

# **APEX8930**

# **SMR Band Repeater**

## **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.

# TABLE OF CONTENTS

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1. GENERAL</b>                                            | <b>1</b>  |
| 1.1 NOTICE                                                   | 1         |
| 1.2 SAFETY PRECAUTIONS                                       | 2         |
| 1.3 VERSION HISTORY                                          | 3         |
| 1.3.1 Manual Version History List                            | 3         |
| 1.3.2 Firmware Version History List                          | 3         |
| 1.3.3 WEB GUI Version History List                           | 3         |
| 1.4 GLOSSARY                                                 | 4         |
| <b>2. INTRODUCTION</b>                                       | <b>5</b>  |
| 2.1 APEX8930                                                 | 5         |
| 2.2 APEX8930 KEY FEATURES                                    | 6         |
| 2.3 COMPONENTS                                               | 7         |
| 2.3.1 APEX8930                                               | 7         |
| 2.4 DESCRIPTION                                              | 8         |
| 2.4.1 Overview                                               | 8         |
| 2.4.2 INTERNAL CONFIGURATION                                 | 9         |
| 2.4.3 RFU (RF Unit)                                          | 9         |
| 2.4.4 Multiplexer                                            | 9         |
| 2.4.5 PSU (Power Supply Unit)                                | 9         |
| 2.4.6 NCU (Network Control Unit)                             | 9         |
| <b>3. MECHANICAL INSTALLATION</b>                            | <b>10</b> |
| 3.1 MOUNTING                                                 | 10        |
| <b>4. CABLE INSTALLATION</b>                                 | <b>12</b> |
| 4.1 CABLE CONNECTION                                         | 12        |
| 4.2 POWER ON                                                 | 12        |
| 4.3 GROUNDING                                                | 13        |
| <b>5. GUI OPERATION</b>                                      | <b>14</b> |
| 5.1 GUI OPERATION FLOW CHART                                 | 14        |
| 5.2 INTERNET NETWORK SETUP                                   | 15        |
| 5.2.1 Windows 7 (Refer to 5.9 for other versions of Windows) | 15        |
| 5.3 SYSTEM LOGIN                                             | 16        |
| 5.4 SYSTEM SETUP                                             | 17        |
| 5.4.1 Time Setting                                           | 17        |
| 5.4.2 Network Setup                                          | 17        |
| 5.4.3 User Note                                              | 19        |

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|           |                                                     |           |
|-----------|-----------------------------------------------------|-----------|
| 5.4.4     | User Comment .....                                  | 20        |
| 5.5       | GUI SYSTEM CONTROL .....                            | 20        |
| 5.5.1     | SYSTEM CONTROL .....                                | 21        |
| 5.5.2     | Operating Control .....                             | 21        |
| 5.5.3     | Alarm Control .....                                 | 22        |
| 5.5.4     | Band Select .....                                   | 23        |
| 5.6       | GUI SYSTEM SETUP .....                              | 23        |
| 5.6.1     | Easy Setup .....                                    | 23        |
| 5.6.2     | MANUAL GAIN SETTING .....                           | 26        |
| 5.7       | GUI STATUS .....                                    | 30        |
| 5.7.1     | System .....                                        | 30        |
| 5.7.2     | Operating .....                                     | 30        |
| 5.7.3     | Alarm .....                                         | 31        |
| 5.8       | FILE UPDATE .....                                   | 31        |
| 5.8.1     | MCU Firmware Download .....                         | 31        |
| 5.8.2     | Web GUI Download .....                              | 32        |
| 5.9       | ATTACHMENT .....                                    | 35        |
| 5.9.1     | Internet Network Setting .....                      | 35        |
| <b>6.</b> | <b>TROUBLESHOOTING .....</b>                        | <b>37</b> |
| 6.1       | LED ALARM .....                                     | 37        |
| 6.2       | GUI ALARM .....                                     | 37        |
| 6.3       | COMMUNICATION LOG-IN PROBLEM .....                  | 39        |
| <b>7.</b> | <b>SPECIFICATIONS .....</b>                         | <b>41</b> |
| 7.1       | RF CHARACTERISTICS .....                            | 41        |
| 7.2       | ENVIRONMENTAL SPECIFICATION .....                   | 42        |
| 7.3       | ELECTRICAL SPECIFICATION .....                      | 42        |
| 7.4       | MECHANICAL SPECIFICATION .....                      | 42        |
| <b>8.</b> | <b>APPENDIX .....</b>                               | <b>43</b> |
| 8.1       | IDEN CHANNEL .....                                  | 43        |
| 8.2       | WARRANTY .....                                      | 44        |
| 8.3       | RETURN MATERIAL AUTHORIZATION (RMA) PROCEDURE ..... | 45        |

# **1. General**

## **1.1 Notice**

### **Trademark**

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### **Notice**

This document describes the specifications, installation, and operation of the APEX8930 repeater.

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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Phone: +1-913-344-9977, 1-888-317-8766

Fax: +1-913-344-9988

e-mail: [info@r-tronamerica.com](mailto:info@r-tronamerica.com)

Website: [www.rtronamerica.com](http://www.rtronamerica.com)

## 1.2 Safety Precautions

### Warning

Opening the APEX8930 equipment could result in electric shock and may cause severe injury.

### Warning

Connect the equipment frame ground to the building ground.

### Warning

Operating the APEX8930 with antennas in very close proximity facing each other can lead to severe damage to the repeater.

### Caution

#### RF EXPOSURE INFORMATION

A minimum separation distance of 7.9 inches (20cm) must be maintained between the user and the external antenna of the repeater to satisfy FCC RF exposure requirements. For more information about RF exposure, please visit the FCC website at [www.fcc.gov](http://www.fcc.gov)

### Caution

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

## 1.3 Version History

### 1.3.1 Manual Version History List

| Revision History |            | Date | Item/Description | Reason |
|------------------|------------|------|------------------|--------|
| Approval Ver.    | Issue Ver. |      |                  |        |
| V1.0             | V1.0       |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |

### 1.3.2 Firmware Version History List

| Revision History |            | Date | Item/Description | Reason |
|------------------|------------|------|------------------|--------|
| Approval Ver.    | Issue Ver. |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |

### 1.3.3 WEB GUI Version History List

| Revision History |            | Date | Item/Description | Reason |
|------------------|------------|------|------------------|--------|
| Approval Ver.    | Issue Ver. |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |
|                  |            |      |                  |        |

## 1.4 Glossary

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

| Abbreviation | Definition                  |
|--------------|-----------------------------|
| AC           | Alternating Current         |
| DC           | Direct Current              |
| DL           | Downlink                    |
| GUI          | Graphic User Interface      |
| LED          | Light Emitting Diode        |
| MCU          | Main Control Unit           |
| NCU          | Network Control Unit        |
| PSU          | Power Supply Unit           |
| RF           | Radio Frequency             |
| UL           | Uplink                      |
| VSWR         | Voltage Standing Wave Ratio |

### **AGC (Automatic Gain Control)**

AGC prevents the repeater 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**.

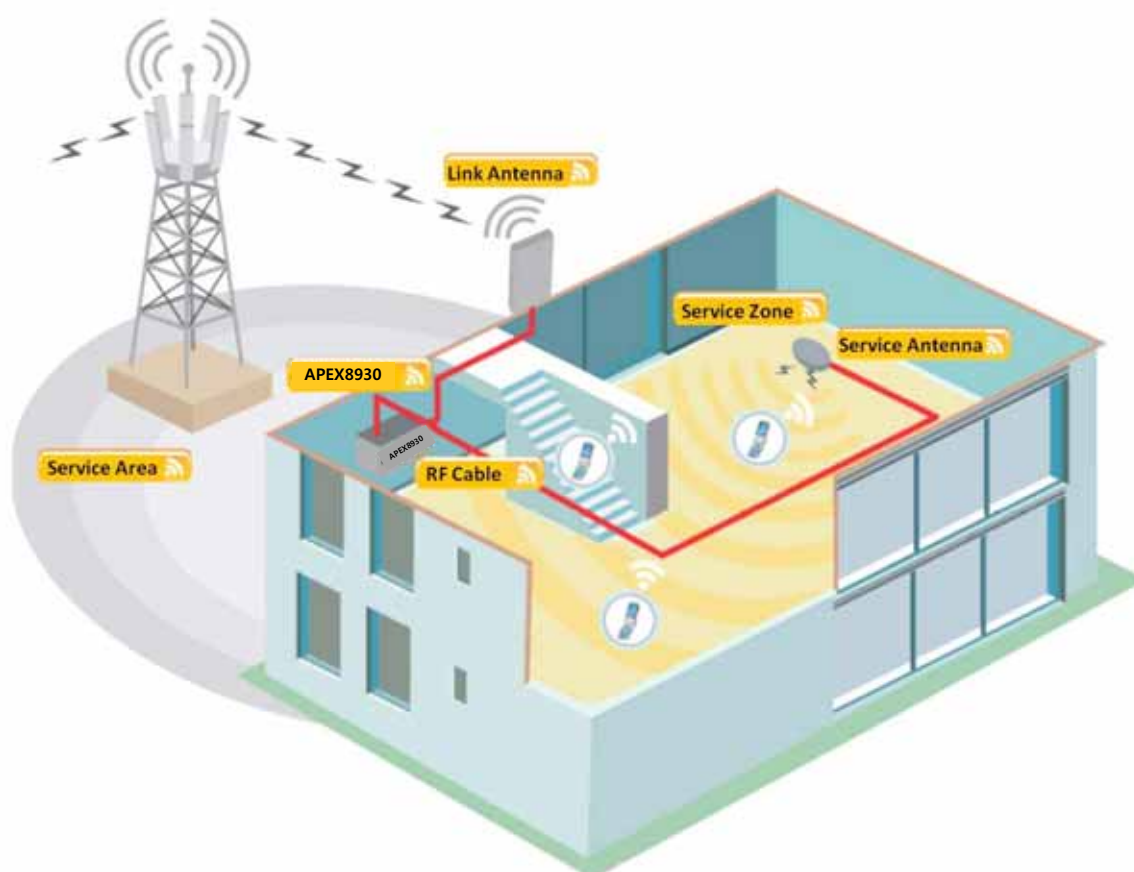
If the output power exceeds higher than the “**ASD LEVEL**”, the repeater will shut down for “**ASD TIME**” seconds. If shutdown repeats “Iteration” times, the repeater will require manual re-start.

## 2. Introduction

### 2.1 APEX8930

APEX8930 is used to fill out areas that may have poor cellular coverage, such as base station fringe areas, business and industrial building, etc.

APEX8930 receives signals from a base station, 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 >

## 2.2 APEX8930 Key Features

### ◆ Design

- Multiple APEX repeaters may be stacked together to created quad band service with a single control interface.
- Digital filtering allows for customized channel selections.
- Digital filtering features 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 connection status and event alarms as a function of SNMP.

### ◆ Protection function

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

## 2.3 Components

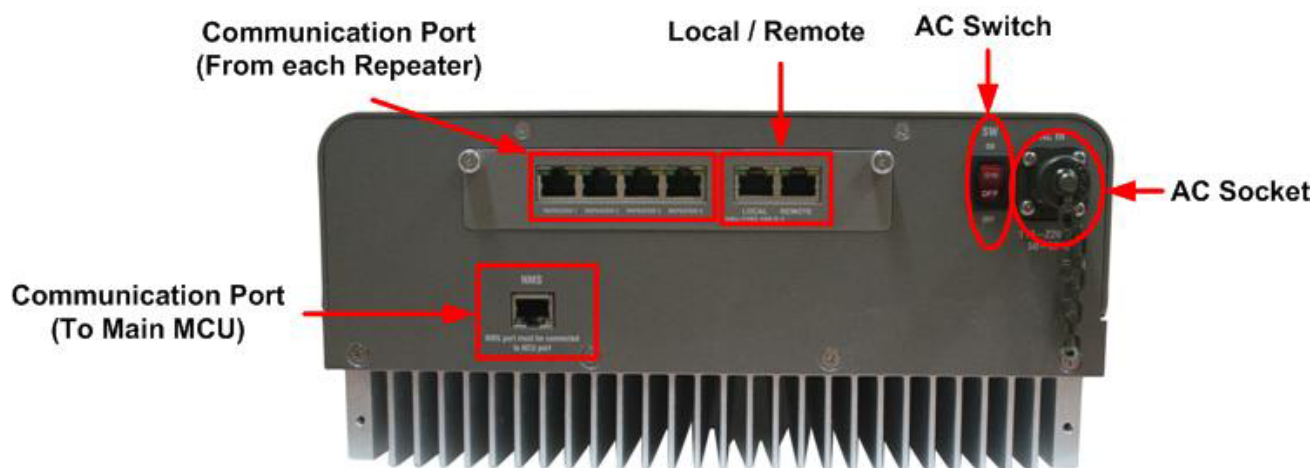
### 2.3.1 APEX8930



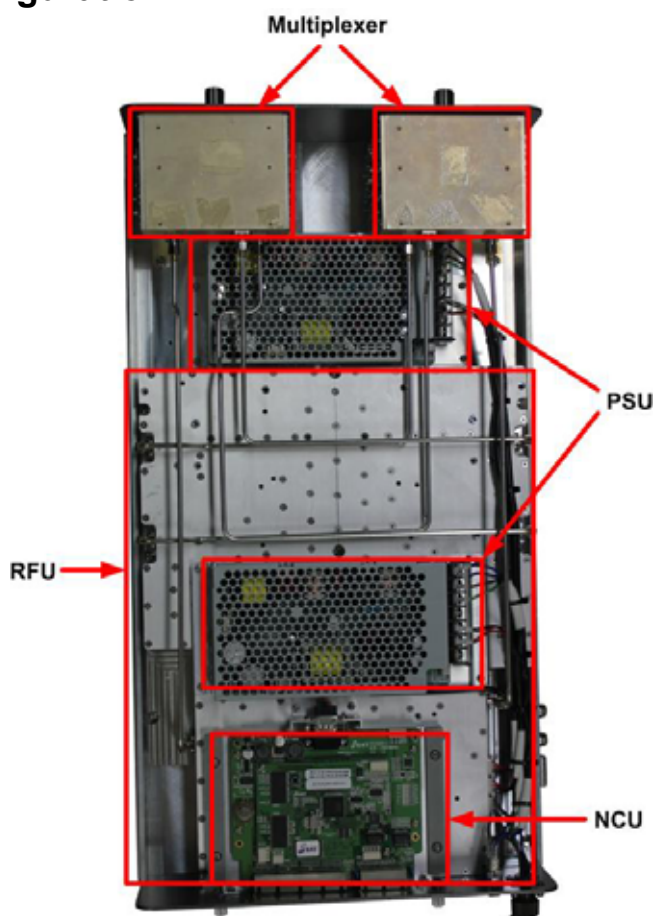
| APEX8930 Package |                    |      |
|------------------|--------------------|------|
| Index            | Items              | Q'ty |
| 1                | Repeater           | 1    |
| 2                | Wall Mount Bracket | 1    |
| 3                | LAN Cable          | 1    |
| 4                | AC Cable           | 1    |
| 5                | Bolt (M4*8mm)      | 2    |
| 6                | Bolt (M6*12mm)     | 4    |
| 7                | Direct LAN Cable   | 1    |
| 8                | Quick Guide        | 1    |
| 9                | User's Manual CD   | 1    |

## 2.4 Description

### 2.4.1 Overview



## 2.4.2 Internal Configuration



### 2.4.3 RFU (RF Unit)

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

### 2.4.4 Multiplexer

A Multiplexer 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 APEX8930 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 APEX8930. The NCU controls and monitors operational parameters, alarms, records event and performs many other functions.

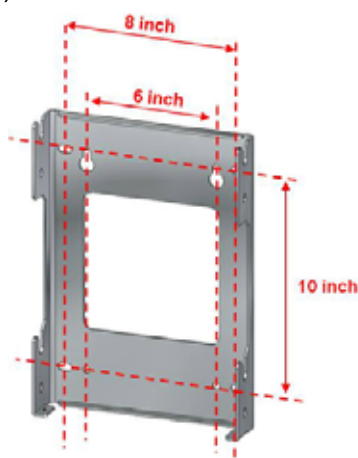
## 3. Mechanical Installation

The installation procedure is as follows:

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

### 3.1 Mounting

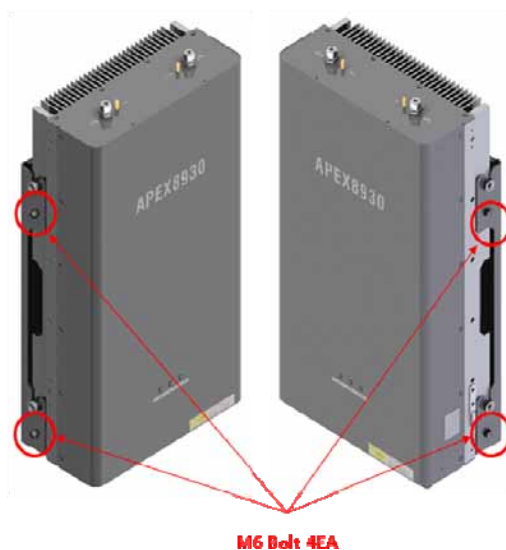
**Step 1** Drill holes directly through the template. Attach the mounting bracket to the wall using provided bolts (16/5\*50mm) or extra screws.



**Step 2** Lean the APEX8930 to hang the topside of the Guide Ring on the mounting bracket, and push toward the wall to mount.



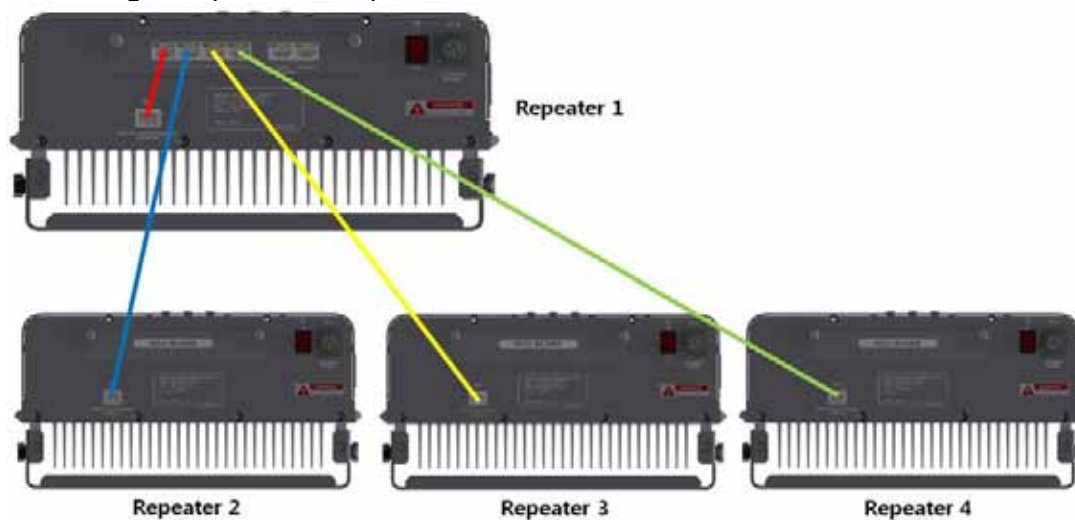
**Step 3** Fix the repeater using the 4 bolts (M6\*12mm) provided.



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



**Step 5** Connecting multiple APEX repeaters.



## 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 repeater's service antenna to the Sever Antenna Port.



Warning

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

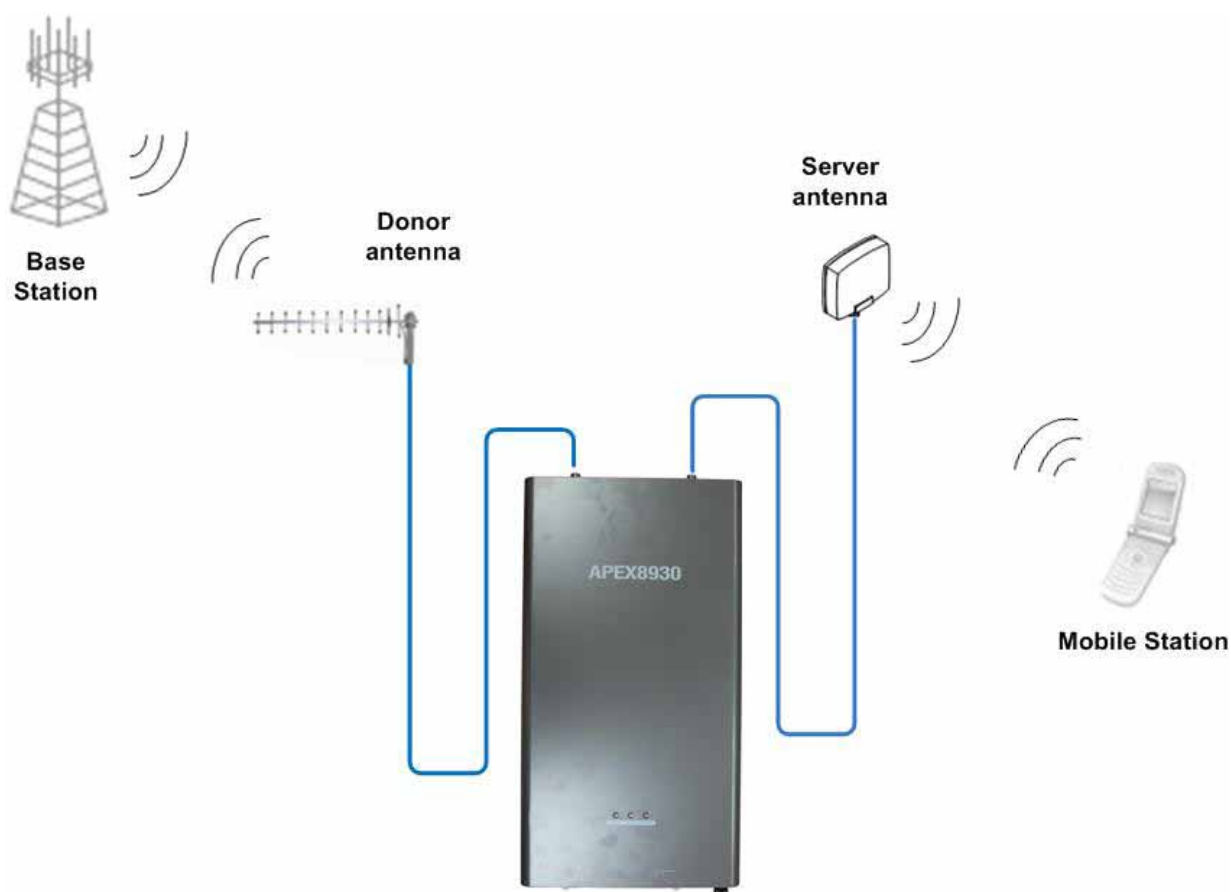
#### Note

##### Enough isolation?

Antenna isolation = Path loss between the server antenna port and the donor antenna port

Antenna isolation  $\geq$  Repeater max. gain +15dB

If antenna isolation < Repeater max. gain +15dB  $\rightarrow$  System oscillation or Low gain



### 4.2 Power On

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



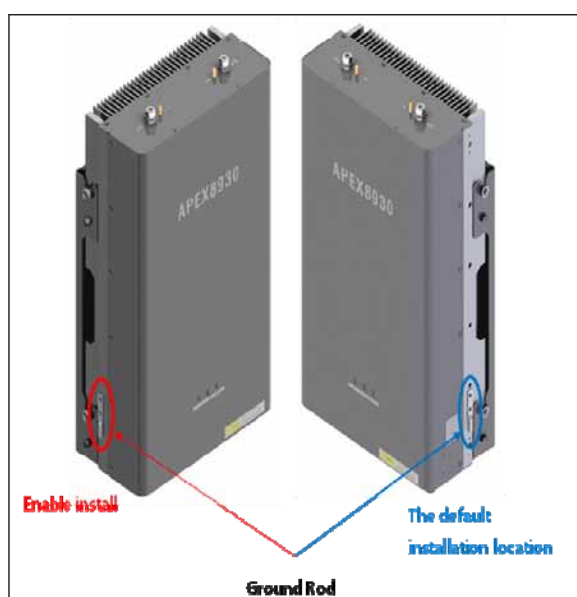
Step 1: Connect the power cord to the Repeater

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

APEX8930 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

APEX8930 operation access to Web GUI and Log in.

|          |          |
|----------|----------|
| User ID  | operator |
| Password | *****    |

#### [3] GUI Network Setup

##### 1. Time Setting

Automatically set to your PC time.

|                                     |                |                |
|-------------------------------------|----------------|----------------|
| >> System Information : Date / Time |                |                |
| Date:                               | 08 / 04 / 2011 | ( MM/DD/YYYY ) |
| Time:                               | 10 : 52 : 24   | ( HH:MM:SS )   |

##### 2. System Information Input

Input Cascade Code and Location Information.

|                         |          |
|-------------------------|----------|
| >> Cascade Code         |          |
| Cascade Code 1          | APEX8930 |
| Cascade Code 2          |          |
| Cascade Code 3          |          |
| Cascade Code 4          |          |
| >> Location Information |          |
| Latitude                | 39.23.59 |
| Longitude               | 119.38.1 |

##### 3. Ethernet Setting

IP address and SNMP IP Input.

|             |               |
|-------------|---------------|
| >> Ethernet |               |
| Mode        | Static IP     |
| IP Address  | 192.168.1.1   |
| Subnet Mask | 255.255.255.0 |
| Gateway     | 192.168.1.1   |
| >> SNMP     |               |
| SNMPv1      | 192.168.1.1   |
| SNMPv2      | 192.168.1.1   |
| SNMPv3      | 192.168.1.1   |
| SNMPv4      | 192.168.1.1   |
| SNMPv5      | 192.168.1.1   |

#### [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.

|                        |         |                       |         |
|------------------------|---------|-----------------------|---------|
| BAND SELECT            |         |                       |         |
| >> Filter Rejection    |         | Frequency Information |         |
| Normal                 |         | Apply                 |         |
| Center Frequency (MHz) |         |                       |         |
| Lower Limit            | 840.000 | Upper Limit           | 815.000 |
| Bandwidth (MHz)        | 18.000  | Offset (MHz)          | 0       |
| 1st                    | 840.000 | 815.000               | 18.000  |
| 2nd                    | 837.500 | 818.500               | 5.000   |
| 3rd                    | 835.000 | 826.000               | 1.000   |

##### 2. Isolation Check

Isolation will calculate the Available Maximum Gain.

|                    |   |
|--------------------|---|
| >> Isolation Check |   |
| Isolation          | 0 |
| Isolation          | 0 |
| Isolation          | 0 |
| Isolation          | 0 |

##### 3. AGC control

AGC automatically assigns gain.

|                                 |     |
|---------------------------------|-----|
| >> Automatic Gain Control (AGC) |     |
| AGC Mode                        | On  |
| AGC Level [dBm]                 | 30  |
| UL Gain Offset [dB]             | 0.0 |

##### 4. Manual Control

Gain value set by User.

|                                 |     |
|---------------------------------|-----|
| >> Automatic Gain Control (AGC) |     |
| AGC Mode                        | Off |
| AGC Level [dBm]                 | 30  |
| UL Gain Offset [dB]             | 0.0 |

#### [5] GUI Status Check

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

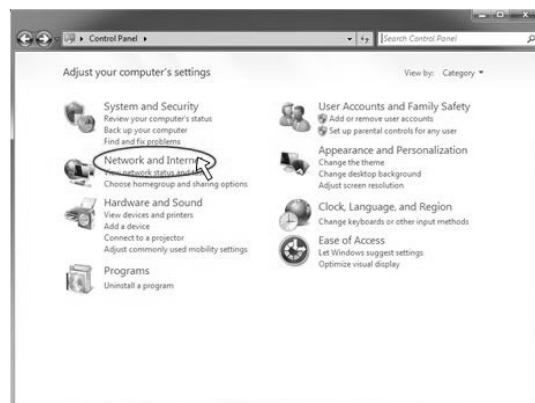
## 5.2 Internet Network Setup

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

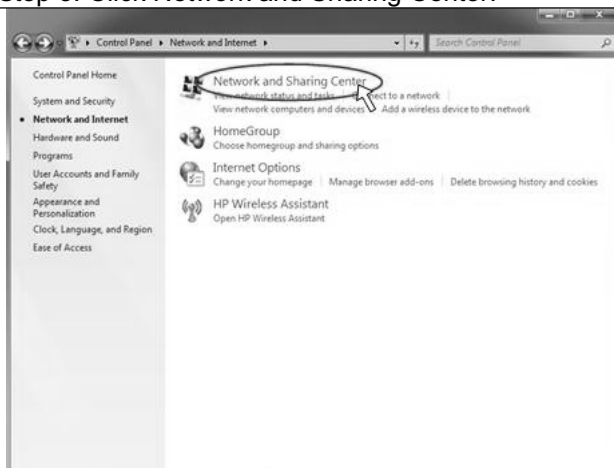
Step 1: Click the Start button and select Control Panel.



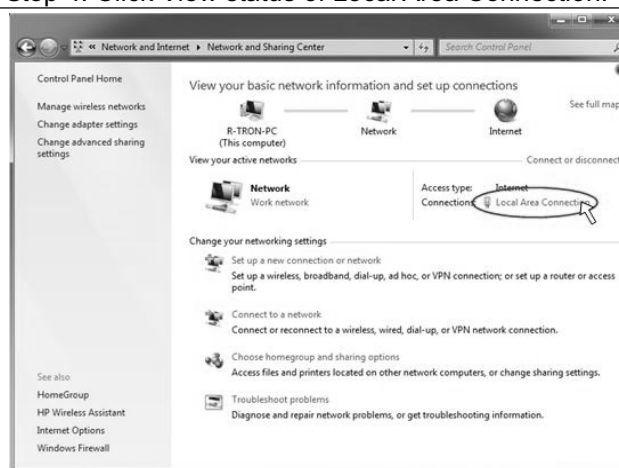
Step 2: Click **Network and Internet**.



Step 3: Click Network and Sharing Center.



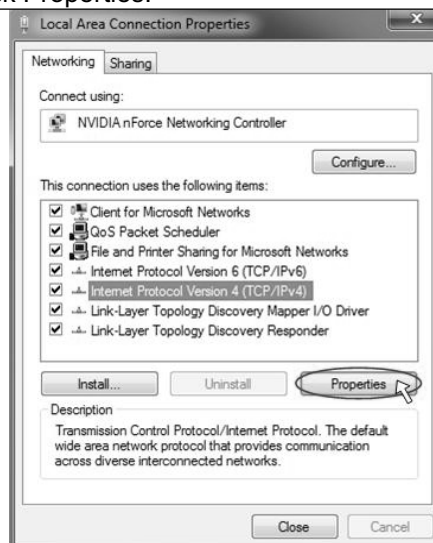
Step 4: Click View status of Local Area Connection.



Step 5: Click Properties and a caution pop-up window will appear. Click OK.

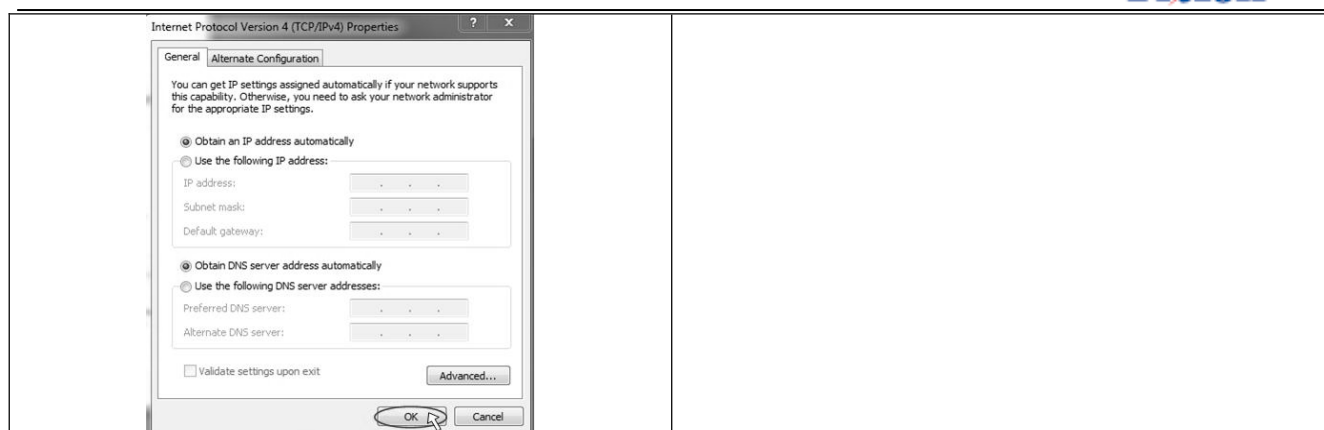


Step 6: Select Internet Protocol Version 4 (TCP/IPv4) and click Properties.



Step 7: Check Obtain an IP address automatically and click OK.

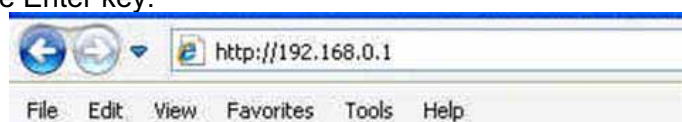
Step 8: Close all windows.



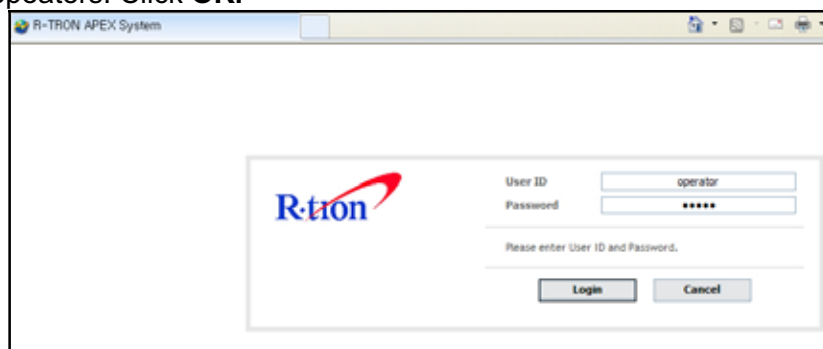
## 5.3 System Login

For APEX8930 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. The user name is **“operator”**, the password should be **“rtron”** to be consistent with our legacy repeaters. Click **OK**.



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

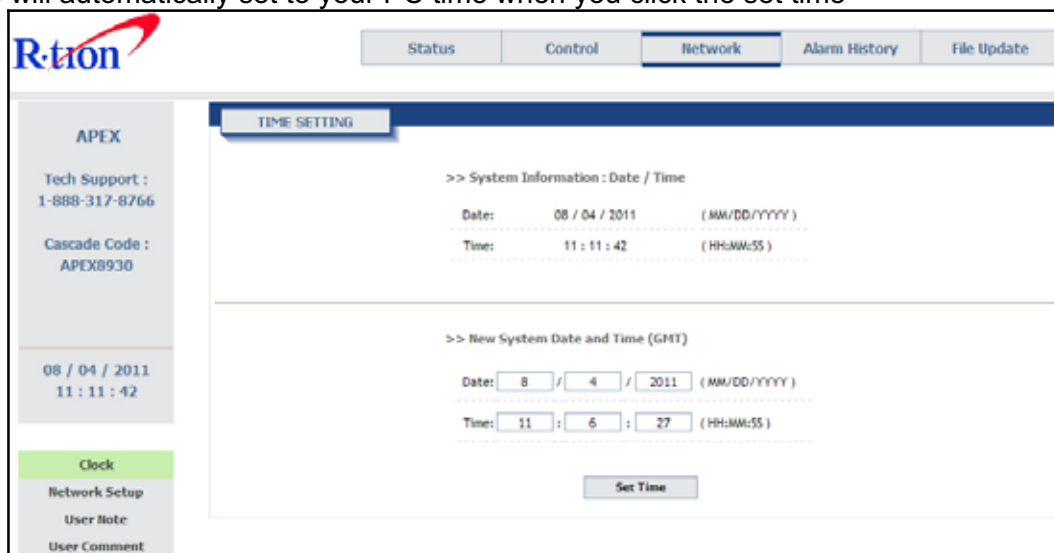


**Step 4.** When the login process is complete, the initial screen will appear.

## 5.4 System Setup

### 5.4.1 Time Setting

The time will automatically set to your PC time when you click the set time



**APEX**

Tech Support :  
1-888-317-8766

Cascade Code :  
APEX8930

08 / 04 / 2011  
11 : 11 : 42

**TIME SETTING**

>> System Information : Date / Time

Date: 08 / 04 / 2011 (MM/DD/YYYY)

Time: 11 : 11 : 42 (HH:MM:SS)

>> New System Date and Time (GMT)

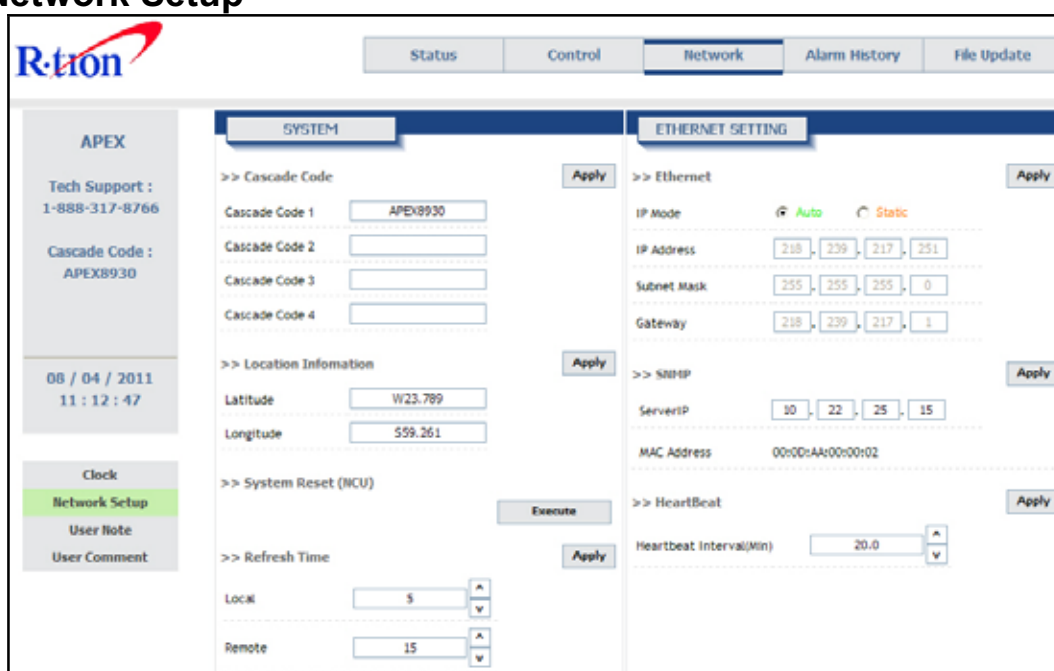
Date: 8 / 4 / 2011 (MM/DD/YYYY)

Time: 11 : 6 : 27 (HH:MM:SS)

Set Time

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

### 5.4.2 Network Setup



**APEX**

Tech Support :  
1-888-317-8766

Cascade Code :  
APEX8930

08 / 04 / 2011  
11 : 12 : 47

**SYSTEM**

>> Cascade Code

Cascade Code 1: APEX8930

Cascade Code 2:

Cascade Code 3:

Cascade Code 4:

>> Location Information

Latitude: W23.789

Longitude: 559.261

>> System Reset (NCU)

Execute

>> Refresh Time

Local: 5

Remote: 15

**ETHERNET SETTING**

>> Ethernet

IP Mode: ☒ Auto ☐ Static

IP Address: 218.239.217.251

Subnet Mask: 255.255.255.0

Gateway: 218.239.217.1

>> SNMP

ServerIP: 10.22.25.15

MAC Address: 00:0D:AA:00:00:02

>> HeartBeat

Heartbeat Interval(Min): 20.0

<Network Set-ups>

➤ **SYSTEM**

- **Cascade Code:** Type the pre-assigned cascade code (site I.D); otherwise, you cannot access the system setup.

### 5.4.2.1 Set up for multiple bands.

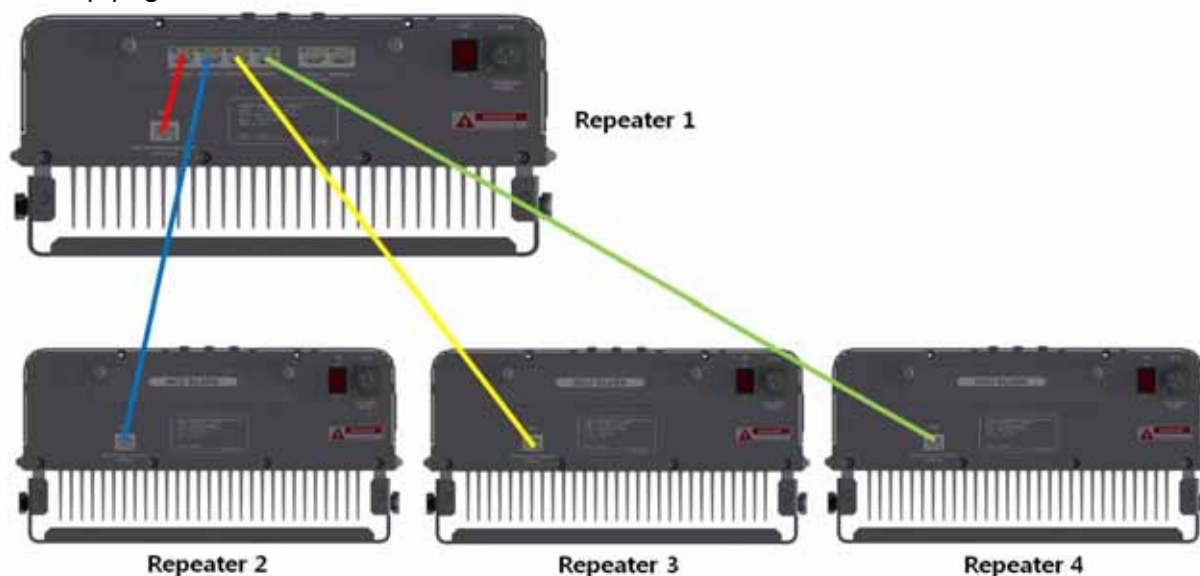
One repeater with installed NCU is designated as the master control. The other repeaters will connect to the master via RJ45 cable.

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

- ※ Cascade code 1 box of SYSTEM in Network setup.



- ※ When adding repeaters refer to the RJ45 cable connection below.
- ※ Add Cascade codes to the cascade code table under the SYSTEM section of the Network setup page.



• **Cascade Code Setting Chart**

| Repeater     | Repeater 1     | Repeater 2     | Repeater 3     | Repeater 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]

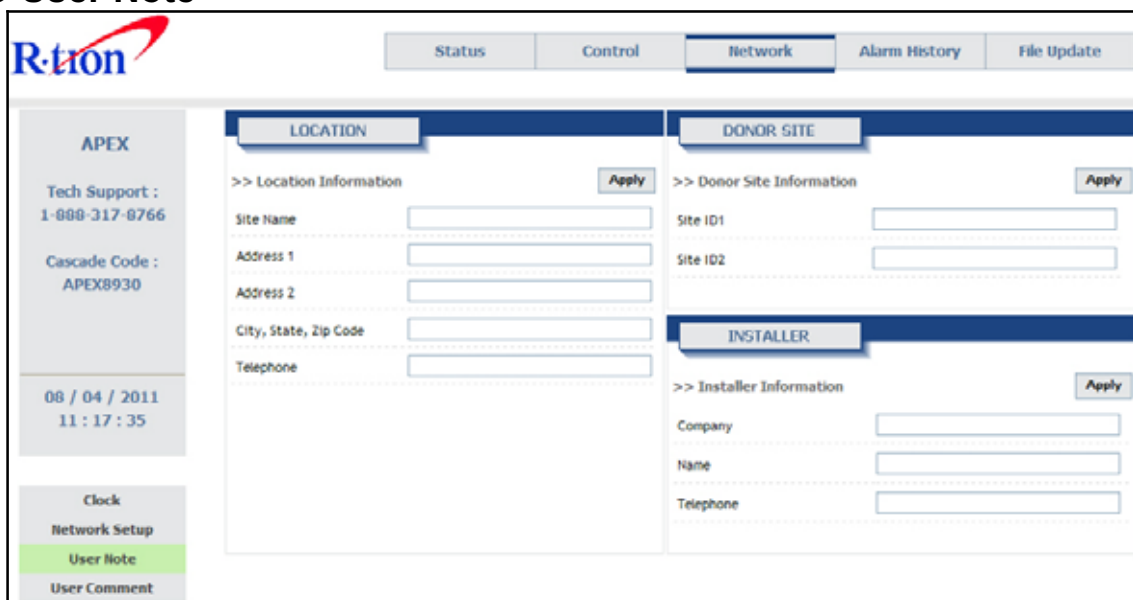
('N/S' | 'E/W') ddd.ddddd: (Latitude: N 39.006967 Longitude: W 94.532306)

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

#### ➤ ETHERNET SETTING

- **Ethernet IP Mode/IP Address:** Enables you to set a connection mode for the network connected to the APEX8930 remote LAN port. When you "select" Auto, the device automatically assigns the IP address. When you select "Static", You will enter the device IP address.
- **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

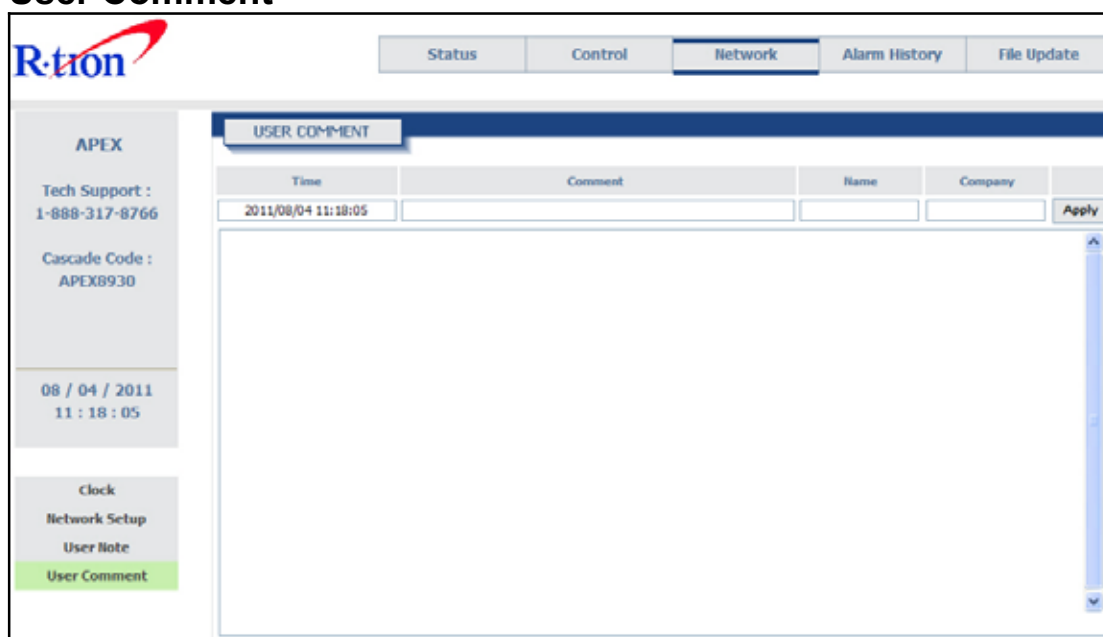


The screenshot shows the R-tion APEX8930 web interface. The top navigation bar includes 'Status', 'Control', 'Network' (selected), 'Alarm History', and 'File Update'. On the left, there's a sidebar with 'APEX' information: Tech Support (1-888-317-8766), Cascade Code (APEX8930), and a clock showing 08 / 04 / 2011 11:17:35. Below the clock are links for 'Clock', 'Network Setup', 'User Note' (highlighted), and 'User Comment'. The main content area is divided into three sections: 'LOCATION', 'DONOR SITE', and 'INSTALLER'. Each section has an 'Apply' button. The 'LOCATION' section includes fields for Site Name, Address 1, Address 2, City, State, Zip Code, and Telephone. The 'DONOR SITE' section includes fields for Site ID1 and Site ID2. The 'INSTALLER' section includes fields for Company, Name, and Telephone.

#### <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 ID. Click **Apply**.
- **Installer Information:** Type the installer information such as the company, name and telephone, Click **Apply**.

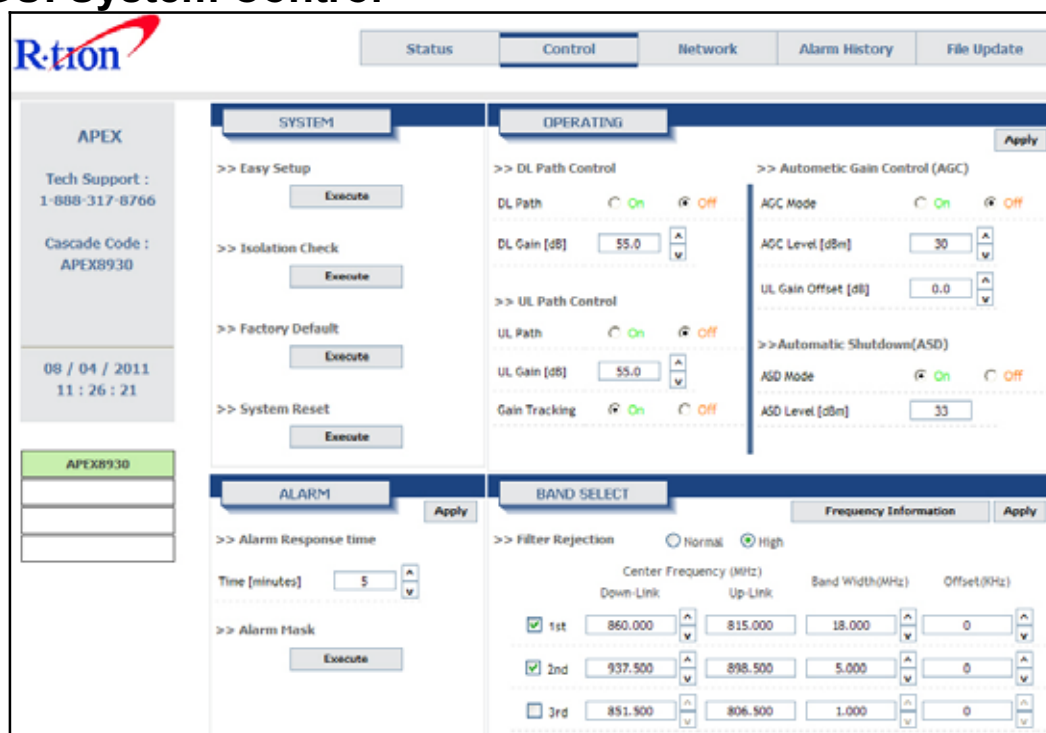
## 5.4.4 User Comment



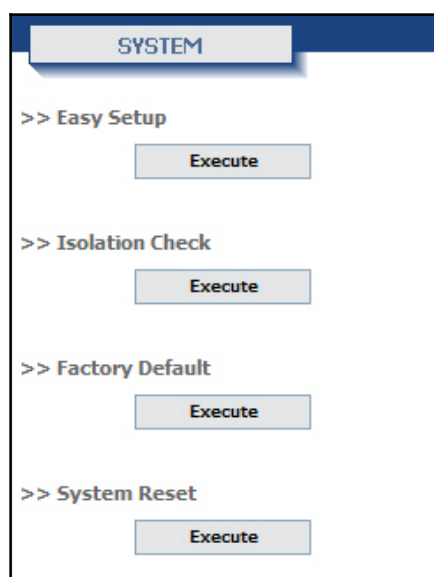
<User Comment>

- **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

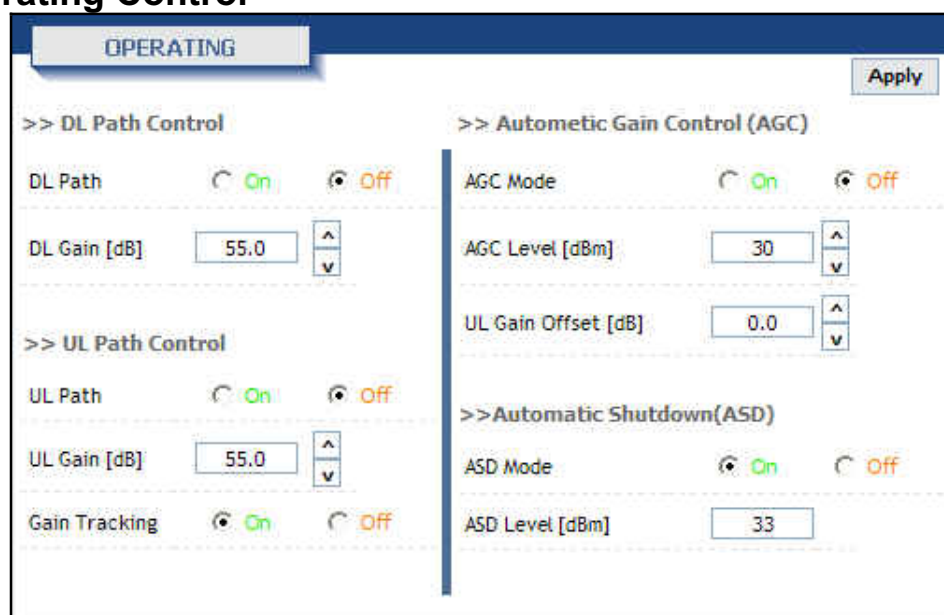


## 5.5.1 System Control



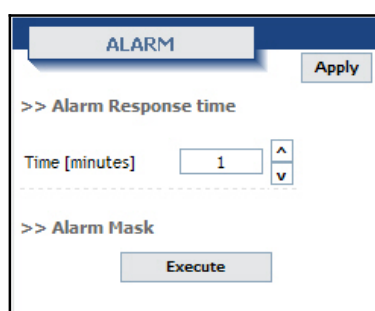
- **Easy Setup** is a fast start function. The function measures isolation, detects input level and assigns gain to achieve maximum output power. The function ends with the repeater set to amplify signals in both directions within the confines of the band selection. Before running easy setup, set the center frequency and bandwidth (refer 5.5.4).
- **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(55dB) and UL gain offset set to 0dB. Band selection and all other system parameters are not changed. The feature is useful in clearing abnormal conditions.
- **System Reset** cycles the microprocessor unit. The function is similar to switching off/on the repeater power switch.

## 5.5.2 Operating Control



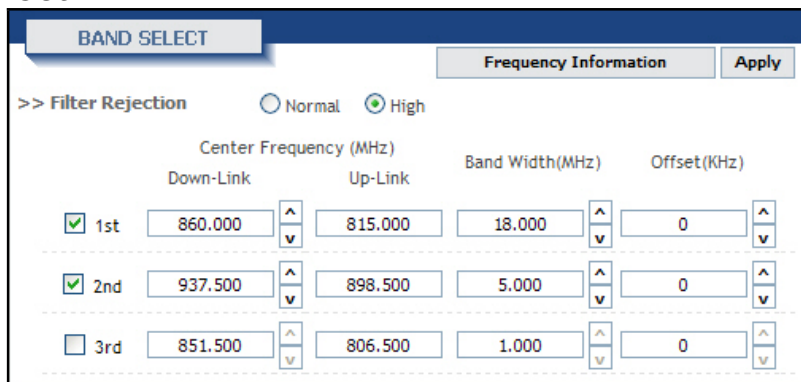
- **DL and UL Path Control** allows the user to toggle on or off the power amplifiers.
- **DL and UL Gain** is available when AGC mode is off. The user may enter gain values manually. Manual gain control is an alternative to automatic gain control(AGC). Manual gain is disabled (grayed out) when AGC mode 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(30dBm) is exceeded.
- **Gain Tracking** sets UL gain equal to DL gain. The feature helps maintain forward and reverse link ballance. 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 (dBm) is automatically set.
  - The user controls gain by adjusting the **AGC level**. The user may set the level from 0dBm to 30dBm. AGC can be used to control the signal level radiated from the server antennas.
  - AGC Window Size: Set AGC range of 1~10dB.  
 Ex 1) System Gain 85dB, Input Power -55dBm, AGC Level 30dBm, AGC Window Size 3dB  
 If Input Power is -50dBm, System Gain is 80dB and Output Power 30dBm,  
 If Input Power is -55dBm, System Gain is 82dB and Output Power 27dBm  
 If Input Power is -56dBm, System Gain is 85dB and Output Power 29dBm  
**AGC Window size = AGC Operation Range → 27~30dBm**  
 Ex 2) System Gain 85dB, Input Power -55dBm, AGC Level 30dBm, AGC Window Size 5dB  
 If Input Power is -50dBm, System Gain is 80dB and Output Power 30dBm.  
 If Input Power is -55dBm, System Gain is 80dB and Output Power 25dBm.  
 If Input Power is -56dBm, System Gain is 85dB and Output Power 29dBm.  
**AGC Window size = AGC Operation Range → 25~30dBm**
  - AGC may also be used to match the repeater 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 most cases UL offset is set to 0dB.
- **Automatic Shutdown (ASD):**
  - ASD temporarily shuts down the amplifier if the ASD level is exeded. It is not necessary to turn off ASD. ASD events are stored in the alarm hostory log. Repeated ASD events will eventually shutdown the amplifier permanently and trigger the external shutdown lamp.
  - ASD Level is set to 33dBm by default. It is not necessary to change the default level.

### 5.5.3 Alarm Control



- **Alarm response time** may be set between 1 and 5 minutes.
- **Alam 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



The screenshot shows the 'BAND SELECT' window. It has two tabs: 'Filter Rejection' and 'Frequency Information'. The 'Filter Rejection' tab is active, showing 'Normal' and 'High' radio buttons, with 'High' selected. Below this is a table for configuring three filter blocks. The columns are 'Center Frequency (MHz)' (split into 'Down-Link' and 'Up-Link'), 'Band Width(MHz)', and 'Offset(KHz)'. The '1st' and '2nd' blocks are checked, while the '3rd' block is unchecked. The values for the 1st block are 860.000 MHz Down-Link, 815.000 MHz Up-Link, 18.000 MHz Band Width, and 0 KHz Offset. The 2nd block has 937.500 MHz Down-Link, 898.500 MHz Up-Link, 5.000 MHz Band Width, and 0 KHz Offset. The 3rd block has 851.500 MHz Down-Link, 806.500 MHz Up-Link, 1.000 MHz Band Width, and 0 KHz Offset. Each input field has up and down arrow buttons for adjustment.

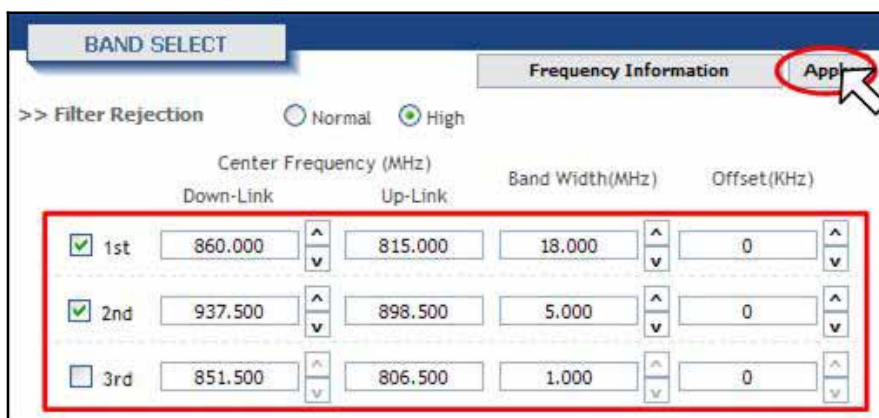
|                                         | Center Frequency (MHz) |         | Band Width(MHz) | Offset(KHz) |
|-----------------------------------------|------------------------|---------|-----------------|-------------|
|                                         | Down-Link              | Up-Link |                 |             |
| <input checked="" type="checkbox"/> 1st | 860.000                | 815.000 | 18.000          | 0           |
| <input checked="" type="checkbox"/> 2nd | 937.500                | 898.500 | 5.000           | 0           |
| <input type="checkbox"/> 3rd            | 851.500                | 806.500 | 1.000           | 0           |

- Band select sets the digital filter to the **center frequency and bandwidth** of the local service for which the repeater is intended to amplify. Likewise, all other signals outside of the selected **Center Frequency and Bandwidth** are not amplified.
- The user can select one or two or three distinct section within the iDEN band. Each of the **1st, 2nd and 3rd** filter blocks can be set to 1MHz to 18MHz of **Bandwidth(800MHz)**. For 900MHz Bandwidth is 1MHz to 5MHz. Only the downlink center frequency is set by the user. The uplink center frequencies are automatically set in accordance with the downlink frequencies.
- **Filter Rejection** allows user to change the digital filter characteristics. Normal rejection is satisfactory for requirement of Frequency rejection over 55dBc(delta 1MHz) and High rejection over 65dBc(delta 500KHz).
- **Frequency information** is a reference for setting the center frequency and band width (refer to section 8.1).
- **Offset(KHz)** is a feature that allows the user to customize the position of the high frequency band edge. The feature provides additional separation, if needed, from an adjacent frequency band(i.e. Cellular A Band)

## 5.6 GUI System Setup

### 5.6.1 Easy Setup

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

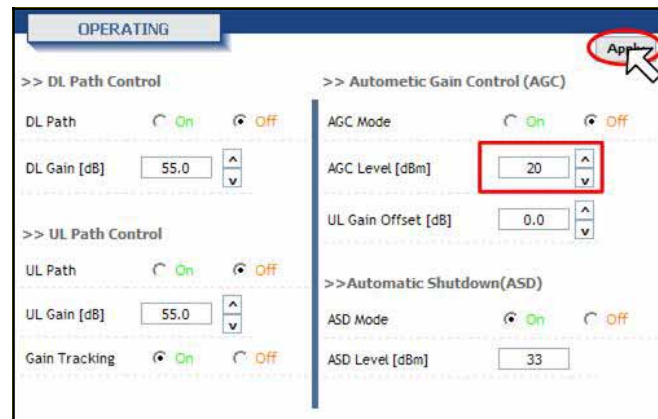


This screenshot is identical to the one above, but with a red circle around the 'Apply' button in the top right corner and a mouse cursor pointing at it. Additionally, a red rectangle highlights the entire table of filter block settings.

## Step 2. Input AGC Level desired and click Apply.

1) AGC Level 30dBm

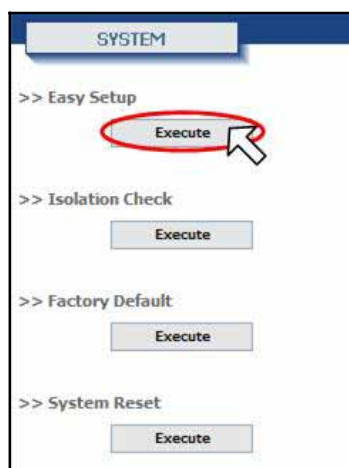
2) AGC Level 20dBm



## Step 3. Easy Setup proceeds to:

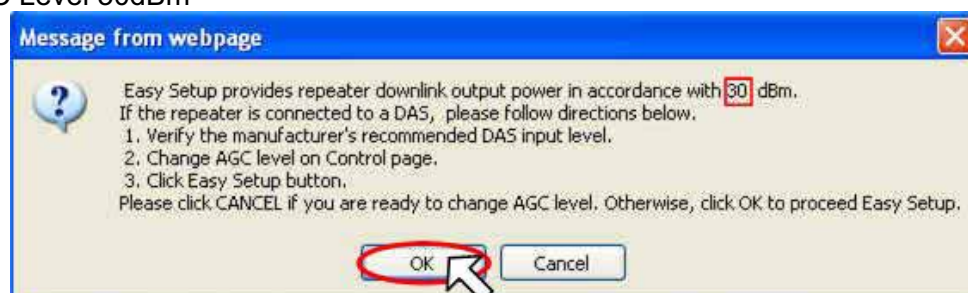
- Data Initial execution
- Isolation Test executed
- Calculation of Available Maximum Gain by the isolation
- DL/UL Path On
- AGC On to obtain DL Output Power AGC Level or Maximum Gain 85dB
- ASD On
- AGC Off
- Easy setup takes about 2minutes.

Click Execute button of Easy Setup

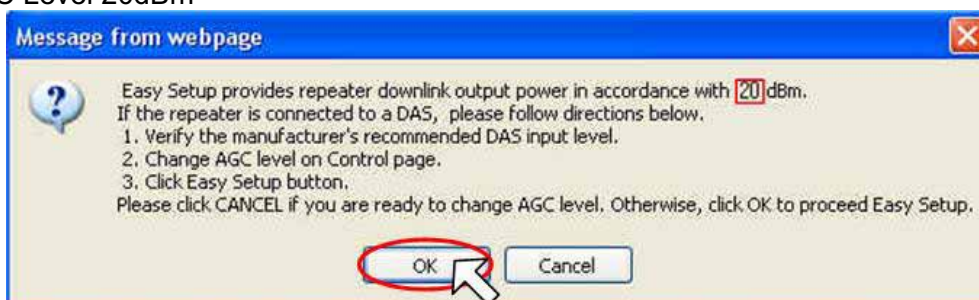


## Step 4. Click OK.

1) AGC Level 30dBm

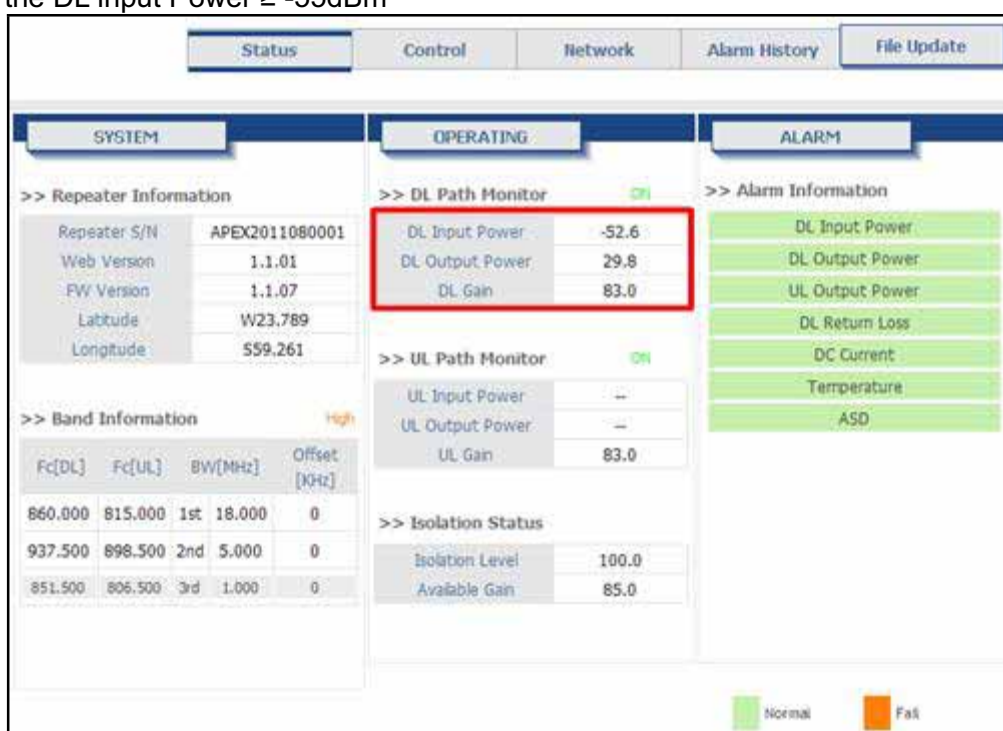


## 2) AGC Level 20dBm



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

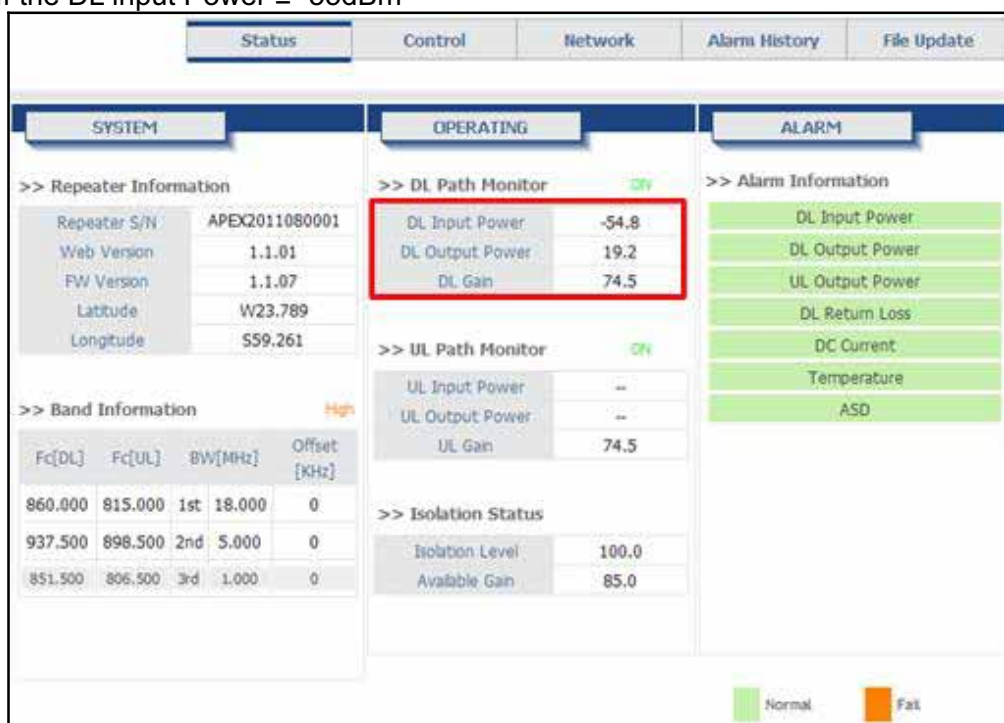
**Result 1.** Constant Maximum DL Output Power 30dBm (AGC Level 30dBm)  
If the DL input Power  $\geq$  -55dBm



| SYSTEM                                                                                                                                                                                                                                                                                                                                                                            |         |            |              |  | OPERATING                                                                                                                                |        | ALARM                                                                                                                                           |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------|--------------|--|------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------|---------|------------|---|---------|---------|-----------|---|---------|---------|-----------|---|------------------------------------------------------------------------------------|--|--|--|
| <b>&gt;&gt; Repeater Information</b><br>Repeater S/N: APEX2011080001<br>Web Version: 1.1.01<br>FW Version: 1.1.07<br>Latitude: W23.789<br>Longitude: 559.261                                                                                                                                                                                                                      |         |            |              |  | <b>&gt;&gt; DL Path Monitor</b> <span style="color: green;">ON</span><br>DL Input Power: -52.6<br>DL Output Power: 29.8<br>DL Gain: 83.0 |        | <b>&gt;&gt; Alarm Information</b><br>DL Input Power<br>DL Output Power<br>UL Output Power<br>DL Return Loss<br>DC Current<br>Temperature<br>ASD |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
| <b>&gt;&gt; Band Information</b> <span style="color: orange;">High</span>                                                                                                                                                                                                                                                                                                         |         |            |              |  | <b>&gt;&gt; UL Path Monitor</b> <span style="color: green;">ON</span><br>UL Input Power: --<br>UL Output Power: --<br>UL Gain: 83.0      |        |                                                                                                                                                 |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
| <table border="1"> <thead> <tr> <th>Fc[DL]</th> <th>Fc[UL]</th> <th>BW[MHz]</th> <th>Offset [KHz]</th> </tr> </thead> <tbody> <tr> <td>860.000</td> <td>815.000</td> <td>1st 18.000</td> <td>0</td> </tr> <tr> <td>937.500</td> <td>898.500</td> <td>2nd 5.000</td> <td>0</td> </tr> <tr> <td>851.500</td> <td>806.500</td> <td>3rd 1.000</td> <td>0</td> </tr> </tbody> </table> |         |            |              |  | Fc[DL]                                                                                                                                   | Fc[UL] | BW[MHz]                                                                                                                                         | Offset [KHz] | 860.000 | 815.000 | 1st 18.000 | 0 | 937.500 | 898.500 | 2nd 5.000 | 0 | 851.500 | 806.500 | 3rd 1.000 | 0 | <b>&gt;&gt; Isolation Status</b><br>Isolation Level: 100.0<br>Available Gain: 85.0 |  |  |  |
| Fc[DL]                                                                                                                                                                                                                                                                                                                                                                            | Fc[UL]  | BW[MHz]    | Offset [KHz] |  |                                                                                                                                          |        |                                                                                                                                                 |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
| 860.000                                                                                                                                                                                                                                                                                                                                                                           | 815.000 | 1st 18.000 | 0            |  |                                                                                                                                          |        |                                                                                                                                                 |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
| 937.500                                                                                                                                                                                                                                                                                                                                                                           | 898.500 | 2nd 5.000  | 0            |  |                                                                                                                                          |        |                                                                                                                                                 |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |
| 851.500                                                                                                                                                                                                                                                                                                                                                                           | 806.500 | 3rd 1.000  | 0            |  |                                                                                                                                          |        |                                                                                                                                                 |              |         |         |            |   |         |         |           |   |         |         |           |   |                                                                                    |  |  |  |

■ Normal    ■ Fail

**Result 2.** Constant Maximum DL Output Power 27dBm (AGC Level 20dBm)  
If the DL input Power  $\geq$  -55dBm



## 5.6.2 Manual Gain Setting

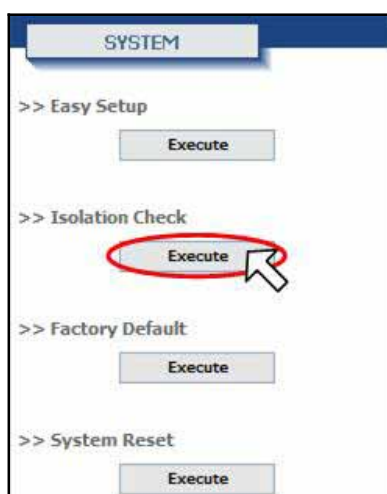
### 5.6.2.1 AGC mode On Setting

**Step 1.** Repeat Step 1 through Step 2

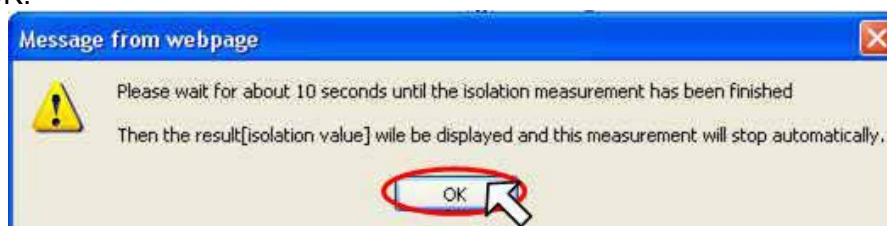
#### Step 2. Isolation Check

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

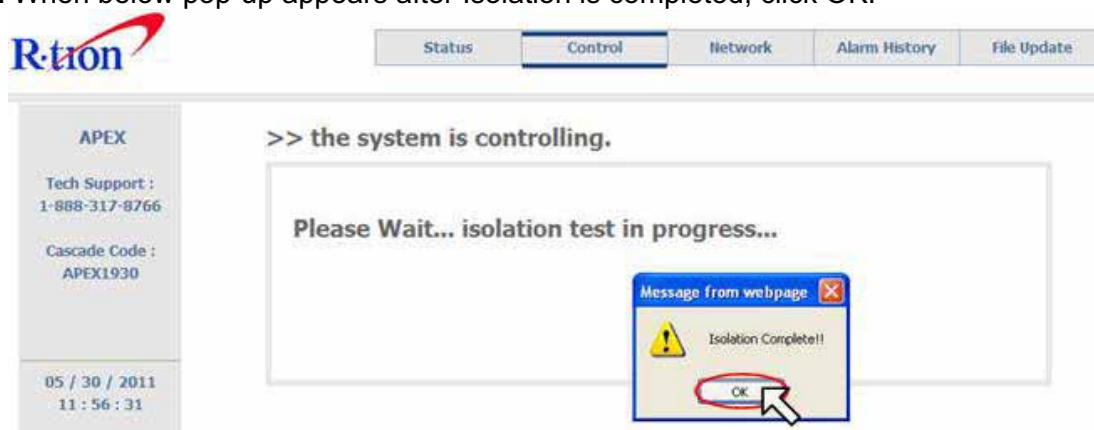
**Click Isolation**



**Step 3.** Click OK.



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

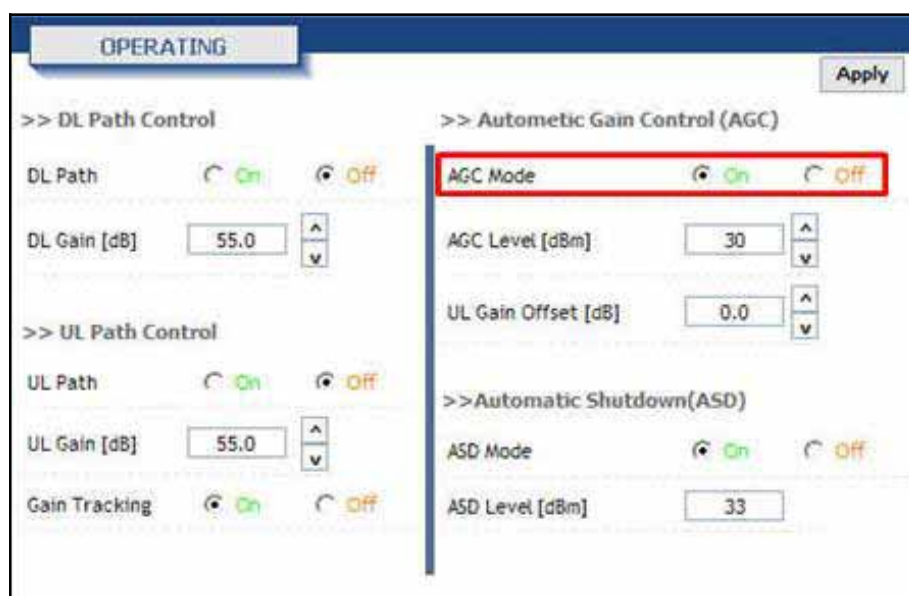


**Step 5. AGC** must be turned on. AGC automatically assigns gain in accordance with AGC level. Use AGC level to increase or decrease gain.

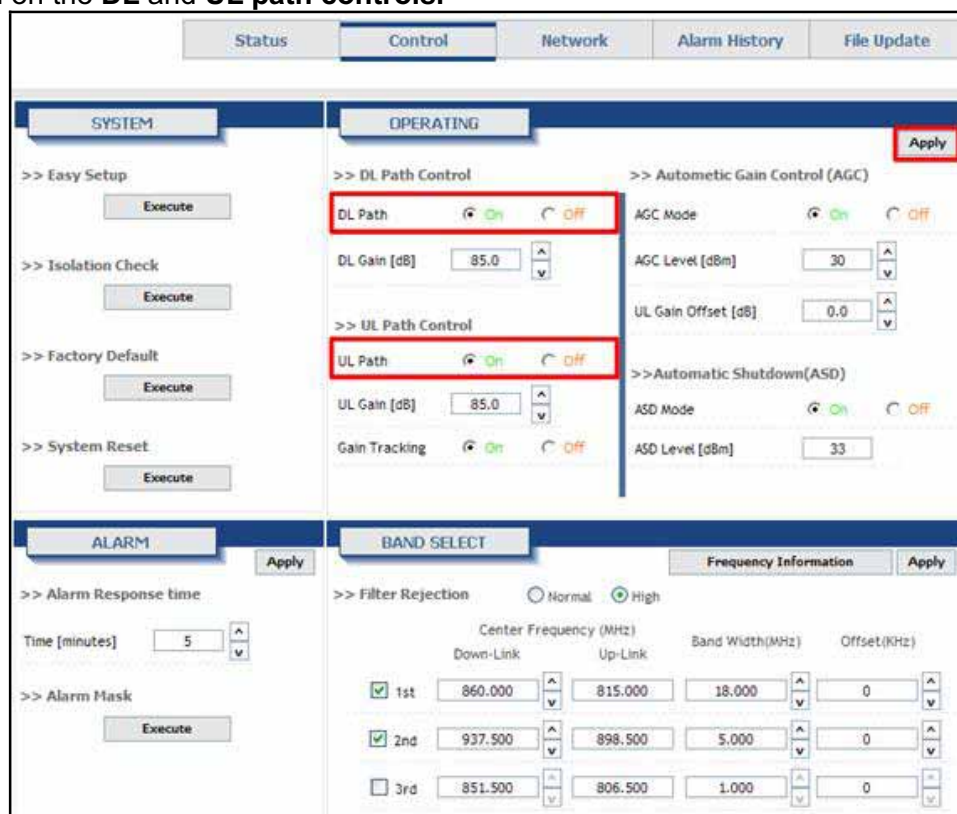
(Gain Offset is a gain differential between DL Output gain and UL output gain.)

Ex>AGC Level 30dBm, Gain Offset -3dB → DL Gain 85dB, UL Gain 82dB

AGC Level 30dBm, Gain Offset 0dB → DL Gain 85dB, UL Gain 85dB



## Step 6. Turn on the DL and UL path controls.

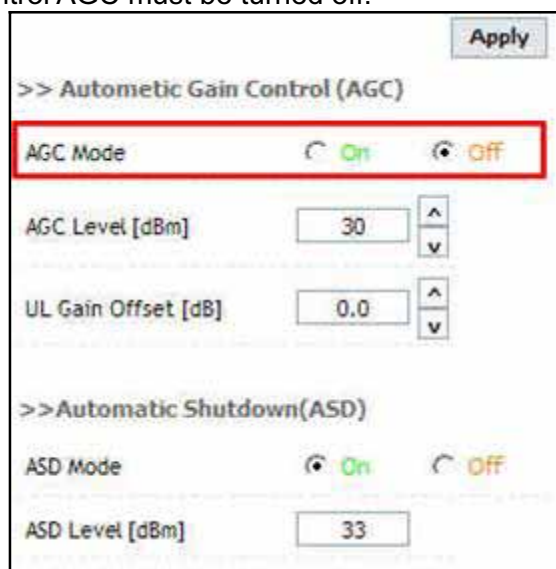


The screenshot shows the 'Control' tab of the R-tion interface. The 'DL Path Control' section has 'DL Path' set to 'On' and 'DL Gain [dB]' set to 85.0. The 'UL Path Control' section has 'UL Path' set to 'On' and 'UL Gain [dB]' set to 85.0. The 'Automatic Gain Control (AGC)' section has 'AGC Mode' set to 'On', 'AGC Level [dBm]' set to 30, and 'UL Gain Offset [dB]' set to 0.0. The 'Automatic Shutdown (ASD)' section has 'ASD Mode' set to 'On' and 'ASD Level [dBm]' set to 33. The 'ALARM' and 'BAND SELECT' tabs are also visible at the bottom.

### 5.6.2.2 Manual gain setting

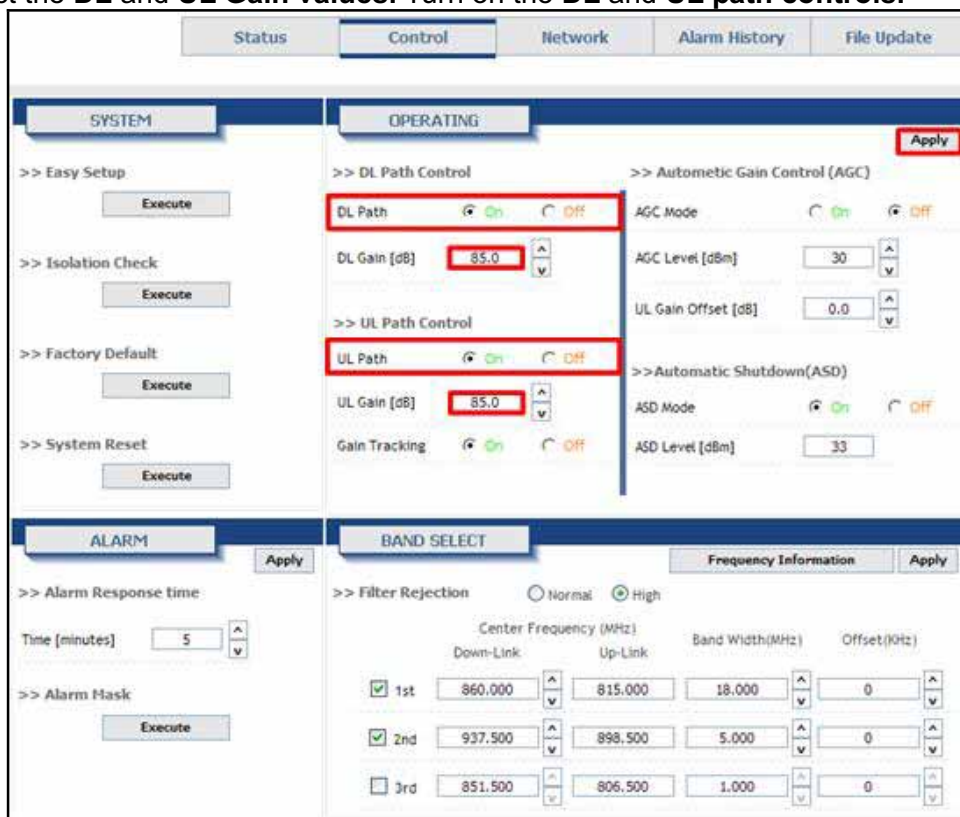
When you want to set gain value not using Auto Gain control refer to the following.

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



The screenshot shows the 'Automatic Gain Control (AGC)' section. The 'AGC Mode' is set to 'Off', which is highlighted with a red box. The 'AGC Level [dBm]' is set to 30, 'UL Gain Offset [dB]' is set to 0.0, 'ASD Mode' is set to 'On', and 'ASD Level [dBm]' is set to 33.

**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**.



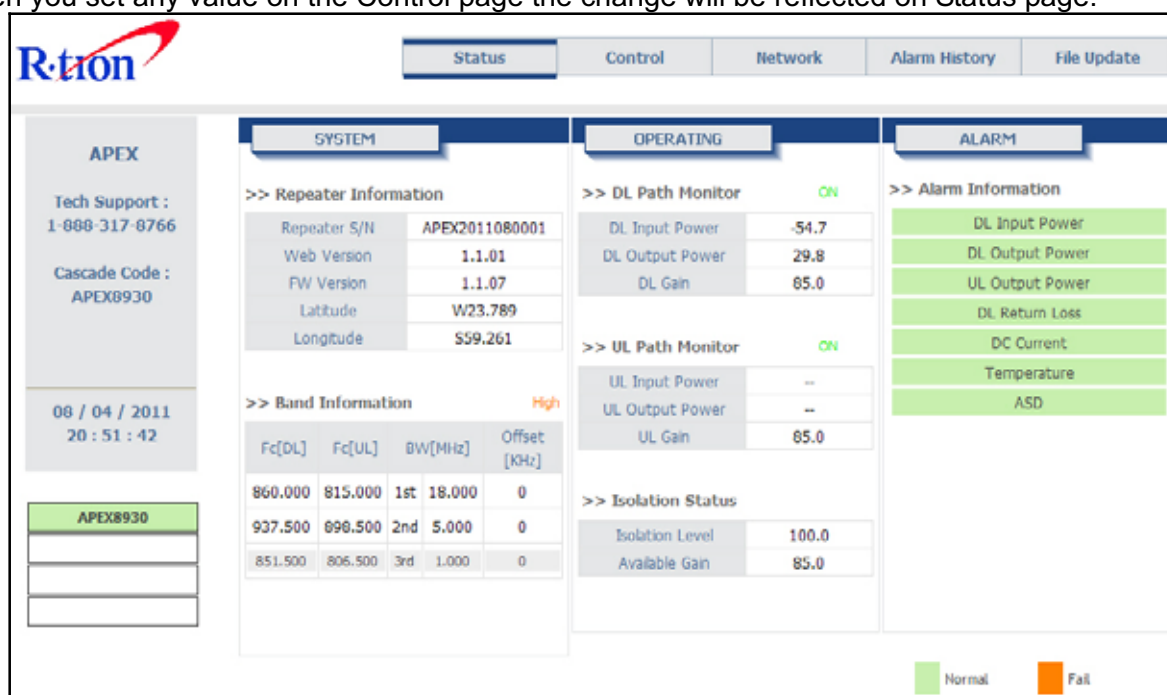
The screenshot displays the 'Control' tab of the R-tion interface. The 'OPERATING' section is active, showing settings for DL Path Control, UL Path Control, Automatic Gain Control (AGC), and Automatic Shutdown (ASD). The 'DL Path' and 'UL Path' are both set to 'On'. The 'DL Gain' is set to 85.0 dB, and the 'UL Gain' is also set to 85.0 dB. The 'AGC Mode' is set to 'On', and the 'ASD Mode' is set to 'On'. The 'ALARM' section shows the 'Alarm Response time' set to 5 minutes. The 'BAND SELECT' section shows the 'Filter Rejection' set to 'High' and a table of frequency information.

|     | Center Frequency (MHz) | Band Width(MHz) | Offset(KHz) |
|-----|------------------------|-----------------|-------------|
| 1st | 860.000                | 18.000          | 0           |
| 2nd | 937.500                | 5.000           | 0           |
| 3rd | 851.500                | 1.000           | 0           |

## 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 **Repeater 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 repeater server antenna port, and downlink amplifier gain.
- **UL Path Monitor** displays input from the server antenna circuit, output power at repeater 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 (85dB) is available if the antenna isolation value is at least 100dB.

### 5.7.3 Alarm

- Alarms are displayed on the status page. If an alarm occurs, the alarm LED on the repeater 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.

>> Alarm History

| Issue Time           | Alarm Information                              |
|----------------------|------------------------------------------------|
| 20226/01/01 00:03:48 | Repeater 1 - APEX8930 : DL Output Power Alarm  |
| 20226/01/01 00:03:38 | Repeater 1 - APEX8930 : DL Output Power Normal |
| 20226/01/01 00:03:38 | Repeater 1 - APEX8930 : DL Output Power Alarm  |
| 20226/01/01 00:00:15 | Repeater 1 - APEX8930 : DL Output Power Normal |
| 20226/01/01 00:00:15 | Repeater 1 - APEX8930 : DL Output Power Alarm  |
| 20226/01/01 00:28:48 | Repeater 1 - APEX8930 : DL Output Power Normal |
| 20226/01/01 00:28:47 | Repeater 1 - APEX8930 : DL Output Power Alarm  |
| 20226/01/01 00:13:25 | Repeater 1 - APEX8930 : DL Output Power Normal |
| 20226/01/01 00:13:24 | Repeater 1 - APEX8930 : DL Output Power Alarm  |
| 2011/07/27 18:40:20  | Repeater 1 - APEX8930 : UL Output Power Normal |
| 2011/07/27 18:40:18  | Repeater 1 - APEX8930 : UL Output Power Alarm  |
| 2011/07/27 18:32:54  | Repeater 1 - APEX8930 : UL Output Power Normal |
| 2011/07/27 18:32:53  | Repeater 1 - APEX8930 : UL Output Power Alarm  |
| 2011/07/27 18:16:06  | Repeater 1 - APEX8930 : DL Input Power Normal  |
| 2011/07/27 18:15:57  | Repeater 1 - APEX8930 : UL Input Power Normal  |
| 2011/07/27 18:13:13  | Repeater 1 - APEX8930 : DL Input Power Alarm   |
| 2011/07/27 18:13:13  | Repeater 1 - APEX8930 : UL Input Power Alarm   |

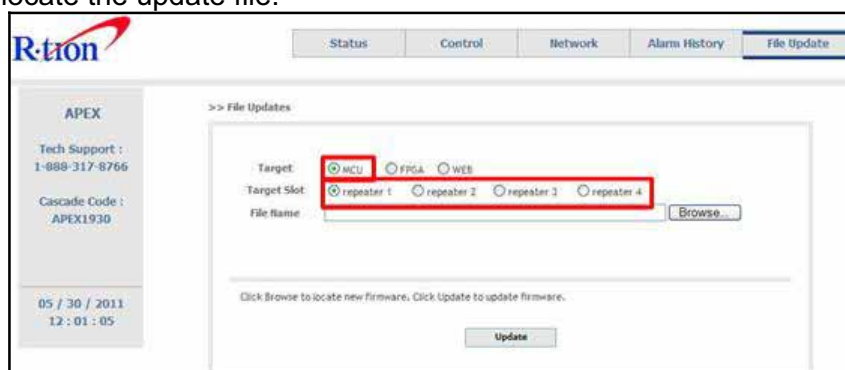
Alarm Request    Delete

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 repeater receiving the update to the host repeater. The LAN port number on the host repeater is the slot number for the repeater receiving the update. Use the browse button to locate the update file.



File Updates

Target: ☒ MCU ☐ FPGA ☐ WEB

Target Slot: ☒ repeater 1 ☐ repeater 2 ☐ repeater 3 ☐ repeater 4

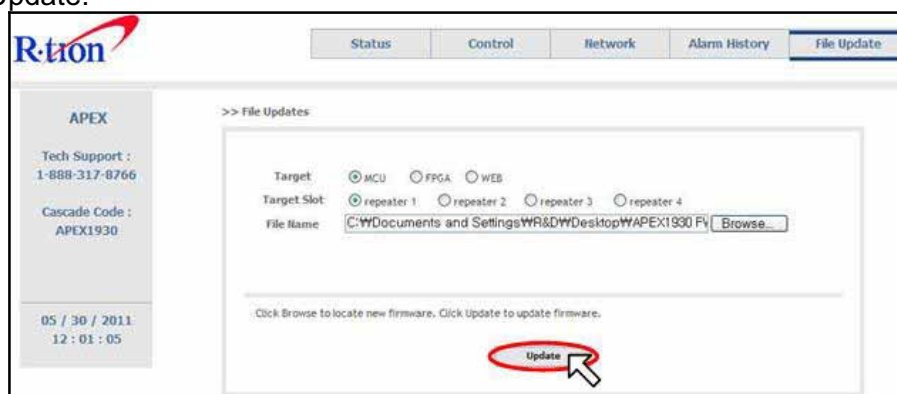
File Name:

Click Browse to locate new firmware, Click Update to update firmware.

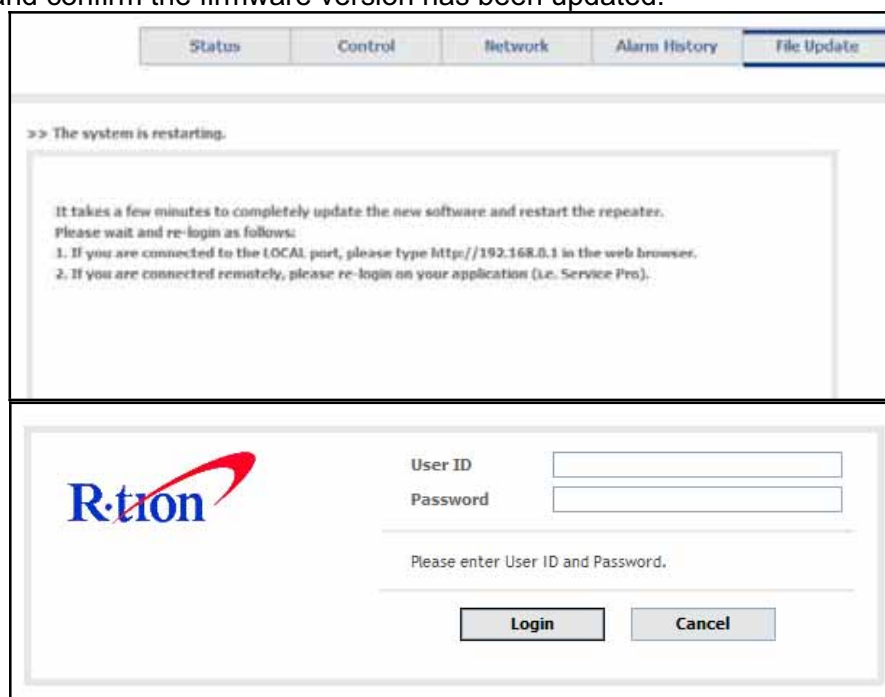
**Step 2.** MCU firmware file has a ".bin" filename extension. Click Open.



**Step 3.** Click Update.

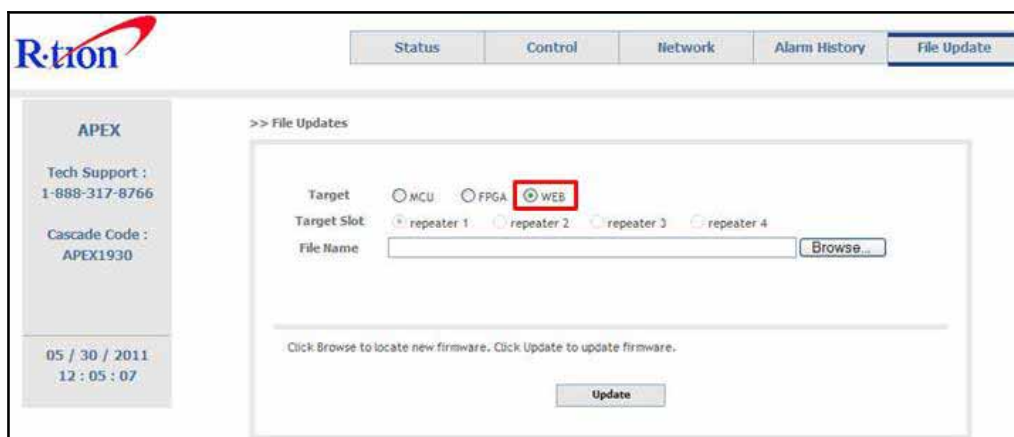


**Step 4.** When File update message appears and updating completed, go to Log-in page. Log-in and confirm the firmware version has been updated.

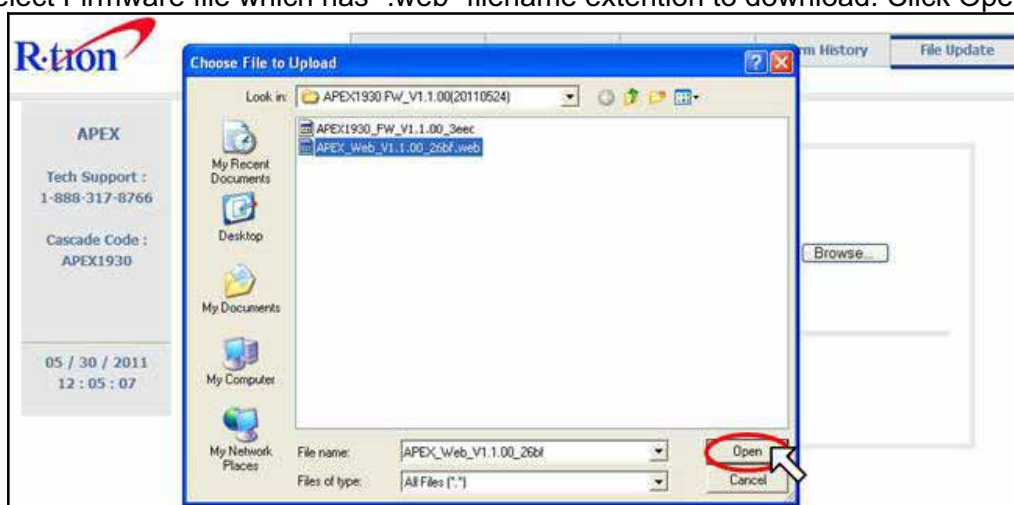


## 5.8.2 Web GUI Download

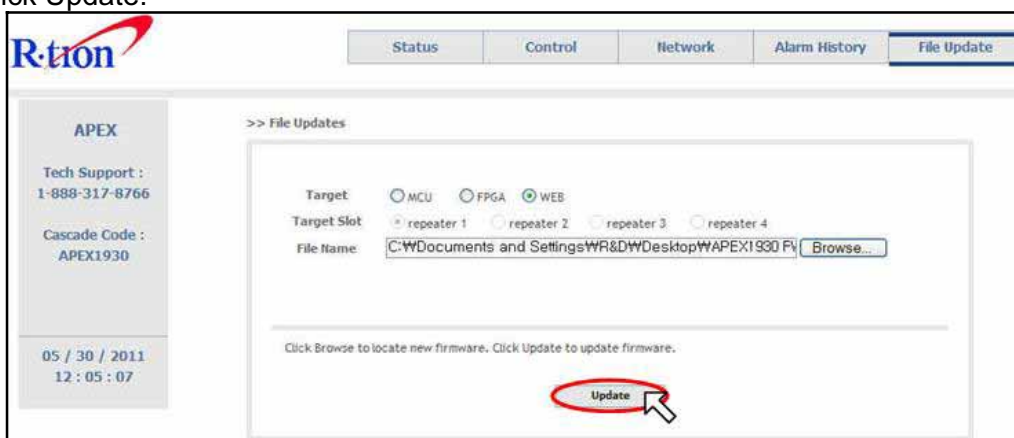
**Step 1.** Select WEB in File Update page and click Browse.



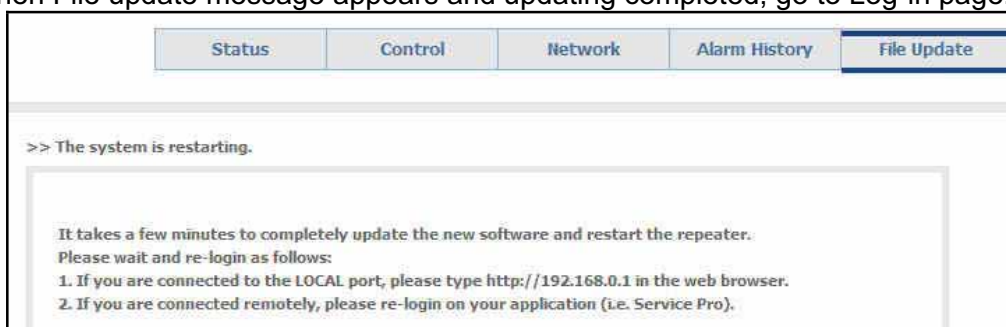
**Step 2.** Select Firmware file which has “.web” filename extension to download. Click Open.



**Step 3.** Click Update.



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

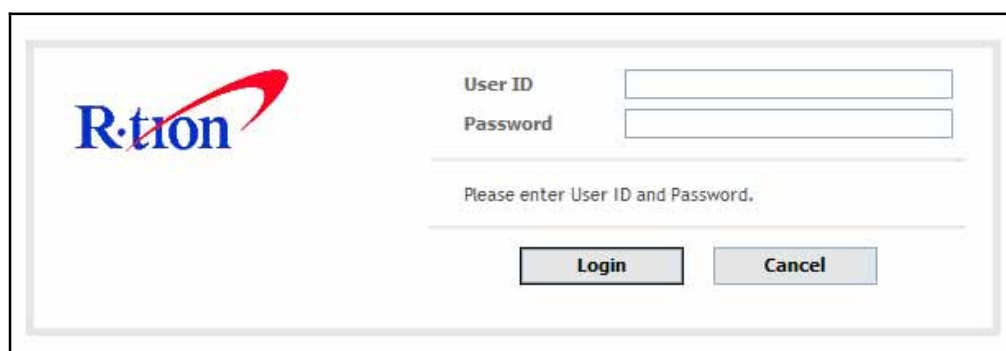


The screenshot shows a web interface with a navigation bar at the top containing five tabs: Status, Control, Network, Alarm History, and File Update. The File Update tab is selected and highlighted. Below the navigation bar, a message box displays the following text:

>> The system is restarting.

It takes a few minutes to completely update the new software and restart the repeater.  
Please wait and re-login as follows:

1. If you are connected to the LOCAL port, please type `http://192.168.0.1` in the web browser.
2. If you are connected remotely, please re-login on your application (i.e. Service Pro).



The screenshot shows a login page with the R-tion logo on the left. On the right, there are two input fields labeled "User ID" and "Password". Below these fields is a horizontal line, followed by the text "Please enter User ID and Password." At the bottom, there are two buttons: "Login" and "Cancel".

## 5.9 Attachment

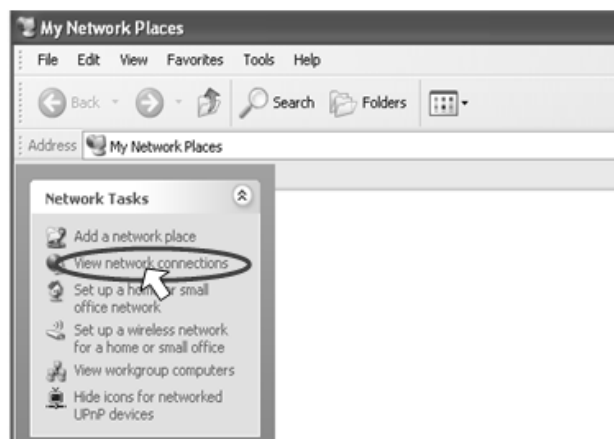
### 5.9.1 Internet Network Setting

#### 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.



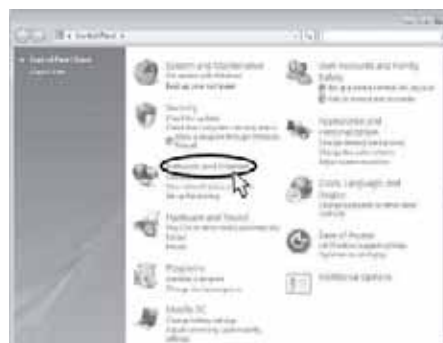
Step 6: Close all widows.

## 5.9.1.2 Windows Vista

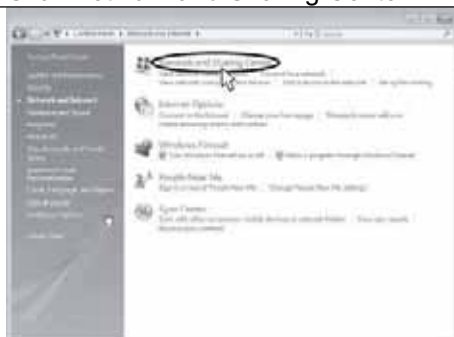
Step 1: Click the Start button and select Control panel.



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 APEX8930 repeater does not work normally after completing the following troubleshooting, please contact your local dealer or R-tron America's Tech support line (1-888-317-TRON).

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

### 6.1 LED Alarm

| Problem                                                                                 | Cause                                       | Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No LED on                                                                               | Power failure                               | Check the power cord for secure connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Mobile device has poor performance.                                                     | Repeater service degraded or not available. | Login to the web GUI.<br>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.<br>1. Reduce repeater gain and/or AGC level.<br>2. Improve the field conditions that cause poor antenna isolation: For example: make an effort to increase downlink input and reduce gain.                                                                                                                                                                                                                                   |
| The red light is on.                                                                    | Automatic Shutdown                          | Automatic shutdown occurs when the amplifier is over driven. The amplifier is most commonly overdriven by:<br>1. Oscillation due to poor antenna isolation.<br>2. High input power combined with high gain settings including high UL input from the mobile device.<br>User the alarm history page to help determine the cause of the shutdown. Eliminate the root cause of the shutdown and restart the repeater.<br>Technical Support<br>Web site: <a href="http://www.r-tronamerica.com">www.r-tronamerica.com</a><br>Toll Free: 888-317-8766 |

### 6.2 GUI Alarm

| Problem         | Check Point        | Solution                                                                                                                                 |
|-----------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>  | 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.                                 |
|                 | Automatic Shutdown | Check Isolation and DL/UL Input power..                                                                                                  |
|                 | Heartbeat          | Check the connection of the Remote NMS Cable.<br>Check the interval of Heartbeat on the WEB GUI                                          |
| <b>Downlink</b> | DL Input Power     | DL Input alarm can be the result of low signal level from the donor antenna circuit.<br>Tune the antenna and/or reduce feeder line loss. |
|                 | DL Output Power    | Check DL input Power.<br>If input power exceeds max input power install an attenuator on the donor antenna transmission line.            |

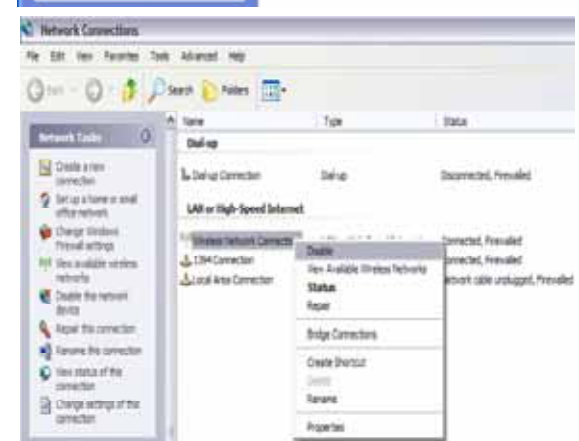
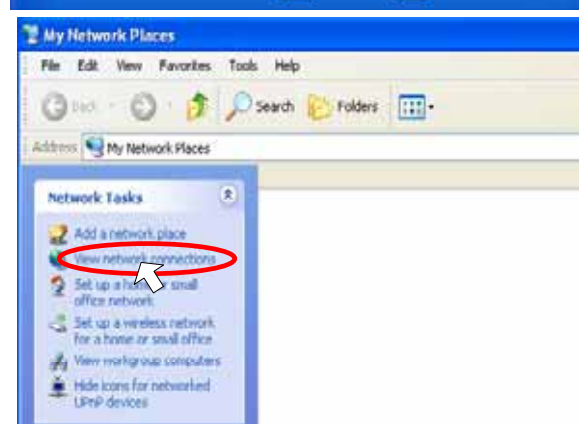
|               |                 |                                                                                                                                                                                                                                                                                                                                                     |
|---------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | VSWR            | VSWR alarm is the result of a poorly matched antenna circuit. The repeater is almost never the reason for return loss issues. A good quality 50 ohm load placed over the repeater server port or donor port will extinguish the alarm and prove the alarm is caused by some external antenna issue.                                                 |
| <b>Uplink</b> | UL Output Power | UL output power alarm is red when the UL output exceeds rated amplifier output. If UL Input Power is high and UL gain is high, the repeater is vulnerable to excessive UL input power from mobile transmitters: Determine the root cause of high mobile TX power. (i.e. insufficient downlink output power, low RSSI in the repeater coverage area) |

## 6.3 Communication log-in problem

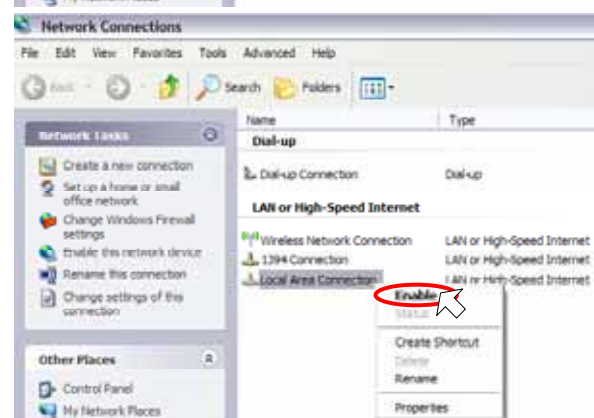
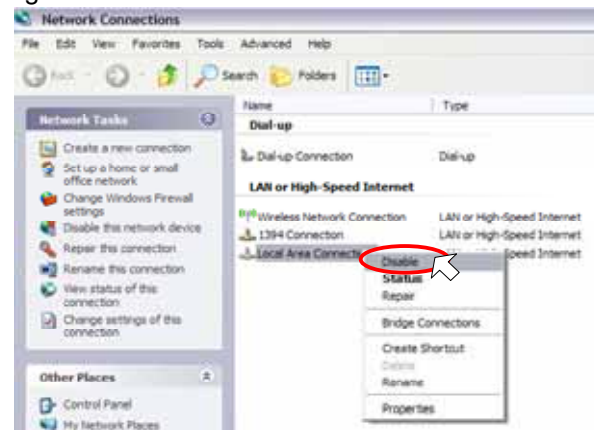
When you can't log in to the web GUI.

### Solution

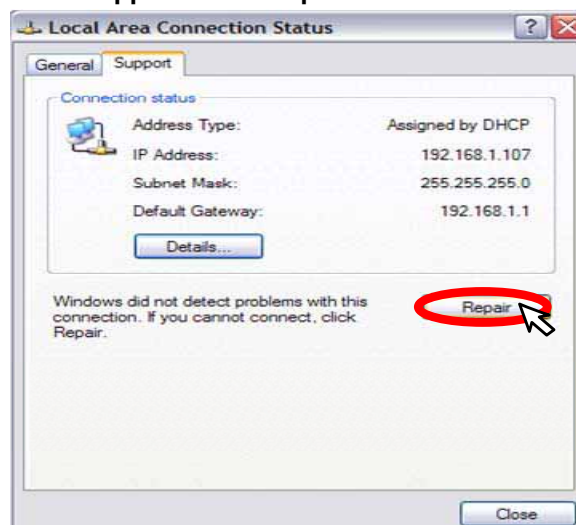
1. Click **My Network places** → **View network connections**. Right-click on the **Wireless Network Connection** and then click **Disable**.



2. Right-click on the **Local Area Connection** and then click **Disable**. After clicking **Disable**, click **Enable** again.



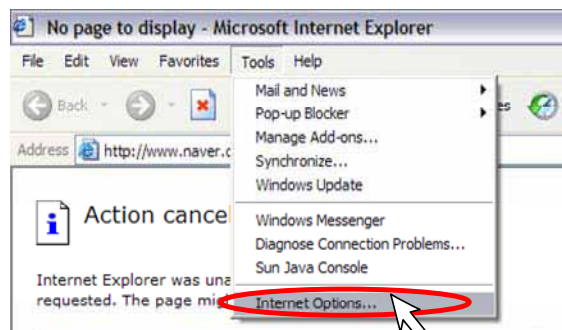
3. Double click the **Local Area Connection** and then click the **Support** tab → **Repair**.



## Solution

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

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

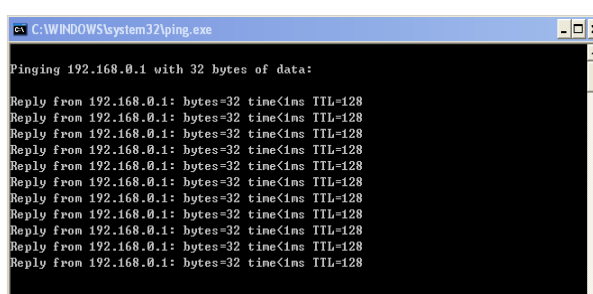
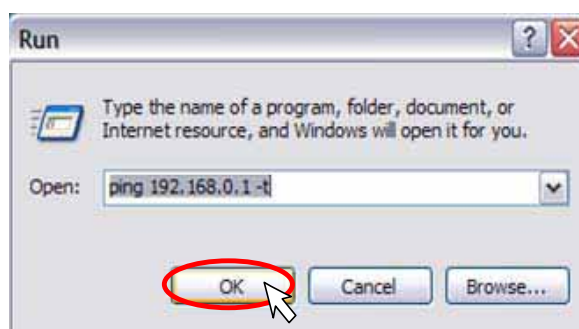


Please try the following:



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                    |             | iDEN 800M+900M Band                                                         |                          |                                                                             | Remark                   |                                        |
|                              |             | TX(Down-Link)                                                               | TX(Down-Link)            | RX(Up-Link)                                                                 |                          | RX(Up-Link)                            |
| Frequency Range              |             | 851 - 869 MHz<br>(18M B.W)                                                  | 935 ~ 940MHz<br>(5M B.W) | 806 - 824 MHz<br>(18M B.W)                                                  | 896 ~ 901MHz<br>(5M B.W) |                                        |
| Service                      |             | iDEN or LTE(FDD) Service                                                    |                          | iDEN or LTE(FDD) Service                                                    |                          |                                        |
| Band Select                  |             | BW 800M (1~18MHz), 900M(1~5MHz)<br>Non-continuous 3 Band                    |                          | BW 800M (1~18MHz), 900M(1~5MHz)<br>Non-continuous 3 Band                    |                          | BW : 1~18MHz<br>Frequency Step : 25kHz |
| Input Power Range            |             | -55 ~ -25 dBm                                                               |                          | -55 ~ -25 dBm                                                               |                          |                                        |
| Max Input Range              |             | -20dBm                                                                      |                          | -20dBm                                                                      |                          |                                        |
| Composite Output Power Range |             | +30dBm                                                                      |                          | +30dBm                                                                      |                          |                                        |
| Gain Range                   |             | 55 ~ 85 dB                                                                  |                          | 55 ~ 85 dB                                                                  |                          |                                        |
| AGC                          | Range       | 30 dB / 0.5dB Step                                                          |                          | 30 dB / 0.5dB Step                                                          |                          |                                        |
|                              | Time        | The AGC must track only slow variations<br>with time on the order of 100ms. |                          | The AGC must track only slow variations<br>with time on the order of 100ms. |                          | AGC Range : -80 ~ -20dBm               |
| Gain Ripple                  |             | ± 1.5 dB                                                                    |                          | ± 1.5 dB                                                                    |                          |                                        |
| Channel Balance              |             | ± 1.5 dB at channel power                                                   |                          | ± 1.5 dB at channel power                                                   |                          |                                        |
| Noise Figure                 | Max Gain    | ≤5 dB                                                                       |                          | ≤5 dB                                                                       |                          |                                        |
|                              | Min Gain    | -                                                                           |                          | ≤12 dB                                                                      |                          |                                        |
| Roll-off                     | High Reject | 65dBc at ± 0.5 MHz from band edge                                           |                          | 65dBc at ± 0.5 MHz from band edge                                           |                          | iDEN                                   |
|                              | Low Delay   | 50dBc at ± 1 MHz from band edge                                             |                          | 50dBc at ± 1 MHz from band edge                                             |                          | PCS & LTE                              |
| Propagation Delay            | High Reject | < 8 μs                                                                      |                          | < 8 μs                                                                      |                          | iDEN                                   |
|                              | Low Delay   | < 5.5 μs                                                                    |                          | < 5.5 μs                                                                    |                          | PCS & LTE                              |
| ACP                          | 25kHz       | ≤-50dBc                                                                     |                          | ≤-50dBc                                                                     |                          | iDEN                                   |
|                              | 50kHz       | ≤-55dBc                                                                     |                          | ≤-55dBc                                                                     |                          |                                        |
|                              | 500kHz      | ≤-55dBc                                                                     |                          | ≤-55dBc                                                                     |                          |                                        |
|                              | 1MHz        | ≤-55dBc                                                                     |                          | ≤-55dBc                                                                     |                          |                                        |
|                              | 2MHz        | ≤-55dBc                                                                     |                          | ≤-55dBc                                                                     |                          |                                        |
| Spurious Emission            |             | >FCC requirements                                                           |                          | >FCC requirements                                                           |                          |                                        |
| Return Loss                  |             | > 15dB                                                                      |                          | > 15dB                                                                      |                          |                                        |
| Power Detect                 | Input       | -75 ~ -15 dBm                                                               |                          | -75 ~ -15 dBm                                                               |                          |                                        |
|                              | Output      | -10 ~ +40 dBm                                                               |                          | -10 ~ +40 dBm                                                               |                          |                                        |
| Impedance                    |             | 50Ω                                                                         |                          | 50Ω                                                                         |                          |                                        |

## 7.2 Environmental Specification

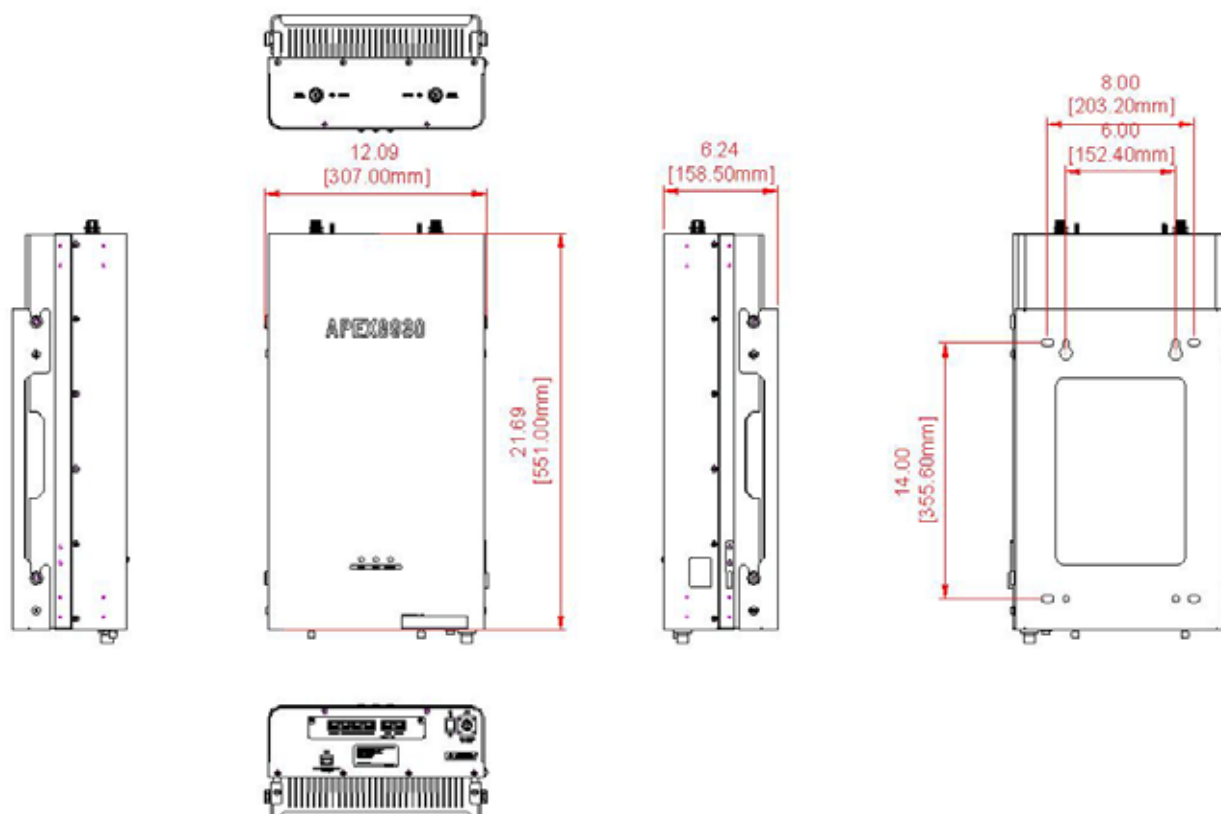
| Parameter     |                | Specification           |
|---------------|----------------|-------------------------|
| Environmental | Operating Temp | -10°C~50°C (14°F~122°F) |
|               | Humidity       | 20%~90%RH               |
|               | Cooling method | Convection.             |

## 7.3 Electrical Specification

| Parameter | Specification    |
|-----------|------------------|
| Voltage   | AC 85-264V       |
| Current   | +24V/7.5A (150W) |
| Frequency | 50/60(47-63)     |

## 7.4 Mechanical Specification

| Parameter          | Specifications                                    | Remark    |
|--------------------|---------------------------------------------------|-----------|
| RF connectors      | N-female x 2                                      |           |
| Dimensions (WxHxD) | 12.09 * 21.69 * 6.24 inch<br>307 * 551 * 158.5 mm | W * D * H |
| Weight             | 50.71 lb<br>23 Kg max                             |           |



## 8. Appendix

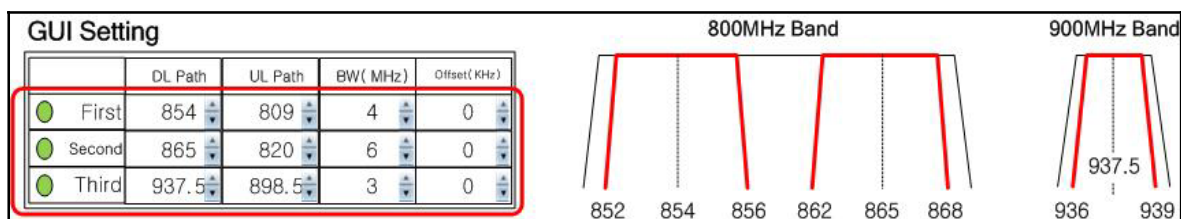
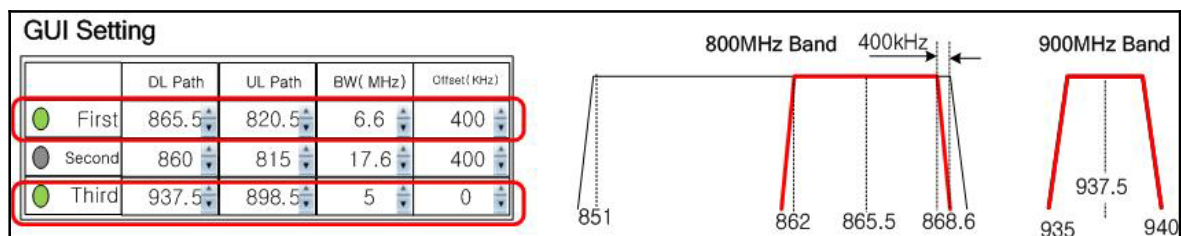
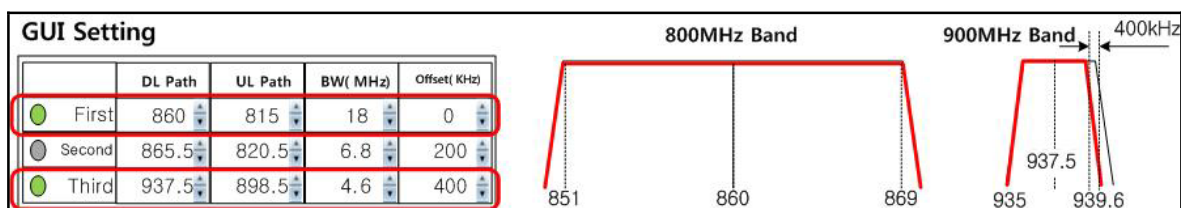
### 8.1 iDEN Channel

#### Frequency Information ( iDEN )

| Select Band & BW |           | Down(Donor) Link |             |            | Up(Server) Link |             |            | Offset (kHz) | Remark                   |
|------------------|-----------|------------------|-------------|------------|-----------------|-------------|------------|--------------|--------------------------|
| Band             | B.W (MHz) | Center (MHz)     | Start (MHz) | Stop (MHz) | Center (MHz)    | Start (MHz) | Stop (MHz) |              |                          |
| 800              | 18        | 860              | 851         | 869        | 815             | 806         | 824        | 0            | 1~18MHz<br>25kHz<br>Step |
|                  | 17.8      | 860              | 851         | 868.8      | 815             | 806         | 823.8      | 200          |                          |
|                  | 17.6      | 860              | 851         | 868.6      | 815             | 806         | 823.6      | 400          |                          |
|                  | 7         | 865.5            | 862         | 869        | 820.5           | 817         | 824        | 0            |                          |
|                  | 6.8       | 865.5            | 862         | 868.8      | 820.5           | 817         | 823.8      | 200          |                          |
|                  | 6.6       | 865.5            | 862         | 868.6      | 820.5           | 817         | 823.6      | 400          |                          |
| 900              | 5         | 937.5            | 935         | 940        | 898.5           | 896         | 901        | 0            | 1~5MHz<br>25kHz<br>Step  |
|                  | 4.8       | 937.5            | 935         | 939.8      | 898.5           | 896         | 900.8      | 200          |                          |
|                  | 4.6       | 937.5            | 935         | 939.6      | 898.5           | 896         | 900.6      | 400          |                          |

#### Frequency Information ( User Setting )

| Select Band & BW |           | Down(Donor) Link |             |            | Up(Server) Link |             |            | Offset (kHz) | Remark        |
|------------------|-----------|------------------|-------------|------------|-----------------|-------------|------------|--------------|---------------|
| Band             | B.W (MHz) | Center (MHz)     | Start (MHz) | Stop (MHz) | Center (MHz)    | Start (MHz) | Stop (MHz) |              |               |
| 800              | 1~18      | 860              | 851         | 869        | 815             | 806         | 824        | 0~1000       | 25kHz<br>Step |
| 900              | 1~5       | 937.5            | 935         | 940        | 898.5           | 896         | 901        |              |               |



## 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 a 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.

