WiMAX-23

RSN-WiMAX-23 L/H

User's Manual

R·tion

Please read this manual before operating this product.

After you finish reading this manual, store it in a safe place for future reference.

Warning !

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

Note !

This unit was tested with shielded cables on the peripheral devices.
Shielded cables must be used with the unit to insure compliance.

Important !

To comply with RF exposure requirement, the antenna must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

⚠ **CAUTION**

This equipment is indoor use and all the communication

Notice

Trademark

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

Other products and company names mentioned here in this manual might be trademarks or trade names of their respective owners.

Copyright

Notice

This document describes the specifications, installation, and operation of the WiMAX 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

Address: R-tron Inc. 6402 College Boulevard, Overland Park, KS 66211

Phone: +1-913-344-9977, 1-888-31R-TRON

Fax: +1-913-344-9988

e-mail: info@r-tronamerica.com

Website: www.rtronamerica.com

Safety Precautions

Warning ⚠

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

Warning ⚠

Connect the equipment frame ground to the building ground.

Warning ⚠

Operating the WiMAX 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

Caution ⚠

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

Contents

Glossary

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

Abbreviation	Definition
AC	Alternating Current
ANT	Antenna
ATT	Attenuator / Attenuation
WiMAX	Worldwide Interoperability for Microwave Access
DC	Direct Current
DL	Downlink
GND	Grounding
GUI	Graphic User Interface
LED	Light Emitting Diode
PLL	Phase-locked loop
PSU	Power Supply Unit
RF	Radio Frequency
RSSI	Received Signal Strength Indication
TEMP	Temperature
TTG/RTG	Transmit/Receive and Receive/Transmit Transition Gaps
UL	Uplink
VSWR	Voltage Standing Wave Ratio

ALC (Automatic Level Control)
ALC feature prevents the repeater from exceeding its maximum output power by reducing the gain automatically. ALC is used to adjust the gain to an appropriate level for a range of input signal levels.

ASD (Automatic Shutdown)
Automatic shut down protects the repeater from the oscillation or excessive input signal and eliminates any degradation to the network.

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

If the output power gets higher than "**ASD LEVEL**", the repeater will shut down for "**ASD TIME**" seconds and then it will turn the amp back on to measure the output power again. If this repeats at "Iteration" times, the repeater will shut down completely.

1. Introduction

WiMAX repeaters are used to fill out areas in the WiMAX mobile systems, such as base station fringe areas, business and industrial buildings, etc.

WiMAX repeaters receive signals from a base station, amplify and retransmit 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

---

A. RSN-WiMAX-23

◆ Band Select

>> designated low and high segment Bandwidth [Low: AB, BC, CD / High: EF, FH, HG]

◆ Easy and Quick Installation

>> Web-based GUI

>> Plug and Play – DHCP Server @ Local Port an DHCP Client

>> Easy Setup(Automatic)

>> Real Time Isolation Detection

◆ Auto Level Control & Auto Shut Down

- This repeater allows the Web Server and Web GUI to communicate with a PC, except for the function of reporting through the radio network. There is only one physical RJ-45 port:

• The local port provides an on-site access to the repeater.
- DHCP server at the local port enables Plug and Play by automatically assigning the IP address to the user's computer
- Parameter setup is only a Power ON away

• Main features of Easy Setup is to set up the output power level along the each time segment of DL/UL path gain after receiving a sync signal from an input signal. Until it is synchronized, it does not progress to the next step where it will measure the isolation and limit the maximum gain accordingly. This will also enable Auto Level Control as well as Auto Shut Down. These two features are strongly recommended to prevent uncontrolled power output, which could have an adverse impact on the RF network and the repeater. For example, ALC will automatically apply attenuation when the input signal strength is increased due to the new base station deployment near the repeater site
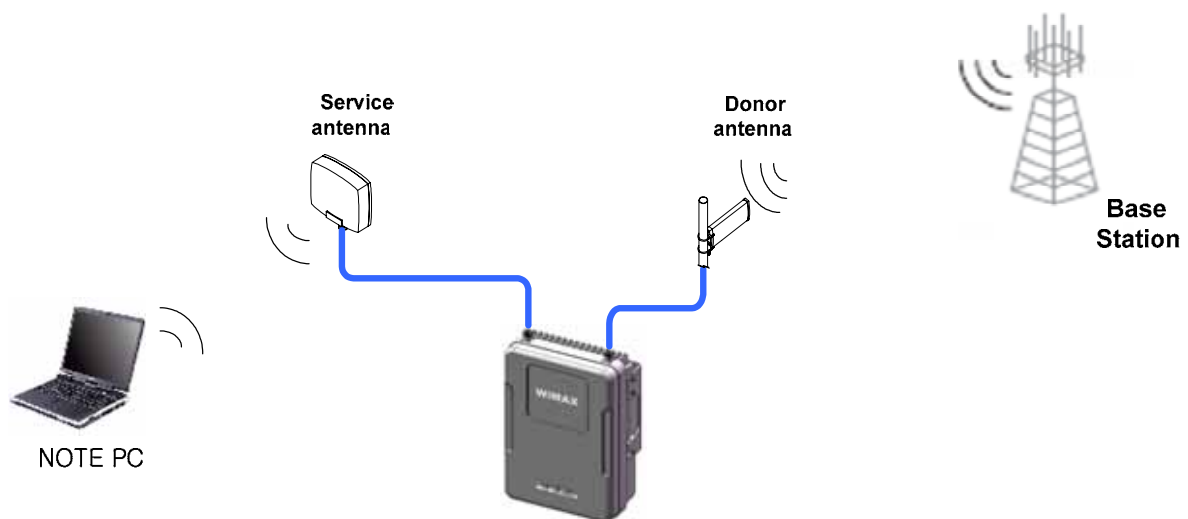
2. Description

2.1 Main Unit Overview

Sever Antenna Port   Donor Antenna Port

UL Gain Ctrl

Shutdown LED

Alarm LED

Power LED

Local Access Port

Ground Contact   Power On/Off Switch   DC Input Jack

1. Ground Contact: Connects the repeater frame ground to the building ground.

2. DC In: DC power Jack.

3. Server Antenna Port: Connects the server antenna

4. Donor Antenna Port: Connects the donor antenna.

5. Alarm LED: When the On-site Alarm occurs, the LED turns on. When it operates normally, the green LED turns on.

6. UL Gain Ctrl: To control only the UL Path gain through a simple switch combination.

7. Power On/Off S/W: Inputting Power On/Off.

8. Local Access Port: To monitor & control through the UTP LAN Cable and PC, and connect to the WEB GUI.

9. DC Input Jack: External AC-DC Adaptor Input Port.

2.2 Internal Configuration

MCU
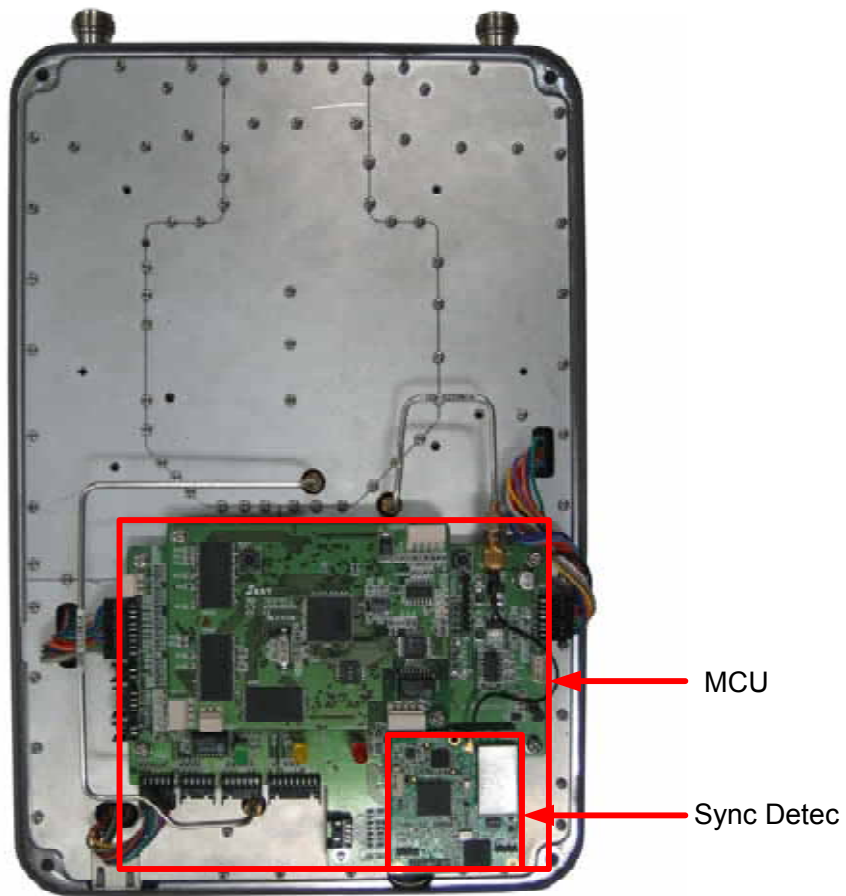
Sync Detec

1. MCU (Main Control Unit)
2. Sync Detec

2.2.1 Block Diagram

The following diagram explains how the WiMAX repeater amplifies the signal.
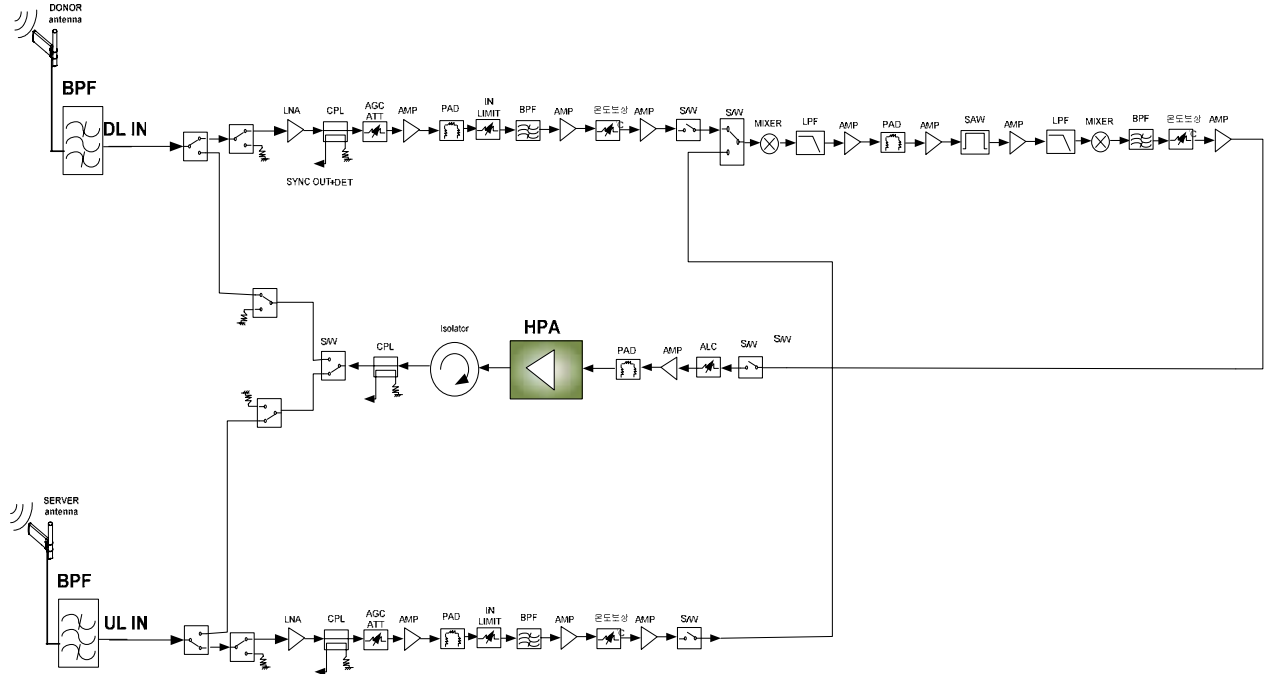
2.2.2 AC-DC Adaptor

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

Specification

Item		Specification
Environmental	Operating Temp	-0˚C~40˚C (32˚F~104˚F)
	Humidity	20%~90%RH
	Cooling method	Convection.
Voltage		AC110~240V
Current		+12V/6.67A
Frequency		40~63Hz typical
Input Current		0.25mA max.@ 254Vzc/50Hz

2.2.3 MCU (Main Control Unit)

The MCU (Main Control Unit) is the control unit of the WiMAX repeater. It controls and monitors operational parameters. It is also responsible for generating alarms, keeping event logs and performing many other functions.
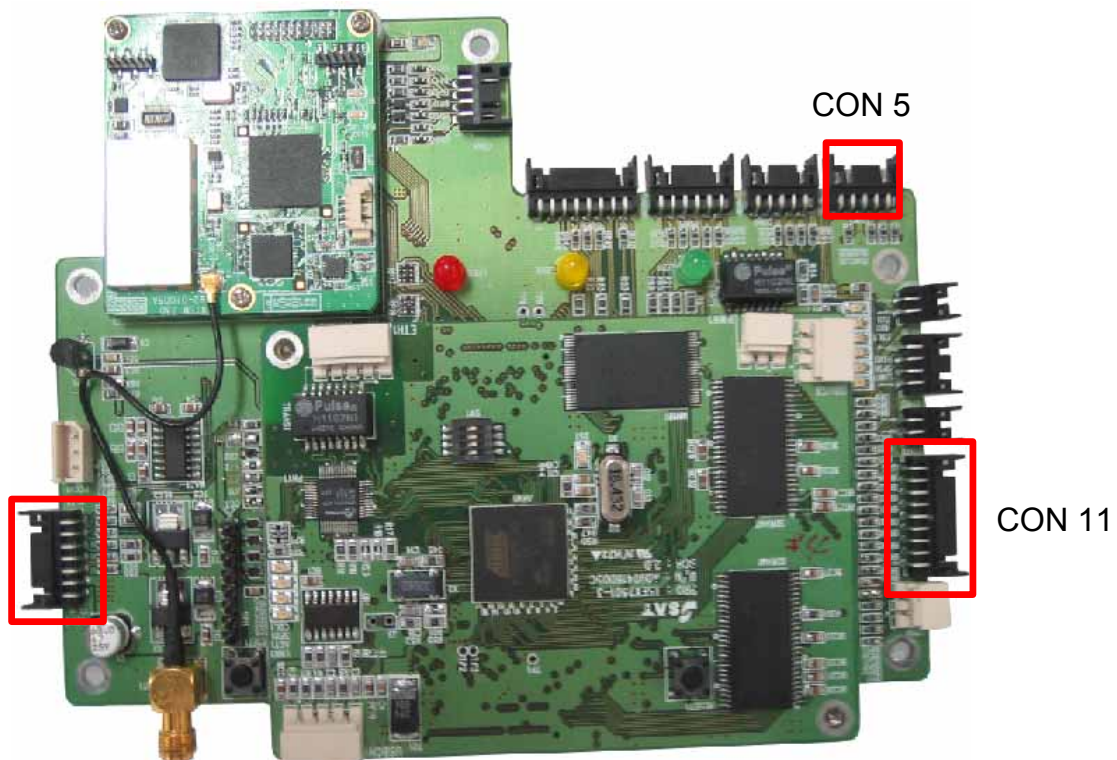
Pin Map

Port	Connected to
CON 11	RFU Control 1
CON 12	RFU Control 2
CON 5	Ethernet

3. Hardware Installation

The installation procedure is as follows:

• Check List of Items

• Mounting

• Grounding

• RF Cable Connection

• Power On

3.1 Check List of Items

Index	Items	Quantity
1	Repeater	1
2	AC-DC Adaptor	1
3	UTP Cross LAN Cable	1
4	AC Cord	1
5	Anchor Bolts	4
6	CD of the User's Manual	1
7	Quick Guide	1

Item Figure

Repeater   **AC- DC Adaptor**   **UTP Cross LAN Cable**

AC Cord   **Anchor Bolts**   **CD of the User's Manual**   **Quick Guide**
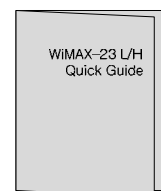
3.2 Mounting

WiMAX repeaters are easy to mount using the assembled mounting bracket, which has 4 holes for the provided 5/16″ fixing screws.

Step 1: Drill holes directly through the template.
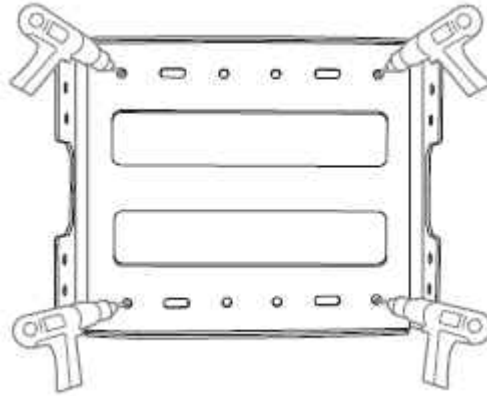
Step 2: Install the set anchor bolts or the plastic anchor bolts on the holes.
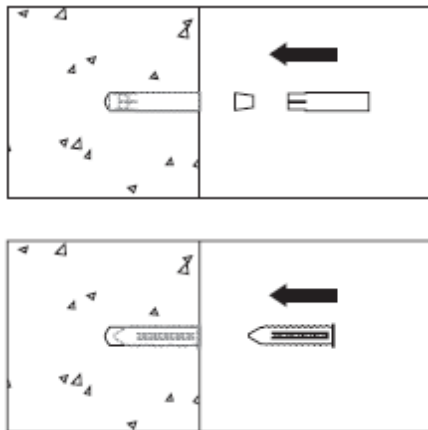
Step 3: Attach the mounting bracket to the wall using provided bolts or extra screws.
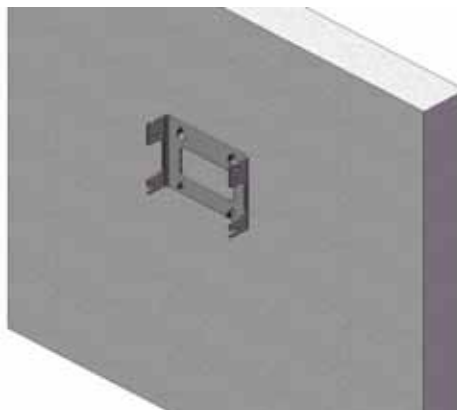
Step 4: Lean the WiMAX to hang the topside of the Guide Ring on the mounting bracket, and push toward the wall to mount.
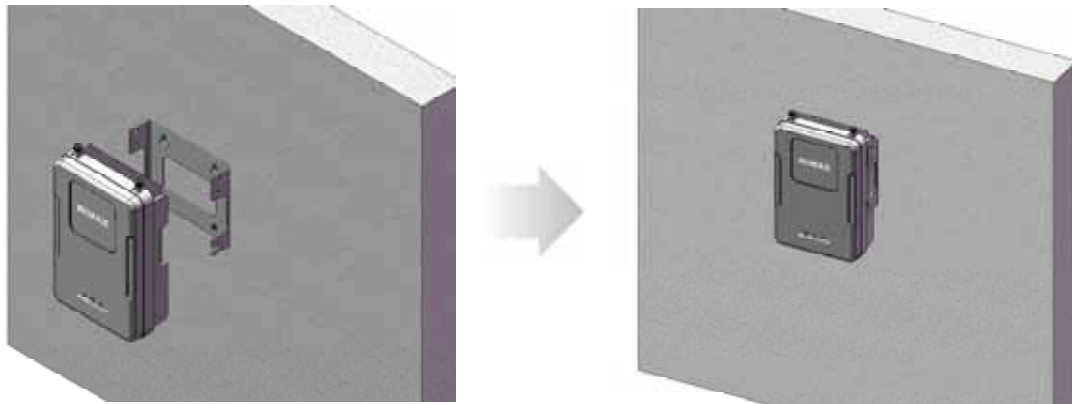
Step 5: Fix the WiMAX using the 6 screws provided.
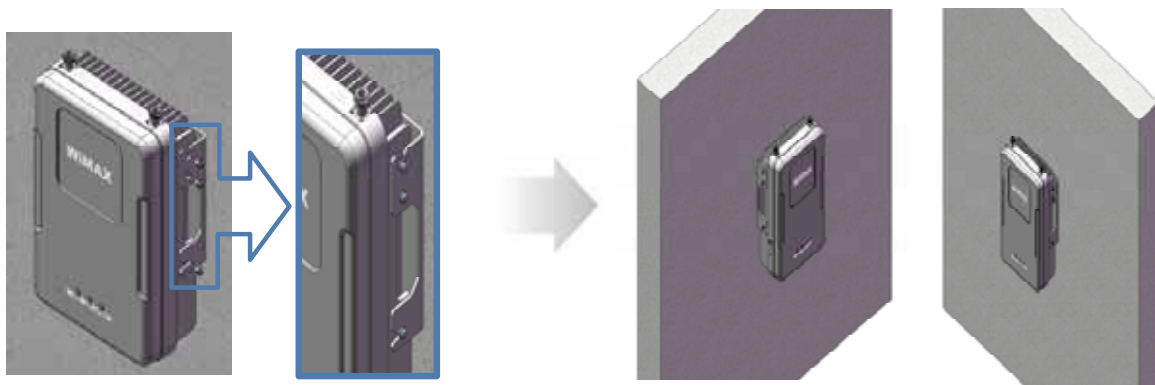
3.3 Grounding

A rod on the left side is intended for a building ground. Connect the ground cable to the rod.
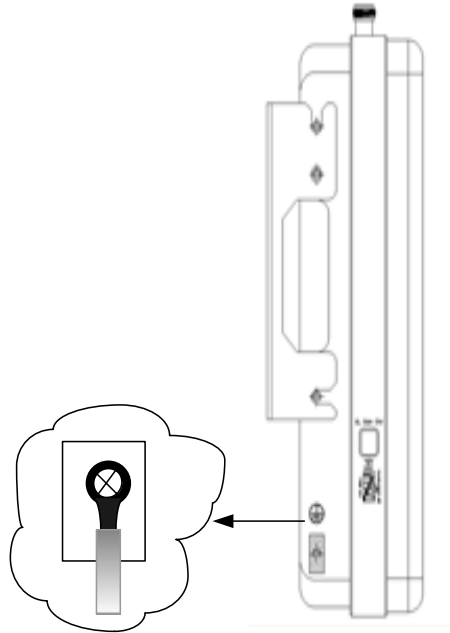
⚠️ Warning	Dangerously high voltages may occur and damage the equipment if the equipment is not grounded properly.

3.4 RF Cable Connection

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

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

⚠ **Warning** DO NOT connect or disconnect the coaxial cable while the power is on.
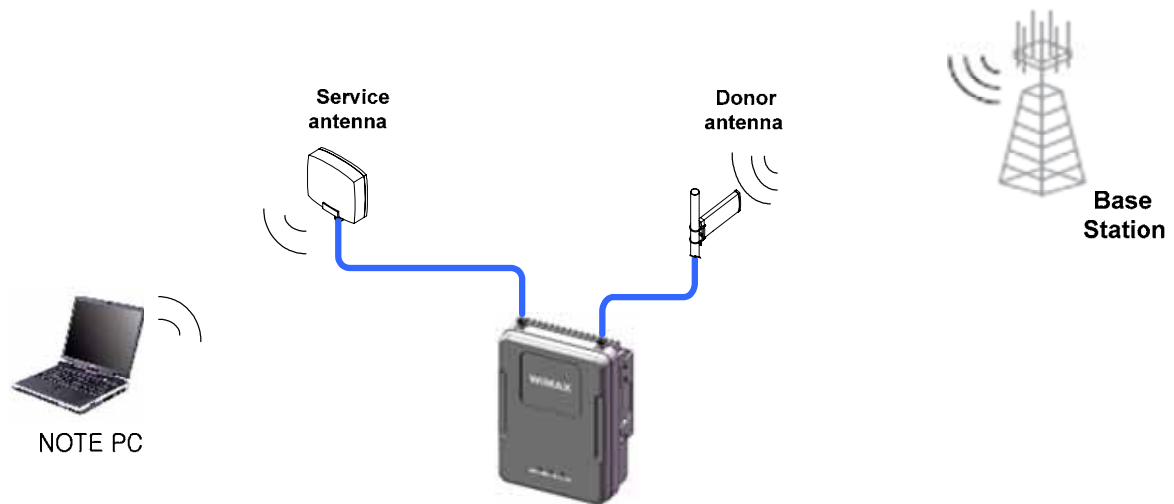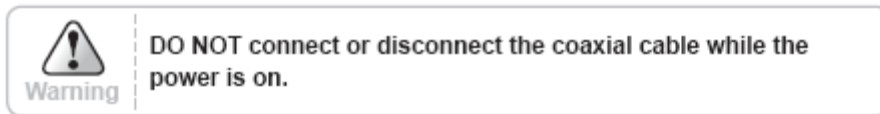
3.5 Power On

Step 1: Connect the power cord.

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

Step 3: Turn on the power switch.

This repeater follows the below set-up algorithm automatically right after the power is ON

16

WiMAX has a function where the gain can be set to a MAX value of -15dB by using an external switch combination. Refer to the following diagram in regards to the switch combination.
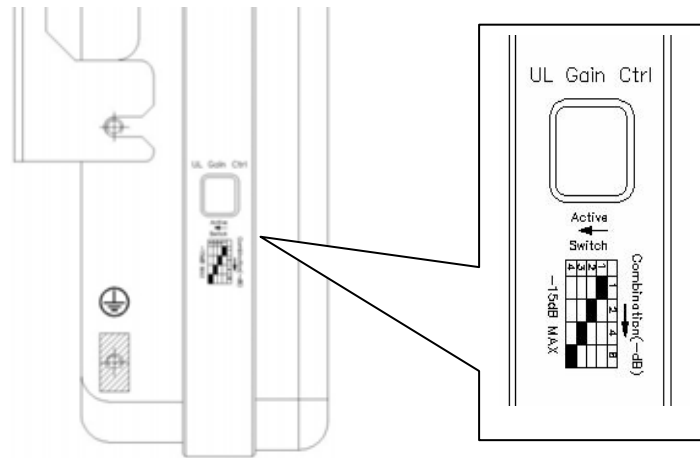
		Switch Combination			
		1	2	3	4
Attenuation Value	0dB				
	-1dB	■			
	-2dB		■		
	-3dB	■	■		
	-4dB			■	
	-5dB	■		■	
	-6dB		■	■	
	-7dB	■	■	■	
	-8dB				■
	-9dB	■			■
	-10dB		■		■
	-11dB	■	■		■
	-12dB			■	■
	-13dB	■		■	■
	-14dB		■	■	■
	-15dB	■	■	■	■

4. Operation

4.1 System Requirements

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

• Windows® 2000, Windows® XP or Windows® Vista

• Internet Explorer 6.0(Recommended) or higher

• 128 MB RAM or higher

• Pentium   processor or higher

• RJ-45 jack required

4.2 Network Setup

4.2.1 Windows XP

Step 1: Click the **Start** button and **My Network Places**.
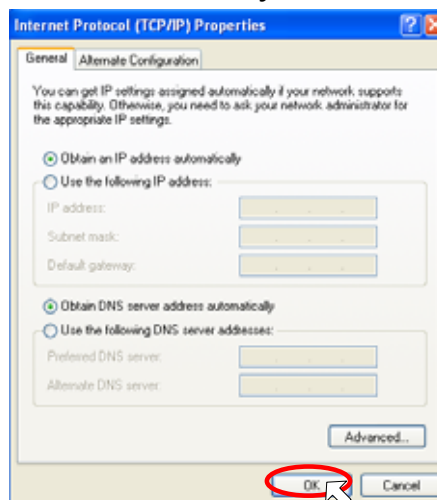

Step 2: Click **View network connections**.
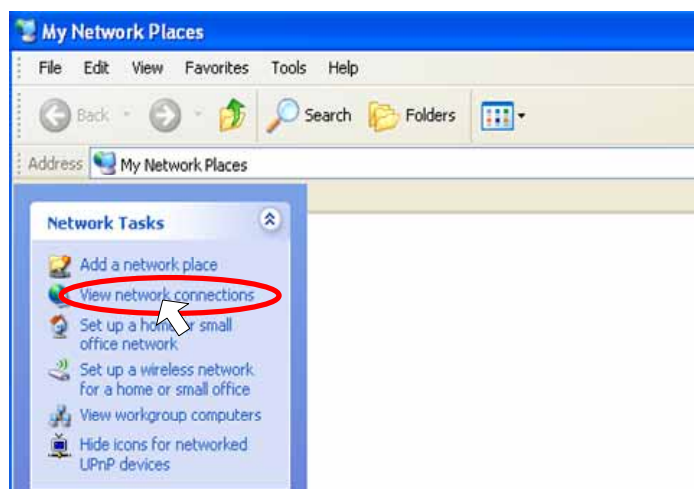
Step 3: Right-click on the **Local Area Connection** and select **Properties** to view the shortcut menu.
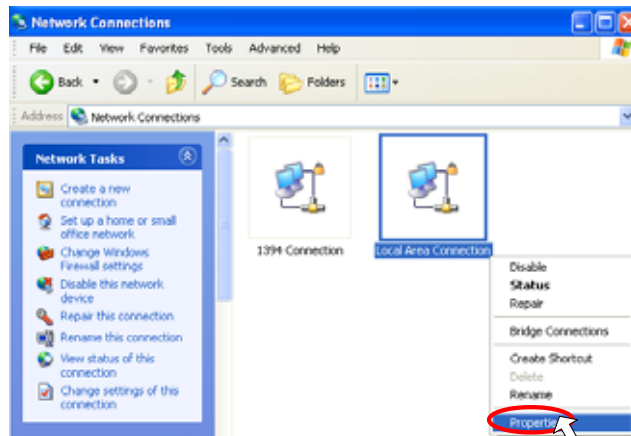
Step 4: Select **Internet Protocol (TCP/IP)** and click **Properties**.
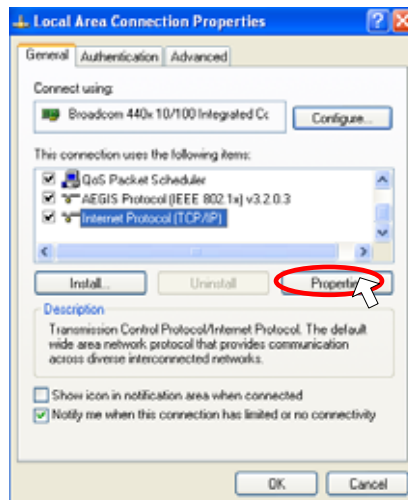
Step 5: Check **Obtain an IP address automatically** and click **OK**.
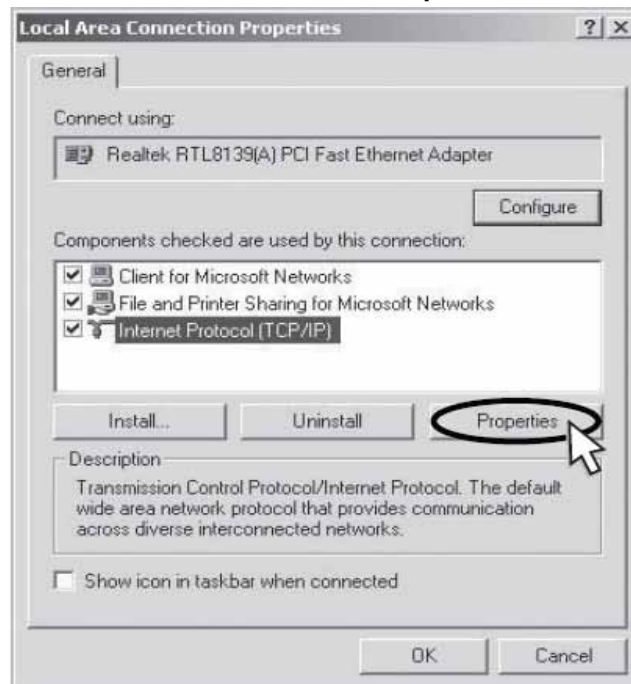

Step 6: Close all widows.

4.2.2 Windows 2000

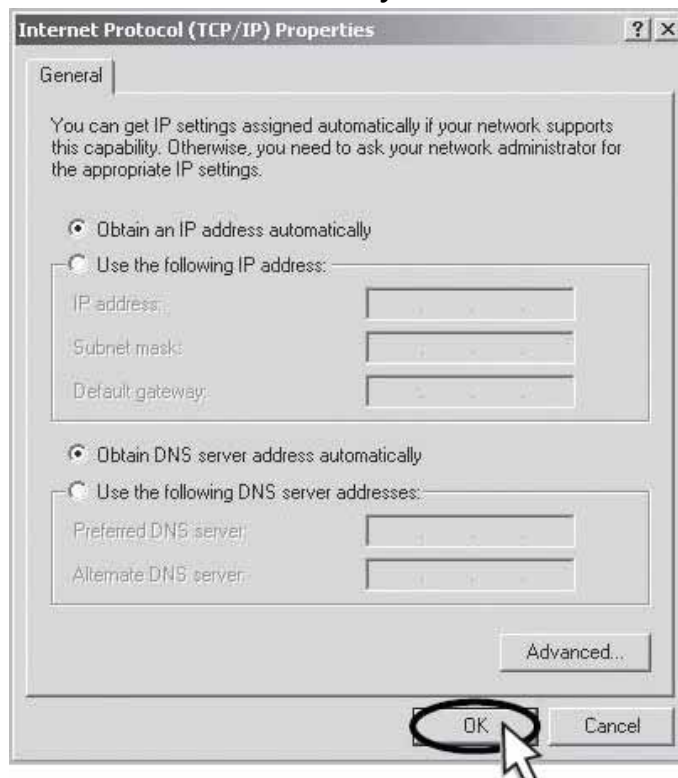Step 1: Click the **Start** button, point to Settings, and then click **Network and Dial-up Connections**.
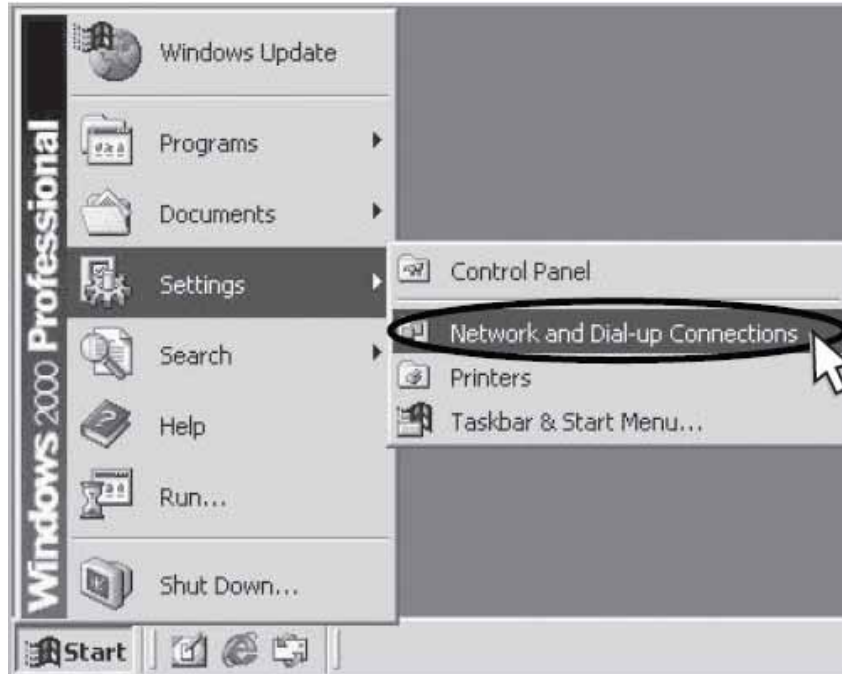
Step 2: Right-click **Local Area Connection** to see a shortcut menu and click **Properties**.
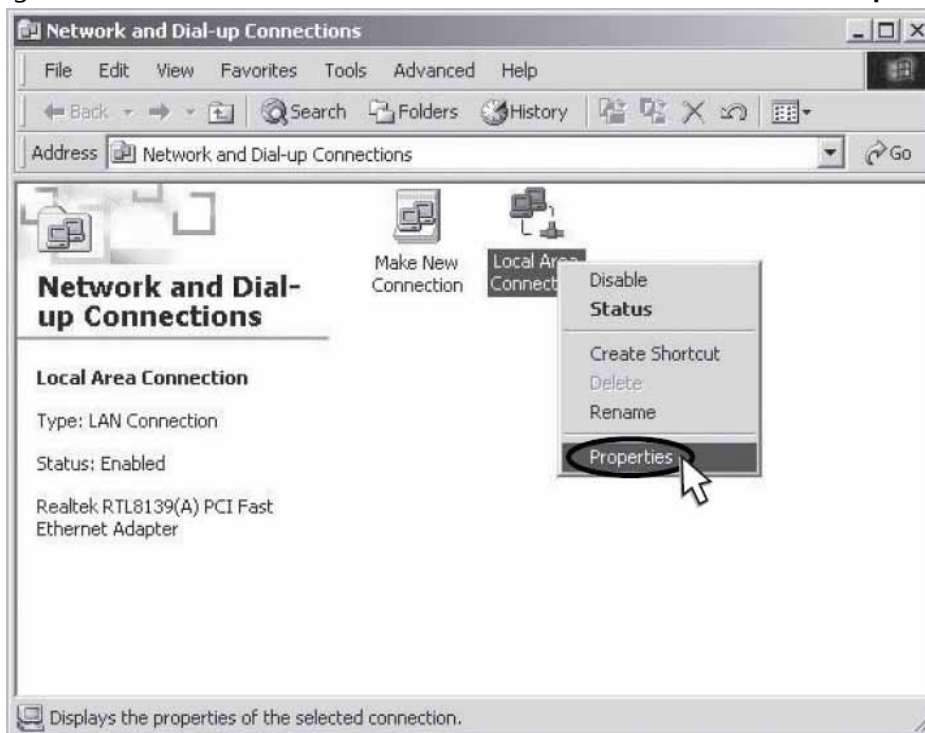
Step 3: Select **Internet Protocol (TCP/IP)** and click **Properties**.

Step 4: Check **Obtain an IP address automatically** and click **OK**.

Step 5: Close all windows.

4.2.3   Windows Vista

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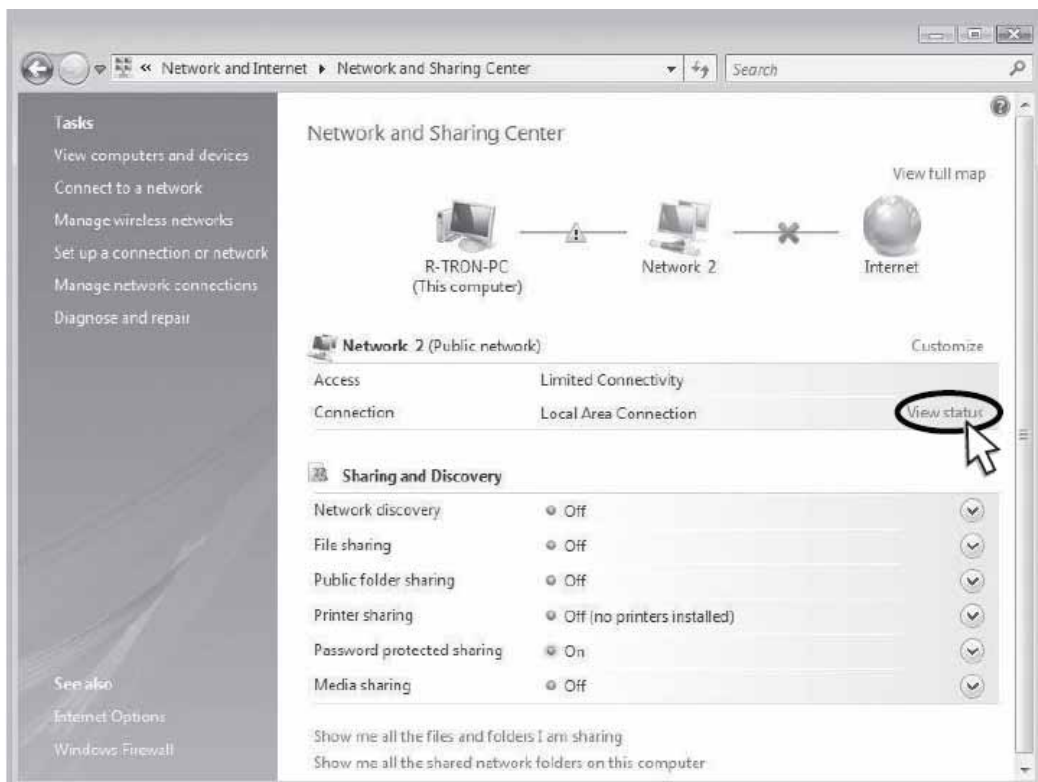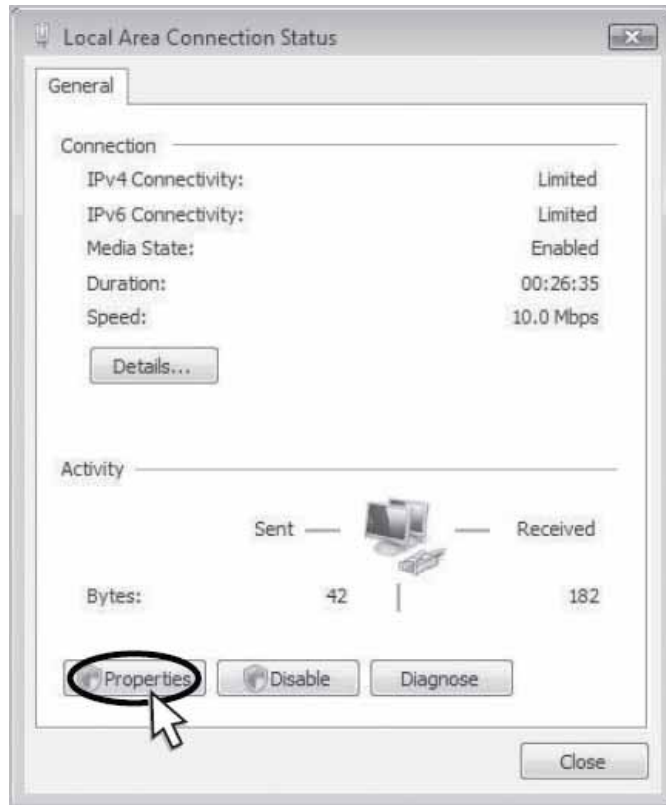

Step 2: Click **Network and Internet**.
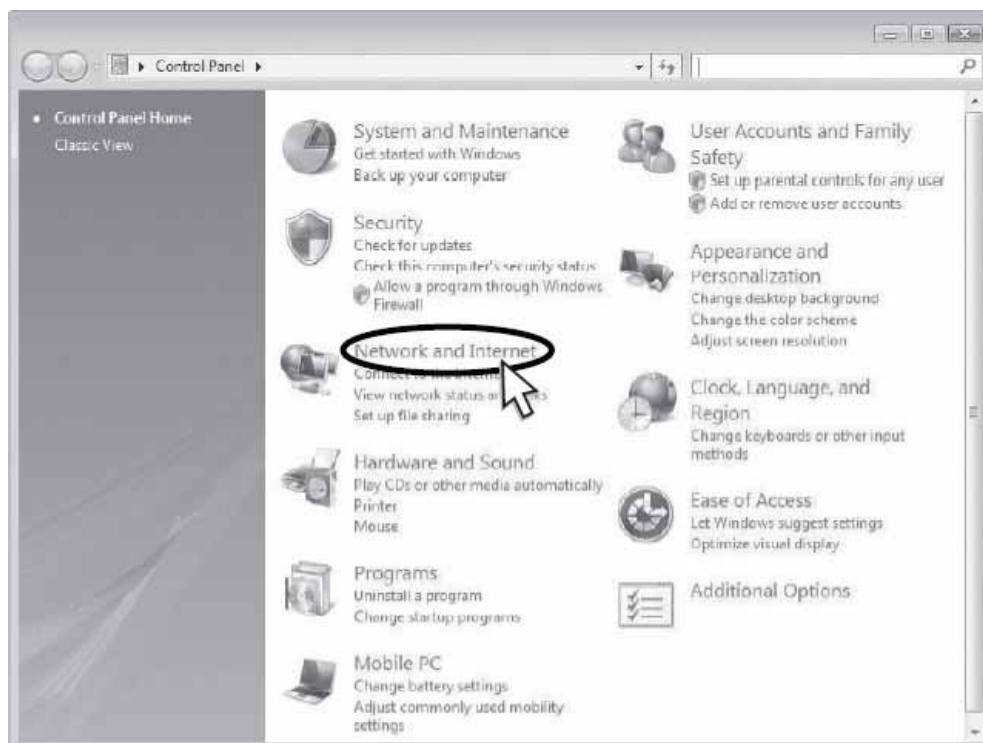
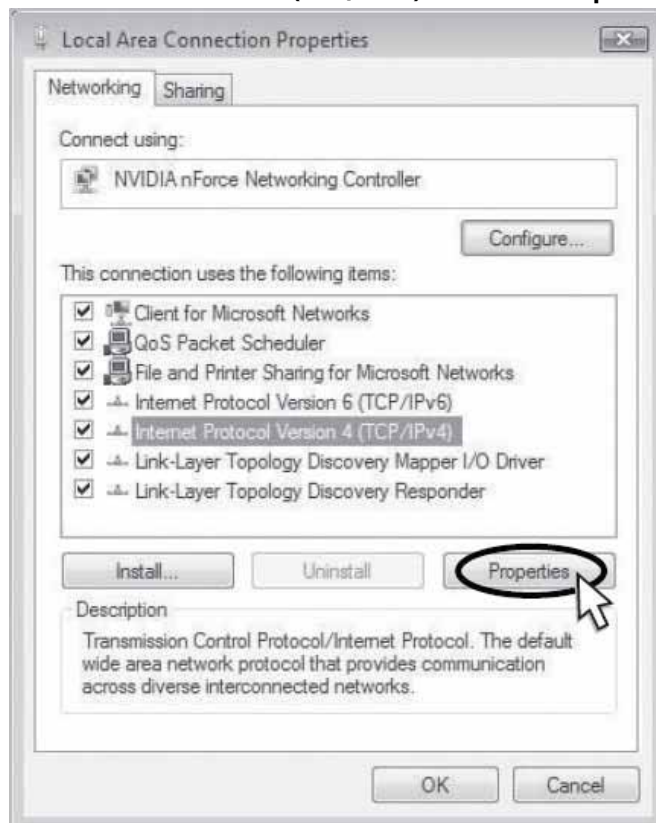Step 3: Click **Network and Sharing Center**.
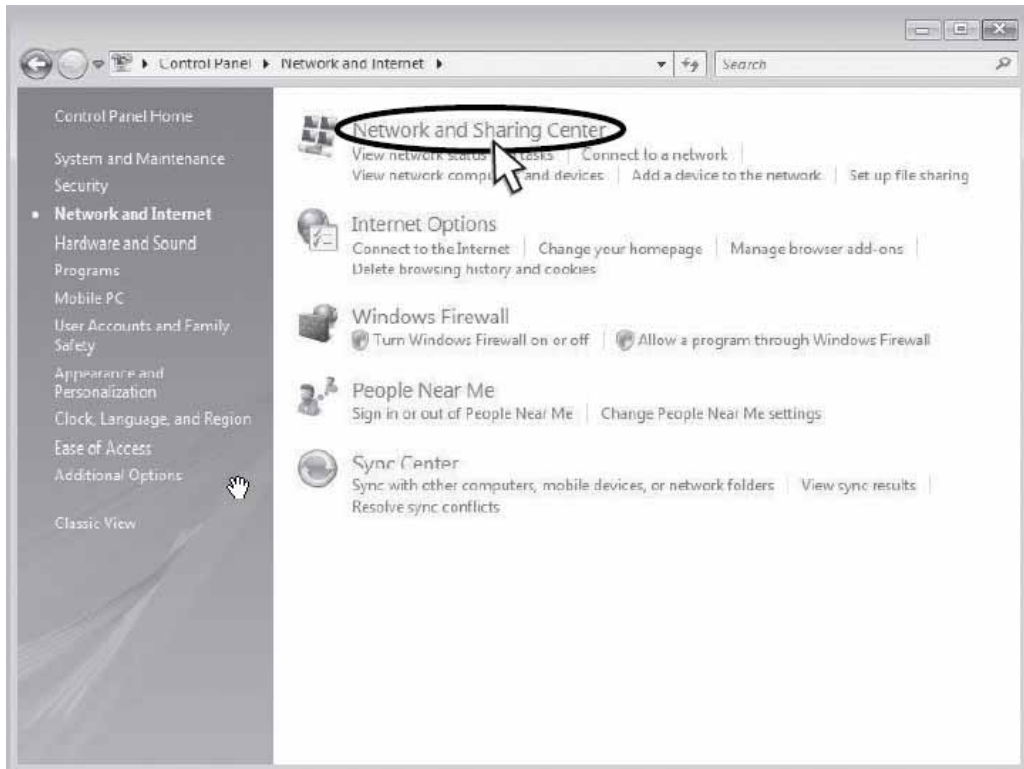
Step 4: Click **View status** of **Local Area Connection**.

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.

4.3 System Login

Open your Web browser and type "192.168.0.1" into the URL address box.
Then press the Enter key.

4.4 System Setup

4.4.1 Clock

The clock automatically sets up to the PC's time setting when you click APPLY.

4.4.2 Auto Refresh

This sentence makes no sense. You should change it to: "When you click on the Auto Refresh button, the Web GUI screen automatically updates itself every 5 seconds."

4.4.3 Control

WiMAX-23 does not need to Log-In. The user can control the repeater directly through the WEB GUI connection.

Solution 1. Easy setup [Recommended]

Step 1 Select the operating Band and click **APPLY.**

Step 2 Easy Setup

   Easy Setup proceeds to:
- ∙ Data initial execution
- ∙ Sync signal acquisition
- ∙ HPA ON
- ∙ ALC gain set
- ∙ ASD ON
- ∙ ALC ON to obtain Maximum DL Output Power 23dBm[Default] or Maximum Gain 80dB.
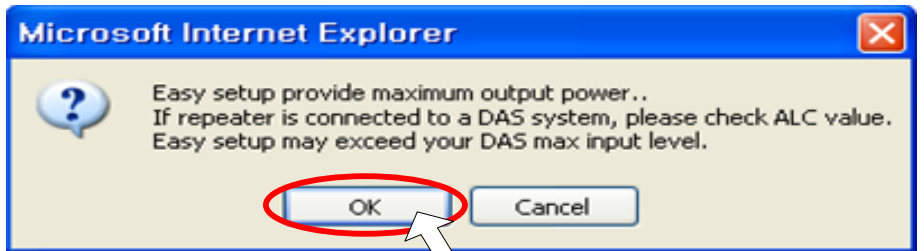- ∙ Real time isolation check

Click Automatic Easy Setup.

Easy Setup feature detects Sync signals from the input RF signal.

If the Easy Setup processor does not receive a sync signal, it does not progress any further and performs the sync signal acquisition step.

Step3 Click OK

Step 4 Setup will automatically begin. This process takes approximately 1 minute.

Result 1 Constant Maximum DL Output Power 23dBm

If the DL Input Power >= -57dBm

Result 2 Maximum Gain 95dB if the DL Input Power < -57dBm

Power Status	Downlink		Uplink	
Output Power	18.7	dBm	18.8	dBm
Input Power	-62.0	dBm	-61.9	dBm

Manual Gain Control						
Downlink	80	dB	80	[45 ~ 80]	APPLY
Uplink	80	dB	80	[45 ~ 80]	APPLY
Manual Control Status	ON			ON	OFF

Power Control					
OUTPUT ALC [Automatic Level Control]					
Output ALC Level	23	dBm	23	[8 ~ 23]	APPLY
ALC Status	ON			ON	OFF

> · **Automatic Level Control**: Type under 23 and then click **APPLY** and **ON**.
>
> This is an example case for a repeater with 23dBm maximum output power, 80dB maximum gain/35dB gain control range,
>
> → If the signal -47dBm and the ALC is set as 23dBm, the gain will be 70dB to adjust to the output power.
>
> If the input signal is -60dBm, the output power will be 20dBm by the limitation of the maximum gain even though the ALC is set as 23dBm

· **Automatic Shutdown:** Type the desired value for dBm, seconds, and times
and then Click **APPLY** and **ON**.

[Example]

A repeater with 23dBm Maximum Output Power, 80dB Maximum Gain/35dB gain control range, assuming **ASD Level: 25dBm, ASD Time, ASD Count** are already fixed at 3seconds, 10times.

If the composite output power is 25dBm(ASD Level) and higher, the repeater will shutdown for 3seconds(ASD Time). If the shutdown occurs 10times(ASD Count), the 11th shutdown will be permanent.

The repeater automatically runs Easy Setup. After that, it is activated with the re-calculated antenna isolation value.

Solution 2. DL Output Power < Max. 23dBm

Step 1A Repeat Step 1 through Step 4

Step 2A Change the level at **Automatic Level Control** and then **APPLY**

Result Constant output power set as the **ALC Level**

Solution 3. Manual Gain Setting Gain [Not Recommended]

Step 1B Repeat **Setps1** through **4**

Step 2B Read the DL Input Power and the gain controlled by the Easy Setup.

Step 3B Turn off **HPA**

Step 4B ALC must be turned off

Step 5B Change the **DL gain** and the **UL gain**
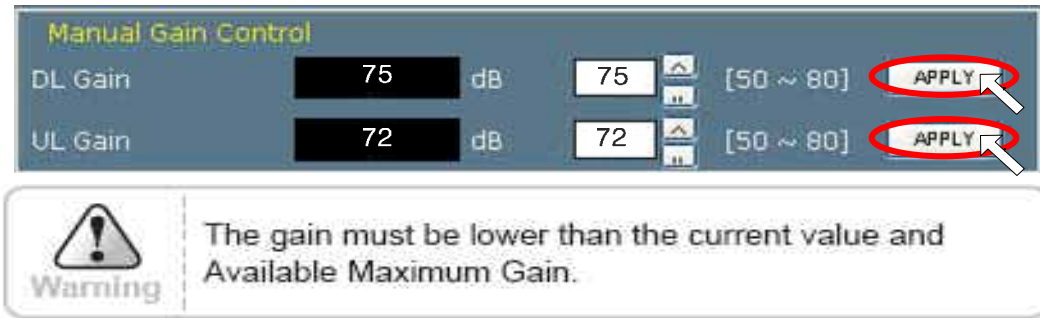
Step 6B Turn on **HPA**

Result DL and UL gain are fixed and the output power depends on the input power.

Alarms

              <Alarm Status>   <Alarm Range>
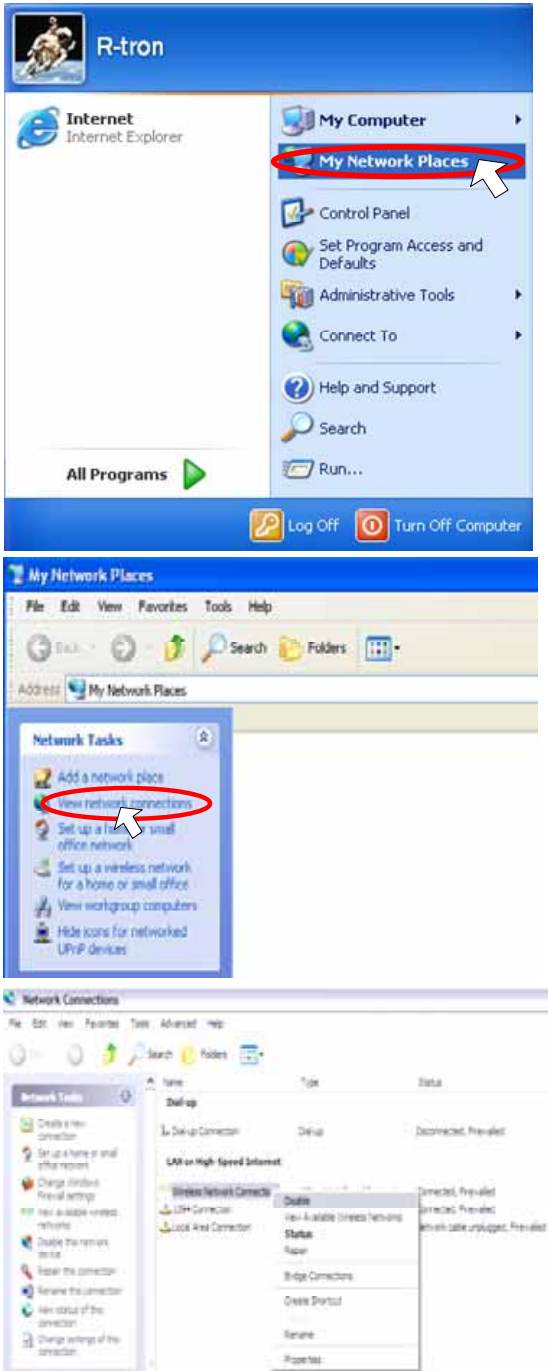
· **Alarm** : If an alarm occurs, the alarm LED on the repeater will turn on. Please refer to the troubleshooting section of this manual.

· No Change in values on the alarm range is recommended.
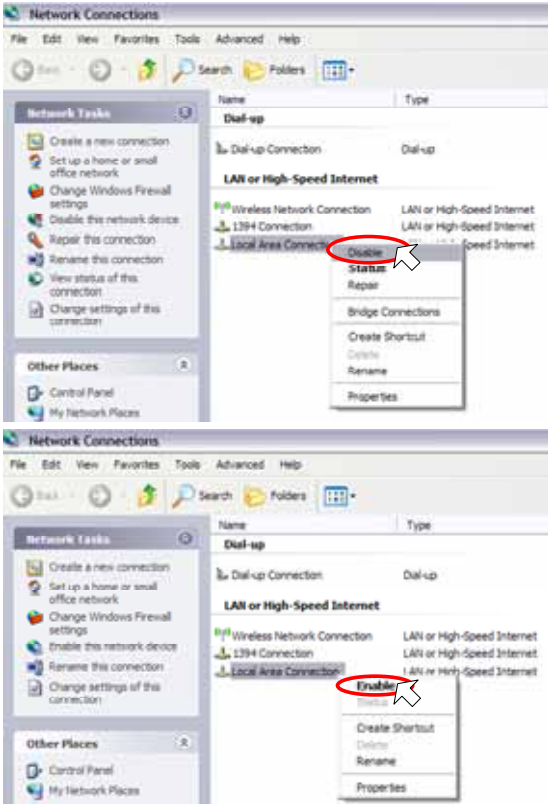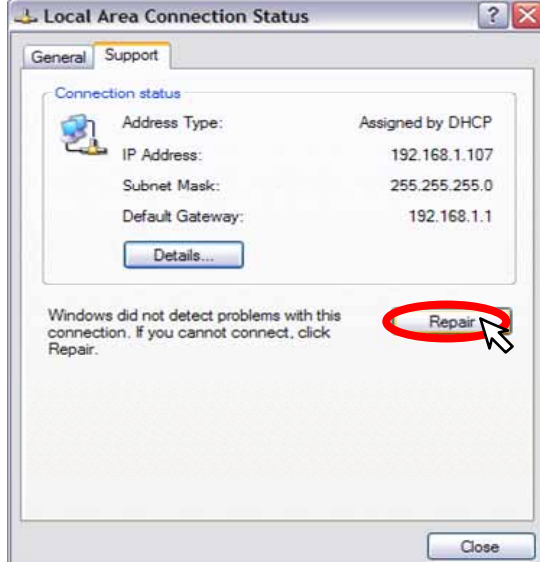
5. Troubleshooting
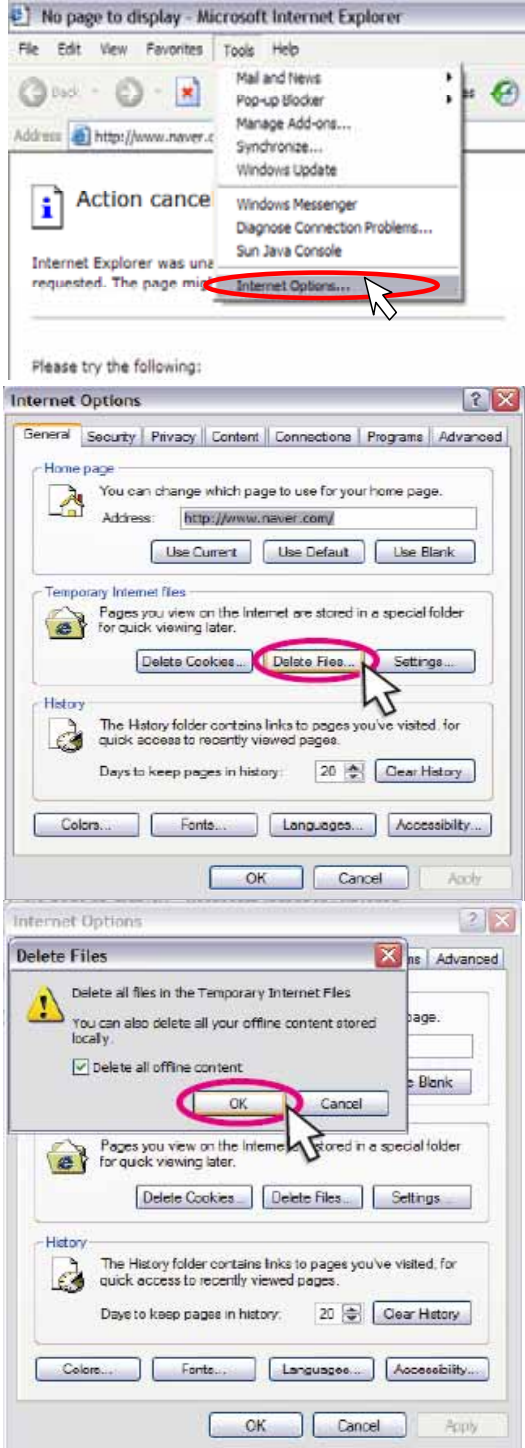
Before contacting your service dealer, please make sure you refer to the following guide. If the WiMAX repeater does not work normally after completing the following troubleshooting, please contact your local dealer or R-tron America's Tech support line (888-31R-TRON).
The alarm information is displayed by the LED lights on the repeater.
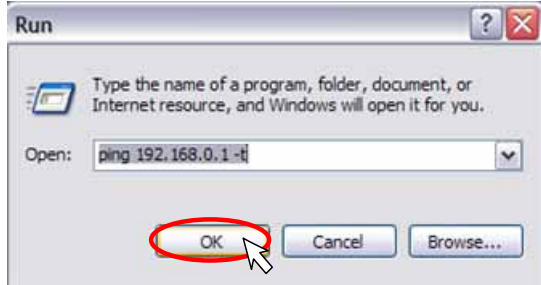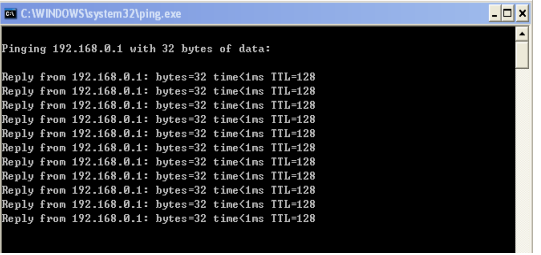
Problem	Cause	Solution
No LED on		Check the power cord for secure connection.
Alarm LED On	In/output power alarm occur and lost a sync signal	Over input, Over Output, out of sync; In case of these 3, the alarm LED is on, If the alarm is by over input or over output, the ASD algorithm is applied. If the RF environment is normal, the LED is automatically turned OFF. For Out of sync, it searches the sync for up to 1 hour when the synch is lost. After that, HPF is turned OFF. If it still searching for the sync. At this moment, the status of TDD S/W maintains DL. If the sync is obtained again, HPA is back ON and the ALARM LED is turned OFF.
Alarm LED **flickering**	Occurs at the lowest limit of output	When the alarm occurs by low input and not by the isolation ATT, it is flashing. When the output power comes back to normal, the LED is turned OFF. When the WiMAX's selected band is different from the actual service band, service is impossible.

Problem	Cause	Solution
Cannot communicate with the repeater.		1. Click **My Network places** → **View network connections.** Right-click on the **Wireless Network Connection** and then click **Disable.**

Problem	Cause	Solution
		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 **Support** tap → **Repair.**

Problem	Cause	solution
		4. Open the Internet Browser and then select **Tools → Internet Options.** Click **Delete Files** button in the Temporary Internet files section.

Problem	Cause	Solution
		5. Click **Start** and select **Run.** Type "ping 192.168.0.1-t" and click **OK.**

39

6. Specifications

RF Characteristics

Electrical Specifications			
Parameter	**Specifications**		**Remark**
	RX(Up-Link)	**TX(Down-Link)**	
Frequency Range	2502 ~ 2690MHz		188M B.W
Output Power / total	+23 dBm		
Gain	80 dB		
Gain Control Range(Input ALC)	35 dB / 1dB step		
Gain Control Range	30 dB / 1dB step		
Input Limit ALC(H/W ALC)	10 dB / 1dB step		
Noise Figure — Max/Middle. Gain	5.0 dB	5.0 dB	
Noise Figure — Min. Gain	12.0 dB	12.0 dB	
Gain Ripple	3 dB		Peak-to-Peak
ACP — Fc ± 16.5MHz	≤ -13 dBm		RBW :100kHz
ACP — Fc ± 18.5MHz	≤ -13 dBm		RBW: 1MHz
ACP — Fc ± 20MHz	≤ -37 dBm		RBW: 1MHz
ACP — Fc ± 23MHz	≤ -37 dBm		RBW: 1MHz
Spurious emission — 1850 ~ 1995 MHz	Below the noise floor		
Spurious emission — 806-826MHz and 851-869MHz	Below the noise floor		
Spurious emission — 896-901MHz and 935-940MHz	Below the noise floor		
Contiguous Capability	Fixed 30MHz only		
EVM	5%		
Frequency error	0.05ppm		
Propagation Delay	< 5 us		
Return Loss / VSWR	> 14dB / < 1.5		
RF Connector	Type-N Female		
Impedance	50Ω		

Electrical & Environmental Specification

Environment Specifications		
Parameter	**Specifications**	**Remark**
Cooling	Convection	
Operating Temperature	-10 ~ +50	
Relative Humidity	5 ~ 95%	

Mechanical Specification

Mechanical Specifications		
Parameter	**Specifications**	**Remark**
Dimensions (WxHxD)	210 x 290 x 74 mm 8.27 x 11.4 x 2.9 inch	
Weight	5Kg(11lbs)	
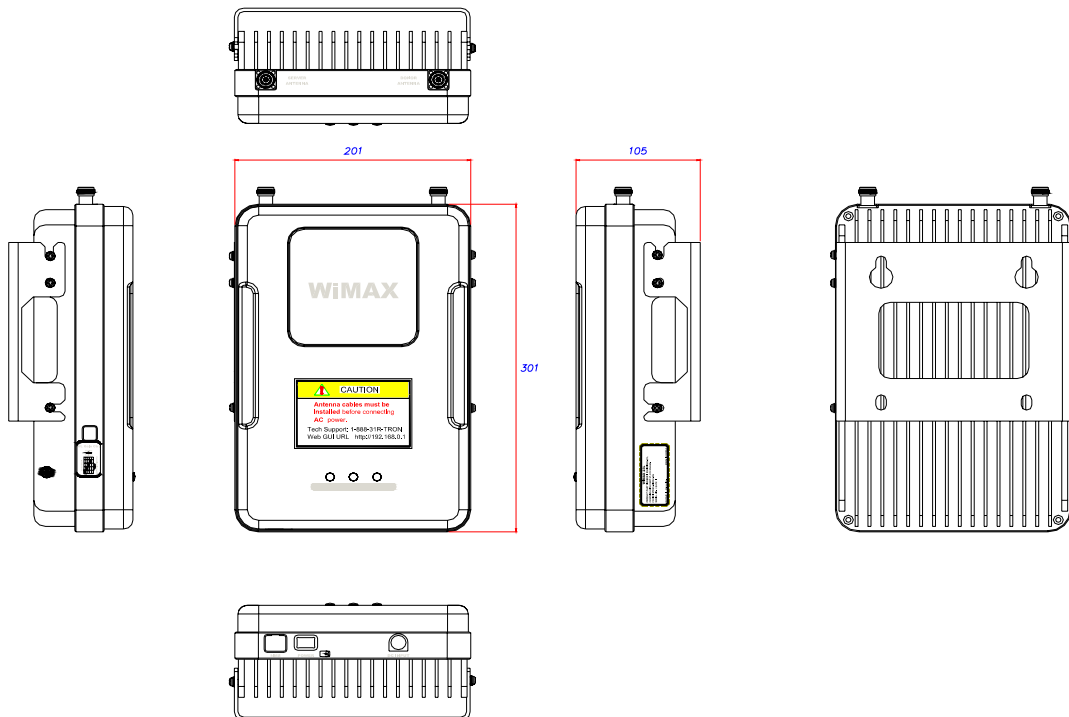
7. Appendix

WiMAX Band Frequency chart

* AB/BC/CD/EF/FH/HG Band

BRS Band	Frequency Range
Band A	2502 ~ 2518.5 MHz
Band B	2518.5 ~ 2535 MHz
Band C	2535 ~ 2551.5 MHz
Band D	2551.5 ~ 2568 MHz
Band E	2624 ~ 2640.5 MHz
Band F	2640.5 ~ 2657 MHz
Band G	2657 ~ 2673.5 MHz
Band H	2673.5 ~ 2690 MHz

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.**

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 and a return label will be provided.
4. The customer must return the product using the original packaging, including all accessories and/or parts.