APEX1933

User's Manual

Please read this manual before operating this product.
After you finish reading this manual, store it in a safe place for future reference.

FCC NOTIFICATION

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 INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

Regulatory Statements

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.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: 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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Modifications: Any modifications made to this device that are not approved by Sun Microsystems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

WARNING: Only authorized antennas and cables described in this manual are permitted to be used with this device. Other antennas and cables are expressly forbidden to be used. Authorized Antennas:

- **YG-1900-12: Yagi Antenna**
- **ACPS-1900-8: Indoor Directional Patch Antenna**

TABLE OF CONTENTS

1. General

1.1 Notice

Trademark

R-tron is a registered trademark of R-tron Inc.

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Copyright

Notice

This document describes the specifications, installation, and operation of the APEX1933 equipment.

Hardware and software mentioned in this document are subject to continuous development and improvement. Consequently, there may be minor discrepancies between the information in the document, performance, and design of the product.

Specifications, dimensions, and other statements mentioned in this document are subject to change without notice.

Questions or Comments

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Website: www.rtronamerica.com

1.2 Safety Precautions

Warning ⚠

Opening the APEX1933 equipment could result in electric shock and may cause severe injury.

Warning ⚠

Connect the equipment frame ground to the building ground.

Warning ⚠

Operating the APEX1933 with antennas in very close proximity facing each other can lead to severe damage to the equipment.

Caution ⚠

RF Exposure Infomation

The antenna(s) must be installed in a fixed installation and provide a separation distance of 76 cm from all persons and must not be collocated with any other transmitters except in accordance with FCC multi-transmitter product procedures for both **YG-1900-12** antenna and **ACPS-1900-8** antenna.

For more information about RF exposure, please visit the FCC website at www.fcc.gov

Caution ⚠

This equipment is for indoor use only and enables the communication wiring to communicate inside the building.

Caution ⚠

Antenna Requirements

ANTENNAS: please read your manufacturers antenna specifications before installation.

Your antenna will require a type "N" connection. The antenna, Coax., and fittings must be 50 ohms.

1.3 Version History

1.3.1 Manual Version History List

Revision History		Date	Item/Description	Reason
Approval Ver.	Issue Ver.			
V1.0		2013. 10. 18	Initial Version	
V1.0	V1.1	2013. 10. 31	Component List Modification	
V1.1	V1.2	2014. 01. 20	Key features Modification	

1.3.2 Firmware Version History List

Revision History		Date	Item/Description	Reason
Approval Ver.	Issue Ver.			
V1.0.00	V1.0.00	2013. 10. 18	Initial Version	

1.3.3 WEB GUI Version History List

Revision History		Date	Item/Description	Reason
Approval Ver.	Issue Ver.			
V1.3.00	V1.3.00	2013. 10. 18	APEX Series Common GUI	

1.4 Glossary

The following is a list of abbreviations and terms used in this manual.

Abbreviation	Definition
AC	Alternating Current
CDMA	Code Division Multiple Access
DC	Direct Current
DL	Downlink
GUI	Graphic User Interface
LED	Light Emitting Diode
PSU	Power Supply Unit
RF	Radio Frequency
UL	Uplink
VSWR	Voltage Standing Wave Ratio
NCU	Network Control Unit
MCU	Main Control Unit
NMS	Network Management System
SNMP	Simple Network Management Protocol

AGC (Automatic Gain Control)

AGC prevents the equipment from exceeding its maximum output power by reducing the gain automatically. AGC is used to adjust the gain to an appropriate level for a range of input signal levels.

ASD (Automatic Shutdown)

ASD helps protect the amplifier from over load. ASD helps protect the network by preventing excessive signal output power.

ASD does not:

1. Prevent oscillation
2. Protect from excessive input.

There are three parameters: **ASD Level**, **ASD Time**, and **ASD Iteration**.

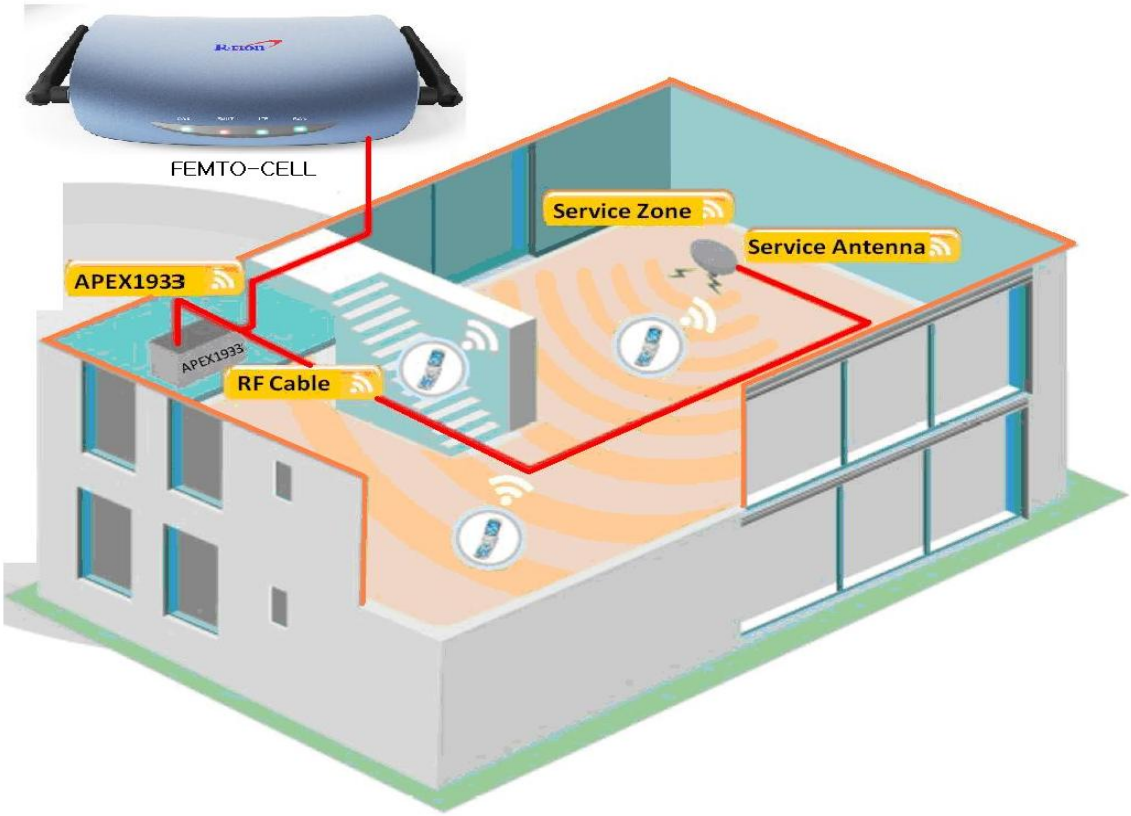
If the output power exceeds higher than the "**ASD LEVEL**", the equipment will shut down for "**ASD TIME**" seconds. If shutdown repeats "Iteration" times, the equipment will require manual re-start.

2. Introduction

2.1 APEX1933

APEX1933 is used to fill out areas in APEX systems, such as base station fringe areas, business and industrial building, etc.

APEX1933 receives signals from a Small Cell (Femto-Cell, Optional), amplifies and retransmits the signals to the mobile stations. It also receives, amplifies and retransmits signals in the opposite direction. Both directions are served simultaneously with the following features:



< Basic Organization >

Note :

Femto-cells will be one of the following products:

FCC ID:R4HAWEPPRO or FCC ID:QHYHUBBUBC4500-RT or FCC ID:QHYHUBBUBC4501-RT.

Femto-cells that are used with APEX 1933 must be connected to a wired uplink configuration. Both up link and down link of the femtocell will be wired connections only when used with APEX 1933.

2.2 APEX1933 Key Features

◈ **Design**

- Digital filtering allows for customized channel selections.
- Digital filtering high quality, out of band rejection, and high performance

◈ **User friendly design.**

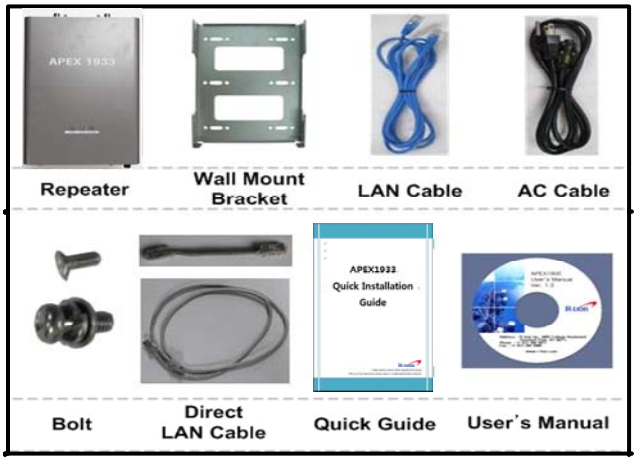
- Local monitoring and control through the Web GUI interface
- Remote monitoring and control through the Web GUI interface.
- Reports the status of connection as a function of SNMP regularly and reports an alarm if the event occurred.

◈ **Protection function**

- Easy setup
- Isolation Check
- Auto Gain Control
- Auto Shutdown

2.3 Components

2.3.1 APEX1933

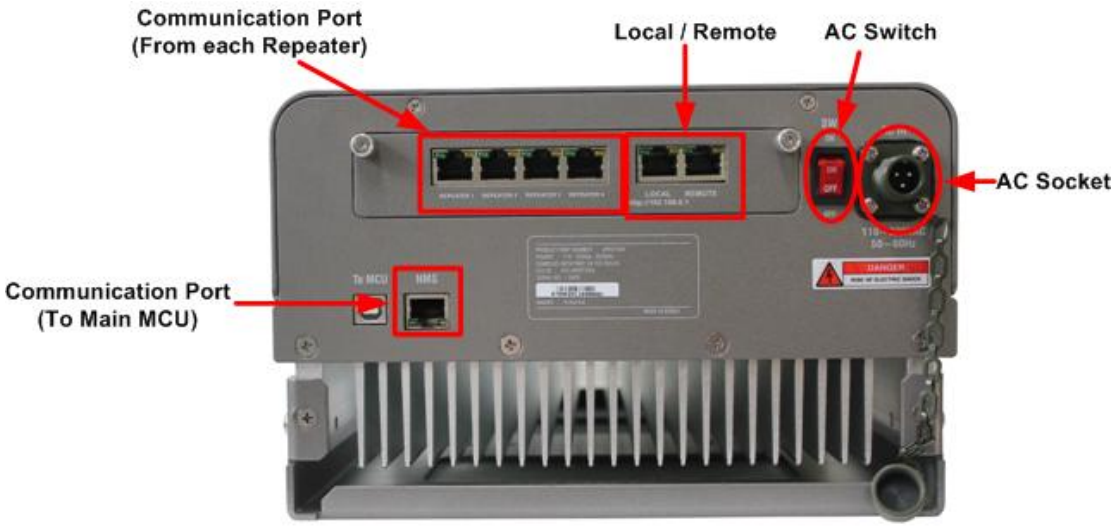


APEX1924/1930/1933 Package			
Index	**Items**	**Q'ty**	**Remark**
1	Equipment	1	
2	NCU (Installed in equipment)	1	For standalone APEX PCS Series operation
3	Wall Mount Bracket	1	
4	LAN Cable	1	Cross Type LAN Cable
5	AC Cable	1	
6	Bolt (M4*8mm)	2	
7	Bolt (M6*16mm)	4	
8	Direct LAN Cable(120mm)	1	Strait through LAN cable for standalone APEX PCS Series operation
9	Direct LAN Cable(1M)	1	Optional
10	Quick Guide	1	
11	User's Manual CD	1	

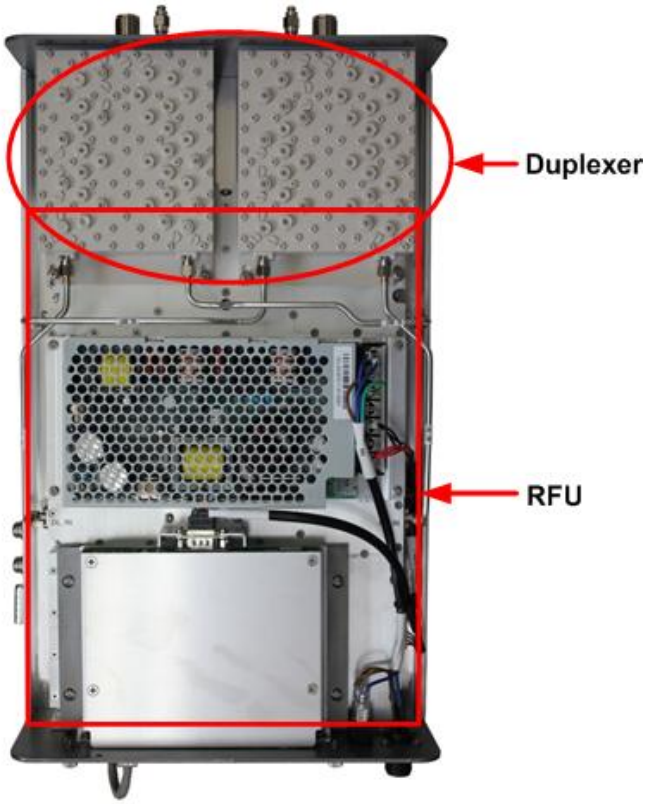
No.2, 4 and 8 are for standalone APEX1924/1930/1933 operation.

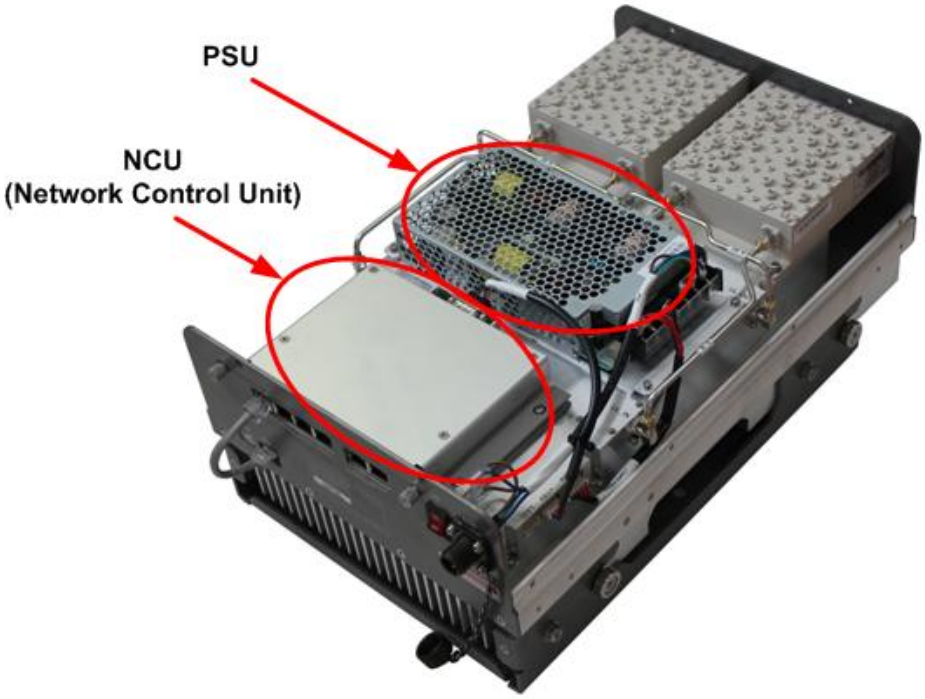
2.4 Description

2.4.1 Overview



2.4.2 Internal Configuration





2.4.3 RFU (Radio Frequency Unit)

The RFU (RF Unit) is a bi-directional amplifier that sharply filters out unwanted noise.

2.4.4 Duplexer

A duplexer is a device that combines two or more signals onto a common channel or medium to increase its transmission efficiency.

2.4.5 PSU (Power Supply Unit)

The AC-DC adaptor supplies a steady DC power to the APEX19xx equipment by drawing power from the general in-wall AC outlets.

2.4.6 NCU (Network Control Unit)

The NCU (Network Control Unit) is the control unit of the APEX19xx. The NCU controls and monitors operational parameters, alarms, records event and performs many other functions.

2.4.7 ANTENNA REQUIREMENTS

ANTENNAS: please read your manufacturers antenna specifications before installation. Your antenna will require a type "N" connection. The antenna, coax, and fittings must be 50 ohms impedance.

MAXIMUM ANTENNA SIZE CONNECTED TO THE APEX1933 REPEATER IS 12dBi,

The CDMA repeater requires antennas that operate in the desired frequency range of the CDMA repeater. The APEX1933 Repeater has a frequency operating range of 1850 to 1915 MHz for the up- link, and 1930 to 1995 MHz for the downlink. Your antennas must operate within these frequencies.

Failure to select the proper antennas will degrade the performance of your repeater.

2.4.8 ANTENNA ISOLATION & COAX CABLES

To protect wireless CDMA networks from interference caused by oscillation, the APEX1933 Repeater has internal automatic oscillation detection/control and auto shut down of the repeater.

Improper installation practices could can initiate automatic shut-down of your repeater.

All repeaters require antenna isolation to prevent oscillation. The usable gain level of your repeater is directly linked to the antenna isolation values. The maximum gain of your repeater must be adjusted to a minimum of 10 dB lower than your antenna isolation values. For example, if your antenna isolation value is 43 dB then your maximum usable repeater gain is 33 dB.

Due to the variations of system layouts and requirements it is not possible to have one procedure that will suffice every installation. You are strongly advised to acquire the services of an RF system designer to calculate your antenna isolation requirements.

Ensure that your antennas are at the maximum possible distance apart. Do not place antennas in close proximity to each other; otherwise you will activate the oscillation detection process.

Coax cables should be low loss 50 ohm, and suitable for 1850 to 1915 / 1930 to 1995 MHz band frequency.

Antenna connections should be clean and moisture free. Do not spray lubricant into the connectors as this prevents the signal traveling through the coax. Use a cleaning solvent that has no oil and does not leave any residue. High quality oil-less contact cleaner is suitable.

All coax connectors must be water tight and wrapped with water proof tape. Any moisture in the connectors will degrade or eliminate the signals.

2.4.9 ANTENNA CONNECTIONS ON THE APEX1933

The APEX1933 can be installed indoors. If mounted indoors ensure there is no elevated room temperatures and free flowing air for cooling of the repeater.

Connect the antenna that is aimed at the Cell Tower to the bottom left side N connector.

Connect the antenna that is aimed towards the Area Fill (target site) to the bottom right side N connector.

Connect your Ethernet cable to the connector socket located on the left side of the power on LED light.

NOTE; Water proof boot cover for the Ethernet connection, contact your Repeater supplier.

2.4.10 ADJUSTING REVERSE LINK MAXIMUM POWER LEVEL.

Additional protection is gained if the reverse link maximum power level is adjusted to prevent the possibility of sudden unwanted high input RF levels. This can happen in various ways, mobile cellular vehicle boosters coming within range of the cellular repeaters, malfunctioning cellular phones, or other stray signals.

The APEX1933 has an adjustable Maximum allowable RF Power limit. The maximum allowable RF power limit is 33dBm. The digitally controlled attenuator will not permit RF signal levels greater than 33dBm.

The user can decrease the maximum allowable RF transmit power from 33 dBm to 0.0dBm. The microprocessor controlled digital attenuator will maintain the preset allowable RF transmit power limit regardless of unwanted high input signal levels.

2.4.11 Calculating the Maximum Output Power allowed

The regulatory limits for maximum output power are specified in EIRP (equivalent isotro pic radiated power). The EIRP level of a device will be installation dependent and final c onfiguration is the responsiblity of the professional installer. However in general the fin al EIRP can be calculated by adding the gain of the antenna used (specified in dBi) to the output power available at the connector (specified in dBm) minus any cable loss.

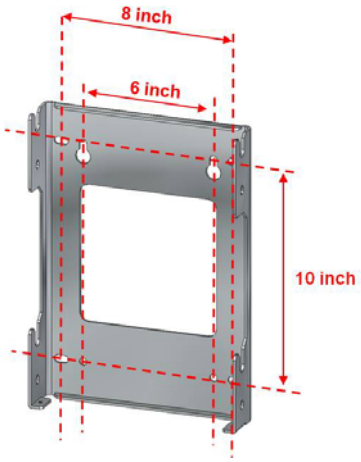
3. Mechanical Installation

The installation procedure is as follows:

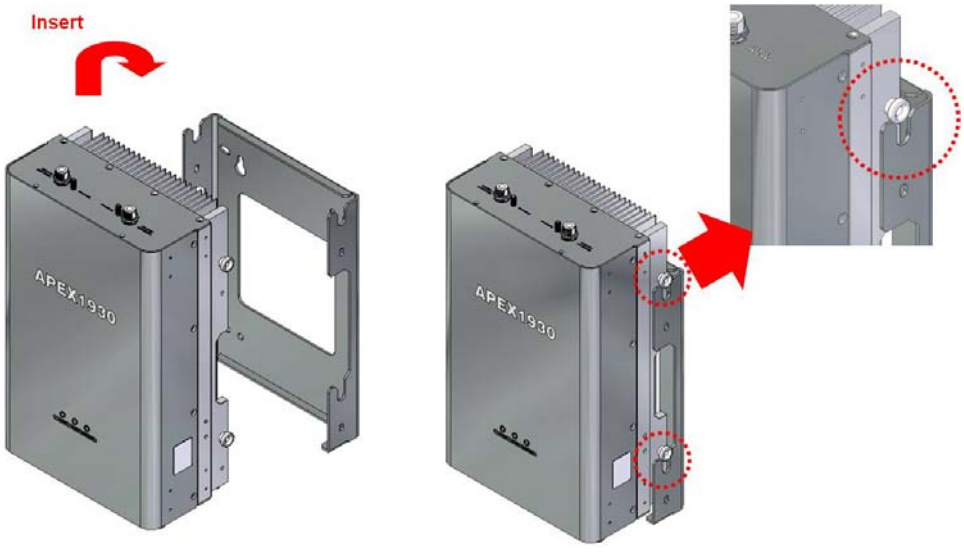
- Confirm Items from List
- Mounting
- Grounding
- RF Cable Connection
- Power On

3.1 Mounting

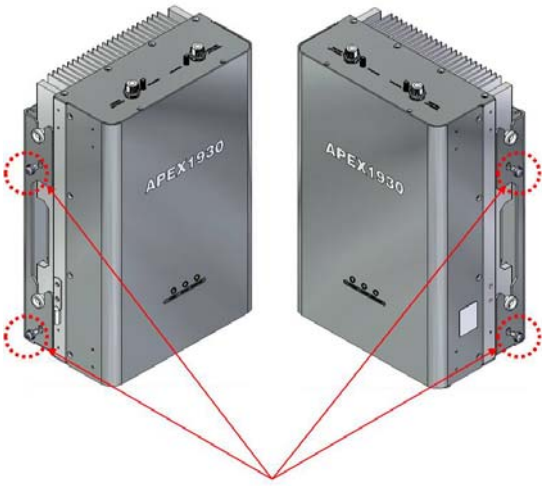
Step 1 Drill holes directly through the template. Attach the mounting bracket to the wall using provided bolts (16/5*50mm) or extra screws.



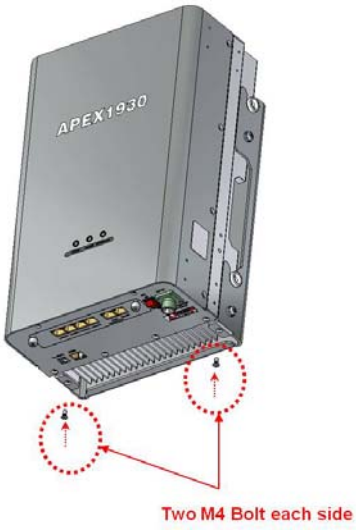
Step 2 Lean the APEX19xx to hang the topside of the Guide Ring on the mounting bracket, and push toward the wall to mount.



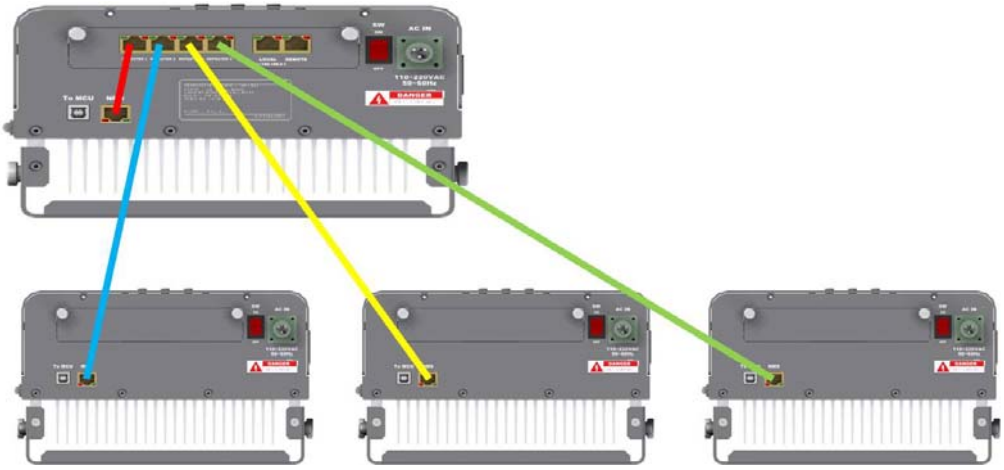
Step 3 Fix the equipment using the 4 bolts (M6*12mm) provided.



Step 4 Fix the equipment using the 2 bolts (M4*8mm) provided.



Step 5 Connecting multiple APEX equipments.



4. Cable Installation

4.1 Cable Connection

Step 1: Connect a cable from the donor antenna to the Donor Antenna Port.

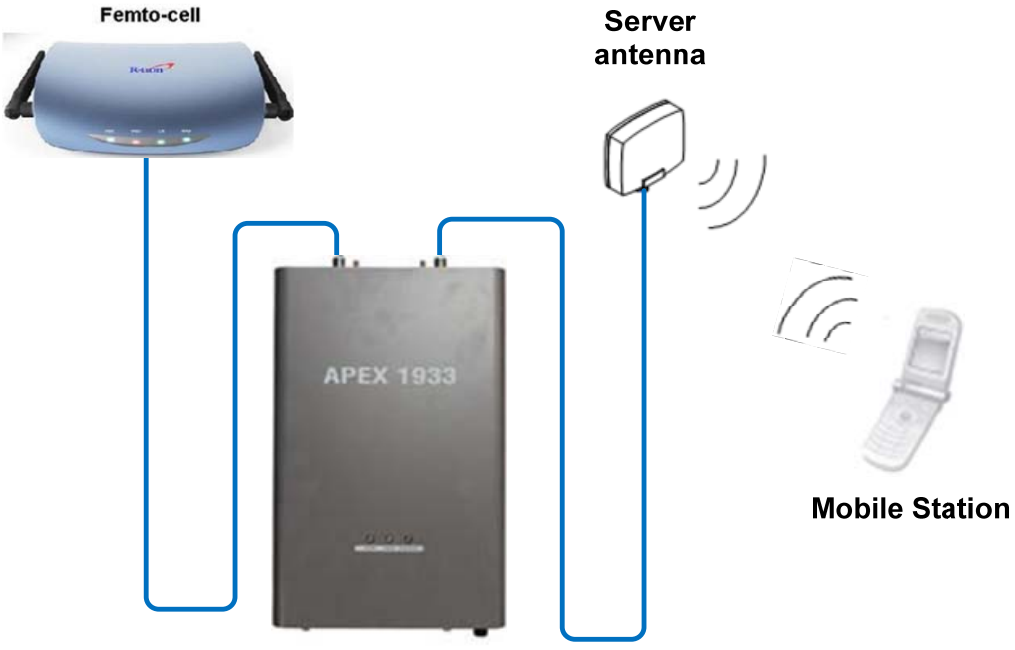
Step 2: Connect a cable from a equipment's service antenna to the Sever Antenna Port.

Warning

DO NOT connect or disconnect the coaxial cable while the power is on.

Note

Enough isolation?
Antenna isolation = Path loss between the server antenna port and the donor antenna port
Antenna isolation ≧ Repeater max. gain +15dB
If antenna isolation < Repeater max. gain +15dB → System oscillation or Low gain



4.2 Power On

※ **Notice: Antenna cables must be installed before connecting AC Power.**

Step 1: Connect the power cord to the Equipment

Step 2: Plug the power cord into a wall outlet.

Step 3: Turn the red power button on

Step 4: Check if the green LED at the Top turns on.

4.3 Grounding

Step 1: A rod on the left side is intended for a building ground.

Step 2: Connect the ground cable to the rod.

Warning

Dangerously high voltages may occur and damage the equipment if the equipment is not grounded properly.

5. GUI Operation

APEX19xx operates on a customer provided PC based platform with the following system requirements:

- Windows® XP or Windows® Vista, Windows 7
- Internet Explorer 6.0(Recommended) or higher.
- 128 MB RAM or higher.
- Pentium Ⅲ processor or higher.
- RJ-45 Cable required.

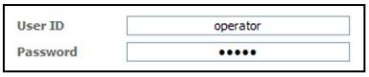
5.1 GUI Operation Flow Chart

[1] Internet Network Setup

Setting in order to acquire the IP address automatically.

[2] GUI Log-in

APEX1900 operation access to Web GUI and Log in.



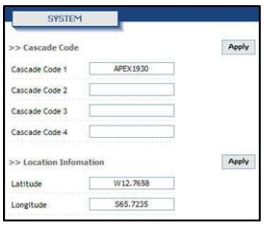
[3] GUI Network Setup

1. Time Setting

Automatically set to your PC time.

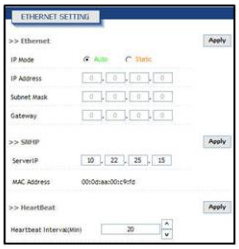
2. System Information Input

Input Cascade Code and Location Information.



3. Ethernet Setting

IP address and SNMP IP Input.

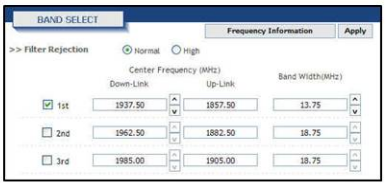


[4] GUI System Control

The user can control the repeater locally using the built-in WEB GUI.

1. Band Select

Set the center frequency and bandwidth.

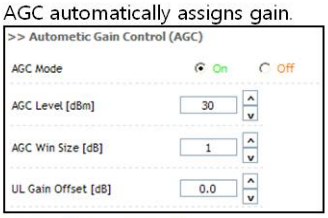


2. Isolation Check

Isolation will calculate the Available Maximum Gain.

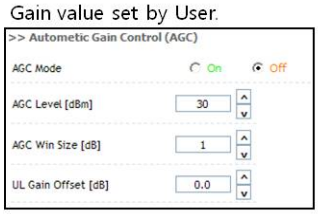
3. AGC control

AGC automatically assigns gain.



4. Manual Control

Gain value set by User.

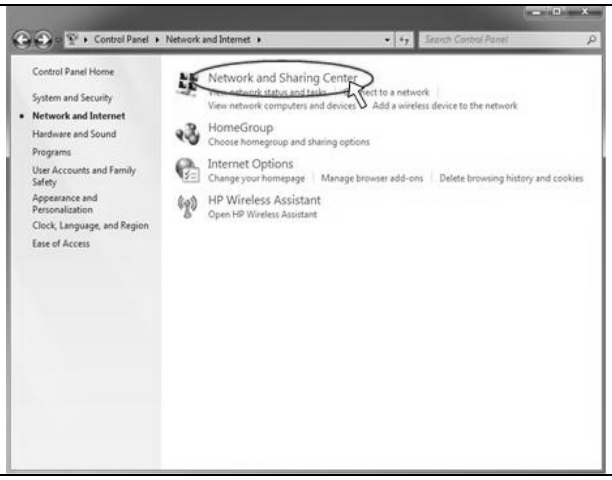
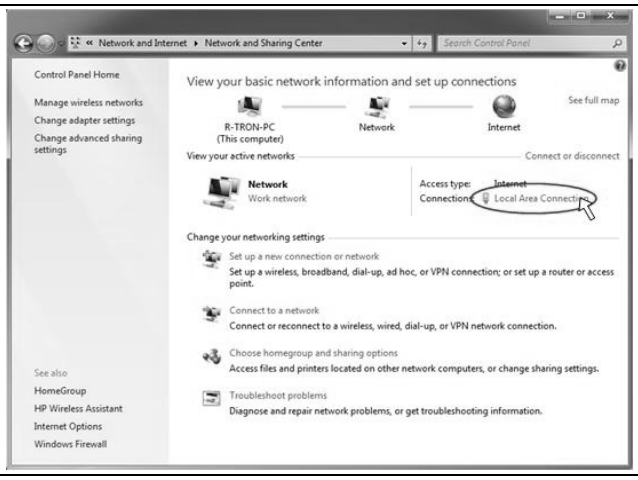
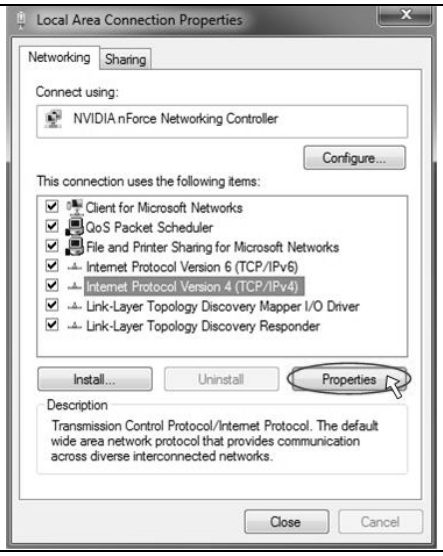


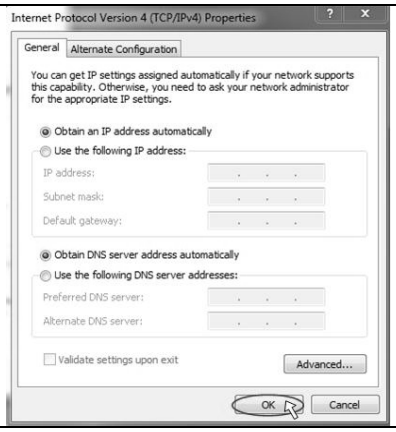
[5] GUI Status Check

You can see system, operating, and alarm information on Status page.

5.2 Internet Network Setup

5.2.1 Windows 7 (Refer to 5.9 for other versions of Windows)

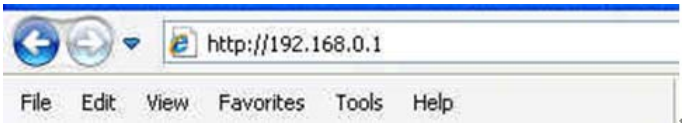
Step 1: Click the Start button and select Control Panel.	Step 2: Click **Network and Internet**.
	
Step 3: Click Network and Sharing Center.	Step 4: Click View status of Local Area Connection.
	
Step 5: Click Properties and a caution pop-up window will appear. Click OK.	Step 6: Select Internet Protocol Version 4 (TCP/IPv4) and click Properties.
	

Step 7: Check Obtain an IP address automatically and click OK.	Step 8: Close all windows.
	

5.3 System Login

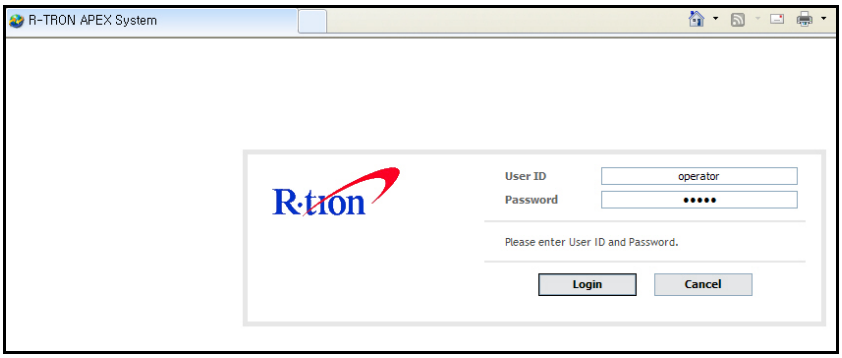
For APEX19xx operation access, go to Web GUI and Log in.

Step 1: Open your Web browser and type **http://192.168.0.1** into the URL address box. Then press the Enter key.



Step 2: Confirm a User ID and type the password into the password box.

Type **"operator"** for the password and then click **OK.**



Step 3: The pop-up message for the login success will appear. Click **OK.**

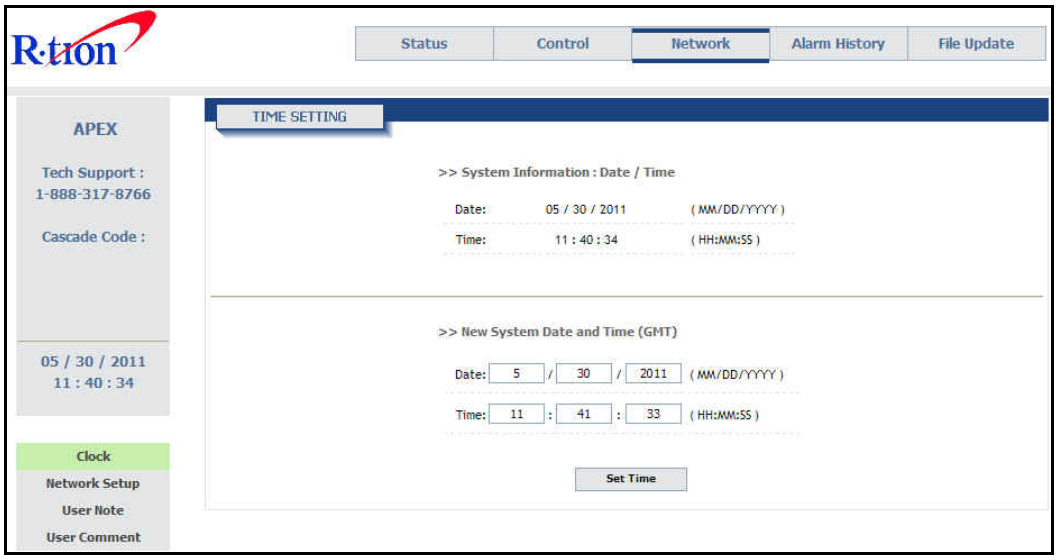
Step 4: When the login process is complete, the initial screen will appear.

5.4 System Setup

When you click Network in the initial screen you can set up User Note, Comment, Ethernet, and time setting.

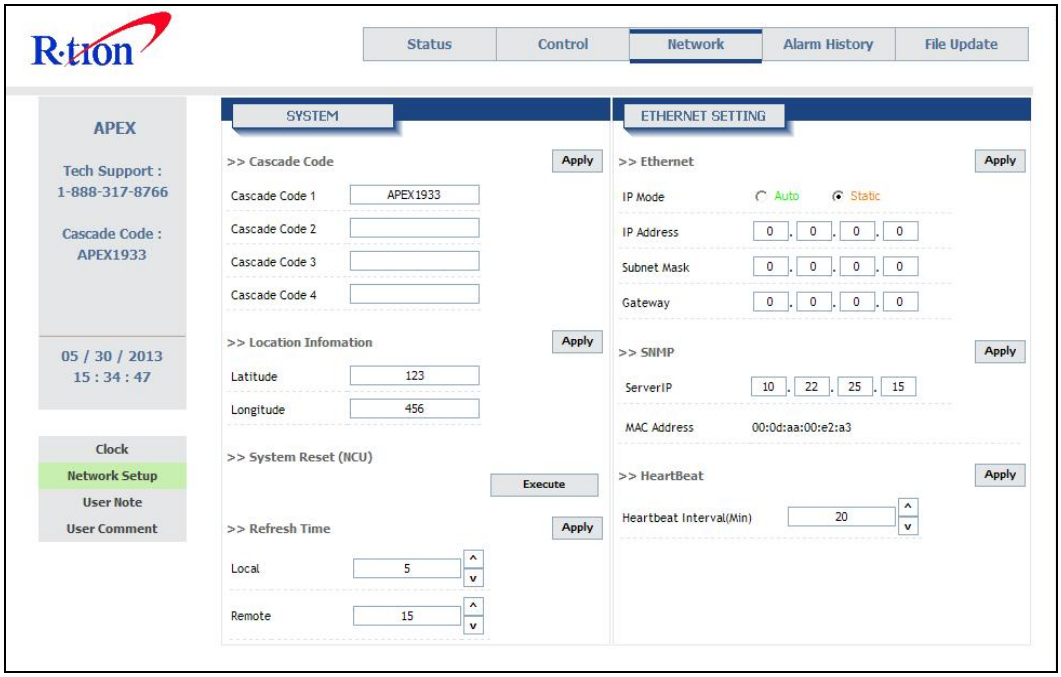
5.4.1 Time Setting

The time will automatically set to your PC time when you click **OK**.



In the above page, you can set system date and time and update time-related information.

5.4.2 Network Setup



<Network Setup>

5.4.2.1 SYSTEM

• **Cascade Code:** Type the pre-assigned cascade code. Otherwise, you cannot access the system setup.

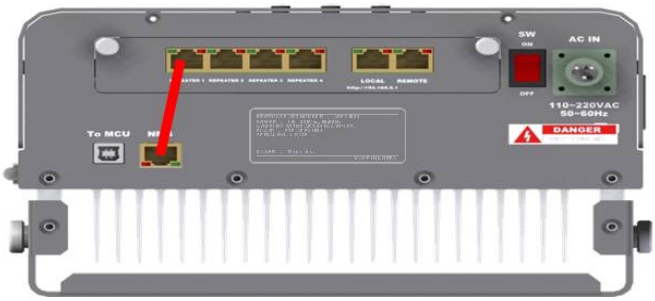
➢ **Set up for multiple bands**

Equipment with NCU installed is designated as the master control. The other equipments will connect to the master via RJ 45 cable.

The master web GUI will display the other equipments if the connection is successful.

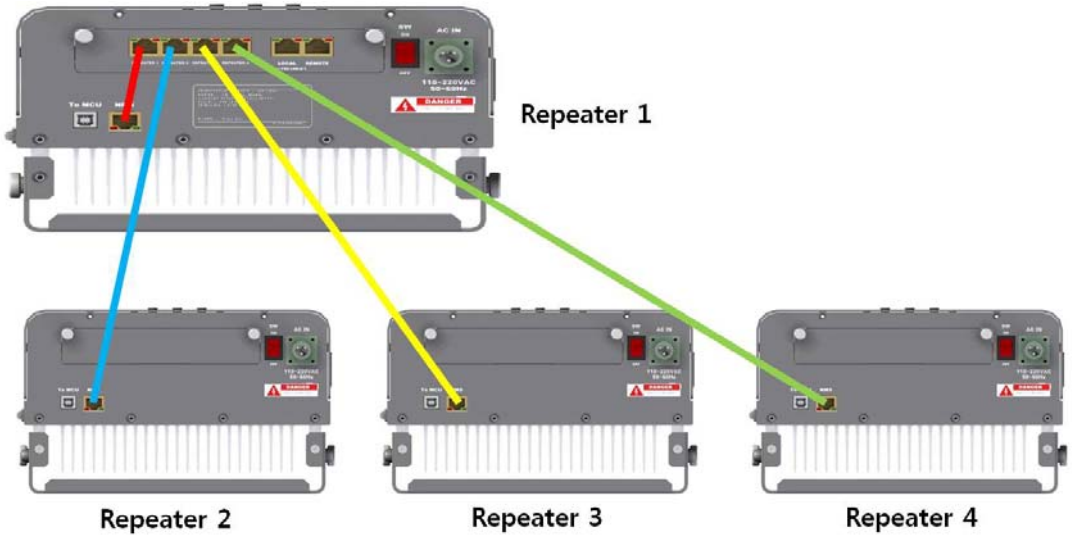
1) Cascade code 1 of SYSTEM in Network setup:

Put Direct LAN Cable into Equipment 1 port and connect to NMS port.



2) For adding equipments refer to the RJ 45 cable connection below.

Input Cascade codes to the cascade code table under the SYSTEM section.



• **Cascade Code Setting Chart**

Equipment	Equipment 1	Equipment 2	Equipment 3	Equipment 4
Cascade code	Cascade Code 1	Cascade Code 2	Cascade Code 3	Cascade Code 4

• **Location Information:** Enter the latitude and longitude. You can input values either in Decimal Degrees or Degrees-Minutes-Seconds.

[Example]

('N/S' | 'E/W') ddd.dddddd: (Latitude: N 39.006967 Longitude: W 94.532306)

• **Refresh Time:** Set each refresh time for connecting to Local port and Remote port.

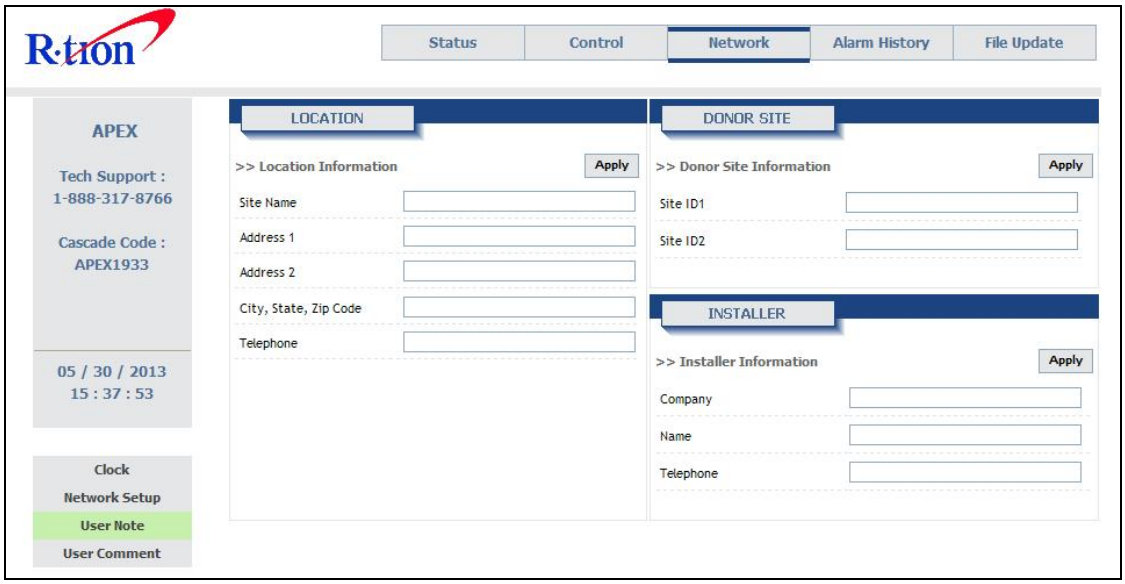
5.4.2.2 ETHERNET SETTING

• **Ethernet IP Mode/IP Address:** Enables you to set a connection mode for the network connected to the APEX19xx remote LAN port. When you "select" Auto, the device automatically assigns the IP address. When you select "Static", it is possible to set an IP address of your choosing.

• **SNMP:** In order to send Heartbeat and alarm related information to a remote monitoring server, you can set a server IP address. The factory default IP address is 10.22.25.15.

• **Heartbeat Interval:** Sets the time to transmit the Heartbeat to the NMC Server. (Default value is 20 minutes.)

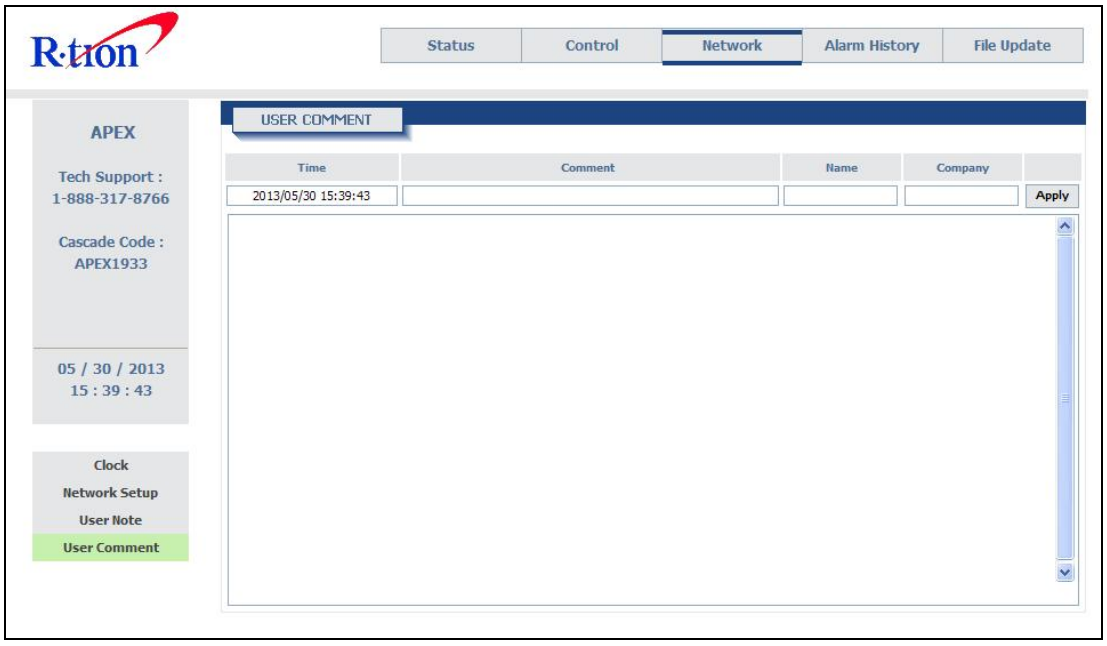
5.4.3 User Note



<User Note>

- **Location Information:** Type the location information such as the building name, address, city, state, zip code and telephone, and then click **Apply**.
- **Donor Site Information:** Type the base station's ID, and then click **Apply**.
- **Installer Information:** Type the installer information such as the company, name and telephone, Click **Apply**.

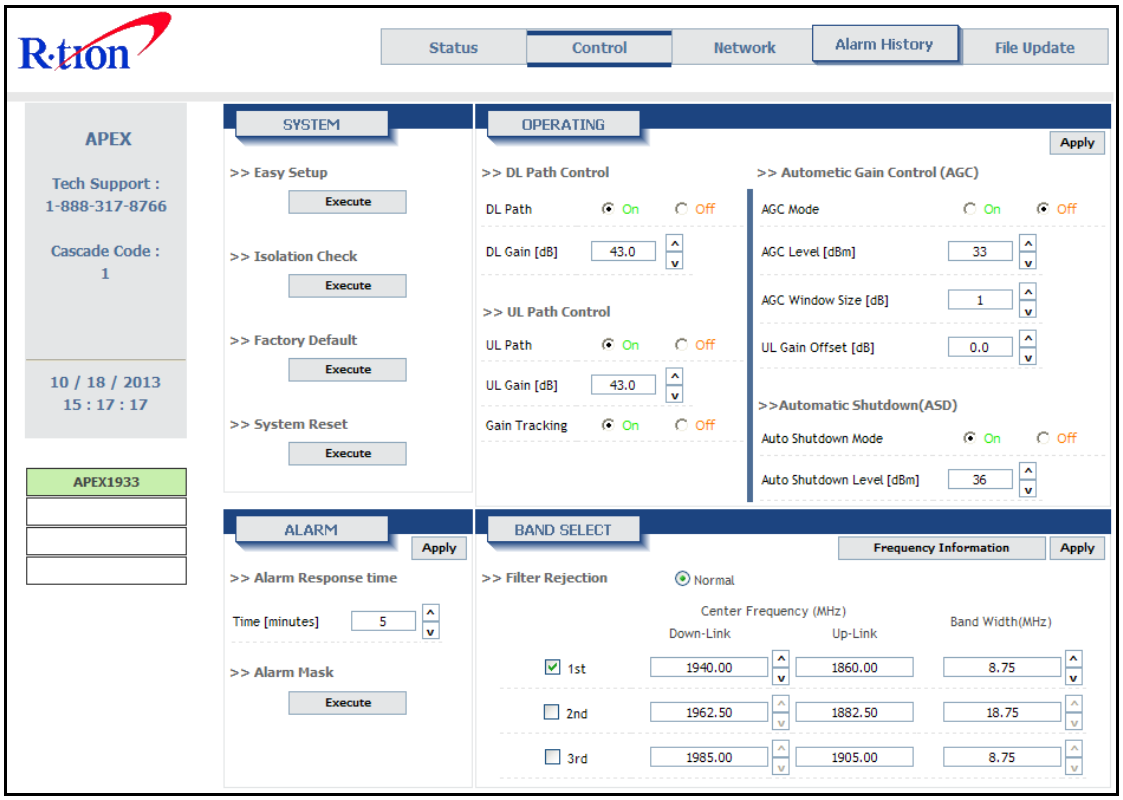
5.4.4 User Comment



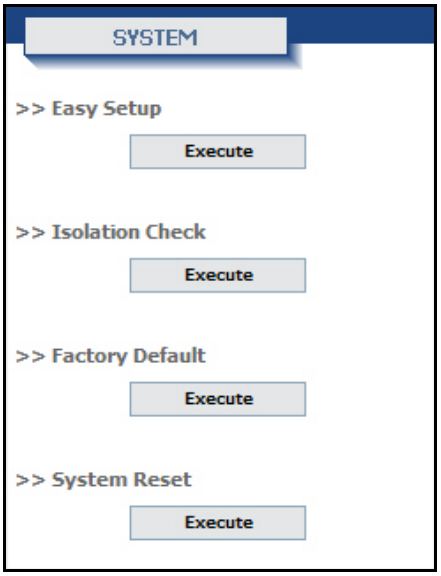
<User Comment>

- **User Comment:** The user can store up to 50 comments in memory. The length of each comment is limited to 20 characters.

5.5 GUI System Control

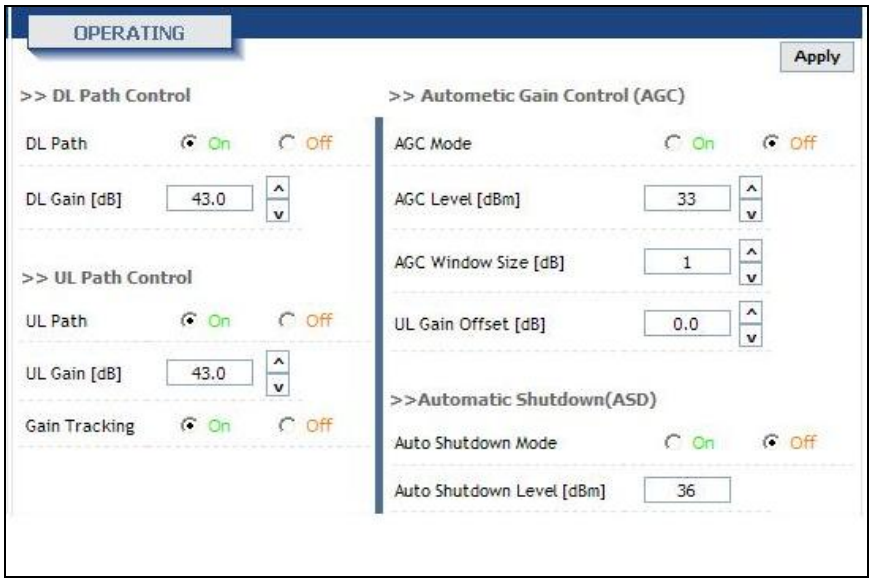


5.5.1 System Control



- **Easy Setup** is a fast start function. The function measures Isolation, detects input level and assign gain to achieve maximum output power. The function ends with the equipment set to amplify signals in both directions within the confines of the band selection. Before running easy setup, set the center frequency and bandwidth (refer to 4.3.3 part 2).
  Maximum DL output power requires at least -10dBm input power and sufficient antenna isolation.
- **Isolation Check** can be executed at anytime to measure isolation between the donor and server antennas. Isolation Check momentarily disables service. Isolation check automatically runs when factory default is initiated.
- **Factory Default** restores the amplifier to its initial state. The function ends with amplifiers off, AGC mode off, gain set to minimum(15dB) and UL gain offset set to 0dB. Band selection and all other system parameters are not changed. The featurs is usefull in claering abnormal conditions.
- **System Reset** cycles the microprocessor unit. The function is similar to switching off/on the equipment power switch.

5.5.2 Operating Control



- **DL and UL Path Control** allows the user to toggle on or off the power amplifiers.
- **DL and UL Gain** is available when AGC mode is off. The user may enter gain values manually. Manual gain control is an alternative to automatic gain control (AGC). Manual gain is disabled (grayed out) when AGC mode is on. Gain cannot be controlled manually above the available gain found on the status page. The system will not allow gain to be increased such that maximum output power (33dBm) is exceeded.

- **Gain Tracking** sets UL gain equal to DL gain. The feature helps maintain forward and reverse link balance. The function control is grayed out when AGC mode is on.
- **Automatic Gain Control :**

- In contrast to manual gain control, **automatic gain control (AGC)** sets gain such that the desired amplifier output level (33dBm) is automatically set.
- The user controls gain by adjusting the **AGC level.** The user may set the level from 0dBm to 33dBm. AGC can be used to control the signal level radiated from the server antennas.
- AGC may also be user to match the equipment to a DAS (distributed antenna system). AGC level may be restricted by available gain and DL input power.

- **UL Gain offset** is used in conjunction with AGC to reduce the amount of amplification in the reverse direction (uplink). In the cases UL offset is set to 0dB.
- **Automatic Shutdown (ASD) :**

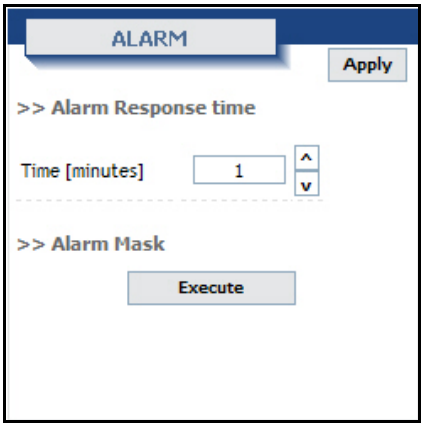
- ASD temporarily shuts down the amplifier if the ASD level is exceeded. It is not necessary to turn off ASD. ASD events are stored in the alarm history log. Repeated ASD events will eventually shutdown the amplifier permanently and trigger the external shutdown lamp.
- ASD Level is set to 36dBm by default. It is not necessary to change the default level.

How to prevent saturation or over-modulation

1. Hardware function
   Input : If this device detect an over input signal, input hardware ALC will automatically activated over
   power rating+2dB within 100ns to protect it and in case of over ALC range
   turn to Thru-Path by activating a relay to prevent from occurring
   saturation of AMP and Digital board.
   Output : If this device detect an over output signal, output hardware ALC will automatically activated over
   power rating+2dB within 100ns to prevent from occurring over output power.
2. Software function to adjust the maximum power output and secure linear operation
   AGC(Automatic Gain Control) : automatically control the output power not to exceed over the set value.
   ALC : activating in AGC off condition to prevent from occurring over-output power

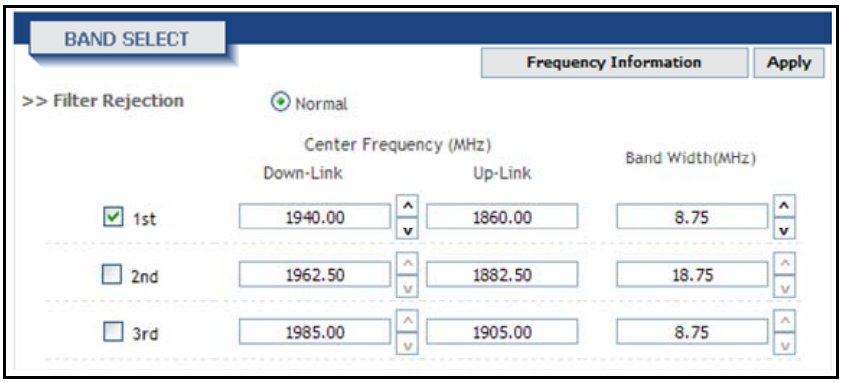
-

5.5.3 Alarm Control



- **Alarm response time** may be set between 0 and 5 minutes.
- **Alarm Mask** allows the user to customize the type of alarms sent to the SNMP server when remote monitoring is in use.

5.5.4 Band Select

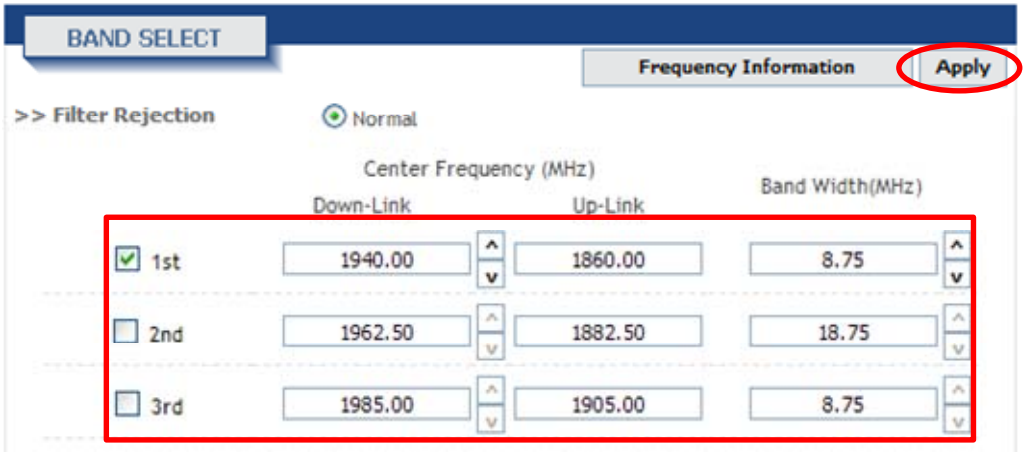


- Band select sets the digital filter to the **center frequency and bandwidth** of the local service for which the equipment is intended to amplify. Likewise, all other signals outside of the selected **Center Frequency and Bandwidth** are rejected.
- The user can select one, two three distinct sections within the PCS band. Each of the **1st, 2nd and 3rd** filter blocks can be set to 1MHz to 20MHz of **Bandwidth.** Only the downlink center frequency is set by the user. The uplink center frequency is automatically set in accordance with the downlink frequencies.
- **Filter Rejection** allows the user to change the digital filter characteristics. Normal rejection is used for CDMA and EVDO service.
- **Frequency information** is available as a reference for setting the center frequency and band width (refer to section 7).

5.6 GUI System Setup

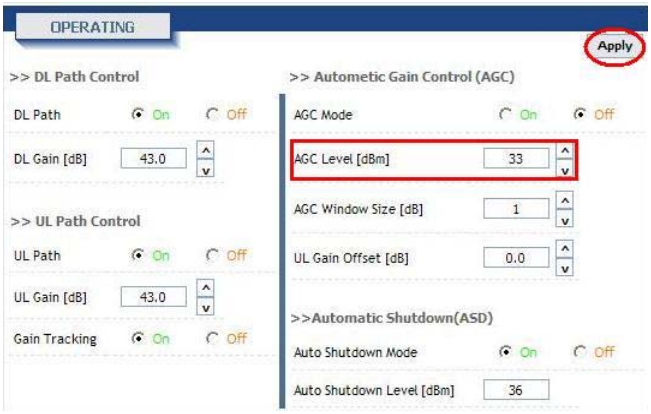
5.6.1 Easy Setup

Step 1: Click Apply after setting Center Frequency and Band Width in use.

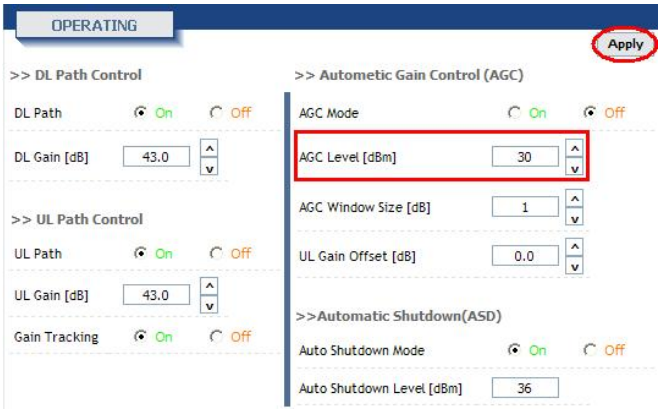


Step 2: Input AGC Level desired and click Apply.

1) AGC Level 33dBm



2) AGC Level 30dBm

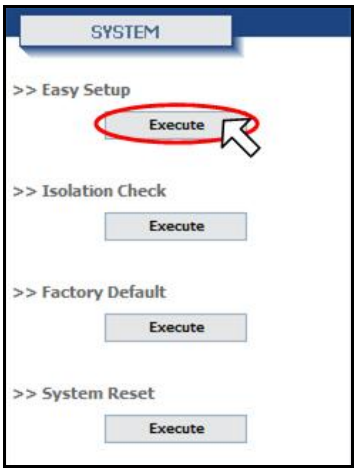


Step 3: Easy Setup proceeds to:

- Data Initial execution
- Isolation Test exeduted
- Calculation of Available Maximum Gain by the isolation
- DL/UL Path On
- AGC On to obtain DL Output Power AGC Level or Maximum Gain 43dB
- ASD On

- AGC Off
- Easy setup takes about 2minutes.

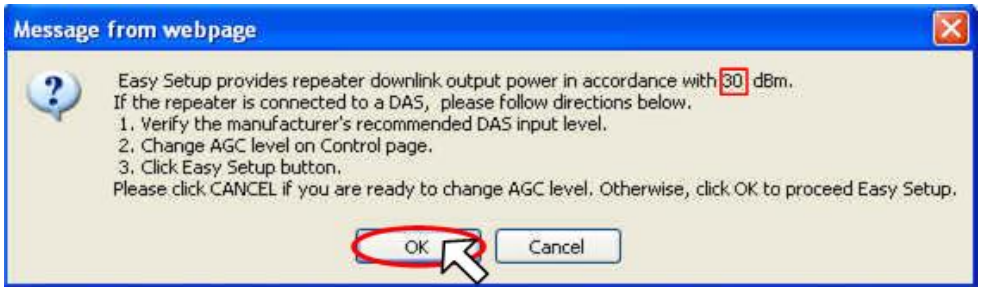
Click Execute button of Easy Setup



Step 4: Click OK.

1) AGC Level 33dBm

2) AGC Level 30dBm



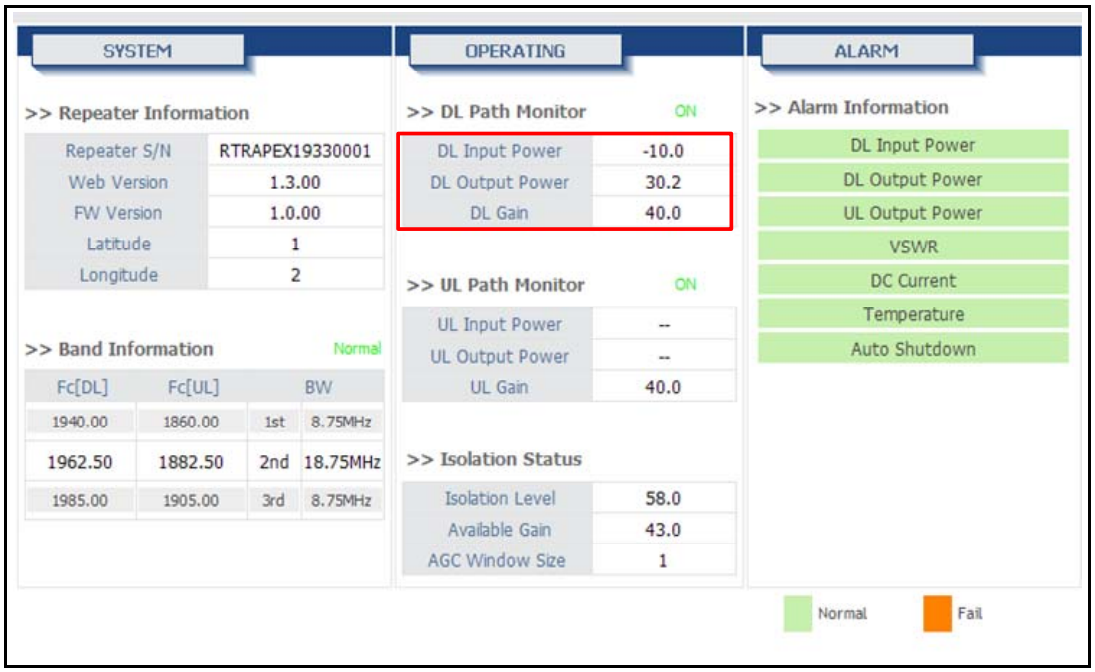
Step 5: Setup will automatically begin. This process takes approximately 3minutes.

Result 1: Constant Maximum DL Output Power 33dBm (AGC Level 33dBm)

If the DL input Power ≥ -10dBm

Result 2: Constant Maximum DL Output Power 30dBm (AGC Level 30dBm)

If the DL input Power ≥ -10dBm



5.6.2 Manual Gain Setting

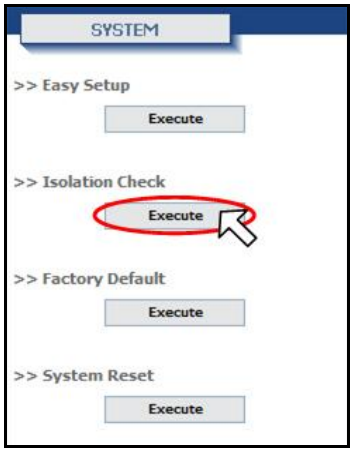
5.6.2.1 AGC mode "On" Setting

Step 1: Repeat Step 1 through Step 2

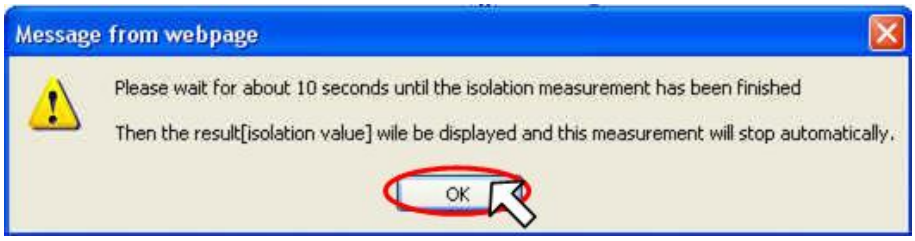
Step 2: Isolation Check

The Isolation will calculate the Available Maximum Gain which defines the maximum gain to be setup.

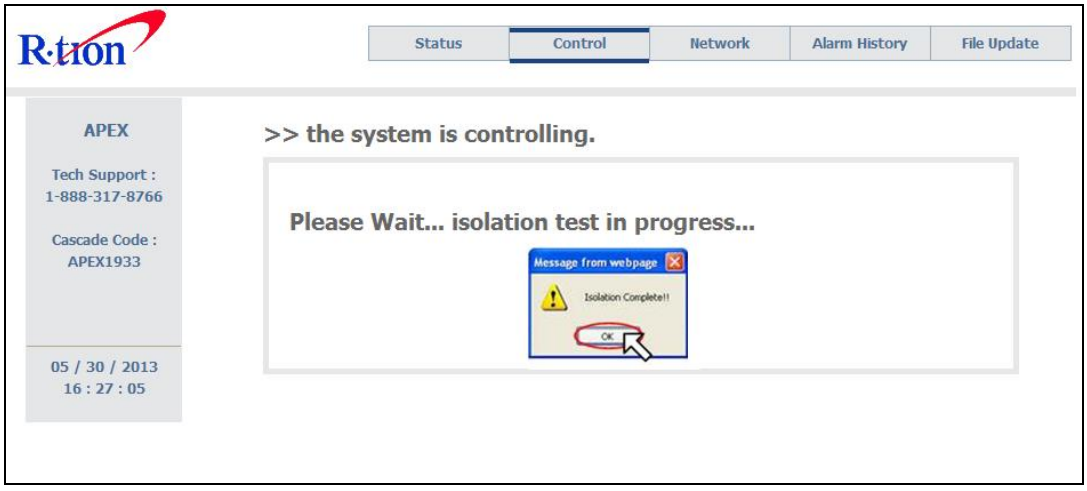
Click Isolation



Step 3: Click OK.



Step 4: When below pop-up appears after Isolation is completed, click OK.

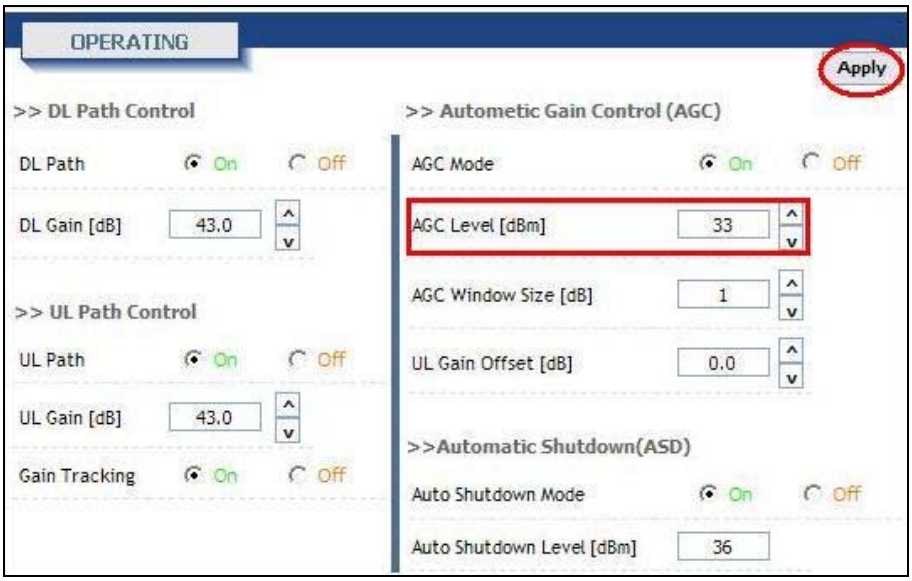


Step 5: AGC must be turned on. AGC automatically assigns gain in accordance with AGC level. Use AGC level to increase or decrease gain.

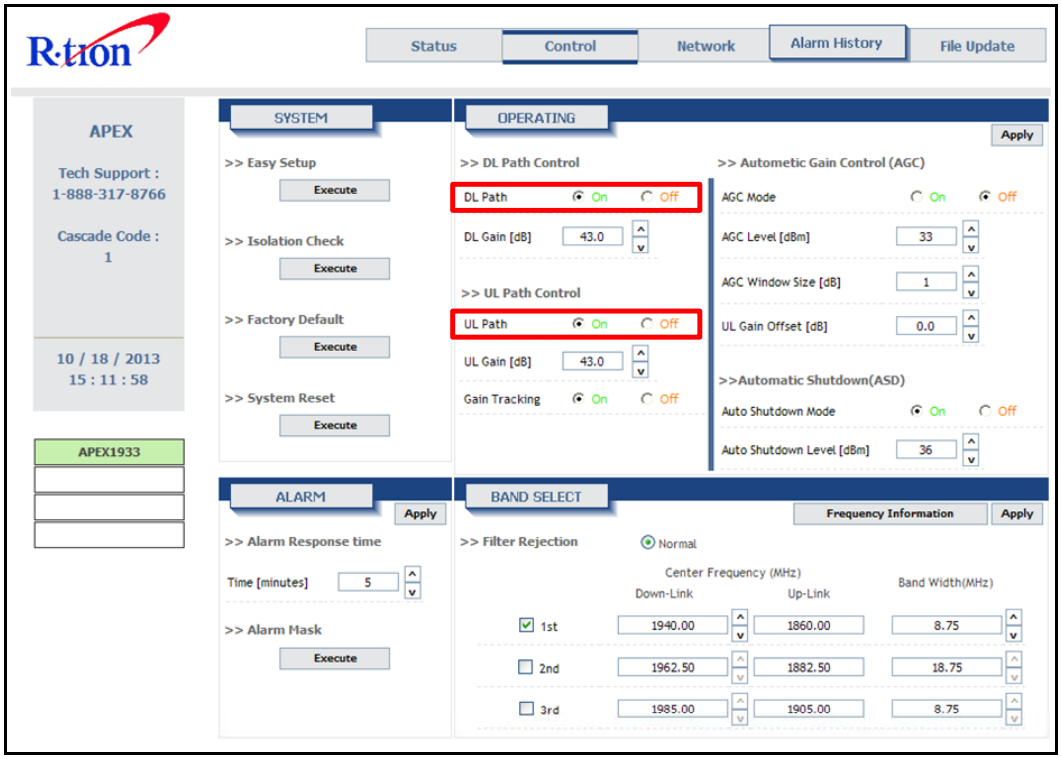
(**Gain Offset** is a gain differential between DL Output gain and UL output gain.)

Ex> **AGC Level 33dBm, Gain Offset -3dB → DL Gain 43dB, UL Gain 40dB**

AGC Level 33dBm, Gain Offset 0dB → DL Gain 43dB, UL Gain 43dB



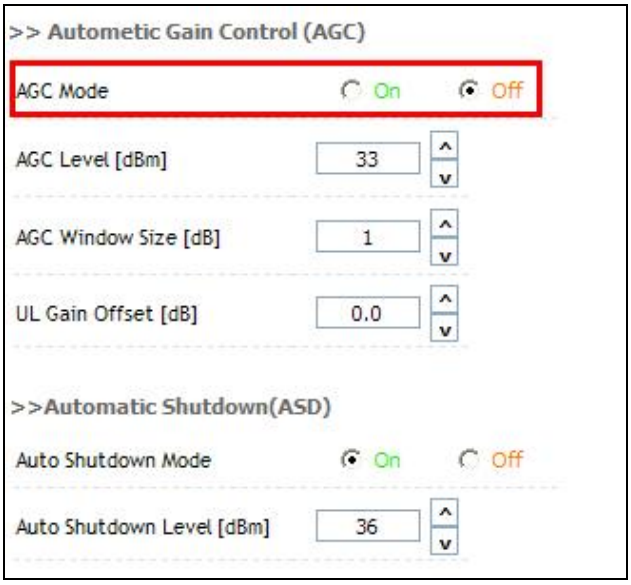
Step 6: Turn on the **DL** and **UL path controls.**



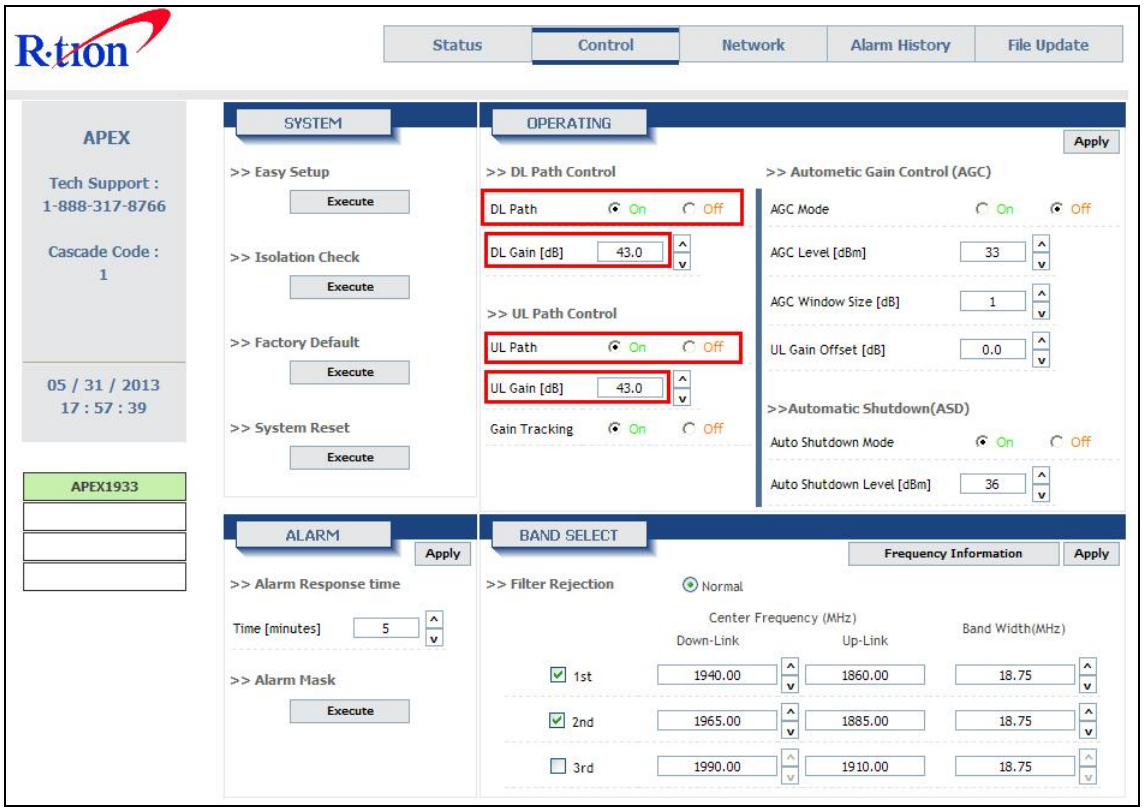
5.6.2.2 AGC mode "Off" setting

When you want to set gain value not using Auto Gain control refer to the following.

Step 1: For manual gain control AGC must be turned off.



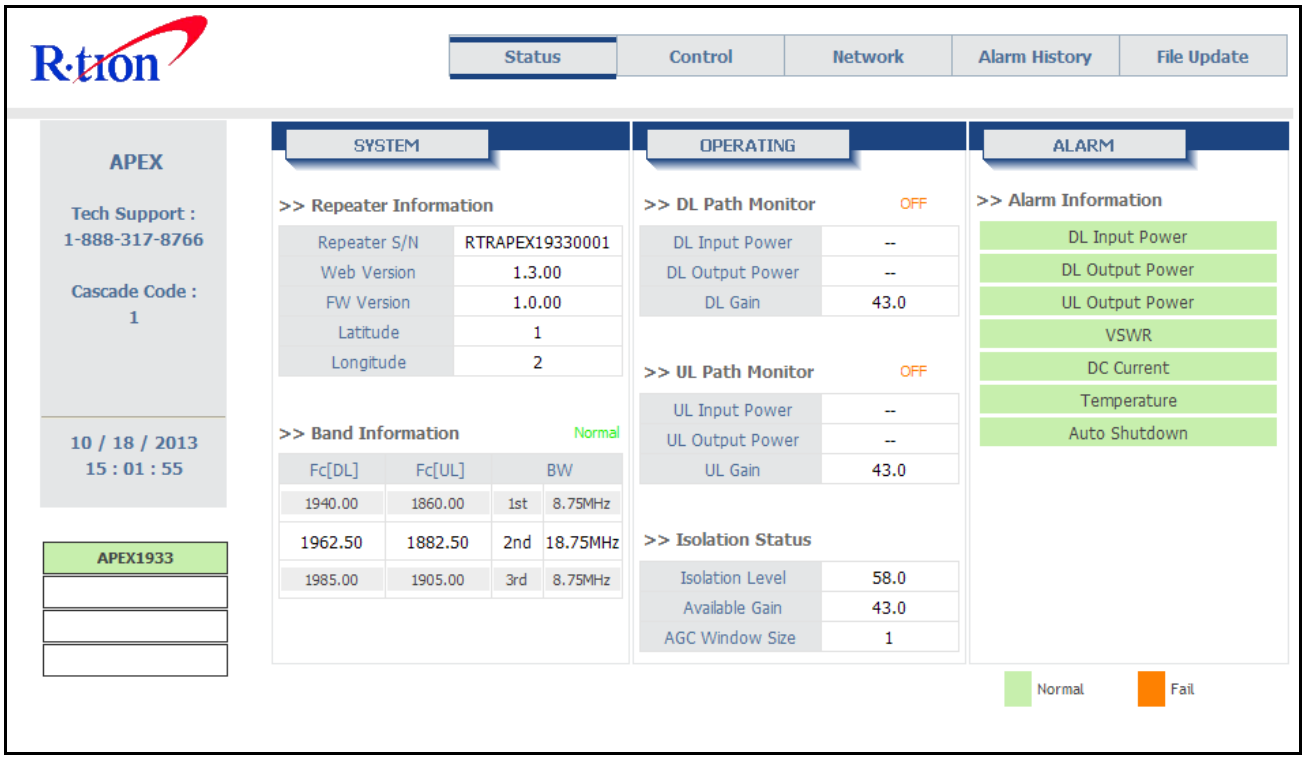
Step 2: The user can select any gain value as long as it does over-drive the amplifier or exceed isolation requirements. Gain is automatically limited where conditions do not permit high gain. Select the **DL** and **UL Gain values.** Turn on the **DL** and **UL path controls.**



5.7 GUI Status

The status page display system, control, and alarm information.

When you set any value on the Control page the change will be reflected on Status page.



<Status>

5.7.1 System

- Firmware version and location are displayed under **Equipment Information.**
- The **current band** setting, set from the control page, is shown in bold font.

5.7.2 Operating

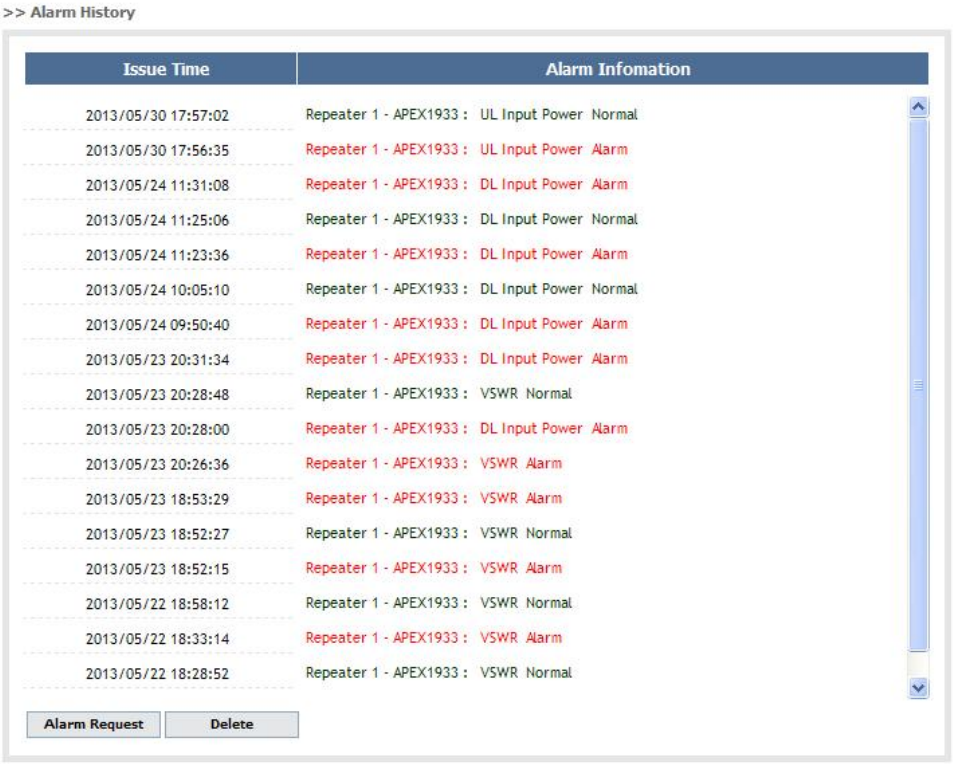
- **DL Path Monitor** displays input from the donor antenna circuit, output power at equipment server antenna port, and downlink amplifier gain.
- **UL Path Monitor** displays input from the server antenna circuit, output power at equipment donor port, and uplink amplifier gain.
- **Isolation Status** shows isolation value (dB) between the donor antenna and server antennas.
- **Available gain** allowed by isolation measurement. Available gain is derived from the antenna isolation value plus 15dB. Full system gain (43dB) is available if the antenna isolation value is at least 58dB.

5.7.3 Alarm

- If an alarm occurs, the alarm LED on the equipment will turn on.

Alarms shown on the status page will have orange (alarm) or green (normal) background.

- Details for alarm events are displayed on the Alarm History page.

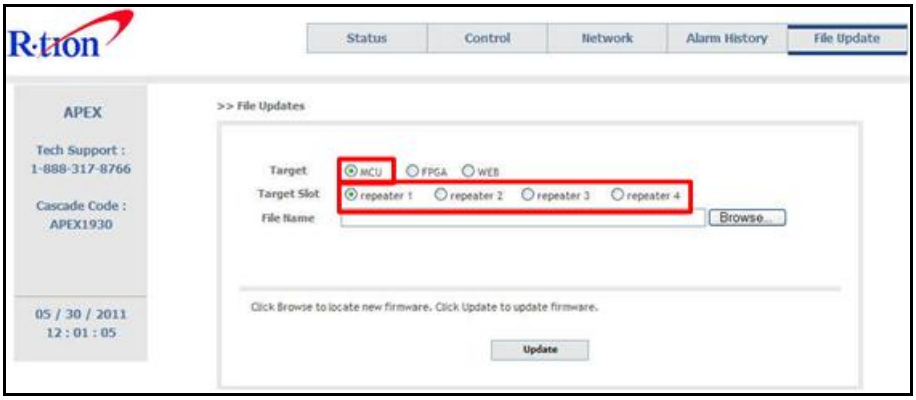


For corrective action please refer to 6. Troubleshooting section.

5.8 File Update

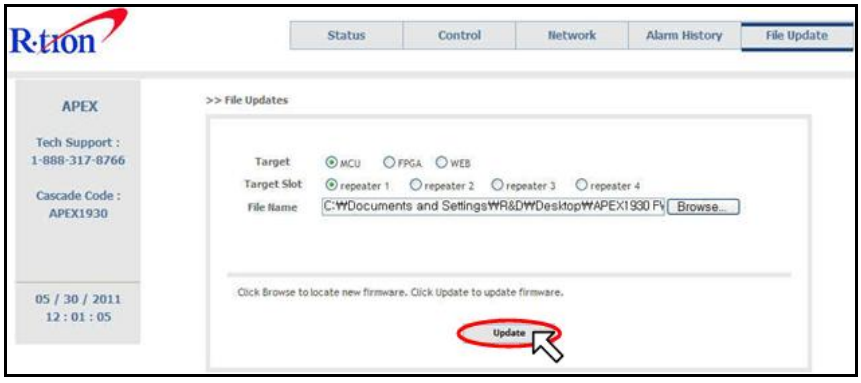
5.8.1 MCU Firmware Download

Step 1. For target, select "MCU". Choose the correct target slot. If you are not sure, follow the LAN cable from the equipment receiving the update to the host equipment. The LAN port number on the host equipment is the slot number for the equipment receiving the update. Use the browse button to locate the update file.

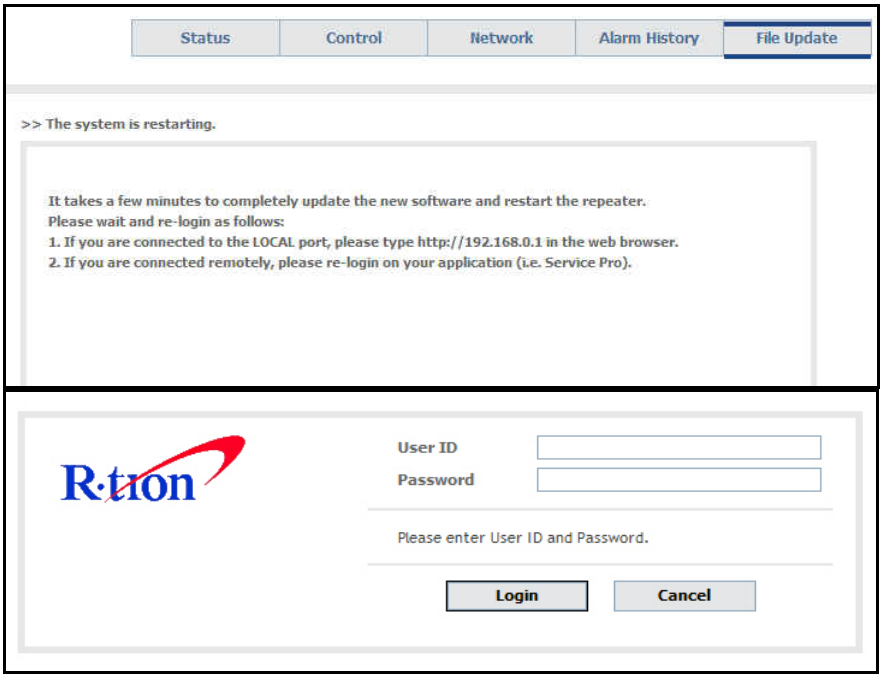


Step 2 MCU firmware file has a ".bin" filename extension. Click Open.

Step 3 Click Update.

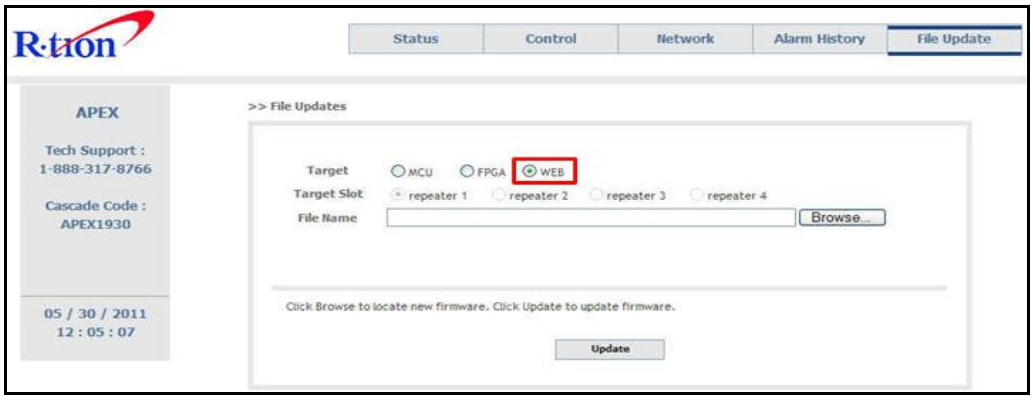


Step 4 When File update message appears and updating completed, go to Log-in page.
Log-in and confirm the firmware version has been updated.

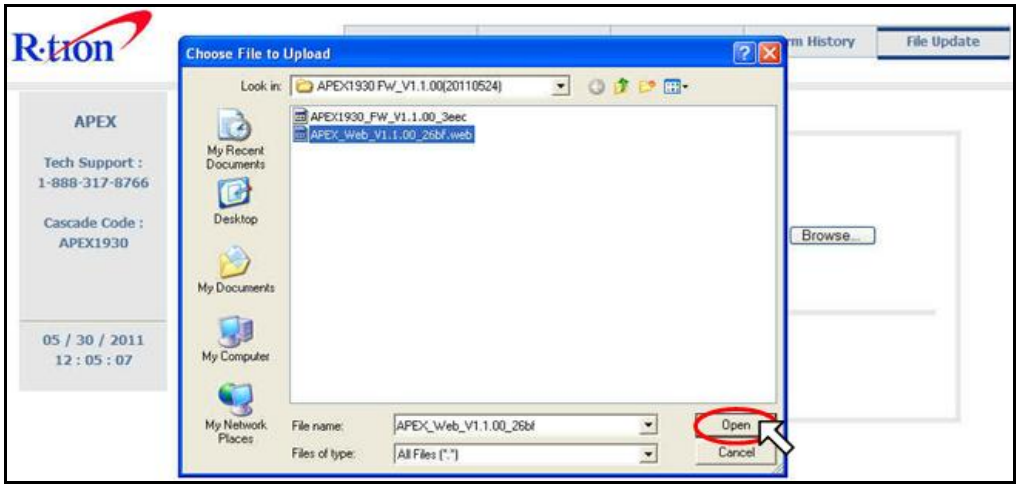


5.8.2 Web GUI Download

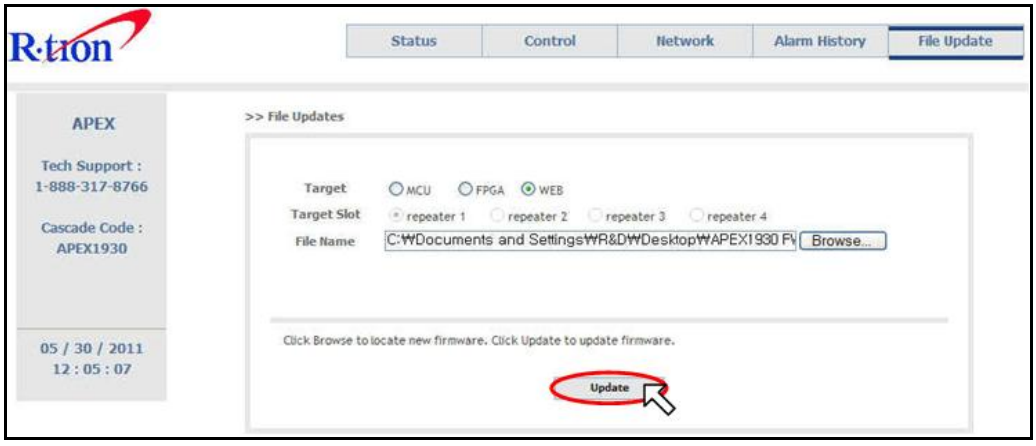
Step 1 Select WEB in File Update page and click Browse.



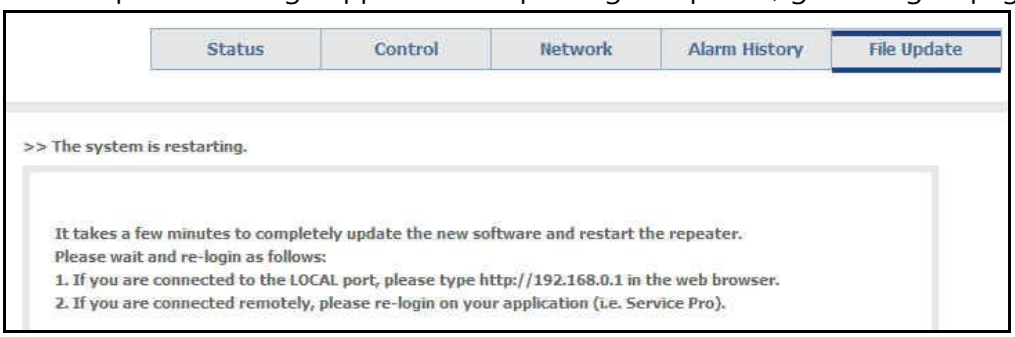
Step 2 Select Firmware file which has ".web" filename extension to download. Click Open.

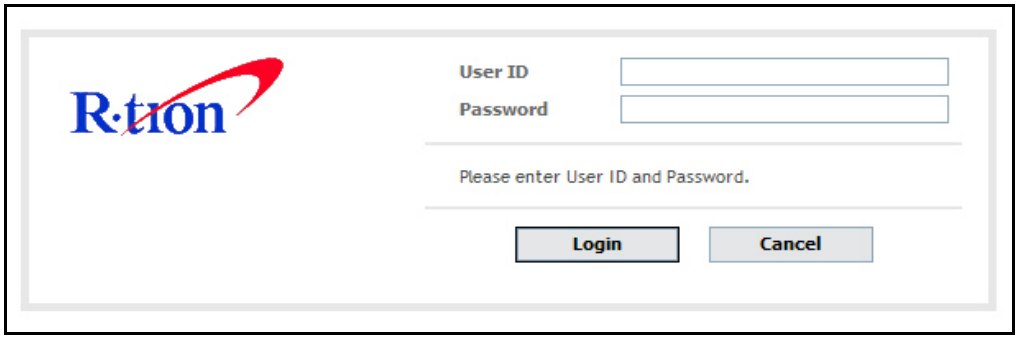


Step 3 Click Update.



Step 4 When File update message appears and updating completed, go to Log-in page.

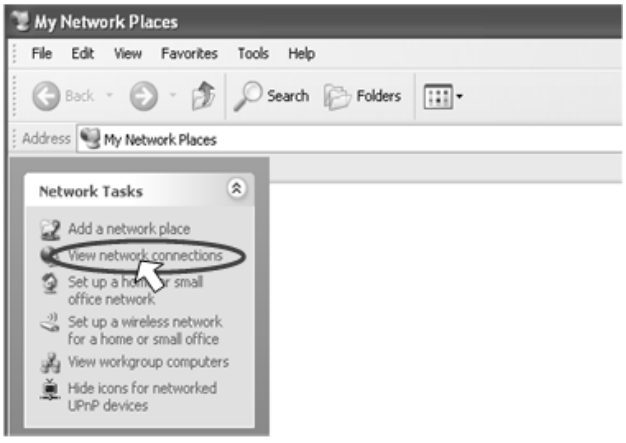


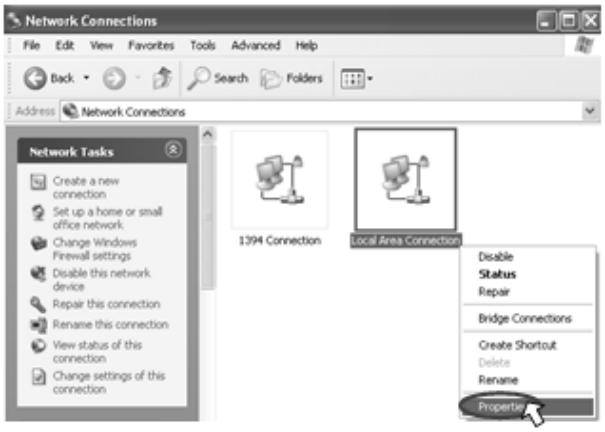


5.9 Attachment

5.9.1 Internet Network Setting

5.9.1.1 Window XP

Step 1: Click the Start button and select My Network places.	Step 2: Click View network connections.
	
Step 3: Right-click on the Local Area Connection and select Properties to view the shortcut menu.	Step 4: Select Internet Protocol (TCP/IP) and click Properties.



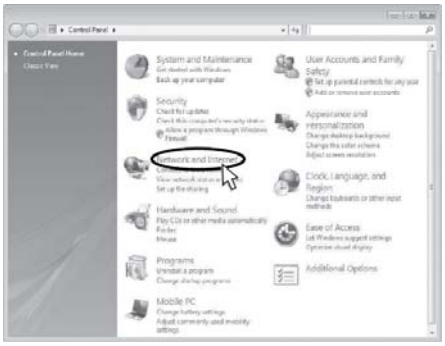
Step 5: Check Obtain an IP address automatically and click OK.

Step 6: Close all widows.

5.9.1.2 Windows Vista

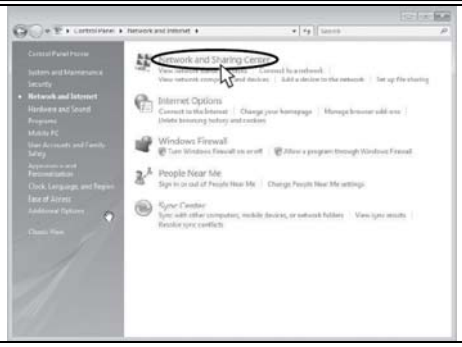
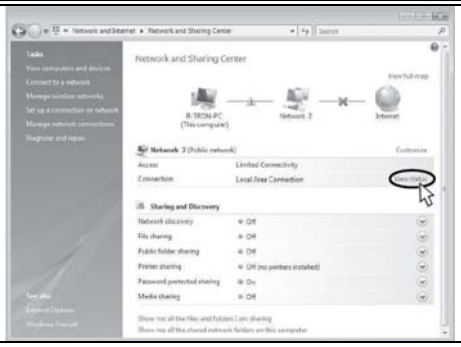
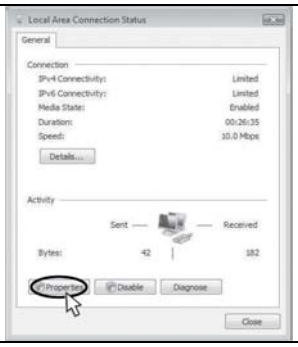
Step 1: Click the Start button and select Control panel.

Step 2: Click Network and Internet



Step 3: Click Network and Sharing Center.

Step 4: Click View status of Local Area Connection.

	
Step 5: Click Properties and a caution pop-up window will appear. Click OK.	Step 6: Select Internet Protocol Version 4 (TCP/IPv4) and click Properties.
	
Step 7: Check Obtain an IP address automatically and Click OK.	Step 8: Close all windows.
	

6. Troubleshooting

Before contacting your service dealer, refer to the following guidelines. If the APEX1933 equipment does not work normally after completing the following troubleshooting, please contact your local dealer or R-tron America's Tech support line (1-888-31R-TRON).

External alarm lamps on the front of the equipment indicate current condition. Green lamp indicates power to the equipment, yellow indicates caution, and red indicates shut sown

6.1 LED Alarm

Problem	Cause	Solution
No LED on	Power failure	Check the power cord for secure connection
Mobile device has poor performance.	Equipment service degraded or not available.	Login to the web GUI. Check the setting, alarm status and input/output power status.
Gain, Input/ Output power or DC Current are changing randomly or appear to be unstable.	Oscillation	Most common cause for unstable gain and power is feedback oscillation brought on by insufficient antenna isolation. 1. Reduce equipment gain and/or AGC level. 2. Improve the field conditions that cause poor antenna isolation.
The red light is on.	Automatic Shutdown	Automatic shutdown occurs when the amplifier is over driven. The amplifier is most commonly overdriven by: 1. Oscillation due to poor antenna isolation. 2. High input power combined with high gain settings including high UL input from the mobile device. User the alarm history page to determine the cause of the shutdown. Eliminate the root cause of the shutdown and restart the equipment. Technical Support Web site: www.r-tronamerica.com Toll Free: 888-317-8766

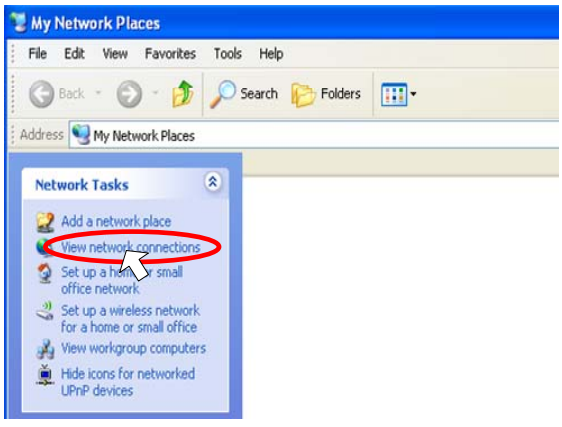
6.2 GUI Alarm

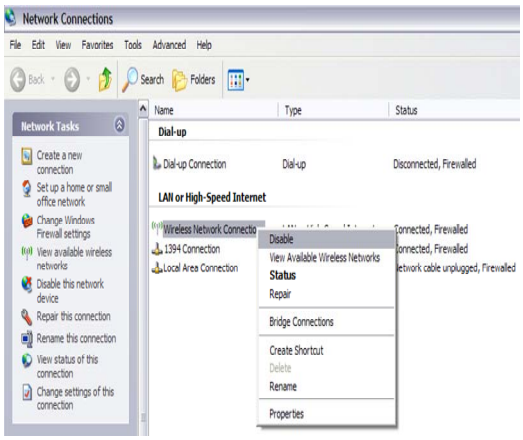
Problem	Check Point	Solution
General	DC Current	If the same alarm occurs after reset Power, request technical support.
	Temperature	Execute of System Reset (NCU) on Network Setup page. If the same alarm occurs request technical support.
	ASD	Check Isolation and DL/UL Input power..
	Heartbeat	Check the connection of the Remote NMS Cable. Check the interval of Heartbeat on the WEB GUI
Downlink	DL Input Power	DL Input alarm can be the result of low signal level from the donor antenna circuit. Tune Femto output level and/or reduce line loss.
	DL Output Power	Check DL input Power. If input power exceeds max input power install an attenuator on the donor antenna feed line.
	DL Return Loss	Return loss alarm is the result of o poorly matched antenna circuit. The equipment is almost never the reason for return loss issues. A good quality 50 ohm load placed over the equipment server port or donor port will extinguish the alarm and prove the alarm is caused by some external antenna issue.
Uplink	UL Output Power	If the UL Input Power is too high, suspect excessive mobile TX power. Determine root cause of high mobile TX power.

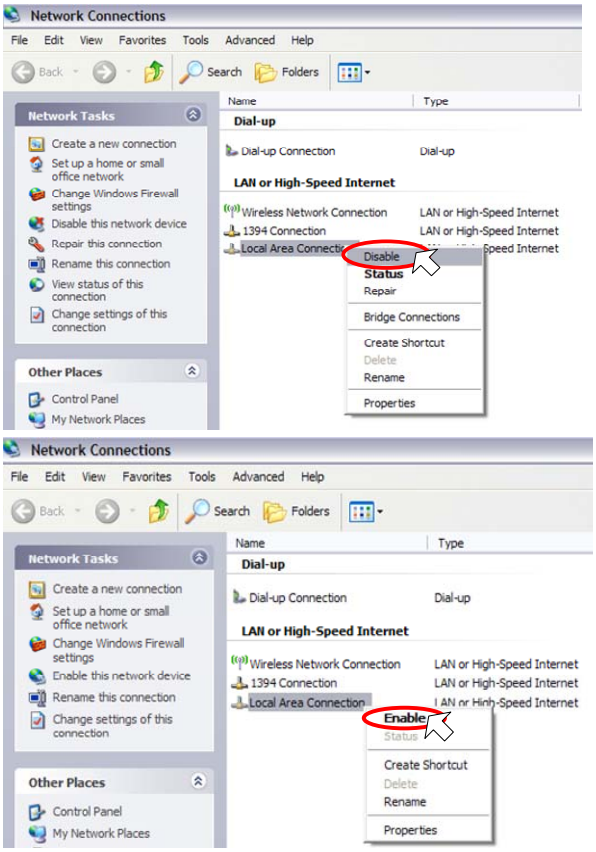
6.3 Communication Alarm

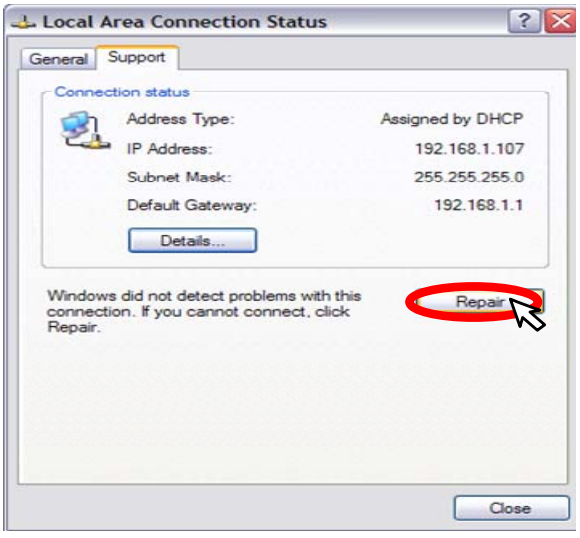
When you cannot login to the web GUI.

Solution
1. Click **My Network places → View network connections.** Right-click on the **Wireless Network Connection** and then click **Disable.**
2. Right-click on the **Local Area Connection** and then click **Disable.** After clicking **Disable,** click **Enable** again.
3. Double click the **Local Area Connection** and then click the **Support** tab → **Repair.**





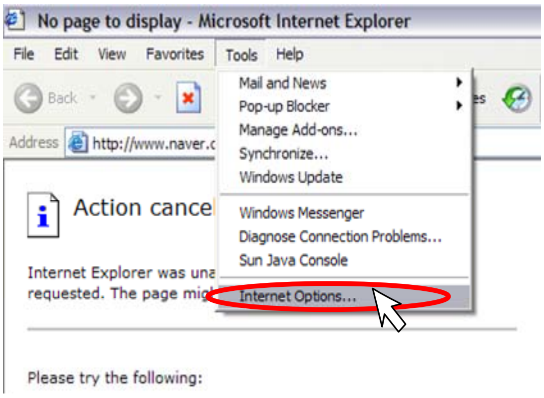


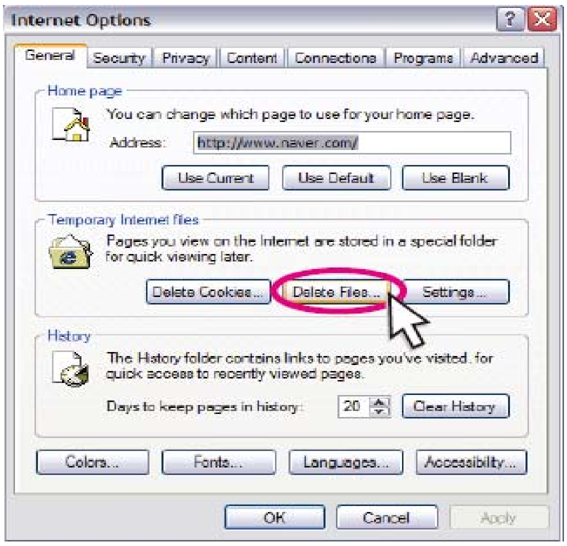


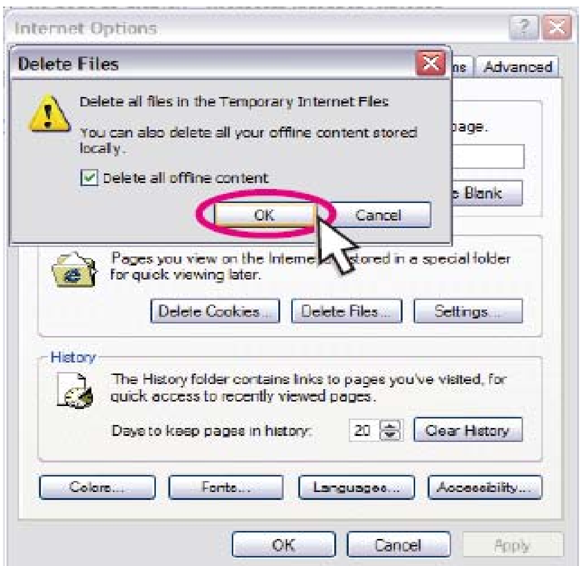
Solution

4. Open the Internet Browser, select **Tools → Internet Options.**

Click **Delete Files** in the Temporary Internet files section.

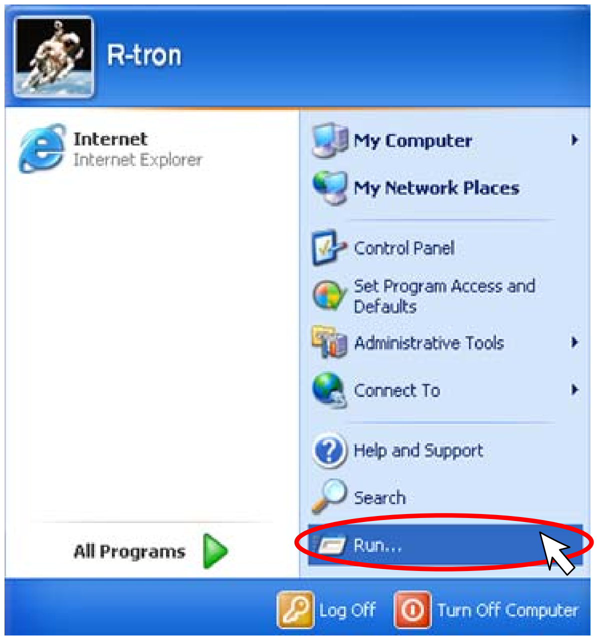


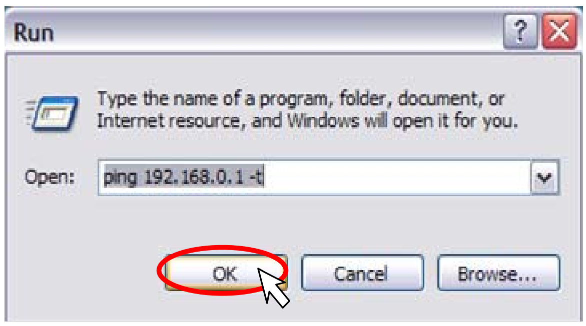


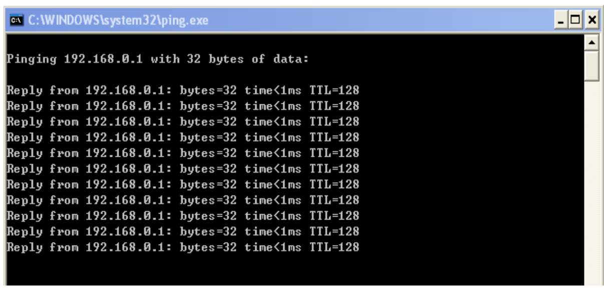


5. Click **Start** and select **Run.**

Type "ping 192.168.0.1-t" and click **OK.**







7. Specifications

7.1 RF Characteristics

Electrical Specifications			
Parameter		**TX (Down-Link)**	**RX (Up-Link)**
Frequency Range		1930 - 1995 MHz	1850 - 1915 MHz
Service		CDMA2000 or LTE(FDD) Service	
Channel Select		Center frequency + BW (1M - 20MHz) Non-continuous 3 channel	
Nomal Input Power Range		-10 ~ +15 dBm	-68 ~ -40 dBm
Composite Output Power Range		0 ~ 33 dBm	~ -25 dBm
Gain Range		15 ~ 43 dB	15 ~ 43 dB
AGC	Range	28 dB	
	Time	the AGC must track only slow variations with time on the order of 100ms.	
Gain Ripple		± 1.0 dB	
Noise Figure	Max Gain	–	5 dB (max)
	Min Gain	–	12 dB (max)
Roll-off		> 50dBc at ± 1 MHz from band edge	
		> 50dBc at ± 2 MHz from band edge	
Propagation Delay		8 μs (max)	
IMD		≤ -13dBm	–
Frequency stability		< 0.02 ppm	< 0.02 ppm
Spurious Emission	885kHz	885kHz : -45dBc / 30kHz	–
	1.25MHz	1.25MHz : -45dBc / 30kHz	–
	1.98MHz	1.98MHz : -50dBc / 30kHz	–
	2.25MHz	2.25MHz : -13dBm / 1MHz	–
	4MHz	4MHz : -13dBm / 1MHz	–
VSWR		1.5 : 1 (max)	
Impedance		50Ω	

7.2 Environmental Specification

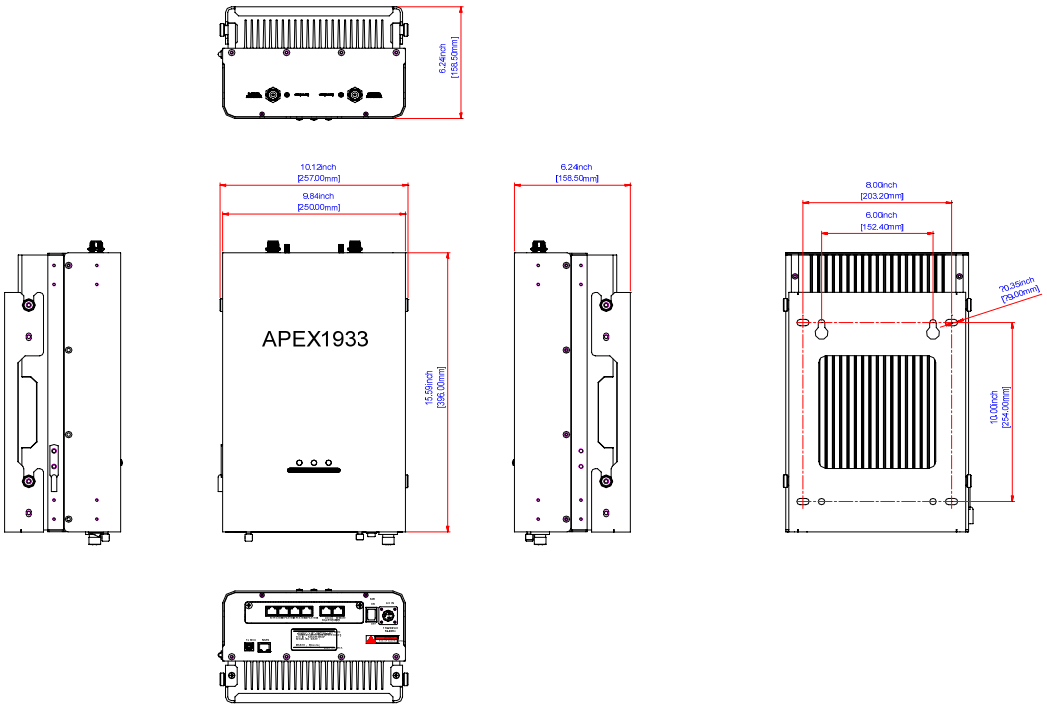
Parameter		Specification
Environmental	Operating Temp	-10˚C~50˚C (14˚F~122˚F)
	Humidity	5% ~ 95%RH
	Cooling method	Convection.

7.3 Electrical Specification

Parameter	Specification
Voltage	AC 85-264V
Current	+24V/6.5A (150W)
Frequency	50/60(47-63)Hz

7.4 Mechanical Specification

Parameter	Specifications	Remark
RF connectors	N-female x 2	
Dimensions (WxHxD)	9.35 * 16.8 * 5.67 Inch 242 * 426 * 144 mm	W * D * H
Weight	44.09 lb 20 Kg max	



8. Appendix

8.1 US PCS Channel

USPCS			Down Link				Up Link			
No	Block	Channel	Center	Start	Stop	BW	Center	Start	Stop	BW
1	A1	25	1931.250	1930.625	1931.875	1.25	1851.250	1850.625	1851.875	1.25
2		50	1932.500	1931.875	1933.125	1.25	1852.500	1851.875	1853.125	1.25
3		75	1933.750	1933.125	1934.375	1.25	1853.750	1853.125	1854.375	1.25
4		100	1935.000	1934.375	1935.625	1.25	1855.000	1854.375	1855.625	1.25
5	A2	125	1936.250	1935.625	1936.875	1.25	1856.250	1855.625	1856.875	1.25
6		150	1937.500	1936.875	1938.125	1.25	1857.500	1856.875	1858.125	1.25
7		175	1938.750	1938.125	1939.375	1.25	1858.750	1858.125	1859.375	1.25
8		200	1940.000	1939.375	1940.625	1.25	1860.000	1859.375	1860.625	1.25
9	A3	225	1941.250	1940.625	1941.875	1.25	1861.250	1860.625	1861.875	1.25
10		250	1942.500	1941.875	1943.125	1.25	1862.500	1861.875	1863.125	1.25
11		275	1943.750	1943.125	1944.375	1.25	1863.750	1863.125	1864.375	1.25
12		300	1945.000	1944.375	1945.625	1.25	1865.000	1864.375	1865.625	1.25
13	D	325	1946.250	1945.625	1946.875	1.25	1866.250	1865.625	1866.875	1.25
14		350	1947.500	1946.875	1948.125	1.25	1867.500	1866.875	1868.125	1.25
15		375	1948.750	1948.125	1949.375	1.25	1868.750	1868.125	1869.375	1.25
16		400	1950.000	1949.375	1950.625	1.25	1870.000	1869.375	1870.625	1.25
17	B1	425	1951.250	1950.625	1951.875	1.25	1871.250	1870.625	1871.875	1.25
18		450	1952.500	1951.875	1953.125	1.25	1872.500	1871.875	1873.125	1.25
19		475	1953.750	1953.125	1954.375	1.25	1873.750	1873.125	1874.375	1.25
20		500	1955.000	1954.375	1955.625	1.25	1875.000	1874.375	1875.625	1.25
21	B2	525	1956.250	1955.625	1956.875	1.25	1876.250	1875.625	1876.875	1.25
22		550	1957.500	1956.875	1958.125	1.25	1877.500	1876.875	1878.125	1.25
23		575	1958.750	1958.125	1959.375	1.25	1878.750	1878.125	1879.375	1.25
24		600	1960.000	1959.375	1960.625	1.25	1880.000	1879.375	1880.625	1.25
25	B3	625	1961.250	1960.625	1961.875	1.25	1881.250	1880.625	1881.875	1.25
26		650	1962.500	1961.875	1963.125	1.25	1882.500	1881.875	1883.125	1.25
27		675	1963.750	1963.125	1964.375	1.25	1883.750	1883.125	1884.375	1.25
28		700	1965.000	1964.375	1965.625	1.25	1885.000	1884.375	1885.625	1.25
29	E	725	1966.250	1965.625	1966.875	1.25	1948.313	1885.625	1886.875	1.25
30		750	1967.500	1966.875	1968.125	1.25	1948.375	1886.875	1888.125	1.25
31		775	1968.750	1968.125	1969.375	1.25	1948.438	1888.125	1889.375	1.25
32		800	1970.000	1969.375	1970.625	1.25	1890.000	1889.375	1890.625	1.25
33	F	825	1971.250	1970.625	1971.875	1.25	1891.250	1890.625	1891.875	1.25
34		850	1972.500	1971.875	1973.125	1.25	1892.500	1891.875	1893.125	1.25
35		875	1973.750	1973.125	1974.375	1.25	1893.750	1893.125	1894.375	1.25
36		900	1975.000	1974.375	1975.625	1.25	1895.000	1894.375	1895.625	1.25
37	C3	925	1976.250	1975.625	1976.875	1.25	1896.250	1895.625	1896.875	1.25
38		950	1977.500	1976.875	1978.125	1.25	1897.500	1896.875	1898.125	1.25
39		975	1978.750	1978.125	1979.375	1.25	1898.750	1898.125	1899.375	1.25
40		1000	1980.000	1979.375	1980.625	1.25	1900.000	1899.375	1900.625	1.25
41	C4	1025	1981.250	1980.625	1981.875	1.25	1901.250	1900.625	1901.875	1.25
42		1050	1982.500	1981.875	1983.125	1.25	1902.500	1901.875	1903.125	1.25
43		1075	1983.750	1983.125	1984.375	1.25	1903.750	1903.125	1904.375	1.25
44		1100	1985.000	1984.375	1985.625	1.25	1905.000	1904.375	1905.625	1.25
45	C5	1125	1986.250	1985.625	1986.875	1.25	1906.250	1905.625	1906.875	1.25
46		1150	1987.500	1986.875	1988.125	1.25	1907.500	1906.875	1908.125	1.25
47		1175	1988.750	1988.125	1989.375	1.25	1908.750	1908.125	1909.375	1.25
48		1200	1990.000	1989.375	1990.625	1.25	1910.000	1909.375	1910.625	1.25
49	G	1225	1991.250	1990.625	1991.875	1.25	1911.250	1910.625	1911.875	1.25
50		1250	1992.500	1991.875	1993.125	1.25	1912.500	1911.875	1913.125	1.25
51		1275	1993.750	1993.125	1994.375	1.25	1913.750	1913.125	1914.375	1.25
52		1300	1995.000	1994.375	1995.625	1.25	1915.000	1914.375	1915.625	1.25

8.2 Warranty

LIMITED WARRANTY

This product, as supplied and distributed by R-tron, in the original carton, is warranted by R-tron against manufacturing defects in materials and workmanship for a limited warranty period of:

Five (5) Year Parts and Labor

This limited warranty begins on the original date of purchase, and is valid only on products purchased and used in the United States. R-tron will repair or replace this product, at our option and at no charge as stipulated herein, with new or reconditioned parts or products if found to be defective during the limited warranty period specified above. All replaced parts and products become the property of R-tron and must be returned to R-tron. Replacement parts and products assume the remaining original warranty.
This limited warranty covers manufacturing defects in materials and workmanship encountered in normal, and except to the extent otherwise expressly provided for in this statement, use of this product, and shall not apply to the following, including, but not limited to: damage which occurs in installation; applications and uses for which this product was not intended; altered product or serial numbers; cosmetic damage or exterior finish; accidents, abuse, neglect, fire, water, lightning or other acts of nature; use of products, equipment, systems, utilities, services, parts, supplies, accessories, applications, installations, repairs, external wiring or connectors not supplied or authorized by R-tron which damage this product or result in service problems; or incorrect electrical line voltage, fluctuations and surges; customer adjustments and failure to follow operating instruction. R-tron does not warrant uninterrupted or error-free operation of the product.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE LISTED AND DESCRIBED ABOVE, AND NO WARRANTIES WHETHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL APPLY AFTER THE EXPRESS WARRANTY PERIODS STATED ABOVE, AND NO OTHER EXPRESS WARRANTY OR GUARANTY GIVEN BY ANY PERSON, FIRM OR CORPORATION WITH RESPECT TO THIS PRODUCT SHALL BE BINDING ON R-tron.

8.3 Return Material Authorization (RMA) Procedure

The return and exchange of products are not allowed without prior approval from R-tron America, Inc. Please follow the exchange procedure below.

1. Call Tech Support for troubleshooting.
2. If the device has hardware problem, R-tron will replace it if it is within warranty.
   A RMA number will be issued for the return.
3. R-tron will ship the replacement unit with a return shipping label.
4. The customer must return the product using the original packaging, including all accessories and/or parts.