

Hercules-S (5W Remote Unit)

User Manual



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Technical Support

SOLiD serial numbers must be available to authorize technical support and/or to establish a return authorization for defective units. The serial numbers are located on the back of the unit, as well as on the box in which they were delivered. Additional support information may be obtained by accessing the SOLiD Tehcnology, Inc. website at www.solid.co.kr or send email at kehan@solid.co.kr

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Section1

Safety & Certification Notice

“Only qualified personnel should handle the DAS equipment. Any person involved in installation or service of the DAS should understand and follow these safety guidelines.”

- Obey all general and regional safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.
- To prevent electrical shock, switch the main power supply off prior to working with the DAS System or Fiber BDA. Never install or use electrical equipment in a wet location or during a lightning storm.
- When working with units outdoors, make sure to securely fasten the door or cover in an open position to prevent the door from slamming shut in windy conditions.
- Use this unit only for the purpose specified by the manufacturer. Do not modify or fit any spare parts that are not sold or recommended by the manufacturer. This could cause fires, electric shock or other injuries.
- Any DAS system or Fiber BDA will generate radio (RF) signals and continuously emit RF energy. Avoid prolonged exposure to the antennas. SOLiD recommends maintaining a 2m (78.74 inches) minimum clearance from the antenna while the system is operating.
- Do not operate this unit on or close to flammable materials, as the unit may reach high temperatures due to power dissipation.
- Do not use any solvents, chemicals, or cleaning solutions containing alcohol, ammonia, or abrasives on the DAS equipment. Alcohol may be used to clean fiber optic cabling ends and connectors.
- Do not look into the ends of any optical fiber or directly into the optical transceiver of any digital unit. Use an optical spectrum analyzer to verify active fibers. Place a protective cap over any radiating transceiver or optical fiber connector to avoid the potential of radiation exposure.
- Allow sufficient fiber length to permit routing without severe bends.
- For pluggable equipment, make sure to install the socket outlet near the equipment so that it is easily accessible.
- Certification
 - FCC: This equipment complies with the applicable sections of Title 47 CFR Parts 15,22,24 and 90
 - UL/CUL: This equipment complies with UL and CUL 1950-1 Standard for safety for information technology equipment,including electrical business equipment
 - FDA/CDRH: This equipment uses a Class 1 LASER according to FDA/CDRH Rules.This product conforms to all applicable standards of 21 CFR Chapter 1, Subchapter J, Part 1040
- A readily accessible disconnect device shall be incorporated external to the equipment.
- This power of this system shall be supplied through wiring installed in a normal building.

If powered directly from the mains distribution system, it shall be used additional protection, such as overvoltage protection device

- Only 50 ohm rated antennas, cables and passive equipment shall be used with this remote. Any equipment attached to this device not meeting this standard may cause degradation and unwanted signals in the bi-directional system. All components connected to this device must operate in the frequency range of this device.
- Only 50 ohm rated antennas, cables and passive components operating from 150 - 3 GHz shall be used with this device.
- Signal booster warning label message should include

WARNING. This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

Section2

Introduction

2.1 Purpose

2.2 Hercules-S

2.1 Purpose

HERCULES-S is a coverage system for in-building services delivering voice and data in high quality and for seamlessly.

As a distributed antenna system, it provides analog and digital phone systems that are served in multiple bands through one antenna.

The system covers general public institutions and private facilities.

- Shopping malls
- Hotels
- Campus areas
- Airports
- Clinics
- Subways
- Multi-use stadiums, convention centers, etc.

The system helps improve in-building radio environments in poor condition and make better poor RSSI and Ec/Io. By providing communication services at every corner of buildings, the system enables users to make a call at any site of buildings.

The system uses both analog (AMPS) and digital (TDMA, CDMA and WCDMA) methods.

The HERCULES-S system supports communication standards and public interface protocols in worldwide use.

- Frequencies: 700MHz, 800MHz,850MHz,1900MHz,2100MHz, etc.
- Voice protocols: AMPS,TDMA, CDMA,GSM,IDEN, etc.
- Data protocols: EDGE,GPRS,WCDMA,CDMA2000,Paging, LTE etc.

HERCULES-S is in modular structure per frequency. To provide desired frequency in a building, all you need to do is to insert a corresponding frequency module into each unit. As it delivers multiple signals with one optical cable, the system, in one-body type, does not require additional facilities whenever new frequency is added.

The system is featured with the following:

- Flexibility & Scalability
 - Support fiber-optic ports up to 32
 - Clustering multiple-buildings (campus) as one coverage
- Modular structures
 - Modular frequency upgrade
 - Plug-in type module
- Multi-Band, Multi Operator

- Signals with a plurality of service provider transmit simultaneously
- Support multi-operator in a band
- Low OPEX / CAPEX
 - Compact design
 - Upgradable design
 - Easy installation and maintenance

2.2 HERCULES-S

Hercules-S is one of series of Alliance DAS and has 5W (+37dBm) composite output power every band. RDU that is integrated on package with Duplexer, Power amplifier and RF unit can be mounted up to 5 in the enclosure.

Hercules-S transports signals that multiple operators and multiple technologies are moved at a same time from Base station to a remote location over the same fiber.

It is available in single and multi-band configuration supporting 700MHz, 800MHz, 850MHz, 1700/2100MHz, 1900MHz in parallel.

It has been specifically tested under a various air interfaces such as iDEN, GSM, CDMA2000, EV-DO, WCDMA, LTE etc.

Furthermore, there is reserved RDU slot to support 2600LTE in the future

Section3

Functional Description

-
- 3.1 General**
 - 3.2 Component of HERCULES-S Remote Unit**
 - 3.3 Dimension**

3.1 General

The following figure shows the block diagram of HERCULES-S Remote Unit.

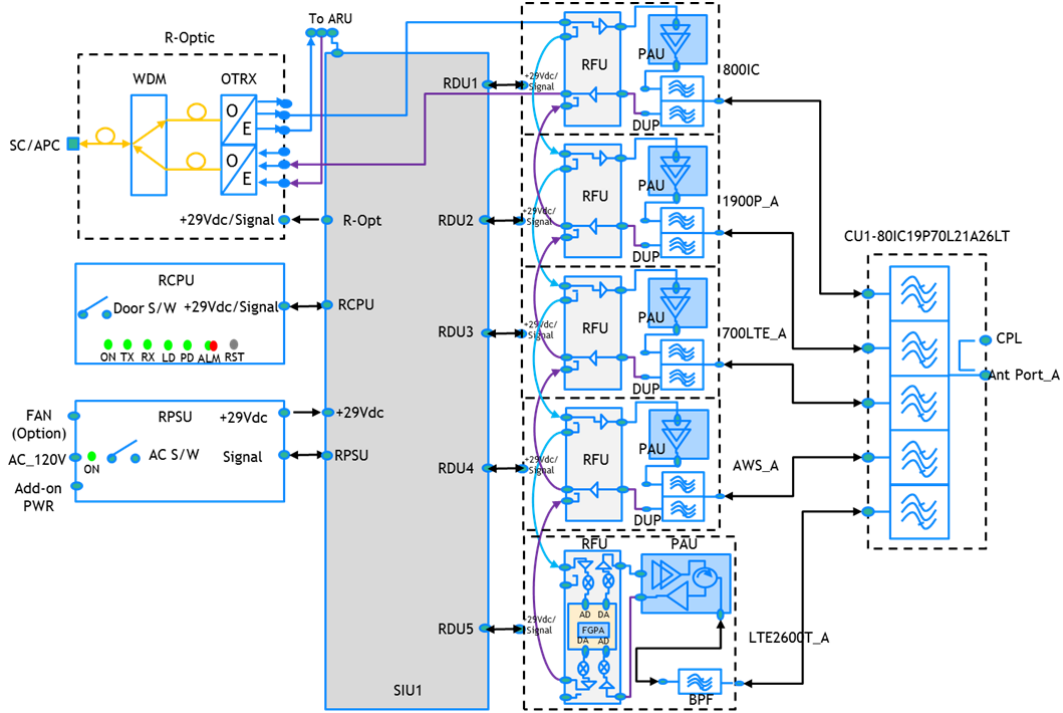


Figure 3.1 – Remote Unit Block Diagram

There are many components;

- R-Optic : Remote Optical Unit
- RCPU : Remote Central Processor Unit
- RPSU : Remote Power Supply Unit
- RDU1-5 : Remote Drive Unit
- CU : Combining Unit

3.2 Component of HERCULES-S Remote Unit

The following figure shows internal configuration of Remote Unit with fully RF equipped.

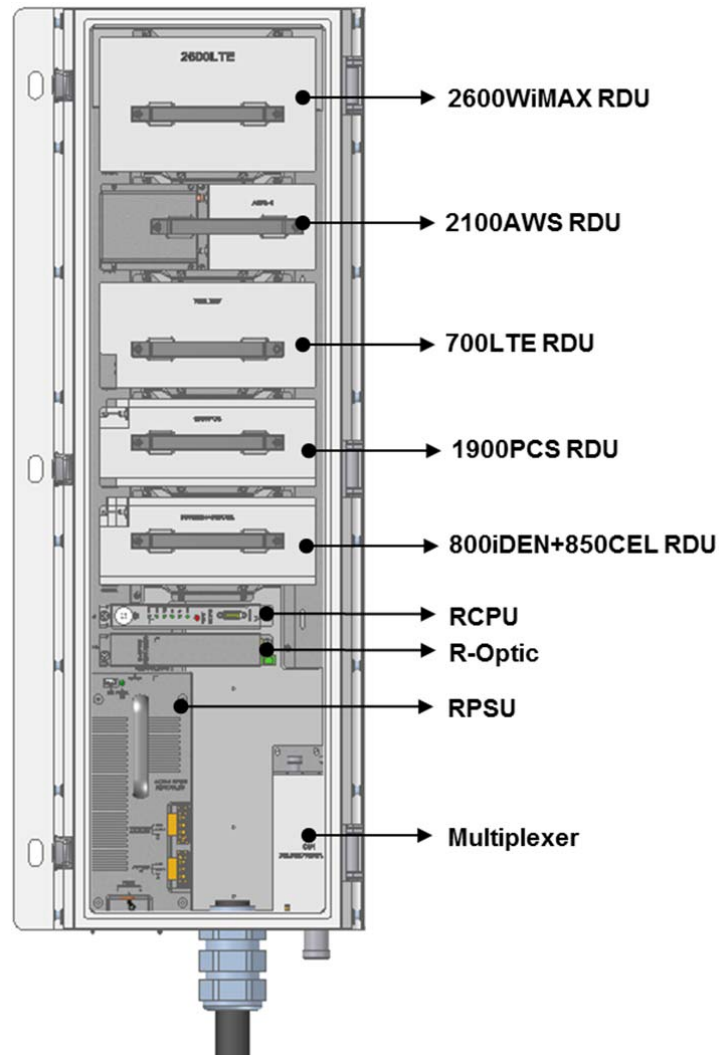


Figure 3.2 – Inside of Remote Unit

Remote Unit receives TX optical signals from Head-End and converts them into RF signals. The converted RF signals are amplified through High Power Amp in a corresponding RDU, combined with Multiplexer module 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 RDU 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. ROU can be equipped with up to five RDUs (Remote Drive Unit)

The following table describes components on Remote Unit

| Unit | Description |
|-----------------------------------|--|
| RDU+BPF x5 | Remote Drive Unit |
| | Filter and amplify TX signals |
| | Filter and amplify RX signals |
| | Remove other signals through BPF |
| RPSU | Remote Power Supply Unit |
| | Input power: 120 VAC +/- 10% |
| | Output power: +29 VDC |
| R-OPTIC | Remote Optic |
| | Make RF conversion of TX optical signals; |
| | Convert RX RF signals into optical signals; Compensates optical loss |
| | Communicates with BIU/OEU through the FSK modem |
| | 10dBo optical link between ODU and ROU |
| | Fiber Connector: SC/APC Connector |
| | Fiber Type: Single Mode Fiber |
| Optical Wavelength: 1310/1550 WDM | |
| RCPU | Remote Central Processor Unit |
| | Controls signal of each unit |
| | Monitors BIU/ODU/OEU through FSK communication |
| Multiplexer | Multiplexer |
| | Combine TX signals from 5 RDUs; Distribute RX signals to 5 RDUs; |
| | Enable you to use a single antenna port |
| ROU Enclosure | Enclosure to satisfy IP66 |
| | Horizontal or Vertical Mount |
| | Ceiling or Pole Mount |
| Input SIU | Input System Interface Unit |
| | Distributes power and signals to each module |
| Output SIU | Output System Interface Unit |
| | Interfacing with multiplexer |

3.3 Dimension

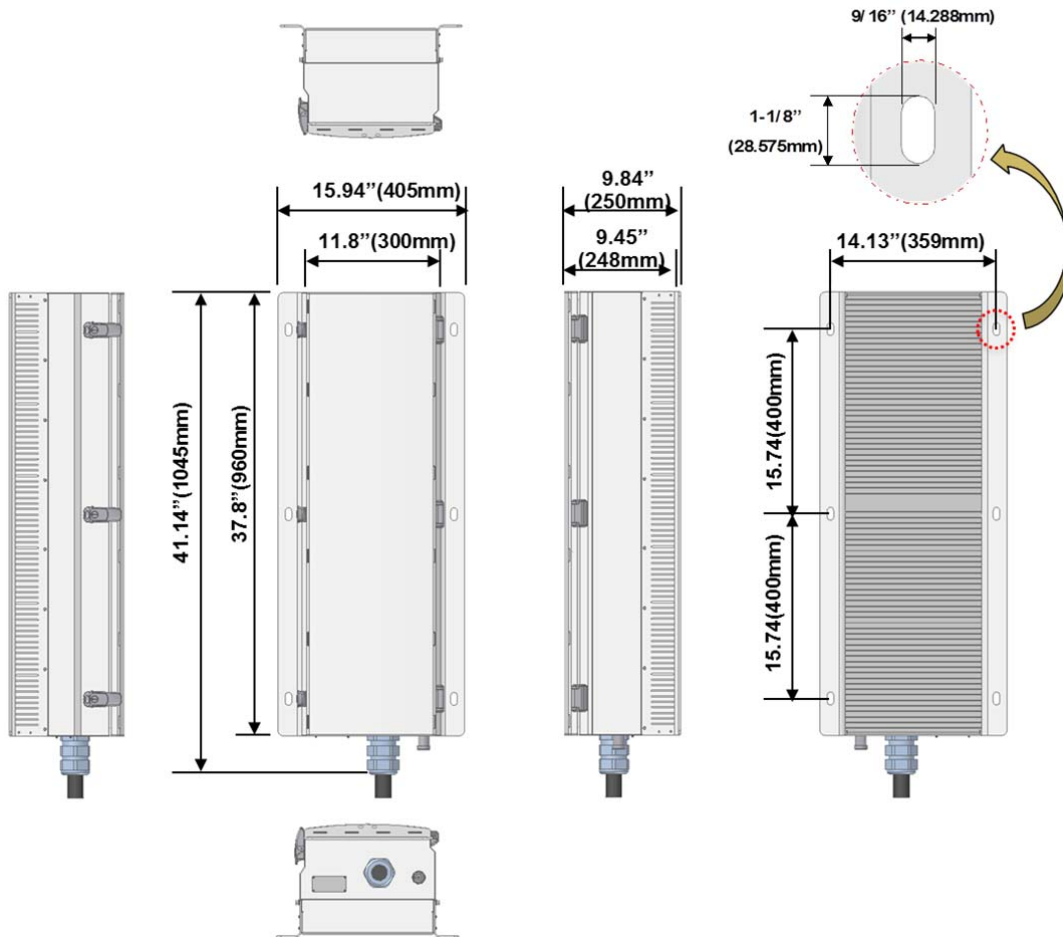


Figure 3.3 – Remote Unit Dimension

| ITEM | SPECIFICATION | REMARK |
|----------------------------|--|---------------------|
| Size(Width, Height, Depth) | 405 x 960 x 250mm/ 15.94" x 37.8" x 9.84 inch | Including Bracket |
| Weight | 51kg / 112lb | Fully loaded |
| Power Consumption | 390W | Fully loaded |
| Operating Temperature | -25 to +55°C / -13 to 131°F | Ambient Temperature |
| Operating Humidity | 0 to 90%, non-condensing | |

Section4

Installation

System

5.1 Remote Unit Installation

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 enclosures of each unit, Power Cabling method and Optic Cabling and RF Interface.

The needed accessories and tools are list up in the below table.

| Steps for installation | Accessories | Included | Tool | Remark |
|-------------------------------|---|----------|---------------------------------------|--------|
| Remote Enclosure Installation | M12 Bolt(6EA) | X | Spanner(19mm) | |
| Power & Optic Connection | Cable for compression connector(HBG-114-1) | X | Installation manual provided by RFS | |
| | Optic : SC-APC | X | | |
| | Power : 20020517M031B01LF(FCI) | O | "4mm" Screw driver(for slotted screw) | |
| Antenna Connection | DIN 7/16 CONNECTOR (Male), Coaxial cable for DIN 7/16 | X | - | |

4.1 REMOTE UNIT Installation

4.1.1 REMOTE UNIT Enclosure installation

REMOTE UNIT is designed to be water- and dirt-proof. The unit has the structure of One-Body enclosure. It satisfies water-proof and quake-proof standards equivalent of NEMA4.

REMOTE UNIT can be mounted on either ceil or the Wall. Basically, REMOTE UNIT has both of a Wall Mount Bracket. The following shows dimension of the fixing point for the Wall Mount Bracket.

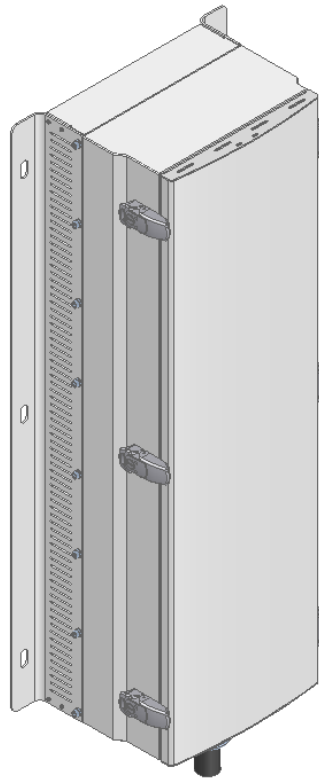


Figure 4.1 – Exterior of Remote Unit

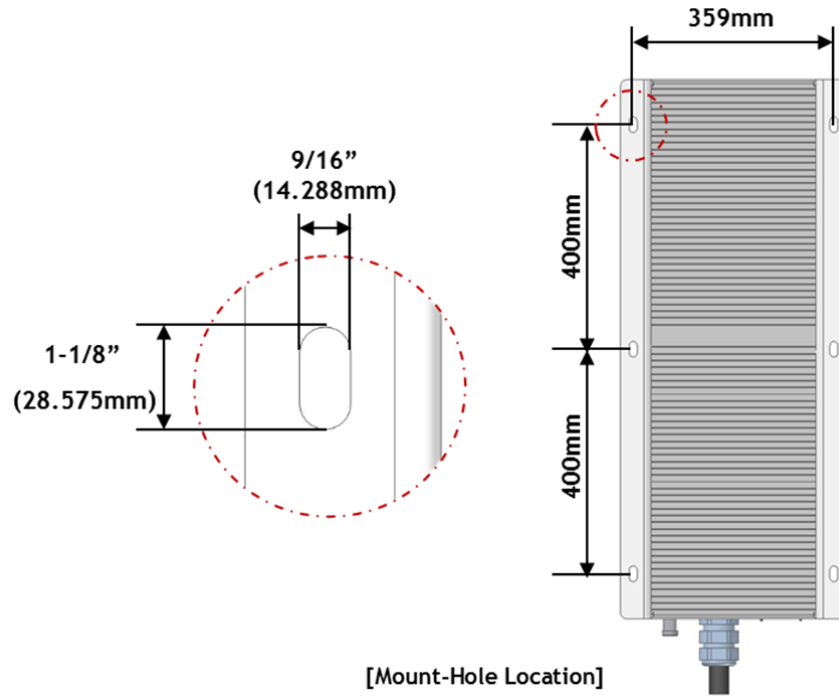


Figure 4.2 – Dimension used to install REMOTE UNIT on the WALL

REMOTE UNIT Ceil Mount Installation

For horizontal installation, minimum separation distance of 130mm is recommended as shown in the below figure.

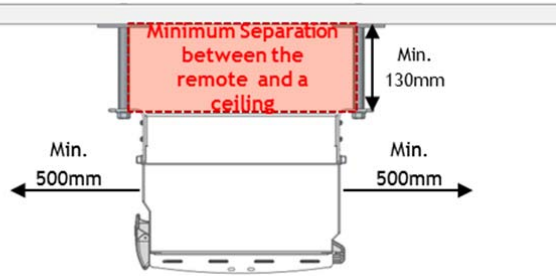


Figure 4.3 – Horizontal Installation

The installation clearance secures system reliability.

Select the right location where the remote unit can be installed securely considering weight load capacity, there would be additional mounting structures can be applied as shown in the below figure



Figure 4.4 – Installation Clearance

Mount remote unit to the mounting location using M12 screws. Different length and material type of the M12 screws can be selected depending on mounting condition

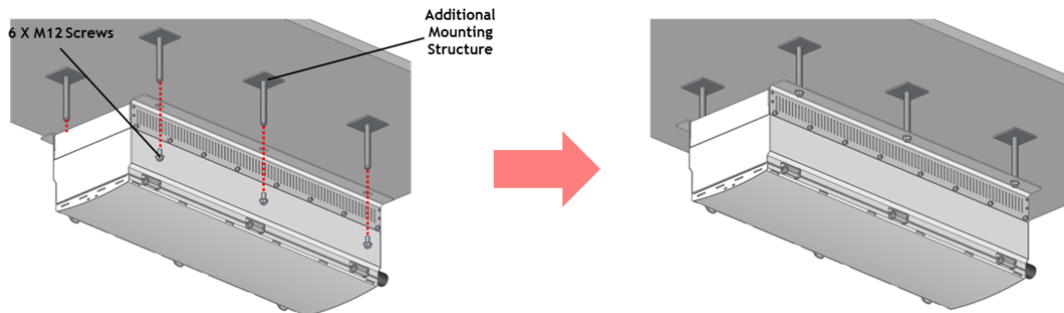
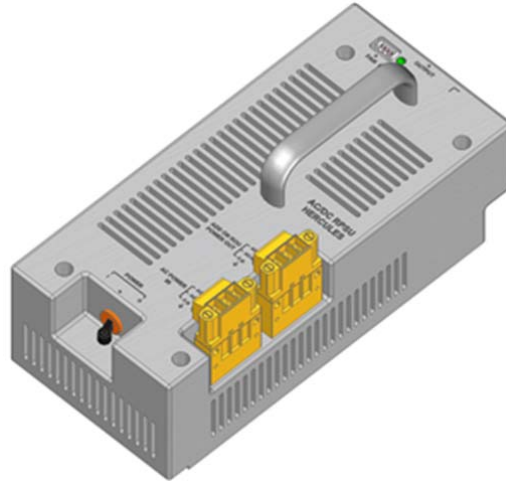


Figure 4.5 – How to Install Remote Unit

4.1.2 Remote Unit Power Cabling

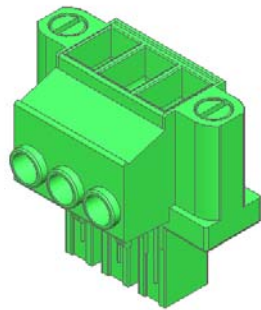
Remote Unit supports only AC120V of input power.


The following figure shows configuration of power supply for AC 120V.



| Lug Naming | RPSU Terminal naming | Remark |
|------------|----------------------|--------|
| AC_H | AC-H | |
| AC_N | AC-N | |
| GND | FG | |

The provided connector is “20020517M031B01LF” of FCI vendor. The following table shows main specification of this connector.

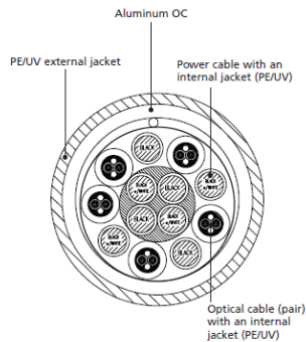


| PROPERTY TABLE | | | | |
|---|--|--|--------|-----|
| FCI SERIES NAME | | 04-762 | | |
| PITCH (mm) | | 7.62 | | |
| VOLTAGE RATING (VAC) | | 300 | | |
| CURRENT RATING (A) | | 32 | | |
| APPLICABLE WIRE RANGE (AWG) | | 1-WIRE | 8~24 | |
| | | 2-WIRE | 14 | |
| WIRE CROSS SECTION (mm ²) | | SOLID | 1-WIRE | 10 |
| | | | 2-WIRE | 2.5 |
| | | STRANDED | 1-WIRE | 6 |
| | | | 2-WIRE | 4 |
| OPENING CONTACT HOUSING(mm ²) | | 3.6x4.1 | | |
| WIRE STRIP LENGTH(mm) | | 6~7 | | |
| TORQUE +/-10% (N-m/Lb-in) | | 0.8/7.0 | | |
| SCREW | | M3.5x0.5 | | |
| WITHSTANDING VOLTAGE (kV) | | 1.6 | | |
| OPERATING TEMP. (°C) | | -40~+115 | | |
| POLES AVAILABLE | | 02~16 | | |
| SAFETY CERTIFICATE | |  US | | |

In order to install the power connection, first connect HBG-114-1 connector(RFS) on hole at bottom of enclosure. This HBG-114-1 connector has 36.0mm diameter and made of aluminum.



The recommended cable is HYBRIFLEX(HB114-1-08U5-S6F, RFS), which consist SM 6F/O, 5DC pairs and 8AWG. The cable's outer conductor armor have corrugated aluminum with external jacket made of polyethylene(PE).



The outer conductor grounding have a role to eliminate typical grounding requirement and saves on installation costs. After stripping external jacket of cable using tool in the proper and then connect it to HBG-114-1 connector. Fasten external hex nut of HBG-114-1 connect to be fixed.

The power installation procedures are as below

1. Take off 20020517M031B01LF connector from RPSU
2. The recommended wire size is below AWG#10
3. Select 3wire among 8AWGs
4. The proper strip length of AWG cable is 6~7mm
5. And insert this wire into designated position of connector
6. Secure M3.5 screw using screw driver with screw type “-“
7. Connect this connector on RPSU and secure screw using screw driver to fix

Check if the connection is the same as one seen in the table above and make sure to turn the power ON.



CAUTION

DOUBLE POLE/NEUTRAL FUSING

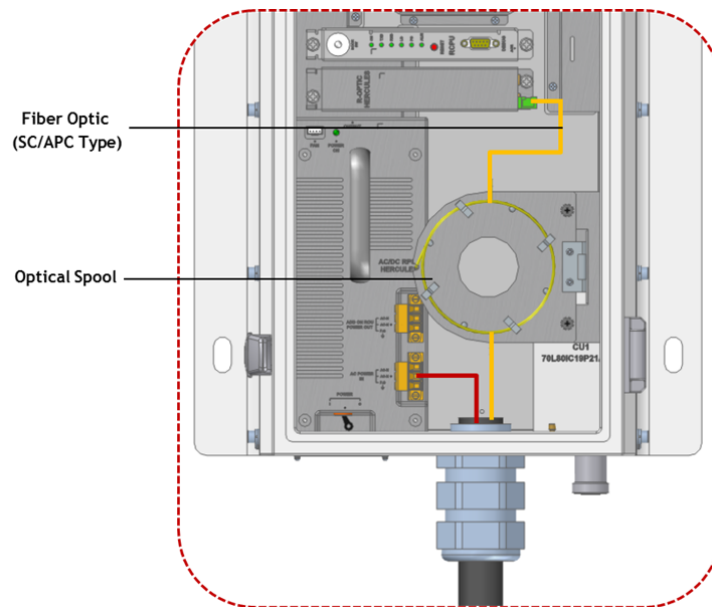
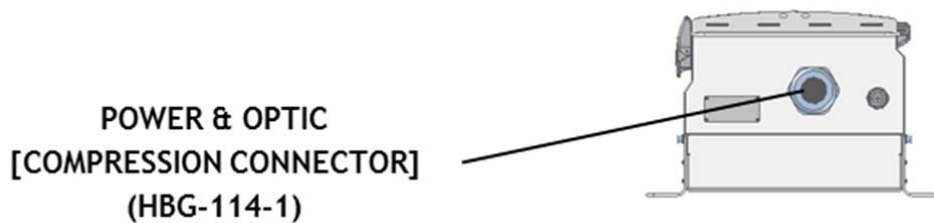


Ground cable with green/yellow color among 3wires of power cables(HOT, NEUTRAL, GND) should be fixed at heatsink of enclosure before connecting with connector to prevent damage from pulling out by external strong force. At this time, secure M3.5 screw using screw driver with screw type "+". The recommended AWG is #10.

4.1.3 Remote Unit Optical Cabling

REMOTE UNIT makes optical-electronic conversion of TX signals from upper ODU makes electronic-optical conversion of RX signals. REMOTE UNIT has one optical module in it. As WDM is installed in the R_OPTIC module, two pieces of wavelength (TX:1310nm, RX:1550nm) can be sent/received with one optical core at the same time. REMOTE UNIT 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 need to clear them using alcohol to remove dirt.

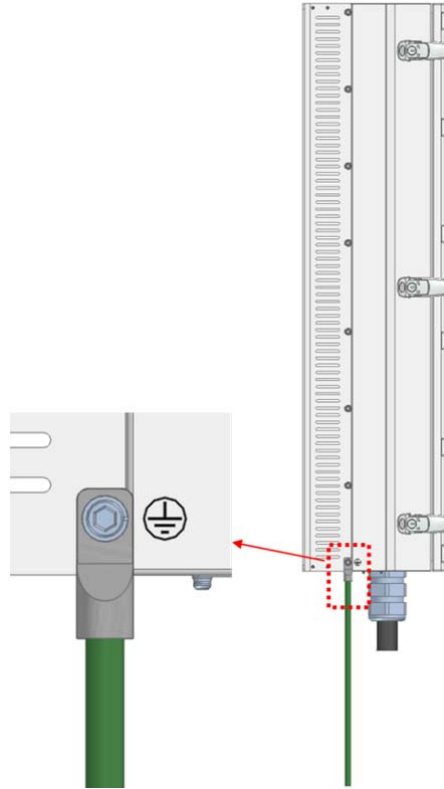


Optical cables should be inserted into Optic Port outside of REMOTE UNIT. Using an optical spool in REMOTE UNIT, you need to coil around one or two roll of cables to be connected with the optical adaptor of ROPTIC.

At this time, curvature of the optical cable should be at least 10Ø to prevent insertion loss from being increased.

4.1.4 GND Terminal Connection

The Ground Terminal is located at the left side of Remote Unit.



Grounding must be carried out. Connect an earth-bonding cable to the grounding connection provided at the outside of the Remote Unit(at left side).

After loosening the hex bolt, connect the earth-bonding cable between the enclosure and hex bolt. Then, fasten all parts again with the hex bolt.



Round terminals located on the side of a 0.75mm² (18AWG) or more wires Using permanently connected to earth (green/yellow color)

4.1.5 Coaxial cable and Antenna Connection

The coaxial cables which are connected to antenna distributed network connect to antenna port of REMOTE UNIT. 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 14dB or VSWR have below 1.5

The part of antenna connection fasten to port not to be loosened and not to be injected the dusty and insects

The antenna connected to REMOTE UNIT is only serviced in inbuilding

Section 5

System Specifications

6.1 Physical Specifications

6.2 RF Performance

6.3 Certification

5.1 Physical Specifications

| Parameter | ROU |
|--------------------------------|--|
| RF Connectors | (1) 7/16 DIN-type, female |
| Serial Interface connector | (1) RS-232 9-pin D-sub, male |
| Fiber connector | (1) SC/APC for ODU |
| LED Alarm and Status Indicator | Power LED |
| | TX LED |
| | RX LED |
| | LD LED |
| | PD LED |
| | ALARM LED |
| | RESET Button |
| AC Power | Normal Range: 120VAC |
| | 50/60Hz |
| | Operating range |
| | 108~132V AC, 50/60Hz |
| Power consumption | 390W |
| | (ROU w/ 5 RDUs) |
| Enclosure Dimensions (mm) | 405 x 960 x 250mm/ 15.94" x 37.8" x 9.84 inch |
| | |
| Weight (Full Load) | 51kg / 112lb |
| Material (Exterior) | 2 mm Aluminum |
| Safety | UL Labeled |
| Certifications | UL, FCC |

5.2 RF performance

| Supported Services | | | | | |
|-------------------------|--|-------------------------------|-------------------------|------------|------------|
| Supported Services | | 700LTE Full Band | 800 Sprint/850 Cellular | 1900 PCS | 2100 AWS |
| Frequency Range | Tx (MHz) | 728-756 | 862-894 | 1930-1995 | 2110-2155 |
| | Rx (MHz) | 698-716 777-787 | 817-849 | 1850-1915 | 1710-1755 |
| Bandwidth | Tx (MHz) | 28 | 32 | 65 | 45 |
| | Rx (MHz) | 18 10 | 32 | 65 | 45 |
| RF Parameters | | | | | |
| Input Power | Tx (dBm) | -20 to +10 | -20 to +10 | -20 to +10 | -20 to +10 |
| | Rx (dBm) | ≤ -50 | ≤ -50 | ≤ -50 | ≤ -50 |
| Output Power | Tx (dBm) | 37 | 37 | 37 | 37 |
| | Rx (dBm) | 0 | 0 | 0 | 0 |
| System Gain | Tx (dBm) | 57 | 57 | 57 | 57 |
| | Rx (dBm) | 50 | 50 | 50 | 50 |
| System Delay | Tx | < 8μs | < 8μs | < 8μs | < 8μs |
| | Rx | < 8μs | < 8μs | < 8μs | < 8μs |
| Impedance | Tx (ohm) | 50 | | | |
| | Rx (ohm) | 50 | | | |
| Spurious Emissions | Tx | ≤ -13dBm @ 9kHz – 5GHz | | | |
| Out of Band Attenuation | Rx | ≤ 45dB @ F_edge ± 1MHz offset | | | |
| Gain Control Range/Step | Tx | 25dB/step 1dB | | | |
| | Rx | 20dB/step 1dB | | | |
| Optical | | | | | |
| Optic Wavelength | Tx | 1310nm WDM | | | |
| | Rx | 1550nm WDM | | | |
| Optic Link AGC | Above 10dB | | | | |
| Optic Link Loss | Max 10dBo | | | | |
| Noise Figure | 8dB Max | | | | |
| Optical Connector | SC-APC (Single Mode Fiber) | | | | |
| RF Connector | DIN-F (Common Output), N-F (UHF/VHF and AOR) | | | | |
| Monitoring Port | -30dB (SMA Female) | | | | |

5.3 Certification

| Title | Standards | | Remarks |
|-----------------------------------|-----------------------------------|---|-----------------------------|
| Environmental | | | |
| Temperature ange | -25°C to +55°C/ -13 to 131°F | | Ambient Temperature |
| Humidity Range | 0% ~ 90% | | Non-condensing |
| Transportation | ETSI EN 300 019-1-2 IEC 60721-3-2 | | Class 2.3 Classes 2K2/2M2 |
| Storage | ETSI EN 300 019-1-1 IEC 60721-3-1 | | Class 1.2 Classes 1K2/1M3 |
| Sealing (Remote Unit) | IEC 60 529 EN 60 529 | | IP66 Complaint |
| Product safety | | | |
| Type approvals and certifications | North America | UL 60950-1, 2nd Edition CSA C22.2 No. 60950-1-07, 2nd Edition, CSA C22.2 No. | UL Certification |
| | North America | FCC Part24 Subpart D and Part90 Subpart I FCC Part22 Subpart H and Part 27 Subpart C FCC Part24 Subpart E and Part 27 Subpart C | FCC Certification |
| | Canada | RSS-131 (ISSUE 2) | IC Certification |
| EMC | | | |
| Emission | North America | FCC Part15 Subpart B, Class A | FCC Verification |
| MTBF | | | |
| Mean Time Between Failures | North America | Telcordia SR-332 Issue 2 | Fits: (Failure Unit) MTBF = |
| | ROU | Failure Rate = 11,823 MTBF = 9.65 Years | Fully loaded ROU |