User Guide

WiMAX 802.16e Indoor Gateway

RG231

User Guide

RG231

Indoor IEEE 802.16e-2005 Mobile WiMAX Gateway,
with 2.3/2.5/3.5 GHz Frequency Band Support,
Four LAN (RJ-45) Ports,
Two VoIP (RJ-11) Ports,
and 802.11n Wi-Fi

RG231
E112010-CS-R01
149100000113W

COMPLIANCES

FEDERAL COMMUNICATION COMMISSION INTERFERENCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

IMPORTANT NOTE:
FCC RADIATION EXPOSURE STATEMENT

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Due to the essential high output power nature of WiMAX devices, use of this device with other transmitters at the same time may exceed the FCC RF exposure limit and such usage must be prohibited (unless such co-transmission has been approved by FCC in the future).

EC CONFORMANCE DECLARATION CE 0560

Marking by the above symbol indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards:

- EN 60950-1 (IEC 60950-1) - Product Safety
- EN 301 489-1, EN 301 489-4, EN 302 326-2 (V1.2.2), EN 302 326-3 (V1.2.2) - EMC requirements for radio equipment

This device is intended for use in all European Community countries.

NCC 警語

Wi-Fi:

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

「本產品內含射頻模組： CCAI09LP1650T1」

WiMAX:

減少電磁波影響，請妥適使用。

About This Guide

Purpose This guide details the hardware features of the RG231 WiMAX CPE, including its physical and performance-related characteristics, and how to install the device and use its configuration software.

Audience This guide is for PC users with a working knowledge of computers. You should be familiar with Windows operating system concepts.

Conventions The following conventions are used throughout this guide to show information:

Note: Emphasizes important information or calls your attention to related features or instructions.

Caution: Alerts you to a potential hazard that could cause loss of data, or damage the system or equipment.

Warning: Alerts you to a potential hazard that could cause personal injury.

Related Publications The following publication gives basic information on how to install and use the WiMAX CPE.

Quick Installation Guide

Also, as part of the CPE's configuration software, there is online help that describes all management features.

Revision History This section summarizes the changes in each revision of this guide.

November 2010 Revision
This is the first revision of this guide. This guide is valid for software version 1.0.2.4.

CONTENTS

FIGURES

TABLES

SECTION I

GETTING STARTED

This section provides an overview of the RG231, and describes how to install and mount the unit. It also describes the basic settings required to access the management interface and run the setup Wizard.

This section includes these chapters:

1 INTRODUCTION

The RG231 WiMAX 802.16e Self-Install Residential Gateway is a WiMAX subscriber station designed to provide Internet access for a home or small office. The unit provides a gateway function between a WiMAX service provider and a local Ethernet LAN. The device enables a service provider to deliver last mile broadband wireless access as an alternative to wired DSL or cable modems.

The RG231 is a plug-and-play device. There are several available models for each of the 2.3, 2.5, and 3.5 GHz WiMAX frequency bands. Which model you use will depend on the frequency band of your service provider's WiMAX service.

The RG231 includes four RJ-45 Ethernet switch ports for LAN connections and two RJ-11 Voice over IP (VoIP) phone ports. Units also support an IEEE 802.11b/g/n Wi-Fi module that provides a local Wi-Fi access point service.

The RG231 offers a user-friendly web-based management interface for the configuration of all the unit's features. Any PC directly attached to the unit can access the management interface using a web browser, such as Internet Explorer (version 6.0 or above) or Firefox (version 1.5 or above).

RG231 HARDWARE DESCRIPTION

The front of the RG231 provides an array of system status indicators. The back includes four LAN ports for 10/100 Mbps Ethernet connections, two RJ-11 VoIP phone ports (on some models), and a DC power jack.

Figure 1: Front of the RG231

WI-FI OPTION

The RG231 includes 802.11b/g/n Wi-Fi support. The unit includes internal antennas for local wireless connections to PCs.

POWER STATUS LED

The RG231 includes a Power LED indicator that simplifies installation and WiMAX network troubleshooting. The LED, which is located on the front panel, is described in the following table.

Figure 2: RG231 LED Indicators

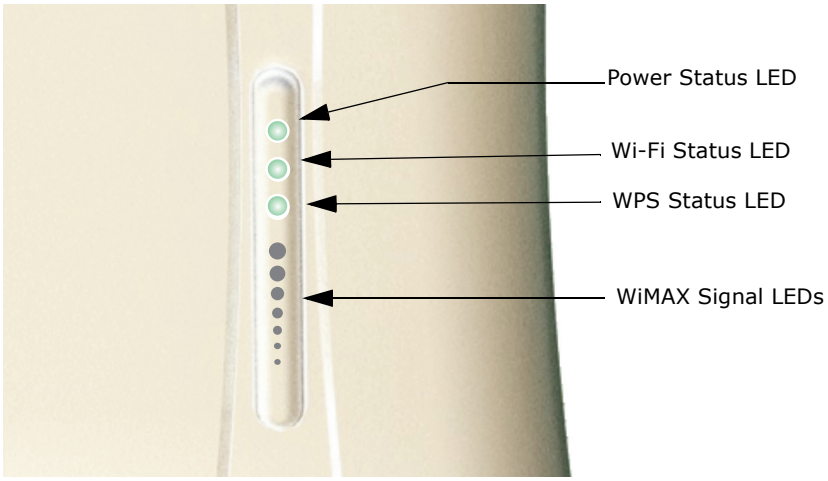


Table 1: Power Status LED

Status	Description
On Green	The unit has completed entry to a WiMAX network.
On Amber	Indicates one of the following conditions: ◆ After power on, indicates the unit is running its self test. ◆ Indicates that the network entry process is in progress or has restarted.
Blinking Amber	When blinking with three of the WiMAX signal LEDs turned on, indicates authentication has failed.
On Red	A system failure has occured.
Off	No power is being supplied to the unit.

WI-FI STATUS LED

The models that support Wi-Fi operation include a Wi-Fi LED indicator that displays the Wi-FI network status. The LED, which is located on the front panel, is described in the following table.

Table 2: Wi-Fi Status LED

Status	Description
On Green	The Wi-Fi radio is enabled and operating normally.
Flashing Green	Indicates data traffic in the Wi-Fi network.
Off	There is no Wi-Fi connection or the radio is disabled.

WPS STATUS LED

The models that support Wi-Fi operation include a WPS LED indicator that displays the status of the Wi-Fi Protected Setup. The LED, which is located on the front panel, is described in the following table.

Table 3: WPS Status LED

Status	Description
On Green	WPS authentication of a client has been sucessfully completed.
Flashing Green	WPS authentication of a client is in progress.
Off	There is no WPS authentication in progress.

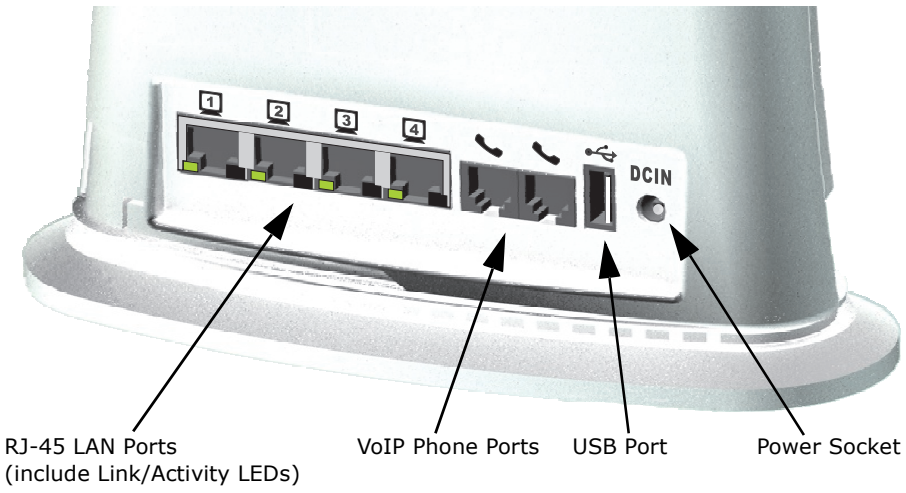
WiMAX SIGNAL LEDS

The RG231 includes seven WiMAX signal strength LED indicators that display the current WiMAX receive signal status. The LEDs, which are located on the front panel, are described in the following table.

Table 4: WiMAX Signal Status LEDs

LED	Status	Description
1	On Blue	Indicates the receive signal is 5 dB or more.
2	On Blue	Indicates the receive signal is 8 dB or more.
3	On Blue	Indicates the receive signal is 12 dB or more.
4	On Blue	Indicates the receive signal is 15 dB or more.
5	On Blue	Indicates the receive signal is 18 dB or more.
6	On Blue	Indicates the receive signal is 20 dB or more.
7	On Blue	Indicates the receive signal is 25 dB or more.
1-7 in sequence	On Blue	The unit is scanning frequency channels.
All 7 LEDs	Off	No power is being supplied to the unit.

Figure 3: Back of the RG231



10BASE-T/ 100BASE-TX LAN PORTS

The RG231 provides four 10BASE-T/100BASE-TX RJ-45 ports. These LAN ports are standard RJ-45 Ethernet network ports that connect directly to PCs. They can also be connected to an Ethernet switch or hub to support more users.

All ports support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. Each of these ports support auto-negotiation, so the optimum transmission mode (half or full duplex), and data rate (10 or 100 Mbps) is selected automatically.

Each RJ-45 port includes a built-in LED indicator. This LED indicator is described in the following table.

Table 5: LAN Port Status LEDs

LED	Status	Description
Link/Activity	On Green	Ethernet port has a valid link with an attached device.
	Flashing Green	The port is transmitting or receiving data.
	Off	Ethernet port has no link with another device.

VOIP PHONE PORTS

Some RG231 models optionally provide two RJ-11 telephone ports that connect directly to a standard (analog) telephone set. This allows a regular telephone to be used for making VoIP calls over the Internet.

USB PORT

Reserved for future use.

POWER ADAPTER SOCKET

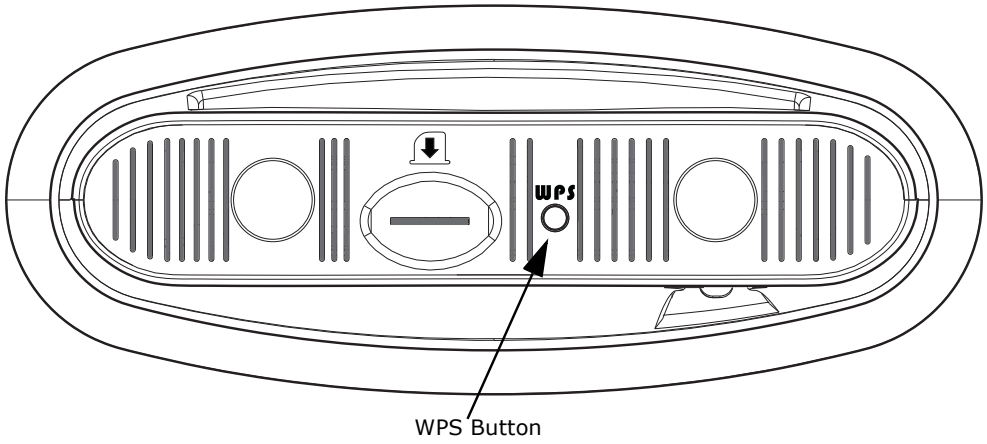
The power socket is located on the rear panel of the RG231. The power socket is for the AC power adapter connection.

The unit is powered on when connected to its AC power adapter, and the power adapter is connected to an AC power source between 100-240 volts at 50-60Hz.

WPS BUTTON

Press to automatically authenticate Wi-Fi Protected Setup (WPS) devices in the Wi-Fi network.

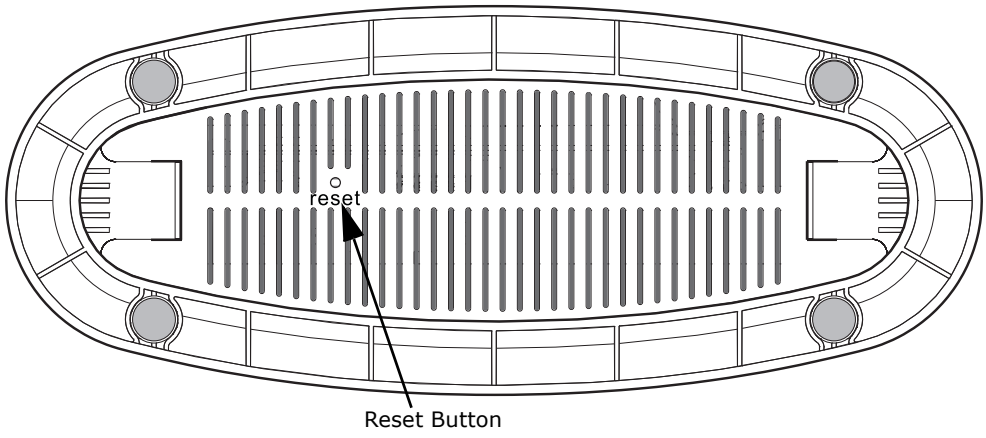
Figure 4: Top of the RG231



RESET BUTTON

The Reset button is located on the base of the RG231 and is used to reset the unit or restore the factory default configuration. If you press the button for less than 1 second, the unit will perform a hardware reset. If you press and hold down the button for 5 seconds or more, any configuration changes you may have made are removed, and the factory default configuration is restored to the unit.

Figure 5: Base of the RG231



2 INSTALLING THE RG231

This section describes how to install and connect the RG231 WiMAX 802.16e Self-Install Residential Gateway.

PACKAGE CHECKLIST

The RG231 package includes:

- RG231 unit (RG231-2.3, RG231-2.5, or RG231-3.5)
- RJ-45 Category 5 network cable
- AC power adapter
- Quick Installation Guide
- User Guide CD

INSTALLATION OVERVIEW

Before installing the RG231, verify that you have all the items listed in the package checklist above. If any of the items are missing or damaged, contact your local dealer. Also, be sure you have all the necessary tools and cabling before installing the RG231.

SELECT A LOCATION

The RG231 can be installed indoors on any horizontal surface, such as a desktop or shelf.

When selecting a suitable location for the device, consider these guidelines:

- Select a cool, dry place, which is out of direct sunlight.
- The device should have adequate space (approximately two inches) on all sides for proper air flow.
- The device must be near an AC power outlet that provides 100 to 240 V, 50 to 60 Hz.

- The device should be accessible for network cabling and allow the status LED indicators to be clearly visible.

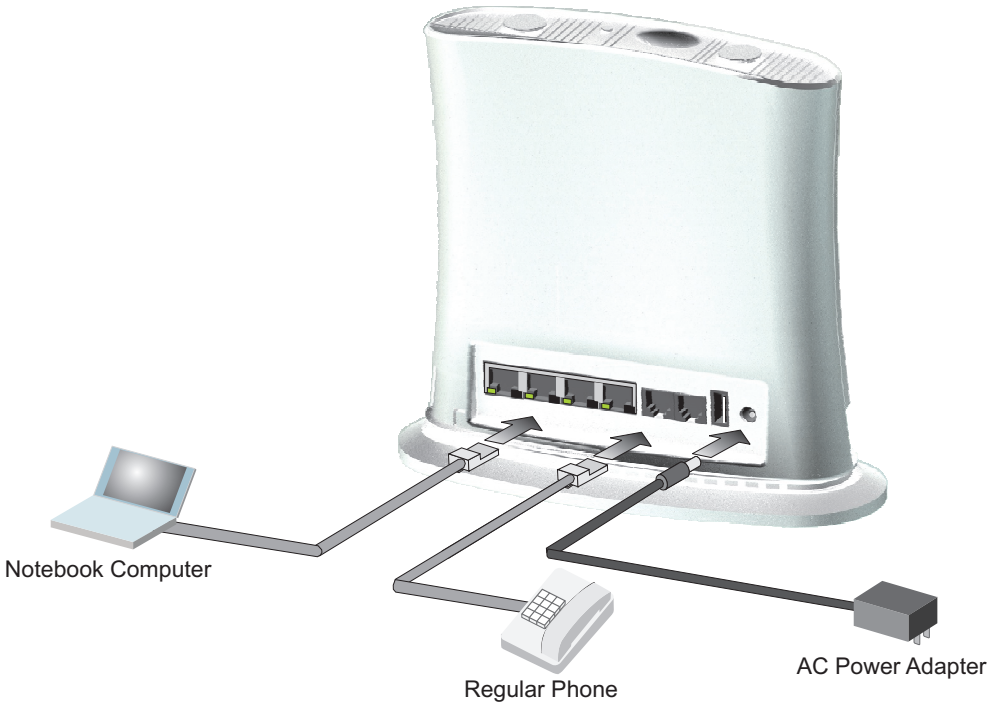
NOTE: If the RG231 displays a weak WiMAX receive signal, try moving it to another location.

CABLE CONNECTIONS

The RG231 is a plug-and-play device, so once it has been connected to your PC and powered up, it is fully operable.

Functioning as a gateway, the unit routes traffic between a WiMAX service provider's base station and PCs or notebooks in the local network.

Figure 6: RG231 Connections



To connect the RG231, follow these steps:

1. Power on the RG231 by by first connecting the AC power adapter to the unit's power socket, and then connecting the adapter to an AC power source.

CAUTION: Use ONLY the power adapter supplied with the RG231. Otherwise, the product may be damaged.

2. Observe the Indicator LEDs. When you power on the RG231, verify that the Power LED turns on and that the other LED indicators start functioning as described under "RG231 Hardware Description" on page 15.

3. Connect Category 5 or better Ethernet cables from the RG231's LAN ports to the network ports of your PCs. Alternatively, you can connect the LAN ports to an Ethernet switch or other devices. Make sure the length of each cable does not exceed 100 meters (328 ft).

   If your PCs are powered on, the RJ-45 LAN port LEDs on the RG231 should turn on to indicate valid links.

4. (Optional) Connect one or two standard (analog) telephone sets to the RG231's VoIP ports using standard telephone cable with RJ-11 plugs.

   The RG231 enables VoIP calls to be made through the unit using a standard (analog) telephone set connected to a VoIP port, or from PCs or other network devices connected to the LAN ports. Standard Session Initiation Protocol (SIP) technology is used to make VoIP calls. You must access the web interface and configure settings for your SIP service provider before being able to make VoIP calls.

5. Use your PC's web browser to access the unit's management interface and run the Setup Wizard to make any configuration changes. For more information, see Chapter 3, "Initial Configuration."

3 INITIAL CONFIGURATION

The RG231 initial configuration steps can be made through its web management interface using the Setup Wizard. It is recommended to make the initial changes by connecting a PC directly to one of the RG231's LAN ports.

ACCESSING THE WEB MANAGEMENT INTERFACE

The RG231 has a default IP address of 192.168.1.1 and a subnet mask of 255.255.255.0. If your PC is set to have an IP address assigned by DHCP (Dynamic Host Configuration Protocol), you can connect immediately to the web management interface. Otherwise, you must first check if your PC's IP address is set on the same subnet as the RG231 (that is, the PC's IP address starts 192.168.1.x).

In the web browser's address bar, type the default IP address: http://192.168.1.1.

The web browser displays the RG231's login page.

Figure 7: Login Page

Language – Selects English or Traditional Chinese as the web interface language.

Logging In – Type the default User Name "admin" and Password "admin," then click Login. The home page displays.

NOTE: It is recommended that you configure a user password as the first step under "Administrator Settings" on page 4 to control management access to the unit.

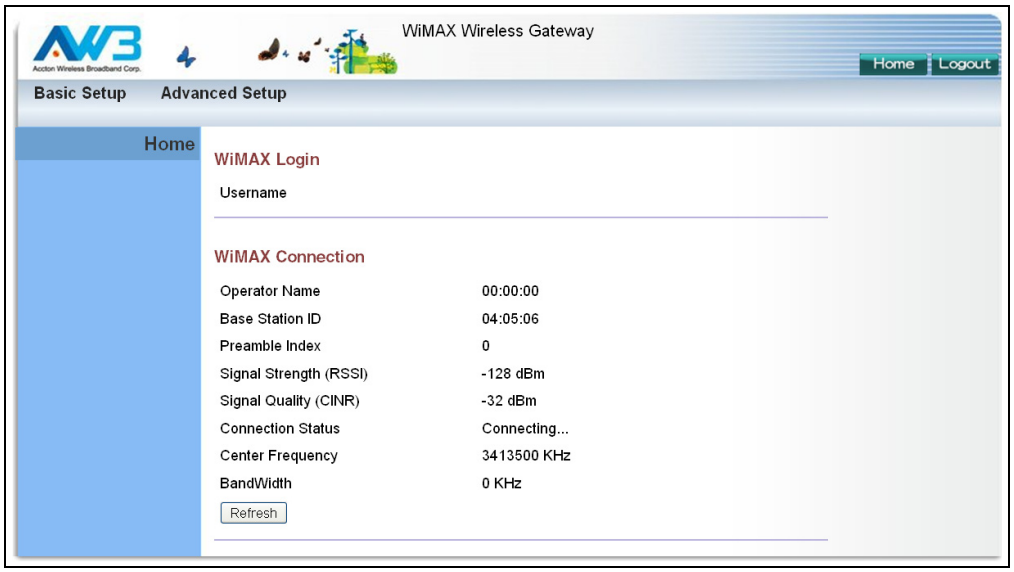
HOME PAGE

The home page displays the current status of the WiMAX connection.

To configure basic settings for the current operating mode, click Basic Setup. For more information, see "Using the Basic Setup Wizard" on page 25.

Alternatively, to configure more detailed settings, click Advanced Setup. For more information, see "The Advanced Setup Menu" on page 27.

Figure 8: Home Page



The following parameters are displayed on the home page:

- **Username** – Describes the WiMAX network login name.
- **Operator Name** – The identity of the operator network.
- **Base Station ID** – The identifier of the connected base station.
- **Preamble Index** – A number that identifies the sector on the connected base station.
- **Signal Strength** – The current signal strength value of the received WiMAX radio signal.
- **Signal Quality** – An indication of the carrier-to-interference-plus-noise-ratio (CINR), which measures the strength of the receive signal compared to other interference and noise.

- **Connection Status** – The current status of the WiMAX connection.
- **Center Frequency** – The center frequency of the WiMAX signal.
- **Bandwidth** – The bandwidth of the WiMAX signal.

USING THE BASIC SETUP WIZARD

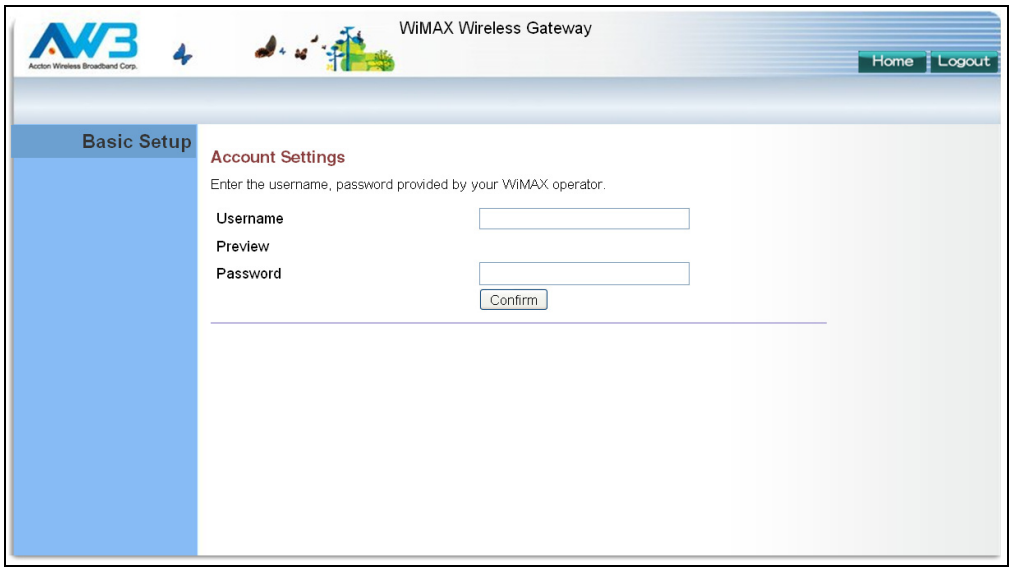
The Basic Setup Wizard takes you through the basic configuration steps for the RG231.

Launching the Basic Setup Wizard – To perform basic configuration, click Basic Setup on the home page.

When configuring the unit through the Setup Wizard you will need to proceed through the following steps:

1. **WiMAX Account Login** – Configures user authentication settings for connection to the WiMAX network.

Figure 9: WiMAX Account Login

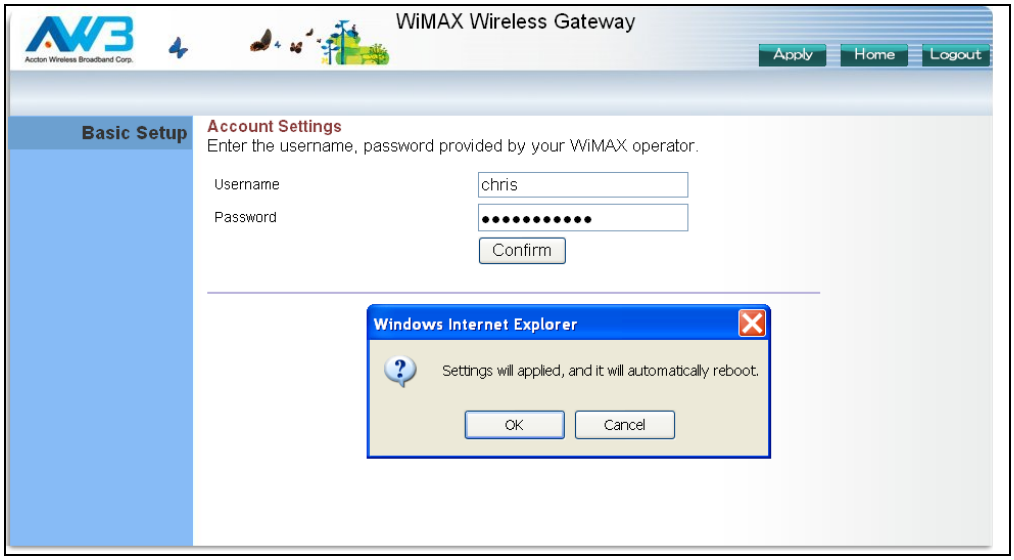


The following parameters are displayed on this page:

- **Username** – The user name required for authentication as provided by the WiMAX operator.
- **Preview** – Displays the current user name that will be used.
- **Password** – The user password required for authentication as provided by the WiMAX operator.

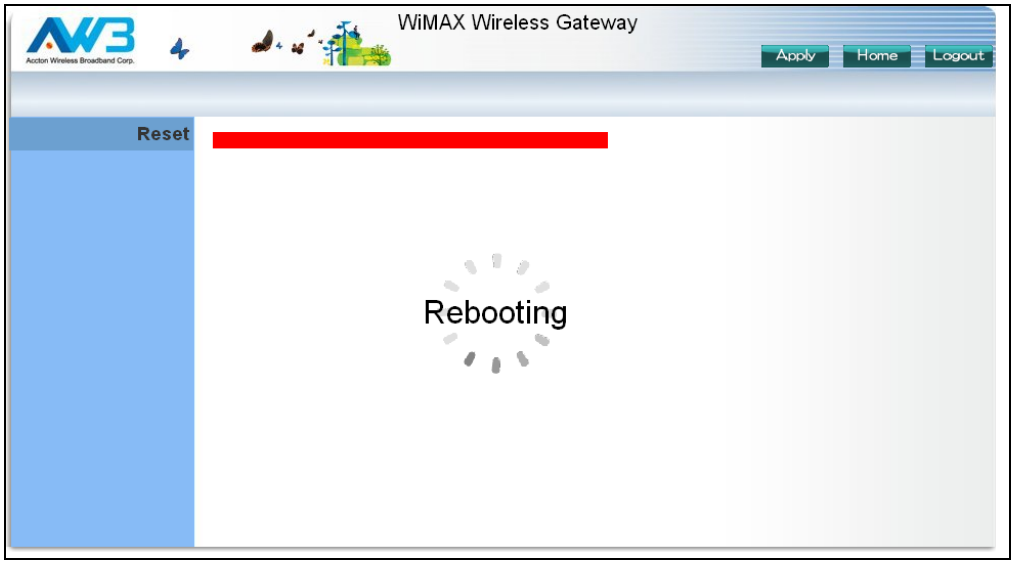
2. **Apply Settings** – Click "Confirm" to apply the basic settings.

Figure 10: Confirm Settings



3. **Basic Setup Finished** – When the Basic Setup steps are completed the unit reboots and attempts to connect to the specified WiMAX network. Log in again to return to the Home page.

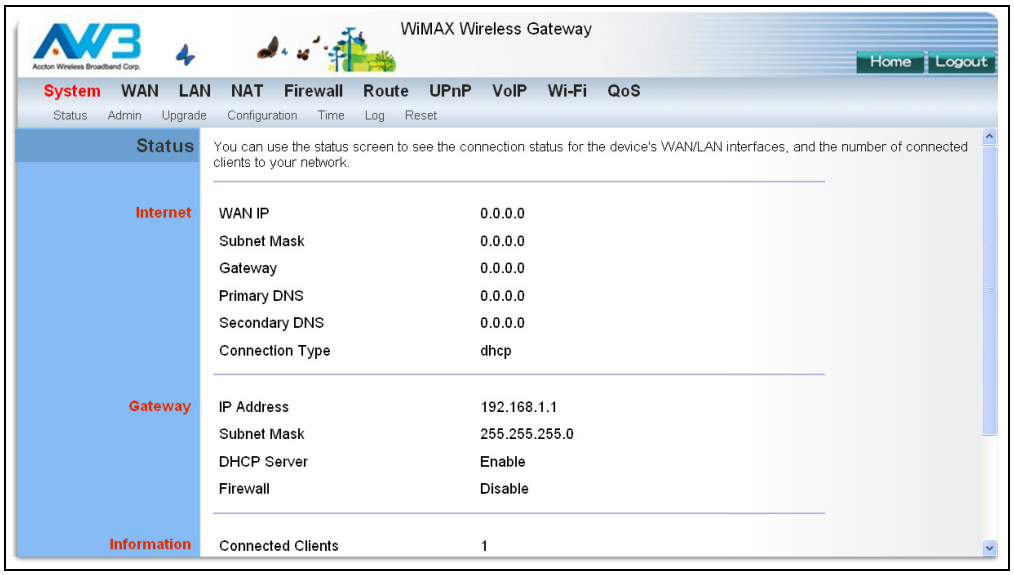
Figure 11: Setup Wizard Finished



THE ADVANCED SETUP MENU

The Advanced Setup menu provides access to all the configuration settings available for the RG231.

Figure 12: Advanced Setup



Each primary menu item is sumarized below with links to the relevant section in this guide where configuration parameters are described in detail:

- **System** – Configures general device settings. See page 30.
- **WAN** – Configures WAN settings. See page 38.
- **LAN** – Configures LAN settings. See page 44.
- **NAT** – Configures Network Address Translation settings. See page 47.
- **Firewall** – Configures firewall settings. See page 52.
- **Route** – Configures static routing settings. See page 59.
- **UPnP** – Enables UPnP. See page 62.
- **VoIP** – Shows VoIP settings. See page 64.
- **Wi-Fi** – Configures Wi-Fi settings. See page 75.
- **QoS** – Configures QoS settings. See page 88.

COMMON WEB PAGE BUTTONS

The web management interface includes some common buttons that are displayed at the top of each page.

Figure 13: Common Web Page Buttons

The list below describes these common buttons:

- **Apply** — Applies all new configuration changes on the current page and saves them to memory.
- **Home** — Returns to the web management home page.
- **Logout** — Immediately closes the current web management session.
- **Reboot** — The Reboot button appears after some configuration changes that require the CPE to be reset. You can make as many changes as you want before restarting the CPE. All changes are saved as they are made, but do not become active until after a restart.

SECTION II

WEB CONFIGURATION

This section provides details on configuring the RG231 using the web browser interface.

This section includes these chapters:

4 System Settings

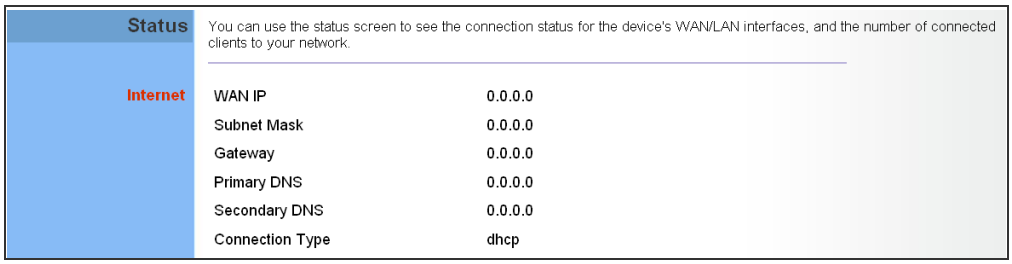
The RG231's System menu allows you to perform general management functions for the unit, including setting the system time, configuring an access password, and upgrading the system software.

The System configuration pages include the following options:

SYSTEM STATUS

The system status page displays connectivity status information for the unit's WiMAX (WAN) and LAN interfaces, and the number of clients connected to the network.

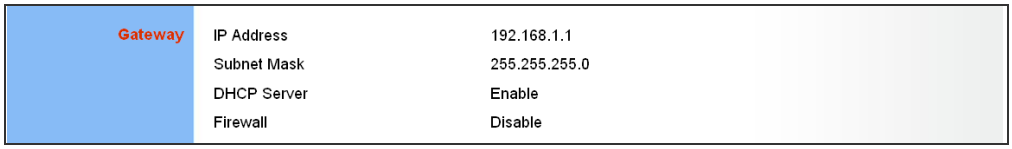
Figure 14: System Status – Internet



Internet – Displays WAN (WiMAX) connection status:

- **WAN IP** – Displays the IP address assigned by the service provider.
- **Subnet Mask** – Displays the WAN subnet mask assigned by the service provider.
- **Gateway** – Displays the WAN gateway address assigned by the service provider.
- **Primary DNS** – Displays the WAN primary DNS address.
- **Secondary DNS** – Displays the WAN secondary DNS address.
- **Connection Type** – Displays the connection type for the WAN. Either "fixed" for a static IP setting, or "dhcp" for dynamic IP assignment.

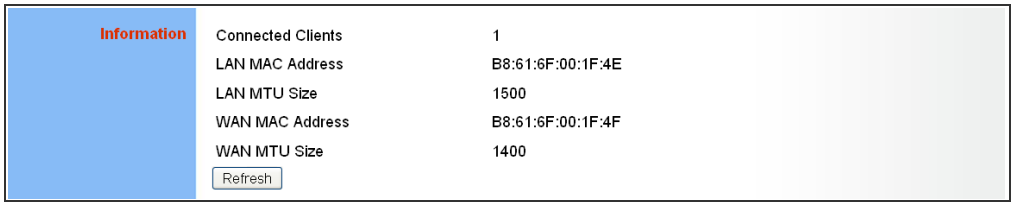
Figure 15: System Status – Gateway



Gateway – Display system IP settings, as well as DHCP, NAT and firewall status:

- **IP Address** – Displays the unit's IP address.
- **Subnet Mask** – Displays the subnet mask.
- **DHCP Server** – Displays the DHCP server status.
- **Firewall** – Displays the firewall status.

Figure 16: System Status – Information



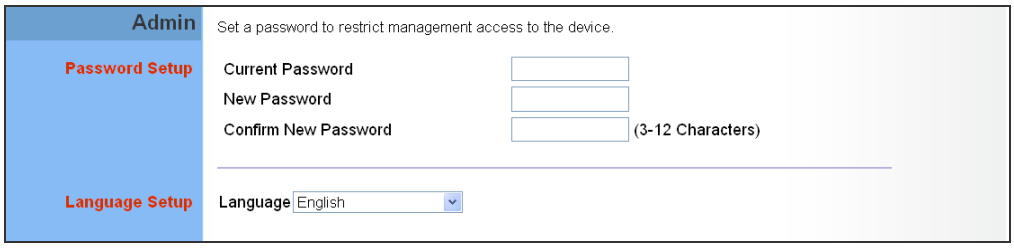
Information – Displays the number of connected clients, as well as the unit's LAN and WAN MAC addresses:

- **Connected Clients** – Displays the number of connected clients, if any.
- **LAN MAC Address** – Displays the LAN MAC address.
- **LAN MTU Size** – The maximum transmission unit size in bytes.
- **WAN MAC Address** – Displays WAN MAC address.
- **WAN MTU Size** – The maximum transmission unit size in bytes.

ADMINISTRATOR SETTINGS

The Administrator Settings page enables you to change the default password for management access to the RG231.

Figure 17: Setting a Password



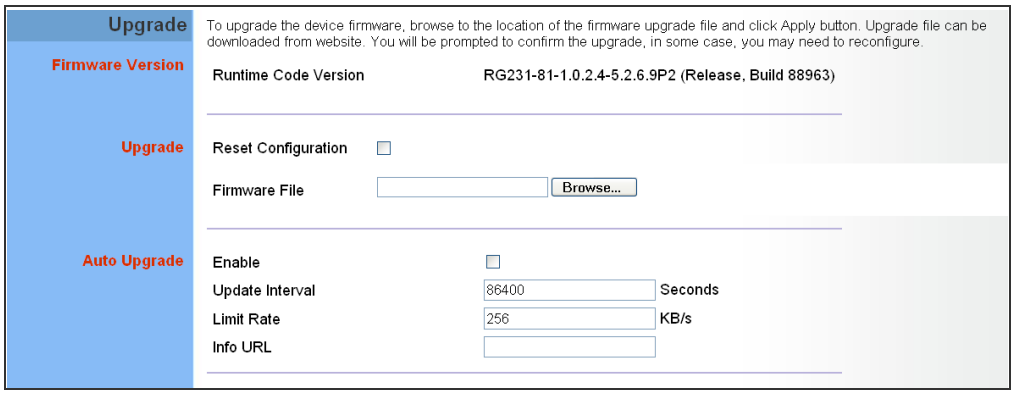
The following parameters are displayed on this page:

- **Current Password** – You need to first enter your current administrator password to be able to configure a new one. (Default: admin)
- **New Password** – Enter a new administrator password. (Range: 3~12 characters)
- **Confirm New Password** – Enter the new password again for verification. (Range: 3~12 characters)
- **Language** – Selects English or Traditional Chinese as the web interface language.

FIRMWARE UPGRADE

The Firmware Upgrade page enables you to download new software to the unit.

Figure 18: Firmware Upgrade



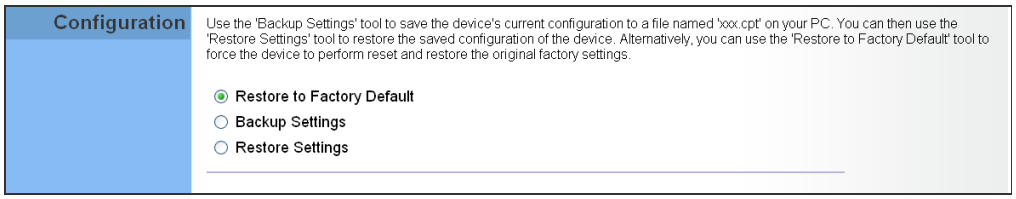
The following parameters are displayed on this page:

- **Upgrade** – Downloads an operation code file from the web management station to the RG231 using HTTP. Use the Browse button to locate the code file locally on the management station and check the Reset Configuration to restore factory defaults. Click Apply to proceed.
- **Auto Upgrade** – Provides a method to automatically upgrade the CPE when new code is available, as indicated by the contents of an information file provided by the WiMAX service operator. The Auto Upgrade information file and code file can be located on the same server or different servers.
  - **Enable** – Enables the automatic upgrade feature.
  - **Update Interval** – A time interval (in seconds) for checking the Info URL for new software information.
  - **Limit Rate** – Places a limit on the firmware download rate from the server.
  - **Info URL** – A text string that indicates the location of an Auto Upgrade information file on an FTP server. The file contains information on the version of software available, and the FTP server on which it is located. (For example: ftp://192.168.1.16/autoupgrade/RG231-autoupgrade.info)

CONFIGURATION TOOLS

The Configurations Tools page allows you to restore factory default settings, or save and restore the unit's configuration settings to or from a file on the management station.

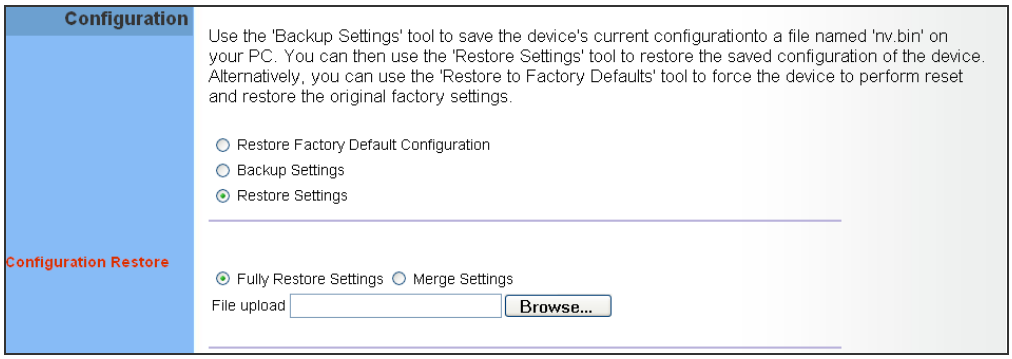
Figure 19: Configuration Tools



The following parameters are displayed on this page:

- **Restore Factory Default Configuration** – Resets the unit to its factory default settings. When you select "Restore Factory Default Configuration" and click Apply, a confirmation page displays. Click OK to continue.
- **Backup Settings** – Saves the current configuration settings to a file on the web management station.
- **Restore Settings** – Restores a saved configuration file to the unit. Configuration files are plain-text files that can be edited directly to modify settings (not all parameters need be defined). You can use the Browse button to locate the file on the web management station.
  - **Fully Restore Settings** – Restores all settings that are defined in the uploaded configuration file. Any undefined settings are returned to factory defaults.
  - **Merge Settings** – Restores defined settings in the uploaded configuration file. All other undefined settings are not changed.

Figure 20: Restore Configuration Settings

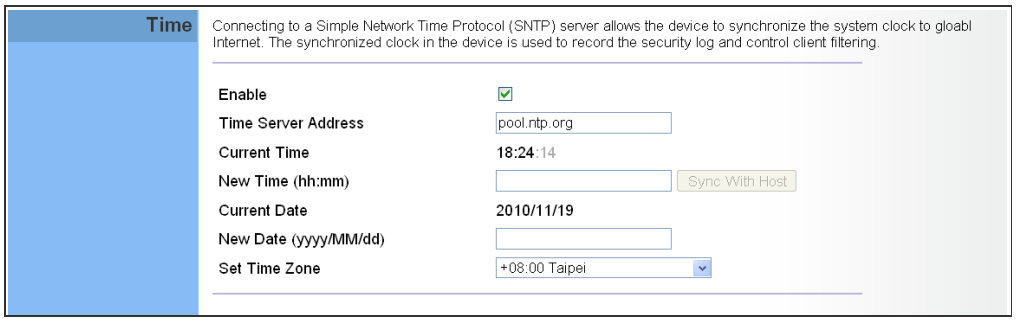


SYSTEM TIME

The RG231 uses the Simple Network Time Protocol (SNTP) to set its internal clock based on periodic updates from a time server. Maintaining an accurate time on the device enables the system log to record meaningful dates and times for event entries.

SNTP uses Coordinated Universal Time (or UTC, formerly Greenwich Mean Time, or GMT) based on the time at the Earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must select your time zone.

Figure 21: System Time



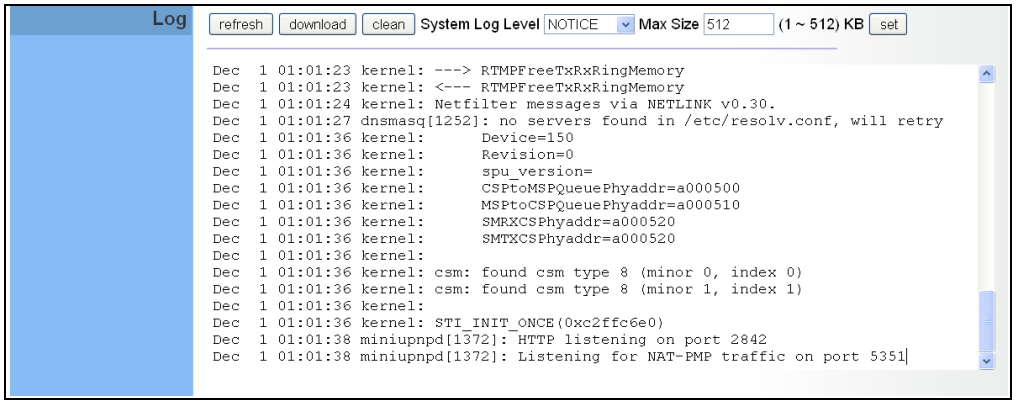
The following parameters are displayed on this page:

- **Enable** – Enables the unit to set its internal clock based on periodic updates from a time server. The unit acts as an SNTP client, periodically sending time synchronization requests to a specified time server. Alternatively, you can select "None" and set the time and date manually.
- **Time Server Address** – The IP address of a time server that the unit attempts to poll for a time update.
- **Current Time (hh:mm:ss)** – The current time of the system clock.
- **New Time (hh:mm:ss)** – Sets the system clock to the time specified.
- **Sync with host** – Sets the unit's time from the web management PC's system time.
- **Current Date (yyyy:mm:dd)** – The current date of the system clock.
- **New Date (yyyy:mm:dd)** – Sets the system clock date.
- **Set Time Zone** – SNTP uses Coordinated Universal Time (or UTC, formerly Greenwich Mean Time, or GMT) based on the time at the Earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must select your time zone from the pull-down list.

SYSTEM LOG

The RG231 supports a logging process that controls error messages saved to memory. The logged messages serve as a valuable tool for isolating device and network problems. The System Log page displays the latest messages logged in chronological order, from the oldest to the newest. Log messages saved in the unit's memory are erased when the device is rebooted.

Figure 22: System Log



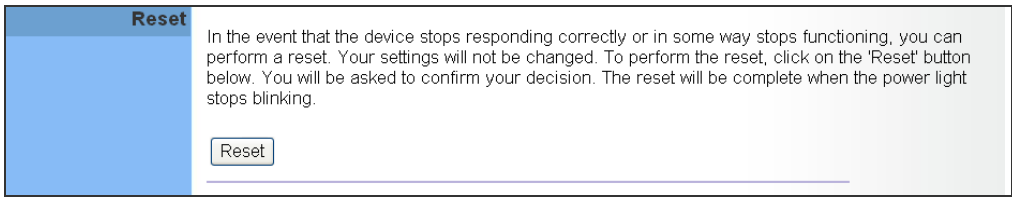
The following items are displayed on this page:

- **Refresh** — Sends a request to add the latest entries to the System Log Table.
- **Download** — Downloads the current system log messages to a file on the web management station.
- **Clean** — Removes all the current system log messages from the System Log Table.
- **System Log Level** — Sets the minimum severity level for event logging. The system allows you to limit the messages that are logged by specifying a minimum severity level. Error message levels range from the most severe (Emergency) to least severe (Debug). The message levels that are logged include the specified minimum level up to the Emergency level.
- **Max Size** — The maximum memory size to be used for log messages on the CPE. (Range: 1-512 KB)
- **Set** — Click to set the Max Size and System Log Level values.

RESET

The Reset page allows you to restart the device's software. If the unit stops responding correctly or in some way stops functioning, performing a reset can clear the condition.

Figure 23: Reset Unit



Reset – Resets the unit. All current settings are retained.

5 WAN CONFIGURATION

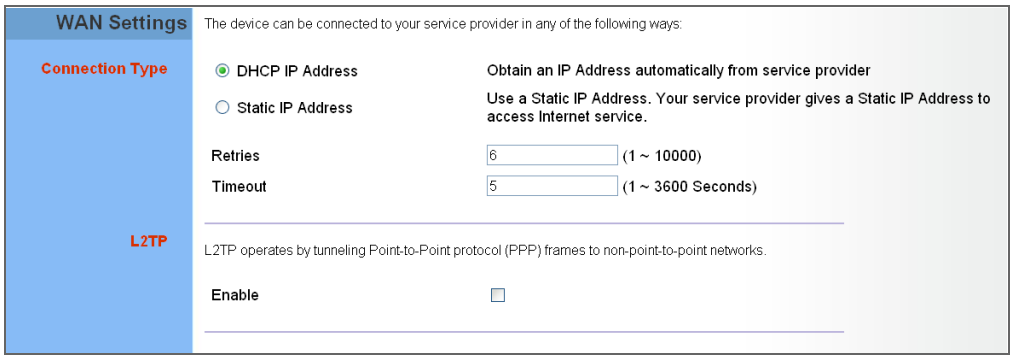
The information in this chapter covers the configuration options for the RG231's WAN connection.

The WAN configuration pages include the following options:

WAN SETTINGS

Select the WAN connection type used by your service provider and specify DNS (Domain Name System) servers.

Figure 24: WAN Settings



The unit can be connected to your ISP in one of the following ways:

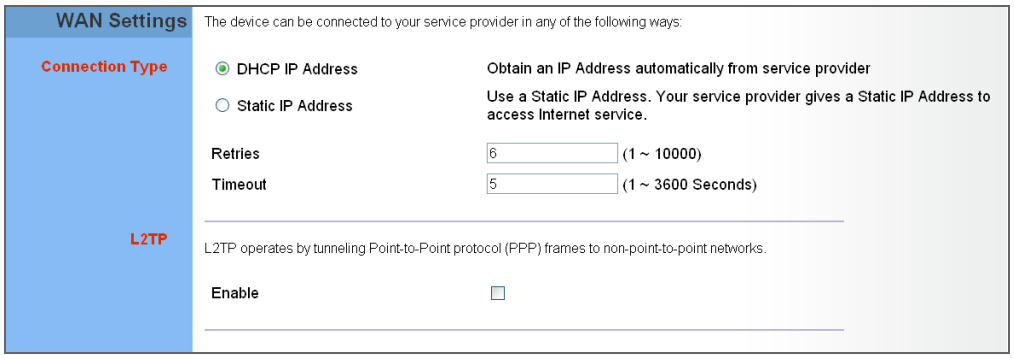
- **DHCP IP Address** – Selects configuration for an Internet connection using DHCP for IP address assignment. This is the default setting.
- **Static IP Address** – Selects configuration for an Internet connection using a fixed IP assignment.
- **Retries** – The maximum number of times the CPE sends a DHCP request to a DHCP server. (Range: 1-10000)
- **Timeout** – The maximum time period (in seconds) the CPE waits for a response from a DHCP server before it resends a request. (Range: 1-3600 seconds)
- **L2TP** – Selects configuration for an Internet connection using the Layer 2 Tunneling Protocol, an access protocol often used for virtual private networks.

NOTE: For the Dynamic IP Address (DHCP) option, the unit requires no further configuration. Selecting other WAN types displays the parameters that are required for configuring the connection.

DYNAMIC IP ADDRESS

For dynamic IP assignment from the service provider, the unit functions as a Dynamic Host Configuration Protocol (DHCP) client. When enabled, no other settings are required.

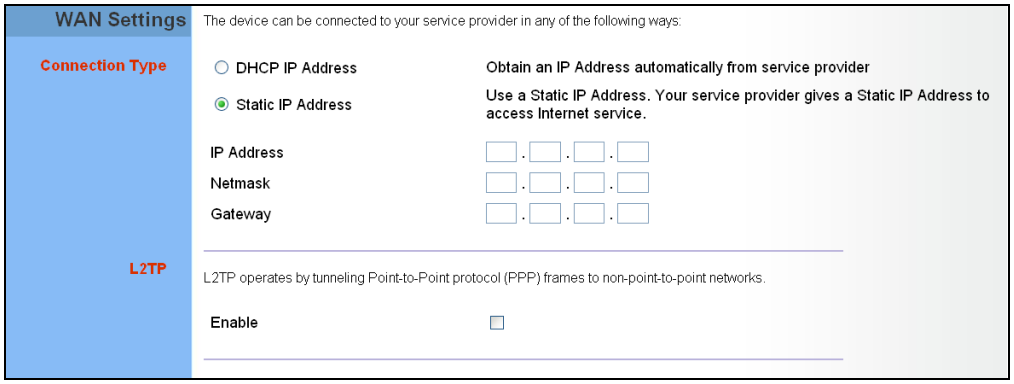
Figure 25: Dynamic IP Address



STATIC IP SETTINGS

Selecting Static IP Address for the WAN type enables you to enter static IP settings as assigned by the service provider.

Figure 26: Static IP Settings



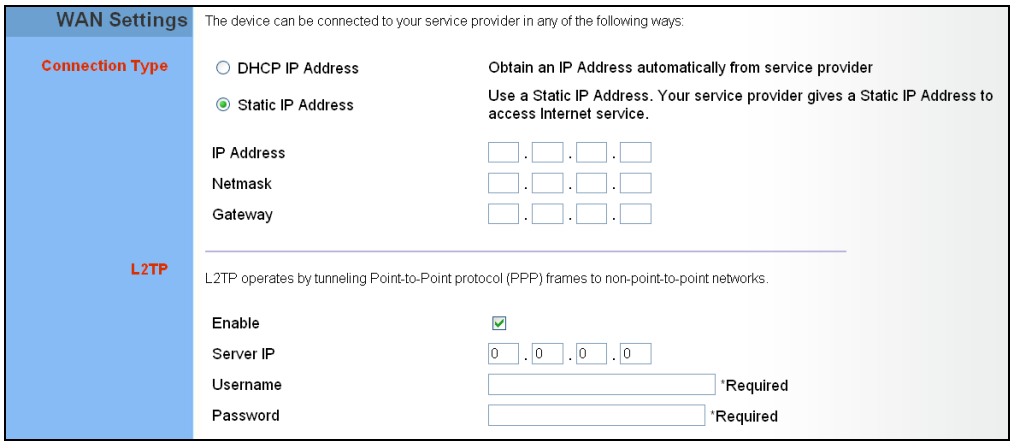
The following parameters are displayed in this section on this page:

- **IP Address** – The IP address provided by your service provider. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods.
- **Netmask** – Indicates the subnet mask, such as 255.255.255.0.
- **Gateway** – The gateway IP address provided by your service provider.

L2TP SETTINGS

If your service provider supports Layer 2 Tunneling Protocol (L2TP) for your Internet connection, configure the settings described below.

Figure 27: L2TP Settings



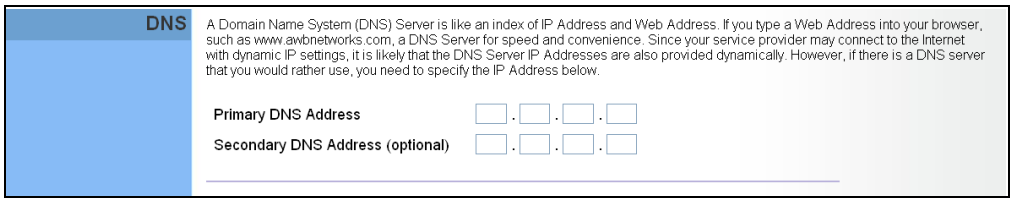
The following parameters are displayed in this section on this page:

- **Enable** – Enables the L2TP settings.
- **Server IP** – The IP address of the L2TP server, as specified by the service provider.
- **Username** – Enter your user name for connecting to the L2TP service, as supplied by the service provider. (Range: 1-20 characters)
- **Password** – Specify the password for your connection, as supplied by the service provider. (Range: 1-20 characters)

DNS

DNS (Domain Name System) server addresses are usually provided by service providers, however if you want to specify certain servers, the DNS page enables you to enter primary and secodary DNS addresses.

Figure 28: DNS Settings



The following parameters are displayed on this page:

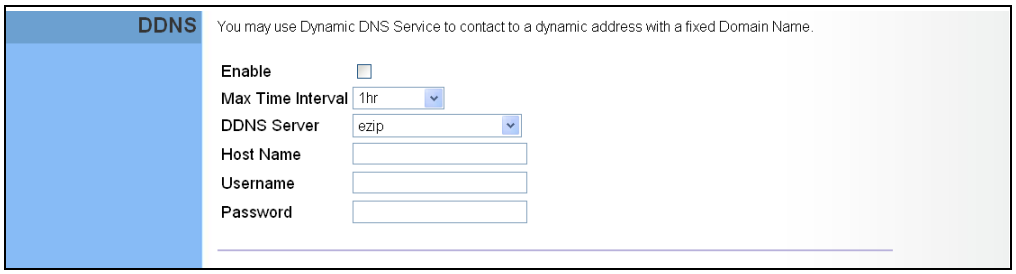
- **Primary DNS Address** – Address of the primary DNS server, specified in the form of 0.0.0.0. (The default address 0.0.0.0 disables the manual DNS setting.)
- **Secondary DNS Address (optional)** – Optional address of a secondary DNS server, specified in the form of 0.0.0.0.

DDNS

Dynamic DNS (DDNS) provides users on the Internet with a method to tie a specific domain name to the unit's dynamically assigned IP address. DDNS allows your domain name to follow your IP address automatically by changing your DNS records when your IP address changes.

The RG231 provides access to a number DDNS service providers, such as DynDns.org, Easydns.com, and ZoneEdit.com. To set up an DDNS account, visit the website of one of the supported service providers.

Figure 29: DDNS Settings



The following items are displayed in this section on this page:

- **Enable** — Enables the DDNS service.
- **Max Time Interval** — The maximum time period before the CPE sends an update to the DDNS provider. (Options: 1hr, 3hr, 6hr, 8hr, 12hr, 1 day, 3 days, 1 week)
- **DDNS Server** — Specifies the DDNS service provider, DynDns.org, Freedns.afraid.org, ZoneEdit.com or Non-IP.com.
- **Host Name** — Specifies the URL of the DDNS service.
- **User Name —** Specifies your user name for the DDNS service.
- **Password** — Specifies your password for the DDNS service.

6 LAN CONFIGURATION

The information in this chapter covers the configuration options for the RG231's LAN functions.

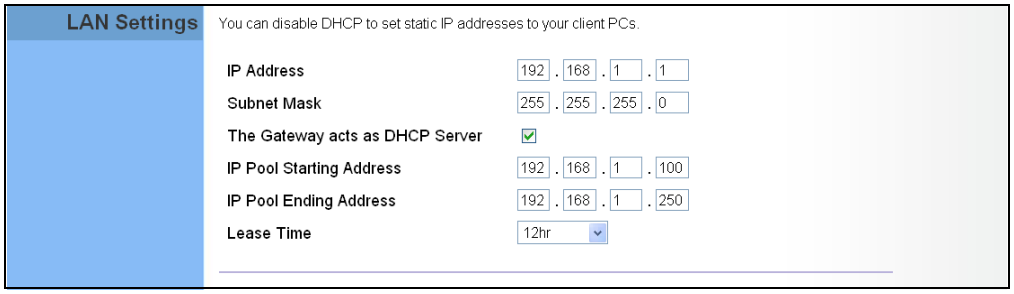
The LAN configuration pages include the following options:

LAN SETTINGS

The RG231 must have a valid IP address for management using a web browser and to support other features. The unit has a default IP address of 192.168.1.1. You can use this IP address or assign another address that is compatible with your existing local network. The unit can also be enabled as a Dynamic Host Configuration Protocol (DHCP) server to allocate IP addresses to local PCs.

The RG231 includes a DHCP server that can assign temporary IP addresses to any attached host requesting the service. Addresses are assigned to clients from a common address pool configured on the unit. Configure an address pool by specifying start and end IP addresses. Be sure not to include the unit's IP address in the address pool range.

Figure 30: LAN Settings



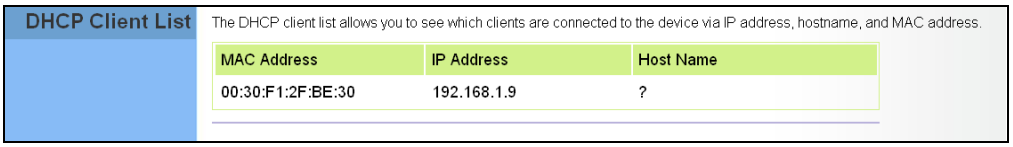
The following parameters are displayed on this page:

- **IP Address** – The IP address of the unit. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods. The default setting is 192.168.1.1.
- **Subnet Mask** – Indicates the local IP subnet mask. The default setting is 255.255.255.0.
- **The Gateway acts as DHCP Server** – Check this box to enable the DHCP server.
- **IP Pool Starting/Ending Address** – Specifies the start and end IP address of a range that the DHCP server can allocate to DHCP clients. You can specify a single address or an address range. Note that the address pool range is always in the same subnet as the unit's IP setting.
- **Lease Time** – Selects a time limit for the use of an IP address form the IP pool. When the time limit expires, the client has to request a new IP address. (Options: 1hr, 3hr, 6hr, 8hr, 12hr, 1 day, 3 days, 1 week)

DHCP CLIENT LIST

The DHCP Client List page enables you to see the MAC address of devices that are currently connected to the unit and have been assigned an IP address by the DHCP server.

Figure 31: DHCP Client List



7 NAT CONFIGURATION

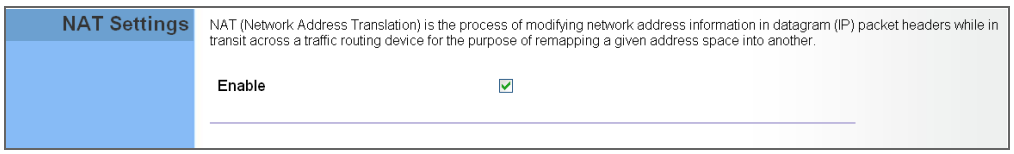
The information in this chapter covers the configuration options for the RG231's Network Address Translation (NAT) functions.

The NAT configuration pages include the following options:

NAT SETTINGS

Network Address Translation (NAT) is a standard method of mapping multiple "internal" IP addresses to one "external" IP address on devices at the edge of a network. For the RG231, the internal (local) IP addresses are the IP addresses assigned to local PCs by the DHCP server, and the external IP address is the IP address assigned to the WiMAX interface.

Figure 32: NAT Settings



The following item is displayed on this page:

- **Enable** – Enables NAT on the device.

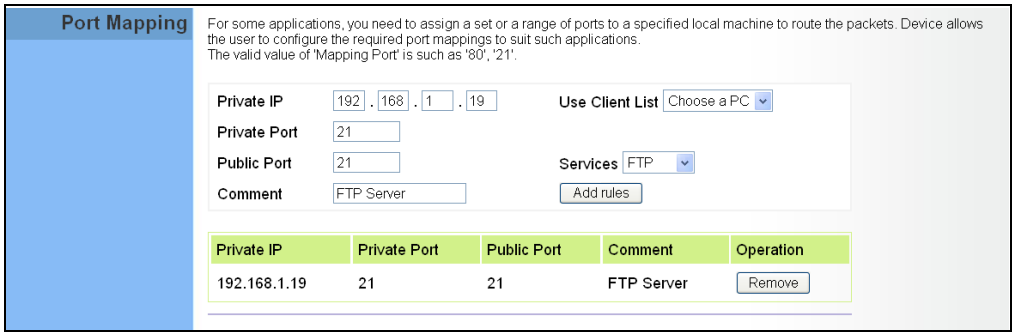
PORT MAPPING

Using the NAT Port Mapping feature, remote users can access different servers on your local network using your single public IP address.

Remote users accessing services such as web or FTP at your local site thorugh your public IP address, are redirected (mapped) to other local server IP addresses and TCP/UDP port numbers. For example, if you set Type/Public Port to TCP/80 (HTTP or web) and the Private IP/Port to 192.168.7.9/80, then all HTTP requests from outside users forwarded to 192.168.7.9 on port 80. Therefore, by just using your external IP address provided by your ISP, Internet users can access the services they need at the local addresses to which you redirect them.

The more common TCP service port numbers include: HTTP: 80, FTP: 21, Telnet: 23, and SSH: 22.

Figure 33: Port Mapping



The following parameters are displayed on this page:

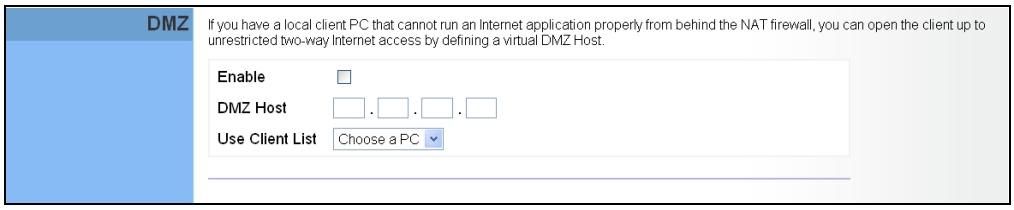
- **Private IP** – The IP address of the server on the local Ethernet network. The specified address must be in the same subnet as the RG231 and its DHCP server address pool. Alternatively, the IP address can be set by selecting a PC from the DHCP client list. (Range: 192.168.1.1 to 192.168.1.254)
- **Use Client List** – Allows the Private IP to be selected from the DHCP client list.
- **Private Port** – Specifies the TCP/UDP port number used on the local server for the service. (Range: 1-65535)
- **Public Port** – Specifies the public TCP/UDP port used for the service on the WAN interface. (Range: 1-65535)
- **Services** – Specifies port numbers for some of the more common services. (Options: FTP, SSH, Telnet, SMTP, HTTP, HTTPS)
- **Comment** – A text comment for the forwarding rule.

- **Add Rules** – Adds the defined rule to the port forwarding table. Use the Delete button next to a rule to remove it from the table.

DMZ

If you have a client PC that cannot run an Internet application properly from behind the NAT firewall, you can open the client up to unrestricted two-way internet access by defining a virtual-DMZ (virtual-demilitarized-zone) host.

Figure 34: DMZ Settings



The following parameters are displayed on this page:

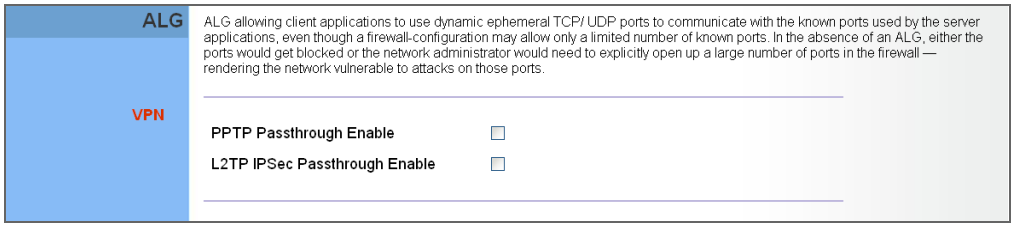
- **Enable** – Enables the feature.
- **DMZ Host** – Specifies the IP address of the virtual DMZ host. Alternatively, the host IP can be set by selecting a PC from the DHCP client list. (Range: 192.168.1.2 to 192.168.1.254)
- **Use Client List** – Allows the host IP to be selected from the DHCP client list.

NOTE: Adding a host to the DMZ may expose your local network to a variety of security risks, so only use this option as a last resort.

ALG

The RG231 supports the passthrough of three of the most commonly used VPN protocols; PPTP, L2TP, and IPsec. These protocols allow remote users to establish a secure connection to their corporate network. If your service provider supports VPNs, then these protocols can be used to create an authenticated and encrypted tunnel for passing secure data over the Internet (that is, a traditionally shared data network).

Figure 35: ALG Settings



The following items are displayed on this page:

- **PPTP Passthrough —** PPTP (Point-to-Point Tunneling Protocol) provides a secure tunnel for remote client access to a PPTP security gateway. PPTP includes provisions for call origination and flow control required by ISPs.

- **L2TP IPsec Passthrough —** L2TP (Layer 2 Tunneling Protocol) merges the best features of PPTP and the Layer 2 Forwarding (L2F) protocol. Like PPTP, L2TP requires that the ISP's routers support the protocol. IPsec (Internet Protocol Security) encrypts and authenticates entire IP packets and encapsulates them into new IP packets for secure communications between networks.

8 FIREWALL CONFIGURATION

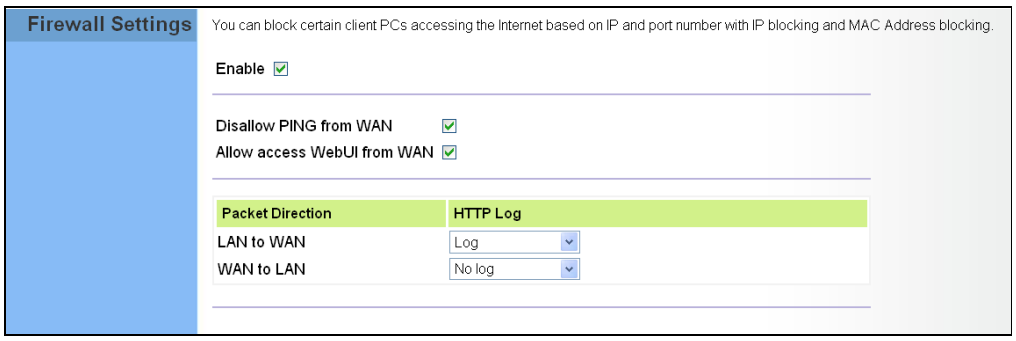
The information in this chapter covers the configuration options for the RG231's firewall functions.

The Firewall configuration pages include the following options:

FIREWALL SETTINGS

The RG231 provides extensive firewall protection by restricting connection parameters to limit the risk of intrusion and defending against a wide array of common hacker attacks. You can also block access to the Internet from clients on the local network based on IP addresses and TCP/UDP port numbers, or specific MAC addresses.

Figure 36: Firewall Settings



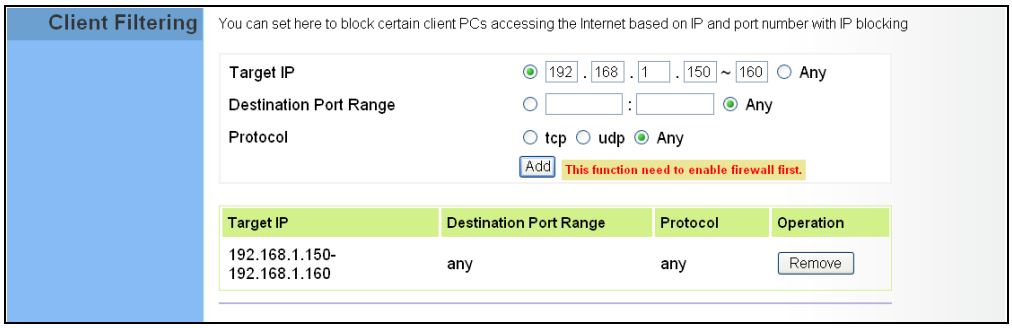
The following parameters are displayed on this page:

- **Enable** – Enables all firewall features.
- **Disallow PING from WAN side** – Prevents pings on the unit's WiMAX interface from being routed to the network.
- **Allow Access WebUI from WAN** – Allows a user to be able to log into the CPE web interface from a remote location.
- **HTTP Log** – Enables LAN-to-WAN and WAN-to-LAN HTTP traffic to be logged. The logged information can be viewed on the system log page.

CLIENT FILTERING

You can block access to the Internet from clients on the local network by specifying IP addresses and TCP/UDP port numbers. You can configure up to five IP filters on the unit.

Figure 37: Client Filtering Settings



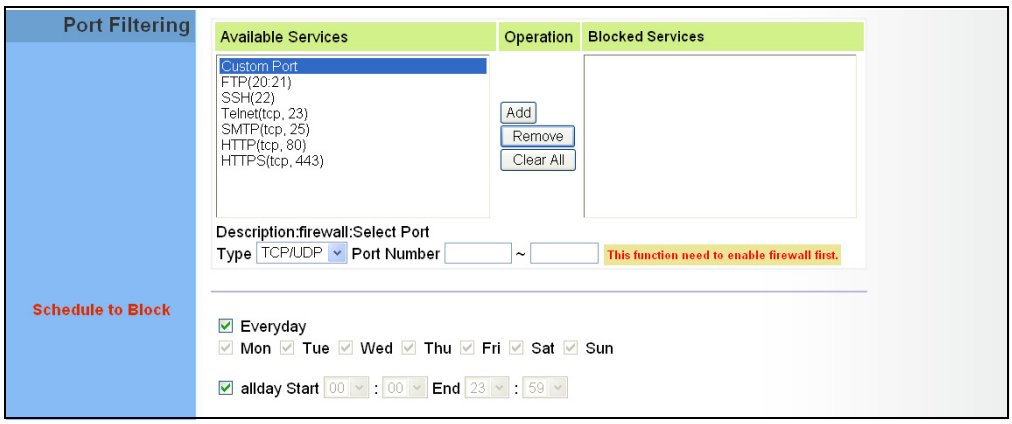
The following parameters are displayed on this page:

- **Target IP** – Specifies an IP address or range on the local network to filter. (Range: 192.168.1.2 to 192.168.1.254, or Any)
- **Destination Port Range** – Specifies a TCP/UDP port number range to filter. (Range: 1-65535 or Any)
- **Protocol** – Specifies the the port type. (Options: TCP, UDP, Any)
- **Add** – Adds a new IP address to the filter table.
- **Remove** – Removes an IP address from the filter table.

PORT FILTERING

Port filtering restricts connections to limit the risk of intrusion and can defend against a wide array of common hacker attacks. The port filtering feature allows the CPE to block traffic for a specified schedule based on TCP/UDP ports.

Figure 38: Port Filtering



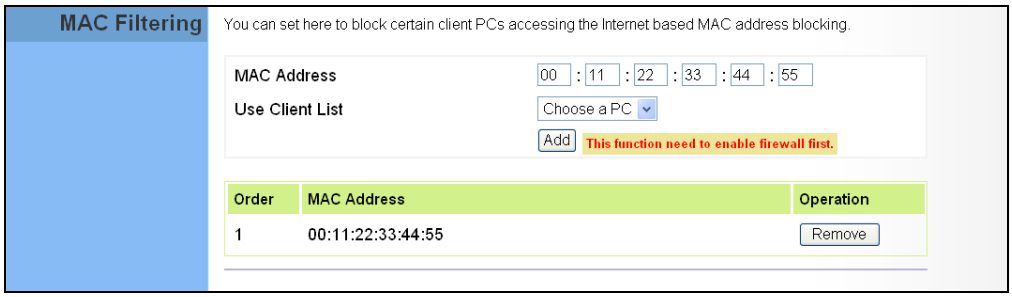
The following items are displayed on this page:

- **Available Services** — The TCP/UDP services allowed access to the CPE. All TCP/UDP ports are open unless specified as blocked. Some common protocols are pre-defined and can be selected to "Add" to the Blocked Services. Select "Custom Port" to define other TCP/UDP port ranges to block.
- **Operation** — Adds, removes, or clears all blocked services.
- **Blocked Services** — Lists the TCP/UDP ports that are blocked
- **Type** — Specifies the port type, TCP, UDP, or TCP/UDP.
- **Port Number** — Specifies a custom-defined range of TCP/UDP ports to block.
- **Schedule to Block** — Configures the days of the week and times to block the defined traffic.

MAC FILTERING

You can block access to the Internet from clients on the local network based on MAC addresses. You can configure up to 20 MAC address filters on the unit.

Figure 39: MAC Filtering



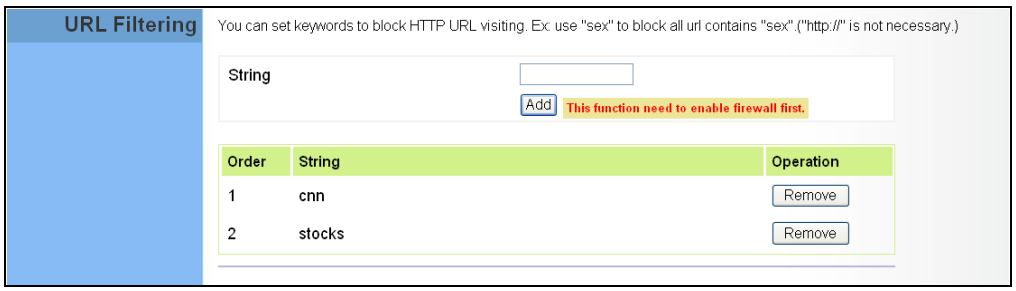
The following parameters are displayed on this page:

- **MAC Address** – Specifies a local PC MAC address.
- **Use Client List** – Selects a local PC MAC address from the CPE's DHCP client list table.
- **Add** – Adds a new MAC address to the filter table.
- **Remove** – Removes a MAC address from the filter table.

URL FILTERING

The RG231 provides a method for blocking Internet access based on Uniform Resource Locator (URL) keywords. By filtering URLs accessed from the network, users can be prevented from reaching prohibited online content.

Figure 40: URL Filtering



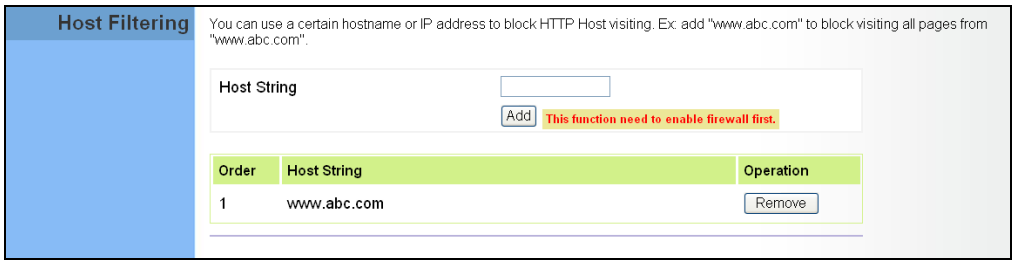
The following items are displayed on this page:

- **String** — Specifies text keyword contained in URLs that will be filtered. (Maximum 256 characters; invalid characters [` " & ' # \].)
- **Add** — Adds a keyword string to the URL filter.

HOST FILTERING

The RG231 provides a method for blocking Internet access based on web domains. A domain name is the name of a particular web site. For example, www.fungames.com.

Figure 41: Host Filtering



The following items are displayed on this page:

- **Host String** — Displays current Host filter. (Maximum 256 characters; invalid characters [` " & ' # \].)
- **Add** — Enters a domain name keyword for a host filtering. For example, myhost.example.com.

9 ROUTING CONFIGURATION

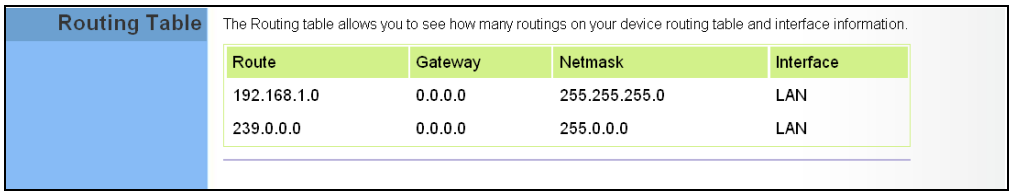
The information in this chapter covers the configuration options for the RG231's Routing functions.

The Routing configuration pages include the following options:

ROUTING TABLE

The Routing Table displays the list of static routes on the unit.

Figure 42: Routing Table



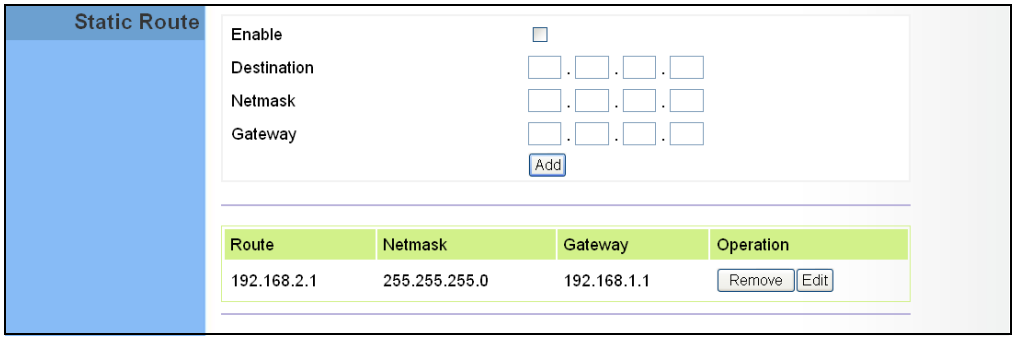
The following parameters are displayed in this section on this page:

- **Route** – The IP address that identifies the IP subnet of the remote network.
- **Gateway** – The IP address of the router within the local IP subnet that forwards traffic to the remote IP subnet.
- **Netmask** – The mask that identifies the IP subnet of the remote network.
- **Interface** – Indicates the local network interface on the unit.

STATIC ROUTE

Static routes allow a manual method to set up routing between specific destination networks, subnetworks, or hosts. Static routes may be required to force the use of a specific route to a subnet. Static routes do not automatically change in response to changes in network topology, so only configure a small number of stable routes to ensure network accessibility.

Figure 43: Static Route



The following items are displayed on this page:

- **Enable** — Enables the configured routes in the Static Route table.
- **Destination** — A destination network or specific host to which packets can be routed.
- **Netmask** — Network mask for the associated IP subnet. This mask identifies the host address bits used for routing to specific subnets.
- **Gateway** — The IP address of the router at the next hop to which matching frames are forwarded.
- **Add** — Adds a new route to the table.

10 UPnP Configuration

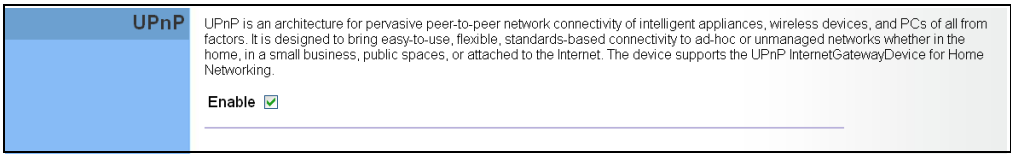
The information in this chapter covers the configuration options for the RG231's Universal Plug and Play Forum (UPnP) feature.

The UPnP configuration pages include the following options:

UPnP

UPnP (Universal Plug and Play Forum) provides inter-connectivity between devices supported by the same standard.

Figure 44: UPnP Setting



The following parameters are displayed in this section on this page:

- **UPnP** – Enables UpnP support on the unit.

11 VoIP Settings

Voice over Internet Protocol (VoIP) technology is a way of using the Internet to make phone calls. Phone calls can be tranmitted over the Internet by encoding a voice call into data packets at one end and then decoding it back into voice calls at the other end. This encoding and decoding is from a analog signal (your voice) into a digital signal (data packets) and then back into an analog signal.

The RG231 uses Session Initiation Protocol (SIP) as the control mechanism that sets up, initiates, and terminates calls between a caller and a called party. The SIP messaging makes use of "Proxy," "Redirect," and "Registration" servers to process call requests and find the location of called parties across the Internet. When SIP has set up a call between two parties, the actual voice communication is a direct peer-to-peer connection using the standard Real-Time Protocol (RTP), which streams the encoded voice data across the network.

You can make VoIP calls by connecting a regular phone to one of the RG231's RJ-11 Phone ports. You can also make VoIP calls from your computer using a VoIP application with a simple microphone and computer speakers. Using either method, VoIP provides an experience identical to normal telephoning.

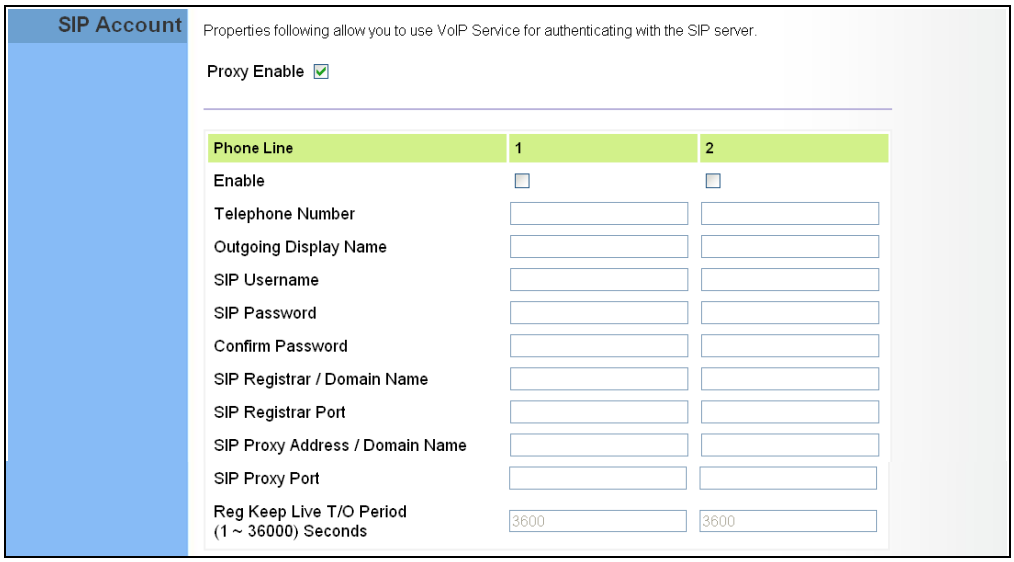
The RG231 allows the two RJ-11 Phone ports to be configured separately with different settings.

The VoIP configuration pages include the following options:

SIP ACCOUNT

From the VoIP SIP Account page, you can view the SIP account numbers that have been provided by the service operator.

Figure 45: SIP Account Settings



The following parameters are displayed on this page:

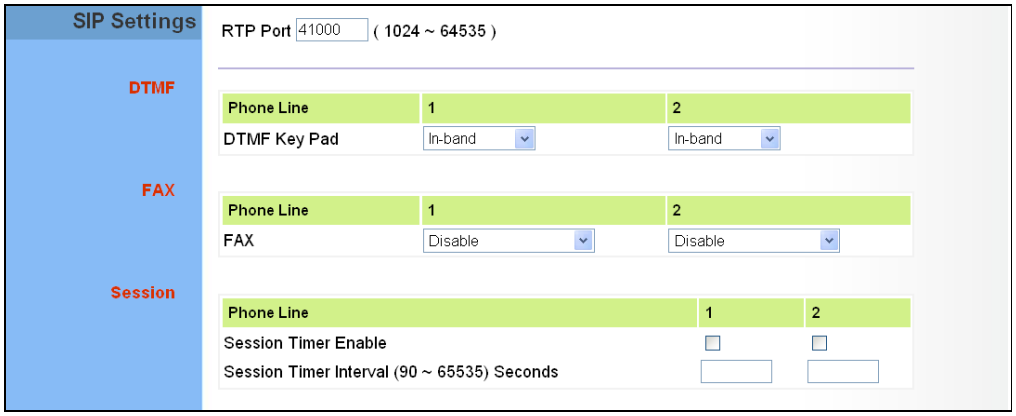
- **Proxy Enable** – Enables the use of proxy servers in the local network to forward SIP requests.
- **Enable** – Enables the VoIP ports on the CPE.
- **Telephone Number** – The SIP VoIP numbers for the ports on the CPE.
- **Outgoing Display Name** – The name that is displayed to the other party during a call.
- **SIP Username —** Enter your SIP user name.
- **SIP Password —** Enter your SIP password.
- **Confirm Password —** Re-enter your SIP password.
- **SIP Registrar/Domain Name** — Enter the IP address or server domain name of the SIP server.
- **SIP Registrar Port —** Enter the port associated with SIP server traffic.
- **SIP Proxy Address/Domain Name** – Address of the VoIP service provider SIP proxy server.
- **SIP Proxy Port** – The TCP port number used by the VoIP service provider's SIP proxy server.

- **Reg Keep Alive I/O Period** — The maximum time (in seconds) between keep-alive messages sent to the SIP register server.

SIP SETTINGS

The SIP Setting page allows you to configure RTP, DTMF, and FAX settings.

Figure 46: SIP Settings



The following items are displayed on this page:

- **RTP Port —** The Real-time Transport Protocol (RTP) and Real-time Control Protocol (RTCP) do not use specified port numbers. You can specify a port base that the RTP and RTCP traffic can use.
- **DTMF Key Pad —** Enables the sending of dual-tone multi-frequency (touch tone) phone signals over the VoIP connection. There are two methods to choose from:
  - **In-band —** The DTMF signals are sent over the RTP voice stream. In the case when low-bandwidth codecs are used, the DTMF signals may be distorted.
  - **RFC2833 —** Uses the RFC 2833 method to relay the DTMF signals over the RTP voice stream without any distortion.
- **FAX —** Selects the method to use when sending fax messages over the VoIP network from a fax machine connected to one of the RJ-11 Phone ports on the CPE.
  - **FAX T.38 —** The SIP protocol sets up the VoIP call, then the T.38 Fax Relay protocol sends the fax data over the network.
  - **FAX Pass-Through —** Enables voice calls and faxes to be sent from the Phone port connection. For this option, fax signals are sent over the VoIP network using the voice codec, just as if it were a voice call.

- **Session Timer Enable —** Enables a limit on the duration of VoIP calls.
- **Session Timer Interval** — Sets the maximum time limit for VoIP calls.

DIAL PLAN

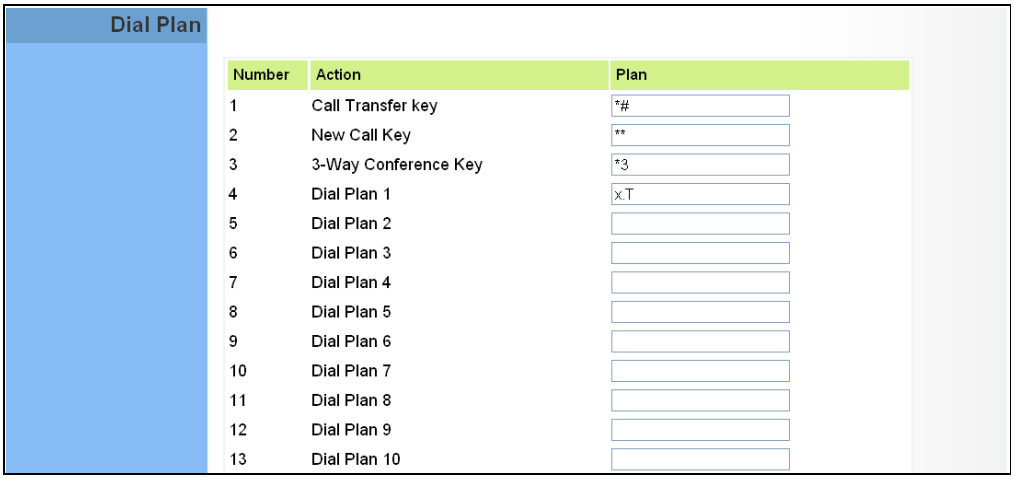
Dial-plan strings specify key sequences used for specific calling features (Transfer, New Call, 3-way conference), as well as defining call restriction filters.

A dial plan can filter the number and pattern of digits that a user dials to reach a particular telephone number. Access codes, area codes, specialized codes, and combinations of the number of digits dialed can all be part of a dial plan. This enables a user to predefine dialling sequences that are permitted.

The dial-plan string consists of a single digit rule. A typical example of a dial-plan string is: [0123]xxxxxx.t

Three standard dial plans are defined; Call Transfer Key, New Call Key, and 3-way Conference. Up to 20 other dial plans can be defined by the user.

Figure 47: Dial Plan Settings



The function of elements allowed in a dial plan are described in the table below:

Table 6: Dial Plan Elements

Element	Example	Description
x	xxxx	Represents a digit of any value (0 to 9) that can be dialed on a phone. This example has a rule with four digits of any number.
.	xx.	Indicates zero or more occurrences of the previous symbol. The example acts like a wildcard, meaning any dialed phone number of two or more digits is allowed.

Table 6: Dial Plan Elements

Element	Example	Description
0-9	01xx	Indicates dialed digits that must be matched. This example only allows four-digit numbers starting "01."
[ ]	[125-8]	Limits a dialed digit to specified values or a range of values. The example specifies that only digits 1, 2, 5, 6, 7, and 8 are permitted.
t	xx.t	The timeout indicator that can placed after dialed digits or at the end of the dial-plan string.

When a user dials a series of digits, the dial-plan rule is tested for a possible match. If a match is made, the dialed sequence is transmitted. If no match is made, the dialed number is blocked and the user will hear an error tone.

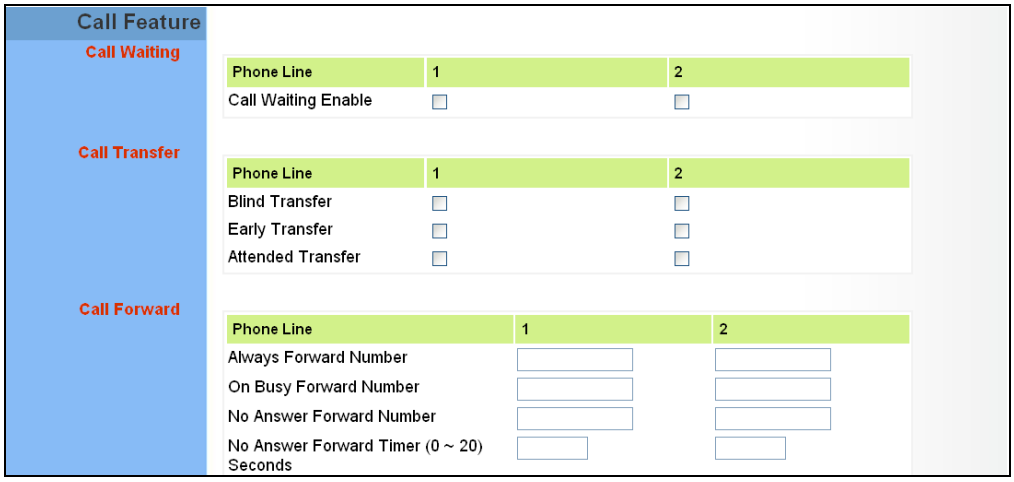
A dial-plan string cannot include spaces between elements. Dialed sequences that are longer than specified in a dial-plan rule are truncated after the number of specified digits. For example, if the dial-plan rule is "011x" and "0115678" is dialed, only the digit sequence "0115" is transmitted.

CALL FEATURE

The RG231 allows you to configure several call features, such as call waiting and call-forwarding. Other call features can be implemented by pressing specific phone buttons or entering dial patterns.

NOTE: Some call features may be dependent on support at the SIP server. Check with the SIP service provider.

Figure 48: Call Features



The following items are displayed on this page:

- **Call Waiting** — Enables a call waiting alert. If during a call there is another incoming call, an alert tone is heard. You can place the active call on hold (press the "Flash" or "Flash Hook" button on the phone) and switch to the incoming call.
- **Call Transfer —** Transfers any received call to another number you specify.
  - **Blind Transfer** — During a call press the "Flash" button, which puts the caller on hold, then enter the transfer key sequence (as defined on the Dial Plan page; default "*#"). You can then dial the transfer number. The call is transfered immediately and you can hang up. The transfered call shows the caller ID of the original calling party and not your caller ID.
  - **Early Transfer** — During a call press the "Flash" button, which puts the caller on hold, then enter the new call key sequence (as defined on the Dial Plan page; default "**"). You can then dial the transfer number. When you hear the transfer number ringtone, enter the transfer key sequence (as defined on the Dial Plan page; default "*#") and then hang up. The transfered call initially shows your

caller ID when the transferee phone is ringing, but then shows the original calling party ID as soon as you hang up.

- **Attended Transfer** — During a call press the "Flash" button, which puts the caller on hold, then enter the new call key sequence (as defined on the Dial Plan page; default "**"). You can then dial the transfer number and talk to the transferee. After speaking to the transferee, enter the transfer key sequence (as defined on the Dial Plan page; default "*#") and then hang up to transfer the call. The transfered call shows your caller ID and not the caller ID of the original calling party.

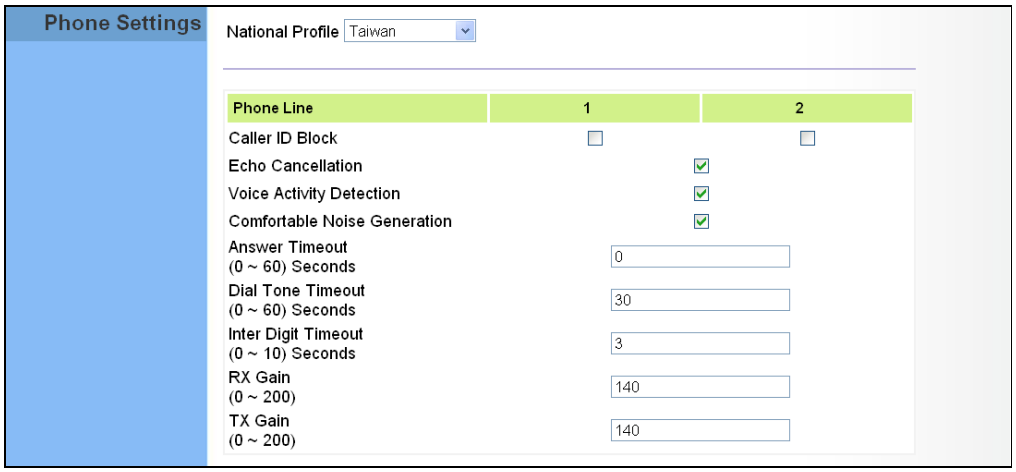
◆ **Call Forward —** Configures settings that control various call forwarding features.

- **Always Forward Number** — Forwards an incoming call to another number.
- **On Busy Forward Number** — When Call Waiting is disabled, specifies another phone number to which incoming calls are forwarded when the phone is busy.
- **No Answer Forward Number** — Another phone number to which incoming calls are forwarded when there is no answer.
- **No Answer Forward Timer** — The time a call waits for an answer before being forwarded to the No Answer Forward Phone Number. (Must be less than or equal to the value of Answer Timeout; Range: 0~20 seconds)

PHONE SETTINGS

The Phone Settings page allows you to configure control features that affect a phone connected to a VoIP port.

Figure 49: Phone Settings



The following items are displayed on this page:

- **National Profile —** Select the compatible telephone standard for the country of operation. (Options: China, Japan, Korea, New Zealand, Singapore, Taiwan, and the United States).
- **Caller ID Block —** Check this box to enable a block on the displayed ID of incoming calls.
- **Echo Cancellation** — Enables a time delay for voice echo cancellation. A voice echo can be created on some two-wire phone loops, which becomes increasingly louder and annoying when there is a long delay. If voice echo is a problem during a call, you can enable this parameter to try and reduce or remove it.
- **Voice Activation Detection** — Enables the detection of periods of silence in the audio stream so that it is not transmitted over the network.
- **Comfortable Noise Generation** — When enabled, creates artificial noise for the listener during detected silent intervals in the audio stream.
- **Answer Timeout** — The time after which a no answer message is sent to the caller. (Range: 0-60 seconds; Setting of zero disables the timeout)
- **Dial Tone Timeout** — The length of time a dial tone is heard on a connected phone. (Range: 0-60 seconds; Setting of zero disables the timeout)

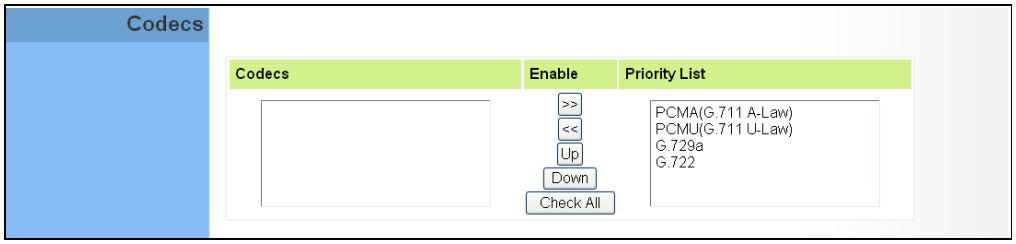
- **Inter Digit Timeout** — The maximum time delay allowed between each dialed digit. When the time is exceeded, a call is made using the dialed digits. (Range: 0-10 seconds; Setting of zero disables the timeout)
- **RX Gain** — Adjusts the volume level of the recieved sound. This control can be used to reduce the sound level if echo is a problem on the line. (Range: 0-200)
- **TX Gain** — Adjusts the volume level of the transmitted sound. This control can be used to reduce the sound level if echo is a problem on the line. (Range: 0-200)

CODECS

A codec (coder/decoder) is the way a voice analog signal is converted into a digital bitstream to send over the network, and how it is converted back into an analog signal at the receiving end. Codecs differ in the type of data compression that is used to save network bandwidth and in the time delay caused in the signal. This results in different voice quality experienced by the user.

The voice codecs in common use today have been standardized by the International Telecommunication Union Telecommunication Standardization Sector (ITU-T) and are identified by a standard number, such as G.711 or G.722. The same codec must be supported at each end of a VoIP call to be able to encode and decode the signal. Since devices in other networks may want to use different codecs, the CPE provides support for several common standards.

Figure 50: VoIP Codecs



The following items are displayed on this page:

- **Codecs** — Lists the codecs supported by the CPE. You can enable specific codecs to use, or enable all. Alternatively, you may want to disable certain codecs, such as high-bandwidth codecs, to preserve network bandwidth.
  - **PCMA (G.711 ALaw)** — The ITU-T G.711 with A-law standard codec that uses Pulse Code Modulation (PCM) to produce a 64 Kbps high-quality voice data stream. This standard is used in Europe and most other countries around the world.

- **PCMU (G.711 ULaw)** — The ITU-T G.711 with mu-law standard codec that uses Pulse Code Modulation (PCM) to produce a 64 Kbps high-quality voice data stream. This standard is used in North America and Japan.

- **G.729a** — The ITU-T G.729ab standard codec that uses Conjugate Structure Algebraic-Code Excited Linear Prediction (CS-ACELP) with silence suppression to produce a low-bandwidth data stream of 8 Kbps. Note that DTMF and fax tones do not transport reliably with this codec, it is better to use G.711 for these signals.

- **G.722** — The ITU-T G.722 standard codec based on sub-band ADPCM (SB-ADPCM) to provide wideband audio at data rates from 48, 56 and 64 kbps. This codec delivers high-quality audio over LANs and networks where bandwidth is available.

- **Priority List** — The CPE automatically negotiates the codec to use for each called party. You can specify a priority for the codecs that you prefer to use. Select a codec in the list, then use the UP and DOWN buttons to set the priority. The CPE attempts to use the codec highest in the list before trying the next lower one.

12 Wi-Fi Settings

The RG231 includes an IEEE 802.11n radio interface for local Wi-Fi communications. The Wi-Fi set up pages include configuration options for the radio signal characteristics and Wi-Fi security.

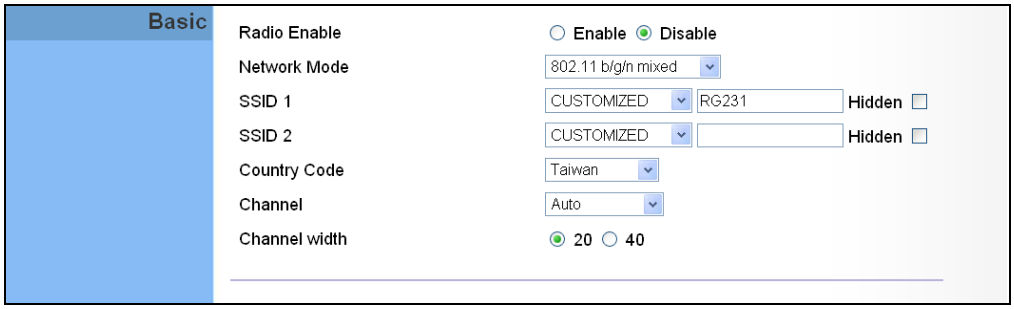
The Wi-Fi configuration pages include the following options:

BASIC WIRELESS SETTINGS

From the WiFi menu, click on Basic to configure basic settings for the unit's Wi-Fi radio interface. The unit's radio can operate in six modes, IEEE 802.11b/g mixed, 802.11b only, 802.11g only, 802.11n only, 802.11g/n mixed, and 802.11b/g/n mixed.

Note that IEEE 802.11g is backward compatible with 802.11b, and 802.11n is backward compatible with 802.11b/g at slower data transmit rates.

Figure 51: Wireless Settings



The following items are displayed on this page:

- **Radio Enable** — Enables or disables the radio.
- **Network Mode** — Defines the radio operating mode.
  - **11b/g mixed**: Both 802.11b and 802.11g clients can communicate with the Wi-Fi radio (up to 108 Mbps), but data transmission rates may be slowed to compensate for 802.11b clients. Any 802.11n clients will also be able to communicate with the Wi-Fi radio, but they will be limited to 802.11g protocols and data transmission rates.
  - **11b only**: All 802.11b, 802.11g, and 802.11n clients will be able to communicate with the Wi-Fi radio, but the 802.11g and 802.11n clients will be limited to 802.11b protocols and data transmission rates (up to 11 Mbps).
  - **11g only**: Both 802.11g and 802.11n clients will be able to communicate with the Wi-Fi radio, but the 802.11n clients will be limited to 802.11g protocols and data transmission rates (up to 54 Mbps). Any 802.11b clients will not be able to communicate with the Wi-Fi radio.
  - **11n only**: Only 802.11n clients will be able to communicate with the Wi-Fi radio (up to 150 Mbps).
  - **11g/n mixed**: Both 802.11g and 802.11n clients can communicate with the Wi-Fi radio (up to 150 Mbps), but data transmission rates may be slowed to compensate for 802.11g clients.

  - **11b/g/n Mixed**: All 802.11b/g/n clients can communicate with the Wi-Fi radio (up to 150 Mbps), but data transmission rates may be slowed to compensate for 802.11b/g clients.

- **SSID 1** — The name of the primary wireless network service provided by the Wi-Fi radio. Clients that want to connect to the network must set their SSID to the same as that of the Wi-Fi radio. Select "CUSTOMIZED" to set a specific text string, or select "MAC" to use the device MAC address as the SSID. (Range: 1-32 characters)

- **SSID 2** — The name of the wireless network service provided by the Wi-Fi radio. Clients that want to connect to the network must set their SSID to the same as that of the Wi-Fi radio. Select "CUSTOMIZED" to set a specific text string, or select "MAC" to use the device MAC address as the SSID. (Range: 1-32 characters)

- **Hidden** — By default, the Wi-Fi radio always broadcasts the SSID in its beacon signal. Disabling the SSID broadcast increases security of the network because wireless clients need to already know the SSID before attempting to connect.

- **Country Code** — The country code restricts operation of the Wi-Fi radio to the channels and transmit power levels permitted for Wi-Fi networks in the specified region. You must set the correct Country Code to be sure the radio conforms to local regulations. (Options: United States, Japan, France, Taiwan, Ireland)

CAUTION: You must set the country code to the country of operation. Setting the country code restricts operation of the access point to the radio channels and transmit power levels permitted for wireless networks in the specified country.

- **Channel** — The radio channel that the Wi-Fi radio uses to communicate with wireless clients. When multiple access points are deployed in the same area, set the channel on neighboring access points at least five channels apart to avoid interference with each other. For example, you can deploy up to three access points in the same area using channels 1, 6, 11. Note that wireless clients automatically set the channel to the same as that used by the Wi-Fi radio to which it is linked. Selecting Auto Select enables the Wi-Fi radio to automatically select an unoccupied radio channel.

NOTE: If you experience poor performance, you may be encountering interference from another wireless device. Try changing the channel, as this may eliminate interference and increase performance. Channels 1, 6, and 11, as the three non-overlapping channels in the 2.4 GHz band, are preferred.

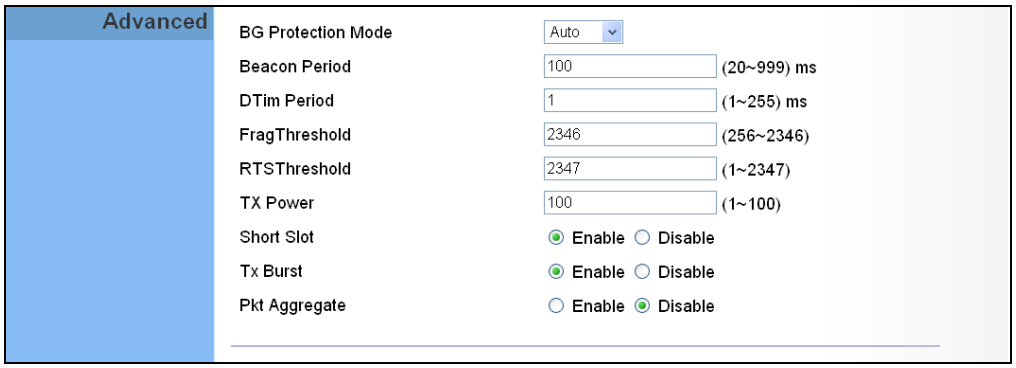
- **Channel Width** — The Wi-Fi radio provides a channel bandwidth of 40 MHz by default giving an 802.11g connection speed of 108 Mbps (sometimes referred to as Turbo Mode) and a 802.11n connection

speed of up to 150 Mbps. Setting the Channel Width to 20 MHz slows connection speed for 802.11g and 802.11n to 54 Mbps and 74 Mbps respectively and ensures backward compliance for slower 802.11b devices.

ADVANCED WIRELESS SETTINGS

The Advanced Settings page includes additional parameters concerning the wireless network and Wi-Fi Multimedia settings.

Figure 52: Advanced Wireless Settings



The following items are displayed on this page:

- **BG Protection Mode** — Enables a backward compatible protection mechanism for 802.11b clients. There are three modes:
  - **Auto** — The unit enables its protection mechanism for 802.11b clients when they are detected in the network. When 802.11b clients are not detected, the protection mechanism is disabled.
  - **On** — Forces the unit to always use protection for 802.11b clients, whether they are detected in the network or not. Note that enabling b/g Protection can slow throughput for 802.11g/n clients by as much as 50%.
  - **Off** — Forces the unit to never use protection for 802.11b clients. This prevents 802.11b clients from connecting to the network.
- **Beacon Period** — The rate at which beacon signals are transmitted from the access point. The beacon signals allow wireless clients to maintain contact with the access point. They may also carry power-management information. (Range: 20-999 TUs)
- **DTIM Period** — The rate at which stations in sleep mode must wake up to receive broadcast/multicast transmissions.

  Known also as the Delivery Traffic Indication Map (DTIM) interval, it indicates how often the MAC layer forwards broadcast/multicast traffic, which is necessary to wake up stations that are using Power Save

mode. The default value of one beacon indicates that the access point will save all broadcast/multicast frames for the Basic Service Set (BSS) and forward them after every beacon. Using smaller DTIM intervals delivers broadcast/multicast frames in a more timely manner, causing stations in Power Save mode to wake up more often and drain power faster. Using higher DTIM values reduces the power used by stations in Power Save mode, but delays the transmission of broadcast/multicast frames. (Range: 1-255 beacons)

- **Frag Threshold** – Configures the minimum packet size that can be fragmented when passing through the access point. Fragmentation of the PDUs (Package Data Unit) can increase the reliability of transmissions because it increases the probability of a successful transmission due to smaller frame size. If there is significant interference present, or collisions due to high network utilization, try setting the fragment size to send smaller fragments. This will speed up the retransmission of smaller frames. However, it is more efficient to set the fragment size larger if very little or no interference is present because it requires overhead to send multiple frames. (Range: 256-2346 bytes)

- **RTS Threshold** — Sets the packet size threshold at which a Request to Send (RTS) signal must be sent to a receiving station prior to the sending station starting communications. The access point sends RTS frames to a receiving station to negotiate the sending of a data frame. After receiving an RTS frame, the station sends a CTS (clear to send) frame to notify the sending station that it can start sending data.

  If the RTS threshold is set to 0, the access point always sends RTS signals. If set to 2347, the access point never sends RTS signals. If set to any other value, and the packet size equals or exceeds the RTS threshold, the RTS/CTS (Request to Send / Clear to Send) mechanism will be enabled.

  The access points contending for the medium may not be aware of each other. The RTS/CTS mechanism can solve this "Hidden Node Problem." (Range: 1-2347 bytes)

- **TX Power** – Adjusts the power of the radio signals transmitted from the unit. The higher the transmission power, the farther the transmission range. Power selection is not just a trade off between coverage area and maximum supported clients. You also have to ensure that high-power signals do not interfere with the operation of other radio devices in the service area. (Range: 1 - 100)

- **Short Slot** — Sets the basic unit of time the access point uses for calculating waiting times before data is transmitted. A short slot time (9 microseconds) can increase data throughput on the access point, but requires that all clients can support a short slot time (that is, 802.11g-compliant clients must support a short slot time). A long slot time (20 microseconds) is required if the access point has to support 802.11b clients.

- **TX Burst** — A performance enhancement that transmits a number of data packets at the same time when the feature is supported by compatible clients.
- **Pkt Aggregate** — A performance enhancement that combines data packets together when the feature is supported by compatible clients.

WIRELESS SECURITY

The RG231's Wi-Fi interface is configured by default as an "open system," which broadcasts a beacon signal including the configured SSID. Wireless clients with a configured SSID of "ANY" can read the SSID from the beacon, and automatically set their SSID to allow immediate connection to the wireless network.

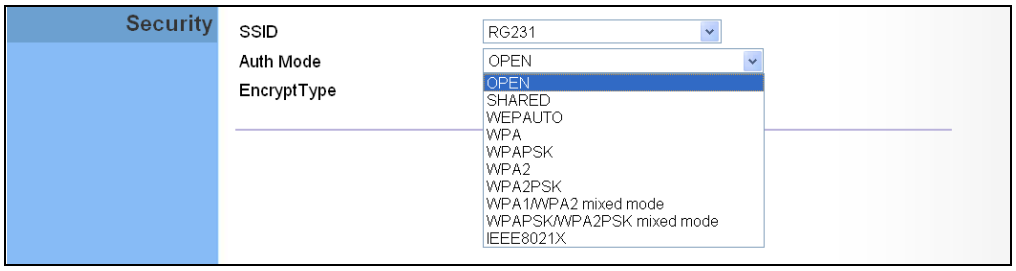
To implement wireless network security, you have to employ two main functions:

- Authentication – It must be verified that clients attempting to connect to the network are authorized users.
- Traffic Encryption – Data passing between the unit and clients must be protected from interception and evesdropping.

The RG231's Wi-Fi interface supports supports ten different security mechanisms that provide various levels of authentication and encryption depending on the requirements of the network.

Click on "Wi-Fi," followed by "Security".

Figure 53: Security Mode Options



The supported security mechanisms and their configuration parameters are described in the following sections:

- **OPEN, SHARED, WEPAUTO** — See "Wired Equivalent Privacy (WEP)" on page 81.
- **WPAPSK, WPA2PSK, WPAPSK/WPA2PSK mixed mode** — See "WPA Pre-Shared Key" on page 82.
- **WPA, WPA2, WPA1/WPA2 mixed mode** — See "WPA Enterprise Mode" on page 83.

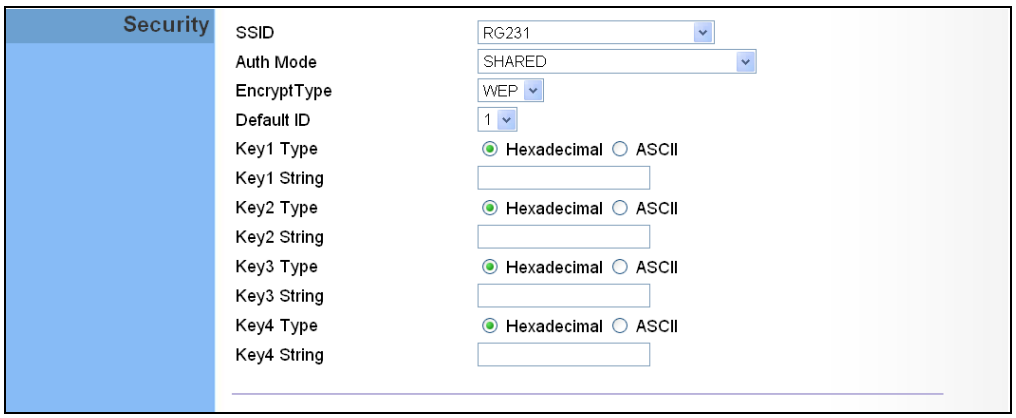
- **IEEE8021X** — See "IEEE 802.1X and RADIUS" on page 84.

WIRED EQUIVALENT PRIVACY (WEP)

WEP provides a basic level of security, preventing unauthorized access to the network, and encrypting data transmitted between wireless clients and an access point. WEP uses static shared keys (fixed-length hexadecimal or alphanumeric strings) that are manually distributed to all clients that want to use the network.

When you select to use WEP, be sure to define at least one static WEP key for user authentication or data encryption. Also, be sure that the WEP shared keys are the same for each client in the wireless network.

Figure 54: Security Mode - WEP



The following items are displayed in this section on this page:

- **Auth Mode** — Configures the WEP security mode used by clients. When using WEP, be sure to define at least one static WEP key for the RG231 and all its clients.
  - **OPEN** — Open-system authentication accepts any client attempting to connect the RG231 without verifying its identity. In this mode the default data encryption type is "WEP."
  - **SHARED** — The shared-key security uses a WEP key to authenticate clients connecting to the network and for data encryption.
  - **WEPAUTO** — Allows wireless clients to connect to the network using Open-WEP (uses WEP for encryption only) or Shared-WEP (uses WEP for authentication and encryption).
- **Encrypt Type** — Selects WEP for data encryption (OPEN mode only).
- **Default ID** — Selects the WEP key number to use for authentication or data encryption. If wireless clients have all four WEP keys configured to the same values, you can change the encryption key to any of the settings without having to update the client keys. (Range: 1~4)

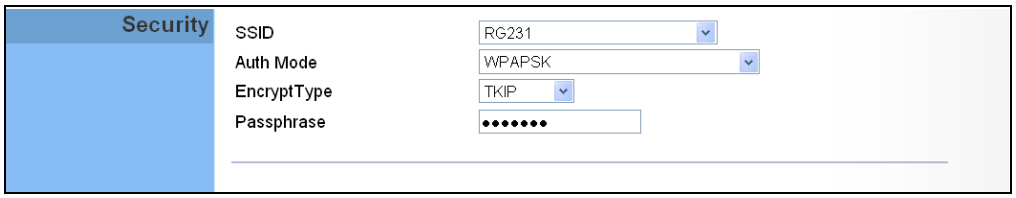
- **Key 1~4 Type** — Sets WEP key type as ASCII or hexadecimal.
- **Key 1~4 String** — Sets WEP key values. The user must first select ASCII or hexadecimal keys. Each WEP key has an index number. Enter key values that match the key type and length settings. Enter 5 alphanumeric characters or 10 hexadecimal digits for 64-bit keys, or enter 13 alphanumeric characters or 26 hexadecimal digits for 128-bit keys.

WPA PRE-SHARED KEY

Wi-Fi Protected Access (WPA) was introduced as an interim solution for the vulnerability of WEP pending the adoption of a more robust wireless security standard. WPA2 includes the complete wireless security standard, but also offers backward compatibility with WPA. Both WPA and WPA2 provide an "enterprise" and "personal" mode of operation.

For small home or office networks, WPA and WPA2 provide a simple "personal" operating mode that uses just a pre-shared key for network access. The WPA Pre-Shared Key (WPA-PSK) mode uses a common password phrase for user authentication that is manually entered on the access point and all wireless clients. Data encryption keys are automatically generated by the access point and distributed to all clients connected to the network.

Figure 55: Security Mode - WPA-PSK



The following items are displayed in this section on this page:

- **Auth Mode** — Configures the WPA-PSK and WPA2-PSK security modes used by clients. When using WPA-PSK or WPA2-PSK, be sure to define the shared key for the RG231 and all its clients.
  - **WPAPSK** — Clients using WPA with a Pre-shared Key are accepted for authentication. The default data encryption type for WPA is TKIP.
  - **WPA2PSK** — Clients using WPA2 with a Pre-shared Key are accepted for authentication. The default data encryption type for WPA is AES.
  - **WPAPSK/WPA2PSK mixed mode** — Clients using WPA or WPA2 with a Pre-shared Key are accepted for authentication. The default data encryption type is TKIP/AES.
- **EncryptType** — Selects the data encryption type to use. (Default is determined by the Security Mode selected.)

- **TKIP** — Uses Temporal Key Integrity Protocol (TKIP) keys for encryption. WPA specifies TKIP as the data encryption method to replace WEP. TKIP avoids the problems of WEP static keys by dynamically changing data encryption keys.

- **AES** — Uses Advanced Encryption Standard (AES) keys for encryption. WPA2 uses AES Counter-Mode encryption with Cipher Block Chaining Message Authentication Code (CBC-MAC) for message integrity. The AES Counter-Mode/CBCMAC Protocol (AES-CCMP) provides extremely robust data confidentiality using a 128-bit key. Use of AES-CCMP encryption is specified as a standard requirement for WPA2. Before implementing WPA2 in the network, be sure client devices are upgraded to WPA2-compliant hardware.

- **TKIPAES** — Uses either TKIP or AES keys for encryption. WPA and WPA2 mixed modes allow both WPA and WPA2 clients to associate to a common SSID. In mixed mode, the unicast encryption type (TKIP or AES) is negotiated for each client.

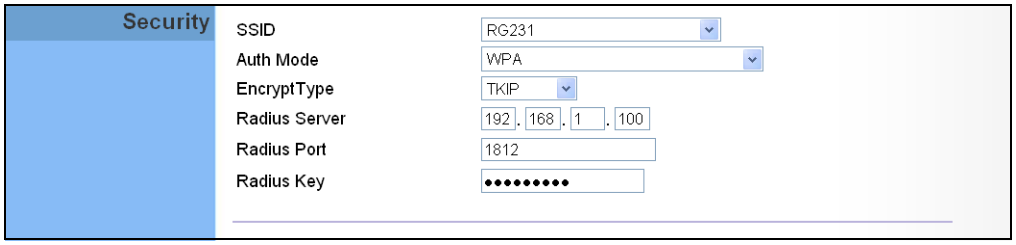
- **Pass Phrase** — The WPA Preshared Key can be input as an ASCII string (an easy-to-remember form of letters and numbers that can include spaces) or Hexadecimal format. (Range: 8~63 ASCII characters, or exactly 64 Hexadecimal digits)

WPA ENTERPRISE MODE

Wi-Fi Protected Access (WPA) was introduced as an interim solution for the vulnerability of WEP pending the adoption of a more robust wireless security standard. WPA2 includes the complete wireless security standard, but also offers backward compatibility with WPA. Both WPA and WPA2 provide an "enterprise" and "personal" mode of operation.

For enterprise deployment, WPA and WPA2 use IEEE 802.1X for user authentication and require a RADIUS authentication server to be configured on the wired network. Data encryption keys are automatically generated and distributed to all clients connected to the network.

Figure 56: Security Mode - WPA



The following items are displayed in this section on this page:

- **Auth Mode** — Configures the WPA and WPA2 security modes used by clients. When using WPA or WPA2, be sure there is a RADIUS server in the connected wired network, and that the RADIUS settings are configured. See "IEEE 802.1X and RADIUS" on page 84 for more information.

- **WPA** — Clients using WPA with an 802.1X authentication method are accepted for authentication. The default data encryption type for WPA is TKIP.
- **WPA2** — Clients using WPA2 with an 802.1X authentication method are accepted for authentication. The default data encryption type for WPA is AES.
- **WPA1/WPA2 mixed mode** — Clients using WPA or WPA2 with an 802.1X authentication method are accepted for authentication. The default data encryption type is TKIP/AES.

◆ **EncryptType** — Selects the data encryption type to use. (Default is determined by the Security Mode selected.)

- **TKIP** — Uses Temporal Key Integrity Protocol (TKIP) keys for encryption. WPA specifies TKIP as the data encryption method to replace WEP. TKIP avoids the problems of WEP static keys by dynamically changing data encryption keys.
- **AES** — Uses Advanced Encryption Standard (AES) keys for encryption. WPA2 uses AES Counter-Mode encryption with Cipher Block Chaining Message Authentication Code (CBC-MAC) for message integrity. The AES Counter-Mode/CBCMAC Protocol (AES-CCMP) provides extremely robust data confidentiality using a 128-bit key. Use of AES-CCMP encryption is specified as a standard requirement for WPA2. Before implementing WPA2 in the network, be sure client devices are upgraded to WPA2-compliant hardware.
- **TKIPAES** — Uses either TKIP or AES keys for encryption. WPA and WPA2 mixed modes allow both WPA and WPA2 clients to associate to a common SSID. In mixed mode, the unicast encryption type (TKIP or AES) is negotiated for each client.

IEEE 802.1X AND RADIUS

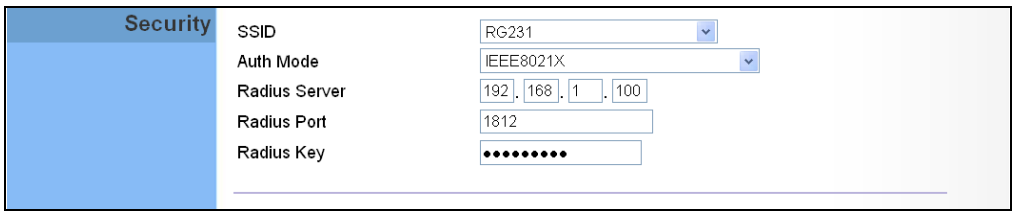
IEEE 802.1X is a standard framework for network access control that uses a central RADIUS server for user authentication. This control feature prevents unauthorized access to the network by requiring an 802.1X client application to submit user credentials for authentication. The 802.1X standard uses the Extensible Authentication Protocol (EAP) to pass user credentials (either digital certificates, user names and passwords, or other) from the client to the RADIUS server. Client authentication is then verified on the RADIUS server before the client can access the network.

Remote Authentication Dial-in User Service (RADIUS) is an authentication protocol that uses software running on a central server to control access to RADIUS-aware devices on the network. An authentication server contains a database of user credentials for each user that requires access to the network.

The WPA and WPA2 enterprise security modes use 802.1X as the method of user authentication. IEEE 802.1X can also be enabled on its own as a security mode for user authentication. When 802.1X is used, a RADIUS server must be configured and be available on the connected wired network.

NOTE: This guide assumes that you have already configured RADIUS server(s) to support the access point. Configuration of RADIUS server software is beyond the scope of this guide, refer to the documentation provided with the RADIUS server software.

Figure 57: Security Mode - 802.1X



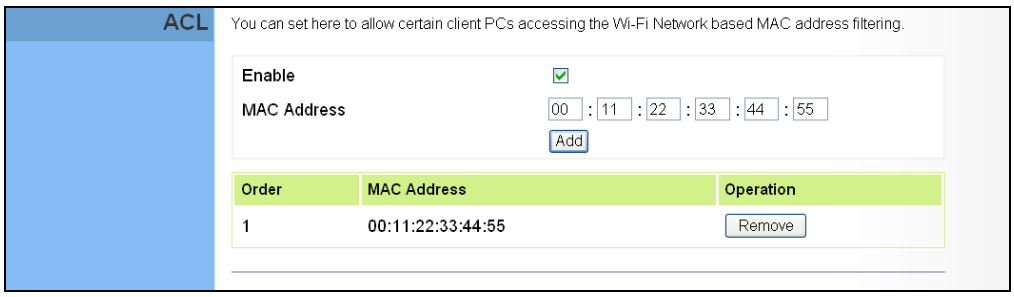
The following items are displayed in this section on this page:

- **Auth Mode** — Configures the 802.1X security mode used by clients. When using 802.1X, either with WPA/WPA2 or on its own, be sure there is a configured RADIUS server in the connected wired network.
- **RADIUS Server** — Specifies the IP address of the RADIUS server.
- **RADIUS Port** — The User Datagram Protocol (UDP) port number used by the RADIUS server for authentication messages. (Range: 1024-65535)
- **RADIUS Key** — A shared text string used to encrypt messages between the access point and the RADIUS server. Be sure that the same text string is specified on the RADIUS server. Do not use blank spaces in the string. (Maximum length: 20 characters)

ACL SETTINGS

Wireless clients can be authenticated for network access by checking their MAC address against a local database configured on the RG231. You can configure a list of up to 32 wireless client MAC addresses in the filter list to allow network access.

Figure 58: ACL Settings



The following items are displayed on this page:

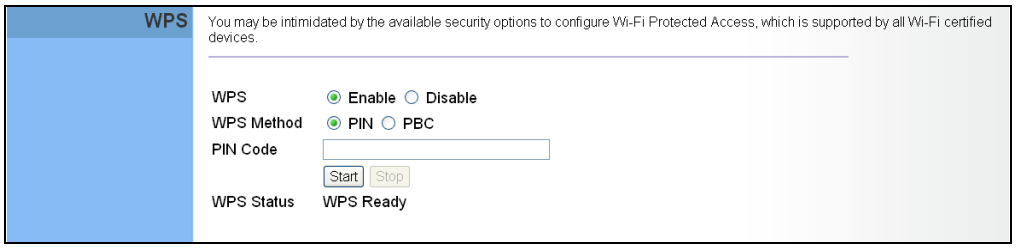
- **Enable** — Enables the ACL feature.
- **MAC Address** — Physical address of a client. Enter six pairs of hexadecimal digits separated by colons; for example, 00:90:D1:12:AB:89.
- **Add** — Click to list a new specified MAC address in the MAC Authentication Table.
- **Operation** — Click the Remove button to delete the specified MAC address from the table.

WI-FI PROTECTED SETUP (WPS)

Wi-Fi Protected Setup (WPS) is designed to ease installation and activation of security features in wireless networks. WPS has two basic modes of operation, Push-button Configuration (PBC) and Personal Identification Number (PIN). The WPS PIN setup is optional to the PBC setup and provides more security. The WPS button on the CPE can be pressed at any time to allow a single device to easily join the network.

The WPS Settings page includes configuration options for setting WPS device PIN codes and activating the virtual WPS button.

Figure 59: WPS



The following items are displayed on this page:

- **WPS** — Enables WPS, locks security settings, and refreshes WPS configuration information.
- **WPS Method** — Selects between methods of broadcasting the WPS beacon to network clients wanting to join the network:
  - **PBC** — This has the same effect as pressing the physical WPS button that is located on the top of the CPE. After checking this option and clicking "Start" you have up to two minutes to activate WPS on a device that needs to join the network.
  - **PIN** — The CPE, along with other WPS devices, such as notebook PCs, cameras, or phones, all come with their own eight-digit PIN code. When one device, the WPS enrollee, sends a PIN code to the CPE, it becomes the WPS registrar. After configuring PIN-Code information you must click "Start" to send the beacon, after which you have up to two minutes to activate WPS on the device that needs to join the network.
- **WPS Status** — Shows the current progress of the WPS process after it has been activated.

13 QoS Configuration

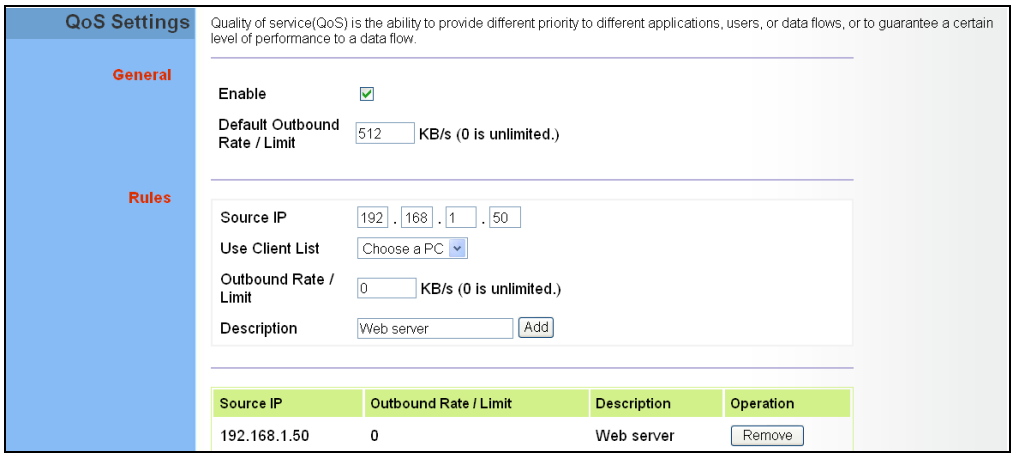
The RG231 supports Quality of Service (QoS) settings that enable traffic rate limits to be set for all or specific LAN clients.

The QoS configuration pages include the following options:

QOS SETTINGS

From the QoS Settings page, you can set rate limits for outbound (WiMAX uplink) traffic from all or specified clients.

Figure 60: QoS Settings



The following parameters are displayed on this page:

- **General** — Sets QoS parameters that apply to all LAN clients (except those listed in the QoS Rules table):
  - **Enable** — Enables the QoS settings on the CPE.
  - **Default Outbound Rate/Limit** — Sets a rate limit for the outbound traffic from all clients not specified in the QoS Rules table. The rate is specified in kilobytes per second (0 means unlimited).
- **Rules** — Specifies the QoS rate limits for specified client source IPs:
  - **Source IP** — Specifies a source IP address on the local network. The IP address can also be selected from the DHCP client list, as indicated by "Use Client List."
  - **Use Client List** – Enables the Source IP to be selected from the DHCP client list.
  - **Outbound Rate/Limit** — Sets a rate limit for the outbound traffic from the specified source IP in kilobytes per second (0 means unlimited).
  - **Description** — A text srting that identifies the rule.

Section III

Appendices

This section provides additional information and includes these items:

A TROUBLESHOOTING

DIAGNOSING LED INDICATORS

Table 7: Troubleshooting Chart

Symptom	Action
Power LED is Off	◆ AC power adapter may be disconnected. Check connections between the unit, the AC power adapter, and the wall outlet.
Power LED is Red	◆ The unit has detected a system error. Reboot the unit to try and clear the condition. ◆ If the condition does not clear, contact your local dealer for assistance.
WiMAX Signal LEDs are Off	◆ Move the location of the unit. ◆ Check with the WiMAX service provider for service coverage information.
LAN link LED is Off	◆ Verify that the unit and attached device are powered on. ◆ Be sure the cable is plugged into both the unit and corresponding device. ◆ Verify that the proper cable type is used and its length does not exceed specified limits. ◆ Check the cable connections for possible defects. Replace the defective cable if necessary.

CANNOT CONNECT TO THE INTERNET

If you cannot access the Internet from the PC, check the following:

- If you cannot access the Internet, be sure your Windows system is correctly configured for TCP/IP. The IP settings should be set to "obtain an IP address automatically."
- You may be out of the service area of the WiMAX network. Check with the WiMAX service provider for service coverage information.
- If you cannot resolve the problem, check the System Status page of the web interface and contact your WiMAX service provider.

CANNOT ACCESS WEB MANAGEMENT

If the management interface cannot be accessed using a web browser:

- Be sure the management station is correctly configured for TCP/IP. The IP settings should be set to "obtain an IP address automatically."
- Try a Ping command from the management station to the unit's IP address to verify that the entire network path between the two devices is functioning correctly.
- Check that the management station has a valid network connection and that the Ethernet port that you are using has not been disabled.
- Check the network cabling between the management station and the unit. If the problem is not resolved, try using a different port or a different cable.

FORGOT OR LOST THE PASSWORD

Set the unit to its default configuration by pressing the reset button on the base for 5 seconds or more. Then use the default password "admin" to access the management interface.

RESETTING THE UNIT

If all other recovery measures fail and the unit is still not functioning properly, take either of these steps:

- Reset the unit using the web interface, or through a power reset.
- Reset the unit to its factory default configuration by pressing the reset button on the base for 5 seconds or more. Then use the default password "admin" to access the management interface.

B HARDWARE SPECIFICATIONS

PHYSICAL SPECIFICATIONS

PORTS 4 LAN ports, 10/100BASE-TX with auto-negotiation, RJ-45 connector
(Optional) 2 FXS ports (PHONE1, PHONE2), RJ-11 connector

NETWORK INTERFACE RJ-45 connector, auto MDI/X:
10BASE-T: RJ-45 (100-ohm, UTP cable; Category 3 or better)
100BASE-TX: RJ-45 (100-ohm, UTP cable; Category 5 or better)

LED INDICATORS System: Power, WiMAX signal strength, WiFi, WPS
Ports: Link/Activity

AC POWER ADAPTER Input: 100-240 VAC, 50-60 Hz, 1 A maximum
Output: 12 VDC, 2 A

UNIT POWER SUPPLY DC Input: 12 VDC, 1.5 A maximum
Power Consumption: 18 W maximum

PHYSICAL SIZE 181.5 x 198.5 x 79 mm (7.15 x 7.81 x 3.11 in)

WEIGHT 412 g (14.5 oz)

TEMPERATURE Operating: -5 to 45 °C (23 to 113 °F)
Storage: -40 to 75 °C (-40 to 167 °F)

HUMIDITY 5% to 95% (non-condensing)

WiMAX Specifications

Antennas
Pattern: Omnidirectional
Transmit and Receive: One transmit and two receive with Maximal-Ratio Combining (MRC). Support for transmitter diversity.
Gain: 5 dBi
Impedance: 50 Ohm

Operating Frequency
FCC-2.5: 2496-2690 MHz
Taiwan NCC: 2500-2690 MHz
Support for Full Scan and Partial Scan

Channel Bandwidth
2.5 GHz model: 5 and 10 MHz

Modulation Scheme
Scaleable OFDMA employing Time-Division Duplex (TDD) mechanism
PRBS subcarrier randomization
Contains pilot, preamble, and ranging modulation

Modulation and Coding Types
Down Link: QPSK, 16 QAM, 64 QAM
Up Link: QPSK, 16 QAM

Receive Sensitivity
-94 dBm maximum

VoIP Specifications

Voice Signaling Protocol
SIP v2 (RFC 3261)

Voice Codec
G.711 (a-law and u-law)
G.726
G.729ab
G.723.1

Voice Quality
VAD (Voice Activity Detection)
CNG (Comfortable Noise Generation)

Echo cancellation (G.165/G.168)
Adaptive jitter buffer, up to 200 milliseconds
DTMF tone detection and generation

CALL FEATURES

Caller ID number and name
Caller ID Block
Call transfer
Call waiting/hold/retrieve
3-way conference call
Call blocking
T.38 fax relay
Dial plan (E.164 dialing plan)
Call forwarding: No Answer/Busy/All

REN (RING EQUIVALENT NUMBER)

3 REN total in system

WI-FI SPECIFICATIONS

MAXIMUM 802.11B/G CHANNELS

FCC/IC/NCC: 1-11
ETSI: 1-13
France: 10-13
MKK: 1-14

OPERATING FREQUENCY

2.4 ~ 2.4835 GHz (US, Canada, ETSI)
2.4 ~ 2.497 GHz (Japan)

MODULATION TYPE

802.11n: BPSK, QPSK, OFDM
802.11g: BPSK, QPSK, OFDM
802.11b: CCK, BPSK, QPSK

RF OUTPUT POWER

802.11b: 16 dBm @ 11 Mbps
802.11g: 14 dBm @ 54 Mbps
802.11n: 14 dBm @ 300 Mbps

RF RECEIVE SENSITIVITY

802.11b: -85 dBm @ 11 Mbps
802.11g: -74 dBm @ 54 Mbps
802.11n: -69 dBm @ 300 Mbps

COMPLIANCES

EMISSIONS
FCC CFR 47 Part 15 Class B
EN 55022 class B
EN 301 489-1/4/17

EMMUNITY
EN 61000-4-2/3/4/5/6/8/11

WiMAX RADIO SIGNAL CERTIFICATION
US: 2.3 GHz - FCC CFR 47 Part 27D
2.5 GHz - FCC CFR 47 Part 27M / Part 25.254
3.5 GHz - FCC CFR 47 Part 90Z
Europe (3.5 GHz): EN 302 326-2 (V1.2.2), EN 302 326-3 (V1.2.2)
NCC: PLMN09

WI-FI RADIO SIGNAL CERTIFICATION
FCC CFR 47 Part 15 Subpart C
EN 300 328
NCC: LP0002

SAFETY
CE: EN 60950-1 (LVD)
NCC: CNS14336
ErP 2009/125/EU

STANDARDS
IEEE 802.16e-2005 WAVE 1 and WAVE 2
IEEE 802.3-2005 10BASE-T and 100BASE-TX
IEEE 802.11b, 802.11g, and 802.11n

C CABLES AND PINOUTS

TWISTED-PAIR CABLE ASSIGNMENTS

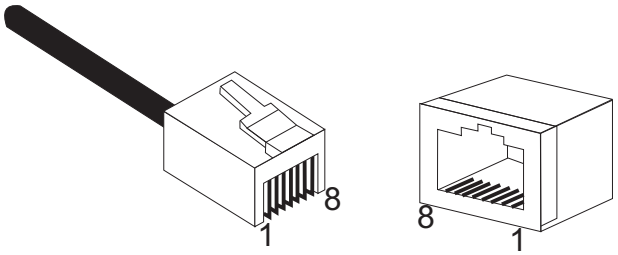
For 10/100BASE-TX connections, a twisted-pair cable must have two pairs of wires. Each wire pair is identified by two different colors. For example, one wire might be green and the other, green with white stripes. Also, an RJ-45 connector must be attached to both ends of the cable.

CAUTION: Each wire pair must be attached to the RJ-45 connectors in a specific orientation. (See "Straight-Through Wiring" on page 98 and "Crossover Wiring" on page 99 for an explanation.)

CAUTION: DO NOT plug a phone jack connector into the RJ-45 port. Use only twisted-pair cables with RJ-45 connectors that conform with FCC standards.

The following figure illustrates how the pins on the RJ-45 connector are numbered. Be sure to hold the connectors in the same orientation when attaching the wires to the pins.

Figure 61: RJ-45 Connector



10/100BASE-TX PIN ASSIGNMENTS

Use unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for RJ-45 connections: 100-ohm Category 3 or better cable for 10 Mbps connections, or 100-ohm Category 5 or better cable for 100 Mbps connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

The RJ-45 ports on the unit supports automatic MDI/MDI-X operation, so you can use straight-through or crossover cables for all network connections to PCs, switches, or hubs. In straight-through cable, pins 1, 2, 3, and 6, at one end of the cable, are connected straight through to pins 1, 2, 3, and 6 at the other end of the cable.

Table 8: 10/100BASE-TX MDI and MDI-X Port Pinouts

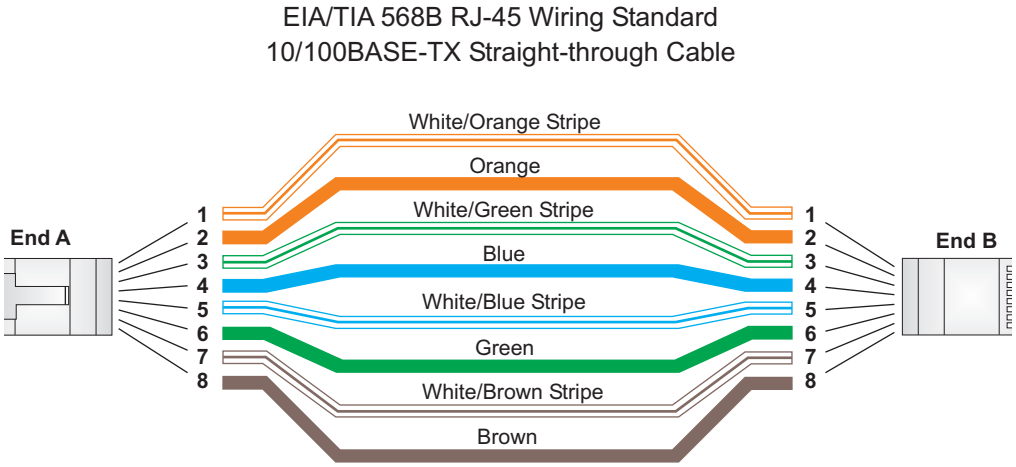
PIN	MDI Signal Name[a]	MDI-X Signal Name
1	Transmit Data plus (TD+)	Receive Data plus (RD+)
2	Transmit Data minus (TD-)	Receive Data minus (RD-)
3	Receive Data plus (RD+)	Transmit Data plus (TD+)
6	Receive Data minus (RD-)	Transmit Data minus (TD-)
4, 5, 7, 8	Not used	Not used

a. The "+" and "-" signs represent the polarity of the wires that make up each wire pair.

STRAIGHT-THROUGH WIRING

If the twisted-pair cable is to join two ports and only one of the ports has an internal crossover (MDI-X), the two pairs of wires must be straight-through.

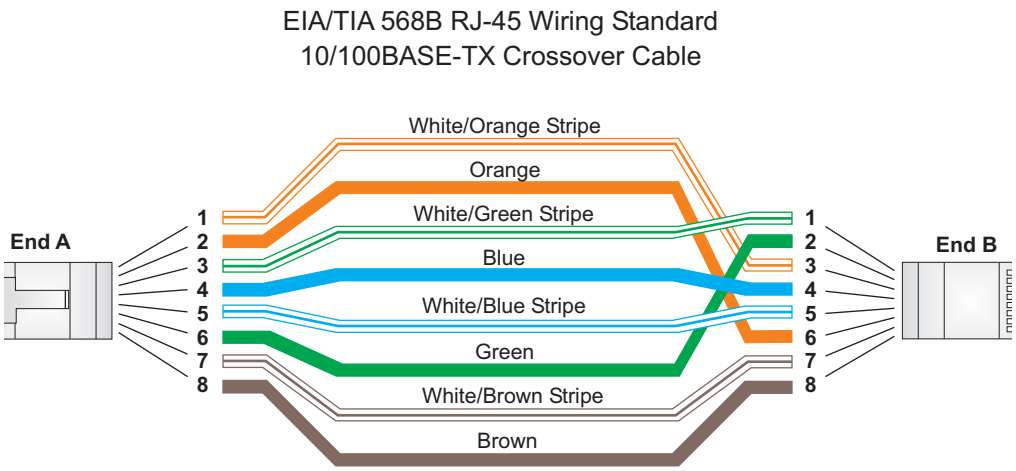
Figure 62: Straight Through Wiring



CROSSOVER WIRING

If the twisted-pair cable is to join two ports and either both ports are labeled with an "X" (MDI-X) or neither port is labeled with an "X" (MDI), a crossover must be implemented in the wiring.

Figure 63: Crossover Wiring



RJ-11 PORTS

Standard telephone RJ-11 connectors and cabling can be found in several common wiring patterns. These six-pin connectors can accommodate up to three wire pairs (three telephone lines), but usually only one or two pairs of conductor pins and wires are implemented.

The RJ-11 ports on this device contain only one wire pair on the inner pins (3 and 4).

Figure 64: RJ-11 Port Pinout

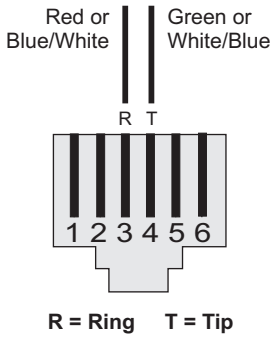


Table 9: RJ-11 Port Pinout

Pin	Signal Name	Wire Color
1	Not used	
2	Not used	
3	Line 1 Ring	Red or Blue/White
4	Line 1 Tip	Green or White/Blue
5	Not used	
6	Not used	

GLOSSARY

10BASE-T IEEE 802.3-2005 specification for 10 Mbps Ethernet over two pairs of Category 3 or better UTP cable.

100BASE-TX IEEE 802.3-2005 specification for 100 Mbps Fast Ethernet over two pairs of Category 5 or better UTP cable.

ACCESS POINT An Wi-Fi internetworking device that seamlessly connects wired and wireless networks.

AUTHENTICATION The process to verify the identity of a client requesting network access.

AUTO-NEGOTIATION Signalling method allowing each node to select its optimum operational mode (speed and duplex mode) based on the capabilities of the node to which it is connected.

BASE STATION A WIMAX service provider's equipment that is installed at a fixed location to provide network connectivity for subscriber stations within a defined service area.

BEACON A signal periodically transmitted from a Wi-Fi access point that is used to identify the network and maintain contact with wireless clients.

CINR Carrier-to-Interference-Plus-Noise Ratio. A measurement of the channel quality in a WiMAX link. Subscriber stations measure the received CINR and send the information back to the base station. The base station can then adjust modulation and coding for the link to optimize throughput.

CENTER FREQUENCY The radio frequency at the center of a WiMAX channel. WiMAX channels can be of different widths (the channel bandwidth) and the transmitted radio signal is spread across the full width of the channel.

CHANNEL BANDWIDTH The range of frequencies occupied by a WiMAX radio signal. The amount of information that can be transmitted in a radio signal is related to the channel bandwidth, which is measured in Megahertz (MHz). WiMAX supports a range of channel bandwidths that can be defined by the service

operator depending on performance requirements, operating preferences, and regulatory constraints.

CPE Customer-Premises Equipment. Terminal equipment provided by a service provider that is located at a subscriber's premises and supports a communication channel between a customer and the service provider.

DNS Domain Name System. A system used for translating host names for network nodes into IP addresses.

DHCP Dynamic Host Configuration Protocol. Provides a framework for passing configuration information to hosts on a TCP/IP network. DHCP is based on the Bootstrap Protocol (BOOTP), adding the capability of automatic allocation of reusable network addresses and additional configuration options.

ENCRYPTION Data passing between a base station and subscribers uses encryption to protect from interception and evesdropping.

ETHERNET A popular local area data communications network, which accepts transmission from computers and terminals.

EAP Extensible Authentication Protocol. An authentication protocol used to authenticate subscribers. EAP is used with TLS or TTLS authentication to provide "mutual authentication" between a subscriber and a WiMAX network.

HTTP Hypertext Transfer Protocol. HTTP is a standard used to transmit and receive all data over the World Wide Web.

ICMP Internet Control Message Protocol. A network layer protocol that reports errors in processing IP packets. ICMP is also used by routers to feed back information about better routing choices.

IEEE 802.11B The Wi-Fi wireless standard that supports communications in the 2.4 GHz band using Direct Sequence Spread Spectrum (DSSS). The standard provides for data rates of 1, 2, 5.5, and 11 Mbps.

IEEE 802.11G The Wi-Fi wireless standard that supports communications in the 2.4 GHz band using using Orthogonal Frequency Division Multiplexing (OFDM). The standard provides for data rates of 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps. IEEE 802.11g is also backward compatible with IEEE 802.11b.

IEEE 802.16E The WiMAX standard that provides mobile broadband wireless access using Scalable Orthogonal Frequency Division Multiple Access (SOFDMA).

IEEE 802.1X Port Authentication controls access to the switch ports by requiring users to first enter a user ID and password for authentication.

IP ADDRESS The Internet Protocol (IP) address is a numerical identification assigned to a device that communicates in a network using the Internet Protocol.

ISP Internet Service Provider. A company that offers an access service that connects customers to the Internet.

LED Light emitting diode. Used for indicating a device or network condition.

LAN Local Area Network. A group of interconnected computer and support devices.

MAC ADDRESS The physical layer address used to uniquely identify network nodes.

MS-CHAPV2 Microsoft's version 2 of the Challenge-Handshake Authentication Protocol. Introduced by Microsoft with Windows 2000, MS-CHAPV2 (defined in RFC 2759) provides mutual authentication between peers using user names and passwords.

ODFM Orthogonal Frequency Division Multiplexing. The air interface defined for IEEE 802.11g Wi-Fi. OFDM allows multiple users to transmit in an allocated band by dividing the bandwidth into many narrow bandwidth carriers.

RADIUS Remote Authentication Dial-in User Service. A logon authentication protocol that uses software running on a central server to control access to a network.

RJ-45 CONNECTOR A connector for twisted-pair wiring.

RSSI Receive Signal Strength Indicator. A measurement of the strength of a received wireless signal. The higher the RSSI value, the stronger the received signal from the antenna.

ROAMING The process where a WiMAX subscriber can move onto another operator's network while maintaining a continuous connection.

SOFDMA Scalable Orthogonal Frequency Division Multiple Access. The air interface defined for mobile WiMAX. SOFDMA is a multiple access method that allows simultaneous transmissions to and from several users, employing a subchannel structure that scales with bandwidth.

SERVICE PROVIDER See *Internet Service Provider*.

SSID Service Set Identifier. A name that is sent in packets over a Wi-Fi network, which functions as a password for clients connecting to the network. The SSID differentiates one Wi-Fi network from another.

SNTP Simple Network Time Protocol. SNTP allows a device to set its internal clock based on periodic updates from a Network Time Protocol (NTP) server. Updates can be requested from a specific NTP server, or can be received via broadcasts sent by NTP servers.

SIM Subscriber Identity Module. A standard for a small removable integrated circuit card that securely stores information used to identify a mobile wireless subscriber.

SUBSCRIBER STATION A general term for a customer's WIMAX terminal equipment that provides connectivity with a base station.

TCP/IP Transmission Control Protocol/Internet Protocol. Protocol suite that includes TCP as the primary transport protocol, and IP as the network layer protocol.

TLS Transport Layer Security. An standard defined in RFC 5216, EAP-TLS is an authentication protocol that provides strong security through the use of client-side certificates.

TTLS Tunneled Transport Layer Security. EAP-TTLS is a protocol extension of EAP-TLS. The authentication server is authenticated to the client using its Certification Authority certificate, this establishes a secure "tunnel" through which the client is then authenticated.

URL Uniform Resource Locator. An easy-to-read character string that is used to represent a resource available on the Internet. For example, "http://www.url-example.com/."

UTP Unshielded twisted-pair cable.

WPA Wi-Fi Protected Access. WPA employs IEEE 802.1X as its basic framework for user authentication and dynamic key management to provide an enhanced security solution for 802.11 Wi-Fi networks.

WEP Wired Equivalent Privacy. WEP is the Wi-Fi security based on the use of RC4 encryption keys. Wi-Fi devices without a valid WEP key are excluded from the network.

PSK WPA Pre-shared Key. PSK security can be used for small Wi-Fi networks that may not have the resources to configure and maintain a RADIUS server. WPA provides a simple operating mode that uses just a pre-shared password for network access.

WiMAX The IEEE 802.16 standard for Worldwide Interoperability for Microwave Access. The IEEE 802.16-2004 standard, known as "fixed WiMAX," supports only point-to-point links and has no support for mobility. The IEEE 802.16e-2005 standard, known as "mobile WiMAX," is an amendment to IEEE 802.16-2004 and supports mobility. Note that mobile WiMAX standard is not backward compatible with the fixed WiMAX standard.

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