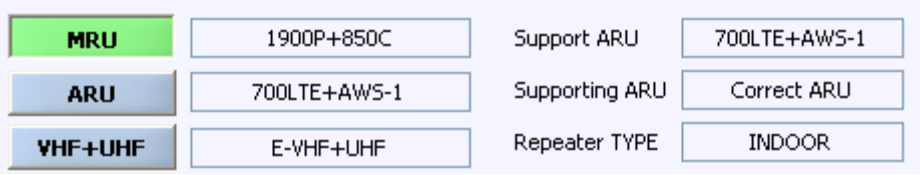


**Figure 6.13 –ROU information assignment**

By clicking the main menu which is MRU,ARU and VHF+UHF, you can query 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.

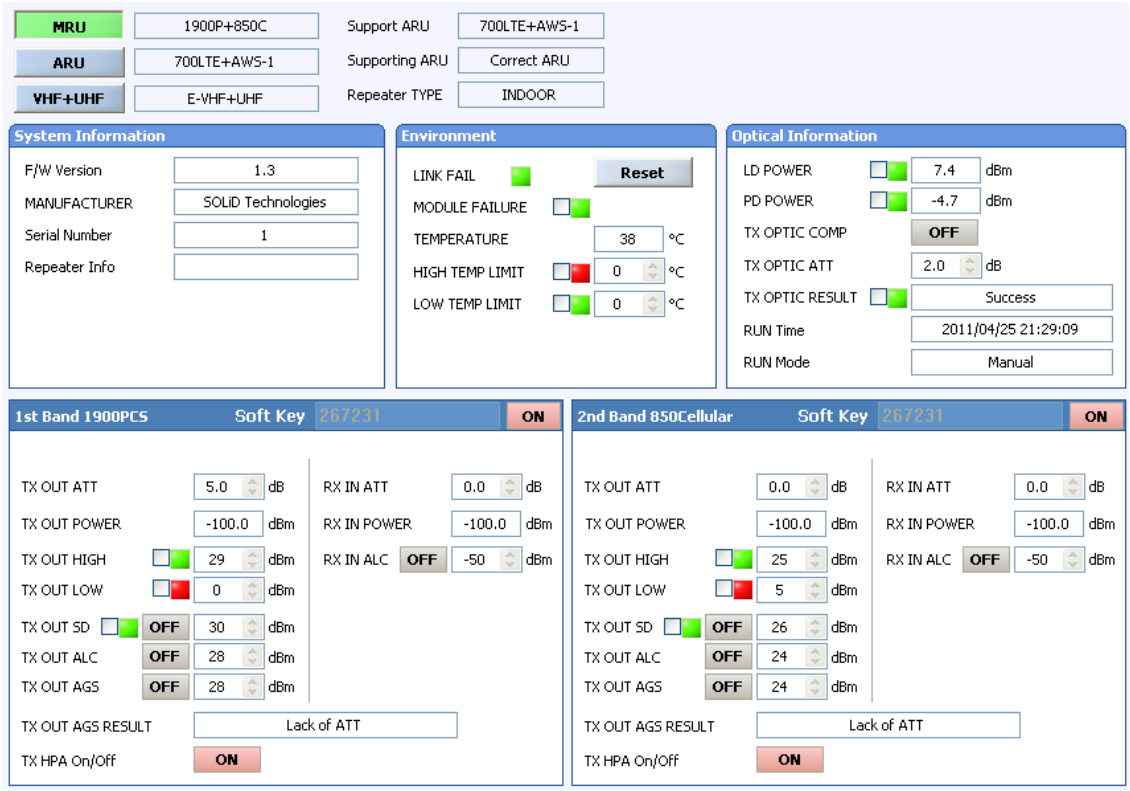


**Figure 6.14 –ROU Menu information**

The table below shows maximally allowable Composite Powerlevels that can be set per band:

| ROU Band | Power that can be maximally set | Setting range | Remark |
|---|---|---|---|
| 700LTE | 24dBm | 0 ~ 24dBm | ARU700LTE+AWS-1 |
| 700LTE(MIMO) | 28dBm | 0 ~ 28dBm | MRU700LTE+AWS-1 |
| 850Cellular | 24dBm | 0 ~ 24dBm | MRU 1900PCS+850C |
| 1900PCS | 28dBm | 0 ~ 28dBm | MRU 1900PCS+850C |
| | 31dBm | 0 ~ 31dBm | MRU 1900PCS |
| AWS-1 | 28dBm | 0 ~ 28dBm | ARU700LTE+AWS-1 |
| 900I | 26dBm | 0 ~ 26dBm | ARU900I+800I |
| 800I | 26dBm | 0 ~ 26dBm | ARU900I+800I |

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 valueis displayed. 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.

Set the upper/lower limits. The following table shows recommended limit settings:

| Item | Recommended Limit | Remark |
|---|---|---|
| TX OUTPUT HIGH ALM | Max Composite Power+1dB | Alarm |
| TX OUTPUT LOW ALM | 0dBm | Alarm |
| TX OUTPUT ALC | Max Composite Power | Auto Level control |
| TX OUTPUT SD | Max Composite 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 FAILURE LED Indicator is green.

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

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

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


**Figure 6.15 –ROU Softkey information**

, The ROU has unique serial number and also a unique softkey.

## 6.3 OEU Operation

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

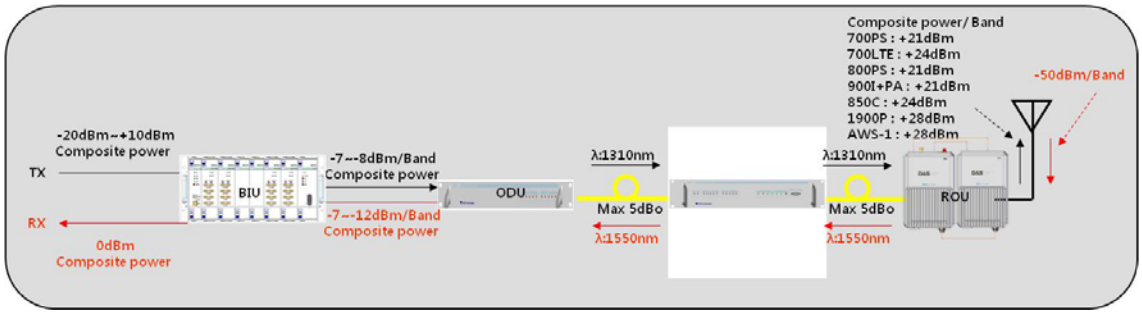


**Figure 6.16 –SC-DAS Link Budget for OEU**

### 6.3.1 OEU Operation

The OEU comes as a rack mount chassis and is located at a remote closet in a building.

The OEUs main function is to act as a hub for expansion to other buildings, It only requires one strand of fiber to expand to 8 ROUs.( OEU supports up to 2 DOUs and the DOU supports up to 4 optical ports that connect ROUs).

The ROU can work with a DC Feeder and an Optic Cable Feeder. of the OEU requires a DC-DC power supply.

In the other direction, the OEU can be connected with a ODU. It has optical loss compensation function for 5dBo of optical cable loss. The following shows operational procedures after installation of the OEU.

**Checking the status of OEU's LED Indicator**

After turning on the switch of the power supply in the 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

Step 1 : checking whether there is communication with the BIU(ODU)

Check if TXD1 and RXD2 LEDs in OEU front LED make communication. Receiving FSK signals from BIU, the OEU sends requested status value to BIU. During reception, RXD1 LED flicks. During tramsmissionTXD1 LED flicks.

Step 2 : Checking whether there is communication with the ROU

OEU configured as a Hub. OEU has two optical ports. One is connected to upper ODU and the others is connected to ROU. Communication with ODU was checked at above step 1

Step 3 is checking whether the OEU communicates with the ROU. The OEU request status to the ROU and then TXD2 blinks If respones data is received from ROU, RXD2 LED blinks

## OEU Optic Comp Operation

The 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 optic as "ON." Optical compensation of the OEU can not be made without communication with the ODU. For 1dBo of optical loss, TX OPTIC ATT is 1dB; 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 the OEU GUI.

LD POWER references the output level of OEU Laser Diode, which is sent to a upper unit by the OEU.

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

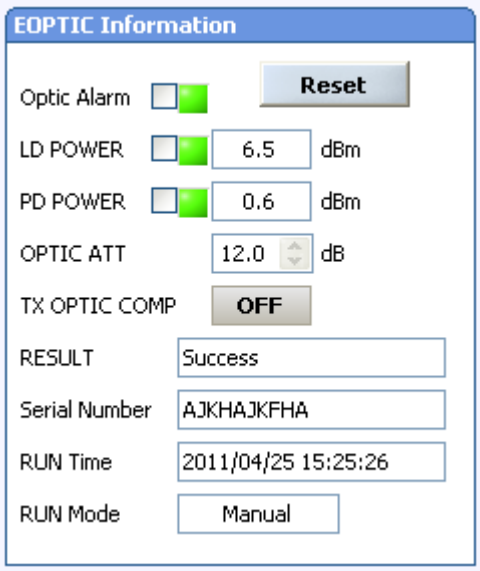


**Figure 6.17 –OEU Optical information**

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

Like the ROU, the OEU performs optical loss compensation automatically when the OEU communicates with upper ODU first.

During optical compensation, the Result window shows "Processing" and then a result value is displayed. 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.

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

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 If OEU does not make optical compensation, there will be errors in the system link budget . It can cause low output levels or make Spurious Emissions detrimental to the system.

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# *Section7*

## 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

Shut down is triggered automatically when the composite power downlink output is above the values defined as average for the device for a period not to exceed 5 seconds. Critical levels are set through the GUI

After automatic shutdown, the system 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. This action will be repeated 5 times

After The 5$^{th}$ time, if the condition is still detected, the DAS will be shutdown permanently. The following diagram shows the shutdown logic

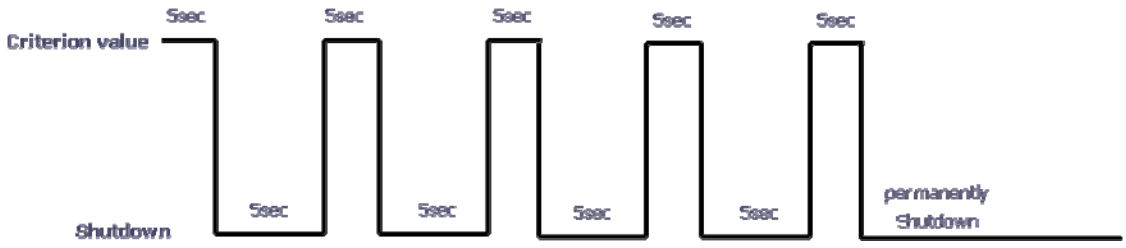


**Figure 7.1 –Shutdown logic diagram**

After the retry logic exhausts itself, 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 the HPA and not to radiate spurious emissions, output power s is limited to a defined value which is set by the operator in advance. To execute this function, operator should turn-on the ALC function and set limit level through the GUI. If the output power exceeds the defined value, the output attenuator is adjusted to return it within defined value. The output attenuator's adjustment range is 25dB max. If output power decreases, attenuation is decreased using the AGC function to return to the initial attenuation level.

### 7.3 Automatic Output power setting function (TX Output AGC)

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

After AGC logic is complete, logic operation results will show on the result window of the 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 can't be executed, changed ATT will return to initial ATT

Through the output AGC function, it can be verified whether optic compensation is executed or not.

### 7.4 Input power AGC function (TX Input AGC)

This function is to help the operator with initial setting during installation.

Without a spectrum analyzer, we can see the input power value through power display window of the GUI. Use the TX IN AGC function and automatically set the internal ATT depending on the input level. The ATT is automatically set based on -20dBm 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 a 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 no more than two input ports in the MDBU of the BIU

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

These two input powers may be different from each other. The DAS has an input attenuator in first stage of the MDBU. Through input AGC function, the input ATT is adjusted according to the input power. If input power increases, the input ATT is adjusted again to limit increased input powerand if the input power decreases, the input ATT will return to the initial ATT setting.

## 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 to the ODU or OEU. For 1dBo of optical loss, basic TX OPTIC ATT is 1dB; 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 the ROU GUI.

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

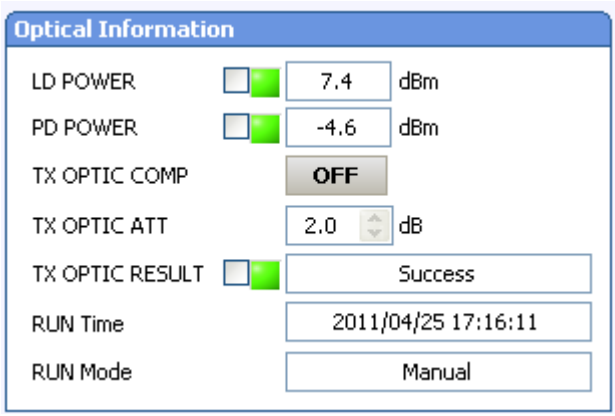

**Figure 7.2 –Optical loss information**

During optical compensation, the Result window shows "Processing" and then a result value is displayed. 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.