**Intelibs, Inc**

# Small Remote Unit Product manual

**DAS**
**Version : 1.7.1**
**09-12-2013**

# 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 B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.*
*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.*

**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.

## Copyright information

# 1   Introduction

Small Remote Unit (SRU) is part of the Hybrid Distributed Antenna Systems (HDAS) to provide remote RF coverage solution from the Radio Hub Unit (RHU) fed by the RF source via wireline connection. SRU is built on a small form factor with a single antenna port for dual band frequencies with the following features:

- Multi-Technology support
- Low Power consumption fed by PoE or local AC adaptor
- 23 dBm + 23 dBm Tx Power per band
- Easy antenna installation
- SNMP based remote management support
- Single mode Fiber fed with 10 Km distance
- Auto Gain Control
- Band and Sub-channel filtering using DSP

Including SRU, Hybrid DAS is comprised of the following subsystems:

- RHU (Radio Hub Unit): Interface unit between RF source and Remote Units, Convert RF signal to optical waves.
- FHU (Fiber Hub Unit): Fiber distribution and aggregation interface between RHU and multiple SRUs. Each FHU supports up to 8 SRU and total up to 32 SRUs by two level FHU configurations
- SRU (Small Remote Unit): Small power (23 dBm per band, 26 dBm in dual band) remote unit
- 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 RHU, FHU and SRU. Each RHU can support up to 16 pair of SRU's that can cover up to 500Ksf$^2$ indoor space.
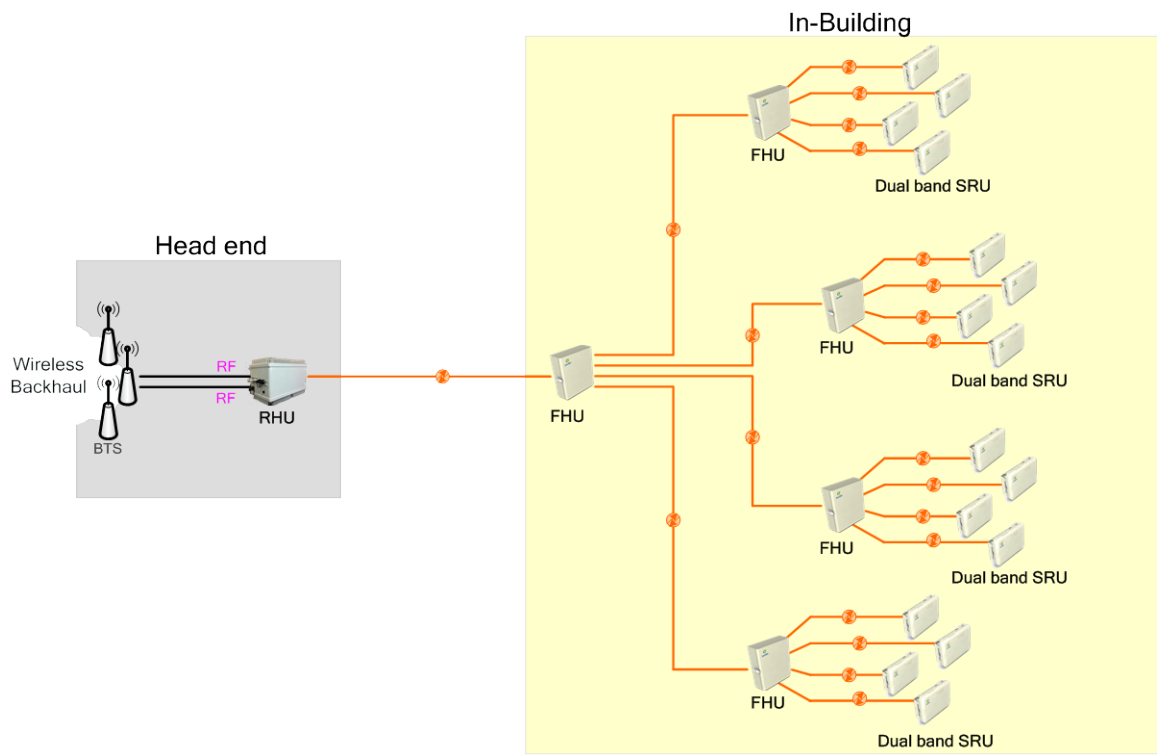
Figure 1-1 RHU-FHU-SRU/RU network diagram

## 2 Product Description

As shown in Figure 2-1, SRU is a compact platform with the natural heat convection. As unified form factor, SRU services multiple technologies on a single platform with Dual band operating frequencies. It can be mounted on the wall, ceiling 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 SRU system

### 2.1 External interface ports and Status Indicators

SRU has all interface connections at topside of the enclosure, which includes optic, antennas, power, and maintenance port. Figure 2-2 shows the front panel of SRU.



Figure 2-2 Top and bottom side SRU

Table 2-1 Interface ports

| Port | Connector type | Position | Description |
|---|---|---|---|
| Power | DC Power Jack | Top | 12V DC inlet, AC/DC converter or PoE adapter |
| Debug | USB | Top | Serial interface for GUI and debugging |
| Optic | FC/APC | Top | Optic fiber connection with FHU |
| LTE | SMA-Female | Top | LTE Uplink/Downlink RF signal interface |
| ANT | SMA-Female | Bottom | Omni ANT connection |

Table 2-2 Status indicator LEDs

| Name | Normal state | Abnormal state | Description |
|---|---|---|---|
| Power | Green | Off | Power injection status |
| RUN | Green/Blinking | Off | CPU working status |
| Alarm | Green | RED | Major Alarm status |

## 2.2   Modules

SRU is comprised of several internal modules as follows;

- Optic module Performs E/O (or O/E) conversion for FWD and RVS signals.
- MCU Board Monitors the status of modules in SRU and controls the configurable parameters of the SRU modules.
- Quadruplexer cavity filter passes FWD and RVS path PCS/Cellular frequency bands.
- RF Transceiver controls the gain of FWD path of PCS/Cellular frequency bands.
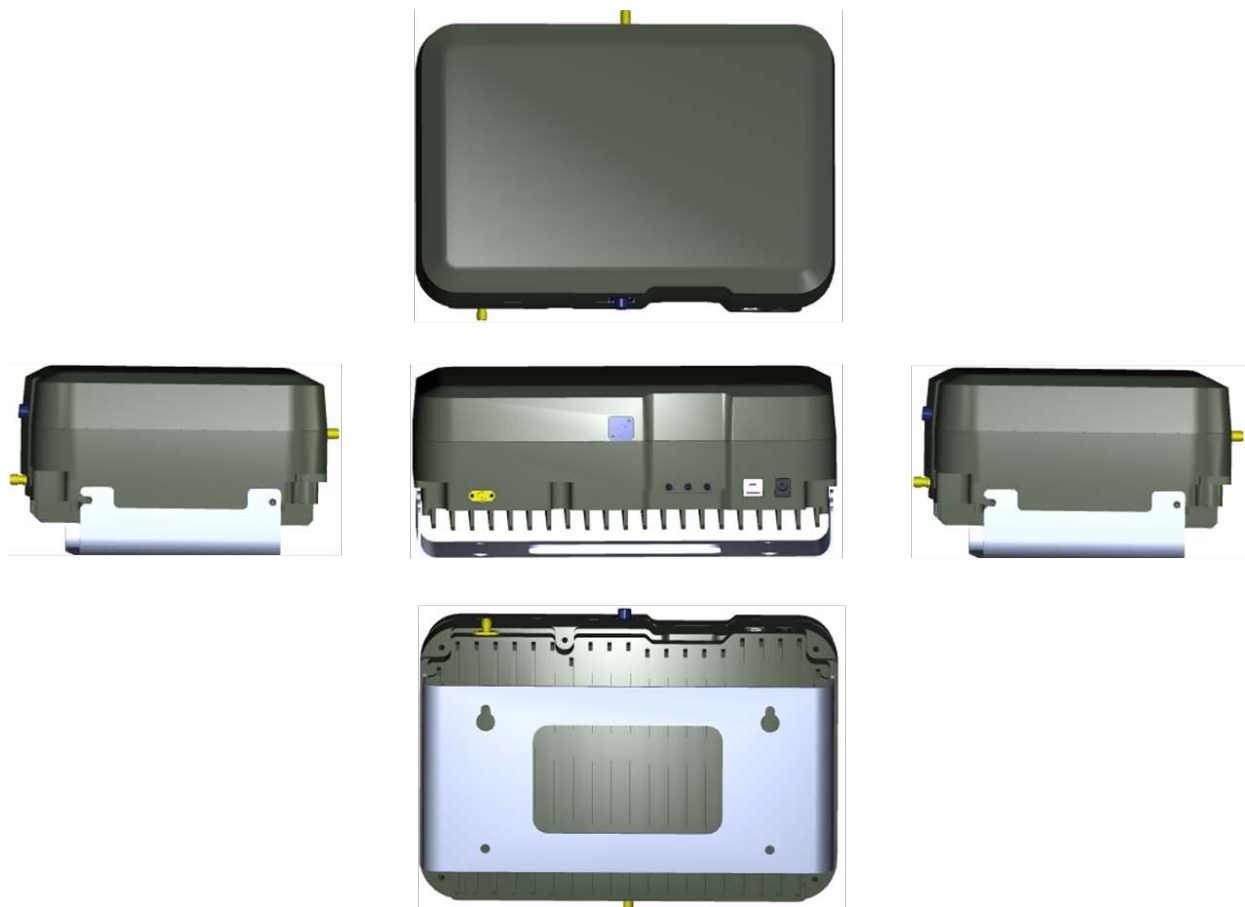
## 2.3   Mechanical Drawing



Figure 2-3 Exterior in 3-dimension

## 2.4  Technical Specifications

### 2.4.1  General specifications

Table 2-3 General Specifications

| Specification | Values | Remarks |
|---|---|---|
| Dimensions | 89(H) x 175.8(W) x 263.8(D) mm | without holder bracket |
| Weight | 4.6 Kg | |
| ANT and RF connector | SMA-type Female | |
| Optic port | FC/APC type | |
| GUI port | USB B-type | |
| Input Supply Voltage | 12V DC | PoE adapter/splitter |
| Operating Temperature | -20 ~ +50 °C | |
| Humidity | 5 ~ 80% Relatively | |

### 2.4.2  Frequency allocation

#### 2.4.2.1  1900 MHz band
Table 2-4 First and last channel center frequency information of 1900MHz band

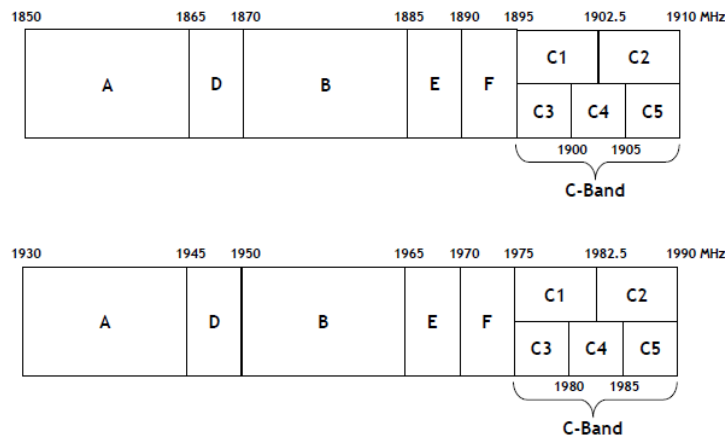| Band Edge | GSM 1900 | | | WCDMA 1900 | | | CDMA 1900 | | |
|---|---|---|---|---|---|---|---|---|---|
| | CH No. | CH Center freq. (MHz) | | CH No. | CH Center freq. (MHz) | | CH No. | CH Center freq. (MHz) | |
| | | Down Link | Up Link | | Down Link | Up Link | | Down Link | Up Link |
| First CH | 512 | 1930.2 | 1850.2 | 9662 | 1932.4 | 1852.4 | 25 | 1931.25 | 1851.25 |
| Last CH | 810 | 1989.8 | 1909.8 | 9938 | 1987.6 | 1907.6 | 1175 | 1988.75 | 1908.75 |



Figure 2-4 Frequency band allocation of 1900 MHz band

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### 2.4.2.2    850 MHz band

Table 2-5 First and last channel center frequency information of 850MHz band

| Band Edge | GSM 850 | | | WCDMA 850 | | | CDMA 850 | | |
| | CH No. | CH Center freq. (MHz) | | CH No. | CH Center freq. (MHz) | | CH No. | CH Center freq. (MHz) | |
| | | Down Link | Up Link | | Down Link | Up Link | | Down Link | Up Link |
|---|---|---|---|---|---|---|---|---|---|
| First CH | 128 | 869.2 | 824.2 | 139 | 871.4 | 826.4 | 1013 | 869.7 | 824.7 |
| Last CH | 251 | 893.8 | 848.8 | 240 | 891.6 | 846.6 | 777 | 893.31 | 848.31 |
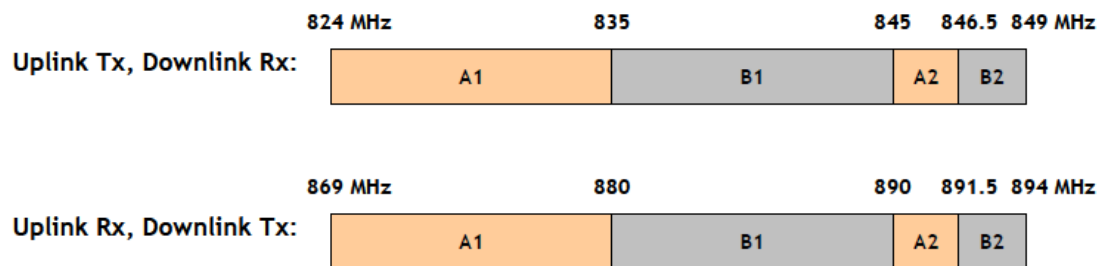


Figure 2-5 Frequency allocation of 850 MHz band

### 2.4.3 RF specifications

Table 2-6 Dual band specifications

| Item | Specification | Remarks |
|---|---|---|
| Downlink Frequency | 869 ~ 894 MHz, 1930 ~ 1990 MHz | |
| Uplink Frequency | 824 ~ 849 MHz, 1850 ~ 1910 MHz | |
| Operating Bandwidth | Cellular: 25MHz BW<br>PCS: 60MHz BW | |
| DL Output Power | +26dBm/composite @ANT Port | Dual Band Output Power |
| Optical wavelength | SRU: DL 1310/UL 1550nm | WDM included |
| Optic Module Gain | 0dB w/ passive device loss | Optic Module Gain FHU ~ SRU |
| Available optical fiber loss | 2dBo (2Km) max. | Including connector loss. |
| Gain ripple over each band | 2 dB Peak to Peak | Gain flatness over 25MHz BW |
| Gain flatness over Dual Band | +/- 2dB(4dBp-p) | Gain flatness of 850/1900MHz |
| Attenuator Control Range | 0 ~ 30dB | Optic loss Compensation |
| Gain Control Step Size | 1 dB | ±0.7 dB tolerance at 0 ~ 25dB |
| Input VSWR | 1.5: 1 Max. | All of RF Port |
| Frequency Stability | ±0.01 ppm | |
| System Delay | 500nsec max. | |
| EVM | 5% max. | |
| Rho | 0.998 min. | |
| Spurious Emissions | Comply to 3GPP, 3GPP2 and FCC | |
| Rx Noise Figure | 5 dB @UL Gain 40dB | @ Room temperature |
| Rx max. input level | -40dBm | CW -30dBm can be receivable |
| System Gain | DL 45~47dB/UL 50~52dB | Gain ±2dB @-20~50°C |

### 2.4.4 Power Specifications

Table 2-7 Power specifications

| Item | Specification |
|---|---|
| Rated Input Voltage | 12 V DC |
| Permissible range | Tolerance ±10% |
| Power consumption | 30 W, maximum |
| | 27 W, typical |

## 2.5 Installation

### 2.5.1 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 SRU
- Dirty Connectors and ports
- Faulty Small Remote Unite (SRU) components
- RF source equipment issue
- External RF Interface problem such as antenna port
- Wrong or Improper Ethernet cable for POE input

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.

#### 2.5.1.1 General Safety Precautions

The following precautions apply to the SRU:

- 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 FHU and SRU unless equipped with protection goggle. Invisible infrared radiation may be present at the front panel of the RHU, FHU and SRU. Do not remove the fiber port dust caps unless the port is going to be used. Do not stare directly into a fiber port.)
- When the service antenna is connected to the SRU, SMA connector must be firmly tightened. (Caution: Do NOT over tighten the connector.)
- The PoE Ethernet cable should be run with the maximum no more than 300 feet distance. It is only for in-building use only.

### 2.5.2 Installation Tools

Table 2-8 Installation tools

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| 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 |
|  |  |  |  |
| Rubber Mallet | Digital Multi-meter | Screw Driver | Optic connector cleaner |
|  |  |  |  |

### 2.5.3 Item Check List

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

Table 2-9 Item check list

| SRU | PoE splitter | PoE adapter | AC power cable |
|---|---|---|---|
|  SRU equipment with bracket: 1 ea |  PoE splitter: 1 ea |  PoE adapter: 1 ea |  AC power cable: 1 ea |

### 2.5.4 Wall Mounting

SRU supports wall mount. The following diagrams illustrate the methods for mounting SRU in a typical wall. The brackets for wall mount are provided with SRU system.



Mounting bracket            Placing SRU on the bracket            Mounting SRU on the bracket
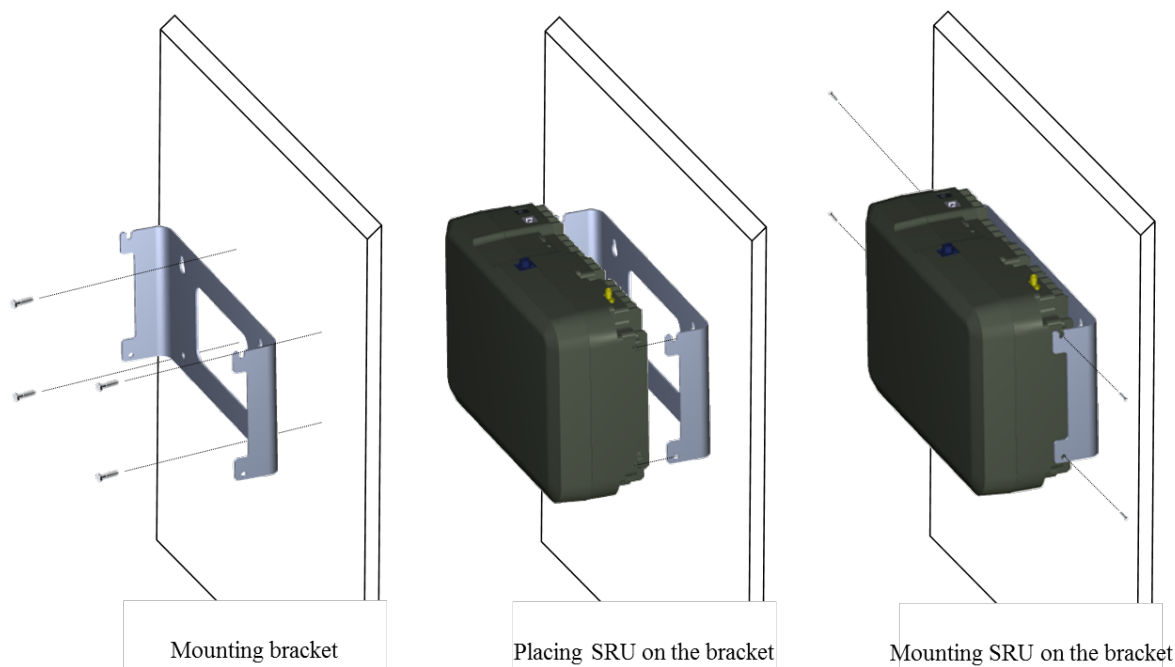
Figure 2-6 Wall mounting

### 2.5.5 Antenna

SRU uses various antennas depends on its application and environment. SRU provides one antenna port "ANT" at the rear side of the system. Figure 2-9 shows antenna connection with swivel blade antenna.



Figure 2-7 Antenna connection

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### 2.5.6 Power cable

SRU uses 12V DC power, and DC power adapter/splitter set using PoE (Power over Ethernet) technology are provided with the system. The PoE adapter converts AC input to 48V DC, and delivers DC power via UTP5 Ethernet cable up to 330 feet. The PoE splitter receives 48V DC power via UTP5 Ethernet cable, and converts 48V to 12V DC. The power connection diagram is described in Figure 2-8.
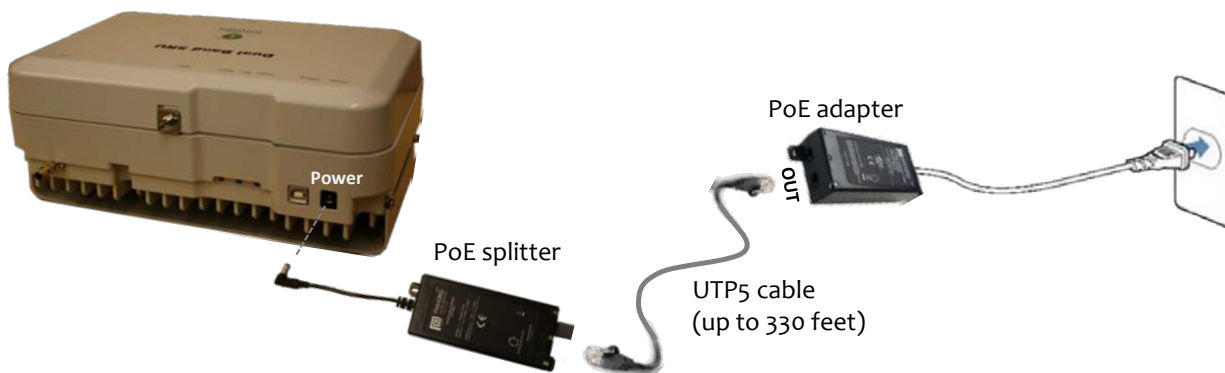


Figure 2-8 Power connection

Power connection sequence is as follows:

① Connects UPT5 cable to "OUT" port of PoE adapter.

② Connects UTP5 cable to "IN" port of PoE splitter.

③ Connects one end of power cable to PoE adapter's AC inlet, and the other side of power cable to AC outlet.

④ Verify the LED status on PoE splitter and adapter

⑤ Connects DC output connector to "Power" port of SRU.

### 2.5.7 Optic cable

SRU provides one optic port for uplink, "Optic" port, and optic connector type is FC-APC (Angle Physical Type). While connecting the optic cable, align the FC type connector at latch and hole position, then plug in and rotate clockwise tightly.



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Figure 2-9 Optic cable connection

Figure 2-10 and 2-11 shows optic connection of RHU-FHU-SRU equipment.
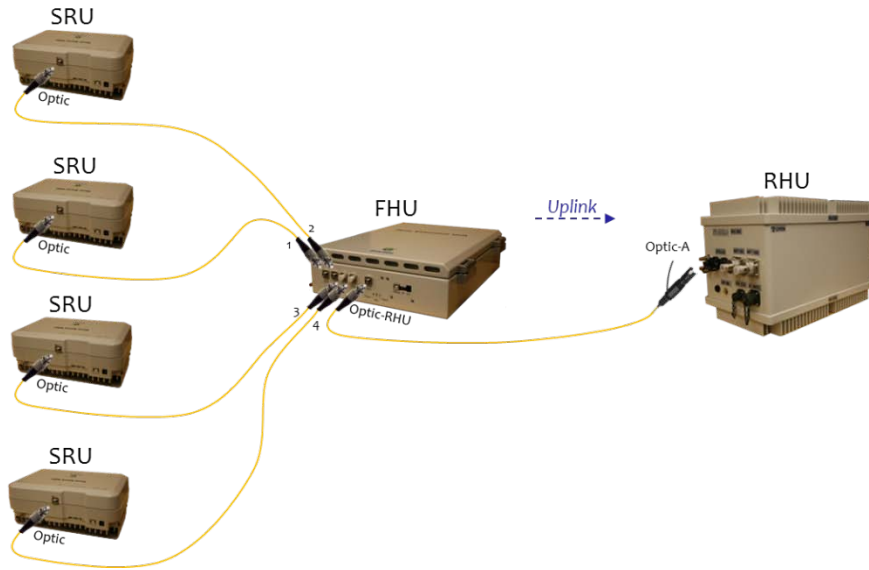


Figure 2-10 Optic cabling when cascading DAS systems with one FHU
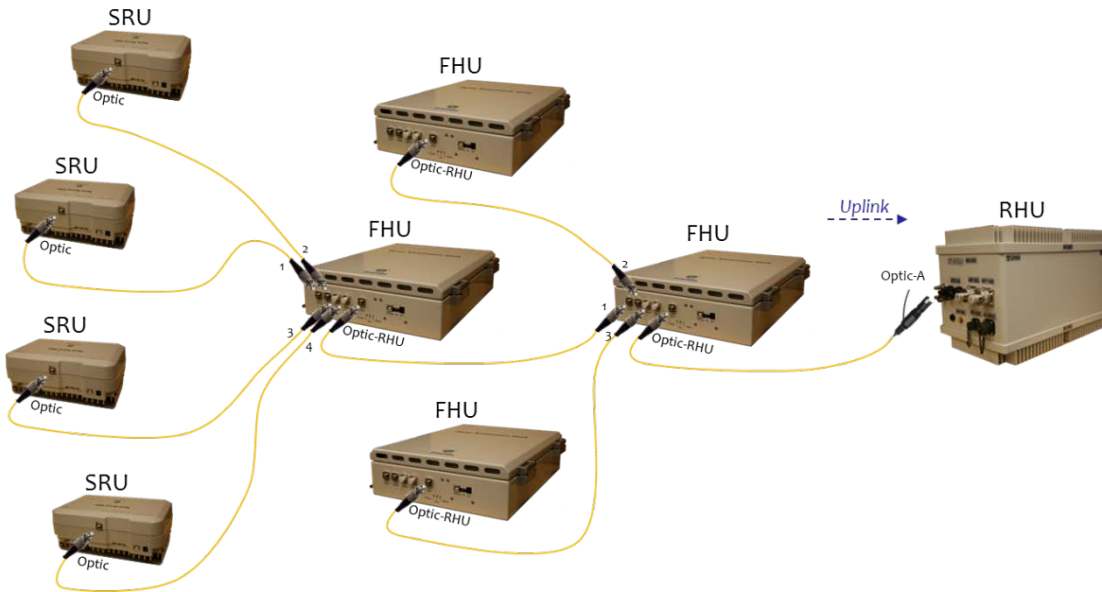


Figure 2-11 Optic cabling when cascading DAS systems with two-stage FHU

Please refer to the SRU Installation Guide for details.

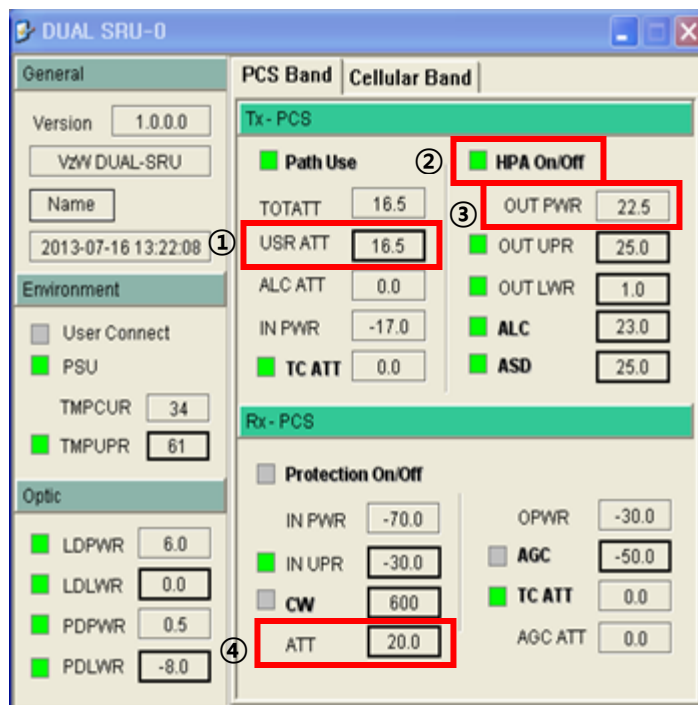## 2.6   SRU power setting

### 2.6.1   Down Link power setting

1. Connect the power cable to SRU

Power

PoE splitter
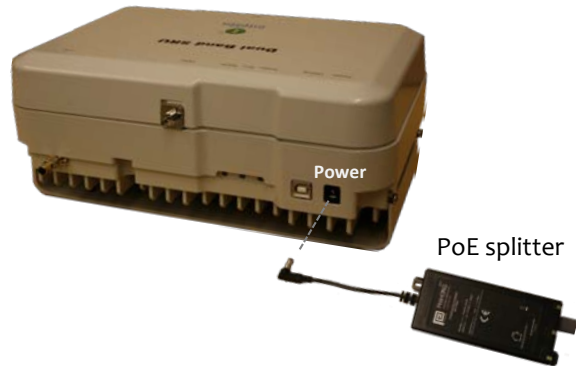
2. Connect USB cable to manage SRU through Laptop.

3. Execute application program and open GUI screen of SRU

4. Decrease the DL "USER ATT(①)" to 30dB(Minimum gain) and verify that antenna is connected at antenna port of SRU properly.

5. Press the "HPA On/Off(②)" button to turn HPA on

6. Monitor the output power level from " OUT PWR(③)" parameter and tune up "USR ATT(①)" to set the proper output power level of SRU.

### 2.6.2 Up Link power setting

1. Use the "ATT(④)" 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 by SRU uplink gain.

3. Try to minimize uplink gain with mobile Tx power.


## 2.7   Configuration and Maintenance

SRU 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 SRU is performed by accessing RHU system through any interfaces provided by RHU.

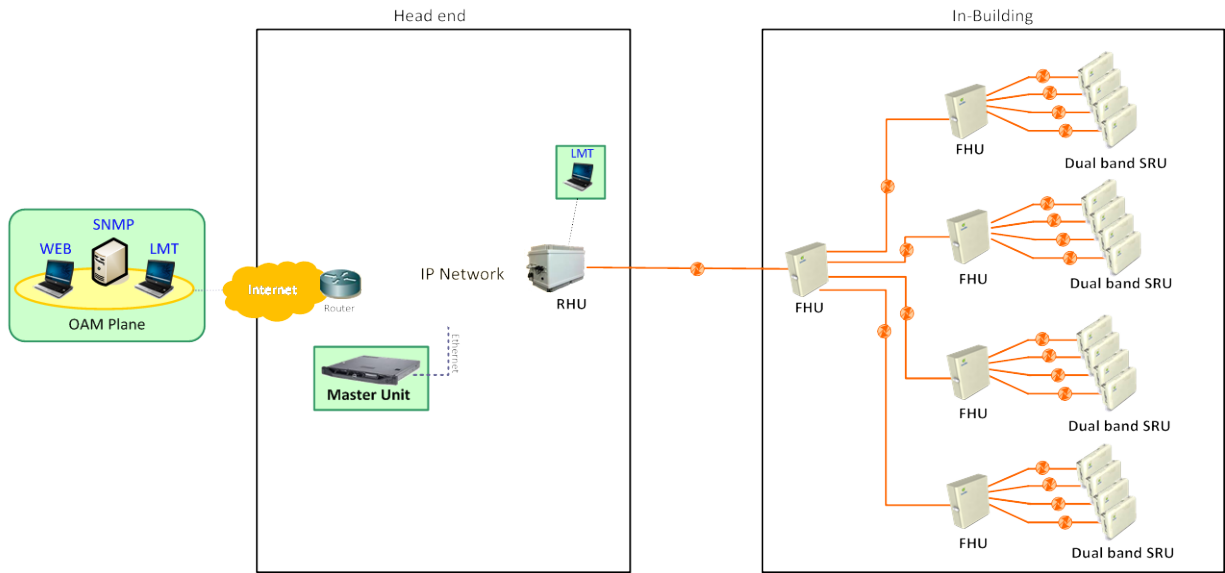Figure below describes a typical DAS management system network and the entities.



Figure 2-12 DAS management network and entities

Table 2-10 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 |
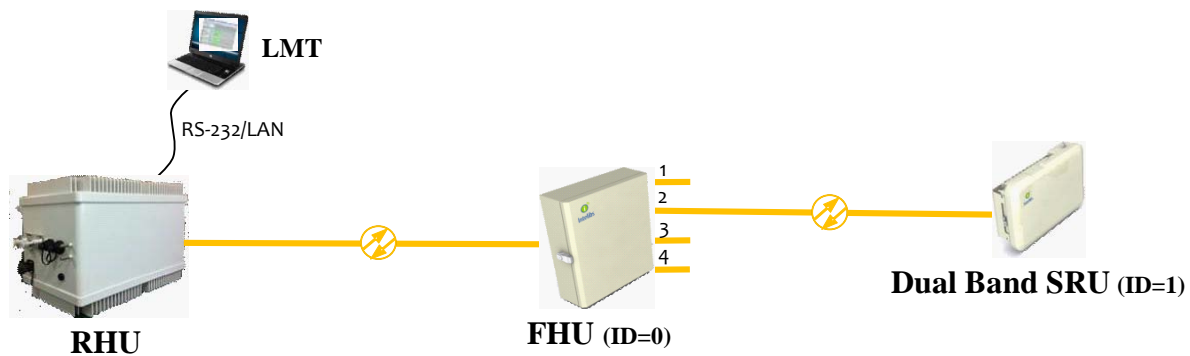


Figure 2-13 RHU/FHU/SRU network

Figure 2-13 is an example of DAS network using LMT to configure DAS system. Followings sections describes how to configure and manage FHU system using LMT via Bluetooth connection or using Web Interface via Internet.

Figure 2-14 Bluetooth connection

### 2.7.1.1 Configuring FHU/SRU

If one of Bluetooth or Ethernet 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.
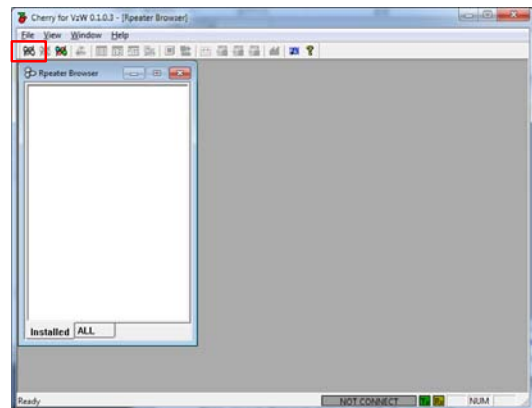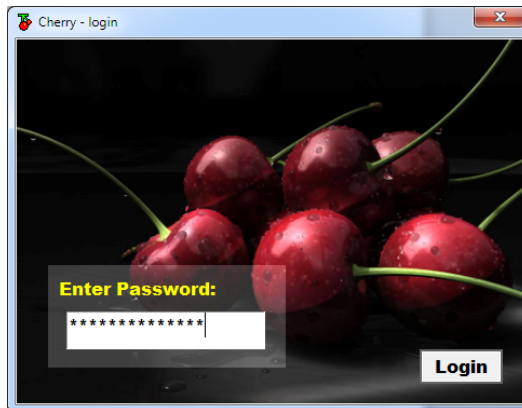


*Step 2*

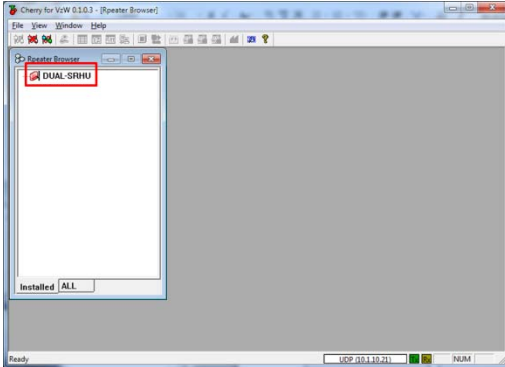- Select the connection parameters as follows:
    - Repeater Types: VzW Dual Band Small Power INB System
    - Connected Device: SRHU [Dual Band]
    - Connections
        o Serial Port: The port number established via Bluetooth or
        o UDP: IP address for the Ethernet interface



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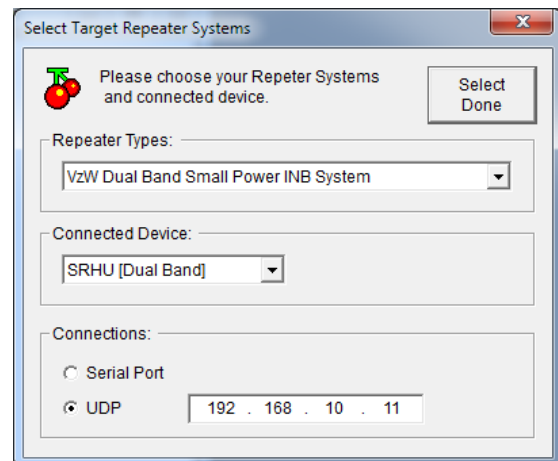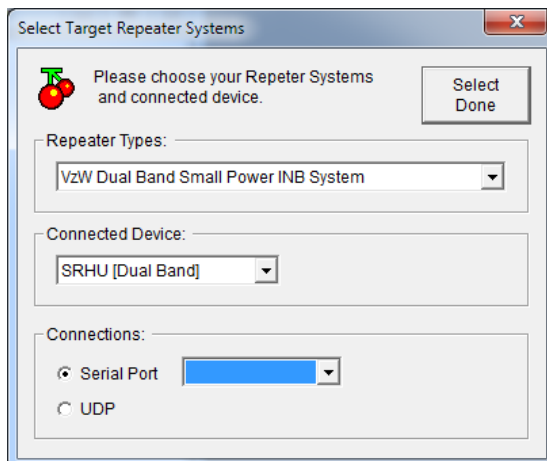
- Click "Select Done" button.

*Step 3*

- If "Repeater Browser" window appears, click DUAL-SRHU system.



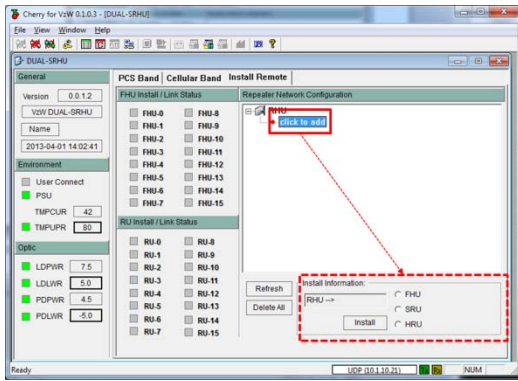*Step 4*

- Select "Install Remote" tab to install FHU and SRU, then click "Refresh" button.
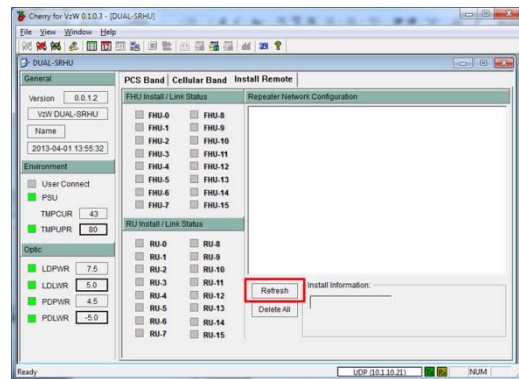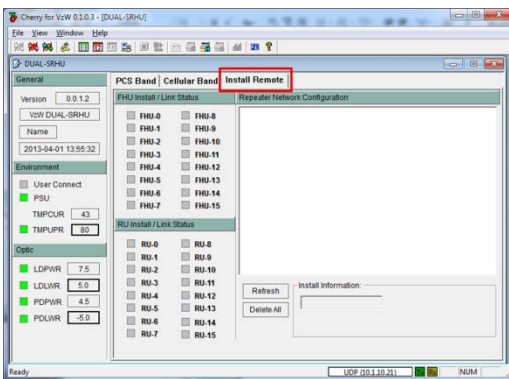


*Step 5*

- At "Repeater Network Configuration" window, click "click to add" text.
- In the "Install Information" select "FHU".
- Select FHU ID from the FHU drop down list. FHU's ID is provided by manufacturer.
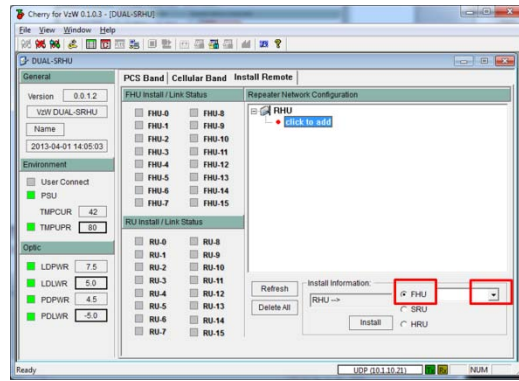
*Step 6*

- If FHU's ID is selected, click "Install" button at "Install Information".
- After Install, click "Refresh" button to display installed equipment.
- If FHU is installed properly, at "FHU Install / Link Status" panel a check box on the left side of FHU's ID turns to GREEN, otherwise it turns to RED.
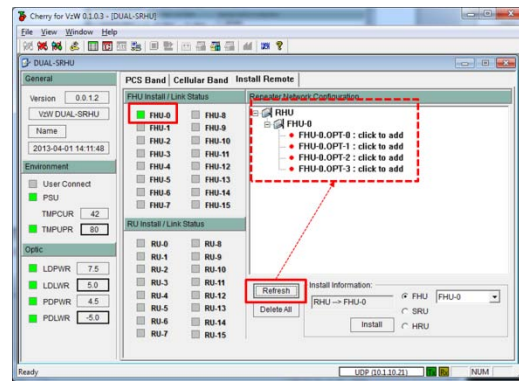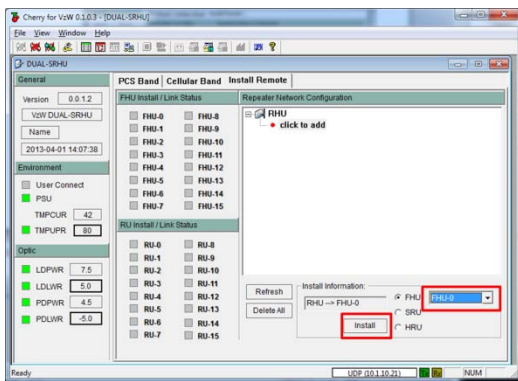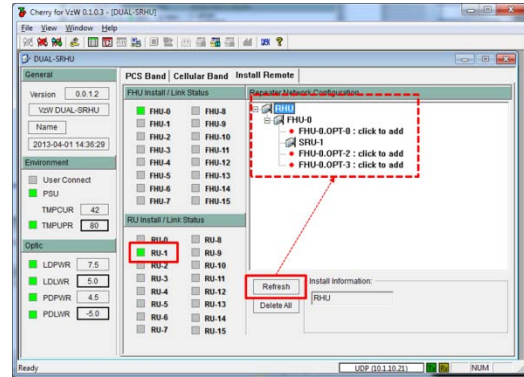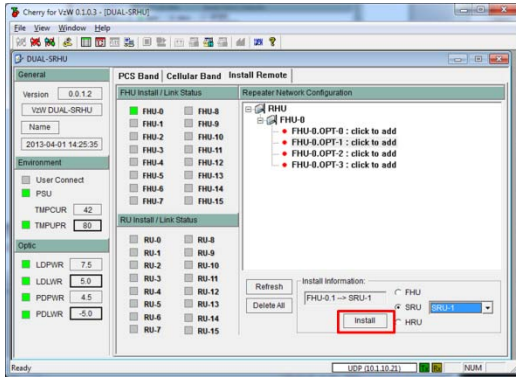


*Step 7*

- Click "click to add" text on FHU's port that SRU attached, then select "SRU" and click drop-down box to select SRU's ID. SRU's ID is provided by manufacturer.
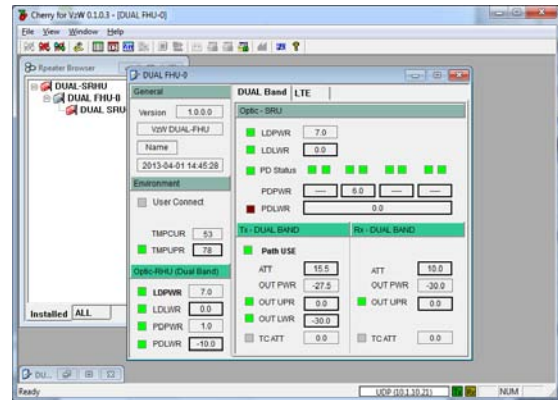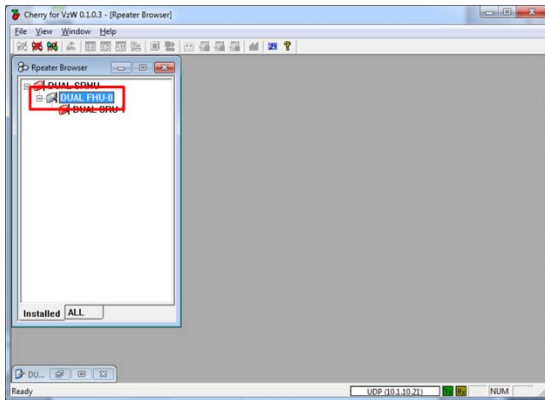


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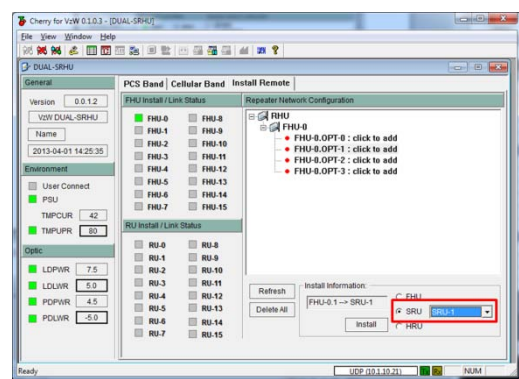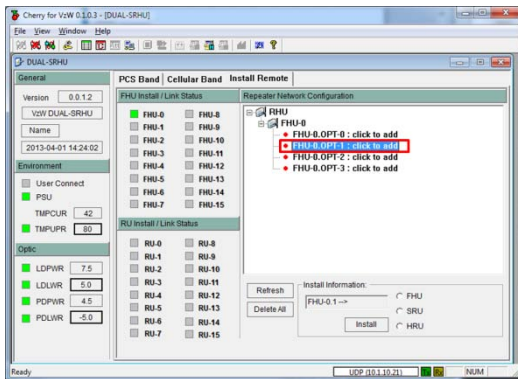
*Step 8*

- If SRU's ID is chosen, then press "Install" button. After Install, press "Refresh".
- If SRU is installed properly, a small box on the left side of SRU's ID turns to GREEN, otherwise it turns to RED.



### Step 9

- 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 SRU can be set by LMT terminal, and all status information can be reported to LMT. SRU's status and parameters controllable by LMT are described in Table 2-11, 2-12, and 2-13.

Table 2-11 General/Environment/Optic

| Status group | Parameters | LED | Settable | Description |
|---|---|---|---|---|
| General<br>Version 1.0.0.0<br>VzW DUAL-SRU<br>Name<br>2013-04-01 16:47:17 | Version | | | Firmware Version of the DAS system |
| | DAS Type | | | The type of the DAS system |
| | Name | | √ | Set following information of the DAS<br> - Name<br> - Model Number |

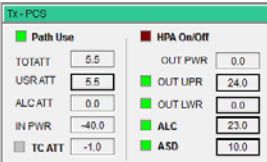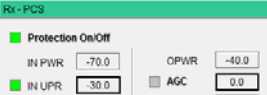| | | | | |
|---|---|---|---|---|
| | | | | - Serial Number |
| | Time/UpTime | | | Current time or Up-time |
|  | User Connect | √ | | Connection status with the DAS |
| | PSU | √ | | Status of Power Supply Unit |
| | TMPCUR | | | Current chassis temperature of the DAS system |
| | TMPUPR | √ | √ | Set temperature upper limit, and display its value and alarm status. |
|  | LDPWR | √ | | Current output power of LD (Laser Diode) of optic module connected to SRU. |
| | LDLWR | √ | √ | Set 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 SRU. |
| | PDLWR | √ | √ | Set the lower limit of input power of PD, and display its value and alarm status. |
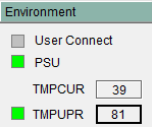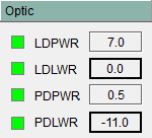
Table 2-12 Tx-PCS/Cellular

| Status group | Parameters | LED | Clickable | Description |
|---|---|---|---|---|
|  | PCS Band | | | Selects PCS channel |
| | Cellular Band | | | Selects Cellular channel |
|  | Path Use | √ | √ | Turning On/Off of usage of the channel, and display its status |
| | TOTATT | | | Downlink total attenuation value |
| | USR ATT | | √ | Set user configurable downlink attenuation value |
| | ALC ATT | | | Downlink ALC (Automatic Level Control) attenuation value |
| | IN PWR | | | Downlink input power from RHU or FHU |
| | 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 | √ | √ | Set upper limit of downlink output power, and displays its value and alarm status |
| | OUT LWR | √ | √ | Set lower limit of downlink output power, and displays its value and alarm status |
| | ALC | √ | √ | Set ALC (Automatic Level Control) function's activation level, and enable/disable ALC. |
| | ASD | √ | √ | Set ASD (Automatic Shut Down) function's activation level, and enable/disable ASD. |

Table 2-13 Rx-PCS/Cellular

| Status group | Parameters | LED | Clickable | Description |
|---|---|---|---|---|
|  | Protection On/Off | √ | √ | Enable/disable uplink Protection function. |
| | IN PWR | | | Uplink input power |

| | IN UPR | √ | √ | Set upper limit of uplink input power, and displays its value and alarm status |
|---|---|---|---|---|
| | CW | √ | √ | Enable/disable uplink Pilot, and selects uplink CW channel. |
| | ATT | | √ | Set uplink attenuation, and displays its value. |
| | OPWR | | | Uplink output power |
| | AGC | √ | √ | Set AGC (Automatic Gain Control) function's activation level, and enable/disable AGC. |
| | TC ATT | √ | √ | Displays uplink temperature compensation attenuation value, and enable/disable uplink temperature compensation. |
| | AGC ATT | | | AGC (Automatic Gain Control) attenuation |

## 2.7.1.2   Setting the Temperature Upper Limit

Following is one example of LMT operation which sets the upper limit of SRU 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.
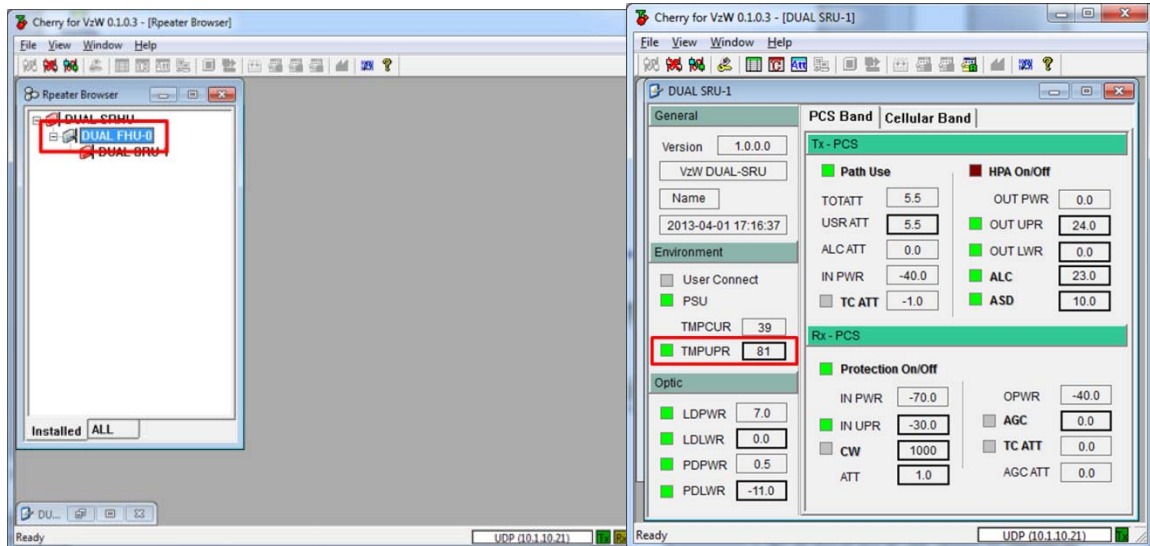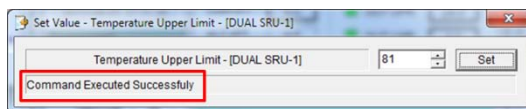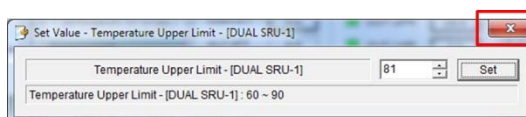


### Step 2

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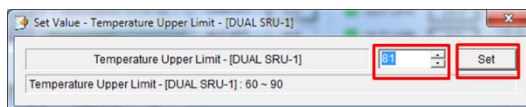


- The result of operation displays at the bottom of the window.



- 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 SRU chassis' temperature. If the box is GREEN, operating status is in normal condition. If the box is RED, "TMPUPR" alarm occurred and remains.

### 2.7.2    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 2-15.



Figure 2-15 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
- RHU system's IP address
- Master Unit's IP address on RHU system

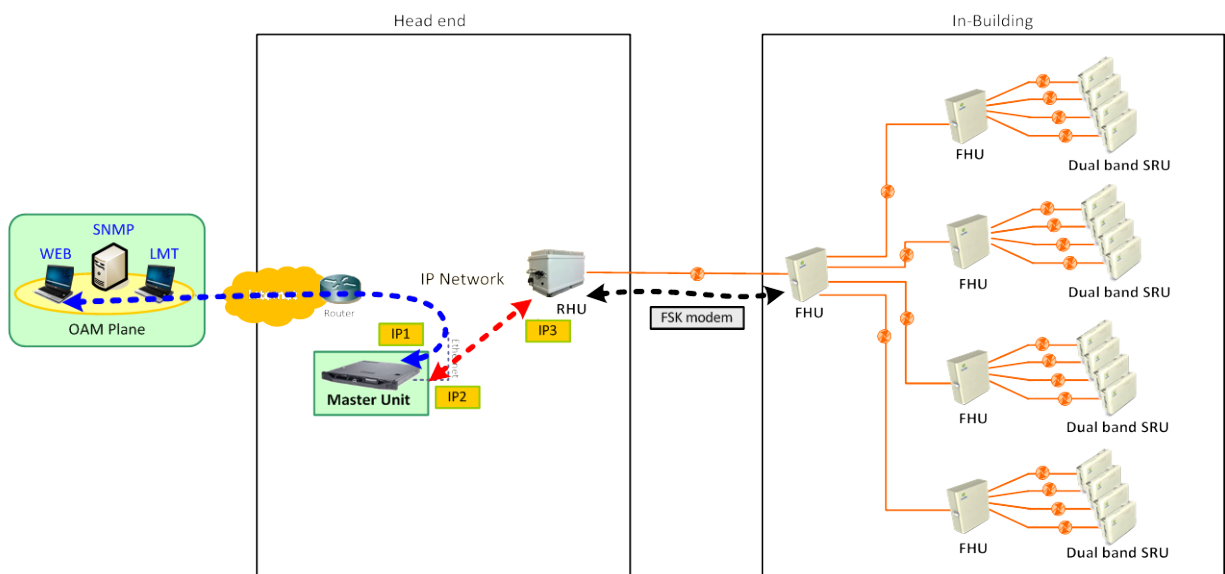Figure 2-16 shows web interface flow over IP network.



Figure 2-16 Web interface flow

`

If IP network connection is established successfully, then parameters of SRU 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 SRU 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.
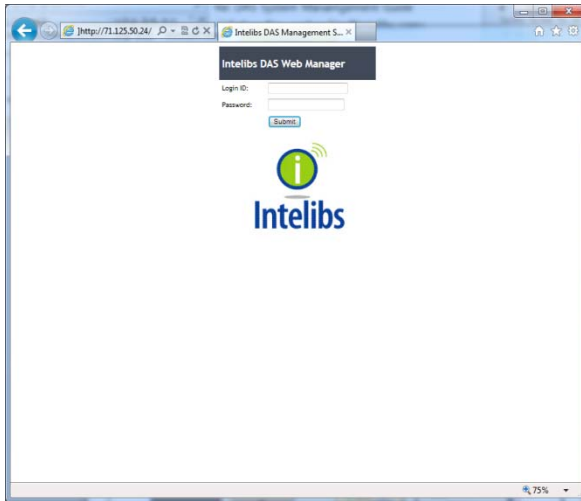


*Step 2*

- 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.
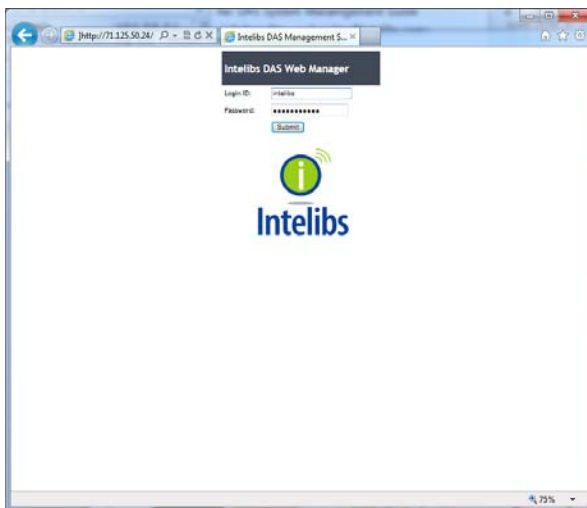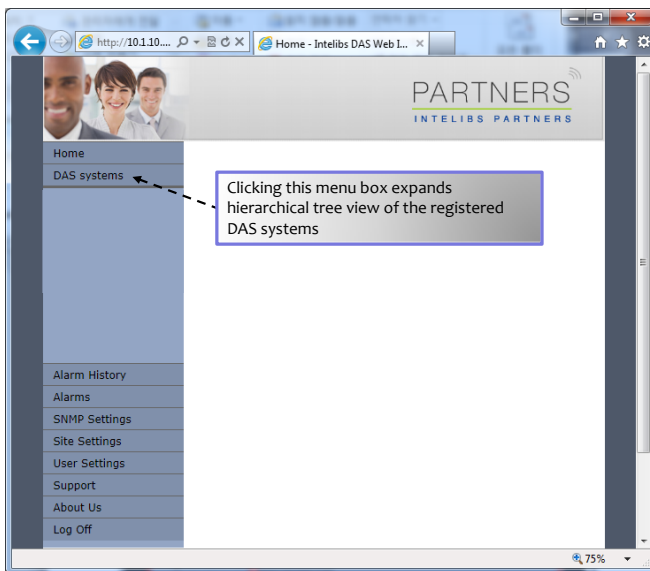


- If ID/PWD matches, Web interface goes to Home page.

*Step 3*

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



Clicking this menu box expands hierarchical tree view of the registered DAS systems

*Step 4*

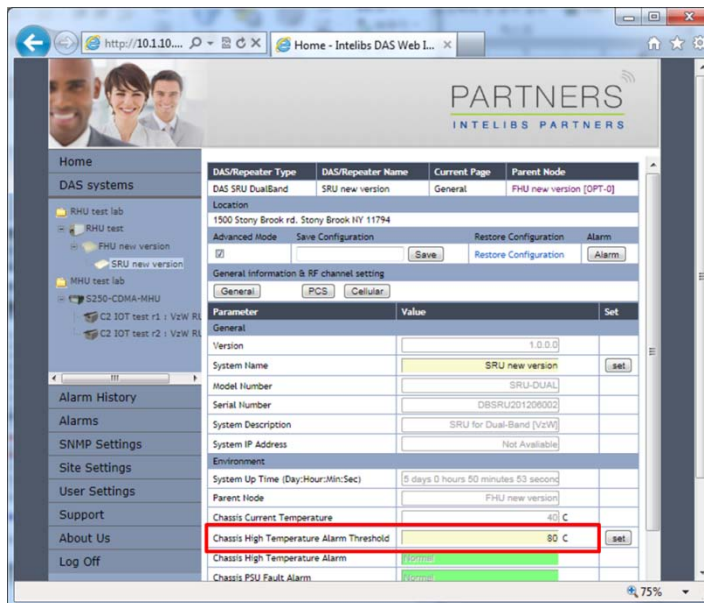- Select a DAS system to control and monitor at the hierarchy view.



*Step 5*

- Select "Advanced Mode" check box to display advanced parameters, for example "Chassis High Temperature Alarm Threshold" in the parameter view panel.
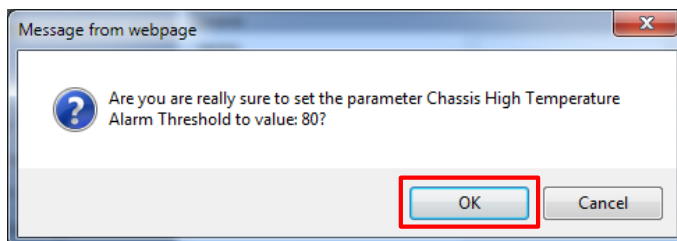
*Step 6*

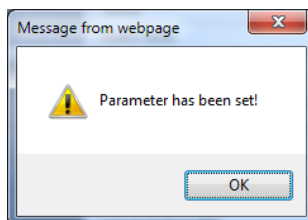- Enter numbers for "Chassis High Temperature Alarm Threshold". Then click "Set" button.



*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 SRU 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.

# 3 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:
  - Larson Dipole Antenna

## Electrical Specifications

| | |
|---|---|
| Frequency [MHz] | 698-960/1710-2170/ 2500-2700 |
| Nominal Impedance [Ω] | 50 |
| VSWR | 2.5:1 |
| Gain [dBi] | 0 Min-2 Max |
| Polarization | Linear Vertical |
| Radiation Pattern | Omni |
| Power Rating [W] | 3 |

  - 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 |

- PoE Ethernet Cable and Adaptor:
  - CAT6e or equivalent cable is recommended.

Phihong PoE Adaptor  (POE61U-560DG-R) and Splitter (POE-45-120-R) or equivalent products



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

# 4   Human RF Exposure – Maximum Permissible Exposure Evaluation

The recent FCC developed guideline for evaluation of the human exposure to the RF emissions. The maximum permission Exposure (MPE) for power density of the transmitter operating RF ranges between 300 KHz and 100 GHz. As the Intelibs SRU belongs to the fixed equipment, Analysis has been conducted to evaluate the MPE from the distance greater than 20 Cm as the fixed equipment required.

Antenna gain is restricted to 1.5W ERP (2.49 W EIRP) in order to satisfy RF exposure compliance requirements. If higher than 1.5W ERP, routing MPE evaluation is needed. The antenna should be installed to provide at least 20 cm from all persons to satisfy MPE requirements of FCC Part 2, 2, 1091.

SRU transmits far below that FCC power density restricts. FCC defines power output limits at 20 cm distance for various frequency ranges:

- Over 300 MHz to 1.5 GHz the limit is determined by frequency /1500
- Above 1.5 GHz the limit is 1 mW/cm^2

The basic equation for determining power density is:

S = PG/4(pie)R^2

Were S is power density, which is mW/Cm^2


PG, the transmitted power from the antenna indentified as EIRP (Equivalent Isotropically Radiated Power)

R is the distance of interest from the antenna.

Typical Installation Example:

As the typical height of a floor is assumed as 10 foot high, an average person is assumed 6 foot high, the distance from antenna to body is 4 feet (112 cm).

For PCS 1900 band, the maximum power output per carrier is assumed 23 dBm. With the assumption of 5 dBi antenna is used, PG in the equation is equal to 28 dBm EIRP.

Using S = PG/4pieR^2

S = 0.63/(4*3.14)*112^2 = 4µW

Also worst case with the assumption of minimum distance of 20 cm according to FCC regulation:

S = 0.63/(4*3.14)*20^2 = 0.1mW

# 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

Contact: supports@intelibs.com

Address: Intelibs, Inc. 1500 Stony Brook road, Stony Brook, NY 11794

Web: http://www.intelibs.com