Intelibs

Intelibs, Inc.

RHU (Radio Hub Unit) Product Manual

RHU Operational Manual for GPS-iDAS application
Version : 0.3
02-29-2016

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

Radio Hub Unit (RHU) is a part of the Hybrid Distributed Antenna Systems (HDAS) to provide RF link solution between RF Source and Remote Unit (RU). This RHU receives RF signal from antenna or wireline and this unit filters, amplifies and converts RF signal into optic signal and transmits to RU through single mode fiber. RHU is built on a small form factor with four antenna ports for 850MHz, 1900MHz and two GPS antenna ports with the following features:

- Support for a multi frequency band, multi-technology and multi-carrier
- Wide band sub-channel selection by digital filter
- Antenna isolation detection and oscillation protection function
- Low Power consumption that can be operated by PoE or small AC/DC converter
- 20dBm Up Link composite power per band
- SNMP based remote management support
- Provide signal to remote unit (RU) site as far as 10Km distance via single mode fiber
- Optic fiber sharing between different carriers
- AGC (Auto Gain Control), ALC (Auto Level Limit Control) and ADS function
- Compact and high capacity with scalable design
- Ruggedized enclosure with more outdoor temperature compliance
- GPS signal support and transmission with path redundancy function

Hybrid DAS RHU is comprised of the following subsystems:

- FHU (Fiber Hub Unit): Interface unit between RHU and Remote Units, Convert O/E, compensate loss and convert E/O. this unit has optic input port and optic output port.
- SRU (Small power Remote Unit): Small power (23dBm per band) remote unit for indoor
- HRU (High power Remote Unit): High power (30 ~ 43dBm per band) remote unit for outdoor
- MU (Master Unit): Element management server

As illustrated in Figure 2-2, Hybrid DAS network is comprised of RHU, FHU and SRU/HRU. RHU provides RUs can transmit signal to coverage area. An optic cable can be shared between different carriers and different band.

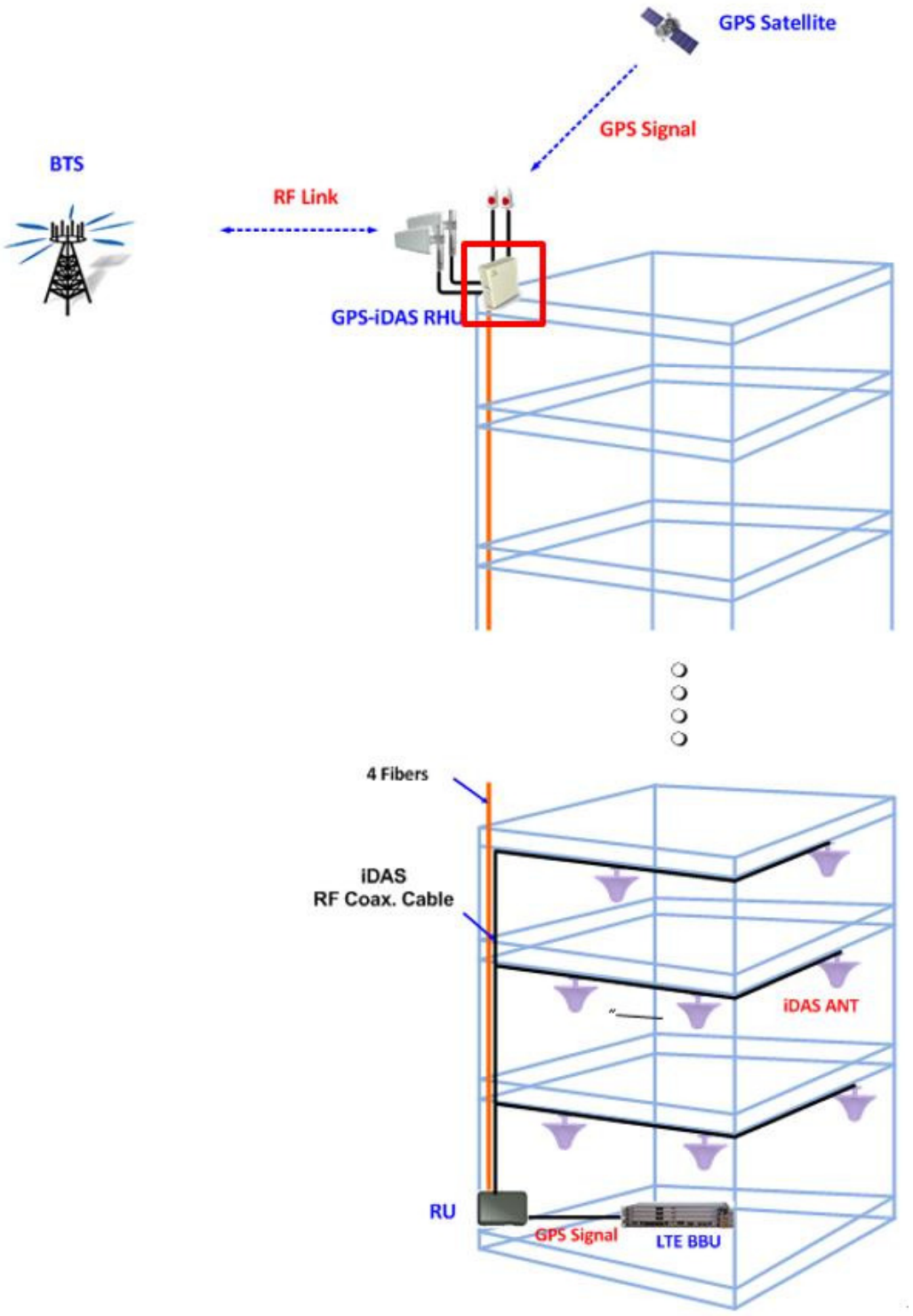


Figure 1-1 RHU-RU connection configuration

2 Product Description

Radio Hub Unit (RHU) is a part of the Distributed Antenna System (DAS) to provide link between RF Source and DAS RU, to fill coverage gaps and to enhance the quality of service of extending coverage of mobile service.

As shown in Figure 2-1, RHU is a compact platform with the natural heat convection. As unified form factor, RHU services multiple technologies on a single platform with 850/1900MHz Dual-band and GPS L1 band frequencies. It can be mounted on the wall or 19" rack. Variety of the donor antenna can be used from Yagi directional antenna to high font-back-ratio directional antenna (or panel antenna).

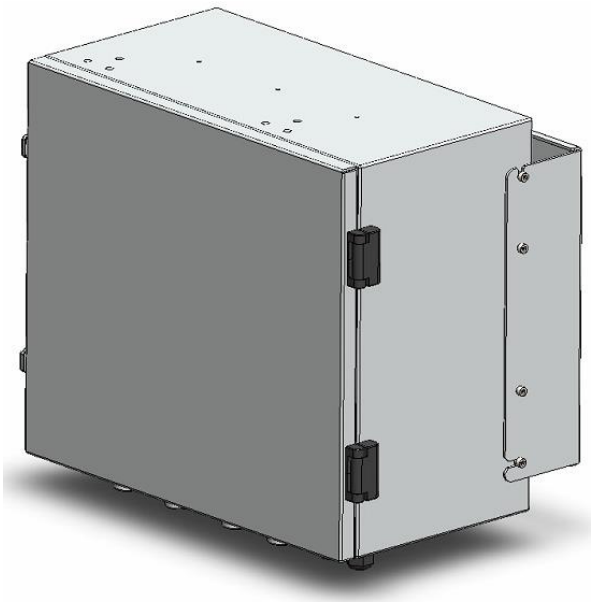


Figure 2-1 RHU system

2.1 Network configuration

Three band RF signals such as 850/1900MHz and GPS L1 band from link and GPS antenna are fed to RHU and RHU amplifies and converts into optical signal, and transmits this optical signals to remote RU system. RHU can have up to 16 RUs and 5 FHU connections. RHU next release will support 700MHz, 2100MHz.

A fiber optic cable can be shared between different carriers or different band. Each frequency band signals are combined to one wavelengths in a single fiber. Table 2-1 describes those wavelength assignments. Maximum allowed optic loss between RHU and RU system is 10 dBo.

Table 2-1 Optic wavelength of each frequency band

Frequency band	Downlink Wavelength	Uplink Wavelength
850/1900MHz band	1,310 nm	1,550 nm
GPS L1 band	1,550 nm	1,310 nm

RHU systems with different operating frequency band can be interconnected via over-the-air. Typical RHU-FHU-SRU/HRU network diagram is depicted in figure 2-2.

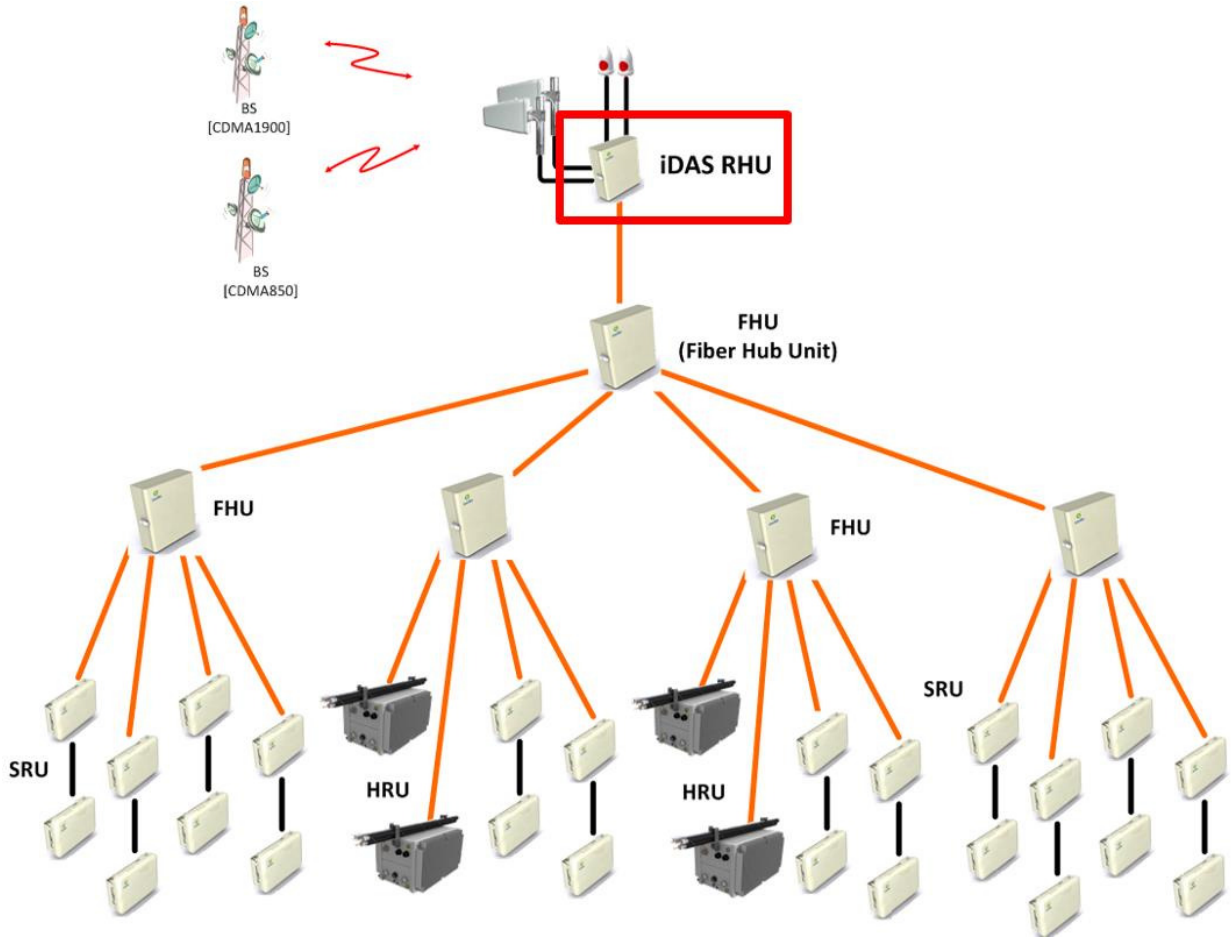


Figure 2-2 Typical iDAS RHU-FHU-RU network diagram

2.2 External interface ports

RHU has all interface connections at bottom side of an enclosure, which includes fiber, antennas and power port. Figure 2-3 shows the bottom side of RHU system.

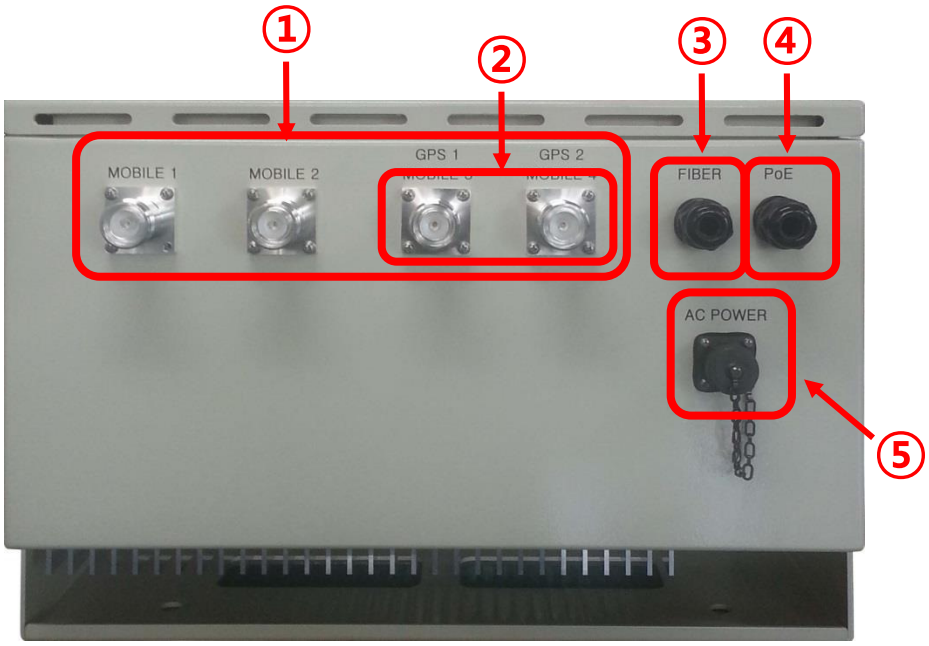


Figure 2-3 Bottom view of RHU system

Table 2-2 Interface ports

No.	Port	Connector type	Description
1	MOBILE 1 ~ 4	DIN Female	Antenna RF cable connection port
2	GPS 1, 2	DIN Female	GPS Antenna cable connection port. These ports may be used for Mobile or GPS antenna connection
3	FIBER	Cable gland	Fiber inlet port
4	PoE	Cable gland	Ethernet cable inlet port for PoE power supply
5	AC POWER	MS Female - 3PIN	110VAC Power cable connector

2.3 Configuration of RHU inside

RHU system is comprised of several internal modules such as RF band modules, GPS module, optic module, and controller modules. Figure 2-4 shows inside of RHU system.

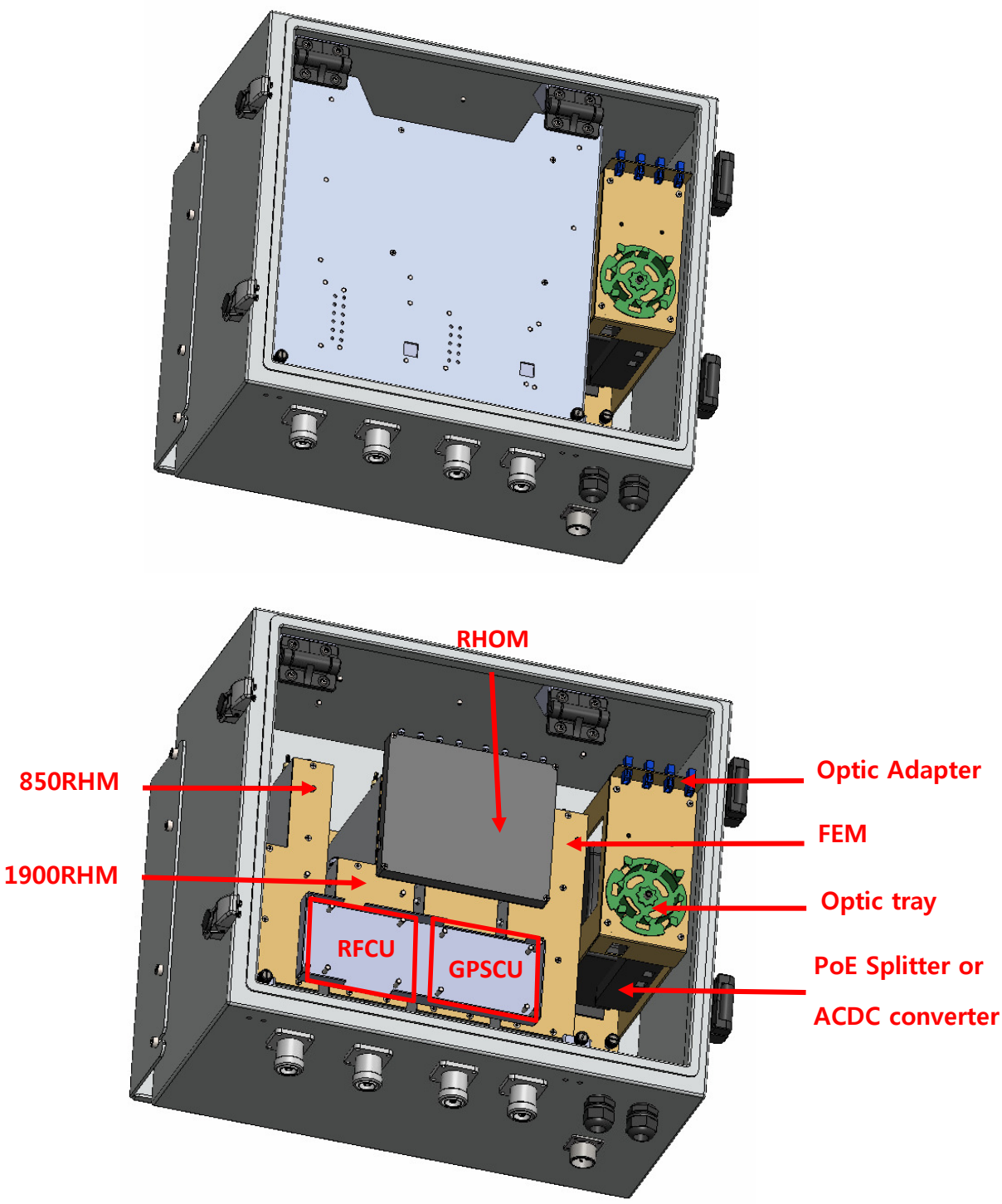
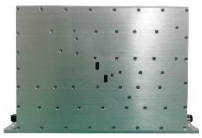
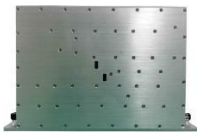
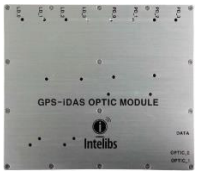


Figure 2-4 Module configuration of RHU inside

Table 2-3 RHU system's modules

Module	Picture	Description
850 RHM		[Down Link] This module filters 850 DL RF signal from link antenna, amplifies with low noise, selects sub-channel by digital band pass filters and transmits the selected 850 DL RF signal to optical module. [Up Link] This module filters 850 UL RF signal from optical module, selects sub-channel by digital band pass filters, amplifies to get high power and transmits 850 UL RF signal to antenna.
1900 RHM		[Down Link] This module filters 1900 DL RF signal from link antenna, amplifies with low noise, selects sub-channel by digital band pass filters and transmits the selected 1900 DL RF signal to optical module. [Up Link] This module filters 1900 UL RF signal from optical module, selects sub-channel by digital band pass filters, amplifies to get high power and transmits 1900 UL RF signal to antenna.
FEM		This unit filters GPS L1 band signal, amplifies by low noise, converts GPS signal into optical signal and transmits this optic signal to RU site via fiber. This unit has two GPS ports to support path redundancy function. If one GPS fails, second GPS port switch over automatically.
RHOM		[Down Link] This module converts RF signal from 850/1900 RHM into optical signal and transmits to RU site via fiber. [Up Link] This module converts optical signal coming from fiber into RF UL signals and amplifies UL signals to compensate fiber loss and transmits to 850/1900 RHM.
RF Controller (RFCU)		This module controls and monitors all parameters of 850RHM, 1900RHM and RHOM which related to 850/1900 DL/UL RF circuits.
GPS Controller (GPSCU)		This module manages all parameters of RF circuits of two GPS path.
PoE Splitter		This module receives DC voltage through the Ethernet cable and supplies DC voltage to each module. RHU uses one of PoE Splitter and ACDC converter according to installation environment.
ACDC Converter		This module converts AC110V voltage to DC 24V and supply this DC voltage to each active module. RHU uses one of PoE Splitter and ACDC converter according to installation environment.

2.4 Mechanical Drawing

Figure 2-5 RHU Outside drawing

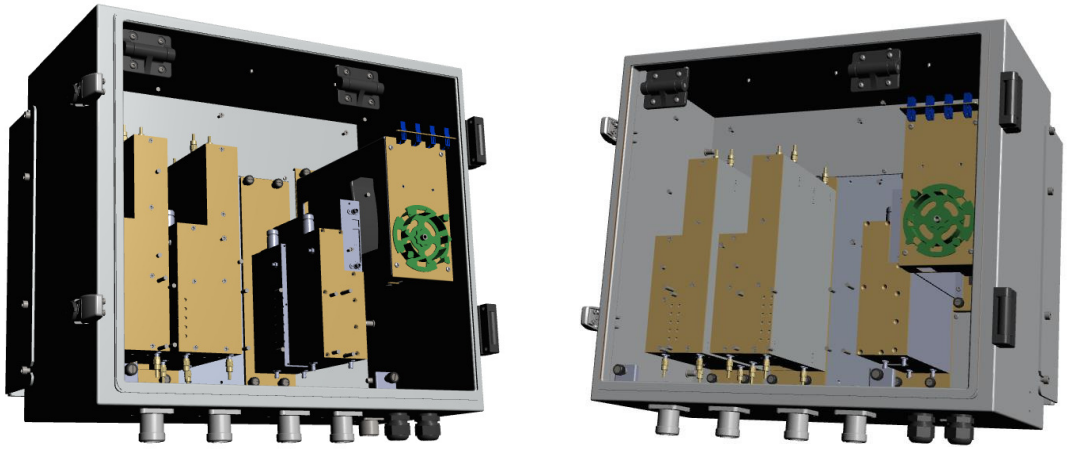


Figure 2-6 RHU Inside drawing

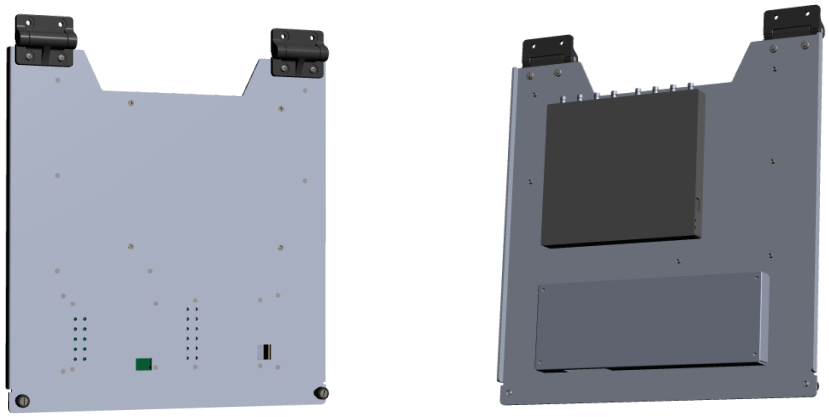


Figure 2-7 RHU Inner door drawing

2.5 RHU Block Diagram

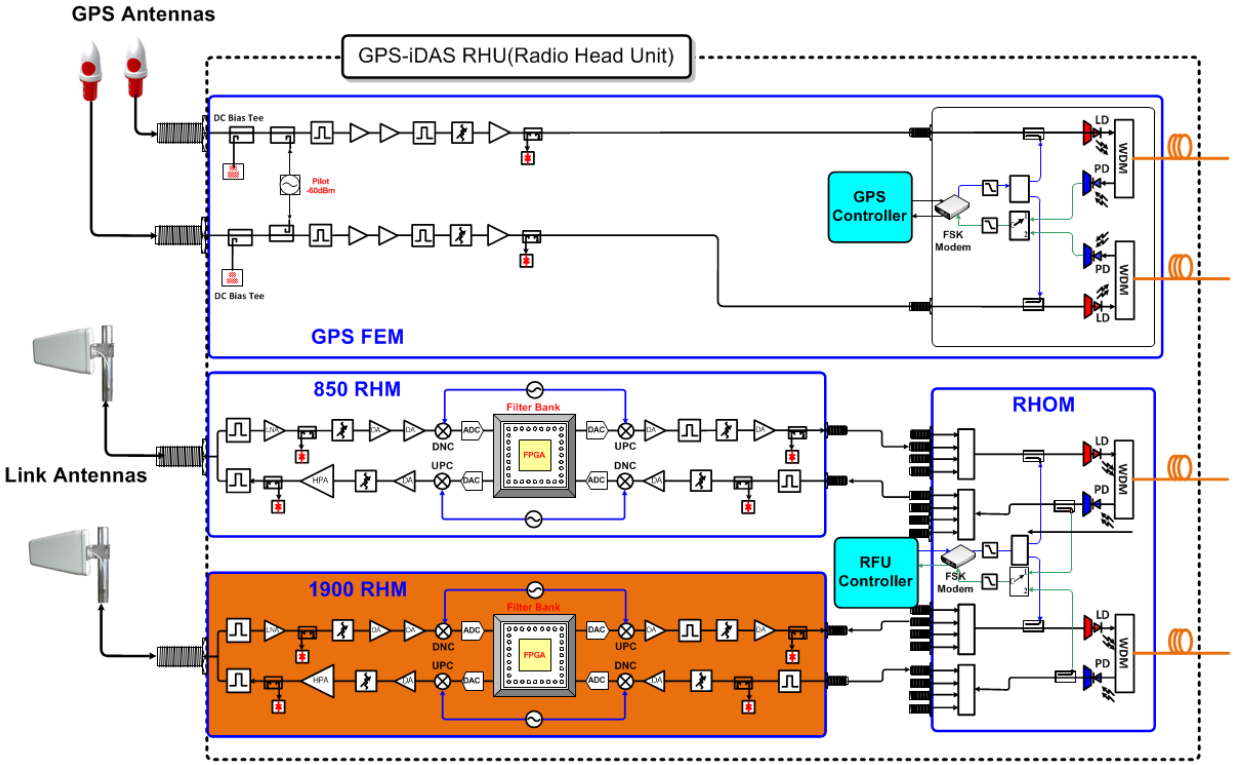


Figure 2-8 RHU system RF Block Diagram

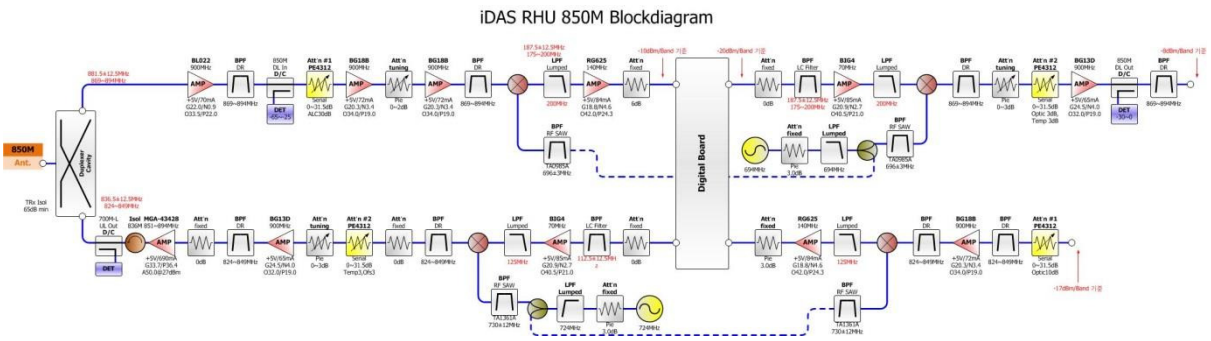


Figure 2-9 850MHz RHU RF Block Diagram

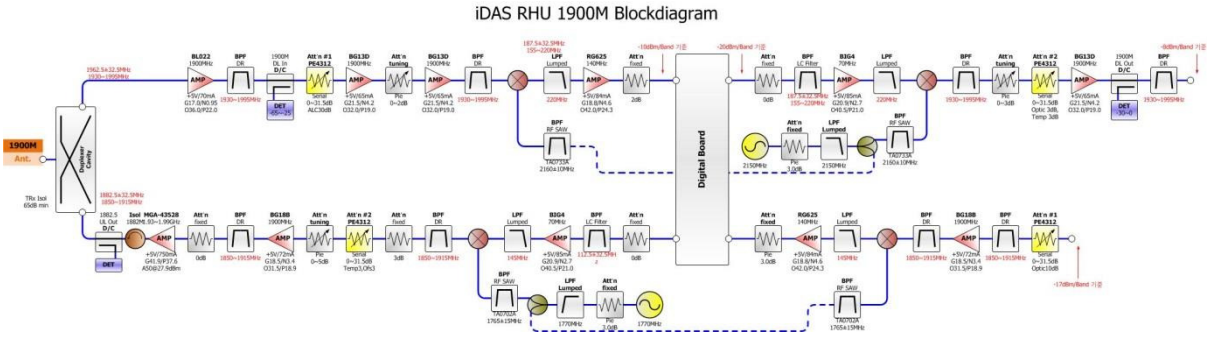
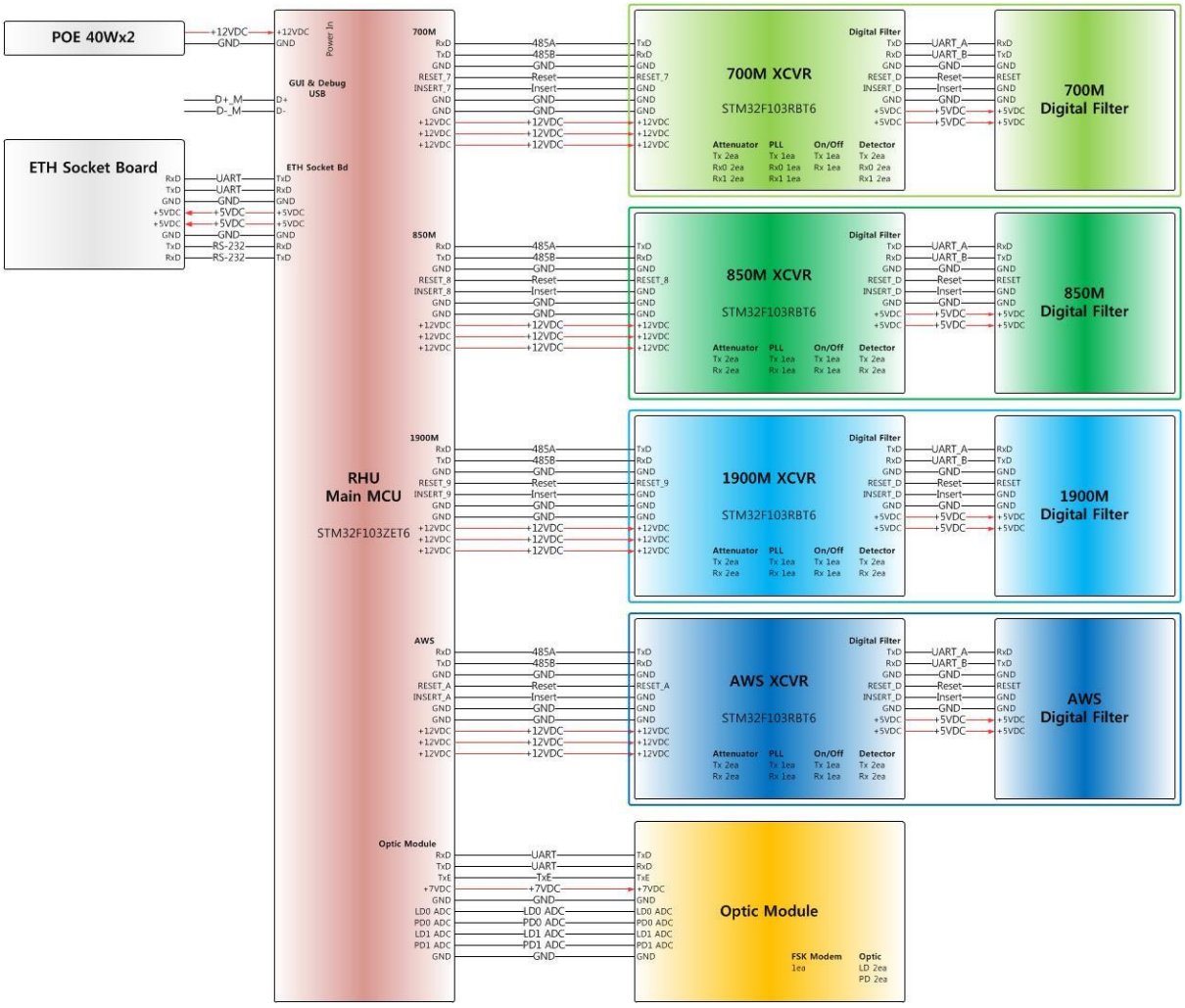


Figure 2-10 1900MHz RHU RF Block Diagram

2.6 RHU power and signal Distribution Diagram



2.7 Technical Specifications

2.7.1 General specifications

Table 2-4 General Specifications

Specification	Values
Enclosure Type	Cabinet
Dimension (mm)	17.5 (H) X 19.5 (W) X 11 (D) inch
Weight (Kg)	57lb (26 Kg)
Power Supply	110-120Vac (Tolerance ±10%), 60Hz
	PoE Input (IEEE 802.3at)
Power Connector	MS Connecter
RF In/Out Port	DIN Type Female, bottom part
Optic Connector Type	LC/UPC inside
Optic Wavelength	DL: 1310nm / UL: 1550nm for 850/1900/GPS DL: 1550nm / UL: 1550nm for GPS only
Operating Temperature	-30°C ~ 55°C

2.7.2 Frequency allocation

2.7.2.1 1900 MHz band

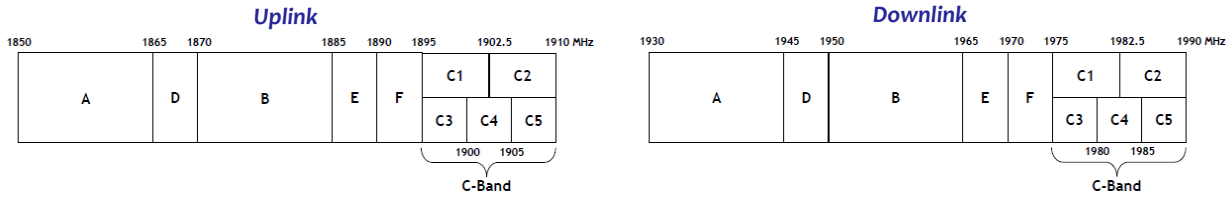


Figure 2-8 Frequency allocation of 1900 MHz band

Table 2-5 1900 MHz Frequency map

Sub-Band	Channel #	DL (MHz)	UL (MHz)	Remarks
A	25	1931.25	1851.25	DL : 1930.625~1944.375MHz UL : 1850.625~1864.375MHz
	75	1933.75	1853.75	
	100	1935.00	1855.00	
	125	1936.25	1856.25	
	150	1937.50	1857.50	
	175	1938.75	1858.75	
	200	1940.00	1860.00	
	225	1941.25	1861.25	
	250	1942.50	1862.50	
	275	1943.75	1863.75	
D	325	1946.25	1866.25	DL : 1945.625~1949.375MHz UL : 1865.625~1869.375MHz
	350	1947.50	1867.50	
	375	1948.75	1868.75	
B	425	1951.25	1871.25	DL : 1950.625~1964.375MHz UL : 1870.625~1884.375MHz
	450	1952.50	1872.50	
	475	1953.75	1873.75	
	500	1955.00	1875.00	
	525	1956.25	1876.25	
	550	1957.50	1877.50	
	575	1958.75	1878.75	
	600	1960.00	1880.00	
	625	1961.25	1881.25	
	650	1962.50	1882.50	
	675	1963.75	1883.75	
E	725	1966.25	1886.25	DL : 1965.625~1969.375MHz UL : 1885.625~1889.375MHz
	750	1967.50	1887.50	
	775	1968.75	1888.75	
F	825	1971.25	1891.25	DL : 1970.625~1974.375MHz UL : 1890.625~1894.375MHz
	850	1972.50	1892.50	
	875	1973.75	1893.75	
C1	925	1976.25	1896.25	C3 Band
	950	1977.50	1897.50	
	975	1978.75	1898.75	
	1000	1980.00	1900.00	
	1025	1981.25	1901.25	C4 Band
	1050	1982.50	1902.50	
C2	1075	1983.75	1903.75	
	1100	1985.00	1905.00	
	1125	1986.25	1906.25	C5 Band
	1150	1987.50	1907.50	
	1175	1988.75	1908.75	

2.7.2.2 850 MHz band

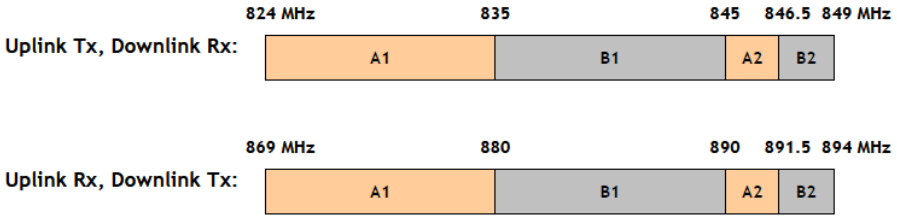


Figure 2-9 Frequency allocation of 850 MHz band

Table 2-6 850 MHz Frequency map

Sub-Band	Channel #	DL (MHz)	UL (MHz)	Remarks
A1	1019	869.88	824.88	DL : 869.265~879.105MHz UL : 824.265~834.105MHz
	37	871.11	826.11	
	78	872.34	827.34	
	119	873.57	828.57	
	160	874.8	829.8	
	201	876.03	831.03	
	242	877.26	832.26	
	283	878.49	833.49	
B1	384	881.52	836.52	DL : 880.905~889.515MHz UL : 835.905~844.515MHz
	425	882.75	837.75	
	466	883.98	838.98	
	507	885.21	840.21	
	548	886.44	841.44	
	589	887.67	842.67	
	630	888.9	843.9	
A2	691	890.73	845.73	DL : 890.115~891.345MHz UL : 845.115~846.345MHz
B2	777	893.31	848.31	DL : 892.695~893.925MHz UL : 847.695~848.925MHz

2.7.2.3 GPS L1 Band

- 1575.42 +/- 10MHz band

2.7.3 RHU RF specifications

Table 2-7 RF specifications

Item	Specification			Remarks
DL Frequency Range	850MHz	Sub-band selection in 869 ~ 894MHz		
	1900MHz	Sub-band selection in 1930 ~ 1995MHz		
	700 LTE*	A/B/Upper C band selection in 728 ~ 757MHz		
	2100 AWS*	Sub-band selection in 2110 ~ 2155MHz		
UL Frequency Range	850MHz	Sub-band selection in 824 ~ 849MHz		
	1900MHz	Sub-band selection in 1850 ~ 1915MHz		
	700 LTE*	A/B/Upper C band selection in 698 ~ 787MHz		
	2100 AWS*	Sub-band selection in 1710 ~ 1755MHz		
DL Input Power	-60 ~ -30dBm/total, the recommended input power is more than -50dBm/total from donor antenna.			
UL Output Power	850MHz	+20dBm /total for 850MHz RHU ANT Port		
	1900MHz	+20dBm/total for 1900MHz RHU ANT Port		
	700 LTE*	+20dBm/total for 700MHz RHU ANT Port		
	2100 AWS*	+20dBm/total for 1700MHz RHU ANT Port		
RHU Gain	DL: 10dB ~ 40dB		UL:10dB ~ 40dB	
FWD Spurious	Comply to 3GPP, 3GPP2 and FCC regulation			
Gain Control Range	FWD: 30dB by 1dB Step		RVS: 30dB by 1dB Step	RU OLC Gain
EVM degradation	Less than 2% compare with RF Source @ max. output power			
Frequency Stability	0.02ppm max.			
Pass-Band Ripple	850MHz	3dB max. in any sub-band BW		
	1900MHz	3dB max. in any sub-band BW		
	700 LTE*	2dB max. in Any A/B/C or upper C band		
	2100 AWS*	2dB max. Any sub-band		
System Delay	Tx: 2us. Max		Rx: 2us. Max	
Tx-Rx Isolation	100dB min. @Between RU Tx Output and RHU Rx Output			
Impedance	50 Ohm			
VSWR	1.5 : 1 max. @ All input/output ports			
Optical Wavelength	Mobile	DL: 1310nm	UL: 1550nm	
	GPS	DL: 1550nm	UL: 1310nm	
RF Connector	DIN Female			

***) 700 MHz and 2100 MHz support available in next release**

2.7.4 Power Specifications

Table 2-8 Power specifications

Item	Specification
Rated Input Voltage	PoE Input (IEEE 802.3at compatible) or 110-120V AC, 60 Hz Input
Permissible range	Tolerance ±10%
Power consumption	80W, maximum
	70 W, typical
Power Connector	Gland type for PoE, MS Male type for AC

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 RHU
- Dirty Connectors and ports
- Faulty Radio Hub Unit (RHU) components
- RF source equipment issue
- External RF Interface problem such as antenna port

The following guidelines are required when the RHU is installed on the 19" rack of Headend room:

- 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.

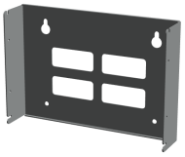
3.1.1 General Safety Precautions

The following precautions apply to the RHU:

- 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 RHU and SRU unless equipped with protection goggle. Invisible infrared radiation may be present at the front panel of the RHU 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.)

3.2 Installation Tools

Table 3-1 Installation tools

Torque Wrench	Torque Wrench	ESD Gloves	Shrink Tubes
			
LC/UPC 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 bolts and nuts	2 Wideband Link Antennas	Heat Gun
			

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

RHU	AC power cable or PoE Injector		
 RHU 1set	 AC power cable: 1.5m, 1 ea	 PoE Injector 1 ea	

3.4 Mounting

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

Step 1

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

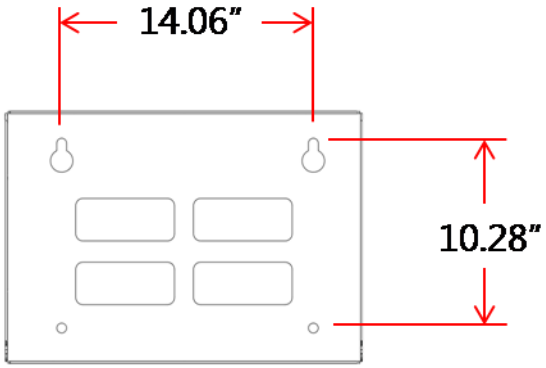


Figure 3-1 Mark the installation position

Step 2

- Install wall mount bracket to the wall using 4 anchor bolts.

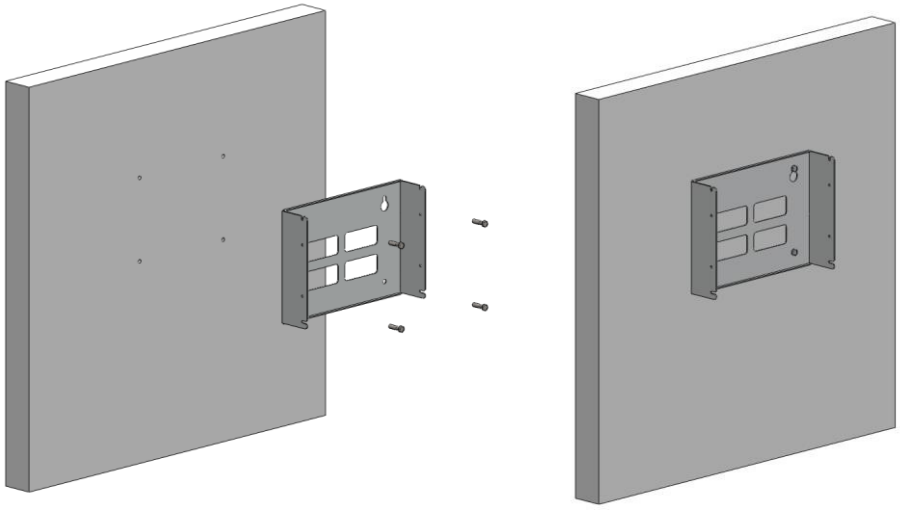


Figure 3-2 Install the wall mount bracket

Step 3

- Install the RHU system as figure below.

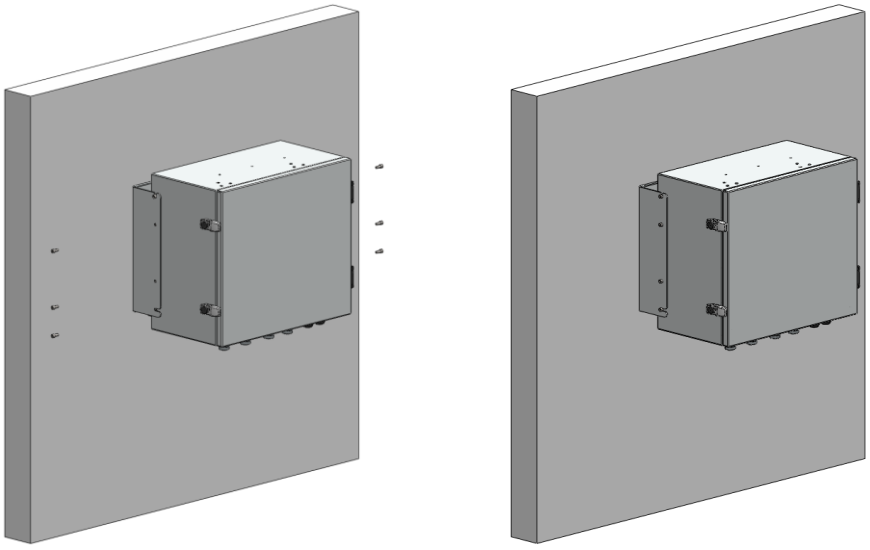


Figure 3-3 Install the RHU to the installed wall mount bracket

3.5 Link (Donor) Antenna

RHU has four antenna ports. Two are the ports for 850MHz/1900MHz antennas and another two are the ports for two GPS antennas. Connect each DIN-type male antenna cable to the desired antenna port, as Figure below.

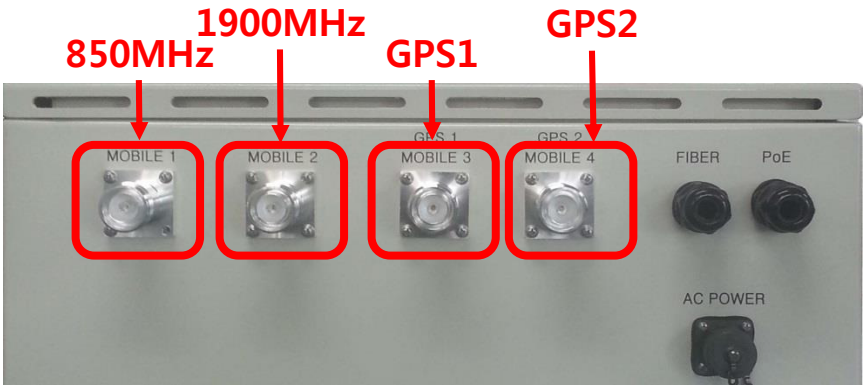


Figure 3-4 Link/GPS Antenna port

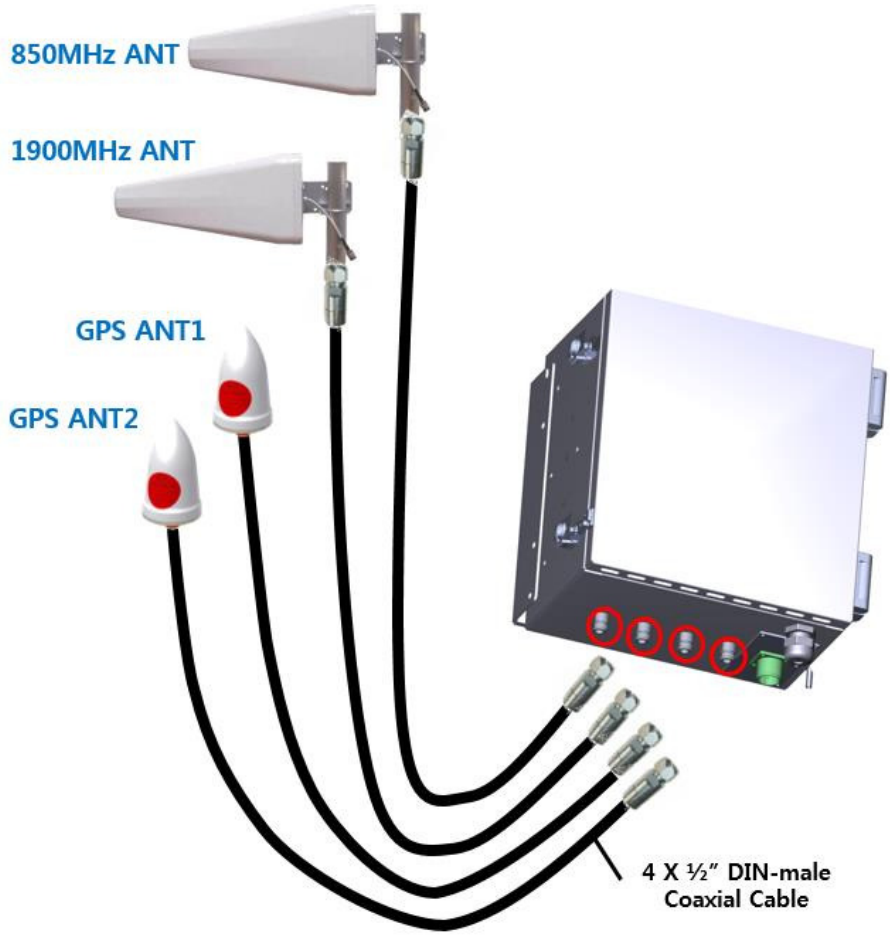
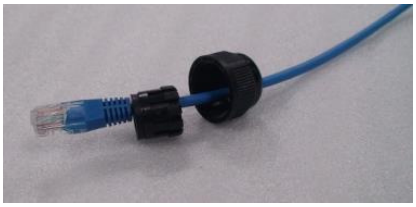


Figure 3-5 Link/GPS Antenna connection diagram

3.6 Power cable

1. In case of PoE Input
   1) Please release gland cap and put Ethernet cable into cap and water protection rubber ring as following picture.



   2) Reassemble cable gland to insert Ethernet cable into RHU enclosure as follows.

3) Please connect Ethernet cable to RJ-45 connector of RHU inside as following picture. And you can find LEDs are turned on if Ethernet cable has DC power.

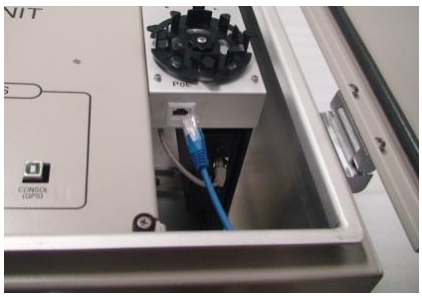


Figure 3-6 Power cable connection (PoE type)

2. The case of AC Input

Connect MS connector-type power cable which is supplied with RHU to the “AC POWER” port. When connecting the end terminal, align connector at latch and hole position as figure below.

Figure 3-7 Power cable connection (AC type)

3.7 Optic cable

RHU provides four optic ports. Fiber_1 and Fiber_2 are the ports to connect with SRU, and Fiber_3 and Fiber_4 are the ports to connect with GPS BEU. The type of fiber connector is all LC/UPC type connector as figure below.

[LC/UPC type fiber connector]

Figure 3-8 LC/UPC fiber connector connection

Connect the fiber connector to the desired optic port in RHU. When connecting the optic connector, align the connector at latch and hole position, then plug in deeply to get the right connection.

Figure 3-9 Fiber cable connection on RHU

4 Configuration and Maintenance

RHU 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 and serial connection.

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

LMT (Local Management Terminal) is local management interface through serial interface.

The configuration and maintenance for RHU is performed by accessing RHU through any interfaces.

Figure below describes a typical iDAS management system network and the entities and management system network of RHU-iDAS is a part of total DAS management. Red marked part is the management network of RHU iDAS system.

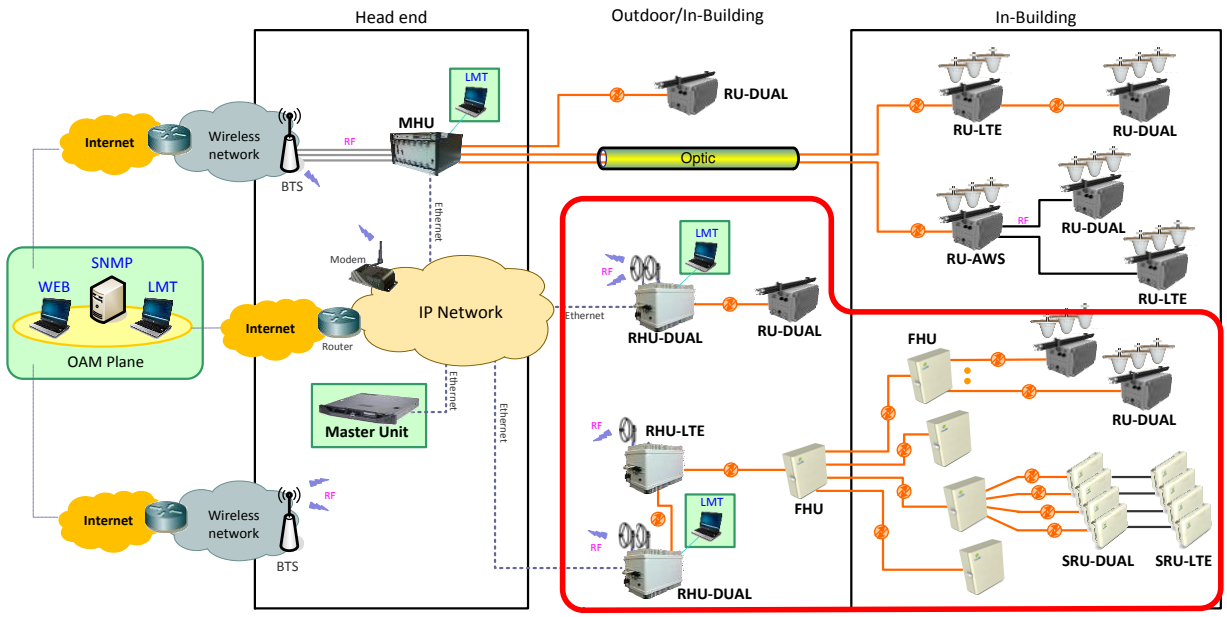


Figure 4-1 DAS management network and entities

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

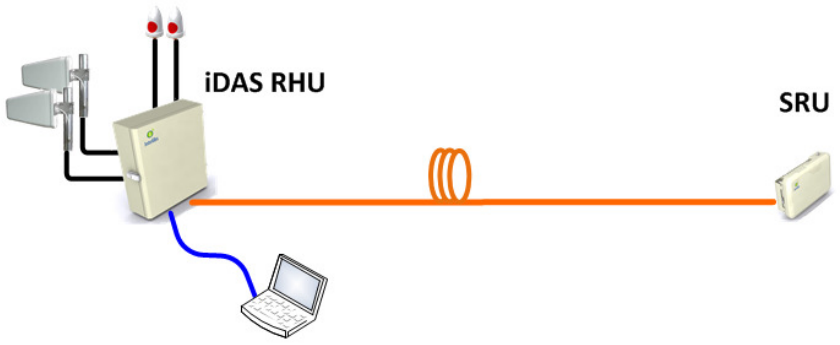


Figure 4-2 RHU-SRU network

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

4.1 Configuring RHU using LMT

If one of serial connection has been established, LMT is ready to start. Launch the Local Management application by clicking the icon “iDAS” and refer to following information.

4.1.1 LMT GUI (Graphic User Interface) Program

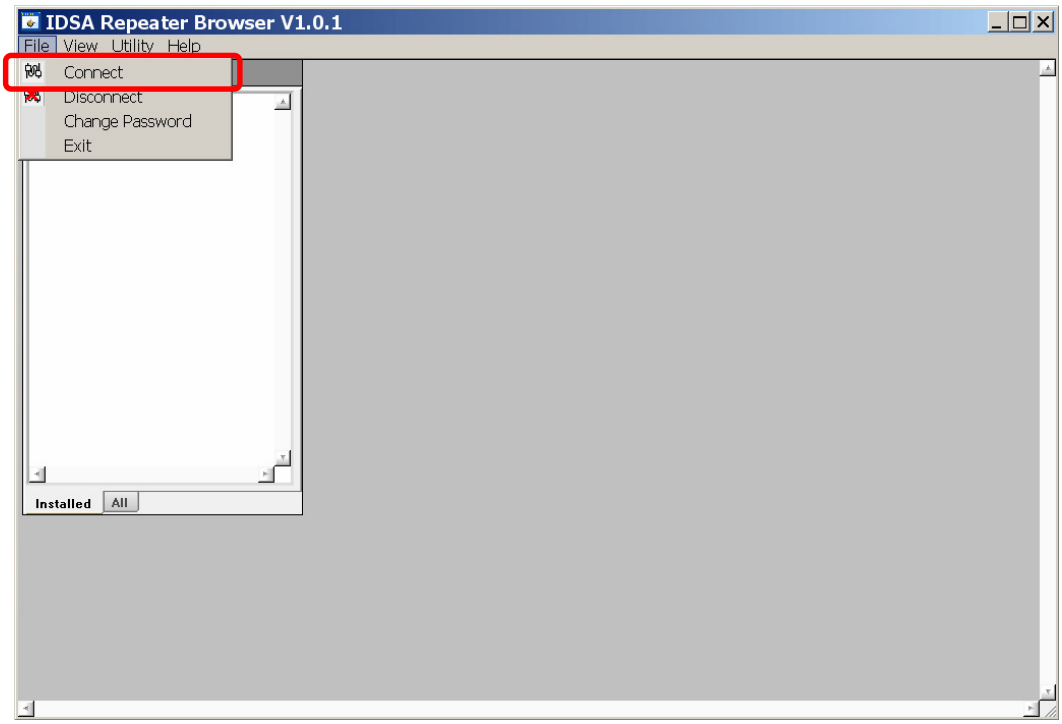
This program is a iDAS management program and provides status of all DAS parameter and can control each parameter you want to control.

4.1.2 System Requirement

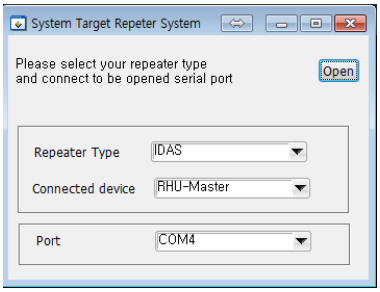
- ⇨ System: Desktop or laptop PC
- ⇨ OS: Windows XP or later version. GUI developed under Windows 7.
- ⇨ Resolution: 1024 ✕ 768 or more

4.1.3 How to connect RHU using LMT GUI

1. Double click iDAS.exe () icon to open LMT GUI of RHU. Then you can see following screen. Press “Connect” button in drop down menu of File.

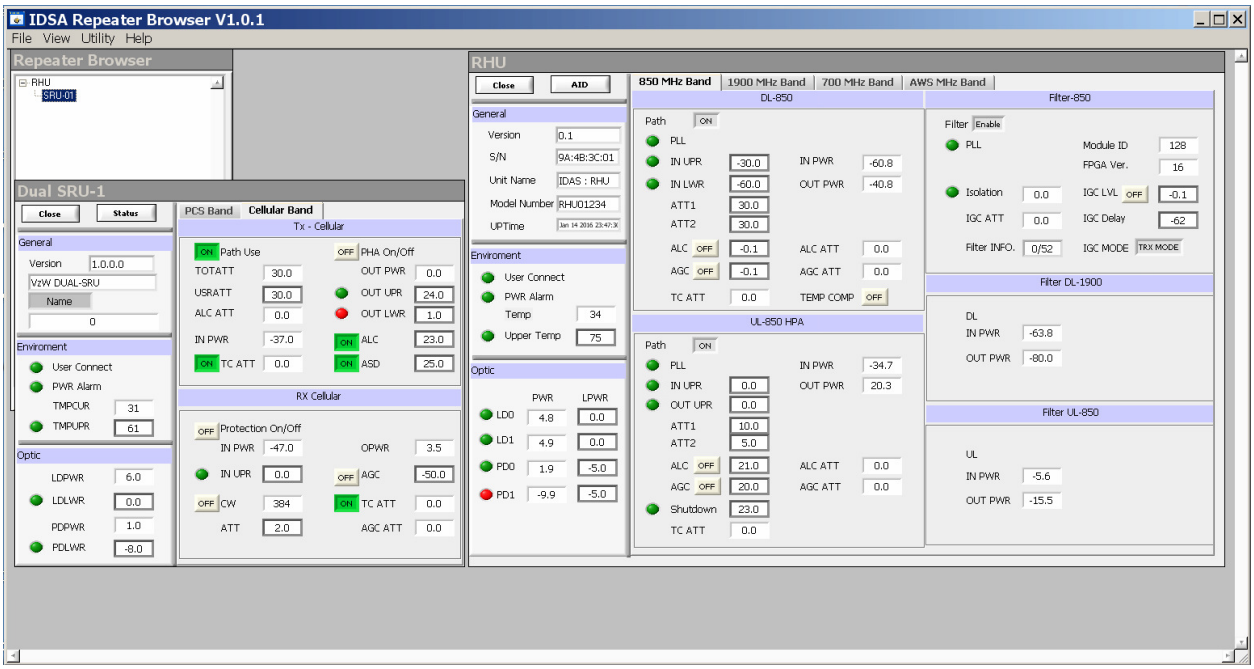


2. After following screen is appeared, please select parameters on this screen as refer to the table below.



Function	Establishing communication between GUI and repeater	
Method	Click button in Menu bar of GUI program	
Description	Port	Combo box to select the com port (COM1, COM2, …) which serial port is set up in Laptop
	Repeater type	Select the “iDAS” system
	Connected device	Select “RHU-Master” if you want to connect to RHU unit

4.1.4 Main Window of LMT GUI



Section	Description

Window Title	IDSA Repeater Browser V1.0.1 , RHU Displays the name and version of management program (GUI) Displays the type of equipment currently connected to the program (RHU or SRU).
Menu Bar	File View Utility Help Presents the working menu for operation. It is associated with tool icons which can activate the tool bar menus.
Work Space	Status information and control functions are provided with new window screen of RHU and SRU.

4.1.4.1 *Status Display of LMT GUI*

Parameters status of each unit are displayed by color of LED's and values.

⇨ LED

- Alarm:  indicates ALARM,  indicates NORMAL
- On/Off:  means ON,  means OFF

⇨ Value

- Units are not displayed.
- Value displayed in box ()

⇨ Control

- The texts of controllable LED or values are displayed in BOLD font. 

4.1.4.2 *Control Policy of LMT GUI*

⇨ Basically, user can change one item at a time.

⇨ Click a controllable item (text, or button)

⇨ To go to Control Mode, press  button. Then this button will be changed to  . Please "enter" key to confirm the control action after changing any parameter you want to change.

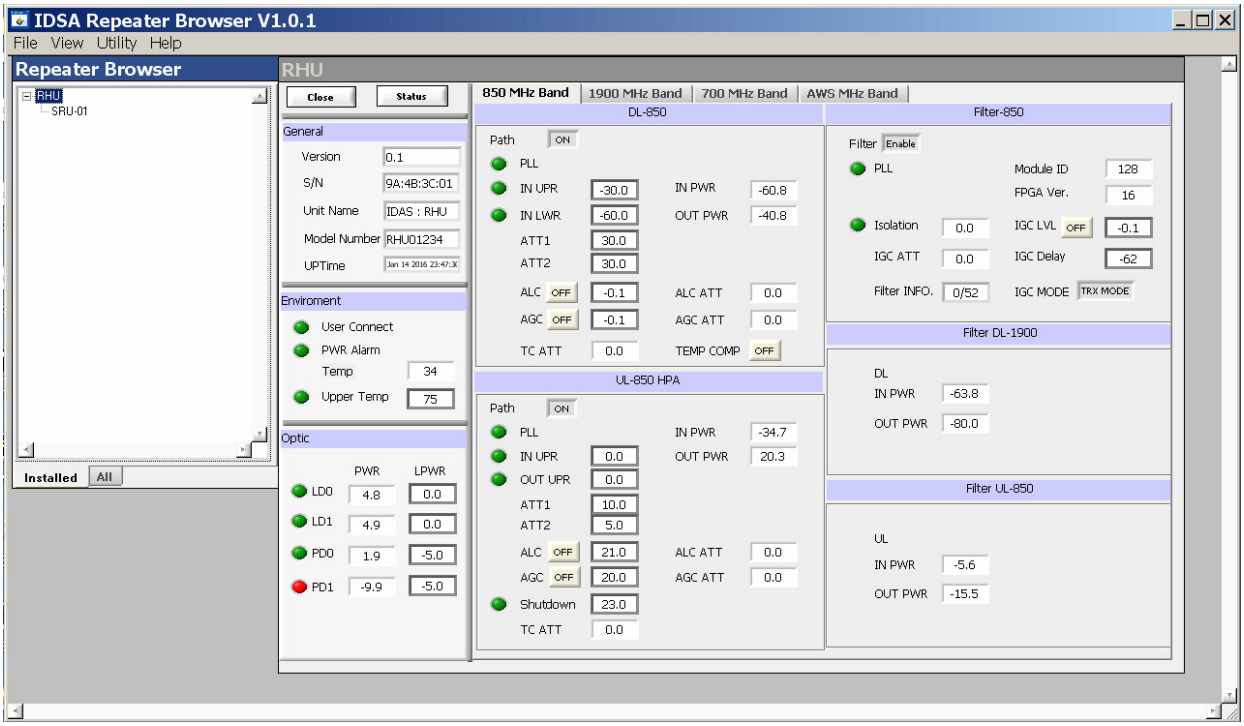
4.1.4.3 *Description of Manu bar of LMT GUI*

Menu	Sub Menu	Function
File	Connect	Establishes connection between PC (GUI) and DAS unit
	Disconnect	Disconnects connection between PC (GUI) and DAS unit
	Exit	Finishes the GUI program.
View	Packet Debug	Presents debug packets of communication between DAS unit and GUI program

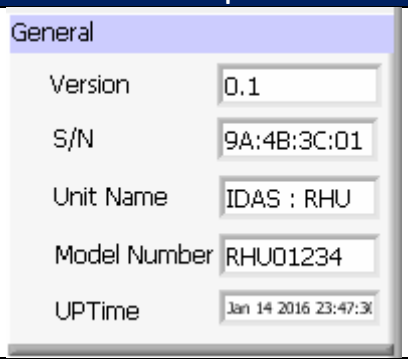
Utility	Firmware Download	Downloads compressed firmware file to RHU equipment
	Table	Presents RF/Optic power, temperature compensation, Attenuator table
Help	About	Displays the version information of GUI

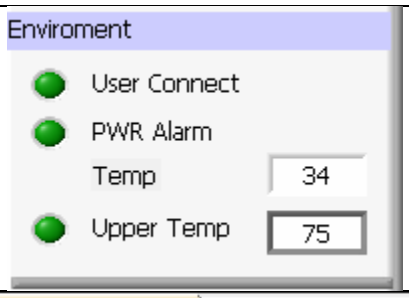
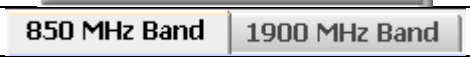
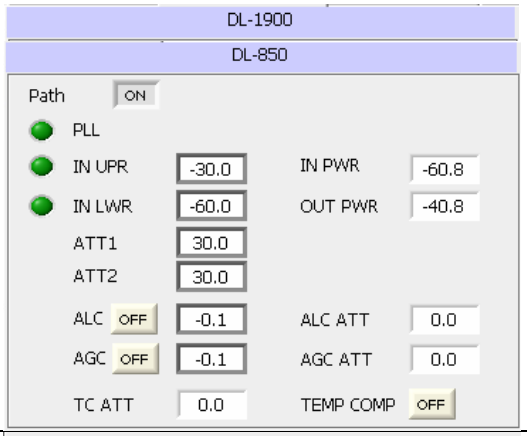
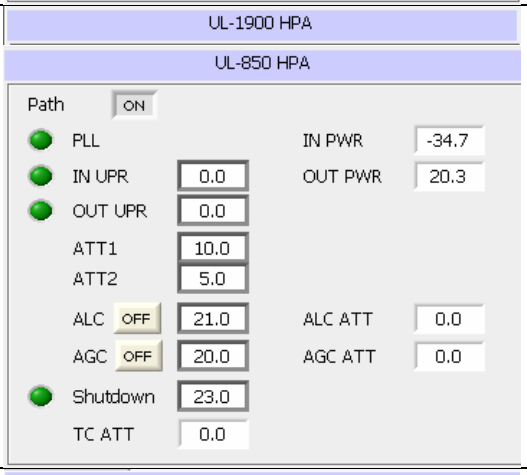
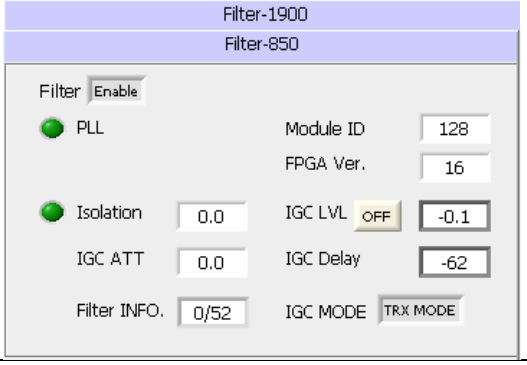
4.2 Detail description of Manu bar in GUI

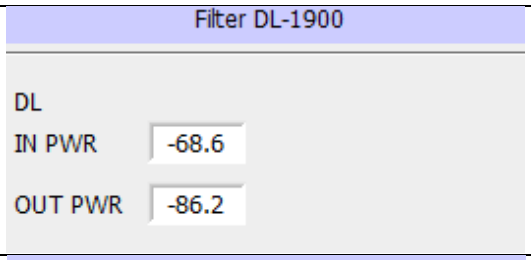
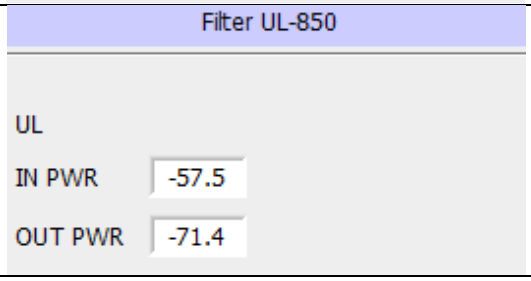
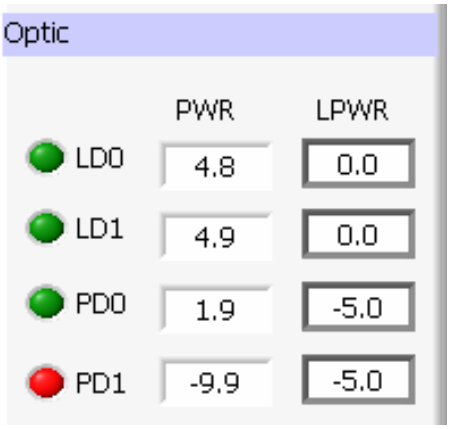
4.2.1 RHU window in GUI screen



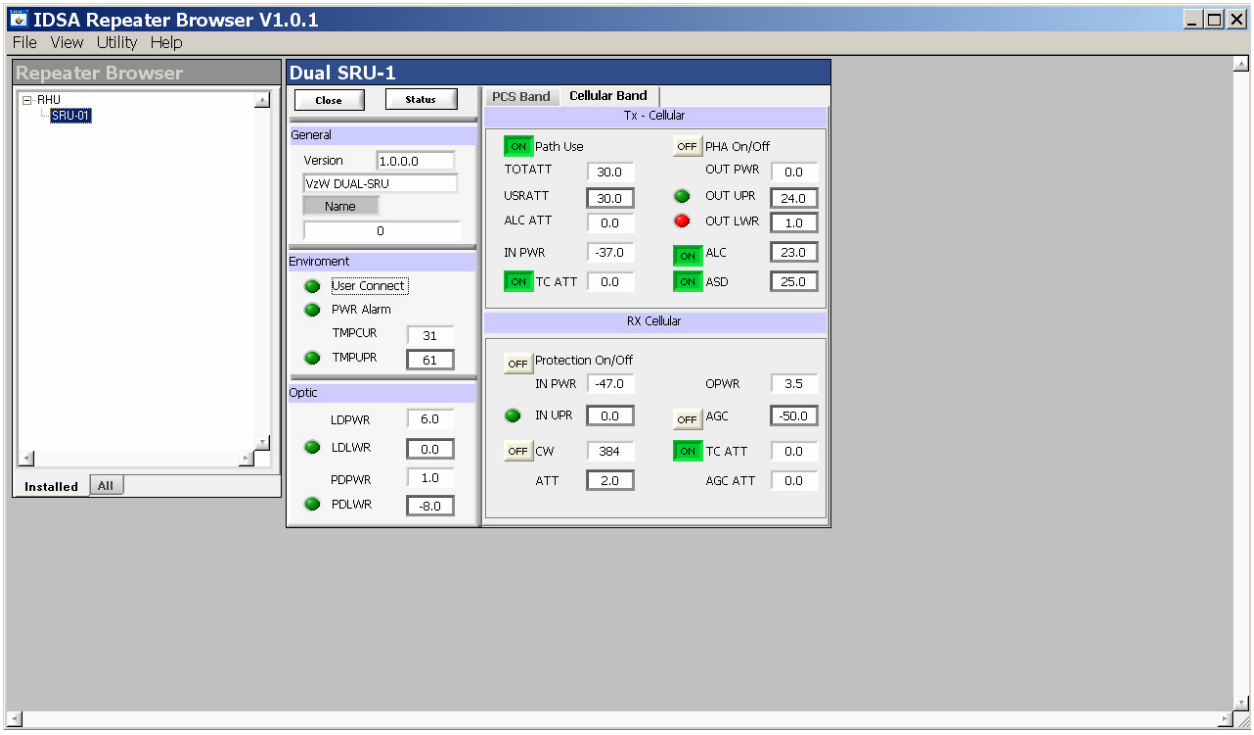
4.2.2 Parameters details in RHU window

Group	Description
	⇨ Version: Firmware Version ⇨ S/N: RHU Serial Number ⇨ Unit Name: RHU ⇨ Model Number: Model number of RHU ⇨ Up Time: operating time and date

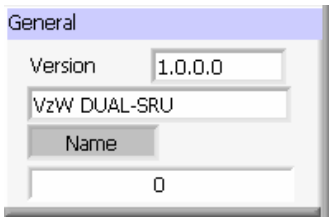
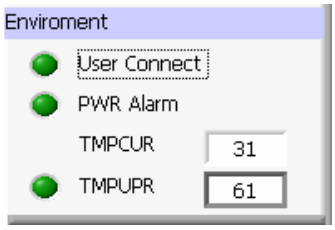
	⇨ User Connect: Connection status between Laptop and RHU ⇨ PWR Alarm: DC power alarm ⇨ Temp: Current temperature of unit inside ⇨ Upper Temp: set the upper threshold value of temperature (Value) and alarm status (LED)
	⇨ Band screen selection TAB.
	⇨ Path ON/OFF: DL Path ON/OFF function ⇨ PLL: PLL lock alarm indicator ⇨ IN PWR: DL input power value ⇨ OUT PWR: DL Output power value ⇨ IN UPR: DL input upper limit value and alarm ⇨ IN LWR: DL input lower limit value and alarm ⇨ ATT 1 & 2: DL Attenuation value for the DL gain control ⇨ ALC: Auto level limit control value and on/off set ⇨ AGC : Auto gain control level and on/off set ⇨ TC ATT: Temperature compensation Attenuation and On/Off button
	⇨ Path ON/OFF: UL Path ON/OFF function ⇨ PLL: PLL lock alarm indicator ⇨ IN PWR: UL input power value ⇨ OUT PWR: UL Output power value ⇨ IN UPR: UL input upper limit value and alarm ⇨ IN LWR: UL input lower limit value and alarm ⇨ ATT 1 & 2: UL Attenuation value for the UL gain control ⇨ ALC: Auto level limit control value and on/off set ⇨ AGC : Auto gain control level and on/off set ⇨ Shutdown: Auto shutdown level value set ⇨ TC ATT: Temperature compensation Attenuation and On/Off button
	⇨ Filter Enable: Digital filter Enable set ⇨ PLL: FPGA PLL lock alarm ⇨ Module ID: Digital filter ID information of FPGA. ⇨ FPGA Ver: FPGA SW version ⇨ Isolation: Isolation margin between two antennas ⇨ IGC LVL: Isolation gain control target margin level set and IGC protection function On / Off ⇨ IGC ATT: applied attenuation value by IGC function ⇨ IGC Delay: Delay set for IGC function ⇨ Filter Info: Digital filter setting information ⇨ IGC MODE: IGC control Tx only or Tx/Rx simultaneously

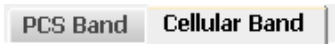
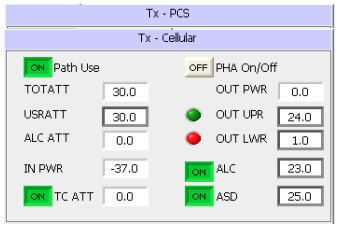
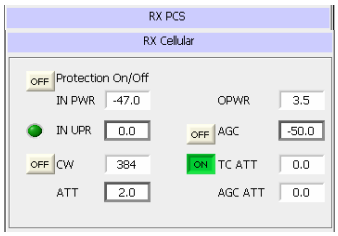
	⇨ IN PWR: DL input level at digital filter input port ⇨ OUT PWR: DL output level at digital filter output port
	⇨ IN PWR: UL input level at digital filter input port ⇨ OUT PWR: UL output level at digital filter output port
	⇨ LD0: Transmitting LD power level value from Optic1 port ⇨ LPWR: Lower threshold value of LD0 power level and lower alarm status of LD0 ⇨ LD1: Transmitting LD power level value from Optic2 port ⇨ LPWR: Lower threshold value of LD1 power level and lower alarm status of LD1 ⇨ PD0: Receiving PD power level value from Optic1 port ⇨ LPWR: Lower threshold value of PD0 power level and lower alarm status of PD0 ⇨ PD1: Receiving PD power level value from Optic2 port ⇨ LPWR: Lower threshold value of PD1 power level and lower alarm status of PD1

4.2.3 SRU window in GUI screen



4.2.4 Parameters details in SRU window

Group	Description
	⇨ Version: Firmware version ⇨ Type: Type of RU unit ⇨ Name: Set the Name, ID, Serial No. of iDAS RU
	⇨ User Connect: Connection status between Laptop and SRU ⇨ PSU: DC alarm status ⇨ TMPCUR: Current temperature of SRU inside ⇨ TMPUPR: Value/control of upper threshold of temperature (button) and alarm status (LED)
	⇨ LDPWR: Transmitted LD power level value ⇨ LDLWR: Lower threshold of LD power level and lower alarm status of LD ⇨ PDPWR: Received PD power level value ⇨ PDLWR: Lower threshold of PD power level and lower alarm status of PD

	⇨ SRU parameter screen selection for PCS/Cellular band TAB.
	⇨ Path Use: Path use/not use selection ⇨ TOTATT: Total attenuation value that is applied to DL path [TOTATT= USRATT + ALCATT + TCATT] ⇨ USRATT: User attenuation set value for user gain set ⇨ ALCATT: Attenuation value that controls DL gain automatically to maintain output level under ALC level when HPA output is higher than ALC level. ⇨ INPWR: Input power level which input to SRU ⇨ TCATT: Temperature compensation attenuation value and temperature compensation Function ON/OFF ⇨ HPA On/Off: HPA ON/OFF function ⇨ OUT PWR: Transmitting output power level from SRU antenna port ⇨ OUT UPR: Output upper threshold level value and alarm ⇨ OUT LWR: Output lower threshold level value and alarm ⇨ ALC: Auto level limit control threshold value and on/off set ⇨ ASD: Auto level shutdown threshold value and on/off set
	⇨ Protection On/Off: Protection Function ON/OFF to protect SRU from over input power ⇨ IN UPR: UL (Rx) input upper threshold level value and alarm ⇨ CW: CH number of pilot signal and ON/OFF function to check UL path gain budget (Pilot signal power level is -60dBm) ⇨ IN PWR: RVS power value at the LNA output point ⇨ ATT: User attenuation set value to control UL (Rx) gain ⇨ OPWR: UL output power level of SRU ⇨ AGC: Auto gain control level value and Function ON/OFF ⇨ AGC ATT: Applied attenuation value by AGC function ⇨ TC ATT: Applied temperature compensation attenuation value and function ON/OFF

4.3 Firmware download

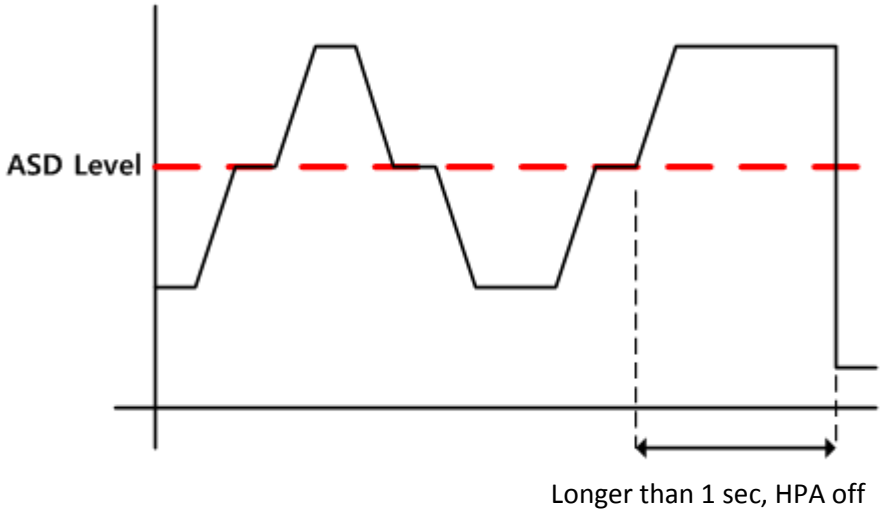
Firmware download is performed when system needs to be updated.

Downloading improper images (executable file of repeater CPU) may cause harmful damages to equipment.

4.4 Additional function of RHU

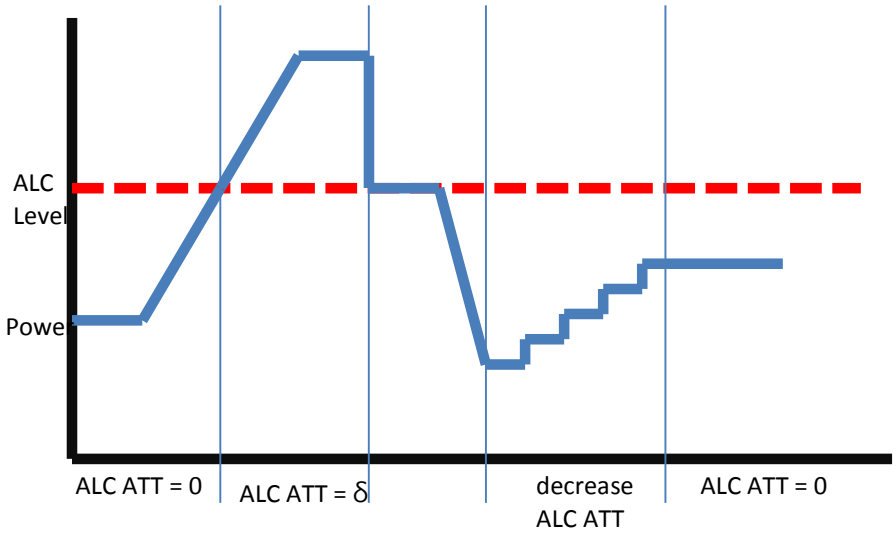
4.4.1 ASD (Auto Shutdown) Function

1. If UL output power level of RHU is above the shutdown level longer than 1 second, RHU automatically turns off amplifier to protect undesirable transmission.
2. During shutdown state, monitor RU input power. If the level is below 5dB from shut down level, turns on UL amplifier automatically.



4.4.2 ALC (Auto Limit level Control) Function

1. If UL output power level of RHU reaches the ALC level, RHU decrease the output power to maintain ALC level automatically.
2. When power level goes down under ALC level, RHU increase output power until ALC ATT is 0 by 500msec ~ 1sec speed.

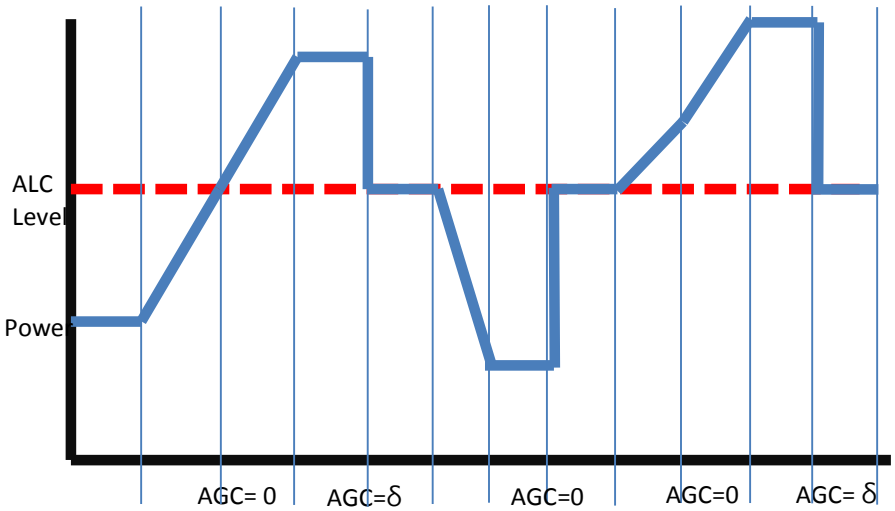


4.4.3 AGC (Auto Gain Control) Function

1. In order to have stable output power, RHU has AGC function that can maintain constant output power with setting output level.
2. When input level is decreased RHU increase gain to maintain continuous output level, when

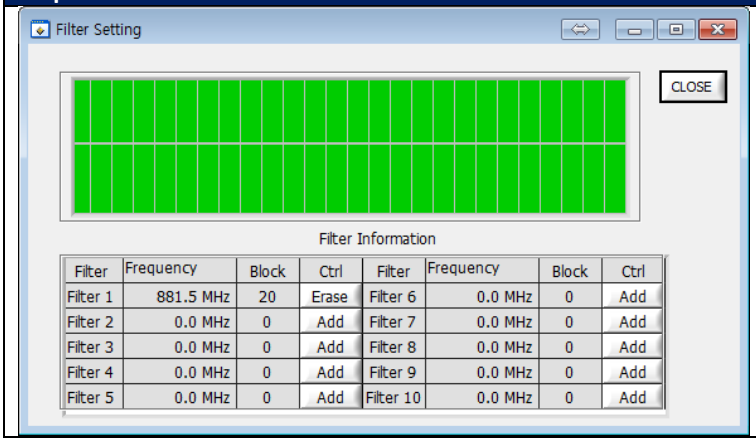
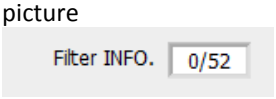
input power is increase RHU decrease gain to have same output power automatically.

3. RHU works AGC function by 500msec ~ 1sec speed.



4.4.4 Sub-band selection Function

RHU can select sub-band up to 10 bands in 65MHz bandwidth using digital filter function. These sub-band filters have very sharp cut-off characteristics and RHU can provide the signal of selected band of 65MHz BW to coverage area. This digital signal processing function also provide input signal information and antenna isolation information between link and coverage antennas.

Step	Descriptions
	If you click “Filter INFO” like following picture  You can build up band pass filter up to 10 filters. Input center frequency, number of block for sub-band and click “Add” button, sub-band filter is built up. If you want to erase filter, click “Erase” button.

Filter	Frequency	Block	Ctrl	Filter	Frequency	Block	Ctrl
Filter 1	881.5 MHz	20	Erase	Filter 6	0.0 MHz	0	Add
Filter 2	0.0 MHz	0	Add	Filter 7	0.0 MHz	0	Add
Filter 3	0.0 MHz	0	Add	Filter 8	0.0 MHz	0	Add
Filter 4	0.0 MHz	0	Add	Filter 9	0.0 MHz	0	Add
Filter 5	0.0 MHz	0	Add	Filter 10	0.0 MHz	0	Add

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:
    - Directional Yagi Antenna

Specific Frequency	700-960 MHz / 1710-2700 MHz
Gain dBi	10 dBi / 11 dBi
Gain dBd	12.35 dBd / 13.35 dBd
Polarization	Vertical
Vertical Beamwidth	50 deg / 40 deg
Horizontal Beamwidth	65 deg / 60 deg
Maximum VSWR	1.5:1
Maximum Power	50 W
Lightning Protection	DC Ground
RF Connectors	N Female
Connector Placement	Pigtail
Type of Jumper Included	Yes
Type of Hardware Included	U-Bolts
Maximum Rated Wind Velocity	100 mile/h
Item Height	1.45 in
Item Length	17.3 in
Item Width	8 in
Item Weight	2.2 lb
Mfg. Warranty	2 Years

    - High isolation antenna

Specific Frequency	698-960 MHz / 1710-2155 MHz
Gain dBi	12.5 dBi / 13 dBi
Minimum Front Back Ratio	25 dB
Polarization	Vertical
Horizontal Beamwidth	20 deg / 12 deg
Maximum VSWR	1.6:1 / 1.7:1
Maximum Power	150 W
Lightning Protection	DC Ground
Electrical Downtilt	Fixed
RF Connectors	N Female
Connector Placement	Back
Jumper Included	No
Type of Jumper Included	None
Type of Hardware Included	Wall or Pole Mounting
Item Height	5.2 in
Item Length	11.9 in
Item Width	43.3 in
Item Weight	25.4 lb
Mfg. Warranty	1 Year

- Coaxial Cable:
    - LDF4, AL4RPV-50 1/2” Plenum Air Aluminum coaxial cable or equivalent coaxial cables
- Fiber Cable:
    - LC/UPC type signal mode optical cable

6 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 RHU 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.

RU 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 identified 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 10foot high, an average person is assumed 6foot high, the distance from antenna to body is 4 feet (112 cm).

For PCS 1900 band, the maximum power output per carrier is assumed 20dBm. With the assumption of 13dBi antenna gain is used, PG in the equation is equal to 33dBm EIRP.

Using S = PG/4pieR^2

S = 2/(4*3.14)*112^2 = 12.7μW/cm^2

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

S = 2/(4*3.14)*20^2 = 0.4mW/cm^2

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