**Intelibs, Inc**

# AWS Band Remote Unit Product Manual

RU-AWS Operational Manual
Version : 1.1
09-30-2013

# Contents

## *FCC WARNING*

*This equipment generates or uses radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.*
*This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLER. 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.*

## *INFORMATION TO THE USER*

*This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.*
*This equipment generates, uses and can generate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer for technical assistance.*

*Suitable for use in environmental air space in accordance with Section 300-22 (c) of the National Electrical Code, and Sections 2-128, 12-010 (3), and 12-100 of the Canadian Electrical Code, Part 1, C22.1.*

*This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.*

**CAUTION** Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. This equipment is intended for use only with Intelibs Hybrid DAS systems.

## Important health and safety precautions

When using this product, the safety precautions below must be taken to avoid possible legal liabilities and damages. Retain and follow all product safety and operating instructions. Observe all warnings in the operating instructions included with the device.

**DANGER** Only use antennas, transceivers and chargers approved by Intelibs. The use of any non-approved antenna, transceiver and charger may be dangerous.

**DANGER** Allow only authorized personnel to service the DAS. Unauthorized service can invalidate the warranty.

**CAUTION** Any modification of this product, including opening the unit, is prohibited and will void your warranty. Any use of the product or its components for purposes not expressly authorized by this document, including any use in an airplane or any other aviation application, is prohibited and will void your warranty.

**NOTE** When using your device for prolonged periods of time, the device may become warm. In most cases, this condition is normal and therefore should not be interpreted as a problem with the device.

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# 1 Introduction

Remote Unit for AWS band (RU-AWS) is a part of the Hybrid Distributed Antenna Systems (HDAS) to provide remote RF coverage solution from the Master Hub Unit (MHU) fed by the RF source via wireline connection. RU-AWS is built on a small form factor with two antenna ports for 2100MHz AWS frequencies with the following features:

- 10W + 10W dual band or MIMO radio for 2100MHz AWS
- Multi-Technology support
- 40 dBm Tx Power per band
- NEMA level 4 with IPX-6
- SNMP based remote management support
- Single mode Fiber fed with 10 Km distance
- Optic fiber sharing between different carriers
- AGC (Auto Gain Control) function
- CFR (Crest Factor Reduction ) function

Including RU-AWS, Hybrid DAS is comprised of the following subsystems:

- MHU (Master Hub Unit): Interface unit between RF source and Remote Units, Convert RF signal to optical waves.
- RU (Remote Unit): High power (40 dBm per band) remote unit for outdoor/indoor
- MU (Master Unit): Element management server

As illustrated in Figure 1-1, Hybrid DAS network is comprised of MHU and RU. Each MHU can support up to 6 RU's that can cover up to 500Ksf$^2$ indoor space. An optic cable can be shared between different carriers by cascading optic connection between MHU systems.

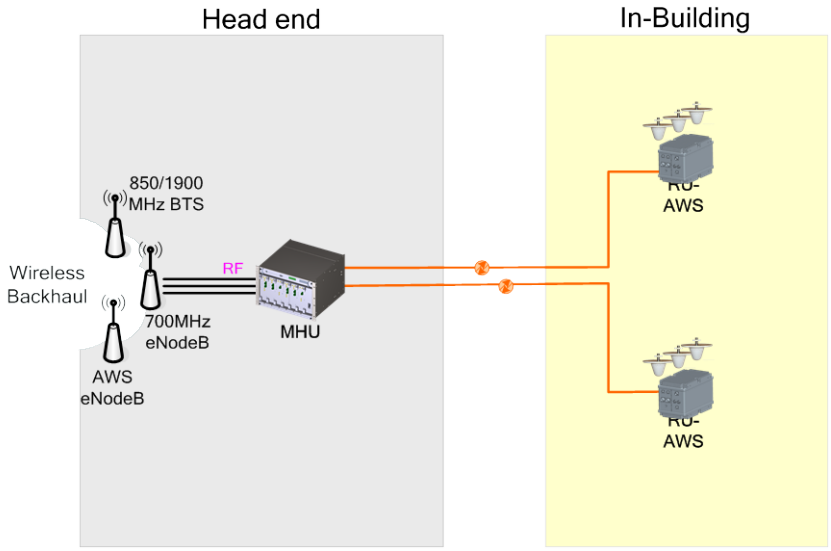



Figure 1-1 MHU-RU application

# 2 Product Description

Remote Unit for AWS is a part of the Distributed Antenna System (DAS) to clear RF shadows, to fill coverage gaps existing among the adjacent cells and to enhance the quality of service of extending coverage of 2100M AWS.

As shown in Figure 2-1, RU is a compact platform with the natural heat convection. As unified form factor, RU services multiple technologies on a single platform with 2100MHz AWS band operating frequencies. It can be mounted on the wall or 19" rack. Variety of the service antenna can be used from short monopole antenna (e.g. rubber ducky antenna) to indoor multi-band ceiling Omni antenna (or panel antenna).

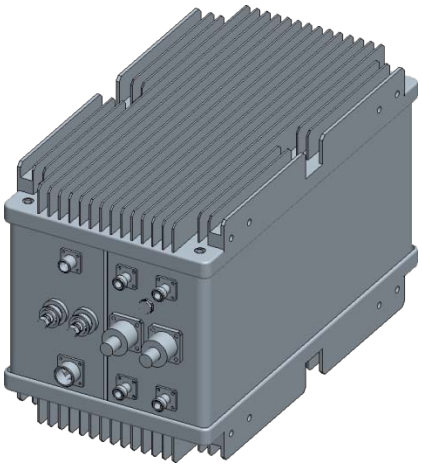


Figure 2-1 RU system

## 2.1 Network configuration

RF signal from a carrier on the 2100MHz AWS band are fed to MHU and directed to fiber optic cable, to transmit RF signals to remote RU system. MHU can have up to 6 connections with RU systems by installing DOU cards. A fiber optic cable can be shared between different carriers by cascading optic connection between MHU systems. Each frequency band signals have their own wavelengths in a single fiber. Table 2-1 describes those wavelength assignments. Maximum allowed optic loss between MHU and RU system is 10 dBo.

Table 2-1 Optic wavelength of each frequency band

| Frequency band | Downlink Wavelength | Uplink Wavelength |
|---|---|---|
| 2100MHz AWS | 1,310 nm | 1,550 nm |
| Cascading 2nd Carrier | 1,350 nm | 1,510 nm |

RU systems with different operating frequency band can be interconnected via RF cables feed from RU-AWS system. Typical MHU-RU network diagram is depicted in figure 2-2.

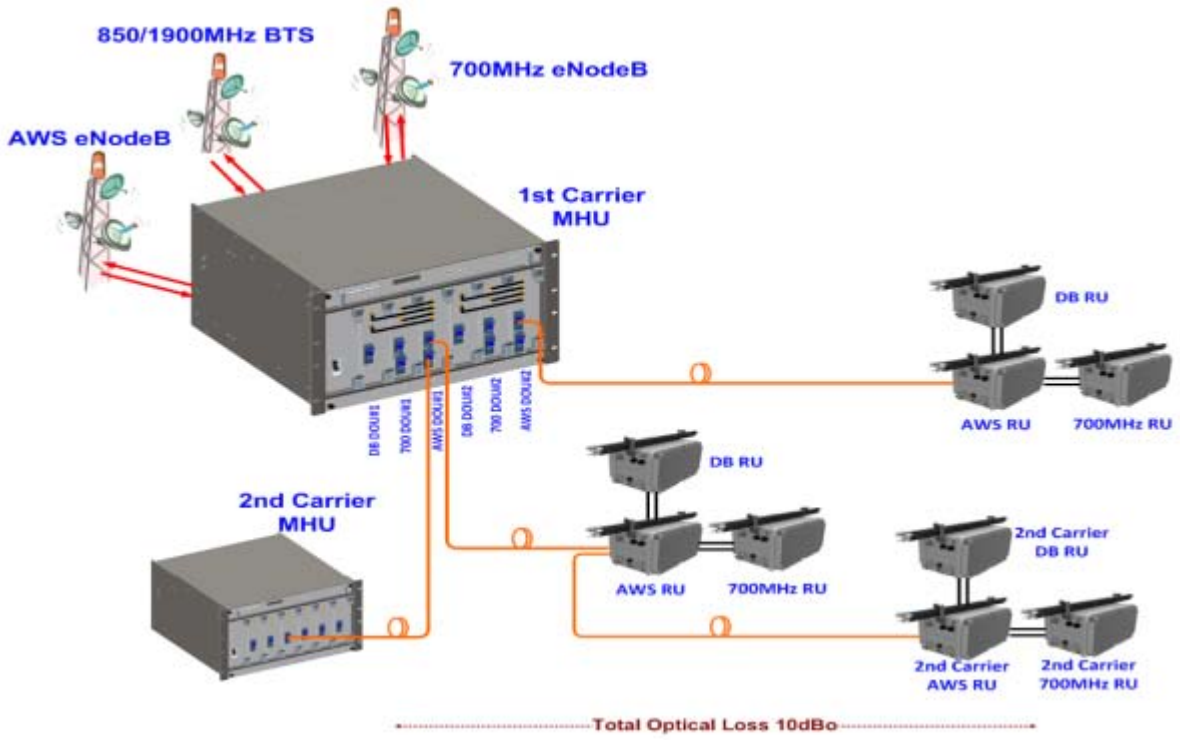



Figure 2-2 Typical MHU-RU network diagram

## 2.2 External interface ports

RU has all interface connections at front side of an enclosure, which includes optic, antennas, power, and maintenance port. Figure 2-3 shows the front panel of RU system.

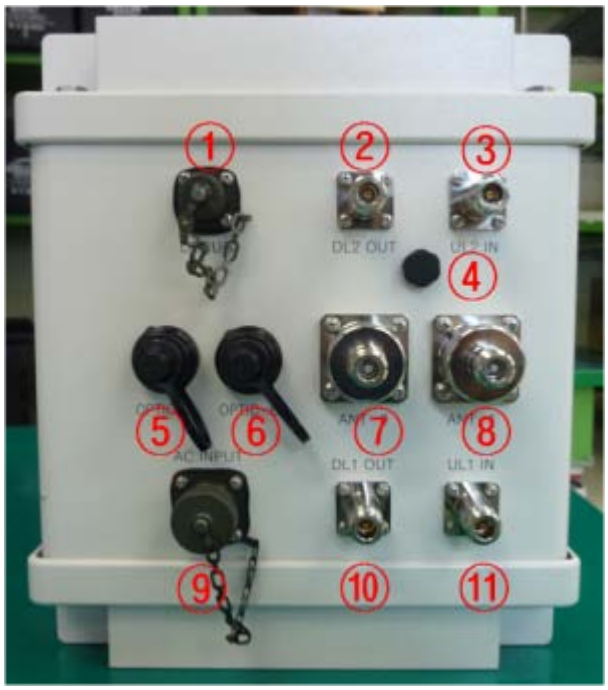



Figure 2-3 Front view of RU system

Table 2-2 Interface ports

| No. | Port | Connector type | Description |
|---|---|---|---|
| 1 | DEBUG | | Serial interface for GUI and debugging |
| 2 | DL2 OUT | N-type Female | 850/1900MHz Downlink RF cable connection port |
| 3 | UL2 IN | N-type Female | 850/1900MHz Uplink RF cable connection port |
| 4 | Goretex | | |
| 5 | OPTIC-A | SC/APC | Optic connection port with MHU |
| 6 | OPTIC-B | SC/APC | Optic connection port with 2nd carrier MHU |
| 7 | ANT-0 | N-type Male | AWS MIMO0 Antenna RF cable connection port |
| 8 | ANT-1 | N-type Male | AWS MIMO1 Antenna RF cable connection port |
| 9 | AC INPUT | MS Connector | 110V AC power cable connection port |
| 10 | DL1 OUT | N-type Female | 700MHz LTE Downlink RF cable connection port |
| 11 | UL1 IN | N-type Female | 700MHz LTE Uplink RF cable connection port |

## 2.3 Modules

RU system is comprised of several internal modules such as combiner, amplifier, optic module, and filters. Figure 2-4 shows inside of RU system.

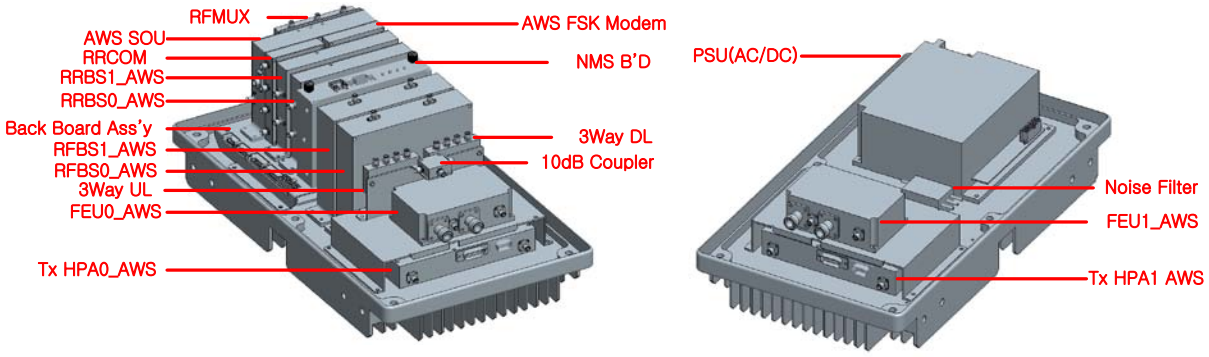
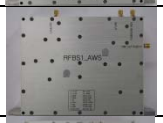
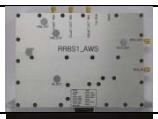



Figure 2-4 RU system's modules

Table 2-3 RU system's modules

| Module | Picture | Description |
|---|---|---|
| RFMUX |  | Divides incoming signals into RF and modem signals, and sends divided signals to RFBS0/RFBS1 and FSK modem. |
| RFBS0_AWS |  | Controls a TX0 path gain, filters downlink frequency band, controls the TX0 signal's Crest Factor, and performs the Automatic level Control (ALC) function. Output of this module is sent to High Power Amp (HPA). |
| RFBS1_AWS |  | Controls a TX1 path gain, filters downlink frequency band, controls the TX1 signal's Crest Factor, and performs the Automatic level Control (ALC) function. Output of this module is sent to High Power Amp (HPA). |
| AWS_SOU |  | Performs E/O (Electric/Optic) or O/E conversion for downlink and uplink signals. |
| AWS_FSK_MODEM |  | Data modem for out of band communications between MHU and RU systems. Followings are modem frequencies for downlink and uplink.<br>- from RU to MHU: 311 MHz<br>- from MHU to RU: 374 MHz |
| RRCOM |  | Combines RX0, RX1, and Modem signals, and sends combined signals to the AWS_SOU module for E/O conversion. |
| RRBS0_AWS |  | Amplifies RX0 signal by low noise high gain amplifier, filters for desired band frequencies, and controls uplink path gain. |

| | | |
|---|---|---|
| RRBS1_AWS |  | Amplifies RX1 signal by low noise high gain amplifier, filters for desired band frequencies, and controls uplink path gain. |
| HPA_AWS<br>for MIMO0 |  | Amplifies TX0 signal by 16W (42dBm) high power amplifier, and sends amplified signal to FE_DUPLEXER_AWS MIMO0 module. |
| HPA_AWS<br>for MIMO1 |  | Amplifies TX1 signal by 16W (42dBm) high power amplifier, and sends amplified signal to FE_DUPLEXER_AWS MIMO1 module. |
| FE_DUPLEXER_AWS<br>for MIMO0 |  | Front-end duplex that passes TX0 and RX0 frequencies bands. |
| FE_DUPLEXER_AWS<br>for MIMO1 |  | Front-end duplex that passes TX1 and RX1 frequencies bands. |
| PSU |  | Converts AC 110V to DC 29V/9V/6.5V/5.5V, and supplies DC converted voltages to entire modules. |
| NMS Controller |  | Monitors status of modules in RU, and controls the configurable parameters of the RU modules. |
| Interface BD |  | Provides interface between NMS and other modules to control and monitor the modules. |

## 2.4 Mechanical Drawing

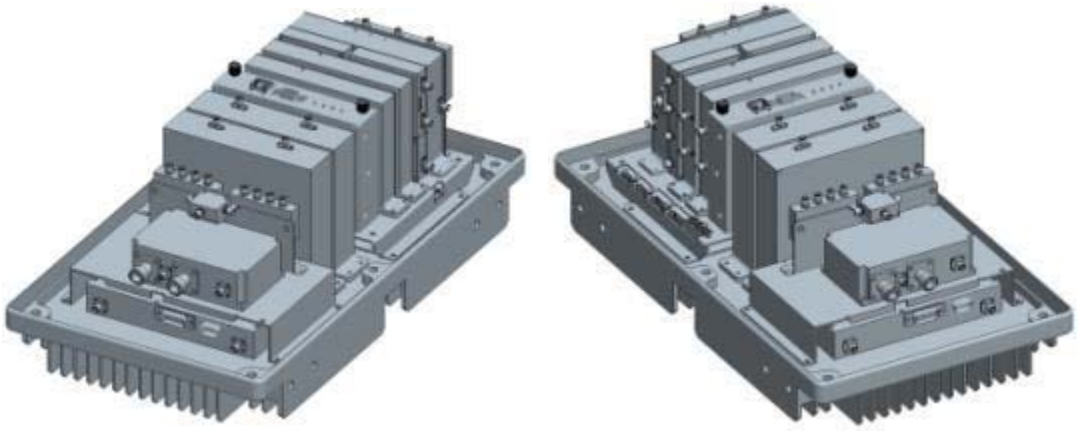


Figure 2-5 RF modules

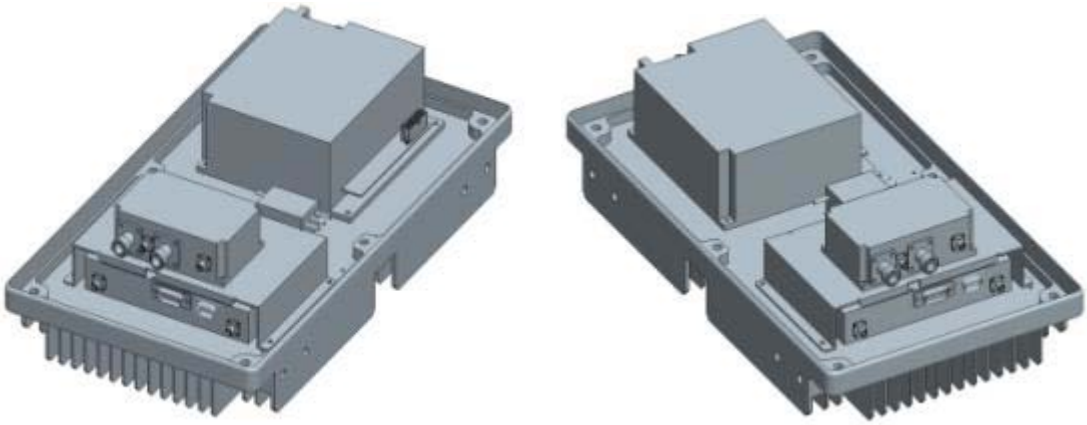


Figure 2-6 PSU module

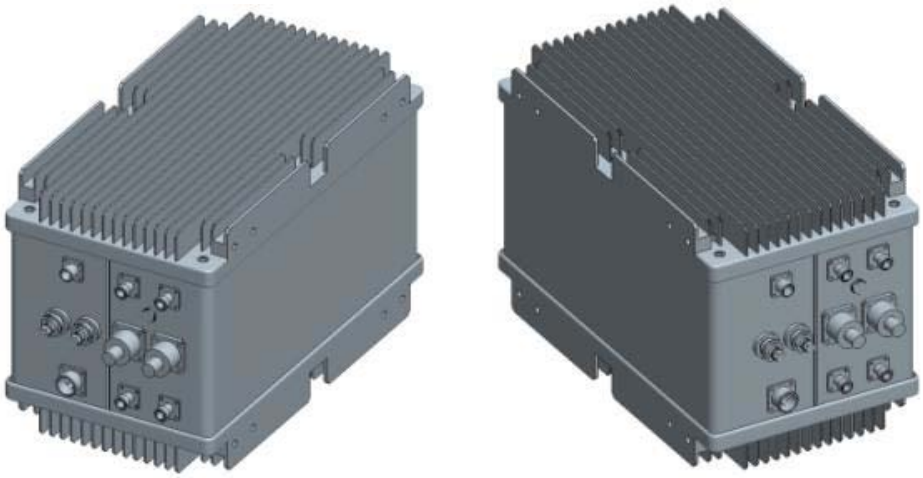


Figure 2-7 Exterior

## 2.5 Technical Specifications

### 2.5.1 General specifications

Table 2-4 General Specifications

| Specification | Values |
|---|---|
| Enclosure Type | Cabinet |
| Dimension (mm) | 471.7(H) X 263.4(W) X 304.8(D)mm |
| Weight (Kg) | 26 Kg |
| Power Supply | 110-120Vac (Tolerance ±10%), 60Hz |
| Power Connector | MS Connecter |
| RF In/Out Port | N Type Female, a side part |
| Optic Connector Type | SC, a side part |
| Optic Wavelength | FWD: 1310nm / RVS: 1550nm AWS DOU 1st Carrier<br>FWD: 1350nm / RVS: 1510nm AWS DOU 2nd Carrier |
| Operating Temperature | -20℃~ 50℃ |

### 2.5.2 2100 MHz AWS band frequency allocation

**Band Plan Detail**

| Spectrum Block | Auction Label | Bandwidth (MHz) | Tier | Lower Frequency (MHz) | Upper Frequency (MHz) |
|---|---|---|---|---|---|
| A | A | 20 | 3 | 1710 – 1720 | 2110 - 2120 |
| B | B | 20 | 2 | 1720 – 1730 | 2120 – 2130 |
| C | C | 10 | 2 | 1730 – 1735 | 2130 – 2135 |
| D | D | 10 | 3 | 1735 – 1740 | 2135 – 2140 |
| E | E | 10 | 3 | 1740 – 1745 | 2140 - 2145 |
| F | F | 20 | 3 | 1745 – 1755 | 2145 - 2155 |

Figure 2-11 Frequency allocation of 2100 MHz AWS band

### 2.5.3 RF specifications

Table 2-7 RF specifications

| Item | Specification | | Remarks |
|---|---|---|---|
| Tx Frequency Range | Contiguous 25MHz Bandwidth in 2110 ~ 2155MHz | | |
| Rx Frequency Range | Contiguous 25MHz Bandwidth in 1710 ~ 1755MHz | | |
| No of Carriers Supported | 2 CH LTE Carrier Max. | | |
| FWD Input Power | -10 ~ 0dBm/total, -5dBm/total is recommended at MHU IN | | |
| FWD Output Power | 40dBm/total for 2100MHz RU ANT Port (MIMO0 / MIMO1) | | |
| RVS Input Power | -45dBm/total max. at RU each ANT Port | | |
| RVS Output Power | -5dBm/total max. at MHU each Rx Output Port | | |
| System Gain | FWD: 20dB ~ 40dB | RVS:20dB ~ 40dB | |
| FWD Spurious | Comply to 3GPP, FCC regulation | | |
| RVS Noise Figure | 5dB max. @ 40dB Gain | | Max. Gain |
| Gain Control Range | FWD: 20dB by 1dB Step | RVS: 20dB by 1dB Step | RU OLC Gain |
| EVM (Error Vector Magnitude) | 12.5% | | |
| Frequency Stability | 0.02ppm | | |
| Pass-Band Ripple | 2dB max. Any CH | | |
| System Delay | Tx: 5us. Max | Rx: 4us. Max | Without optical cable |
| Tx0-Tx1 Isolation | min. 40dBc | | 700LTE, AWS |
| Rx0-Rx1 Isolation | min. 40dBc | | 700LTE, AWS |
| Tx-Rx Isolation | 100dB min. @Between RU Tx Output and MHU Rx Output | | |
| Impedance | 50 Ohm | | |
| VSWR | 1.5 : 1 max. @ All input/output ports | | |
| Optical Wavelength | FWD: 1310nm<br>FWD: 1350nm, 2nd Carrier | RVS: 1550nm<br>RVS: 1510nm, 2nd Carrier | |
| RF I/O Connector | MHU: SMA-type Female | RU: N-type Female | |

### 2.5.4 Power Specifications

Table 2-8 Power specifications

| Item | Specification |
|---|---|
| Rated Input Voltage | 110-120V AC, 60 Hz |
| Permissible range | Tolerance ±10% |
| Power consumption | 250 W, maximum |
| | 200 W, typical |
| Power Connector | MS Connecter |

# 3 Installation

## 3.1 Installation Requirements

Before and during installation, the following should be carefully verified in order to avoid any problem:

- Faulty Cabling/Connectors: Fiber cable and connectors must be verified prior to plugging into the RU
- Dirty Connectors and ports
- Faulty Remote Unite (RU) components
- RF source equipment issue
- External RF Interface problem such as antenna port

The following guidelines are required when the Headend unit is installed on the 19" rack:

- Locate the equipment with the space for the sufficient airflow to prevent build-up from the overheating. Do not compromise the amount of airflow required for safe operation of the equipment.
- Verify the power connection and Fiber cables prior to turning on the systems.

WARNING: Equipment loading must be verified prior to mounting the equipment on the wall or 19" rack.

### 3.1.1 General Safety Precautions

The following precautions apply to the RU:

- The units have no user-serviceable parts. Faulty or failed units are fully replaceable through Intelibs.
- When the Fiber cable is connected to the equipment, the connectors must be free from the dust and connected according to the cable manufacturer's instructions. (WARNING: For the safety, DO NOT conduct eye-contact at the connector ends of the fibers or the port of the MHU and RU unless equipped with protection goggle. Invisible infrared radiation may be present at the front panel of the MHU and RU. Do not remove the fiber port dust caps unless the port is going to be used. Do not stare directly into a fiber port.)

## 3.2 Installation Tools

Table 3-1 Installation tools

| Torque Wrench | Torque Wrench | ESD Gloves | 4ea of 5m SMA cable |
|---|---|---|---|
|  |  |  |  |
| FC/APC-SC/APC Optic Fiber, 10m | Ground wire line | 2ea of ANT RF Cable | Wire Stripper & Cutter |
|  |  |  |  |
| Digital Multi-meter | Screw Driver | Optic connector cleaner | Optic cable, 3m SC/APC |
|  |  |  |  |
| Mounting bracket | Fixing nuts | RU ANT for AWS, 2ea | |
|  Wall mount bracket, 1 set |  |  | |

## 3.3 Item Check List

Check that all the following items have been included with the box delivered. If anything is missing, please contact Intelibs.

Table 3-2 Item check list

| RU-AWS | AC power cable | | |
|---|---|---|---|
|  RU equipment: 1 ea |  AC power cable: 1.5m, 1 ea | | |

## 3.4 Mounting

RU supports wall mount. The following diagrams illustrate the methods for mounting RU on a typical wall.

***Step 1***

- Mark the upper position by using the wall mount bracket for upper position.
- Mark the lower position by using the wall mount bracket for lower position.

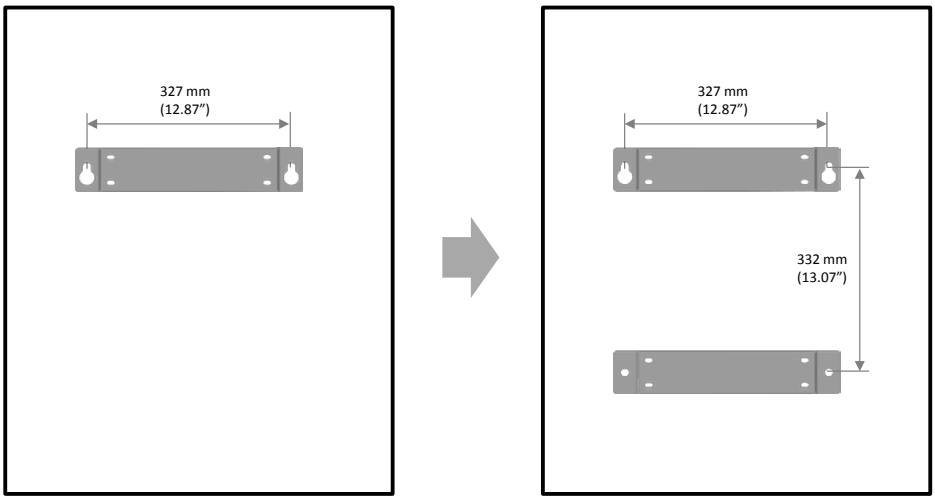



Figure 3-1 Mark the installation position

***Step 2***

- Screw two bolts to the upper positions.

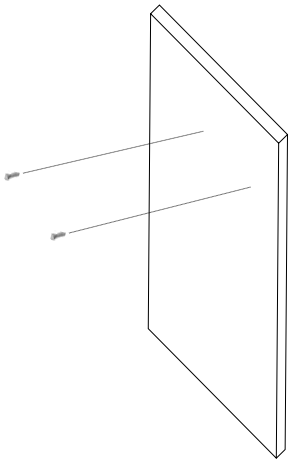


Figure 3-2 Install the upper bolts

***Step 3***

- Install the wall mount brackets as figure below. The wall mount brackets and the bolts are provided along with RU system.

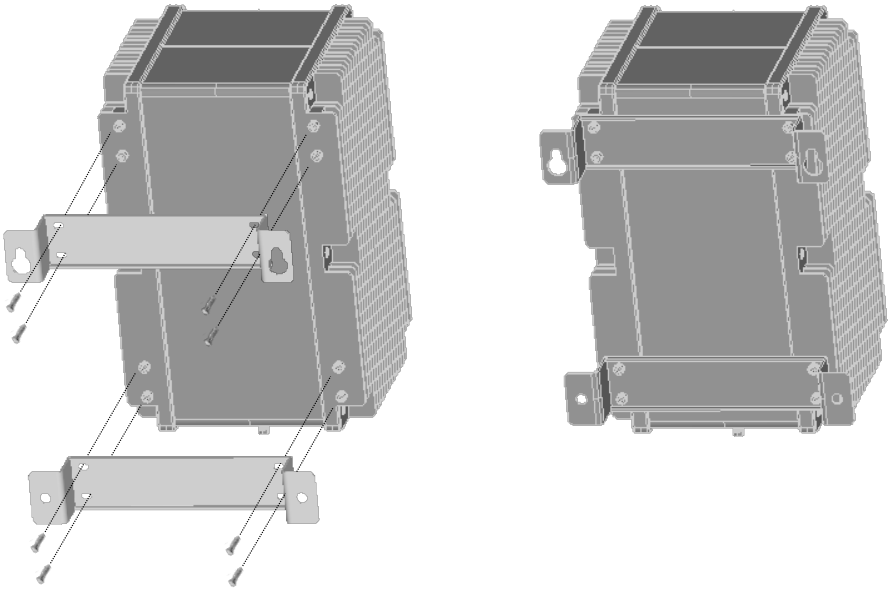
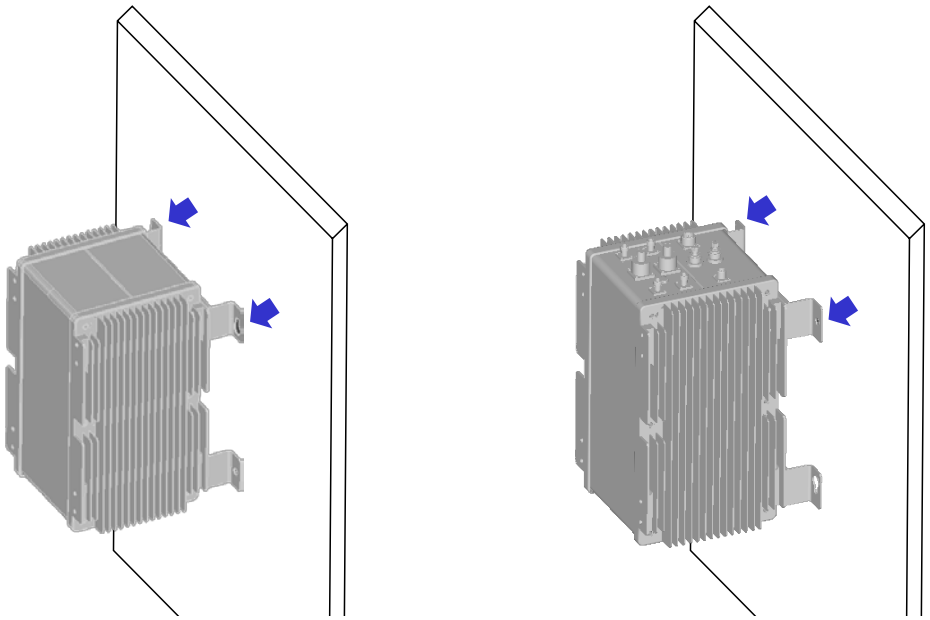



Figure 3-3 Install the wall mount bracket

***Step 3***

- Insert upper bracket hole into installed bolts on the upper positions.



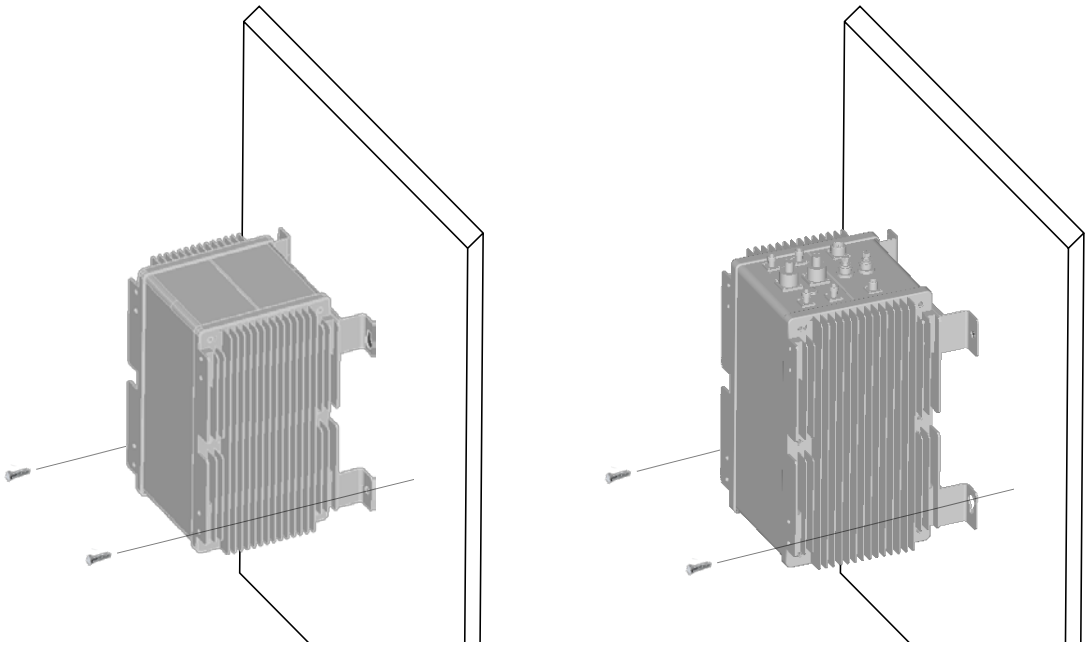
Interface ports on the bottom

Interface ports on the top

Figure 3-4 Hanging the upper bracket on the installed bolt

***Step 4***

- Screw two bolts to the lower positions.



Interface ports on the bottom

Interface ports on the top

Figure 3-5 Install the lower bolts

## 3.5 Link (Donor) Antenna

RU has two antenna ports. The one is for Cellular/LTE-main/AWS-main channel, the other is for PCS/LTE-MIMO/ASW-MIMO channel. Connect N-type female antenna cable to the desired antenna port, “ANT-0” or “ANT-1”, as Figure below.


Figure 3-6 Link Antenna connection

The duplex can be used which combine two port signals into one.

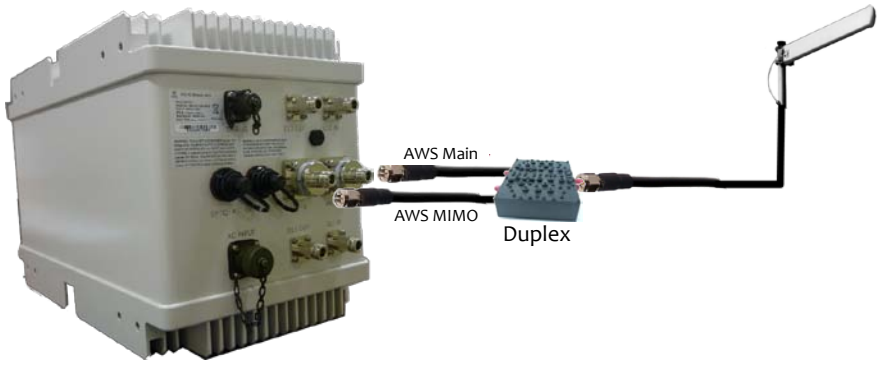



Figure 3-7 Link Antenna connection with Duplex

## 3.6 Power cable

Connect MS connector-type power cable to the “AC-INPUT” port. When connecting the end terminal, align connector at latch and hole position as marked in red circle in Figure below.

Figure 3-8 Power cable connection

## 3.7 Optic cable

RU provides two optic ports. The one is for main channel, the other is for cascading purpose. The connector used for optic interface is an OSP (Outside Plant) hardened SC/APC connector. This ruggedized connector is compatible with industry standard OSP terminals. Figure 3-9 shows OSP optic cable supplied with RU system.

Figure 3-9 OSP hardened SC/APC optic cable

Connect ruggedized OSP side optic connector to the desired optic port on RU, “OPTIC-A” as Figure below. When connecting the optic connector, align the connector at latch position, then plug in and rotate clockwise tightly.

Figure 3-10 Optic cable connection

## 3.8 RF power setting

### 3.8.1 Down Link power setting

***Step 1***

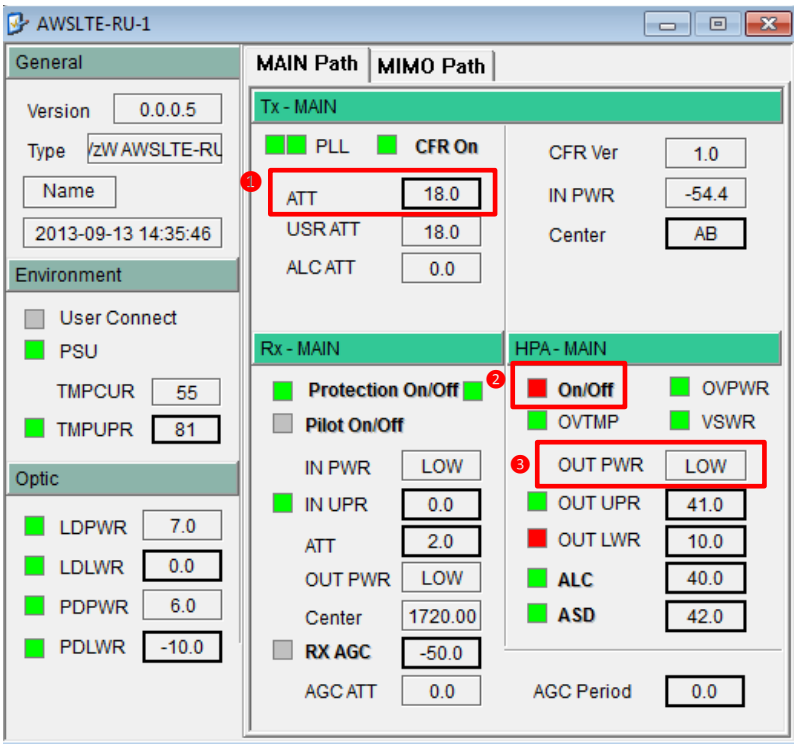
- Connect the power cable to RU to turn on the system.

***Step 2***

- Connect USB cable to manage RU through Laptop.

***Step 3***

- Run LMT application as the procedure described in 2.8.1.1.
- Adjust parameters as follows:
  ① Decrease the DL “USER ATT” to 30dB(Minimum gain) and verify that antenna is connected at antenna port of RU properly.
  ② Press the “HPA On/Off” button to turn HPA on.
  ③ Monitor the output power level from “ OUT PWR” parameter, and tune up “USR ATT” to set the proper output power level.



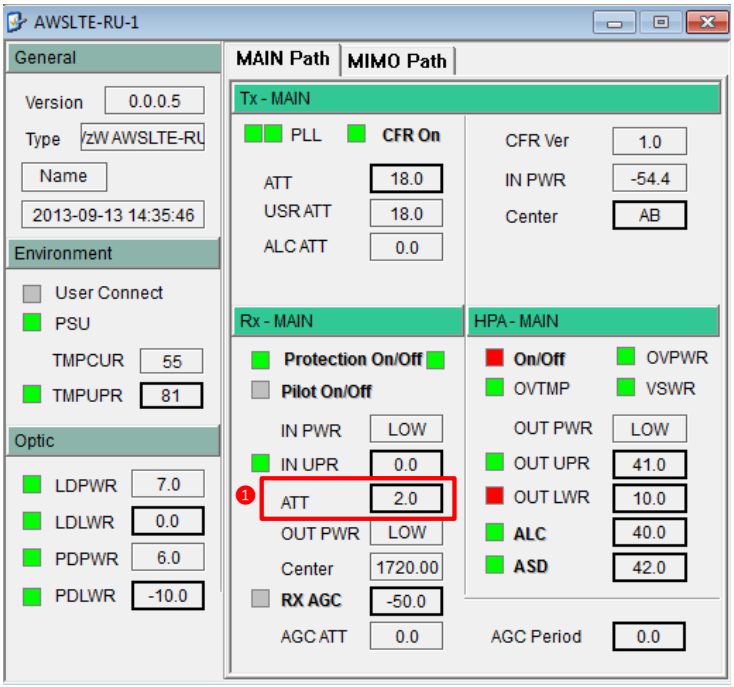

### 3.8.2 Up Link power setting

***Step 1 – Step 2***

- Follow same steps as Downlink power setting.

***Step 3***

- Run LMT application as the procedure described in 2.8.1.1.
- Adjust parameters as follows:
  ① Use the “ATT” to control Uplink gain.
  ② Uplink gain is very important parameter because uplink is connected to RF source of BTS. If you have wrong uplink gain set, BTS receiver sensitivity may be degraded due to improper uplink gain.
  ③ Try to minimize uplink gain with mobile Tx power.




# 4 Configuration and Maintenance

RU can be configured in three ways via remote internet connection or local serial port connection.

- SNMPv3 interface through the internet
- Web interface through the internet
- Local management interface through the internet, serial connection, and Bluetooth

Master Unit is a remote management system that provides SNMP v3 and Web interface, and maintains all functions of optical DAS system including configurations, monitoring, and real time alarm reporting.

LMT (Local Management Terminal) is local management interface through IP network, serial interface, and Bluetooth.

The configuration and maintenance for RUs are performed by accessing MHU system through any interfaces provided by MHU.

Figure below describes a typical DAS management system network and the entities.

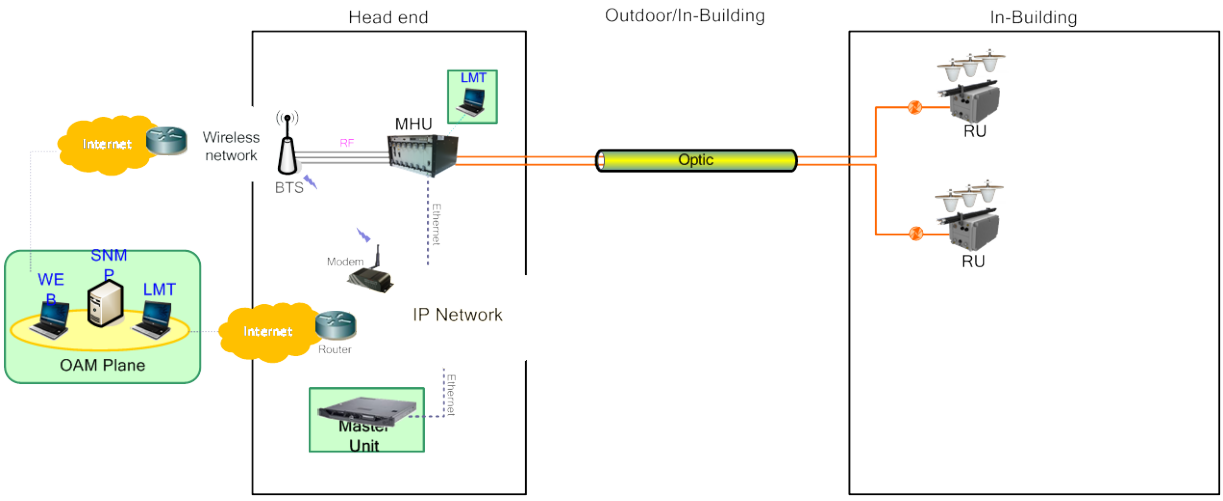



Figure 4-1 DAS management network and entities

Table 4-1 DAS management entities and their functions

| Functions | | SNMPv3 | Web | LMT |
|---|---|---|---|---|
| On-site Installation | Serial interface | | | o |
| | IP address assignment | | | o |
| | ID assignment (for Remote Unit) | | | o |
| | System Password | | | o |
| System Registration | System Registration/Unregister | o | | |
| Site/Location setting | DAS system's site and location information | | o | |
| Remote/Local management | Capture and restore the configuration | | o | |
| | Parameters settings and retrieval | o | o | o |
| | F/W upgrade | o | | o |
| | Alarms | o | o | o |
| Alarms | Alarm history | | o | |
| | Current Alarm | o | o | o |
| User management | Creation & Deletion of users | o | o | |
| | Password management | o | o | o |

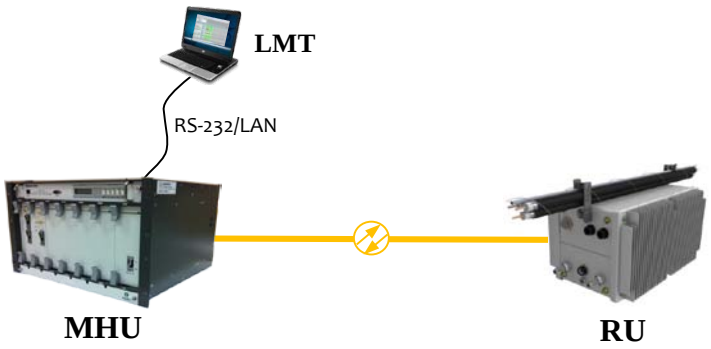



Figure 4-2 MHU/RU network

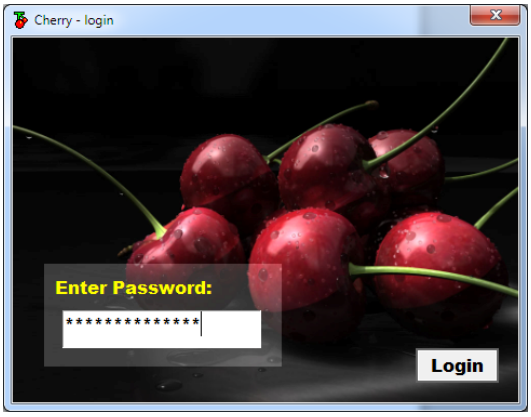
Figure 4-2 is an example of DAS network using LMT to configure DAS system. Following sections describes how to configure and manage RU system using LMT via serial/LAN connection or using Web Interface via Internet.

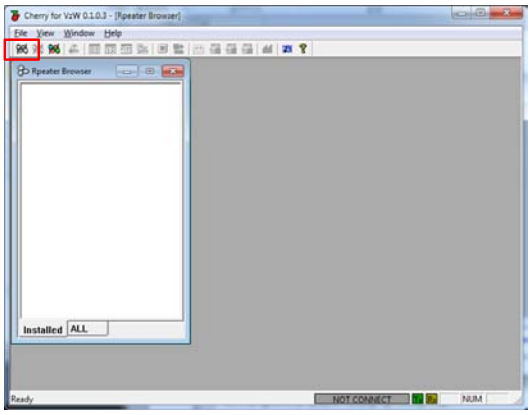
## 4.1 Configuring RU using LMT

If one of serial or LAN connection has been established, LMT is ready to start. Launch the Local Management application by clicking the icon “Cherry” and follows the steps below.

***Step 1***

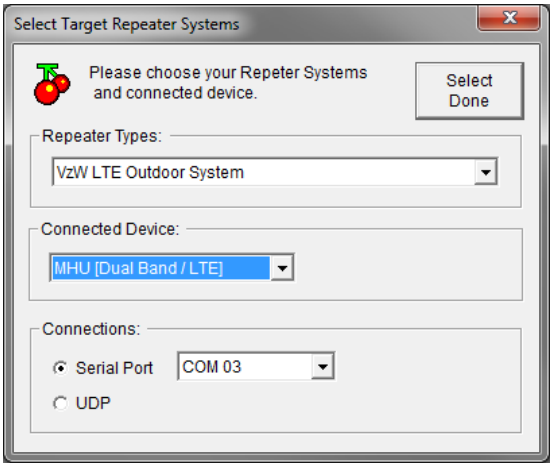
- Launch the application “Cherry”.
- Enter the password, click “Login”.
- Click “Connect” icon on the left top corner of window or click [File]-[connect] menu.

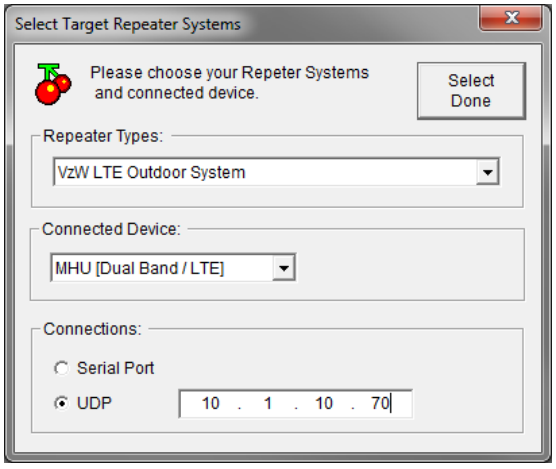


***Step 2***

- Select the connection parameters as follows:
    - Repeater Types: VzW LTE Outdoor System
    - Connected Device: MHU [Dual Band / LTE]
    - Connections
        - Serial Port: The port number established via serial interface or
        - UDP: IP address for the Ethernet interface

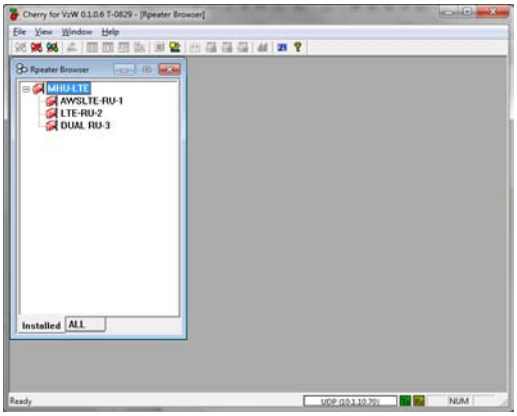



- Click “Select Done” button.

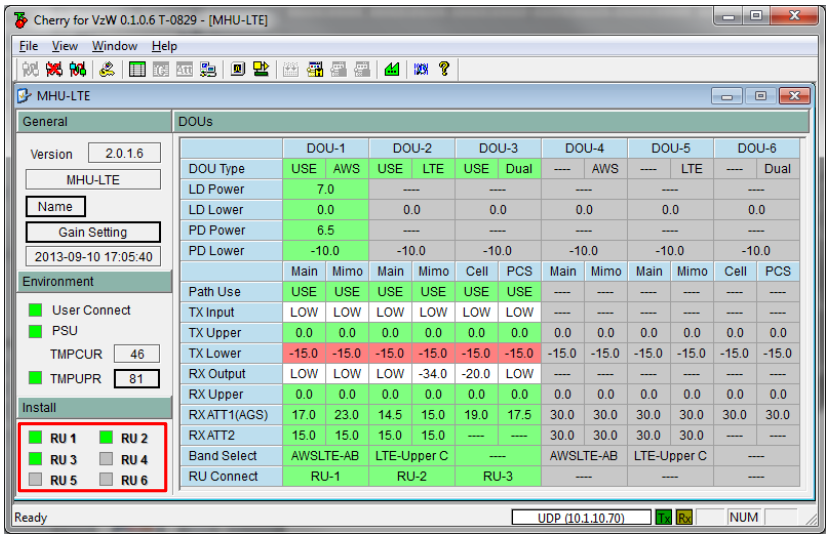
## Step 3

- If “Repeater Browser” window appears, click MHU-LTE system.



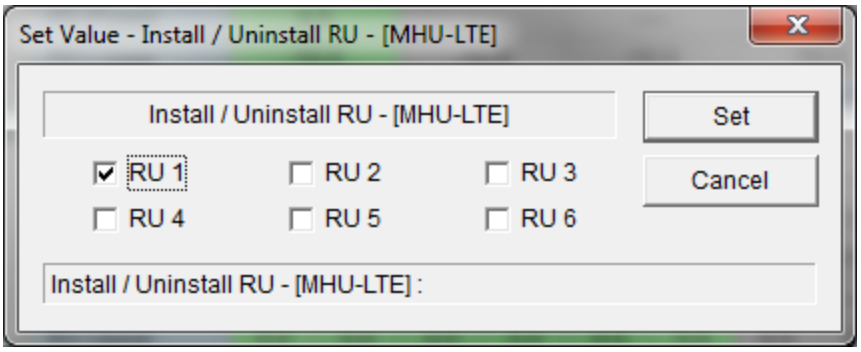

## Step 4

- Click any place inside of “Install” panel area.



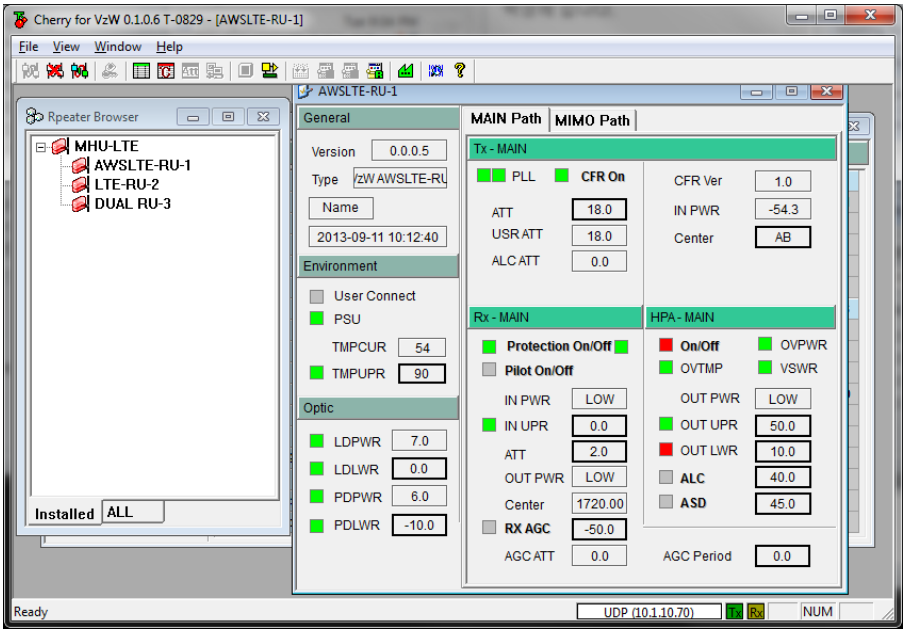

## Step 5

- At “Install / Uninstall RU – [MHU-LTE]” window, click the RU systems that has been installed according to MHU’s port number that is connected via optic cable.
- Then click “Set” button.




***Step 6***

- If RU is installed properly, the RU system can be found under the MHU system in "Repeater Browser" window.
- At "Repeater Browser" window, click the DAS system to be managed, then the selected DAS system's control window will pop up.




If connection is established successfully, then all parameters of RU system can be read/set by LMT terminal, and all status information can be reported to LMT. RU's status and parameters controllable by LMT are described in Table 4-2, 4-3, 4-4, and 4-5.

Table 4-2 General/Environment/Optic

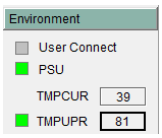
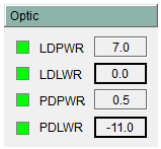
| Status group | Parameters | LED | Settable | Description |
|---|---|---|---|---|
|  | Version | | | Firmware Version of the DAS system |
| | DAS Type | | | The type of the DAS system |
| | Name | | √ | Sets following information of the DAS<br>- Name<br>- Model Number<br>- Serial Number |
| | Time/UpTime | | | Current time or Up-time |
|  | User Connect | √ | | Connection status with the DAS |
| | PSU | √ | | Status of Power Supply Unit |
| | TMPCUR | | | Current chassis temperature of the DAS system |
| | TMPUPR | √ | √ | Sets temperature upper limit, and display its value and alarm status. |
|  | LDPWR | √ | | Current output power of LD (Laser Diode) of optic module connected to RU. |
| | LDLWR | √ | √ | Sets the lower limit of output power of LD, and display its value and alarm status. |
| | PDPWR | √ | | Current input power of PD (Photo Detector) of optic module connected to RU. |
| | PDLWR | √ | √ | Sets the lower limit of input power of PD, and display its value and alarm status. |

Table 4-3 Tx-MAIN/MIMO

| Status group | Parameters | LED | Clickable | Description |
|---|---|---|---|---|
|  | MAIN Path | | | Selects MAIN channel |
| | MIMO Path | | | Selects MIMO channel |
|  | PLL | √ | | PLL's Alarm status |
| | CFR ON | √ | √ | ON/OFF status and control of CFR (Crest Factor Reduction) function |
| | CFR Ver. | | | Version of CFR function currently working |
| | ATT | | √ | Sets ATT value to control downlink Gain.<br>ATT = USR ATT + ALC ATT |
| | USR ATT | | | Used for downlink Auto Gain Control and fine tuning of gain. |
| | ALC ATT | | | Downlink ALC (Automatic Level Control) attenuation value. Available when ALC function is activated. |
| | IN PWR | | | Downlink input power from MHU |
| | Center | | √ | Sets a center frequency of downlink AWS band. |
| | TC ATT | | √ | Displays downlink temperature compensation attenuation value, and enable/disable downlink temperature compensation. |
| | HPA On/Off | √ | √ | Enable/disable downlink HPA (High Power Amp). |
| | OUT PWR | | | Downlink output power |
| | OUT UPR | √ | √ | Sets upper limit of downlink output power, and displays its value and alarm status |

| | | | | |
|---|---|---|---|---|
| | OUT LWR | √ | √ | Sets lower limit of downlink output power, and displays its value and alarm status |
| | ALC | √ | √ | Sets ALC (Automatic Level Control) function's activation level, and enable/disable ALC. |
| | ASD | √ | √ | Sets ASD (Automatic Shut Down) function's activation level, and enable/disable ASD. |

Table 4-4 Rx-MAIN/MIMO

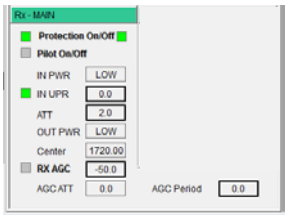
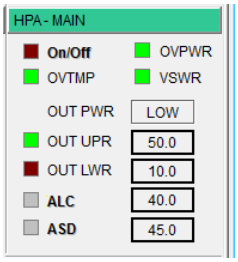
| Status group | Parameters | LED | Clickable | Description |
|---|---|---|---|---|
|  | Protection On/Off | √ | √ | Enable/disable uplink Protection function. In order to protect RU system from unexpected uplink high input power. If uplink input signal is higher than "IN UPR" level, RU system is shut downed and the LED color turns to red color. |
| | Pilot On/Off | √ | √ | Enable CW signal. It is used for uplink gain setting. |
| | IN PWR | | | Uplink input power |
| | IN UPR | √ | √ | Sets upper limit of uplink input power, and displays its value and alarm status |
| | ATT | | √ | Sets uplink attenuation, and displays its value. |
| | OUT PWR | | | Uplink output power |
| | Center | | | Indicates a frequency of pilot signal, and this value is changed automatically as downlink center frequency changed. |
| | RX AGC | √ | √ | Enable uplink path AGC (Automatic Gain Control) function, and sets its level. |
| | AGC ATT | | | Attenuation value of uplink path AGC function |
| | AGC Period | | | Time period of uplink path AGC function |

Table 4-5 HPA-MAIN/MIMO

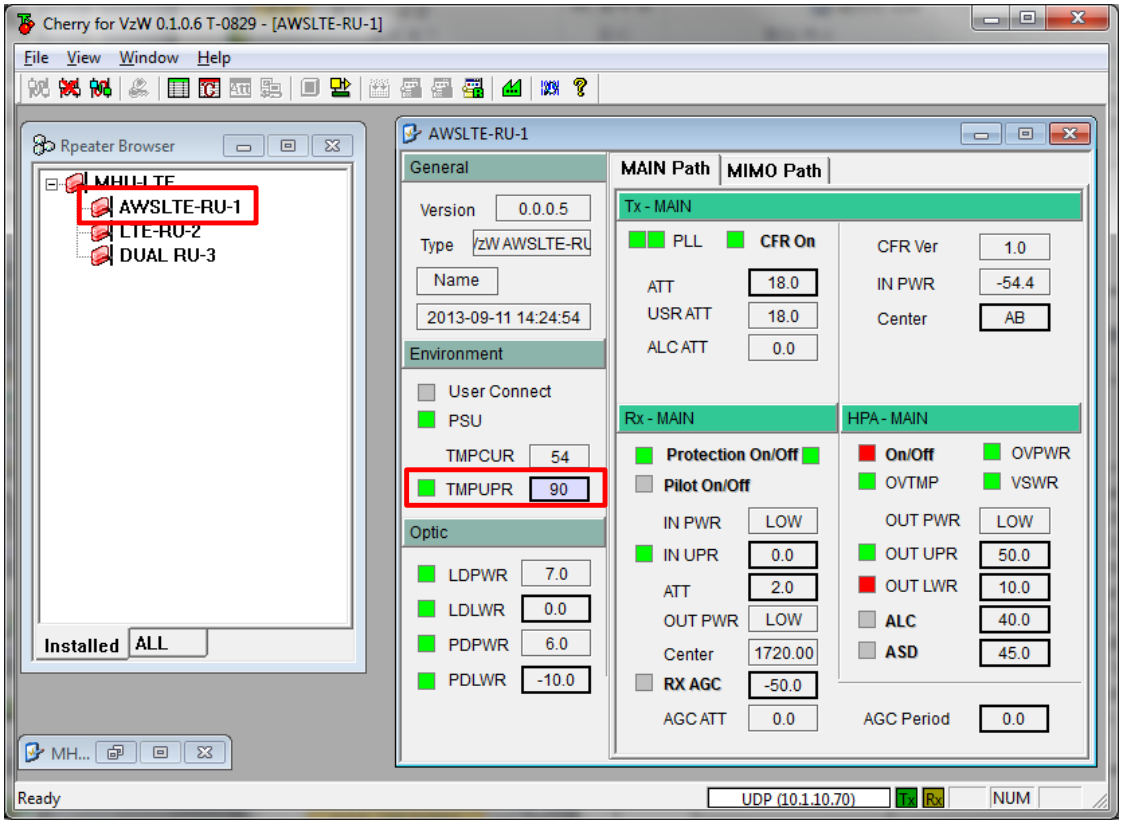
| | | | | |
|---|---|---|---|---|
|  | On/Off | √ | √ | Enable downlink HPA (High Power Amplifier) function, and indicates its status. |
| | OVTMP | √ | | Indicates current alarm status of HPA's over-temperature. |
| | OVPWR | √ | | Indicates current alarm status of HPA's over-Power. |
| | VSWR | √ | | Indicates current alarm status of HPA's VSWR (Voltage Standing Wave Ratio). |
| | OUT PWR | | | Indicates HPA's output power level. |
| | OUT UPR | √ | √ | Indicates current alarm status of HPA's output power upper limit, and sets upper limit value. |
| | OUT LWR | √ | √ | Indicates current alarm status of HPA's output power lower limit, and sets lower limit value. |
| | ALC | √ | √ | Indicates ALC (Automatic Level Control) function's current on/Off status, and sets ALC activation level. |
| | ASD | √ | √ | Indicates ASD (Automatic Shut Down) function's current on/Off status, and sets ASD activation level. |

## 4.2 Example: Setting the Temperature Upper Limit

Following is one example of LMT operation which sets the upper limit of RU chassis' temperature.

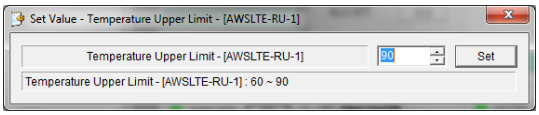
### *Step 1*

- At "Repeater Browser" window, click the DAS system to be managed, then the selected DAS system's control window will pop up.
- Click the temperature upper limit box which is on the right side of "TMPUPR". A number in the box represents current upper limit of chassis' temperature.

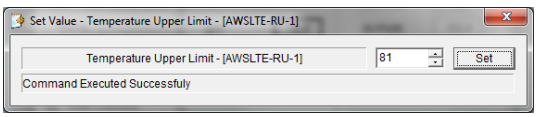



### *Step 2*

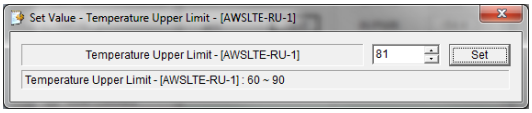
- Select TMPUPR value by clicking up/down button or enter temperature upper limit. Then click "Set" button.




- The result of operation displays at the bottom of the window.



- Click close button on the upper right corner of the window to exit the command window.




The small color box on the left side of "TMPUPR" represents current status of upper limit of RU chassis' temperature. If the box is GREEN, operating status is in normal condition. If the box is RED, "TMPUPR" alarm occurred and remains.

## 4.3 Web interface

Master Unit provides comprehensive management of the Intelibs optical DAS systems via Web GUI. Master Unit provides following functions for Web clients:

- Hierarchical view of the DAS systems
- Alarms histories
- Current Alarms
- SNMP agent settings
- Site and location information settings
- Web user settings
- Capture and restore the configuration of the DAS systems
- Parameter settings of the DAS systems

The web GUI is divided into two parts, a menu panel and a Parameter view panel. The menu panel is on the left side of main window, and the other side is the parameter view panel as shown in Figure 4-3.


Figure 4-3 Web GUI

The menu panel contains following menu functions:

- Home: Introductions of Intelibs, Inc, and brief introduction of GUI usage.
- DAS systems: Hierarchical view of registered DAS systems.
- Alarm history: Alarm log of all registered DAS systems.
- Alarms: Current alarms of all registered DAS systems.
- SNMP settings: SNMP environment settings such as trap IP, community, V3 user, etc.
- Site settings: Assign site and location information to each registered Das systems.
- User settings: Add/delete web user and change user's password
- Support: Intelibs' support information.
- About us: Redirect to Intelibs' web page.
- Log Off: Logging off current user's session.

Before using web interface, followings should be assigned and set correctly:

- Master Unit's IP address
- MHU system's IP address
- Master Unit's IP address on MHU system

Figure 4-4 shows web interface flow over IP network.

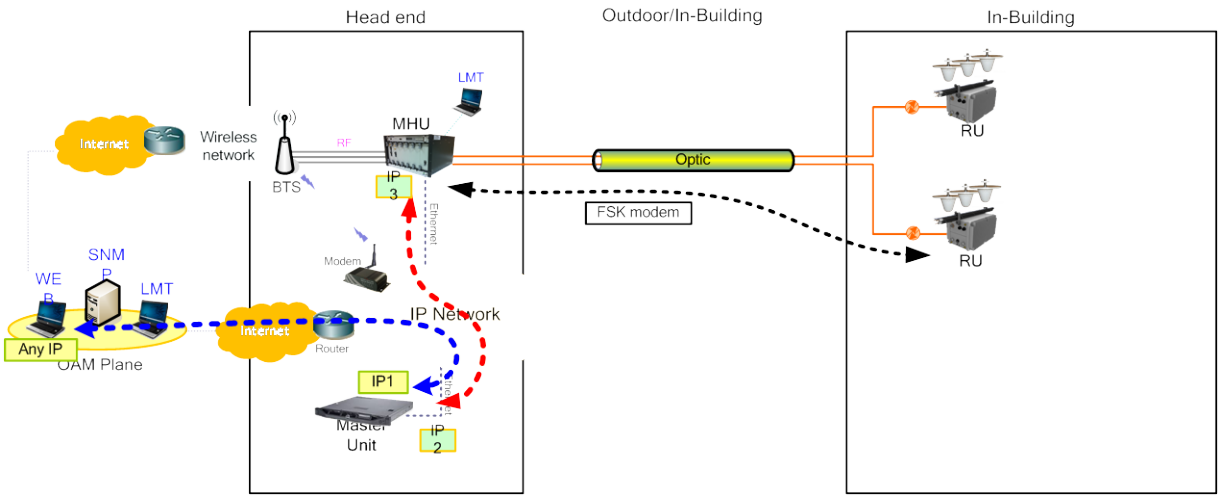



Figure 4-4 Web interface flow

If IP network connection is established successfully, then parameters of RU can be set by Web browser, and all status information can be reported to Web browser.

Following is one example of Web operation which sets the upper limit of RU chassis' temperature.

***Step 1***

- Open Web browser such as Internet Explorer or Chrome.
- Enter Master Unit's IP address that is assigned for Web interface. Usually the IP address is global IP or private IP if web client is on the same network where Master Unit is.


***Step 2***

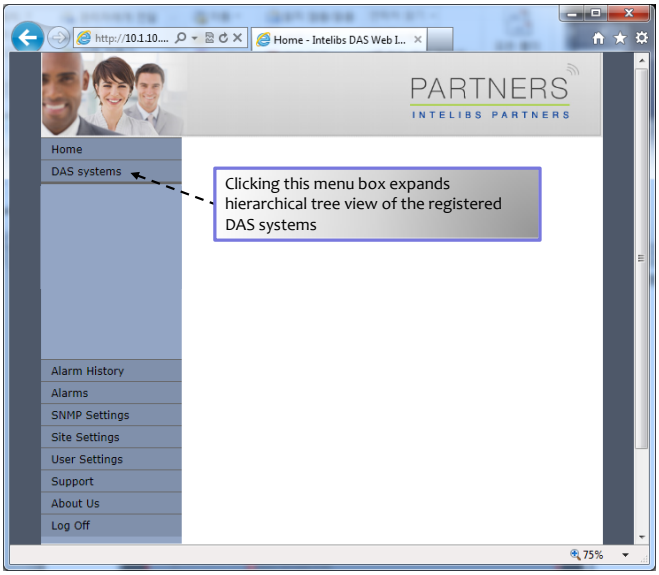
- Enter Login ID and Password. (Please contact Intelibs for login ID and password)

  The web interface provides two level user access, privileged or not. Privileged users can retrieve and change the advanced parameters that control the DAS system. For example, "TMPUPR" parameter is an advanced parameter that requires privileged user login.


- If ID/PWD matches, Web interface goes to Home page.


## *Step 3*

- Click “DAS systems” menu box to see the Hierarchy view of DAS systems.



## *Step 4*

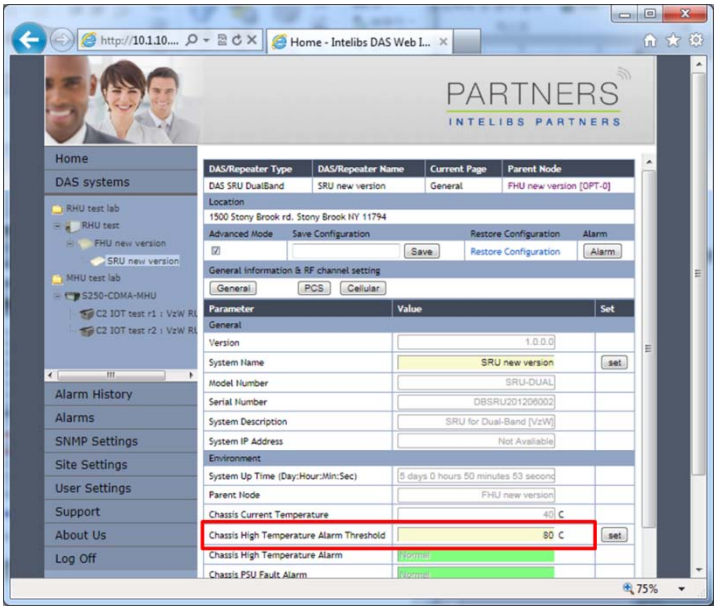
- Select a DAS system to control and monitor at the hierarchy view.


## *Step 5*

- Select “Advanced Mode” check box to display advanced parameters, for example “Chassis High Temperature Alarm Threshold” in the parameter view panel.

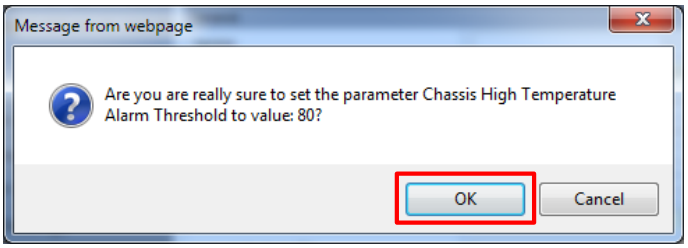
***Step 6***

- Enter numbers for “Chassis High Temperature Alarm Threshold”. Then click “Set” button.

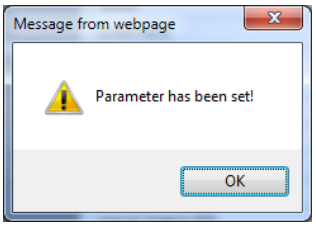



***Step 7***

- If confirmation window pops up, click “OK” button to confirm changing the parameter value.




- Then result window will pop up.




The column “Chassis High Temperature Alarm” represents upper limit of RU chassis’ temperature. If the value box is GREEN, operating status is in normal condition. If the box is ORANGE, this indicates “TMPUPR” alarm is turned on.

# 5 Appendix I. Ancillary Devices – Antenna, Cable and other Passive Device

Intelibs does not provide the ancillary device, however the following or equivalent devices are recommended:

- Recommended Antenna:
  - Commscope

| Electrical Specifications | | | |
|---|---|---|---|
| **Frequency Band, MHz** | **698–800** | **800–960** | **1710–2700** |
| Gain, dBi | 1.5 | 1.5 | 5.0 |
| Beamwidth, Horizontal, degrees | 360 | 360 | 360 |
| VSWR \| Return Loss, dB | 1.8 \| 10.9 | 1.5 \| 14.0 | 1.5 \| 14.0 |
| Input Power per Port, maximum, watts | 50 | 50 | 50 |
| Polarization | Vertical | Vertical | Vertical |
| Impedance | 50 ohm | 50 ohm | 50 ohm |

- Coaxial Cable:
  - RG142 or equivalent coaxial cables
- Fiber Cable:
  - SC/APC optical cable

# Limited Warranty

Intelibs, Inc ("Intelibs") offers a standard two year warranty from defects in material and installation. INTELIBS may at any time exclude from this Agreement any Hardware or Software which (1) has been modified, repaired or serviced by anyone other than Intelibs' service staff without the prior written approval of Intelibs, (2) has been subjected to unusual physical or electrical stress, whether such stress results from accident, neglect, misuse, lightning, failure of electrical power, air conditioning, humidity control, transportation, the making of specification or configuration changes requested by Customer, or any other cause other than ordinary use, and whether or not such stress is the fault of the Customer, (3) has been purchased from another Vendor and is networked, linked, attached or otherwise intended to work with the System or (4) has been moved from the place of installation. When the system has been improperly modified, repaired, stressed, used or moved as described above, Intelibs may, at its option and subject to the approval of the Customer, perform such corrective work, including any repairs, replacements and adjustments, as are in Vendor's opinion necessary to restore the System to the condition it would have been in if subjected only to normal wear and tear at the Customer's expense.

# Index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