

WiMAX CPE Series

MAX208M, MAX218M, MAX208M2W, MAX218M2W,
MAX218M1W, MAX218MW, MAX318M2W, MAX308M,
MAX318M

User's Guide

Default Login Details

IP Address	http://192.168.1.1
Admin's User Name /Password	admin / 1234
Guest's User Name /Password	guest / guest

Firmware Version 2.00
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www.zyxel.com

ZyXEL

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the WiMAX Device. See the product-specific QSG for hardware setup.

Note: This is a configuration manual for a series of products. Therefore, some features or options in this guide may not be available in your product.

Related Documentation

- Quick Start Guide

The Quick Start Guide is designed to help you get your WiMAX Device up and running right away. It contains information on setting up your network and configuring for Internet access.

- Web Configurator Online Help

The embedded Web Help contains descriptions of individual screens and supplementary information.

- Support Disc

Refer to the included CD for support documents.

Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your device.

Note: Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

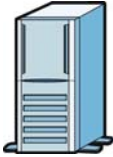
Syntax Conventions

- The WiMAX Device may be referred to as the “WiMAX Device”, the “device” or the “system” in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the “enter” or “return” key on your keyboard.
- “Enter” means for you to type one or more characters and then press the [ENTER] key. “Select” or “choose” means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the “metric” value or the “scientific” value. For example, “k” for kilo may denote “1000” or “1024”, “M” for mega may denote “1000000” or “1048576” and so on.
- “e.g.,” is a shorthand for “for instance”, and “i.e.,” means “that is” or “in other words”.

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The WiMAX icon is not an exact representation of your device.

Graphics in this book may differ slightly from the product due to differences in operating systems, operating system versions, or if you installed updated firmware/software for your device. Every effort has been made to ensure that the information in this manual is accurate.

WiMAX Device 	Computer 	Notebook computer 
Server 	Base Station 	Firewall 
Router 	Switch 	Telephone 
Internet 	Wireless Signal 	

Safety Warnings

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- ONLY qualified service personnel should service or disassemble this device.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device.
- Connect the power adaptor or cord to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT remove the plug and connect it to a power outlet by itself; always attach the plug to the power adaptor first before connecting it to a power outlet.
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the power outlet.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- For indoor devices, do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device. Use only No. 26 AWG (American Wire Gauge) or larger telecommunication line cord.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).
- If you wall mount your device, make sure that no electrical lines, gas or water pipes will be damaged.
- Make sure that the cable system is grounded so as to provide some protection against voltage surges.

Your product is marked with this symbol, which is known as the WEEE mark. WEEE stands for Waste Electronics and Electrical Equipment. It means that used electrical and electronic products should not be mixed with general waste. Used electrical and electronic equipment should be treated separately.



Contents Overview

User's Guide	15
Introduction to the Series	17
Introduction to the Web Configurator	20
Setup Wizard.....	25
Tutorials	35
Technical Reference	61
System Status	63
WiMAX	67
Network Setting	91
Security	125
The VoIP General Screens	151
The VoIP Account Screens	157
The VoIP Line Screens	171
Maintenance	175
Troubleshooting	197
Product Specifications	203

Table of Contents

About This User's Guide	3
Document Conventions	4
Safety Warnings.....	6
Contents Overview	7
Table of Contents	9
 Part I: User's Guide	 15
 Chapter 1	
Introduction to the Series	17
1.1 About Your WiMAX Device	17
1.1.1 WiMAX Internet Access	18
1.1.2 Models with Phone Ports	18
1.1.3 Models with WiFi	19
1.2 Good Habits for Managing the WiMAX Device	19
 Chapter 2	
Introduction to the Web Configurator.....	20
2.1 Overview	20
2.1.1 Accessing the Web Configurator	20
2.1.2 Saving and Canceling Changes	21
2.1.3 Working with Tables	21
2.2 The Main Screen	22
 Chapter 3	
Setup Wizard	25
3.1 Overview	25
3.1.1 Welcome to the Setup Wizard	25
3.1.2 LAN Settings	26
3.1.3 WiMAX Frequency Settings	27
3.1.4 WiMAX Authentication Settings	28
3.1.5 VoIP Settings	30
3.1.6 WLAN Settings	32
3.1.7 Setup Complete	34

Chapter 4	
Tutorials.....	35
4.1 Overview	35
4.2 WiMAX Connection Settings	35
4.3 Setting Up a Small Network for the LAN	36
4.4 Making a Telephone Call Over the Internet	38
4.4.1 Configure Your SIP Account	38
4.5 Blocking Web Access from the WiMAX Device	40
4.6 Restricting Wireless Access to the WiMAX Device	40
4.7 Allowing Internet Users to use Internal Servers	42
4.8 Access the WiMAX Device with a Domain Name	44
4.8.1 Registering a DDNS Account on www.dyndns.org	45
4.8.2 Configuring DDNS on Your WiMAX Device	46
4.8.3 Testing the DDNS Setting	46
4.9 Configuring Static Route for Routing to Another Network	46
4.10 Remotely Managing Your WiMAX Device	48
4.11 Changing Certificate to Communicate with Other Networks	49
4.12 Using Virtual Networks	50
4.12.1 Scenario 1	51
4.12.2 Scenario 2	52
4.12.3 Scenario 3	54
4.12.4 Scenario 4	56
4.12.5 Scenario 5	58

Part II: Technical Reference..... 61

Chapter 5	
System Status	63

5.1 Overview	63
5.2 System Status	63

Chapter 6	
WiMAX	67

6.1 Overview	67
6.1.1 What You Need to Know	67
6.2 Connection Settings	70
6.3 Frequency Settings	72
6.4 Authentication Settings	74
6.5 Channel Plan Settings	77
6.6 CAPL Settings	79
6.6.1 CAPL Settings: Add	80

6.7 RAPL Settings	81
6.8 Home NSP Settings	82
6.9 Connect	83
6.10 Wide Scan	85
6.11 Link Status	87
6.12 Link Statistics	88
6.13 Connection Info	89
6.14 Service Flow	89
Chapter 7	
Network Setting	91
7.1 Overview	91
7.1.1 What You Need to Know	91
7.2 WAN	94
7.3 PPPoE	96
7.4 GRE	97
7.5 EtherIP	98
7.6 IP	98
7.7 DHCP	99
7.8 WLAN	100
7.9 WPS	102
7.10 MAC Address Filter	103
7.11 Static Route	104
7.12 Static Route Add	104
7.13 RIP	105
7.14 Port Forwarding	107
7.14.1 Port Forwarding Wizard	108
7.15 Port Trigger	108
7.15.1 Port Trigger Wizard	110
7.15.2 Trigger Port Forwarding Example	111
7.16 DMZ	111
7.17 ALG	112
7.18 QoS	113
7.19 UPnP	113
7.19.1 Installing UPnP in Windows XP	114
7.19.2 Web Configurator Easy Access	118
7.20 VLAN	119
7.21 DDNS	121
7.22 IGMP Proxy	123
7.23 Content Filter	123
Chapter 8	
Security.....	125

8.1 Overview	125
8.1.1 What You Need to Know	125
8.2 IP Filter	125
8.3 MAC Filter	126
8.4 DDOS	127
8.5 PPTP VPN Server	129
8.6 PPTP VPN Client	130
8.7 PPTP VPN Client: Add	131
8.8 L2TP VPN Server	133
8.9 L2TP VPN Client	135
8.10 L2TP VPN Client: Add	135
8.11 IPsec VPN	137
8.11.1 IPsec VPN: Add	139
8.12 Technical Reference	144
8.12.1 IPsec Architecture	144
8.12.2 Encapsulation	145
8.12.3 IKE Phases	146
8.12.4 Negotiation Mode	147
8.12.5 IPsec and NAT	147
8.12.6 VPN, NAT, and NAT Traversal	148
8.12.7 ID Type and Content	148
8.12.8 Pre-Shared Key	150
8.12.9 Diffie-Hellman (DH) Key Groups	150
Chapter 9	
The VoIP General Screens	151
9.1 VoIP Overview	151
9.1.1 What You Need to Know	151
9.1.2 Before you Begin	152
9.2 Media	153
9.3 QoS	154
9.4 SIP Settings	155
9.5 Speed Dial	155
9.6 Technical Reference	156
9.6.1 DSCP and Per-Hop Behavior	156
Chapter 10	
The VoIP Account Screens	157
10.1 Overview	157
10.1.1 What You Need to Know	157
10.2 Status	160
10.3 Server	161
10.4 SIP	163

10.5 Feature	165
10.6 Dialing	166
10.7 FAX	167
10.8 Technical Reference	167
10.8.1 SIP Call Progression with Session Timer	167
10.8.2 SIP Client Server	170
Chapter 11	
The VoIP Line Screens	171
11.1 Overview	171
11.1.1 What You Need to Know	171
11.2 Phone	172
11.3 Voice	172
11.4 Region	173
Chapter 12	
Maintenance	175
12.1 Overview	175
12.1.1 What You Need to Know	175
12.2 Password	180
12.3 HTTP	181
12.4 Telnet	181
12.5 SSH	182
12.6 SNMP	183
12.7 CWMP	183
12.8 OMA-DM	185
12.9 Date/Time	187
12.10 Time Zone	187
12.11 Upgrade File	188
12.11.1 The Firmware Upload Process	189
12.12 Upgrade Link	189
12.13 CWMP Upgrade	189
12.14 Backup/Restore	190
12.15 Restore	190
12.15.1 The Restore Configuration Process	191
12.16 Factory Defaults	191
12.17 Log Setting	192
12.18 Log Display	192
12.19 Network Test	193
12.20 Traceroute	194
12.21 About	194
12.22 Reboot	195

Chapter 13	
Troubleshooting.....	197
13.1 Power, Hardware Connections, and LEDs	197
13.2 WiMAX Device Access and Login	198
13.3 Internet Access	199
13.4 Wireless Internet Access (for Models with WiFi)	201
13.5 Phone Calls and VoIP (for Models with Phone Ports)	201
13.6 Reset the WiMAX Device to Its Factory Defaults	202
13.6.1 Pop-up Windows, JavaScript and Java Permissions	202
Chapter 14	
Product Specifications.....	203
Appendix A WiMAX Security	207
Appendix B Importing Certificates	211
Appendix C Common Services.....	237
Appendix D Open Software Announcements	241
Appendix E Legal Information.....	277
Index	285

PART I

User's Guide

Introduction to the Series

1.1 About Your WiMAX Device

The WiMAX Device allows you to access the Internet by connecting to a WiMAX wireless network. For some models, you can use a traditional analog telephone to make Internet calls using the WiMAX Device's Voice over IP (VoIP) communication capabilities.

Additionally, The web browser-based Graphical User Interface (GUI), also known as the web configurator, provides easy management of the device and its features.

Please refer to the following description of the product name format.

- Models starting with "2" (for example MAX208M2W) denote an indoor CPE device; models starting with "3" (for example MAX318M2W) denote an outdoor CPE device.
- Models with the second number as "0" (for example MAX208M2W) denote that its frequency band is 2.5GHz ~ 2.7GHz; models with the second number as "1" (for example MAX218M2W) denote that its frequency band is 3.4GHz ~ 3.6GHz.
- The number after the letter "M" denote the number of VoIP ports that the device has. For example, MAX208M2W has 2 VoIP ports; MAX218M has no VoIP port.
- Models ending with "W" (for example MAX208M2W) denote WiFi functionality, including 802.11n mode.

See the following table for the main features for each specific model:

Table 1 Main Features

FEATURE / MODEL	FREQUENCY BAND	NUMBER OF PHONE PORTS	WIFI FUNCTION	INDOOR DEVICE	OUTDOOR DEVICE
MAX208M	2.5 ~ 2.7 GHz	N/A	N/A	✓	
MAX218M	3.4 ~ 3.6 GHz	N/A	N/A	✓	
MAX208M2W	2.5 ~ 2.7 GHz	2	✓	✓	
MAX218M2W	3.4 ~ 3.6 GHz	2	✓	✓	
MAX218M1W	3.4 ~ 3.6 GHz	1	✓	✓	
MAX218MW	3.4 ~ 3.6 GHz	N/A	✓	✓	
MAX318M2W	3.4 ~ 3.6 GHz	2	✓		✓
MAX308M	2.5 ~ 2.7 GHz	N/A	N/A		✓
MAX318M	3.4 ~ 3.6 GHz	N/A	N/A		✓

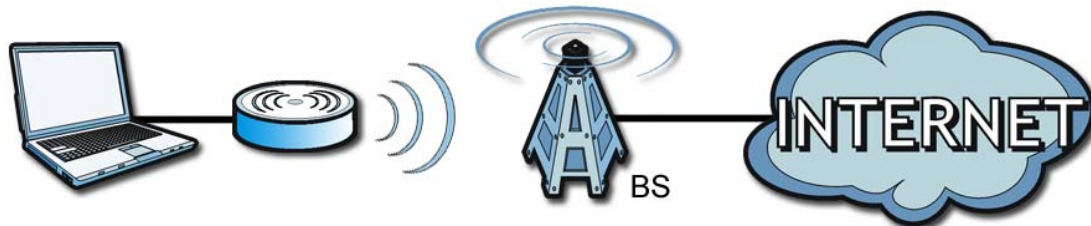
1.1.1 WiMAX Internet Access

Connect your computer or network to the WiMAX Device for WiMAX Internet access. See the Quick Start Guide for instructions on hardware connection.

In a wireless metropolitan area network (MAN), the WiMAX Device connects to a WiMAX base station (BS) for Internet access.

The following diagram shows a notebook computer equipped with the WiMAX Device connecting to the Internet through a WiMAX base station (marked **BS**).

Figure 1 Mobile Station and Base Station



When the firewall is on, all incoming traffic from the Internet to your network is blocked unless it is initiated from your network.

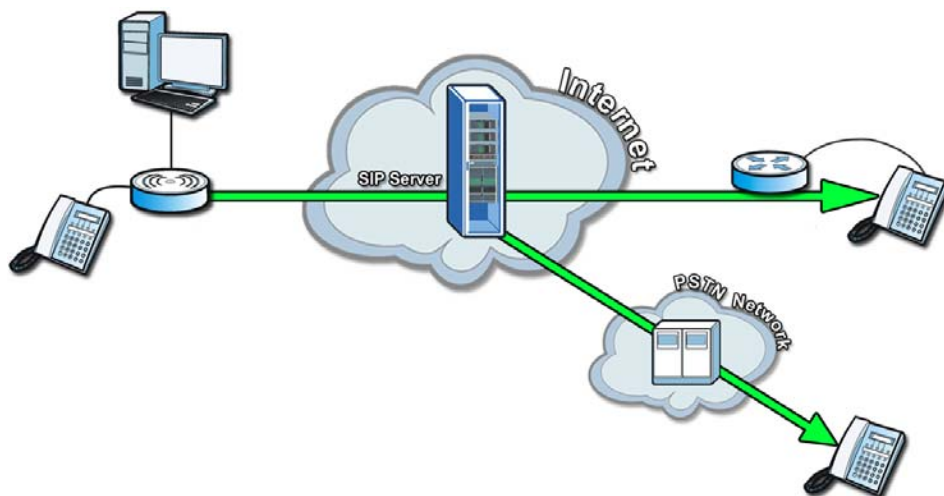
Use content filtering to block access to web sites with URLs containing keywords that you specify. You can define time periods and days during which content filtering is enabled and include or exclude particular computers on your network from content filtering. For example, you could block access to certain web sites for the kids.

1.1.2 Models with Phone Ports

For models with phone ports, you can use the WiMAX Device to make and receive Voice over Internet Phone (VoIP) telephone calls:

- Calls via a VoIP service provider - The WiMAX Device sends your call to a VoIP service provider's SIP server which forwards your calls to either VoIP or PSTN phones.

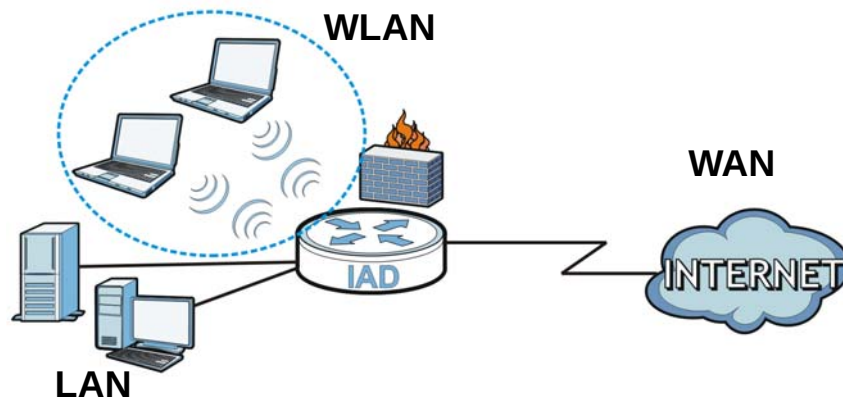
Figure 2 Calls via VoIP Service Provider



1.1.3 Models with WiFi

For WiFi models, IEEE 802.11b/g/n compliant clients can wirelessly connect to the WiMAX Device to access network resources. You can set up a wireless network with WPS (WiFi Protected Setup) or manually add a client to your wireless network.

Figure 3 WiFi Connection Application



1.2 Good Habits for Managing the WiMAX Device

Do the following things regularly to make the WiMAX Device more secure and to manage the WiMAX Device more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the WiMAX Device becomes unstable or even crashes. If you forget your password, you will have to reset the WiMAX Device to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the WiMAX Device. You could simply restore your last configuration.

Introduction to the Web Configurator

2.1 Overview

The Web Configurator is an HTML-based management interface that allows easy device set up and management via any web browser that supports: HTML 4.0, CSS 2.0, and JavaScript 1.5, and higher. The recommended screen resolution for using the web configurator is 1024 by 768 pixels and 16-bit color, or higher.

In order to use the Web Configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in many operating systems and web browsers.
- JavaScript (enabled by default in most web browsers).
- Java permissions (enabled by default in most web browsers).

See the [Appendix C on page 233](#) for more information on configuring your web browser.

2.1.1 Accessing the Web Configurator

- 1 Make sure your WiMAX Device hardware is properly connected (refer to the Quick Start Guide for more information).
- 2 Launch your web browser.
- 3 Enter 192.168.1.1 as the URL.
- 4 A login screen displays. Enter the default **Username** (admin) and **Password** (1234), then click **Login**.

Figure 4 Login screen

The image shows the ZyXEL login screen. At the top left is the ZyXEL logo. Below it is the heading "Welcome". The text reads: "Welcome to [redacted] configuration interface. Please enter username and password to login." Below this is the instruction "Enter your username and password." followed by two input fields: "- Username:" and "- Password:". At the bottom right are two buttons: "Login" and "Reset".

ZyXEL

Welcome

Welcome to [redacted] configuration interface. Please enter username and password to login.

Enter your username and password.

- Username:

- Password:

Login Reset

Note: For security reasons, the WiMAX Device automatically logs you out if you do not use the Web Configurator for five minutes. If this happens, log in again.

2.1.2 Saving and Canceling Changes

All screens to which you can make configuration changes must be saved before those changes can go into effect. If you make a mistake while configuring the WiMAX Device, you can cancel those changes and start over.

Figure 5 Saving and Canceling Changes

The screenshot shows a web interface titled "Wide Scan Result". It contains a table with three columns: "#", "Frequency (KHz)", and "Bandwidth (MHz)". Below the table, there is a text field showing "Total Num: 0" and two buttons labeled "Search" and "Clear". At the bottom of the interface, there are two buttons labeled "Save" and "Cancel", which are circled in red in the image.

This screen contains the following fields:

Table 2 Saving and Canceling Changes

LABEL	DESCRIPTION
Save	Click this to save your changes.
Cancel	Click this to restore the settings on this page to their last saved values.

Note: If you make changes to a page but do not save before switching to another page or exiting the Web Configurator, those changes are discarded.

2.1.3 Working with Tables

Many screens in the WiMAX Device contain tables to provide information or additional configuration options.

Figure 6 Tables Example

The screenshot shows a web interface with a table. Above the table, there is a pagination control with a dropdown menu set to "10" and the text "per page", followed by navigation arrows and another dropdown menu set to "0" with the text "page". The table has four columns: "#", "SFID", "SF Status", and "SF Direction". Below the table, there is a text field showing "Total Num: 0".

This screen contains the following fields:

Table 3 Saving and Canceling Changes

LABEL	DESCRIPTION
10 per page	Items per Page This displays the number of items displayed per table page. Use the menu to change this value.
⏪	First Page Click this to go to the first page in the table.

Table 3 Saving and Canceling Changes (continued)

LABEL	DESCRIPTION
	Previous Page Click this to go to the previous page in the table.
 page	Page Indicator / Jump to Page This indicates which page is currently displayed in the table. Use the menu to jump to another page. You can only jump to other pages if those pages exist.
	Next Page Click this to go to the previous page in the table.
	Last Page Click this to go to the last page in the table.
#	This indicates an item's position in the table. It has no bearing on that item's importance or lack there of.
Total Num	This indicates the total number of items in the table, including items on pages that are not visible.

2.2 The Main Screen

When you first log into the Web Configurator, the **Main** screen appears. Here you can view a summary of your WiMAX Device's connection status. This is also the default "home" page for the Web Configurator and it contains conveniently-placed shortcuts to all of the other screens.

Note: Some features in the Web Configurator may not be available depending on your model and firmware version and/or configuration.

Note: The available menus and screens vary depending on the type of account (admin or guest) you use for login.

Figure 7 Main Screen



The following table describes the menus in this screen.

Table 4 Main > Menu

MENU	DESCRIPTION
Language	Use this menu to select the Web Configurator's language.
Setup Wizard	Click this to open the Setup Wizard, where you can configure the most essential settings for your WiMAX Device to work.
Logout	Click this to log out of the Web Configurator.
System Status	Click this to open the Main screen, which shows your WiMAX Device status and other information.
WiMAX	Click this to open the WiMAX menu, which gives you options for configuring your WiMAX settings.
Network Setting	Click this to open the Network menu, which gives you options for configuring your WAN/LAN/WiFi network settings.
Security	Click this to open the Security menu, which gives you options for configuring your firewall and security settings.
VoIP	Click this icon to open the VoIP menu, which gives you options on how to make telephone calls over the Internet via the WiMAX Device.
Maintenance	Click this to open the Maintenance menu, which gives you options for maintaining your WiMAX Device and performing basic network connectivity tests.

Setup Wizard

3.1 Overview

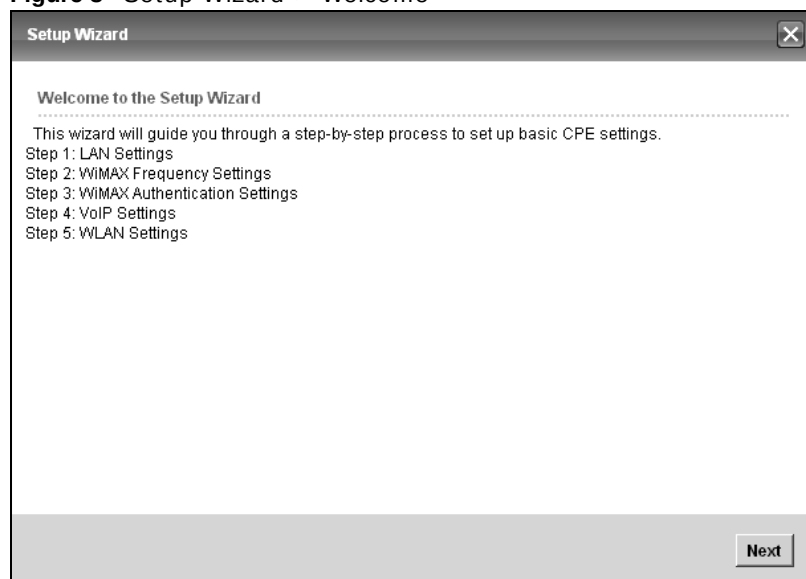
This chapter provides information on the Setup Wizard. The wizard guides you through several steps for configuring your network settings.

3.1.1 Welcome to the Setup Wizard

This screen provides a quick summary of the configuration tasks the wizard helps you to perform. They are:

- 1 Set up your Local Area Network (LAN) options, which determine how the devices in your home or office connect to the WiMAX Device.
- 2 Set up your WiMAX Device's broadcast frequency, which is the radio channel it uses to communicate with the ISP's base station.
- 3 Set up your WiMAX Device's login options, which are used to connect your LAN to the ISP's network and verify your account.
- 4 For models with VoIP feature, set up your WiMAX Device's VoIP Settings, which will allow you to make calls over the Internet.
- 5 For models with WiFi feature, set up your WiMAX Device's wireless LAN so that other devices, such as a laptop or a smartphone, can connect wirelessly to the Internet using the WiMAX Device.

Figure 8 Setup Wizard > Welcome



3.1.2 LAN Settings

The LAN Settings screen allows you to configure your local network options.

Figure 9 Setup Wizard > LAN Settings

The following table describes the labels in this screen.

Table 5 Setup Wizard > LAN Settings

LABEL	DESCRIPTION
LAN TCP/IP	
IP Address	Enter the IP address of the WiMAX Device on the LAN. Note: This field is the IP address you use to access the WiMAX Device on the LAN. If the web configurator is running on a computer on the LAN, you lose access to it as soon as you change this field. You can access the web configurator again by typing the new IP address in the browser.
IP Subnet Mask	Enter the subnet mask of the LAN.
DHCP Server	
Enable	Select this if you want the WiMAX Device to be the DHCP server on the LAN. As a DHCP server, the WiMAX Device assigns IP addresses to DHCP clients on the LAN and provides the subnet mask and DNS server information.
Start IP	Enter the IP address from which the WiMAX Device begins allocating IP addresses.
End IP	Enter the IP address at which the WiMAX Device stops allocating IP addresses.
Lease Time	Enter the duration in minutes before the device requests a new IP address from the DHCP server.
DNS Server assigned by DHCP Server	
First DNS Server	Specify the first IP address of three DNS servers that the network can use. The WiMAX Device provides these IP addresses to DHCP clients.

Table 5 Setup Wizard > LAN Settings (continued)

LABEL	DESCRIPTION
Second DNS Server	Specify the second IP address of three DNS servers that the network can use. The WiMAX Device provides these IP addresses to DHCP clients.
Third DNS Server	Specify the third IP address of three DNS servers that the network can use. The WiMAX Device provides these IP addresses to DHCP clients.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.

3.1.3 WiMAX Frequency Settings

The WiMAX Frequency Settings screen allows you to configure the broadcast radio frequency used by the WiMAX Device.

Note: The frequency band varies for different models. See [Section 1.1 on page 17](#) for more information.

Note: These settings should be provided by your ISP.

Figure 10 Setup Wizard > WiMAX Frequency Settings

Setup Wizard

Step 2: WiMAX Frequency Settings

Set Frequency

Setting Type:

Bandwidth: MHz

#	Frequency(MHz)
Total Num: 0	

Valid Band Info:

#	Band Start(KHz)	Band End(KHz)
1	2490000	2700000
Total Num: 1		

The following table describes the labels in this screen.

Table 6 Setup Wizard > WiMAX Frequency Settings

LABEL	DESCRIPTION
Setting Type	Select the WiMAX frequency setting type from the list. • By Range - Select this to set up the frequency based on a range of MHz. • By List - Select this to set up the frequency on an individual MHz basis. You can add multiple MHz values to the list.
Step	Enter the increments in MHz by which to increase the frequency range. Note: This field only appears when you select By Range under Setting Type .
Start Frequency	Enter the frequency value at the beginning of the frequency range to use. The frequency is increased in increments equal to the Step value until the End Frequency is reached, at which time the cycle starts over with the Start Frequency . Note: This field only appears when you select By Range under Setting Type .
End Frequency	Enter the frequency value at the end of the frequency range to use. Note: This field only appears when you select By Range under Setting Type .
Bandwidth	Set the frequency bandwidth in MHz that this WiMAX Device uses.
#	This is an index number for enumeration purposes only.
Frequency (MHz)	Displays the frequency MHz for the item in the list.
Total Num	Displays the total number of items in the list.
Delete	Click this to remove an item from the list.
Add	Click this to add an item to the list.
OK	Click this to save an newly added item to the list.
#	This is an index number for enumeration purposes only.
Band Start (KHz)	Indicates the beginning of the frequency band in KHz.
Band End (KHz)	Indicates the end of the frequency band in KHz.
Total Num	Displays the total number of items in the list.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.

3.1.4 WiMAX Authentication Settings

The WiMAX Authentication Settings screen allows you to configure how your WiMAX Device logs into the service provider's network.

Note: These settings should be provided by your ISP.

Note: The EAP supplicant settings on this screen vary depending on the authentication mode you select.

Figure 11 Setup Wizard > WiMAX Authentication Settings

Setup Wizard

Step 3: WiMAX Authentication Settings

Authentication

Authentication Mode: User and device authentication

EAP Supplicant

EAP Mode: EAP-TTLS

Anonymous ID:

Ignore Cert Verification: ☒

Server Root CA Cert. File: Browse...

Server Root CA Cert. Info: /C=US/O=WiMAX Forum(R)/CN=WiMAX Forum(R) Server Root - CA1

Device Cert. File: Browse...

Device Cert. Info: /C=TW/O=ZyXEL/OU=WiMAX Forum(R) Devices/CN=0023F87dc6d9 MAX series

Device Private Key: Browse...

Device Private Key Info: No private key found

Device Private Key Password:

Inner Mode: MS-CHAPv2

Username:

Password:

Back Next

The following table describes the labels in this screen.

Table 7 Setup Wizard > WiMAX Authentication Settings

LABEL	DESCRIPTION
Authentication	
Authentication Mode	Select a WiMAX authentication mode for authentication network sessions with the ISP. Options are: - No authentication - User authentication - Device authentication - User and Device authentication
EAP Supplication	
EAP Mode	Select an EAP authentication mode. See Table 14 on page 76 if you need more information.
Anonymous Id	Enter your anonymous ID. Note: Some modes may not require this.
Ignore Cert Verification	Select this to ignore base station certification verification when a certificate is received during EAP-TLS or EAP-TTLS.

Table 7 Setup Wizard > WiMAX Authentication Settings (continued)

LABEL	DESCRIPTION
Server Root CA Cert. File	Browse for and choose a server root certificate file, if required.
Server Root CA Cert. Info	This field displays information about the assigned server root certificate.
Device Cert. File	Browse for and choose a device certificate file, if required.
Device Cert. Info.	This field displays information about the assigned device certificate.
Device Private Key	Browse for and choose a device private key, if required.
Device Private Key Info	This field displays information about the assigned device private key.
Device Private Key Password	Enter the device private key, if required.
Inner Mode	Select an inner authentication mode (MS-CHAP, MS-CHAPV2, CHAP, MD5, PAP. See Table 14 on page 76 if you need more information.
Username	Enter your authentication username.
Password	Enter your authentication password.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.

3.1.5 VoIP Settings

For models with VoIP feature, you can configure your VoIP settings in the **Setup Wizard**. The VoIP Settings screen allows you to configure how your WiMAX Device connects to the VoIP service provider's network and makes calls over the Internet.

Note: This settings should be provided by your VoIP service provider.

Figure 12 Setup Wizard > VoIP Settings

Setup Wizard

Step 4: VoIP Settings

Line 1 SIP Account

Enable ☐

SIP Server

Port Number

Subscriber Number

Display Name max
length:64 characters

Authentication Name

Password

Line 2 SIP Account

Enable ☐

SIP Server

Port Number

Subscriber Number

Display Name max
length:64 characters

Authentication Name

Password

Back **Next**

The following table describes the labels in this screen.

Table 8 Setup Wizard > VoIP Settings

LABEL	DESCRIPTION
Line 1/2 SIP Account - Configure this section to use the PHONE 1 and/or PHONE 2 port.	
Enable	Select this to activate the SIP account.
SIP Server	Enter the IP address or domain name of the SIP server.
Port Number	Enter the SIP server's listening port number.
Subscriber Number	Enter your SIP number. In the full SIP URI, this is the part before the @ symbol.
Display Name	Enter the name that appears on the other party's device if they have Caller ID enabled.
Authentication Name	Type the SIP user name associated with this account for authentication to the SIP server.
Password	Type the SIP password associated with this account.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.

3.1.6 WLAN Settings

For models with WiFi wireless feature, you can configure your WLAN settings in the **Setup Wizard**. The WLAN Settings screen lets you set up how other devices connect to the Internet wirelessly using the WiMAX Device.

Figure 13 Setup Wizard > WLAN Settings

Setup Wizard

Step 5: WLAN Settings

WiFi Settings

Enable WLAN ☒

WLAN Mode 802.11 B/G/N mixed

WLAN Channel channel 1

SSID Settings

WLAN SSID MS1

Hide SSID ☐

Encryption Type WEP

SSID WEP Settings

Authentication Method OPEN SYSTEM

WEP Encryption Length 64-bit

☒ Key 1 HEX *****

☐ Key 2 HEX *****

☐ Key 3 HEX *****

☐ Key 4 HEX *****

Back Next

Figure 14 Setup Wizard > WLAN Settings > Encryption Type: WPA Personal

SSID WPA Settings

WPA Mode WPA

Cipher Type TKIP

Pre-shared Key *****

The following table describes the labels in this screen.

Table 9 Setup Wizard > WLAN Settings

LABEL	DESCRIPTION
Wifi Settings	
Enable WLAN	Select this box to enable the wireless service and allow other wireless clients to connect to the Internet using the WiMAX Device.

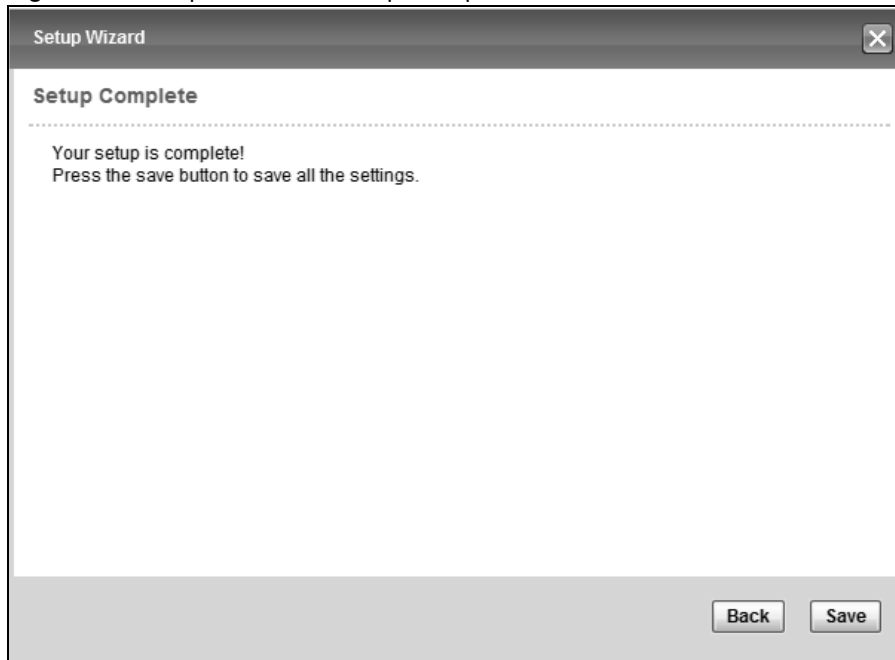
Table 9 Setup Wizard > WLAN Settings (continued)

LABEL	DESCRIPTION
WLAN Mode	Select the mode that the WiMAX Device will be using to communicate: 802.11 B/G mixed , 802.11 B only , 802.11 G only , 802.11 N only , or 802.11 B/G/N mixed .
WLAN Channel	Select one channel from 1 to 13 for wireless communications with the wireless stations.
SSID Settings	
WLAN SSID	This field displays the name of the wireless network associated with the WiMAX Device.
Hide SSID	Select this option if you wish to keep the name of the wireless network hidden.
Encryption Type	Select the type of encryption that the network will be using: None , WEP , or WPA Personal .
SSID WEP Settings	
Note: You will only see this options if you selected WEP as the Encryption Type .	
Authentication Method	Select the type of authentication used to join the network: Open System or Shared Key .
WEP Encryption Length	Select the length of the encryption key: 64-bit or 128-bit.
Key 1 - 4	Pick one of four available keys. The key can be in either Hexagecimal (HEX) or ASCII format. Type the key using any letters and numbers. The field is case sensitive and the length must match the length picked in the step above (64-bit or 128-bit). A warning message will appear if you fail to do this.
SSID WPA Settings	
Note: You will only see this options if you selected WPA Personal as the Encryption Type .	
WPA Mode	Select either WPA , WPA2 or Auto (WPA or WPA2) .
Cipher Type	Select the type of authentication that you wish to use for your network: TKIP , AES or TKIP and AES . AES is more secure.
Pre Shared Key	Type the pre-shared key or PSK previously shared between the two parties.

3.1.7 Setup Complete

Click **Save** to save the Setup Wizard settings and close it.

Figure 15 Setup Wizard > Setup Complete



Launch your web browser and navigate to your favorite website. If everything was configured properly, the web page should display. You can now surf the Internet!

Refer to the rest of this guide for more detailed information on the complete range of WiMAX Device features available in the more advanced web configurator.

Note: If you cannot access the Internet, open the web configurator again to confirm that the Internet settings you configured in the **Wizard Setup** are correct.

Tutorials

4.1 Overview

Run the Setup Wizard for the basic setup of your WiMAX Device. This chapter shows you how to configure some of the advanced settings WiMAX Device's features.

Note: Be sure to read [Introduction to the Web Configurator on page 20](#) before working through the tutorials presented here. For field descriptions for individual screens, see the related technical reference in this User's Guide.

This chapter includes the following configuration examples:

- [WiMAX Connection Settings on page 35](#)
- [Setting Up a Small Network for the LAN on page 36](#)
- [Making a Telephone Call Over the Internet on page 38](#)
- [Blocking Web Access from the WiMAX Device on page 40](#)
- [Restricting Wireless Access to the WiMAX Device on page 40](#)
- [Allowing Internet Users to use Internal Servers, see page 42](#)
- [Access the WiMAX Device with a Domain Name, see page 44](#)
- [Configuring Static Route for Routing to Another Network, see page 46](#)
- [Remotely Managing Your WiMAX Device on page 48](#)
- [Changing Certificate to Communicate with Other Networks on page 49](#)
- [Using Virtual Networks on page 50](#)

4.2 WiMAX Connection Settings

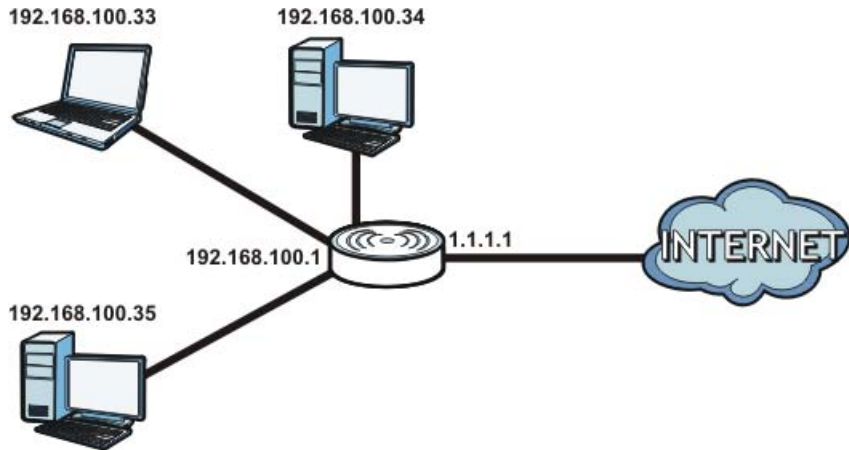
This tutorial provides you with pointers for configuring the WiMAX Device to connect to an ISP.

- 1 Connect the WiMAX Device to the ISP's nearest base station. See [Section 6.2 on page 70](#).
- 2 Configure the WiMAX Device's broadcast frequency. [Section 6.3 on page 72](#).
- 3 Configure the WiMAX Device to connect securely to the ISP's authentication servers. See [Section 6.4 on page 74](#).
- 4 Check the WiMAX Device's connection status to ensure everything is working properly. See [Section 6.11 on page 87](#).

4.3 Setting Up a Small Network for the LAN

This tutorial shows you how to set up a small network in your office or home.

Goal: Connect three computers to your WiMAX Device to form a small network.



Required: The following table provides a summary of the information you will need to complete the tasks in this tutorial.

INFORMATION	VALUE	SEE ALSO
LAN IP Address	192.168.100.1	Chapter 7 on page 98
Starting IP Address	192.168.100.10	Chapter 7 on page 99
Ending IP Address	192.168.100.30	
DNS Servers	From ISP	

- 1 In the Web Configurator, open the **Network Setting > LAN** screen and set the IP Address to 192.168.100.1. Use the default **IP Subnet Mask** of 255.255.255.0. Click **Save**.

IP Address	192.168.100.1
IP Subnet Mask	255.255.255.0
Save Cancel	

- 2 Manually change the IP address of your computer that you are using to 192.168.100.x (for example, 192.168.100.5) and keep the subnet set to 255.255.255.0.
- 3 Type <http://192.168.100.1> in your browser after the WiMAX Device finishes starting up completely.

- 4 Log into the Web Configurator and open the **Network Setting > LAN > DHCP** screen.

DHCP Server

DHCP Mode:

Start IP:

End IP:

Lease Time: (minutes)

Relay IP:

DNS Server assigned by DHCP Server

First DNS Server:

Second DNS Server:

Third DNS Server:

Static DHCP

10 per page page

#	MAC Address	IP Address
Total Num: 0		

Add OK

- 5 Select **Server** for the DHCP mode, then enter 192.168.100.10 and 192.168.100.30 as your DHCP starting and ending IP addresses.
- 6 Leave the other settings as their defaults and click **Save**.
- 7 Next, go to the **Network Setting > WAN** screen and select **NAT** in the **Operation Mode** field. Click **Save**.

Operation Mode

WAN Protocol:

Bridging LAN ARP:

Get IP Method:

WAN IP Request Timeout: seconds (0~600, infinite:0)

WAN IP Address:

WAN IP Subnet Mask:

Gateway IP Address:

MTU:

Clone MAC Address:

WAN DNS

First DNS Server:

Second DNS Server:

Third DNS Server:

Save Cancel

- 8 Connect your computers to the WiMAX Device's Ethernet ports and you're all set!

Note: You may need to configure the computers on your LAN to automatically obtain IP addresses. For information on how to do this, see [Appendix B on page 209](#).

Once your network is configured and hooked up, you will want to connect it to the Internet next. To do this, just run the **Internet Connection Wizard** ([Chapter 3 on page 25](#)), which walks you through the process.

4.4 Making a Telephone Call Over the Internet

For models with phone port(s), you can make a call over the Internet using the WiMAX Device.

4.4.1 Configure Your SIP Account

Your WiMAX Device needs to be configured with the details of your SIP account before you can use it to make calls over the Internet.

Once you have connected the WiMAX Device to your computer and accessed the Web Configurator, follow the steps below to configure your SIP settings.

For some models (see [Section 1.1 on page 17](#) for the specific models) that have 2 phone ports, you can configure 2 SIP accounts. The following example uses only 1 SIP account, as the configuration steps are the same for the second account if there is one.

The following parameters are used in this example:

Registrar Server	sip.example.net
Proxy Server	192.168.0.35
Subscriber Number	12345678
Authentication Name	ChangeMe
Password	ThisIsMySIP

- 1 Click **VoIP > Account > Server**.
- 2 Enter the fields in the screen according to the parameters provided. For field information that is not provided, leave it as the default setting.

Registrar Server

Registrar Server

Port Number

SIP Service Domain

Register Period Time seconds (60~65535)

Proxy Server

Proxy Server

Port Number

Outbound Server

Outbound Server

Port Number

- 3 Click **Save** to save your settings.
- 4 Click **VoIP > Account > SIP**.
- 5 Select the **Enable** checkbox and enter the parameters provided in the **SIP Account** section.

SIP Account

Enable ☒

SIP Local Port

Subscriber Number

Authentication Name

Password

Codec Settings

1st Codec

2nd Codec

3rd Codec

Session Timer

Min Session Timer seconds (90~65535)

Session Timer seconds (120~65535)

- 6 Click **Save** to save your settings.
- 7 Click **VoIP > Account > Status**. Click **Connect** to register the WiMAX Device to the register server. If the **Register Status** is **Registered**, it is ready to use. If this field shows **Register Fail**, contact your VoIP provider to confirm that you have the correct settings and that your account is active.

Server Status	
SIP Registrar	sip.example.net:5060
SIP Service Domain	sip.example.net:5060
Proxy Server	192.168.0.35:5060
Outbound Server	0.0.0.0:5060
Register Status	Registered

Line Status	
Subscriber Number	12345678
Account Status	Enable
Phone Status	Idle

Call History	
Received call	0
Missing call	0
Outgoing call	0

4.5 Blocking Web Access from the WiMAX Device

If your WiMAX Device is in a home or office environment you may decide that you want to block an Internet website access. You may need to block both the website's IP address and domain name.

Goal: Configure the WiMAX Device's content filter to block a website with a domain name `www.example.com`.

See Also: [Section 7.23 on page 123](#).

- 1 Open the **Network Setting > Content Filter**.
- 2 Select **Enable URL Filter**.
- 3 Select **Blacklist**.
- 4 Click **Add** and configure a URL filter rule by selecting **Active** and entering `www.example.com` as the URL.
- 5 Click **OK**.
- 6 Click **Save**.

URL List

Enable URL Filter ☒

Blacklist/Whitelist Blacklist

URL Filter Rules

10 per page 1 page

#	Active	URL
1	Y	www.example.com

Total Num: 1

Add OK Save Cancel

Open a browser from your computer in the WiMAX Device's LAN network, you should get an **"Access Violation"** message when you try to access to <http://www.example.com>. You may also need to block the IP address of the website if you do not want users to access to the website through its IP address.

4.6 Restricting Wireless Access to the WiMAX Device

This tutorial shows you how to use the MAC filter to block a DHCP client's access to the WiMAX network.

- 1 First of all, you have to know the MAC address of the computer. If not, you can look for the MAC address in the **Network Setting > LAN > DHCP** screen. (192.168.100.3 mapping to 00:02:E3:53:16:95 in this example).

DHCP Server

DHCP Mode:

Start IP:

End IP:

Lease Time: (minutes)

Relay IP:

DNS Server assigned by DHCP Server

First DNS Server:

Second DNS Server:

Third DNS Server:

Static DHCP

per page

#	MAC Address	IP Address
Total Num: 0		

DHCP Leased Hosts

per page page

#	MAC Address	IP Address	Remaining Time
1	00:02:E3:57:3A:1C	192.168.100.2	23:57:44
2	00:02:E3:53:16:95	192.168.100.3	23:57:50
Total Num: 2			

- 2 Click **Security > Firewall > MAC Filter**. Select **Blacklist** and click the **Add** button in the **MAC Filter Rules** table.

MAC List

Blacklist/Whitelist:

MAC Filter Rules

per page

#	Active	Source MAC	Destination MAC	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Start Time	End Time
Total Num: 0												

- 3 An empty entry appears. Enter the computer's MAC address in the **Source MAC** field and leave the other fields set to their defaults. Click **Save**.

MAC List

Blacklist/Whitelist: Blacklist

MAC Filter Rules

10 per page 1 page

#	Active	Source MAC	Destination MAC	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Start Time	End Time
1	☒	00:02:E3:53:16:95		☒	☒	☒	☒	☒	☒	☒	00:00	23:59

Total Num: 1

Save Cancel

The computer will no longer be able to access any host on the WiMAX network through the WiMAX Device.

4.7 Allowing Internet Users to use Internal Servers

Thomas recently received an Xbox 360 as his birthday gift. His friends invited him to play online games with them on Xbox LIVE. In order to communicate and play with other gamers on Xbox LIVE, Thomas needs to configure the port settings on his WiMAX Device.

Xbox 360 requires the following ports to be available in order to operate Xbox LIVE correctly:

TCP: 53, 80, 3074

UDP: 53, 88, 3074

- 1 You have to know the Xbox 360's IP address first. You can check it through the Xbox 360 console. You may be able to check the IP address on the WiMAX Device if the WiMAX Device has assigned a DHCP IP address to the Xbox 360. Check the **DHCP Leased Hosts** table in the **Network > LAN > DHCP** screen. Look for the IP address for the Xbox 360.

DHCP Leased Hosts

10 per page 0 page

#	MAC Address	IP Address	Remaining Time
1	00:02:E3:57:3A:1C	192.168.100.2	23:57:44
2	00:1E:52:C3:56:95	192.168.100.3	23:57:50

Total Num: 2 Refresh

- 2 NAT mode is required to use port forwarding. Click **Network Setting > WAN** and make sure **NAT** is selected in the **Operation Mode** field. Click **Save**.

Operation Mode: **NAT**

WAN Protocol: Ethernet

Bridging LAN ARP: No

Get IP Method: From ISP

WAN IP Request Timeout: 120 seconds (0~600, infinite:0)

WAN IP Address: 0.0.0.0

WAN IP Subnet Mask: 0.0.0.0

Gateway IP Address: 0.0.0.0

MTU: 1400

Clone MAC Address: 00:23:F8:7D:C6:D9

WAN DNS

First DNS Server: From ISP 0.0.0.0

Second DNS Server: From ISP 0.0.0.0

Third DNS Server: From ISP 0.0.0.0

Save Cancel

- 3 Click **Network Setting > NAT > Port Forwarding** and then click the first entry to edit the rule.

#	Active	Name	Protocol	Incoming Port(s)		Forward Port(s)		Server IP
				Start Port	End Port	Start Port	End Port	
1	N	Name1	TCP	0	0	0	0	1.1.1.1
2	N	Name2	TCP	0	0	0	0	1.1.1.1
3	N	Name3	TCP	0	0	0	0	1.1.1.1
4	N	Name4	TCP	0	0	0	0	1.1.1.1
5	N	Name5	TCP	0	0	0	0	1.1.1.1

Total Num: 5

Save Cancel

- 4 Configure the screen as follows to open TCP/UDP port 53 for the Xbox 360. Click **OK**.

#	Active	Name	Protocol	Incoming Port(s)		Forward Port(s)		Server IP
				Start Port	End Port	Start Port	End Port	
1	☒	Xbox 360	TCP	53	53	53	53	192.168.1.34
2	N	Name2	TCP	0	0	0	0	1.1.1.1
3	N	Name3	TCP	0	0	0	0	1.1.1.1
4	N	Name4	TCP	0	0	0	0	1.1.1.1
5	N	Name5	TCP	0	0	0	0	1.1.1.1

Total Num: 5

Save Cancel

- 5 Repeat steps 2 and 3 to open the rest of the ports for the Xbox 360. The port forwarding settings you configured are listed in the **Port Forwarding** screen.

The screenshot shows a 'Port Forwarding' screen with a table of configurations. A red circle highlights the first four rows, which are for Xbox 360. The table has columns for #, Active, Name, Protocol, Incoming Port(s) (Start Port, End Port), Forward Port(s) (Start Port, End Port), and Server IP. The first four rows show port forwarding for Xbox 360 on ports 53, 80, 88, and 3074. The fifth row is for a device named 'Name5' on port 0. Below the table, there are buttons for 'Save', 'Cancel', 'Add', 'OK', and 'Wizard'. The 'Total Num' is 5.

#	Active	Name	Protocol	Incoming Port(s)		Forward Port(s)		Server IP
				Start Port	End Port	Start Port	End Port	
1	Y	Xbox 360	TCP	53	53	53	53	192.168.1.34
2	Y	Xbox 360	TCP	80	80	80	80	192.168.1.34
3	Y	Xbox 360	TCP	88	88	88	88	192.168.1.34
4	Y	Xbox 360	TCP	3074	3074	3074	3074	192.168.1.34
5	N	Name5	TCP	0	0	0	0	1.1.1.1

Total Num: 5

Buttons: Save, Cancel, Add, OK, Wizard

- 6 Click **Save**.

Thomas can then connect his Xbox 360 to the Internet and play online games with his friends.

In this tutorial, all port 80 traffic is forwarded to the Xbox 360, but port 80 is also the default listening port for remote management via WWW. If Thomas also wants to manage the WiMAX Device from the Internet, he has to assign an unused port to WWW remote access.

Click **Maintenance > Remote MGMT**. Enter an unused port in the **Port** field (81 in this example). Click **Save**.

The screenshot shows the 'HTTP Server' configuration screen. It has sections for 'HTTP Server', 'HTTPS Server', 'HTTP and HTTPS', and 'HTTP Session Timeout'. The 'Enable' checkbox for 'HTTP Server' is checked. The 'Port Number' field is set to 81 and is circled in red. The 'Enable' checkbox for 'HTTPS Server' is also checked, and its 'Port Number' is 443. The 'Allow Connection from WAN' checkbox under 'HTTP and HTTPS' is checked. The 'Session Timeout' field is set to 20 minutes. The 'Save' button is circled in red.

HTTP Server

Enable ☒

Port Number

HTTPS Server

Enable ☒

Port Number

HTTP and HTTPS

Allow Connection from WAN ☒

HTTP Session Timeout

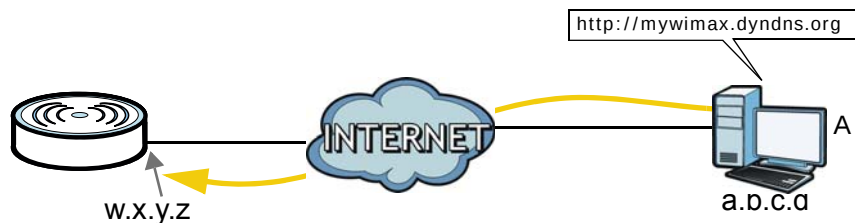
Session Timeout minutes (0~99, default:5, 0 means disabled)

Buttons: Save, Cancel

4.8 Access the WiMAX Device with a Domain Name

If you connect your WiMAX Device to the Internet and it uses a dynamic WAN IP address, it is inconvenient for you to manage the device from the Internet. The WiMAX Device's WAN IP address

changes dynamically. Dynamic DNS (DDNS) allows you to access the WiMAX Device using a domain name.



To use this feature, you have to apply for DDNS service at www.dyndns.org.

This tutorial covers:

- [Registering a DDNS Account on \[www.dyndns.org\]\(http://www.dyndns.org\)](#)
- [Configuring DDNS on Your WiMAX Device](#)
- [Testing the DDNS Setting](#)

Note: If you have a private WAN IP address (see [Private IP Addresses on page 250](#)), then you cannot use DDNS.

4.8.1 Registering a DDNS Account on www.dyndns.org

- 1 Open a browser and type **<http://www.dyndns.org>**.
- 2 Apply for a user account. This tutorial uses **UserName1** and **12345** as the username and password.
- 3 Log into www.dyndns.org using your account.
- 4 Add a new DDNS host name. This tutorial uses the following settings as an example.
 - Hostname: **mywimax.dyndns.org**
 - Service Type: **Host with IP address**
 - IP Address: Enter the WAN IP address that your WiMAX Device is currently using. You can find the IP address on the WiMAX Device's Web Configurator **Status** page.

Then you will need to configure the same account and host name on the WiMAX Device later.

4.8.2 Configuring DDNS on Your WiMAX Device

Configure the following settings in the **Network Setting > DDNS** screen.

Enable Dynamic DNS	☒
Service Provider	dyndns.org(www.dyndns.org)
Service Type	Dynamic
Domain Name	mywimax . dyndns.org
Login Name	UserName1
Password	
IP Update Policy	WAN IP
User Defined IP	
Wildcards	☐
MX	☐
Backup MX	☐
MX Host	

Save Cancel

- 1 Select **Enable Dynamic DNS**.
- 2 Select **dyndns.org** for the service provider.
- 3 Select **Dynamic** for the service type.
- 4 Type **mywimax.dyndns.org** in the **Domain Name** field.
- 5 Enter the user name (**UserName1**) and password (**12345**).
- 6 Select **WAN IP** for the IP update policy.
- 7 Click **Save**.

4.8.3 Testing the DDNS Setting

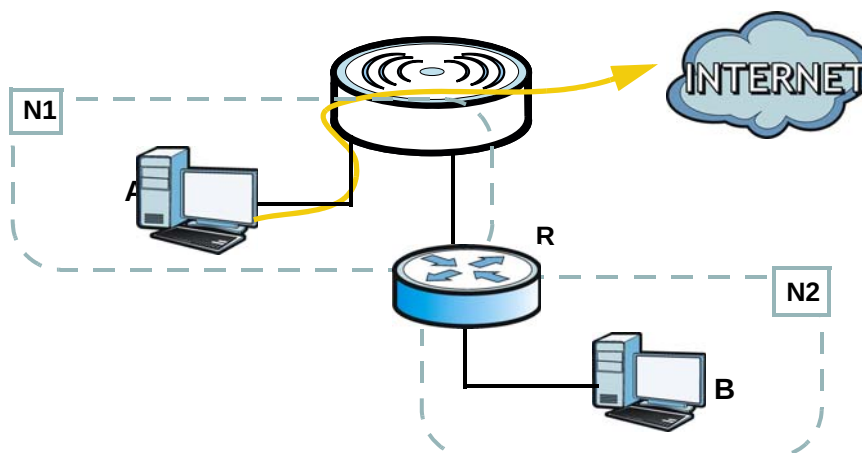
Now you should be able to access the WiMAX Device from the Internet. To test this:

- 1 Open a web browser on the computer (using the IP address **a.b.c.d**) that is connected to the Internet.
- 2 Type **http://mywimax.dyndns.org** and press [Enter].
- 3 The WiMAX Device's login page should appear. You can then log into the WiMAX Device and manage it.

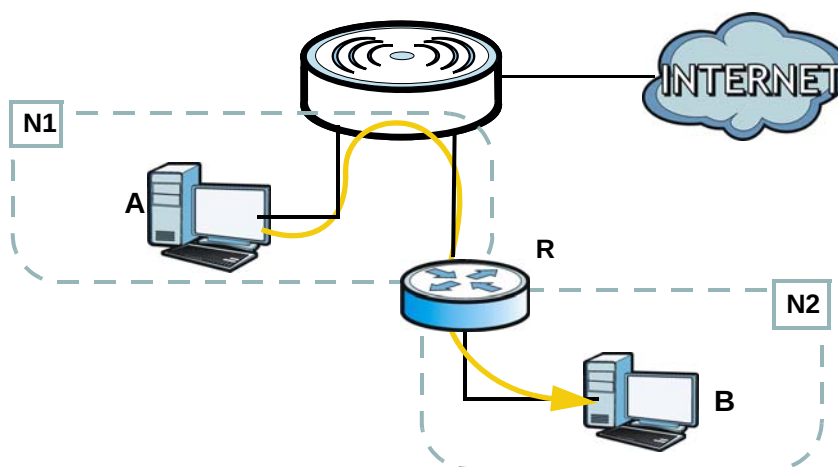
4.9 Configuring Static Route for Routing to Another Network

In order to extend your Intranet and control traffic flowing directions, you may connect a router to the WiMAX Device's LAN. The router may be used to separate two department networks. This tutorial shows how to configure a static routing rule for two network routings.

In the following figure, router **R** is connected to the WiMAX Device's LAN. **R** connects to two networks, **N1** (192.168.1.x/24) and **N2** (192.168.10.x/24). If you want to send traffic from computer **A** (in **N1** network) to computer **B** (in **N2** network), the traffic is sent to the WiMAX Device's WAN default gateway by default. In this case, computer **B** will never receive the traffic.



You need to specify a static routing rule on the WiMAX Device to specify **R** as the router in charge of forwarding traffic to **N2**. In this case, the WiMAX Device routes traffic from computer **A** to **R** and then **R** routes the traffic to computer **B**.



This tutorial uses the following example IP settings:

Table 10 IP Settings in this Tutorial

DEVICE / COMPUTER	IP ADDRESS
The WiMAX Device's WAN	172.16.1.1
The WiMAX Device's LAN	192.168.1.1
A	192.168.1.34
R 's IP address on N1	192.168.1.253

Table 10 IP Settings in this Tutorial

DEVICE / COMPUTER	IP ADDRESS
R's IP address on N2	192.168.10.2
B	192.168.10.33

To configure a static route to route traffic from **N1** to **N2**:

- 1 Click **Network Setting > Route > Static Route**.
- 2 Click **Add** to create a new route.

- 3 Configure the **Edit Static Route** screen using the following settings:
 - 3a Enter **192.168.10.0** and subnet mask **255.255.255.0** for the destination, **N2**.
 - 3b Enter **192.168.1.253** (R's IP address on N1) in the **IP Address** field under **Next Hop**.

- 3a Click **Save**.

Now computer **B** should be able to receive traffic from computer **A**. You may need to additionally configure **R**'s firewall settings to accept specific traffic to pass through.

4.10 Remotely Managing Your WiMAX Device

The remote management feature allows you to log into the device through the Internet.

Goal: Set up the WiMAX Device to allow management requests from the WAN (Internet).

See Also: [Section 7.20 on page 119](#).

- 1 Open the **Maintenance > Remote MGMT > HTTP** screen.

HTTP Server

Enable ☒

Port Number

HTTPS Server

Enable ☒

Port Number

HTTP and HTTPS

Allow Connection from WAN ☒

HTTP Session Timeout

Session Timeout minutes (0~99, default:5, 0 means disabled)

- 2 Select **Enable** in both **HTTP Server** and **HTTPS Server** sections and leave the **Port Number** settings as "80" and "443".
- 3 Select **Allow Connection from WAN**. This allows remote management connections not only from the local network but also the WAN network (Internet).
- 4 Click **Save**.

4.11 Changing Certificate to Communicate with Other Networks

This tutorial shows you how to import a new security certificate, which allows your device to communicate with other network servers.

Goal: Import a new security certificate into the WiMAX Device.

See Also: [Appendix B on page 211](#).

- 1 Go to the **WiMAX > Profile > Authentication Settings** screen. In the **EAP Supplicant** section, click each **Browse** button and locate the security certificates that were provided by your new ISP.

EAP Mode

Anonymous ID

Server Root CA Cert. File

Server Root CA Cert. Info

Device Cert. File

Device Cert. Info

Device Private Key

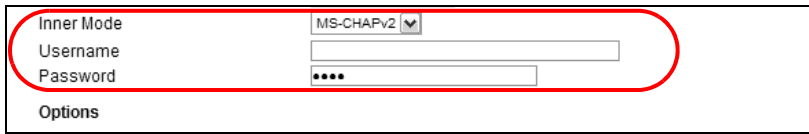
Device Private Key Info

Device Private Key Password

Inner Mode

Username

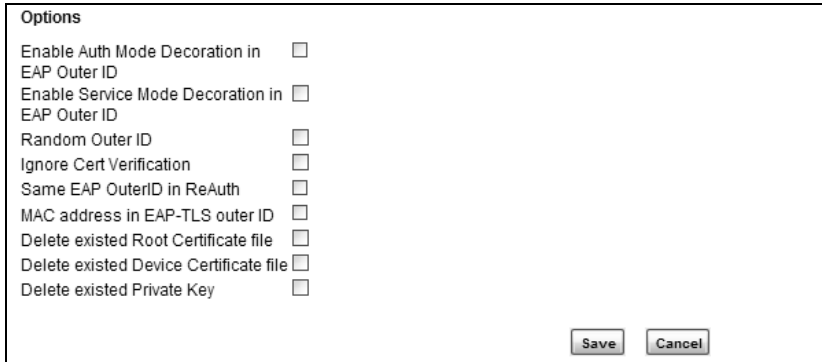
- 2 Configure your new Internet access settings based on the information provided by the ISP.



Inner Mode: MS-CHAPv2
Username:
Password:
Options

Note: You can also use the Internet Connection Wizard to configure the Internet access settings.

- 3 You may need to configure the **Options** section according to the information provided by the ISP.



Options

- Enable Auth Mode Decoration in EAP Outer ID ☐
- Enable Service Mode Decoration in EAP Outer ID ☐
- Random Outer ID ☐
- Ignore Cert Verification ☐
- Same EAP OuterID in ReAuth ☐
- MAC address in EAP-TLS outer ID ☐
- Delete existed Root Certificate file ☐
- Delete existed Device Certificate file ☐
- Delete existed Private Key ☐

Save Cancel

- 4 Click **Save**. You should now be able to connect to the Internet through your new service provider!

4.12 Using Virtual Networks

This section shows VLAN configuration scenarios.

See [Section 7.20 on page 119](#) if you need more information about VLAN.

Before enabling VLANs you will need to change the WiMAX Device to bridge mode.

Click **Network Setting > WAN**. Change the WiMAX Device to bridge mode and then click **Save**. If you cannot obtain IP address settings from a WAN DHCP server, select **User** as the **Get IP Method** and enter the **WAN IP Address**, **WAN IP Subnet Mask** and **Gateway IP Address**.

Operation Mode: Bridge

WAN Protocol: Ethernet

Bridging LAN ARP: No

Get IP Method: From ISP

WAN IP Request Timeout: 120 seconds (0~600, infinite:0)

WAN IP Address: 0.0.0.0

WAN IP Subnet Mask: 0.0.0.0

Gateway IP Address: 0.0.0.0

MTU: 1400

Clone MAC Address: 00:23:F8:7D:C6:D9

WAN DNS

First DNS Server: From ISP 0.0.0.0

Second DNS Server: From ISP 0.0.0.0

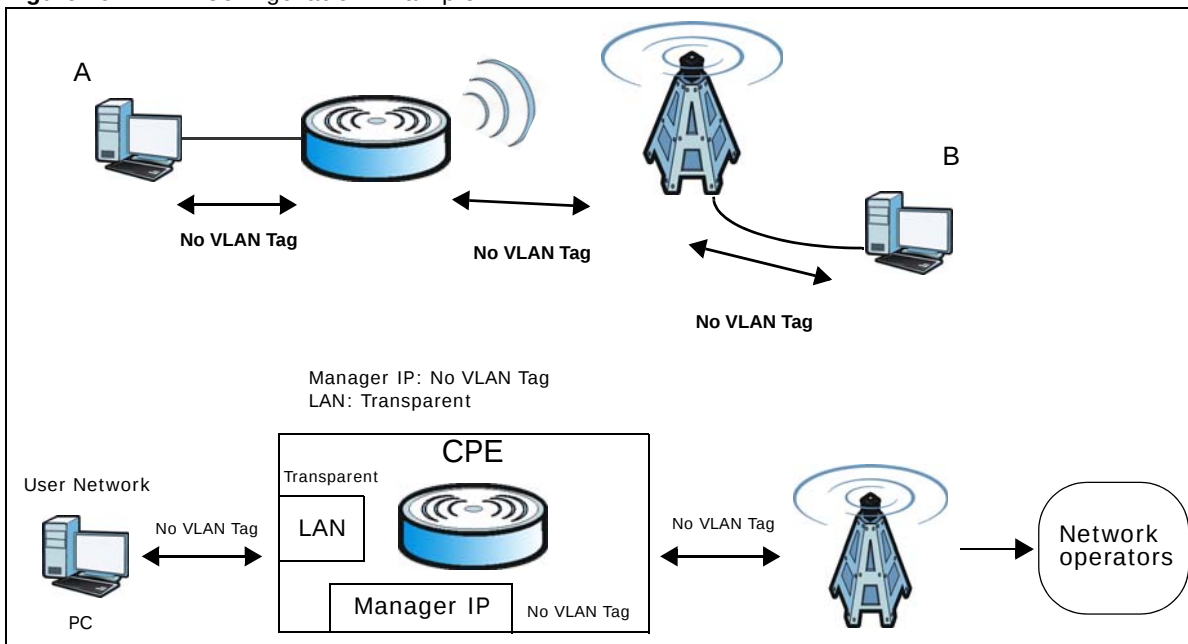
Third DNS Server: From ISP 0.0.0.0

Save Cancel

4.12.1 Scenario 1

In this scenario, PC A is connected directly to interface LAN1 on the WiMAX Device. PC B is connected to interface WiMAX and interface IAD for managing the WiMAX Device.

Figure 16 VLAN Configuration Example 1



- 1 Configure the **Link Type**, **PVID** and **Tag/Untag** settings for the interfaces as below by clicking each row. Then press **OK**.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	5	0	NO	Untag
2	WiMAX	ACCESS	5	0	NO	Untag
3	IAD	TRUNK	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y

Total Num: 1

- 2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. The WiMAX Device will tag packets it receives on each interface so that they are recognized in VLAN 5. Tagged packets will be untagged when they are forwarded out of each interface since the devices attached to these interfaces do not support VLAN tagged packets.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	5	0	NO	Untag
2	WiMAX	ACCESS	5	0	NO	Untag
3	IAD	TRUNK	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y

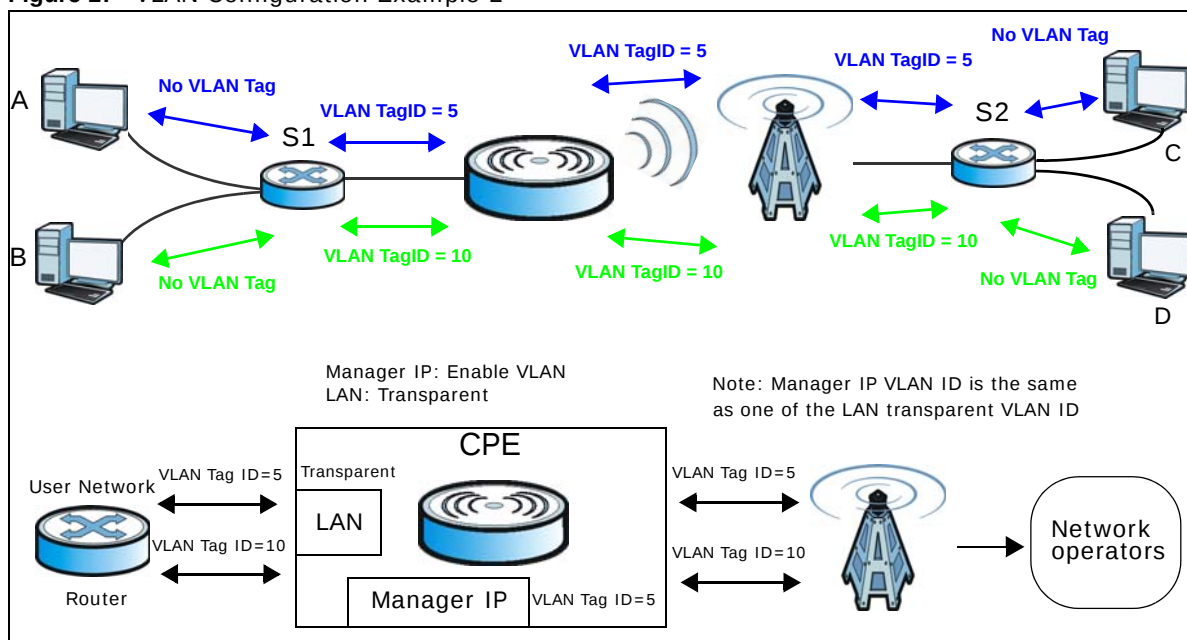
Total Num: 1

4.12.2 Scenario 2

In this scenario, PC A and PC C are on VLAN 5, while PC B and PC D are on VLAN 10. PC A and PC B are connected to interface LAN1 through VLAN supporting switch S1. PC C is connected to interface WiMAX and interface IAD for managing the WiMAX Device, through VLAN supporting switch S2. PC D is connected to interface WiMAX through VLAN supporting switch S2.

Note: You will need to configure the VLAN supporting switches to tag the received packets with the appropriate VLAN IDs. For example, packets received on switch S1 from PC A on the LAN would be tagged to VLAN 5.

Figure 17 VLAN Configuration Example 2



- 1 Configure the **Link Type**, **PVID** and **Tag/Untag** settings for the interfaces as below by clicking each row. Then press **OK**.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	11	0	NO	Tag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag Priority	Priority Number	Ports			
					LAN1	WiMAX	IAD	
1	example	5	Disable	0	Y	Y	Y	Delete
2	example2	10	Disable	0	Y	Y	Y	Delete

Total Num: 2

- 2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links, so the WiMAX Device will recognize VLAN 5 and VLAN 10 tagged packets it receives on these interfaces from the VLAN supporting switches. VLAN tagged packets will also be forwarded out of these interfaces. Interface **IAD** is configured as an Access port, so tagged packets will be untagged when they are forwarded.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	11	0	NO	Tag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag	Priority	Number	Ports		
						LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y	
2	example2	10	Disable	0	Y	Y	Y	

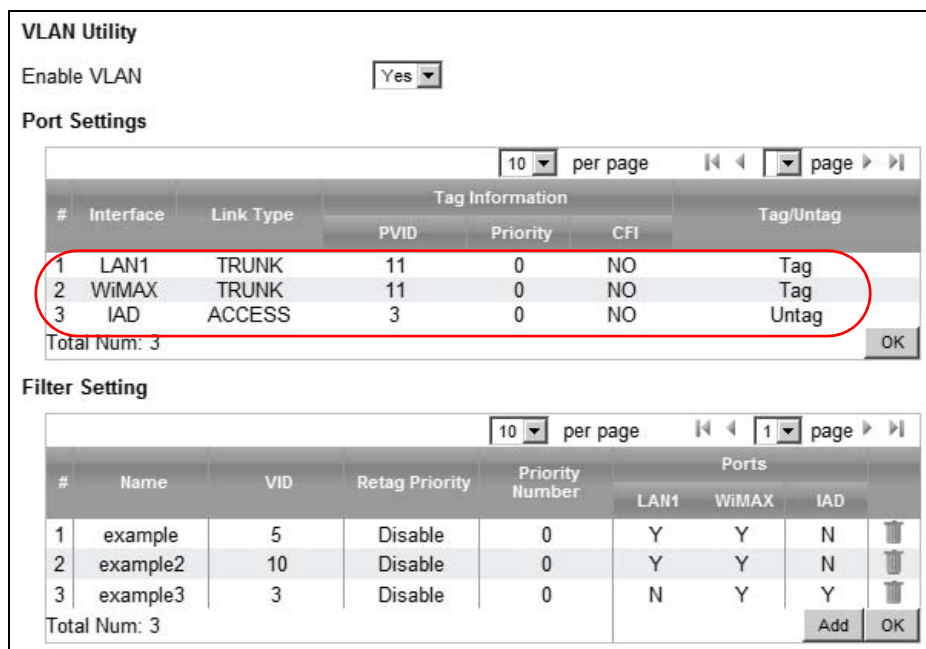
Total Num: 2

4.12.3 Scenario 3

In this scenario, PC A and PC C are on VLAN 5, PC B and PC D are on VLAN 10, and PC E is on VLAN 3. PC A and PC B are connected to interface LAN1 through VLAN supporting switch S1. PC C and PC D are connected to interface WiMAX through VLAN supporting switch S2. PC E is connected to interface IAD through VLAN supporting switch S2 for managing the WiMAX Device.

55

- 1 Configure the **Link Type**, **PVID** and **Tag/Untag** settings for the interfaces as below by clicking each row. Then press **OK**.



- 2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links, so the WiMAX Device will recognize VLAN 5 and VLAN 10 tagged packets it receives on these interfaces from the VLAN supporting switches. VLAN tagged packets will also be forwarded out of these interfaces. Interface **IAD** is configured as an Access port, so tagged packets will be untagged when they are forwarded.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	11	0	NO	Tag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	3	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag	Priority	Priority Number	Ports			
						LAN1	WiMAX	IAD	
1	example	5	Disable	0	Y	Y	N	Delete	
2	example2	10	Disable	0	Y	Y	N	Delete	
3	example3	3	Disable	0	N	Y	Y	Delete	

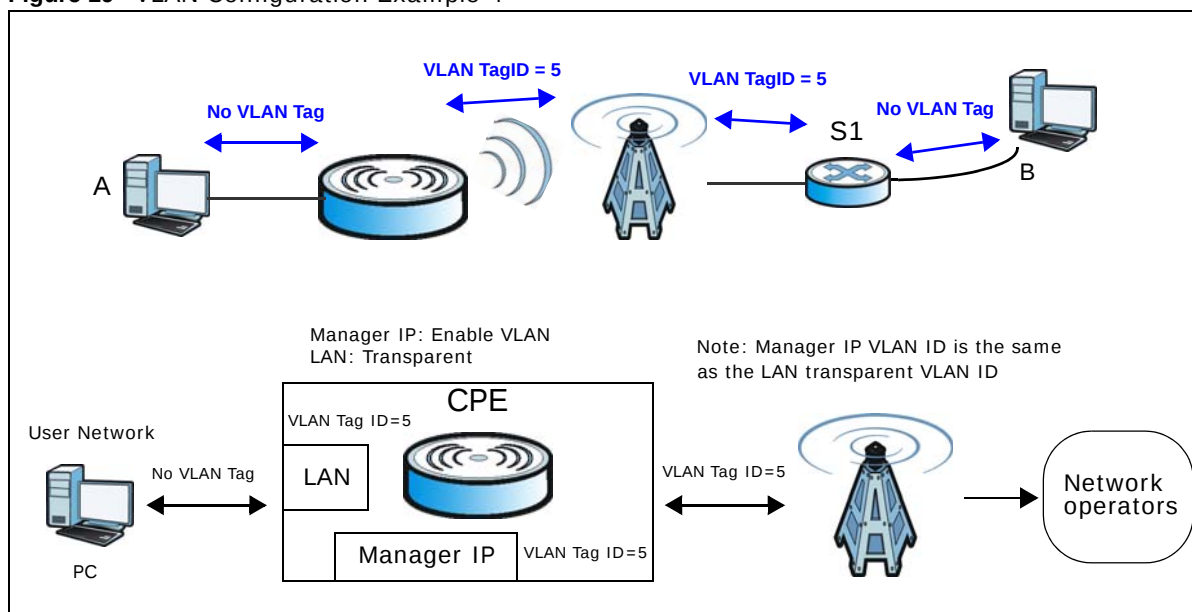
Total Num: 3

4.12.4 Scenario 4

In this scenario, PC A is connected directly to interface LAN1 on the WiMAX Device, while PC B is on VLAN 5. PC B is connected to interface WiMAX and interface IAD for managing the WiMAX Device, through VLAN supporting switch S1.

Note: You will need to configure the VLAN supporting switches to tag the received packets with the appropriate VLAN IDs. For example, packets received on switch S1 from PC B on the LAN would be tagged to VLAN 5.

Figure 19 VLAN Configuration Example 4



- 1 Configure the **Link Type**, **PVID** and **Tag/Untag** settings for the interfaces as below by clicking each row. Then press **OK**.

VLAN Utility

Enable VLAN

Port Settings

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	5	0	NO	Untag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

Filter Setting

#	Name	VID	Retag Priority	Priority Number	Ports			
					LAN1	WiMAX	IAD	
1	example	5	Disable	0	Y	Y	Y	Add

Total Num: 1

- 2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links. On the WiMAX interface, the WiMAX Device will recognize VLAN 5 tagged packets it receives from the VLAN supporting switch. VLAN tagged packets will also be forwarded out of this interface. On the LAN1 interface, the WiMAX Device will tag packets it receives so that they are recognized in VLAN 5. On LAN1, tagged packets will be untagged when they are forwarded out since PC A does not support VLAN tagged packets. Interface **IAD** is configured as an Access port, so tagged packets will be untagged when they are forwarded.

VLAN Utility

Enable VLAN

Yes

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	5	0	NO	Untag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

OK

Filter Setting

10 per page

#	Name	VID	Retag	Priority	Number	Ports		
						LAN1	WiMAX	IAD
1	example	5	Disable	0		Y	Y	Y

Total Num: 1

Add

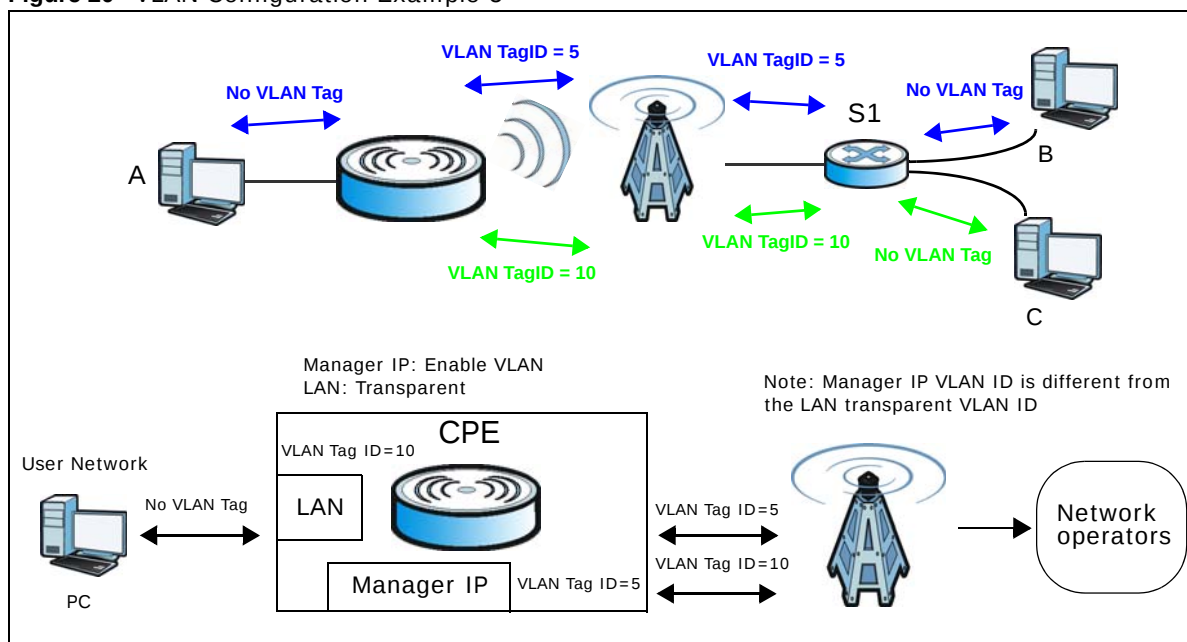
OK

4.12.5 Scenario 5

In this scenario, PC A is directly connected to interface LAN1 on the WiMAX Device. PC B is on VLAN 5 while PC C is on VLAN 10. PC B is connected to interface WiMAX and interface IAD for managing the WiMAX Device, through VLAN supporting switch S1. PC C is connected to interface WiMAX through VLAN supporting switch S1.

Note: You will need to configure the VLAN supporting switches to tag the received packets with the appropriate VLAN IDs. For example, packets received on switch S1 from PC C on the LAN would be tagged to VLAN 10.

Figure 20 VLAN Configuration Example 5



- 1 Configure the **Link Type**, **PVID** and **Tag/Untag** settings for the interfaces as below by clicking each row. Then press **OK**.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	10	0	NO	Untag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag Priority	Priority Number	Ports			
					LAN1	WiMAX	IAD	
1	example	5	Disable	0	Y	Y	Y	X
2	example2	10	Disable	0	Y	Y	N	X

Total Num: 2

- 2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links. On the WiMAX interface the WiMAX Device will recognize VLAN 5 and VLAN 10 tagged packets it receives from the VLAN supporting switch. VLAN tagged packets will also be forwarded out of these interfaces. On the LAN1 interface, the WiMAX Device will tag packets it receives so that they are recognized in VLAN 10. On LAN1, tagged packets will be untagged when they are forwarded out, since PC A does not support VLAN tagged packets. Interface **IAD** is configured as an Access port, so tagged packets will be untagged when they are forwarded.

VLAN Utility

Enable VLAN

Port Settings

10 per page

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	TRUNK	10	0	NO	Untag
2	WiMAX	TRUNK	11	0	NO	Tag
3	IAD	ACCESS	5	0	NO	Untag

Total Num: 3

Filter Setting

10 per page

#	Name	VID	Retag	Priority	Ports			
					LAN1	WiMAX	IAD	
1	example	5	Disable	0	Y	Y	Y	Delete
2	example2	10	Disable	0	Y	Y	N	Delete

Total Num: 2

PART II

Technical Reference

System Status

5.1 Overview

Use this screen to view a summary of your WiMAX Device connection status.

5.2 System Status

This screen allows you to view the current status of the device, system resources, and interfaces (LAN and WAN).

Click **System Status** to open this screen as shown next.

Figure 21 System Status



The following tables describe the labels in this screen.

Table 11 Status

LABEL	DESCRIPTION
System Information	
System Model Name	This field displays the WiMAX Device system model name. It is used for identification.
Software Version	This field displays the Web Configurator version number.
CROM Version	This field displays the CROM version number.
Firmware Version	This field displays the current version of the firmware inside the device.
Firmware Date	This field shows the date the firmware version was created.
System Time	This field displays the current system time.
Uptime	This field displays how long the WiMAX Device has been running since it last started up.
System Resources	
Memory	This field displays what percentage of the WiMAX Device's memory is currently used. The higher the memory usage, the more likely the WiMAX Device is to slow down. Some memory is required just to start the WiMAX Device and to run the web configurator. You can reduce the memory usage by disabling some services; by reducing the amount of memory allocated to NAT and firewall rules (you may have to reduce the number of NAT rules or firewall rules to do so); or by deleting rules in functions such as incoming call policies, speed dial entries, and static routes.
CPU	This field displays what percentage of the WiMAX Device's CPU is currently used. The higher the CPU usage, the more likely the WiMAX Device is to slow down.
WiMAX	
Device Status	This field displays the WiMAX Device current status for connecting to the selected base station. • Scanning - The WiMAX Device is scanning for available base stations. • Ready - The WiMAX Device has finished a scanning and you can connect to a base station. • Connecting - The WiMAX Device attempts to connect to the selected base station. • Connected - The WiMAX Device has successfully connected to the selected base station.
Connection Status	This field displays the status of the WiMAX connection between the WiMAX Device and the base station. • Network Search - The WiMAX Device is scanning for any available WiMAX connections. • Disconnected - No WiMAX connection is available. • Network Entry - A WiMAX connection is initializing. • Normal - The WiMAX connection has successfully established.
BSID	This field displays the MAC address of the base station to which the device is connected.
Frequency	This field indicates the frequency the WiMAX Device is using.
Signal Strength	This field indicates the strength of the connection that the WiMAX Device has with the base station.
Link Quality	This field indicates the relative quality of the link the WiMAX Device has with the base station.
WAN	

Table 11 Status (continued)

LABEL	DESCRIPTION
Status	This field indicates the status of the WAN connection to the WiMAX Device.
MAC Address	This field indicates the MAC address of the port making the WAN connection on the WiMAX Device.
IP Address	This field indicates the current IP address of the WiMAX Device in the WAN.
Subnet Mask	This field indicates the current subnet mask on the WAN.
Gateway	This field indicates the IP address of the gateway to which the WiMAX Device is connected.
MTU	This field indicates the Maximum Transmission Unit (MTU) between the WiMAX Device and the ISP servers to which it is connected.
DNS	This field indicates the Domain Name Server (DNS) to which your WiMAX Device is connected.
LAN	
MAC Address	This field indicates the MAC address of the port making the LAN connection on the WiMAX Device.
IP Address	This field displays the current IP address of the WiMAX Device in the LAN.
Subnet Mask	This field displays the current subnet mask in the LAN.
MTU	This field indicates the Maximum Transmission Unit (MTU) between the WiMAX Device and the client devices to which it is connected.
VOIP Phone	
Account1/2 Subscriber	This field displays the SIP number for the SIP account. If your WiMAX Device has only one phone port, there is only one account.
Registered Status	This field displays whether the SIP account is already registered with a SIP server (Up or Disabled).
Phone1/2 Status	This field displays whether the phone line (mapping to the VoIP port) is in use or not (idle). If your WiMAX Device has only one phone port, there is only one phone line.

6.1 Overview

This chapter shows you how to set up and manage the connection between the WiMAX Device and your ISP's base stations.

6.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

WiMAX

WiMAX (Worldwide Interoperability for Microwave Access) is the IEEE 802.16 wireless networking standard, which provides high-bandwidth, wide-range wireless service across wireless Metropolitan Area Networks (MANs). ZyXEL is a member of the WiMAX Forum, the industry group dedicated to promoting and certifying interoperability of wireless broadband products.

In a wireless MAN, a wireless-equipped computer is known either as a mobile station (MS) or a subscriber station (SS). Mobile stations use the IEEE 802.16e standard and are able to maintain connectivity while switching their connection from one base station to another base station (handover) while subscriber stations use other standards that do not have this capability (IEEE 802.16-2004, for example). The following figure shows an MS-equipped notebook computer **MS1** moving from base station **BS1**'s coverage area and connecting to **BS2**.

Figure 22 WiMax: Mobile Station



WiMAX technology uses radio signals (around 2 to 10 GHz) to connect subscriber stations and mobile stations to local base stations. Numerous subscriber stations and mobile stations connect to the network through a single base station (BS), as in the following figure.

Figure 23 WiMAX: Multiple Mobile Stations



A base station's coverage area can extend over many hundreds of meters, even under poor conditions. A base station provides network access to subscriber stations and mobile stations, and communicates with other base stations.

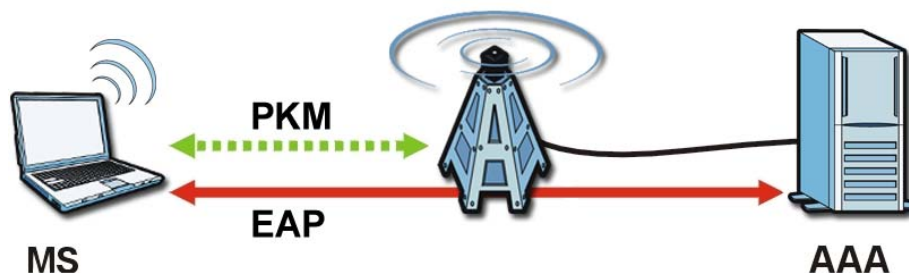
The radio frequency and bandwidth of the link between the WiMAX Device and the base station are controlled by the base station. The WiMAX Device follows the base station's configuration.

Authentication

When authenticating a user, the base station uses a third-party RADIUS or Diameter server known as an AAA (Authentication, Authorization and Accounting) server to authenticate the mobile or subscriber stations.

The following figure shows a base station using an **AAA** server to authenticate mobile station **MS**, allowing it to access the Internet.

Figure 24 Using an AAA Server

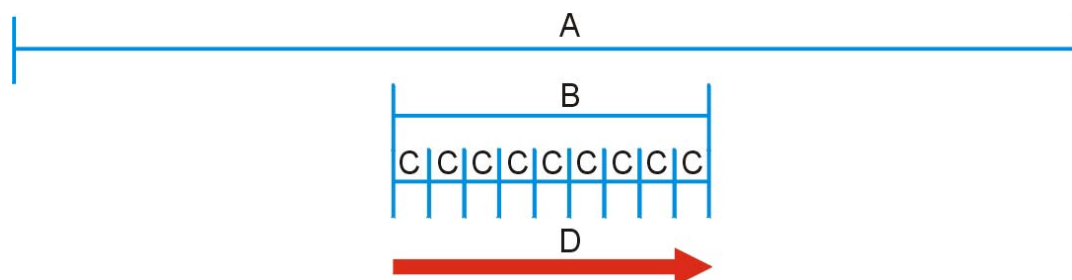


In this figure, the dashed arrow shows the PKM (Privacy Key Management) secured connection between the mobile station and the base station, and the solid arrow shows the EAP secured connection between the mobile station, the base station and the AAA server. See the WiMAX security appendix for more details.

Frequency Ranges

The following figure shows the WiMAX Device searching a range of frequencies to find a connection to a base station.

Figure 25 Frequency Ranges



In this figure, **A** is the WiMAX frequency range. “WiMAX frequency range” refers to the entire range of frequencies the WiMAX Device is capable of using to transmit and receive (see the Product Specifications appendix for details).

In the figure, **B** shows the operator frequency range. This is the range of frequencies within the WiMAX frequency range supported by your operator (service provider).

The operator range is subdivided into bandwidth steps. In the figure, each **C** is a bandwidth step.

The arrow **D** shows the WiMAX Device searching for a connection.

Have the WiMAX Device search only certain frequencies by configuring the downlink frequencies. Your operator can give you information on the supported frequencies.

The downlink frequencies are points of the frequency range your WiMAX Device searches for an available connection. Use the **Site Survey** screen to set these bands. You can set the downlink frequencies anywhere within the WiMAX frequency range. In this example, the downlink frequencies have been set to search all of the operator range for a connection.

Certification Authority

A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities. You can use the WiMAX Device to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

Certificate File Formats

The certification authority certificate that you want to import has to be in one of these file formats:

- Binary X.509: This is an ITU-T recommendation that defines the formats for X.509 certificates.
- PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses lowercase letters, uppercase letters and numerals to convert a binary X.509 certificate into a printable form.
- Binary PKCS#7: This is a standard that defines the general syntax for data (including digital signatures) that may be encrypted. The WiMAX Device currently allows the importation of a PKS#7 file that contains a single certificate.

- PEM (Base-64) encoded PKCS#7: This Privacy Enhanced Mail (PEM) format uses 64 ASCII characters to convert a binary PKCS#7 certificate into a printable form.

CINR

Carrier to Interference-plus-Noise Ratio (CINR) measures the effectiveness of a wireless signal and plays an important role in allowing the WiMAX Device to decode signal burst. If a burst has a high signal strength and a high interference-plus-noise ratio, it can use Digital Signal Processing (DSP) to decode it; if the signal strength is lower, it can switch to an alternate burst profile.

RSSI

Received Signal Strength Indicator (RSSI) measures the relative strength of a given wireless signal. This is important in determining if a signal is below the Clear-To-Send (CTS) threshold. If it is below the arbitrarily specified threshold, then WiMAX Device is free to transmit any data packets.

EAP Authentication

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The WiMAX Device supports EAP-TLS and EAP-TTLS (at the time of writing, TTLS is not available in Windows Vista). For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). Certificates (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

6.2 Connection Settings

This screen allows you to configure how the WiMAX Device connects to the base stations on the WiMAX network.

Click **WiMAX > Profile > Connection Settings** to open this screen as shown next.

Figure 26 Connection Settings Screen

Connect Option Settings

Auto Reconnect: 3 seconds (0~60, 0 means disabled)

Auto Connect Mode: by CINR

Enable Handover: ☐

Enable MS Initiated Idle Mode: ☒

Idle Mode Interval: 60 seconds

CINR & RSSI Refresh Interval: 1000 msec

LDRP(Low Data Rate Protection) Time: 20000 msec (0 means disabled)

LDRP TX Rate: 10000 bytes/sec

LDRP RX Rate: 10000 bytes/sec

Connect Type Settings

Auto Connect Mode: [Dropdown]

#	BSID	NSP	NAP	Network Type	Preamble ID	Frequency (MHz)	Bandwidth (MHz)	RSSI (dBm)	CINR (dB) R3/R1
Total Num: 0									

Search

Save Cancel

This screen contains the following fields:

Table 12 Connection Settings

LABEL	DESCRIPTION
Connection Option Settings	
Auto Reconnect	Select the interval in seconds that the WiMAX Device waits after getting disconnected from the base station before attempting to reconnect.
Auto Connect Mode	Select the auto connect mode. • By channel power - Auto connects to the base station if the signal strength of the channel is sufficient for the WiMAX Device. • By CINR - Auto connects to the base station if the signal-to-noise ratio is sufficient for the WiMAX Device.
Enable Handover	Select this to maintain connectivity while the WiMAX Device switches its connection from one base station to another base station.
Enable MS Initiated Idle Mode	Select this to have the WiMAX Device enter the idle mode after it has no traffic passing through for a pre-defined period. Make sure your base station also supports this before selecting this.
Idle Mode Interval	Set the idle duration in minutes. This is how long the WiMAX Device waits during periods of no activity before going into idle mode.
CINR & RSSI Refresh Interval	Set the refresh interval in milliseconds for calculating the signal-to-noise measurement (CINR) and signal strength measurement (RSSI) of the WiMAX Device.
LDRP (Low Data Rate Protection)	Enter the Low Data Rate Protection (LDRP) time in milliseconds. If the uplink/downlink data rate is smaller than the LDRP time, the WiMAX Device sends a disconnect request to the base station.
LDRP TX Rate	Enter the outgoing data rates for LDRP in bytes per second.
LDRP RX Rate	Enter the incoming data rates for LDRP in bytes per second.
Connection Type Settings	

Table 12 Connection Settings (continued)

LABEL	DESCRIPTION
Mode Select	Select how the WiMAX Device connects to the base station. • Auto Connect Mode - The device connects automatically to the first base station in range. • Network Search Mode - The device scans for available base stations then connects to the best one it can. • NSP Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID. To specify the NSP ID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID, and the best CINR or RSSI. • NSP / NAP Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID and NAP ID. To specify the NSP ID and NAP ID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID and NAP ID, and the best CINR or RSSI. • NSP / NAP / BSID Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID, NAP ID and BSID. To specify the NSP ID, NAP ID and BSID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID, NAP ID and BSID, and the best CINR or RSSI.
BSID	This displays the MAC address of a base station within range of the WiMAX Device.
NSP	This field displays the NSP ID.
NAP	This field displays the NAP ID.
Preamble ID	The preamble ID is the index identifier in the header of the base station's broadcast messages. In the beginning of a mobile stations's network entry process, it searches for the preamble and uses it to additional channel information. The preamble ID is used to synchronize the upstream and downstream transmission timing with the base station.
Frequency (MHz)	This field displays the radio frequency of the WiMAX Device's connection to the base station.
Bandwidth (MHz)	This field displays the bandwidth of the base station in megahertz (MHz).
RSSI (dBm)	This field displays the Received Signal Strength Indication (RSSI), which is an overall measurement of radio signal strength. A higher RSSI level indicates a stronger signal.
CINR (dB) R3/R1	This field displays the average Carrier to Interference plus Noise Ratio for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
Search	Click this to have the WiMAX Device scan for base stations.

6.3 Frequency Settings

Use this screen to have the WiMAX Device to scan one or more specific radio frequencies (given by your WiMAX service provider) to find available connections to base stations.

Note: The frequency band varies for different models. See [Section 1.1 on page 17](#) for more information.

Click **WiMAX > Profile > Frequency Settings** to open this screen as shown next.

Figure 27 Frequency Settings Screen (By List)

Setting Type:

Join Wide Scan Result:

Default Bandwidth: MHz

#	Frequency(KHz)	Bandwidth(MHz)
Total Num: 0		

Add OK

Valid Band Info:

#	Band Start(KHz)	Band End(KHz)
1	2490000	2700000
Total Num: 1		

Figure 28 Frequency Settings Screen (By Range)

Setting Type:

#	Start Frequency (KHz)	End Frequency (KHz)	Step (KHz)	Bandwidth (MHz)
1				0
Total Num: 1				

OK

Valid Band Info:

#	Band Start(KHz)	Band End(KHz)
1	2490000	2700000
Total Num: 1		

This screen contains the following fields:

Table 13 Frequency Settings

LABEL	DESCRIPTION
Setting Type	Select whether to scan base stations by entering specific frequency(-ies) (By List) or a range of frequencies (By Range). Note: When you select By Range, you can only configure one range of frequencies in this screen. To configure multiple frequency ranges, use the WiMAX > Wide Scan screen. Note: Some settings in this screen are only available depending on the Setting Type selected.
Join Wide Scan Result	The scanning result of the frequency to scan you configured in this screen will be shown in the WiMAX > Connect screen. Select this option to determine whether to also append the wide scanning result (configured in the WiMAX > Wide Scan screen) to the same table.
Default Bandwidth	Select the default bandwidth (size) per frequency band you specify in table A.
A (When By List is selected in the Setting Type field)	
Frequency (KHz)	This displays the center frequency of an frequency band in kilohertz (KHz). Click the number to modify it. Enter the center frequency in this field when you are adding an entry.

Table 13 Frequency Settings (continued)

LABEL	DESCRIPTION
Bandwidth (MHz)	This displays the bandwidth of the frequency band in megahertz (MHz). If you set a center frequency to 2600000 KHz with the bandwidth of 10 MHz, then the frequency band is from 2595000 to 2605000 KHz. Click the number to modify it. Enter the bandwidth of the frequency band in this field when you are adding an entry.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
OK	Click this button to save any changes made to the list.
A (When By Range is selected in the Setting Type field)	
Start Frequency (KHz)	This indicates the beginning of a frequency band in kilohertz (KHz). Click this field to modify it. Enter the beginning frequency when you are adding an entry.
End Frequency (KHz)	This indicates the end of the frequency band in kilohertz (KHz). Click this field to modify it.
Step (KHz)	This indicates the frequency step within each band in kilohertz (KHz). Click this field to modify it.
Bandwidth (MHz)	This indicates the bandwidth in megahertz (MHz). Click this field to modify it.
OK	Click this button to save any changes made to the list.
Valid Band Info (B)	
This table displays the entire frequency band the WiMAX Device supports. The frequenc(ies) to scan that you configured in table A must be within this range.	
Band Start (KHz)	This indicates the beginning of the frequency band in kilohertz (KHz).
Band End (KHz)	This indicates the end of the frequency band in kilohertz (KHz).

6.4 Authentication Settings

These settings allow the WiMAX Device to establish a secure (authenticated) connection with the service provider.

Click **WiMAX > Profile > Authentication Settings** to open this screen as shown next.

Figure 29 Authentication Settings Screen

Authentication Mode	User authentication ▼	
Data Encryption		
AES-CCM	☒	
AES-CBC	☒	
Key Encryption		
AES-key wrap	☒	
AES-ECB	☒	
EAP Supplicant		
EAP Mode	EAP-TTLS ▼	
Anonymous ID		
Server Root CA Cert. File		Browse...
Server Root CA Cert. Info	/C=US/O=WiMAX Forum(R)/CN=WiMAX Forum(R) Server Root - CA1	
Device Cert. File		Browse...
Device Cert. Info	/C=TW/O=ZyXEL/OU=WiMAX Forum(R) Devices/CN=0023F87dc6d9 MAX series	
Device Private Key		Browse...
Device Private Key Info	No private key found	
Device Private Key Password		
Inner Mode	MS-CHAPv2 ▼	
Username		
Password		
Options		
Enable Auth Mode Decoration in EAP Outer ID	☐	
Enable Service Mode Decoration in EAP Outer ID	☐	
Random Outer ID	☐	
Ignore Cert Verification	☒	
Same EAP Outer ID in ReAuth	☐	
MAC address in Outer ID	☐	
Delete existed Root Certificate file	☐	
Delete existed Device Certificate file	☐	
Delete existed Private Key	☐	

This screen contains the following fields:

Table 14 Authentication Settings

LABEL	DESCRIPTION
Authentication Mode	Select the authentication mode from the list. The WiMAX Device supports the following authentication modes: • No authentication • User authentication • Device authentication • User and device authentication
Data Encryption	
AES-CCM	Select this to enable AES-CCM encryption. CCM combines counter-mode encryption with CBC-MAC authentication.
AES-CBC	Select this to enable AES-CBC encryption. CBC creates message authentication code from a block cipher.
Key Encryption	
AES-key wrap	Select this to encapsulate cryptographic keys in a symmetric encryption algorithm.
AES-ECB	Select this to divide cryptographic keys into blocks and encrypt them separately.
EAP Supplicant	
EAP Mode	Select an Extensible Authentication Protocol (EAP) mode. The WiMAX Device supports the following: • EAP-TLS - In this protocol, digital certifications are needed by both the server and the wireless clients for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead. • EAP-TTLS - This protocol is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.
Anonymous ID	Enter the anonymous ID used for EAP supplicant authentication.
Server Root CA Cert File	Browse for and choose a server root certificate file, if required.
Server Root CA Info	This field displays information about the assigned server root certificate.
Device Cert File	Browse for and choose a device certificate file, if required. Before you import certificate from WebGUI, the certificate file must be signed by chipset vendor due to security reason.
Device Cert Info	This field displays information about the assigned device certificate.
Device Private Key	Browse for and choose a device private key, if required.
Device Private Key Info	This field displays information about the assigned device private key.
Device Private Key Password	Enter the device private key, if required.

Table 14 Authentication Settings (continued)

LABEL	DESCRIPTION
Inner Mode	Sets the EAP-TTLS inner mode. The WiMAX Device supports the following: • MS-CHAP v2 - This is version 2 of Microsoft's variant of Challenge Handshake Authentication Protocol (CHAP). It allows for mutual authentication between devices. • MS-CHAP - This is Microsoft's variant of Challenge Handshake Authentication Protocol (CHAP). It allows for mutual authentication between devices. • CHAP - The Challenge Handshake Authentication Protocol (CHAP) uses PPP to authenticate remote devices using a three-way handshake and shared secret verification. • MD5 - Message-Digest, algorithm 5, (MD5) encryption is typically used for checking file integrity. Because this encryption protocol contains a number of serious security flaws it is generally not recommended that you use it for authentication security. • PAP - Password Authentication Protocol uses unencrypted plaintext to send a passwords for authentication over the network. It's probably not a good idea to rely on this for security.
Username	Enter the username required for the EAP-TTLS inner method.
Password	Enter the password required for the EAP-TTLS inner method.
Options	
Enable Auth Mode Decoration in EAP Outer ID	Select this to enable authentication mode.
Enable Service Mode Decoration in EAP Outer ID	Select this to enable service mode.
Random Outer ID	Select this to allow the WiMAX Device to generate a 16-byte random number as a username for the EAP Identity Response message.
Ignore Cert Verification	Select this to ignore base station certification verification when a certificate is received during EAP-TLS or EAP-TTLS.
Same EAP OuterID in ReAuth	Select this to use the same EAP to the outer ID when reauthenticating.
MAC address in EAP-TLS outer Id	Adds the MAC address of the WiMAX Device to the outer ID while the EAP mode is set to EAP-TLS.
Delete existed Root Certificate file	Select this to delete an existing root certificate file from the WiMAX Device.
Delete existed Device Certificate file	Select this to delete an existing device certificate file from the WiMAX Device.
Delete existed Private Key	Select this to delete an existing private key from the WiMAX Device.

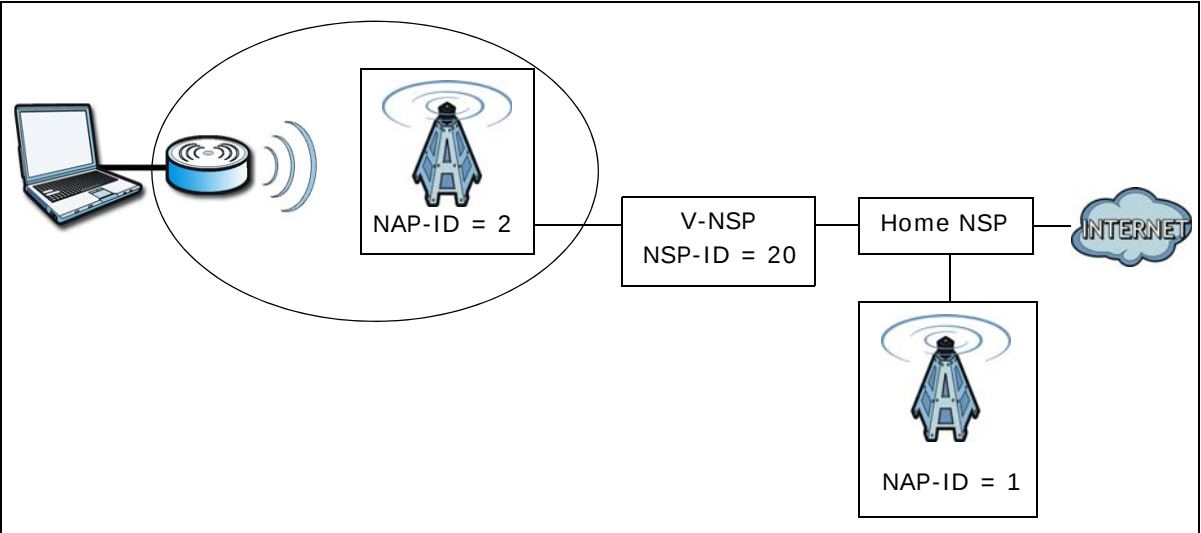
6.5 Channel Plan Settings

This screen allows you to specify channel plan settings for Network Discovery and Selection (ND&S). The WiMAX Device uses ND&S to establish connections when it is roaming. To do this, the WiMAX Device will scan for base stations that are operated by Network Access Providers (NAP) that have service agreements with the subscriber's service provider (Home-Network Service Provider or

Home NSP). Through the NAP's base station, which is identified by a NAP-ID, the subscriber's WiMAX Device can access the Internet through a network service provider (NSP). Access can be through another network service provider (Visited-Network Service Provider or V-NSP) or his own network service provider (Home NSP), depending on his service agreement.

In the following scenario, the subscriber's WiMAX Device cannot reach a base station owned by his Home NSP (base station with NAP-ID = 1). The WiMAX Device uses ND&S and is able to access another base station with NAP-ID = 2. This base station is associated with another service provider (V-NSP with NSP-ID = 20). The subscriber's service agreement specifies to route traffic from the other service provider to the Home NSP, so the Home NSP authenticates and authorizes the connection.

Figure 30 ND&S Scenario



The channel plan settings specify the allowed frequency range to search for a NAP. The channel plan is necessary to speed up the network discovery process.

Click **WiMAX > ND&S > Channel Plan Settings** to open this screen as shown next.

Figure 31 Channel Plan Settings

Channel Plan Settings

#	Start Frequency (KHz)	End Frequency (KHz)	Step (KHz)	Bandwidth (MHz)	
1	2490000	2700000	1000	10	

Total Num: 1

Add OK

Valid Band Info

#	Band Start(KHz)	Band End(KHz)
1	2490000	2700000

Total Num: 1

Save Cancel

This screen contains the following fields:

Table 15 Channel Plan Settings

LABEL	DESCRIPTION
Channel Plan Settings - You can configure multiple ranges of frequencies to scan for different NAPs. The configured frequency ranges to scan must be within the Valid Band. Specify the Channel Plan to scan for each NAP on the CAPL Settings: Add screen (Section 6.6.1 on page 80).	
Start Frequency (KHz)	This indicates the beginning of a frequency band in kilohertz (KHz). Click this field to modify it. Enter the beginning frequency when you are adding an entry.
End Frequency (KHz)	This indicates the end of the frequency band in kilohertz (KHz). Click this field to modify it.
Step (KHz)	This indicates the frequency step within each band in kilohertz (KHz). Click this field to modify it. The minimum step is 250KHz and the maximum step is the difference between the start frequency and end frequency.
Bandwidth (MHz)	This indicates the bandwidth in megahertz (MHz). Click this field to modify it.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
OK	Click this button to save any changes made to the list.
Valid Band Info - This table displays the entire frequency band the WiMAX Device supports. The frequency ranges to scan that you configured in Channel Plan Settings must be within this range.	
Band Start (KHz)	This indicates the beginning of the frequency band in kilohertz (KHz).
Band End (KHz)	This indicates the end of the frequency band in kilohertz (KHz).
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

6.6 CAPL Settings

This screen allows you to view the Contractual Agreement Preference List (CAPL) of NAPs for base stations that are preferred for establishing connections. The CAPL is a list of NAPs that are affiliated with the Home NSP through contractual agreements.

Click **WiMAX > ND&S > CAPL Settings** to open this screen as shown next.

Figure 32 CAPL Settings

The screenshot shows the 'CAPL Settings' interface. It features a table with the following columns: '#', 'NAP ID', 'Priority (1~250)', and 'Channel Plan ID'. Below the table, the text 'Total Num: 0' is displayed next to an 'Add' button. At the bottom of the screen, there are 'Save' and 'Cancel' buttons.

This screen contains the following fields:

Table 16 CAPL Settings

LABEL	DESCRIPTION
NAP ID	This displays the NAP ID.
Priority	This displays the priority for the NAP ID.
Channel Plan ID	This displays the Channel Plan ID.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

6.6.1 CAPL Settings: Add

This screen allows you to specify the Contractual Agreement Preference List (CAPL) of NAPs, and the corresponding channel plan to search for the NAP.

Click **WiMAX > ND&S > CAPL Settings: Add** to open this screen as shown next.

Figure 33 CAPL Settings: Add

CAPL Option Settings

NAP ID

Priority(1~250)

Select Channel Plan ID

#	Select	Start Frequency (KHz)	End Frequency (KHz)	Step (KHz)	Bandwidth (MHz)
1	☒	2490000	2700000	1000	10

Total Num: 1 OK

Save Cancel

This screen contains the following fields:

Table 17 CAPL Settings: Add

LABEL	DESCRIPTION
NAP ID	Specify the NAP ID in the format XX:XX:XX where X is a hexadecimal character. The NAP ID is typically the first three blocks of the BSID of the base station.
Priority	Specify the priority for the NAP ID. Enter 1-250 where 1 is the highest priority. The WiMAX Device will search for NAPs according to the priority specified. Priority may be determined by the number of base stations an NAP has, with a NAP having more base stations being assigned a higher priority. If the same priority is assigned to a NAP ID, the WiMAX Device will consider them as having equal priority.
Select Channel Plan ID	
Select	After clicking a Channel Plan ID entry in the list, you can click this check box to select it.
Start Frequency (KHz)	This indicates the beginning of a frequency band in kilohertz (KHz).

Table 17 CAPL Settings: Add (continued)

LABEL	DESCRIPTION
End Frequency (KHz)	This indicates the end of the frequency band in kilohertz (KHz).
Step (KHz)	This indicates the frequency step within each band in kilohertz (KHz).
Bandwidth (MHz)	This indicates the bandwidth in megahertz (MHz).
OK	Click this button to save any changes made to the list.
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

6.7 RAPL Settings

This screen allows you to specify the Roaming Agreement Preference List (RAPL) of preferred NSPs for establishing connections to the Home NSP. The RAPL is a list of NSPs that are affiliated with the Home NSP through roaming agreements. A NSP specified in the RAPL is a V-NSP and can route data to the Home NSP.

Click **WiMAX > ND&S > RAPL Settings** to open this screen as shown next.

Figure 34 RAPL Settings

This screen contains the following fields:

Table 18 RAPL Settings

LABEL	DESCRIPTION
NSP ID	Specify the Network Service Provider (NSP) ID in the format XX:XX:XX where X is a hexadecimal character. If the Home NSP ID is entered in this list, the WiMAX Device will try to use it to establish a connection.
Priority	Specify the priority for the NSP. Enter 1-250 where 1 is the highest priority.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
OK	Click this button to save any changes made to the list.
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

6.8 Home NSP Settings

On this screen, you can configure settings for the Home NSP. The Home NSP can authenticate and authorize connections and may support roaming through relationships with other NSPs.

Click **WiMAX > ND&S > Home NSP Settings** to open this screen as shown next.

Figure 35 Home NSP Settings

This screen contains the following fields:

Table 19 Home NSP Settings

LABEL	DESCRIPTION
NDS Option Settings	
NDS Mode	Select Enable to use NDS to establish connections to the Home NSP.
RAPL Policy	Select Strict to only allow V-NSPs specified in the RAPL to be used for establishing connections to the H-NSP. Select Partially Flexible to allow the WiMAX Device to use V-NSPs not specified in the RAPL to connect to the H-NSP. Before attempting V-NSPs not specified in the RAPL the WiMAX Device will first try the V-NSPs specified in the RAPL to connect to the H-NSP. Select Flexible to allow the WiMAX Device to use any V-NSPs for establishing connections to the H-NSP. V-NSPs specified in the RAPL will have the same priority as V-NSPs not specified in the RAPL.
CAPL Policy	Select Strict to only allow NAPS specified in the CAPL to be used for establishing connections to the H-NSP. Select Partially Flexible to allow the WiMAX Device to use NAPS not specified in the CAPL to connect to the H-NSP. Before attempting NAPS not specified in the CAPL the WiMAX Device will first try the NAPS specified in the CAPL to connect to the H-NSP. Select Flexible to allow the WiMAX Device to use any NAPS for establishing connections to the H-NSP. NAPS specified in the CAPL will have the same priority as NAPS not specified in the CAPL.
Home NSP Settings	
NSP ID	After clicking the entry in the NSP ID list, you can enter the NSP ID for the Home NSP here in the format XX:XX:XX where X is a hexadecimal character. Only one Home NSP can be entered.
OK	Click this button to save any changes made to the list.

Table 19 Home NSP Settings (continued)

LABEL	DESCRIPTION
Save	Click this button to save any changes made to the list. Note: If you change the NDS Mode , the WiMAX Device will reboot when you click save.
Cancel	Click this avoid any changes made from being saved to your configuration.

6.9 Connect

This screen allows you to view the available WiMAX frequency band(s) and base station(s) the WiMAX Device found through scanning and choose a base station to which to connect.

Click **WiMAX > Connect** to open this screen as shown next.

Figure 36 Connect Screen

Applied Frequency Information

#	Frequency(KHz)	Bandwidth(MHz)
Total Num: 0		

Available Network List

Auto Connect Mode

#	BSID	NSP	NAP	Network Type	Preamble ID	Frequency (MHz)	Bandwidth (MHz)	RSSI (dBm)	CINR (dB) R3/R1
Total Num: 0									

Connected BS Info

#	Device Status	UMAC State	BSID	Frequency (MHz)	RSSI(dBm)	CINR(dB) R3/R1
1	Ready	Disconnected	00:00:00:00:00:00	0	0.00	0.00/0.00
Total Num: 1						

Connected NSP Info

#	NSP ID	Name	Network Type
1	--	--	--
Total Num: 1			

This screen contains the following fields:

Table 20 Connect

LABEL	DESCRIPTION
Applied Frequency Information	
This table shows the scanning result you made in the WiMAX > Profile > Frequency Settings and WiMAX > Wide Scan screens.	
Note: You cannot see the wide scanning result that you made in WiMAX > Wide Scan screen if the Join Wide Scan Result is set to No in the WiMAX > Profile > Frequency Settings screen.	
Applied Frequency Information	
Frequency (KHz)	This field displays the available center frequency of a frequency band in kilohertz (KHz).
Bandwidth (MHz)	This field displays the bandwidth of the frequency band in megahertz (MHz).
Available Network List	
Connected Mode	Select a connect mode: • Auto Connect Mode - This allows the WiMAX Device to connect to any of the base stations on the list automatically. • Network Search Mode - This allows the WiMAX Device to connect to a user-specified base station. Select this option, choose a base station, click Connect. • NSP Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID. To specify the NSP ID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID, and the best CINR or RSSI. • NSP / NAP Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID and NAP ID. To specify the NSP ID and NAP ID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID and NAP ID, and the best CINR or RSSI. • NSP / NAP / BSID Mode - This allows the WiMAX Device to connect to a base station with a user-specified NSP ID, NAP ID and BSID. To specify the NSP ID, NAP ID and BSID, select a result in the list and click Connect. The WiMAX Device will automatically connect to a base station with the same NSP ID, NAP ID and BSID, and the best CINR or RSSI.
Connect	Click this to connect to the selected base station.
Disconnect	Click this to disconnect from the selected base station.
BSID	This field displays the base station MAC address.
NSP	This field displays the NSP ID.
NAP	This field displays the NAP ID.
Network Type	This field displays the network type.
Preamble ID	This field displays the preamble ID. The preamble ID is the index identifier in the header of the base station's broadcast messages. In the beginning of a mobile stations's network entry process, it searches for the preamble and uses it to additional channel information. The preamble ID is used to synchronize the upstream and downstream transmission timing with the base station.
Frequency (MHz)	This field displays the center frequency the base station uses in kilohertz (KHz).
Bandwidth (MHz)	This field displays the frequency band bandwidth the base station uses in megahertz (MHz).

Table 20 Connect (continued)

LABEL	DESCRIPTION
RSSI (dBm)	This field displays the Received Signal Strength Indication (RSSI), which is an overall measurement of radio signal strength. A higher RSSI level indicates a stronger signal.
CINR (dB) R3/R1	This field displays the average Carrier to Interference plus Noise Ratio for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
Search	Click this to have the WiMAX Device scan for base stations in the frequency band(s) listed in the Applied Frequency Information table.
Connected BS Info	
Device Status	This field displays the WiMAX Device current status for connecting to the selected base station. • Scanning - The WiMAX Device is scanning for available base stations. • Ready - The WiMAX Device has finished scanning and you can connect to a base station. • Connecting - The WiMAX Device attempts to connect to the selected base station. • Connected - The WiMAX Device has successfully connected to the selected base station.
UMAC State	This field displays the status of the WiMAX connection between the WiMAX Device and the base station. • Network Search - The WiMAX Device is scanning for any available WiMAX connections. • Disconnected - No WiMAX connection is available. • Network Entry - A WiMAX connection is initializing. • Normal - The WiMAX connection has been successfully established.
BSID	This field displays the MAC address of the base station to which the WiMAX Device is connected.
Frequency (MHz)	This field displays the frequency the base station uses in megahertz (MHz).
RSSI (dBm)	This field displays the Received Signal Strength Indication (RSSI), which is an overall measurement of radio signal strength. A higher RSSI level indicates a stronger signal.
CINR (dB)	This field displays the average Carrier to Interference plus Noise Ratio for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
Connected NSP Info	
NSP ID	This field displays the NSP ID of the connected NSP.
Name	This field displays the name of the connected NSP.
Network Type	This field displays the network type of the connected NSP.

6.10 Wide Scan

This screen allows you to discover base stations by entering one or more frequency ranges and bandwidth on which to scan.

Click **WiMAX > Wide Scan** to open this screen as shown next.

Figure 37 Wide Scan Screen

Wide Scan Settings

Auto Wide Scan

No ▾

Wide Scan Range

#	Start Frequency (KHz)	End Frequency (KHz)	Step (KHz)	Bandwidth (MHz)	
1				10 ▾	

Total Num: 1

AddOK

Wide Scan Result

#	Frequency (KHz)	Bandwidth (MHz)
---	-----------------	-----------------

Total Num: 0

SearchClear

Save

Cancel

This screen contains the following fields:

Table 21 Wide Scan

LABEL	DESCRIPTION
Wide Scan Settings	
Auto Wide Scan	Use this to enable (Yes) or disable (No) automatically scanning for base stations.
Wide Scan Range	
Start Frequency (KHz)	Enter the start frequency in kilohertz (KHz) for a wide scan range.
End Frequency (KHz)	Enter the end frequency in kilohertz (KHz) for a wide scan range.
Step (KHz)	Enter the step increment in kilohertz (KHz) that the wide scan jumps each time it scans between the start and end frequencies.
Bandwidth (MHz)	Enter the frequency bandwidth to be scanned.
Delete	Click this to remove a range of frequencies from the wide scan range list.
Add	Click this to add a range of frequencies to the wide scan range list.
OK	Click this so save any changes to the wide scan range list.
Wide Scan Result	
This table displays the available frequency band(s) found through the wide scan.	
Frequency (KHz)	This field displays the frequency in kilohertz (KHz).
Bandwidth (MHz)	This field displays the bandwidth in megahertz (MHz).
Search	Click this to initiate a wide scan.
Clear	Click this to clear the wide scan results.

6.11 Link Status

This screen provides a general overview of the current WiMAX connection with the service provider.

Click **WiMAX > Link Status** to open this screen as shown next.

Figure 38 Link Status Screen

Connection Status	
Profile	Wimax
BSID	00:00:00:00:00:00
RSSI	0.00 dBm
CINR R3	0.00 dB
CINR R1	0.00 dB
CINR Std Dev	0.00 dB
Frequency	0 KHz
TX Power	0 dBm
UL MCS	QPSK [CC] 1/2
DL MCS	QPSK [CC] 1/2
RF Temperature	25 C
Link Uptime	00:00:00
Handover Attempt	0
Handover Success	0
Handover Fail	0
Handover Maximum Latency	0
Handover Minimum Latency	0
Handover Average Latency	0

This screen contains the following fields:

Table 22 Link Status

LABEL	DESCRIPTION
Profile	This field displays the profile name.
BSID	This field displays the MAC address of the base station to which the WiMAX Device is currently connected.
RSSI	This field displays the Received Signal Strength Indication (RSSI), which is an overall measurement of radio signal strength. A higher RSSI level indicates a stronger signal.
CINR R3	This field displays the average Carrier to Interference plus Noise Ratio (R3) for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
CINR R1	This field displays the average Carrier to Interference plus Noise Ratio (R1) for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
CINR Std Dev	This field displays the average Carrier to Interference plus Noise Ratio (Std Dev) for the current connection. This value is an indication of overall radio signal quality, where a higher value means a better quality signal.
Frequency	This field displays the frequency in kilohertz (KHz).
TX Power	This field displays the transmission power of the WiMAX Device in dBm.
UL MCS	This field displays the Uplink Modulation and Coding Sequence (UL MCS).
DL MCS	This field displays the Downlink Modulation and Coding Sequence (DL MCS).
RF Temperature	This field displays the temperature in centigrade of the WiMAX Device's RF circuit.
Link Uptime	This field displays the length of time the current connection has been up.
Handover Success	This field displays how many times the WiMAX Device had ever successfully switched its connection from one base station to another base station, since the WiMAX Device last restarted.

Table 22 Link Status (continued)

LABEL	DESCRIPTION
Handover Fail	This field displays how many times the WiMAX Device had been failed to switch its connection from one base station to another base station, since the WiMAX Device last restarted.
Handover Maximum Latency	This field displays the maximum latency for switching connections from one base station to another base station, since the WiMAX Device last restarted.
Handover Minimum Latency	This field displays the minimum latency for switching connections from one base station to another base station, since the WiMAX Device last restarted.
Handover Average Latency	This field displays the average latency for switching connections from one base station to another base station, since the WiMAX Device last restarted.

6.12 Link Statistics

This screen provides a detailed overview of the current WiMAX connection with the service provider.

Click **WiMAX > Link Statistics** to open this screen as shown next.

Figure 39 Link Statistics Screen

Link			
TX Connections		Downlink PDU	undefined
RX Connections	undefined	Downlink SDU	undefined
Frame Number	undefined	DL Discard Frame	undefined
Frame Duration	undefined	UL Fragmentation	undefined
Init Rang. Code Start	undefined	DL Unpacking	undefined
Init Rang. Code End	undefined	DL Defrag	undefined
Periodic Rang. Code Start	undefined	Mng Msg Send	undefined
Periodic Rang. Code End	undefined	Mng Msg Recv	undefined
Uplink PDU	undefined	Mng Msg Drop	undefined
Uplink SDU	undefined	DL frequency	undefined
MIMO A Burst	undefined	PSD Ratio	undefined %
MIMO B Burst	undefined	Beam Forming Burst	undefined
AMC Burst	undefined		
HARQ			
TX Burst	undefined	Re-TX Burst	undefined
RX Valid Burst	undefined	Rx Invalid Burst	undefined
RX Dup. Burst	undefined	Uplink Retrans. Ratio	undefined %
Downlink NAK Ratio	undefined %		
TX/RX			
Packets Sent	0	Packets Received	0
Transmit Bytes	0	Received Bytes	0
Transmit Bytes Rate	0	Received Bytes Rate	0
MCS			
QPSK-1/2		QPSK-3/4	undefined
16QAM-1/2	undefined	16QAM-3/4	undefined
64QAM-1/2	undefined	64QAM-2/3	undefined
64QAM-3/4	undefined	64QAM-5/6	undefined

This screen contains the following sections:

Table 23 Link Statistics

LABEL	DESCRIPTION
Link	This section provides a detailed overview of link statistics.
HARQ	This section provides a detailed overview of Hybrid Automatic Repeat Request link statistics.
TX/RX	This section provides a detailed overview of transmission and receiving link statistics.
MCS	This section provides a detailed overview of Modulation and Coding Sequence (MCS) link statistics

6.13 Connection Info

This screen displays all of the connections made through the WiMAX device since its last reboot.

Click **WiMAX > Connection Info** to open this screen as shown next.

Figure 40 Connection Info Screen

10 per page		
#	Active Connection CID	Connection Type
Total Num: 0		

This screen contains the following fields:

Table 24 Connection Info

LABEL	DESCRIPTION
Active Connection CID	This displays the unique, unidirectional 16-bit Connection Identifier (CID) for an active connection.
Connection Type	This displays the type of connection.

6.14 Service Flow

This screen displays data priority information for all of the connections made through the WiMAX device since its last reboot.

Click **WiMAX > Service Flow** to open this screen as shown next.

Figure 41 Service Flow Screen

			10 per page	  	 	page	 
#	SFID	SF Status	SF Direction				
Total Num: 0							

This screen contains the following fields:

Table 25 Service Flow

LABEL	DESCRIPTION
SFID	This displays a 32-bit service flow identifier.
SF Status	This display the service flow status.
SF Direction	This displays the service flow direction.

Network Setting

7.1 Overview

This chapter shows you how to configure the WiMAX Device's network setting.

7.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

IP Address

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet Masks

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

DHCP

A DHCP (Dynamic Host Configuration Protocol) server can assign your WiMAX Device an IP address, subnet mask, DNS and other routing information when it's turned on.

DNS Server Address

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a machine before you can access it. The DNS server addresses that you enter in the DHCP setup are passed to the client machines along with the assigned IP address and subnet mask.

There are two ways that an ISP disseminates the DNS server addresses. The first is for an ISP to tell a customer the DNS server addresses, usually in the form of an information sheet, when s/he signs up. If your ISP gives you the DNS server addresses, enter them in the **DNS Server** fields; otherwise, leave them blank.

Some ISPs choose to pass the DNS servers using the DNS server extensions of PPP IPCP (IP Control Protocol) after the connection is up. If your ISP did not give you explicit DNS servers, chances are the DNS servers are conveyed through IPCP negotiation. The WiMAX Device supports the IPCP DNS server extensions through the DNS proxy feature.

If the **Primary** and **Secondary DNS Server** fields are not specified, for instance, left as 0.0.0.0, the WiMAX Device tells the DHCP clients that it itself is the DNS server. When a computer sends a DNS query to the WiMAX Device, the WiMAX Device forwards the query to the real DNS server learned through IPCP and relays the response back to the computer.

Please note that DNS proxy works only when the ISP uses the IPCP DNS server extensions. It does not mean you can leave the DNS servers out of the DHCP setup under all circumstances. If your ISP gives you explicit DNS servers, make sure that you enter their IP addresses. This way, the WiMAX Device can pass the DNS servers to the computers and the computers can query the DNS server directly without the WiMAX Device's intervention.

RIP Setup

RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. When set to:

- **RX / TX** - the WiMAX Device will broadcast its routing table periodically and incorporate the RIP information that it receives.
- **RX Only** - the WiMAX Device will not send any RIP packets but will accept all RIP packets received.
- **TX Only** - the WiMAX Device will send out RIP packets but will not accept any RIP packets received.
- **None** - the WiMAX Device will not send any RIP packets and will ignore any RIP packets received.

The **Version** field controls the format and the broadcasting method of the RIP packets that the WiMAX Device sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting.

Port Forwarding

A NAT server set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make accessible to the outside world even though NAT makes your whole inside network appear as a single machine to the outside world.

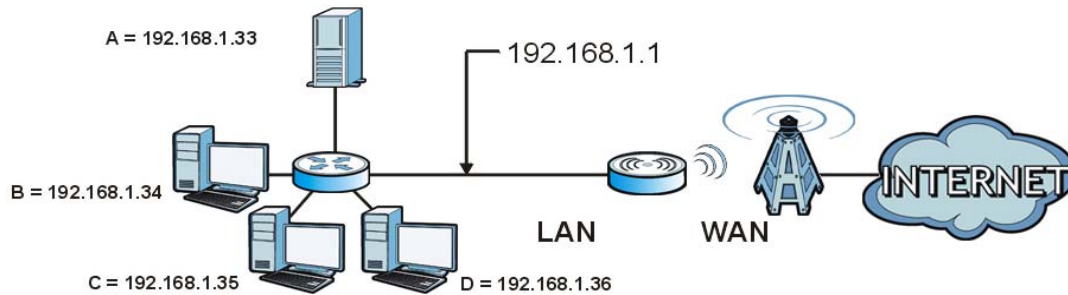
With port forwarding, you can forward incoming service requests to the server(s) on your local network. You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers.

In addition to the servers for specified services, NAT supports a default server. A service request that does not have a server explicitly designated for it is forwarded to the default server. If the default is not defined, the service request is simply discarded.

For example, let's say you want to assign ports 21-25 to one FTP, Telnet and SMTP server (A in the example), port 80 to another (B in the example) and assign a default server IP address of

192.168.1.35 to a third (C in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 42 Multiple Servers Behind NAT Example



Trigger Ports

Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem is that port forwarding only forwards a service to a single LAN IP address. In order to use the same service on a different LAN computer, you have to manually replace the LAN computer's IP address in the forwarding port with another LAN computer's IP address,

Trigger port forwarding solves this problem by allowing computers on the LAN to dynamically take turns using the service. The WiMAX Device records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the WiMAX Device's WAN port receives a response with a specific port number and protocol ("incoming" port), the WiMAX Device forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

ALG

Some applications, such as SIP, cannot operate through NAT (are NAT un-friendly) because they embed IP addresses and port numbers in their packets' data payload. Some NAT routers may include a SIP Application Layer Gateway (ALG). An Application Layer Gateway (ALG) manages a specific protocol (such as SIP, H.323 or FTP) at the application layer.

A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream.

UPnP

Universal Plug and Play (UPnP) is a distributed, open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between devices. A UPnP device can dynamically join a network, obtain an IP address, convey its capabilities and learn about other devices on the network. In turn, a device can leave a network smoothly and automatically when it is no longer in use.

How do I know if I'm using UPnP?

UPnP hardware is identified as an icon in the Network Connections folder (Windows XP). Each UPnP compatible device installed on your network will appear as a separate icon. Selecting the icon of a UPnP device will allow you to access the information and properties of that device.

NAT Traversal

UPnP NAT traversal automates the process of allowing an application to operate through NAT. UPnP network devices can automatically configure network addressing, announce their presence in the network to other UPnP devices and enable exchange of simple product and service descriptions. NAT traversal allows the following:

- Dynamic port mapping
- Learning public IP addresses
- Assigning lease times to mappings

Windows Messenger is an example of an application that supports NAT traversal and UPnP.

Cautions with UPnP

The automated nature of NAT traversal applications in establishing their own services and opening firewall ports may present network security issues. Network information and configuration may also be obtained and modified by users in some network environments.

All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

UPnP and ZyXEL

ZyXEL has received UPnP certification from the official UPnP Forum (<http://www.upnp.org>). ZyXEL's UPnP implementation supports IGD 1.0 (Internet Gateway Device).

The WiMAX Device only sends UPnP multicasts to the LAN.

Content Filter

Internet content filtering allows you to create and enforce Internet access policies tailored to their needs. Content filtering is the ability to block certain specific URL keywords.

7.2 WAN

Use these settings to configure the WAN connection between the WiMAX Device and the service provider.

Click **Network Setting > WAN** to open this screen as shown next.

Figure 43 WAN Screen

Operation Mode	NAT
WAN Protocol	Ethernet
Bridging LAN ARP	No
Get IP Method	From ISP
WAN IP Request Timeout	120 seconds (0~600, infinite:0)
WAN IP Address	0.0.0.0
WAN IP Subnet Mask	0.0.0.0
Gateway IP Address	0.0.0.0
MTU	1400
Clone MAC Address	00:23:F8:7D:C6:D9
WAN DNS	
First DNS Server	From ISP 0.0.0.0
Second DNS Server	From ISP 0.0.0.0
Third DNS Server	From ISP 0.0.0.0
Save Cancel	

This screen contains the following fields:

Table 26 WAN

LABEL	DESCRIPTION
Operation Mode	Select the WiMAX Device's operational mode. • Bridge - This puts the WiMAX Device in bridge mode, acting as a transparent middle man between devices on the LAN and the devices on the WAN. • Router - Select Router from the drop-down list box if your ISP gives you one IP address only and you want multiple computers to share an Internet account. • NAT - This allows the WiMAX Device to tag frames for NAT, allowing devices on the LAN to use their own internal IP addresses while communicating with devices on the WAN.
WAN Protocol	Select the protocol the WiMAX Device uses to connect to the WAN. The options are: • Ethernet - Select this if you have a persistent connection to the network. • PPPoE - Select this if must log into the network before initiating a persistent connection. • GRE Tunnel - Select this if you connect to the network using Point-to-Point Protocol to create VPNs. • EtherIP Tunnel - Select this if you need to tunnel Ethernet and IEEE 802.3 MAC frames across an IP Internet.
Bridging LAN ARP	This option enables or disables allow ARP requests to cross the WiMAX Device.
Get IP Method	Select how the WiMAX Device receives its IP address. • User - Select this to manually enter the IP address the WiMAX Device uses. • From ISP - Select to automatically get the IP address the WiMAX Device uses from the ISP.

Table 26 WAN (continued)

LABEL	DESCRIPTION
WAN IP Request Timeout	Enter the number of seconds the WiMAX Device waits for an IP from the ISP before it times out.
WAN IP Address	If the WiMAX Device gets its IP from the user, enter the IP address it is to use.
WAN IP Subnet Mask	If the WiMAX Device gets its IP from the ISP, enter the IP address it is to use.
Gateway IP Address	If the WiMAX Device gets its gateway IP address from the user, enter the IP address it is to use.
MTU	Enter the Maximum Transmission Unit (MTU) for the WiMAX Device. This is the largest protocol unit that the WiMAX Device allows to pass through it.
Clone MAC Address	Enter a MAC address here for registering bridged devices on the network if their current MAC addresses are causing problems. For example, this can happen when a desktop computer swaps network interface cards; the original NIC may have used its MAC address to register itself on the network and now the new NIC is unrecognized. Using a MAC address that you know is valid, i.e. a "clone", allows that device to stay registered.
WAN DNS	
First-Third DNS Server	Select how the WiMAX Device acquires its DNS server address. • From ISP - Select this to have the WiMAX Device acquire its DNS server address from the ISP. • User Define - Select this to manually enter the DNS server used by the WiMAX Device.

7.3 PPPoE

Use these settings to configure the PPPoE connection between the WiMAX Device and the service provider.

Click Network Setting > WAN > PPPoE.

Figure 44 PPPoE Screen

PPPoE

User Name

Password

Retype Password

Auth Protocol

☒ PAP
 ☒ CHAP
 ☒ MSCHAPv1
 ☒ MSCHAPv2

MPPE Encryption

No ▾

MPPE Stateful

No ▾

Idle Timeout

0 (0~86400 seconds; enter 0 to never timeout)

AC Name

DNS overwrite

No ▾

Connection Trigger

Manual ▾

Connection Timeout

0 (0~86400 seconds; enter 0 to never timeout)

PPPoE Connect

PPPoE Disconnect

This screen contains the following fields:

Table 27 PPPoE

LABEL	DESCRIPTION
User Name	Enter the username for PPPoE login into the WAN network.
Password	Enter the password for PPPoE login into the WAN network.
Retype Password	Retype the password to confirm it.
Auth Protocol	Select a PPPoE authentication protocol. The WiMAX Device supports the following: • PAP - Password Authentication Protocol uses unencrypted plaintext to send a passwords for authentication over the network. It's probably not a good idea to rely on this for security. • CHAP - The Challenge Handshake Authentication Protocol (CHAP) uses PPP to authenticate remote devices using a three-way handshake and shared secret verification. • MS-CHAP v1/2 -This is Microsoft's variant of Challenge Handshake Authentication Protocol (CHAP). It allows for mutual authentication between devices.
MPPE Encryption	Use this option to enable or disable authentication through Microsoft Point-To-Point Encryption (MPPE) protocol.
MPPE Stateful	Use this option to allow or disallow the WiMAX Device to use the Microsoft Point-To-Point Encryption (MPPE) protocol for stateful peer negotiation.
Idle Timeout	Enter the number of second the WiMAX Device waits during authentication before timing out.
AC Name	Enter the access concentrator name for the PPPoE interface if your ISP uses an AC PPPoE service.
DNS Overwrite	Use this option to allow or disallow the WiMAX Device to overwrite DNS static DNS entries on client devices.
Connection Trigger	Set whether the WiMAX Device is persistently connected to the WAN (AlwaysOn) or you must click the PPPoE Connect button each time you want to get on the WAN (Manual).
Connection Timeout	Enter in seconds the duration the WiMAX Device waits for idle activity before disconnecting from the WAN.
PPPoE Connect	Click this to connect to the WAN using PPPoE.
PPPoE Disconnect	Click this to disconnect from the WAN.

7.4 GRE

Use these settings to configure the peer setting of the Generic Routing Encapsulation (GRE) tunnel between the WiMAX Device and another GRE peer.

Click **Network Setting > WAN > GRE** to open this screen as shown next.

Figure 45 GRE Screen

GRE Peer

Peer IP Address

This screen contains the following fields:

Table 28 GRE

LABEL	DESCRIPTION
Peer IP Address	Enter the IP address of the GRE peer.

7.5 EtherIP

Use these settings to configure the peer setting of the EtherIP tunnel between the WiMAX Device and another EtherIP peer.

Click **Network Setting > WAN > EtherIP** to open this screen as shown next.

Figure 46 EtherIP Screen

EtherIP Tunnel Bridge

Peer IP Address

This screen contains the following fields:

Table 29 EtherIP

LABEL	DESCRIPTION
Peer IP Address	Enter the IP address of the EtherIP peer.

7.6 IP

Use these settings to configure the LAN connection between the WiMAX Device and your local network.

Click **Network Setting > LAN > IP** to open this screen as shown next.

Figure 47 IP Screen

IP Address

IP Subnet Mask

This screen contains the following fields:

Table 30 IP

LABEL	DESCRIPTION
IP address	Enter the IP address of the LAN interface for the WiMAX Device.
IP Subnet Mask	Enter the IP subnet mask of the LAN interface for the WiMAX Device.

7.7 DHCP

Use these settings to configure whether the WiMAX Device functions as a DHCP server for your local network, or a DHCP relay between the local network and the service provider. You can also disable the DHCP functions.

Click **Network Setting > LAN > DHCP** to open this screen as shown next.

Figure 48 DHCP Screen

DHCP Server

DHCP Mode:

Start IP:

End IP:

Lease Time: (minutes)

Relay IP:

DNS Server assigned by DHCP Server

First DNS Server:

Second DNS Server:

Third DNS Server:

Static DHCP

10 per page | page |

#	MAC Address	IP Address
Total Num: 0		

Add OK

DHCP Leased Hosts

10 per page | 1 page |

#	MAC Address	IP Address	Remaining Time
1	00:24:21:7E:20:96	192.168.1.33	23:44:55
Total Num: 1			

Refresh

This screen contains the following fields:

Table 31 DHCP

LABEL	DESCRIPTION
DHCP Server	
DHCP Mode	Select this if you want the WiMAX Device to be the DHCP server on the LAN. As a DHCP server, the WiMAX Device assigns IP addresses to DHCP clients on the LAN and provides the subnet mask and DNS server information. None - This disables DHCP mode for the WiMAX Device. Server - This sets the WiMAX Device as a DHCP server for the LAN. Relay - This sets the WiMAX Device as a DHCP relay for the LAN, allowing it to pass-through IP addresses assigned to LAN devices from the ISP servers.
Start IP	Enter the start IP address from which the WiMAX Device begins allocating IP addresses.
End IP	Enter the end IP address at which the WiMAX Device ceases allocating IP addresses.

Table 31 DHCP (continued)

LABEL	DESCRIPTION
Lease Time	Enter the duration in minutes that devices on the LAN retain their DHCP-issued IP addresses. At the end of the lease time, they poll the WiMAX Device for a renewed or replacement IP.
Relay IP	Enter the name of the IP address to be used.
DNS Server Assigned by the DHCP Server	
First~Third DNS Server	Select how the WiMAX Device acquires its DNS server address. • None - Select this to not use a DNS server. • From ISP - Select this to have the WiMAX Device acquire its DNS server address from the ISP. • User Define - Select this to manually enter the DNS server used by the WiMAX Device.
Static DHCP	
MAC Address	This field displays the MAC address of the static DHCP client connected to the WiMAX Device.
IP Address	This field displays the IP address of the static DHCP client connected to the WiMAX Device.
Add	Click this to add a new static DHCP entry.
OK	Click this to save any changes made to this list.
DHCP Leased Hosts	
MAC Address	This displays the MAC address of the DHCP leased host.
IP Address	This displays the IP address of the DHCP leased host.
Remaining Time	This displays the how much time is left on the host's lease.
Refresh	Click this to refresh the list.

7.8 WLAN

This screen is available for models with WiFi wireless feature. Use the **WLAN** screen to configure the connections between the WiMAX Device and the wireless clients that want to access the Internet.

Click **Network Setting > WLAN** to open this screen as shown next.

Figure 49 WLAN Screen

WiFi Settings

Enable WLAN ☒

WLAN Mode 802.11 B/G/N mixed

WLAN Channel channel 1

WLAN Maximum STA number 16 (1 ~ 16)

WLAN TxPower default

SSID Settings

WLAN SSID MS1

Hide SSID ☐

Encryption Type WPA Personal

SSID WPA Settings

WPA Mode WPA

Cipher Type TKIP

Pre-shared Key

Save Cancel

This screen contains the following fields:

Table 32 WLAN

LABEL	DESCRIPTION
WiFi Settings	
Enable WLAN	Select this to activate the wireless LAN.
WLAN Mode	Select 802.11B/G mixed to allow both IEEE802.11b and IEEE802.11g compliant WLAN devices to associate with the WiMAX Device. Select 802.11B only to allow only IEEE 802.11b compliant WLAN devices to associate with the WiMAX Device. Select 802.11A only to allow only IEEE 802.11a compliant WLAN devices to associate with the WiMAX Device. Select 802.11G only to allow only IEEE 802.11g compliant WLAN devices to associate with the WiMAX Device.
WLAN Channel	Select this option and set the operating frequency/channel depending on your particular region. Select Auto to have the WiMAX Device scan and find an available channel.
WLAN Maximum STA number	Enter the maximum number of wireless stations that is allowed to associate with the WiMAX Device.
WLAN TxPower	Select a number between 1 and 24 dB in the drop down box to control the strength of the connection signal, or leave it as default to let the WiMAX Device control this feature.
SSID Settings	
WLAN SSID	This field displays the name of the wireless network and it will appear to other computers that wish to connect wirelessly to the Internet.
Hide SSID	Select this to make the name of the network invisible to others.
Encryption Type	Select the type of encryption that the network will use: None , WEP or WPA Personal .

Table 32 WLAN (continued)

LABEL	DESCRIPTION
SSID WEP Settings	
Note: You will only see these options if you selected WEP as the Encryption Type.	
Authentication Method	Select the type of authentication used to join the network: OPEN SYSTEM or SHARED KEY .
WEP Encryption Length	Select the length of the encryption key: 64-bit or 128-bit.
Key 1 - 4	Pick one of four available keys. The key can be in either HexaDecimal (HEX) or ASCII format. Type the key using any letters and numbers. The field is case sensitive and the length must match the length picked in the step above (64-bit or 128-bit). A warning message will appear if you fail to do this.
SSID WPA Settings	
Note: You will only see these options if you selected WPA Personal as the Encryption Type.	
WPA Mode	Select either WPA , WPA2 or Auto (WPA or WPA2) .
Cipher Type	Select the type of authentication that you wish to use for your network: TKIP , AES or TKIP and AES . AES is more secure.
Pre-shared Key	Type a pre-shared key from 8 to 63 case-sensitive ASCII characters (including spaces and symbols).

7.9 WPS

This screen is available for models with WiFi wireless feature. Use the WPS screen to configure WiFi Protected Setup (WPS) on your WiMAX Device.

WPS allows you to quickly set up a wireless network with strong security without having to configure security settings manually. Set up each WPS connection between two devices. Both devices have to support WPS.

Click **Network Setting > WLAN > WPS** to open this screen as shown next.

Figure 50 WPS Screen

The screenshot shows the WPS configuration screen. At the top, it says 'Enable WPS'. Below this, there is a label 'Enable WPS' followed by a dropdown menu set to 'Enable' and an 'Apply' button. Below that, there is a section titled 'WPS PBC' with a 'Start WPS PBC' button.

This screen contains the following fields:

Table 33 WPS

LABEL	DESCRIPTION
Enable WPS	Select Enable and click Apply to activate WPS on the WiMAX Device. Select Disable and click Apply to deactivate WPS.
Start WPS PBC	This field is available after you select Enable in the Enable WPS field and click Apply . Click this to activate the Push Button Configuration. After clicking this you will be able to use the WPS button at the back of the device to add new wireless clients. Note: You must press the WPS buttons within two minutes of each other.

7.10 MAC Address Filter

This screen is available for models with WiFi wireless feature. Use this screen to restrict access to the WiFi network by device ID (MAC address).

Click on **Network Setting > WLAN > MAC Address Filter**. The screen appears as shown.

Figure 51 MAC Address Filter Screen

This screen contains the following fields:

Table 34 MAC Address Filter

LABEL	DESCRIPTION
Enable MAC Address Filter	Select the check box to enable MAC address filtering. Then, the following fields display.
Mode	Define the filter action for the list of MAC addresses in the MAC address table. Select Allow listed stations to permit access to the WiMAX Device only to addresses listed. MAC addresses not listed will be denied access to the WiMAX Device. Select Deny listed stations to block access to the WiMAX Device to the computers or devices listed in this list.
#	This is the index number of the MAC address.
Active	Select this box to make the policy effective or ineffective for a particular device.
Name	Type the name of the device. The name can be up to 20 characters long, and any combination of letters, numbers or symbols.

Table 34 MAC Address Filter (continued)

LABEL	DESCRIPTION
MAC Address	Enter the MAC addresses of the wireless devices that are allowed or denied access to the WiMAX Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Delete	Click to delete a specific MAC address from the list.
Add	Click to add a MAC address to the list.
OK	Click this button when you are done adding a MAC Address.

7.11 Static Route

Use these settings to create fixed paths through the network.

Click **Network Setting > Route > Static Route** to open this screen as shown next.

Figure 52 Static Route Screen

#	Destination	Subnet Mask	Next Hop	Metric
Total Num: 0				

Add

This screen contains the following fields:

Table 35 Static Route

LABEL	DESCRIPTION
Destination	This field displays the destination IP address of the static route.
Subnet Mask	This field displays the subnet mask of the static route.
Next Hop	This field displays next hop information of the static route.
Metric	This field displays the static route metric.
Add	Click this to add a new static route to the list.

7.12 Static Route Add

Use these settings to configure a static route.

Click **Add** in the **Network Setting > Route > Static Route** screen to open this screen as shown next.

Figure 53 Static Route Screen

Edit Static Route

Destination IP: 0.0.0.0

Subnet Mask: 0.0.0.0

Next Hop: ☐ Interface ☒ IP Address

WAN (dropdown menu)

Metric (1-255): 1

This screen contains the following fields:

Table 36 Static Route

LABEL	DESCRIPTION
Destination IP	Enter the destination IP address of the static route.
Subnet Mask	Enter the subnet mask of the static route.
Next Hop	Select Interface and then select WAN or LAN for the next hop of the static route. If the next hop is an IP address rather than an interface on the WiMAX Device, select IP Address and enter the IP address.
Metric	Enter the static route metric.

7.13 RIP

Use these settings to configure how the WiMAX Device exchanges information with other routers.

Click **Network Setting > Route > RIP** to open this screen as shown next.

Figure 54 RIP Screen

General Setup

Enable ☐

Redistribute

Active	Type	Metric(0~16)
Y	static route	7

Total Num: 1 OK

LAN

Direction RX/TX

Version RIP-2M

Authentication None

Authentication ID

Authentication Key

WAN

Direction RX/TX

Version RIP-2M

Authentication None

Authentication ID

Authentication Key

Save Cancel

This screen contains the following fields:

Table 37 RIP

LABEL	DESCRIPTION
General Setup	
Enable	Select this to enable RIP on the WiMAX Device.
Redistribute	
Active	This indicates whether a route is being redistributed.
Type	This indicates what type of route is being redistributed.
Metric	This indicates the metric that is being used for redistribution.
Edit	Click this to edit a selected route.
OK	Click this to save any changes to the redistribution table.
LAN	
Direction	Set the LAN network direction to use with RIP.
Version	Set the RIP version to use.
Authentication	Use this option to enable or disable RIP authentication.
Authentication ID	Enter the authentication ID to use for RIP authentication.
Authentication Key	Enter the authentication key to use for RIP authentication.
WAN	
Direction	Set the WAN network direction to use with RIP.
Version	Set the RIP version to use.

Table 37 RIP (continued)

LABEL	DESCRIPTION
Authentication	Use this option to enable or disable RIP authentication.
Authentication ID	Enter the authentication ID to use for RIP authentication.
Authentication Key	Enter the authentication key to use for RIP authentication.

7.14 Port Forwarding

Use these settings to forward incoming service requests to the ports on your local network.

Note: Make sure you did not configure a DMZ host in the **Network Setting > NAT > DMZ** screen if you want to make the settings of this screen work.

Click **Network Setting > NAT > Port Forwarding** to open this screen as shown next.

Figure 55 Port Forwarding Screen

#	Active	Name	Protocol	Incoming Port(s)		Forward Port(s)		Server IP
				Start Port	End Port	Start Port	End Port	
1	☒		TCP					

Total Num: 1

Wizard Add OK

This screen contains the following fields:

Table 38 Port Forwarding

LABEL	DESCRIPTION
Active	This indicates whether the port forwarding rule is active or not.
Name	The displays the name of the port forwarding rule.
Protocol	This displays the protocol to which the port forwarding rule applies.
Incoming Port(s)	
Start Port	This displays the starting port number for incoming traffic for the port forwarding rule.
End Port	This displays the ending port number for incoming traffic for the port forwarding rule.
Forward Port(s)	
Start Port	This field displays the beginning of the range of port numbers forwarded by this rule.
End Port	This field displays the end of the range of port numbers forwarded by this rule. If it is the same as the Start Port , only one port number is forwarded.
Server IP	This displays the IP address of the server to which packet for the selected port(s) are forwarded.
Delete	Click this to delete a specified rule.
Wizard	Click this to open the port forwarding "wizard".
Add	Click this to add a new port forwarding rule.
OK	Click this to save any changes made to the port forwarding list.

7.14.1 Port Forwarding Wizard

Use this wizard to set up a port forwarding rule for incoming service requests to the ports on your local network.

Click **Network Setting > NAT > Port Forwarding > Wizard** to open this screen as shown next.

Figure 56 Port Forwarding Wizard Screen

Edit Port Forwarding Rule

Active	☐
Port Forward Rule	Dynamic Name Server(DNS) ▼
Rule Name	Dynamic Name Server(DNS)
Protocol	UDP ▼
Incoming Start Port	53
Incoming End Port	53
Forwarding Start Port	53
Forwarding End Port	53
Server IP	

This screen contains the following fields:

Table 39 Port Forwarding Wizard

LABEL	DESCRIPTION
Active	Select this to make this port forwarding rule active.
Port Forward Rule	Select the type of port forwarding rule.
Rule Name	Enter a name for the port forwarding rule.
Protocol	Select the port forwarding protocol.
Incoming Start Port	Enter the starting port number for incoming traffic for the port forwarding rule.
Incoming End Port	Enter the ending port number for incoming traffic for the port forwarding rule.
Forwarding Start Port	Enter the starting port number for forwarded traffic for the port forwarding rule.
Forwarding End Port	Enter the ending port number for forwarded traffic for the port forwarding rule.
Server IP	Enter the port forwarding server IP address.

7.15 Port Trigger

Use these settings to automate port forwarding and allow computers on local network to provide services that would normally require a fixed address on the local network.

Click **Network Setting > NAT > Port Trigger** to open this screen as shown next.

Figure 57 Port Trigger Screen

This screen contains the following fields:

Table 40 Port Trigger

LABEL	DESCRIPTION
Active	This indicates whether the port trigger rule is active or not.
Name	The displays the name of the port trigger rule.
Trigger Protocol	This displays the protocol to which the port trigger rule applies.
Trigger Port(s)	
Start / End Port	This displays the start / end trigger port for the port trigger rule. Click Add to create a new, empty rule, then enter the incoming port number or range of port numbers you want to forward to the IP address the WiMAX Device records. To forward one port number, enter the port number in the Start Port and End Port fields. To forward a range of ports, - enter the port number at the beginning of the range in the Start Port field - enter the port number at the end of the range in the End Port field. If you want to delete this rule, click the Delete icon.
Open Protocol	This indicates which protocol is used to open the port trigger ports.
Open Port(s)	
Start / End Port	This displays the start / end open port for the port trigger rule. Click Add to create a new, empty rule, then enter the outgoing port number or range of port numbers that makes the WiMAX Device record the source IP address and assign it to the selected incoming port number(s). To select one port number, enter the port number in the Start Port and End Port fields. To select a range of ports, - enter the port number at the beginning of the range in the Start Port field - enter the port number at the end of the range in the End Port field. If you want to delete this rule, click the Delete icon.
Delete	Click this to delete a specified rule.
Wizard	Click this to open the port trigger "wizard".
Add	Click this to add a new port trigger rule.
OK	Click this to save any changes made to the port trigger list.

7.15.1 Port Trigger Wizard

Use the wizard to create a port trigger rules that will allow the WiMAX Device to automate port forwarding and allow computers on local network to provide services that would normally require a fixed address on the local network.

Click Network Setting > NAT > Port Trigger > Wizard

Figure 58 Port Trigger Wizard Screen

Edit Port Trigger Rule

Active

☐

Port Trigger Rule

Aim Talk

Rule Name

Aim Talk

Trigger Protocol

TCP

Trigger Start Port

4099

Trigger End Port

4099

Open Protocol

TCP

Open Start Port

5191

Open End Port

5191

This screen contains the following fields:

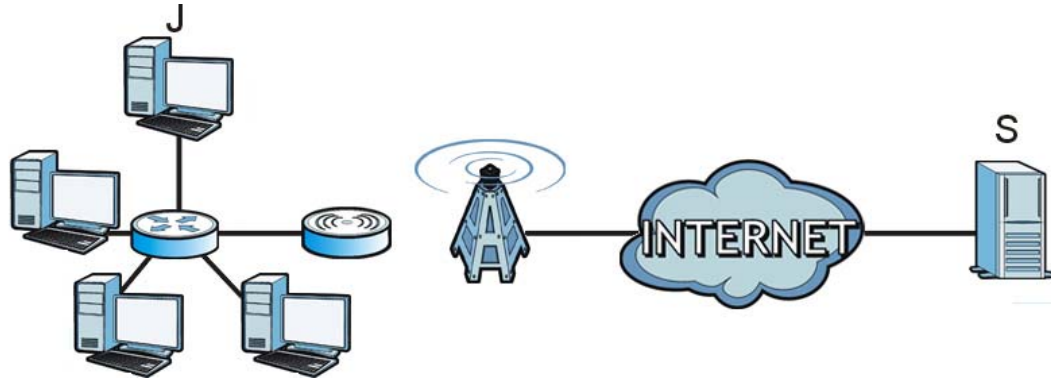
Table 41 Port Trigger Wizard

LABEL	DESCRIPTION
Active	Select this to make this port trigger rule active.
Port Trigger Rule	Select the type of port trigger rule.
Rule Name	Enter a name for the port trigger rule.
Trigger Protocol	Select the type of port trigger protocol.
Trigger Start Port	Enter the port trigger start port.
Trigger End Port	Enter the port trigger end port.
Open Protocol	Select the type of open protocol for the port trigger rule.
Open Start Port	Select the starting open port for the port trigger rule.
Open End Port	Select the ending open port number for the port trigger rule.

7.15.2 Trigger Port Forwarding Example

The following is an example of trigger port forwarding. In this example, **J** is Jane's computer and **S** is the Real Audio server.

Figure 59 Trigger Port Forwarding Example



- 1 Jane requests a file from the Real Audio server (port 7070).
- 2 Port 7070 is a "trigger" port and causes the WiMAX Device to record Jane's computer IP address. The WiMAX Device associates Jane's computer IP address with the "incoming" port range of 6970-7170.
- 3 The Real Audio server responds using a port number ranging between 6970-7170.
- 4 The WiMAX Device forwards the traffic to Jane's computer IP address.
- 5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The WiMAX Device times out in three minutes with UDP (User Datagram Protocol), or two hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

Two points to remember about trigger ports:

- 1 Trigger events only happen on data that is coming from inside the WiMAX Device and going to the outside.
- 2 If an application needs a continuous data stream, that port (range) will be tied up so that another computer on the LAN can't trigger it.

7.16 DMZ

Use this page to set the IP address of your network DMZ (if you have one) for the WiMAX Device. All incoming packets received by this WiMAX Device's WAN interface will be forwarded to the DMZ host you set.

Click **Network Setting > NAT > DMZ** to open this screen as shown next.

Note: The configuration you set in this screen takes priority than the **Network Setting > NAT > Port Forwarding** screen.

Figure 60 DMZ Screen

DMZ Enable	☒
DMZ Host	0.0.0.0

This screen contains the following fields:

Table 42 DMZ

LABEL	DESCRIPTION
DMZ Enable	Click this check box to enable DMZ.
DMZ Host	Enter the IP address of your network DMZ host, if you have one. 0.0.0.0 means this feature is disabled.

7.17 ALG

Use these settings to bypass NAT on your WiMAX Device for those applications that are "NAT unfriendly".

Click **Network Setting > NAT > ALG** to open this screen as shown next.

Figure 61 ALG Screen

Enable FTP ALG	☒
Enable H.323 ALG	☒
Enable IPsec ALG	☒ (Allow IPsec pass through)
Enable L2TP ALG	☒ (Allow L2TP pass through)
Enable PPTP ALG	☒ (Allow PPTP pass through)
Enable RTSP ALG	☒ (Allow RTSP pass through)
Enable SIP ALG	☒
SIP Port	5060
Enable SIP ALG Set BSID	☐

This screen contains the following fields:

Table 43 ALG

LABEL	DESCRIPTION
Enable FTP ALG	Turns on the FTP ALG to detect FTP (File Transfer Program) traffic and helps build FTP sessions through the WiMAX Device's NAT.
Enable H.323 ALG	Turns on the H.323 ALG to detect H.323 traffic (used for audio communications) and helps build H.323 sessions through the WiMAX Device's NAT.
Enable IPsec ALG	Turns on the IPsec ALG to detect IPsec traffic and helps build IPsec sessions through the WiMAX Device's NAT.
Enable L2TP ALG	Turns on the L2TP ALG to detect L2TP traffic and helps build L2TP sessions through the WiMAX Device's NAT.
Enable PPTP ALG	Turns on the PPTP ALG to detect PPTP traffic and helps build PPTP sessions through the WiMAX Device's NAT.

Table 43 ALG (continued)

LABEL	DESCRIPTION
Enable RTSP ALG	Turns on the RTSP ALG to detect RTSP traffic and helps build RTSP sessions through the WiMAX Device's NAT.
Enable SIP ALG	Turns on the SIP ALG to detect SIP traffic and helps build SIP sessions through the WiMAX Device's NAT.
SIP Port	If you are using a custom UDP port number (not 5060) for SIP traffic, enter it here.
Enable SIP ALG Set BSID	Check this box to add the base station ID to the outgoing SIP messages. Select this option only if the media server forwarding calls requires this information.

7.18 QoS

Use this page to configure QoS settings on the WiMAX Device.

Click **Network Setting > QoS** to open this screen as shown next.

Figure 62 QoS Screen

Interface	DSCP (-1 ~ 63)	Priority
LAN1	-1	1
LAN2	-1	2
IAD	-1	6

Total Num: 3

OK

This screen contains the following fields:

Table 44 QoS

LABEL	DESCRIPTION
Interface	This displays the interface for the QoS rule. The IAD interface is for device management. Configure DiffServ Code Point (DSCP) and/or Priority marking based on which method is supported within your network. With DSCP you can use 64 (0-63) different markings, compared to 6 (1-6) with Priority marking.
DSCP	Specify a DiffServ Code Point (DSCP) classification identification number (-1-63) to mark traffic that passes through this interface. Setting the DSCP to -1 indicates marking is not enabled. A higher number indicates higher priority. The DSCP allows marked packets to receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow.
Priority	Select a priority level (1 to 6) to assign a priority to traffic that passes through this interface. A higher number indicates higher priority. Like DSCP, this marking is used to identify traffic for specific treatment.
OK	Click this to save any changes made to the QoS rules.

7.19 UPnP

Use this page to enable the UPnP networking protocol on your WiMAX Device and allow easy network connectivity with other UPnP-compatible devices.

Click **Network Setting > UPnP** to open this screen as shown next.

Figure 63 UPnP Screen

Enable UPnP	☐
Enable NAT-PMP	☐

This screen contains the following fields:

Table 45 UPnP

LABEL	DESCRIPTION
Enable UPnP	Select this to enable UPnP on the WiMAX Device.
Enable NAT-PMP	Select this to enable NAT Port Mapping Protocol on the WiMAX Device.

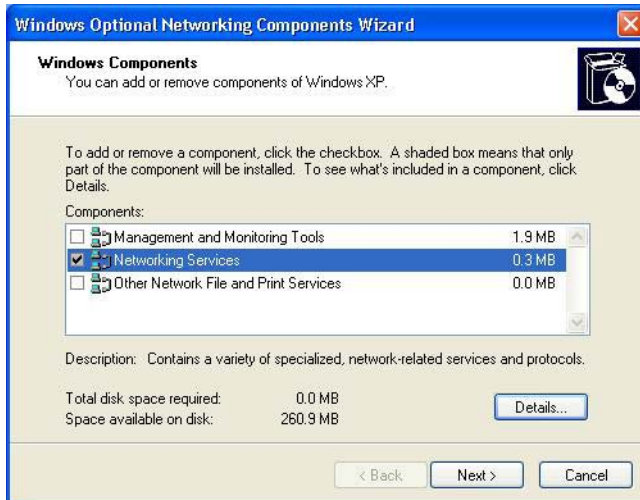
7.19.1 Installing UPnP in Windows XP

Follow the steps below to install the UPnP in Windows XP.

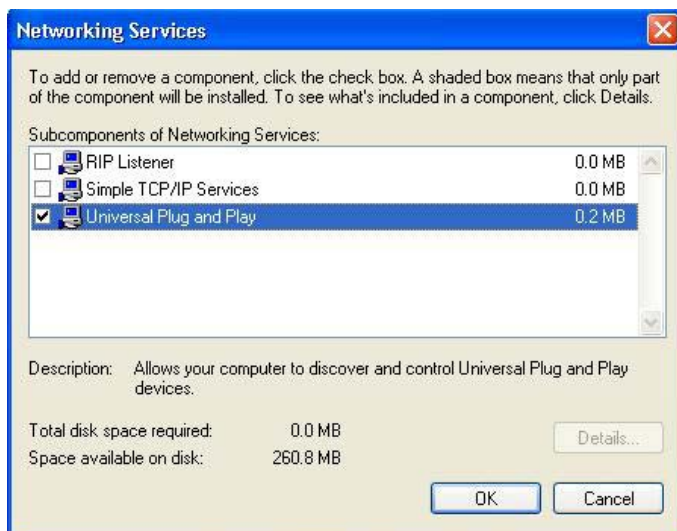
- 1 Click **Start > Control Panel**.
- 2 Double-click **Network Connections**.
- 3 In the **Network Connections** window, click **Advanced** in the main menu and select **Optional Networking Components ...**.



- 4 The **Windows Optional Networking Components Wizard** window displays. Select **Networking Service** in the **Components** selection box and click **Details**.



- 5 In the **Networking Services** window, select the **Universal Plug and Play** check box.



- 6 Click **OK** to go back to the **Windows Optional Networking Component Wizard** window and click **Next**.

7.19.1.1 Auto-discover Your UPnP-enabled Network Device in Windows XP

This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the WiMAX Device.

Make sure the computer is connected to a LAN port of the WiMAX Device. Turn on your computer and the WiMAX Device.

- 1 Click **Start** and **Control Panel**. Double-click **Network Connections**. An icon displays under Internet Gateway.

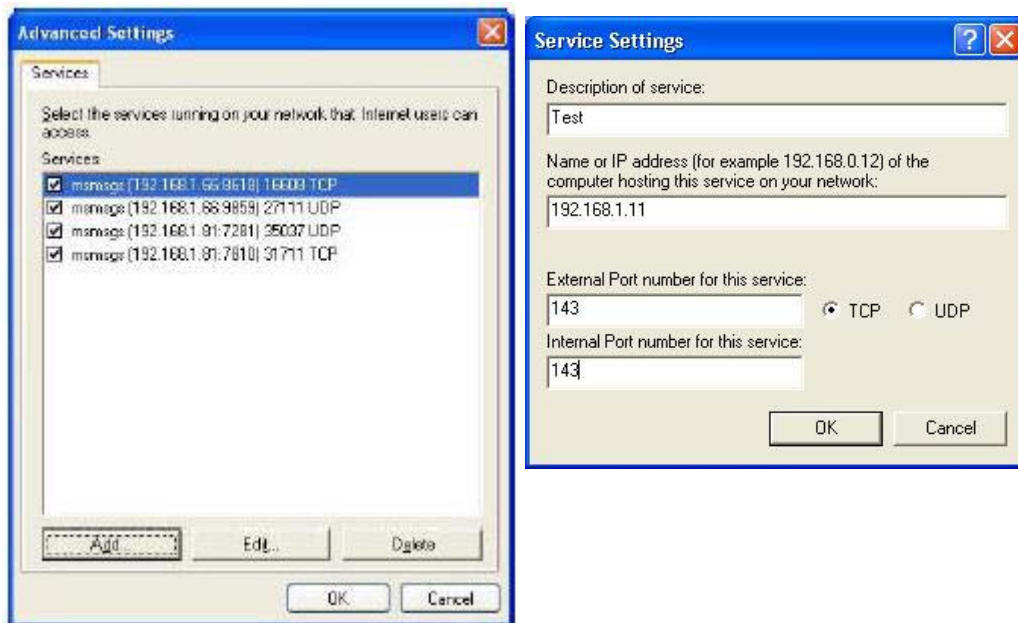
- 2 Right-click the icon and select **Properties**.



- 3 In the **Internet Connection Properties** window, click **Settings** to see the port mappings there were automatically created.



- 4 You may edit or delete the port mappings or click **Add** to manually add port mappings.



- 5 When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.
- 6 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.



- 7 Double-click on the icon to display your current Internet connection status.

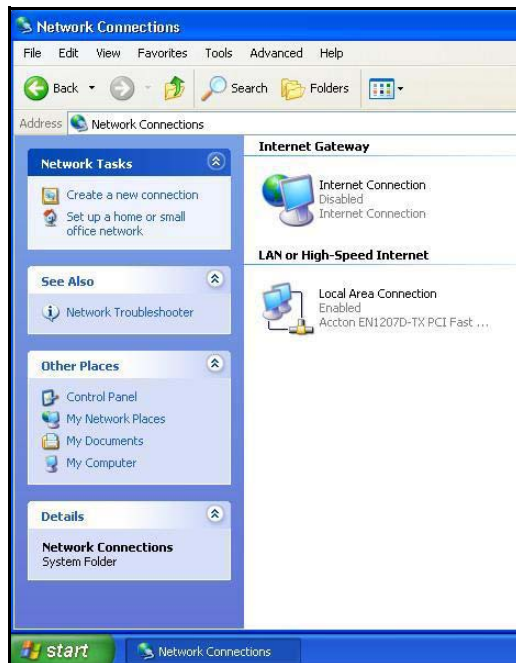


7.19.2 Web Configurator Easy Access

With UPnP, you can access the web-based configurator on the WiMAX Device without finding out the IP address of the WiMAX Device first. This becomes helpful if you do not know the IP address of the WiMAX Device.

Follow the steps below to access the web configurator:

- 1 Click **Start** and then **Control Panel**.
- 2 Double-click **Network Connections**.
- 3 Select **My Network Places** under **Other Places**.



- 4 An icon with the description for each UPnP-enabled device displays under **Local Network**.
- 5 Right-click on the icon for your WiMAX Device and select **Invoke**. The web configurator login screen displays.



- 6 Right-click on the icon for your WiMAX Device and select **Properties**. A properties window displays with basic information about the WiMAX Device.



7.20 VLAN

Use this screen to configure port-based VLAN settings on the WiMAX Device. This screen allows you to assign port(s) to specific virtual LAN(s) in order to isolate traffic from different VLAN groups. See [Section 4.12 on page 50](#) for example configurations for VLANs.

Click **Network Setting > VLAN** to open the screen as shown next.

Figure 64 VLAN Screen

VLAN Utility

Enable VLAN Yes ▾

Port Settings

10 ▾ per page ⏪ ⏩ 1 ▾ page ⏪ ⏩

#	Interface	Link Type	Tag Information			Tag/Untag
			PVID	Priority	CFI	
1	LAN1	ACCESS	1	0	NO	Tag
2	LAN2	ACCESS	1	0	NO	Tag
3	WIMAX	ACCESS	1	0	NO	Untag
4	IAD	ACCESS	1	0	NO	Untag

Total Num: 4 OK

Filter Setting

10 ▾ per page ⏪ ⏩ 1 ▾ page ⏪ ⏩

#	Name	VID	Retag Priority	Priority Number	Ports				
					LAN1	LAN2	WIMAX	IAD	
1	default	1	Disable	0	Y	Y	Y	N	

Total Num: 1 Add OK

Save Cancel

This screen contains the following fields:

Table 46 VLAN

LABEL	DESCRIPTION
VLAN Utility	
Enable VLAN	Select Yes to enable the VLAN function on the WiMAX Device. Note: To use VLAN on the WiMAX Device, you must switch the operation mode to "bridge" on the Network Setting > WAN screen. It will then require system restart to take effect.
Port Settings	
#	This is the index number of the port setting.
Interface	This displays the interface that the port setting applies to.
Link Type	Select Access if this port forwards traffic for only one VLAN. The device connected to an access port does not support VLAN tagged packets, so the WiMAX Device will remove packets forwarded out of this port. Packets received on access ports will be tagged with the specified PVID. Select Trunk to allow packets belonging to different VLAN groups to pass through the port. The device connected to this port should support VLAN tagged packets. You must configure Filter Settings for the port and VLAN ID for tagged packets to be forwarded. If received packets are already tagged, the PVID set for this port should not be the same as the VLAN IDs configured in Filter Settings. This will allow the tagged packets to be forwarded to the specified VLANs. If received packets are not tagged, the WiMAX Device will tag them with the PVID. Select Hybrid to allow the port to function as an access port and trunk port.
PVID	A PVID (Port VLAN ID) is a tag that adds to incoming untagged packets received on a port so that the packets are forwarded to the VLAN group that the tag defines. Enter a number between 1 and 4094 as the port VLAN ID.

Table 46 VLAN (continued)

LABEL	DESCRIPTION
Priority	Enter a priority level (1~7) that the WiMAX Device assigns to packets belonging to this VLAN. Enter "0" for no priority assigned.
CFI	Select Yes if the CFI (Canonical Format Indicator) field in a received packet is set to 1, indicating non-Canonical Format. In this case, the packet should not be forwarded as it is to an untagged port.
Tag/Untag	You can only select Tag if the port is configured as a Trunk or Hybrid port. The WiMAX Device will receive and forward VLAN tagged packets. Untagged packets will be tagged with the PVID. If you select Untag the WiMAX Device will remove tags from tagged packets it forwards out of the port. Untagged packets received will be forwarded. If the port is an Access port, the WiMAX Device will add tags to untagged packets it receives and drop tagged packets it receives. If the port is a Trunk port, the WiMAX Device will add tags to untagged packets it receives and retag tagged packets.
OK	Click this to save the changes in the Port Setting section.
Filter Setting	
#	This is the index number of a filter.
Name	This is the name of a filter rule.
VID	This field displays the VLAN ID for the filter. Click this field to change the VLAN ID.
Retag Priority	Select Yes to retag the priority of a packet received on a Trunk or Hybrid port.
Priority Number	If Retag Priority is enabled, specify the new priority level (1~7) to tag. Enter "0" for no priority assigned.
Ports	This field displays the ports included in the filter. Click this field to select which ports to include.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
OK	Click this button to save any changes made to the list.
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

7.21 DDNS

Use this page to configure the WiMAX Device as a dynamic DNS client.

Click Network Setting > DDNS

Figure 65 DDNS Screen

This screen contains the following fields:

Table 47 DDNS

LABEL	DESCRIPTION
Enable Dynamic DNS	Select this to enable dynamic DNS on the WiMAX Device.
Service Provider	Select the dynamic DNS service provider for the WiMAX Device.
Service Type	Select the dynamic DNS service type.
Domain Name	Enter the domain name.
Login Name	Enter the user name.
Password	Enter the password.
IP Update Policy	Select the policy used by the WiMAX Device. Options are: - Auto Detect - WAN - User Defined
User Defined IP	If chose "User Defined" for the IP Update Policy , enter the user defined IP address.
Wildcards	Select this to allow a hostname to use wildcards such as "*".
MX	Select this to enable mail routing, if supported by the specified DYNDNS service provider.
Backup MX	Select this to enable a secondary mail routing, if supported by the specified DYNDNS service provider.
MX Host	Enter the host to which mail is routed when the MX option is selected.

7.22 IGMP Proxy

IGMP proxy allows the WiMAX Device to get subscribing information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly. Use this screen to enable IGMP Proxy on the WiMAX Device.

Click **Network Setting > IGMP Proxy** to open this screen as shown next.

Figure 66 IGMP Proxy

This screen contains the following fields:

Table 48 IGMP Proxy

LABEL	DESCRIPTION
Enable IGMP Proxy	Internet Group Multicast Protocol (IGMP) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. Select this option to have the WiMAX Device act as an IGMP proxy. This allows the WiMAX Device to get subscribing information and maintain a joined member list for each multicast group. It can reduce multicast traffic significantly.
Save	Click this to save the changes made.
Cancel	Click this avoid any changes made from being saved to your configuration.

7.23 Content Filter

Use these settings to allow ("whitelist") or block ("blacklist") connections to and from specific web sites through the WiMAX Device.

Click **Network Setting > Content Filter** to open this screen as shown next.

Figure 67 Content Filter Screen

#	Active	URL
1	☒	

This screen contains the following fields:

Table 49 Content Filter

LABEL	DESCRIPTION
URL List	
Enable URL Filter	Select this employ the content filter to allow ("whitelist") or block ("blacklist") specific URL connections made through the WiMAX Device.
Blacklist/Whitelist	Select whether the current filtering applies to the blacklist (sites that are blocked) or the whitelist (sites that are allowed).
URL Filter Rule	
Active	Indicates whether the current URL filter is active or not.
URL	Indicates the URL to be filtered according to blacklist or whitelist rules.
Delete	Click this to delete a specified rule.
Add	Click this to add a new filter rule.
OK	Click this to save any changes made to the list.

Security

8.1 Overview

This chapter shows you how to configure the WiMAX Device's network settings.

8.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

About the WiMAX Device's Security Features

The WiMAX Device security features are designed to protect against Denial of Service attacks when activated as well as block access to and from specific URLs and MAC addresses. Its purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The WiMAX Device can be used to prevent theft, destruction and modification of data.

The WiMAX Device is installed between the LAN and a WiMAX base station connecting to the Internet. This allows it to act as a secure gateway for all data passing between the Internet and the LAN.

The WiMAX Device has one Ethernet (LAN) port. The LAN (Local Area Network) port attaches to a network of computers, which needs security from the outside world. These computers will have access to Internet services such as e-mail, FTP and the World Wide Web. However, "inbound access" is not allowed (by default) unless the remote host is authorized to use a specific service.

8.2 IP Filter

Use this screen to block incoming connections from specific IP addresses.

Click **Security > Firewall > IP Filter** to open this screen as shown next.

Figure 68 IP Filter Screen

#	Active	Source IP	Source Port	Destination IP	Destination Port	Protocol
1	☒					TCP

Total Num: 1

Add OK

This screen contains the following fields:

Table 50 IP Filter

LABEL	DESCRIPTION
Active	Indicates whether the current IP filter is active or not.
Source IP	This displays the source IP address for the IP filter rule. Click Add to create a new, empty rule, then enter the incoming IP address for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Source Port	This displays the source port number for the IP filter rule. Click Add to create a new, empty rule, then enter the incoming port number for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Destination IP	This displays the destination IP address for the IP filter rule. Click Add to create a new, empty rule, then enter the outgoing IP address for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Destination Port	This displays the destination port number for the IP filter rule. Click Add to create a new, empty rule, then enter the outgoing port number for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Protocol	This displays the protocol blocked by the IP filter rule. Click Add to create a new, empty rule, then select the protocol type for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Delete	Click this to delete a specified rule.
Add	Click this to add a new filter rule.
OK	Click this to save any changes made to the list.

8.3 MAC Filter

Use this screen to allow ("whitelist") or block ("blacklist") connections to and from specific devices on the network based on their unique MAC addresses.

Note: This feature only works when the WiMAX Device is in bridge mode.

Click **Security > Firewall > MAC Filter** to open this screen as shown next.

Figure 69 MAC Filter Screen

MAC List

Blacklist/Whitelist: Blacklist

MAC Filter Rules

10 per page 1 page

#	Active	Source MAC	Destination MAC	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Start Time	End Time	
1	☒			☒	☒	☒	☒	☒	☒	☒	00:00	23:59	

Total Num: 1

Add OK

Save Cancel

This screen contains the following fields:

Table 51 MAC Filter

LABEL	DESCRIPTION
Blacklist/Whitelist	Select either whitelist or blacklist for viewing and editing.
Source MAC	This displays the source MAC for the MAC filter rule. Click Add to create a new, empty rule, then enter the incoming MAC address for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Destination MAC	This displays the destination MAC for the MAC filter rule. Click Add to create a new, empty rule, then enter the outgoing MAC address for the WiMAX Device to block. If you want to delete this rule, click the Delete icon.
Mon ~ Sun	Select which days of the week you want the filter rule to be effective.
Start / End Time	Select what time each day you want the filter rule to be effective. Enter times in 24-hour format; for example, 3:00pm should be entered as 15:00.
Add	Click this to add a new filter rule.
OK	Click this to save any changes made to the list.

8.4 DDOS

Use these settings to potentially block specific types of Denial of Service attacks directed at your WiMAX Device.

Click **Security > Firewall > DDOS** to open this screen as shown next.

Figure 70 DDOS Screen

Prevent from TCP SYN Flood	☐
Prevent from UDP Flood	☐
Prevent from ICMP Flood	☐
Prevent from Port Scan	☐
Prevent from LAND Attack	☐
Prevent from IP Spoof	☐
Prevent from ICMP redirect	☐
Prevent from PING of Death	☐
Prevent from PING from WAN	☐

This screen contains the following fields:

Table 52 DDOS

LABEL	DESCRIPTION
Prevent from TCP SYN Flood	Select this to monitor for and block TCP SYN flood attacks. A SYN flood is one type of denial of service attack where an overwhelming number of SYN requests assault a client device.
Prevent from UDP Flood	Select this to monitor for and block UDP flood attacks. An UDP flood is a type of denial of service attack where an overwhelming number of UDP packets assault random ports on a client device. Because the device is forced to analyze and respond to each packet, it quickly becomes unreachable to other devices.
Prevent from ICMP Flood	Select this to monitor for and block ICMP flood attacks. An ICMP flood is a type of denial of service attack where an overwhelming number of ICMP ping assault a client device, locking it down and preventing it from responding to requests from other servers.
Prevent from Port Scan	Select this to monitor for and block port scan attacks. A port scan attack is typically the precursor to a full-blown denial of service attack wherein each port on a device is probed for security holes that can be exploited. Once a security flaw is discovered, an attacker can initiate the appropriate denial of service attack or intrusion attack against the client device.
Prevent from LAND Attack	Select this to monitor for and block LAND attacks. A Local Area Network Denial (LAND) attack is a type of denial of service attack where a spoofed TCP SYN packet targets a client device's IP address and forces it into an infinite recursive loop of querying itself and then replying, effectively locking it down.
Prevent from IP Spoof	Select this to monitor for and block IP address spoof attacks. An IP address spoof is an attack whereby the source IP address in the incoming IP packets allows a malicious party to masquerade as a legitimate user and gain access to the client device.
Prevent from ICMP redirect	Select this to monitor for and block ICMP redirect attacks. An ICMP redirect attack is one where forged ICMP redirect messages can force the client device to route packets for certain connections through an attacker's host.

Table 52 DDOS (continued)

LABEL	DESCRIPTION
Prevent from PING of Death	Select this to monitor for and block ping of death attacks. A Ping of Death (POD) attack is one where larger-than-allowed ping packets are fragmented then sent against a client device. This results in the client device suffering from a buffer overflow and subsequent system crash.
Prevent from PING from WAN	Select this to ignore ping requests from the WAN.

8.5 PPTP VPN Server

Use this screen to configure settings for a Point to Point Tunneling Protocol (PPTP) server.

Click **Security > PPTP VPN > PPTP Server** to open this screen as shown next.

Figure 71 PPTP Server

PPTP Server

Enable ☐

Server Name

Auth Protocol ☒ PAP ☒ CHAP ☒ MSCHAPv1 ☒ MSCHAPv2

MPPE Encryption

Local IP Address

Remote Start IP -

Idle Timeout (minutes; enter 0 to never timeout)

DNS Server 1 (options)

DNS Server 2 (options)

User Access List

10 per page page

#	User Name	Server	Password	IP Address
Total Num: 0				

Add OK

Connection List

10 per page page

#	User Name	Remote IP Address	PPTP IP Address	Login Time	Link Time(s)
Total Num: 0					

Disconnect

This screen contains the following fields:

Table 53 PPTP Server

LABEL	DESCRIPTION
PPTP Server	
Enable	Use this field to turn the WiMAX Device'S PPTP VPN function on or off.
Server Name	Enter the server name for the PPTP VPN connection.

Table 53 PPTP Server (continued)

LABEL	DESCRIPTION
Auth Protocol	Select the Authentication Protocol allowed for the connection. Options are: • PAP - Password Authentication Protocol (PAP) authentication occurs in clear text and does not use encryption. It's probably not a good idea to rely on this for security. • CHAP - Challenge Handshake Authentication Protocol (CHAP) provides authentication through a shared secret key and uses a three way handshake. • MSCHAPv1 - Microsoft CHAP v1 (MSCHAPv1) provides authentication through a shared secret key and uses a three way handshake. It provides improved usability with Microsoft products. • MSCHAPv2 - Microsoft CHAP v2 (MSCHAPv2) provides encryption through a shared secret key and uses a three way handshake. It provides additional security over MSCHAPv1, including two-way authentication.
MPPE Encryption	If MSCHAPv1 or MSCHAPv2 is selected as an Auth Protocol, use the drop-down list box to select the type of Microsoft Point-to-Point Encryption (MPPE). Options are: • MPPE 40 bits - MPPE with 40 bit session key length • MPPE 128 bits - MPPE with 128 bit session key length • Auto - Automatically select either MPPE 40 bits or MPPE 128 bits
Local IP Address	Enter the local endpoint for the PPTP connection.
Remote Start IP	Enter the local IP address range the WiMAX Device assigns to remote users if the remote client device is set to obtain an IP address automatically.
Idle Timeout	Enter the time in minutes to timeout PPTP connections.
DNS Server 1 DNS Server 2	Specify the IP addresses of DNS servers to assign to the remote users.
User Access List	
User Name	Enter the user name for the remote user.
Server	Select the server that the remote user has access to: PPTPD , L2TPD or Both .
Password	Enter the password for the remote user.
IP Address	Enter the local IP address the WiMAX Device assigns to the remote user. Entering 0.0.0.0 indicates the local IP address will be dynamically assigned.
Delete	Select an entry and click this to delete it.
Add	Click this to create a new entry.
OK	Click this to save the changes.
Connection List	
User Name	This displays the user name for the remote user.
Remote IP Address	This displays the remote endpoint IP address of the remote user.
PPTP IP Address	This displays the local IP address of the PPTP server.
Login Time	This displays the time the PPTP connection started.
Link Time(s)	This displays the duration of the PPTP connection.

8.6 PPTP VPN Client

Use this screen to view settings for Point to Point Tunneling Protocol (PPTP) clients.

Click **Security > PPTP VPN > PPTP Client** to open this screen as shown next.

Figure 72 PPTP Client

The screenshot shows a web interface for managing PPTP clients. At the top right, there is a search bar and a dropdown menu showing '10 per page'. Below this is a table with the following columns: '#', 'Profile Name', 'Server IP', 'Assign IP', 'MTU', and 'Status'. Below the table, it says 'Total Num: 0'. To the right of the table are 'Add' and 'Edit' buttons. At the bottom of the interface are 'Connect' and 'Disconnect' buttons.

This screen contains the following fields:

Table 54 PPTP Client

LABEL	DESCRIPTION
#	This is the index number of the connection.
Profile Name	This is the name of this client connection.
Server IP	This is the IP address of the PPTP VPN server.
Assign IP	This is the local IP address the client assigns to itself or is assigned by the server.
MTU	This field indicates the Maximum Transmission Unit (MTU) for the connection.
Status	This is the connection status.
Add	Click this to add a VPN client profile.
Edit	Click this to edit an existing VPN client profile.
Connect	Select a VPN client connection and click this to connect.
Disconnect	Select a VPN client connection and click this to disconnect.

8.7 PPTP VPN Client: Add

Use this screen to configure settings for Point to Point Tunneling Protocol (PPTP) clients.

Click **Security > PPTP VPN > PPTP Client > Add** to open this screen as shown next.

Figure 73 PPTP Client: Add

Edit PPTP Client

Profile Name

NAT Mode? ☒ Yes ☐ No

Auth Protocol ☐ PAP ☐ CHAP ☐ MSCHAPv1 ☐ MSCHAPv2

MPPE Encryption

MPPE Stateful? ☒ No ☐ Yes

Server IP Address

User Name

Password

Retype

Get IP automatically? ☒ Yes ☐ No

Assign IP Address

Idle Timeout (minutes; enter 0 to never timeout)

This screen contains the following fields:

Table 55 PPTP Client: Add

LABEL	DESCRIPTION
Profile Name	Enter the name for this client connection.
NAT Mode?	Select Yes if the client will be located behind a NAT enabled router. This will allow multiple clients using NAT to connect with PPTP at the same time.
Auth Protocol	Select the Authentication Protocol allowed for the connection. Options are: PAP - Password Authentication Protocol (PAP) authentication occurs in clear text and does not use encryption. It's probably not a good idea to rely on this for security. CHAP - Challenge Handshake Authentication Protocol (CHAP) provides authentication through a shared secret key and uses a three way handshake. MSCHAPv1 - Microsoft CHAP v1 (MSCHAPv1) provides authentication through a shared secret key and uses a three way handshake. It provides improved usability with Microsoft products. MSCHAPv2 - Microsoft CHAP v2 (MSCHAPv2) provides encryption through a shared secret key and uses a three way handshake. It provides additional security over MSCHAPv1, including two-way authentication.
MPPE Encryption	If MSCHAPv1 or MSCHAPv2 is selected as an Auth Protocol , use the drop-down list box to select the type of Microsoft Point-to-Point Encryption (MPPE). Options are: MPPE 40 - MPPE with 40 bit session key length. MPPE 128 - MPPE with 128 bit session key length. Auto - Automatically select either MPPE 40 or MPPE 128.
MPPE Stateful?	Select Yes to enable stateful MPPE encryption. This can increase performance over stateless MPPE, but should not be used in lossy network environments like layer two tunnels over the Internet.
Server IP Address	Enter the IP address of the PPTP server.
User Name	Enter the user name for connecting to the PPTP server.
Password	Enter the password for connecting to the PPTP server.
Retype	Retype the password for connecting to the PPTP server.

Table 55 PPTP Client: Add (continued)

LABEL	DESCRIPTION
Get IP automatically	Select Yes to have the PPTP server assign a local IP address to the client.
Assign IP Address	Enter the IP address for the client. Ensure that the IP address is configured to be allowed on the PPTP server.
Idle Timeout	Enter the time in minutes to timeout PPTP connections.

8.8 L2TP VPN Server

Use this screen to configure settings for Layer 2 Tunneling Protocol (L2TP) server.

Click **Security > L2TP VPN > L2TP Server** to open this screen as shown next.

Figure 74 L2TP Server

L2TP Server

Enable ☐

Server Name

Support Protocol Version

Auth Protocol ☒ PAP ☒ CHAP ☒ MSCHAPv1 ☒ MSCHAPv2

MPPE Encryption

Local IP Address

Remote Start IP -

Restrict Client IP? ☐ Yes ☒ No

Allow Client IP -

Idle Timeout (minutes; enter 0 to never timeout)

DNS Server 1 (options)

DNS Server 2 (options)

User Access List

10 per page |< < > >| page

#	User Name	Server	Password	IP Address
Total Num: 0				

Add OK

Connection List

10 per page |< < > >| page

#	User Name	Remote IP Address	L2TP IP Address	Login Time	Link Time(s)
Total Num: 0					

Disconnect

Save Cancel

This screen contains the following fields:

Table 56 L2TP Server

LABEL	DESCRIPTION
L2TP Server	
Enable	Use this field to turn the WiMAX Device'S L2TP VPN function on or off.
Server Name	Enter the server name for the L2TP VPN connection.

Table 56 L2TP Server (continued)

LABEL	DESCRIPTION
Support Protocol Version	Select the L2TP Protocol Version: All , 2 , or 3 . L2TPv2 is a standard method for tunneling Point-to-Point Protocol (PPP) while L2TPv3 provides improved support for other types of networks including frame relay and ATM.
Auth Protocol	Select the Authentication Protocol allowed for the connection. Options are: • PAP - Password Authentication Protocol (PAP) authentication occurs in clear text and does not use encryption. It's probably not a good idea to rely on this for security. • CHAP - Challenge Handshake Authentication Protocol (CHAP) provides authentication through a shared secret key and uses a three way handshake. • MSCHAPv1 - Microsoft CHAP v1 (MSCHAPv1) provides authentication through a shared secret key and uses a three way handshake. It provides improved usability with Microsoft products. • MSCHAPv2 - Microsoft CHAP v2 (MSCHAPv2) provides encryption through a shared secret key and uses a three way handshake. It provides additional security over MSCHAPv1, including two-way authentication.
MPPE Encryption	If MSCHAPv1 or MSCHAPv2 is selected as an Auth Protocol , use the drop-down list box to select the type of Microsoft Point-to-Point Encryption (MPPE). Options are: • MPPE 40 - MPPE with 40 bit session key length • MPPE 128 - MPPE with 128 bit session key length • Auto - Automatically select either MPPE 40 or MPPE 128
Local IP Address	Enter the local endpoint for the L2TP connection.
Remote Start IP	Enter the local IP address range the WiMAX Device assigns to remote users if the remote client device is set to obtain an IP address automatically.
Restrict Client IP?	Select Yes to restrict the remote client device local IP address.
Allow Client IP	Enter the local IP address range the remote client device is restricted to. If the client device is configured with a static IP address, it should be in this range.
Idle Timeout	Enter the time in minutes to timeout L2TP connections.
DNS Server 1 DNS Server 2	Specify the IP addresses of DNS servers to assign to the remote users.
User Access List	
User Name	Enter the user name for the remote user.
Server	Select the server that the remote user has access to: PPTPD , L2TPD or Both .
Password	Enter the password for the remote user.
IP Address	Enter the local IP address the WiMAX Device assigns to the remote user. Entering 0.0.0.0 indicates the local IP address will be dynamically assigned.
Delete	Select an entry and click this to delete it.
Add	Click this to create a new entry.
OK	Click this to save the changes.
Connection List	
User Name	This displays the user name for the remote user.
Remote IP Address	This displays the remote endpoint IP address of the remote user.
L2TP IP Address	This displays the local IP address of the L2TP server.
Login Time	This displays the time the L2TP connection started.

Table 56 L2TP Server (continued)

LABEL	DESCRIPTION
Link Time(s)	This displays the duration of the L2TP connection.
Disconnect	Select a client and click this button to disconnect the selected client.

8.9 L2TP VPN Client

Use this screen to view settings for Layer 2 Tunneling Protocol (L2TP) clients.

Click **Security > L2TP VPN > L2TP Client** to open this screen as shown next.

Figure 75 L2TP Client

This screen contains the following fields:

Table 57 L2TP Client

LABEL	DESCRIPTION
#	This is the index number of the connection.
Profile Name	This is the name of this client connection.
Server IP	This is the IP address of the L2TP VPN server.
Assign IP	This is the local IP address the client assigns to itself or is assigned by the server.
MTU	This field indicates the Maximum Transmission Unit (MTU) for the connection.
Status	This is the connection status.
Add	Click this to add a VPN client profile.
Edit	Click this to edit an existing VPN client profile.
Connect	Select a VPN client connection and click this to connect.
Disconnect	Select a VPN client connection and click this to disconnect.

8.10 L2TP VPN Client: Add

Use this screen to configure settings for Layer 2 Tunneling Protocol (L2TP) clients.

Click **Security > L2TP VPN > L2TP Client > Add** to open this screen as shown next.

Figure 76 L2TP Client: Add

This screen contains the following fields:

Table 58 L2TP Client: Add

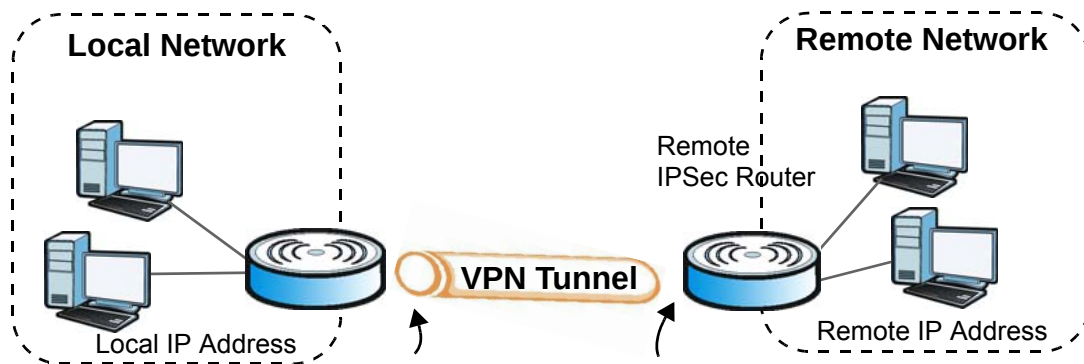
LABEL	DESCRIPTION
Profile Name	Enter the name for this client connection.
L2TP Protocol Version	Select the L2TP Protocol Version 2 or 3 . L2TPv2 is a standard method for tunneling Point-to-Point Protocol (PPP) while L2TPv3 provides improved support for other types of networks including frame relay and ATM.
NAT Mode?	Select Yes if the client will be located behind a NAT enabled router. This will allow multiple clients using NAT to connect with L2TP at the same time.
Auth Protocol	Select the Authentication Protocol allowed for the connection. Options are: PAP - Password Authentication Protocol (PAP) authentication occurs in clear text and does not use encryption. It's probably not a good idea to rely on this for security. CHAP - Challenge Handshake Authentication Protocol (CHAP) provides authentication through a shared secret key and uses a three way handshake. MSCHAPv1 - Microsoft CHAP v1 (MSCHAPv1) provides authentication through a shared secret key and uses a three way handshake. It provides improved usability with Microsoft products. MSCHAPv2 - Microsoft CHAP v2 (MSCHAPv2) provides encryption through a shared secret key and uses a three way handshake. It provides additional security over MSCHAPv1, including two-way authentication.
MPPE Encryption	If MSCHAPv1 or MSCHAPv2 is selected as an Auth Protocol , use the drop-down list box to select the type of Microsoft Point-to-Point Encryption (MPPE). Options are: MPPE 40 bits - MPPE with 40 bit session key length MPPE 128 bits - MPPE with 128 bit session key length Auto - Automatically select either MPPE 40 bits or MPPE 128 bits
MPPE Stateful?	Select Yes to enable stateful MPPE encryption. This can increase performance over stateless MPPE, but should not be used in lossy network environments like layer two tunnels over the Internet.
Server IP Address	Enter the IP address of the L2TP server.
User Name	Enter the user name for connecting to the L2TP server.

Table 58 L2TP Client: Add (continued)

LABEL	DESCRIPTION
Password	Enter the password for connecting to the L2TP server.
Retype	Retype the password for connecting to the L2TP server.
Get IP automatically	Select Yes to have the L2TP server assign a local IP address to the client.
Assign IP Address	Enter the IP address for the client. Ensure that the IP address is configured to be allowed on the L2TP server.
Idle Timeout	Enter the time in minutes to timeout L2TP connections.

8.11 IPsec VPN

The following figure helps explain the main fields in the web configurator.

Figure 77 IPsec Fields Summary

Click **Security > IPsec VPN** to open the **General** screen as shown next.

Figure 78 IPsec VPN

10 per page						
#	Name	Enabled	Local Endpoint	Remote Endpoint	Local Network	Remote Network
Total Num: 0						Add

This screen contains the following fields:

Table 59 IPsec VPN

LABEL	DESCRIPTION
#	This is the VPN policy index number.
Name	Enter the name of the VPN connection.
Enabled	This displays if the VPN policy is enabled.
Local Endpoint	This displays the IP address of the WiMAX Device.
Remote Endpoint	This displays the IP address of the remote IPsec router.
Local Network	This displays the single (static) IP address on the LAN behind your WiMAX Device or the IP address and subnet mask of a network behind your WiMAX Device.

Table 59 IPSec VPN (continued)

LABEL	DESCRIPTION
Remote Network	This displays the single (static) IP address on the LAN behind the remote IPSec router or the IP address and subnet mask of a network behind the remote IPSec router.
Add	Click this button to add an item to the list.

8.11.1 IPSec VPN: Add

Use these settings. Click **Security > IPSec VPN > Add** to open this screen as shown next.

Figure 79 IPSec VPN: Add

Property
Enable ☒
Connection Name
Connection Type

Gateway Information
Local Endpoint
☒ Interface
☐ IP Address (Domain Name or IP Address)
Remote Endpoint
IP Address (Domain Name or IP Address)

Authentication Method
☒ Pre-Shared Key
Local ID Type
Content
Remote ID Type
Content

IKE Phase 1
Proposal

#	Encryption	Authentication	
1	AES128	SHA-1	

Total Num: 1

Key Group
SA Life Time
Dead Peer Detection(DPD) ☒
DPD Interval (seconds)
DPD Idle Try

Local Network
Address Type
Start IP Address
Subnet Mask
Local Port

Remote Network
Address Type
Start IP Address
Subnet Mask
Remote Port

IPSec Proposal
Encapsulation Mode
Active Protocol ☐ AH ☒ ESP
Encryption Algorithm
Authentication Algorithm
SA Life Time
Perfect Forward Secrecy (PFS) ☒

This screen contains the following fields:

Table 60 IPSec VPN: Add

LABEL	DESCRIPTION
Property	
Enable	Select Enable to activate this VPN policy.
Connection Name	Enter the name of the VPN connection.
Connection Type	Select the scenario that best describes your intended VPN connection. • Initiator - Choose this to connect to an IPSec server. The WiMAX Device is the client (dial-in user) and can initiate the VPN connection. • On Demand - Choose this if the remote IPSec router has a static IP address or a domain name. This WiMAX Device can initiate the VPN tunnel. • Responder - Choose this to allow incoming connections from IPSec VPN clients. The clients can have dynamic IP addresses and are also known as dial-in users. Only the clients can initiate the VPN tunnel.
Gateway Information	
Local Endpoint	
Interface	Select the interface for the VPN gateway.
IP Address	Enter the IP address of the WiMAX Device in the IKE SA.
Remote Endpoint	
IP Address	Enter the IP address of the remote IPSec router in the IKE SA.
Authentication Method	
Pre-Shared Key	Type your pre-shared key in this field. A pre-shared key identifies a communicating party during a phase 1 IKE negotiation. Type from 8 to 31 case-sensitive ASCII characters or from 16 to 62 hexadecimal ("0-9", "A-F") characters. You must precede a hexadecimal key with a "0x" (zero x), which is not counted as part of the 16 to 62 character range for the key. For example, in "0x0123456789ABCDEF", "0x" denotes that the key is hexadecimal and "0123456789ABCDEF" is the key itself.
Local ID Type	Select IP to identify the WiMAX Device by its IP address. Select Domain Name to identify this WiMAX Device by a domain name. Select E-mail to identify this WiMAX Device by an e-mail address.
Content	When you select IP in the Local ID Type field, type the IP address of your computer in the Content field. If you configure the Content field to 0.0.0.0 or leave it blank, the WiMAX Device automatically uses the Pre-Shared Key (refer to the Pre-Shared Key field description). It is recommended that you type an IP address other than 0.0.0.0 in the Content field or use the Domain Name or E-mail ID type in the following situations. • When there is a NAT router between the two IPSec routers. • When you want the remote IPSec router to be able to distinguish between VPN connection requests that come in from IPSec routers with dynamic WAN IP addresses. When you select Domain Name or E-mail in the Local ID Type field, type a domain name or e-mail address by which to identify this WiMAX Device in the Local Content field. Use up to 31 ASCII characters including spaces, although trailing spaces are truncated. The domain name or e-mail address is for identification purposes only and can be any string.

Table 60 IPSec VPN: Add (continued)

LABEL	DESCRIPTION
Remote ID Type	Select IP to identify the remote IPSec router by its IP address. Select Domain Name to identify the remote IPSec router by a domain name. Select E-mail to identify the remote IPSec router by an e-mail address.
Content	The configuration of the remote content depends on the remote ID type. For IP, type the IP address of the computer with which you will make the VPN connection. If you configure this field to 0.0.0.0 or leave it blank, the WiMAX Device will use the address in the Remote Endpoint field (refer to the Remote Endpoint field description). For Domain Name or E-mail, type a domain name or e-mail address by which to identify the remote IPSec router. Use up to 31 ASCII characters including spaces, although trailing spaces are truncated. The domain name or e-mail address is for identification purposes only and can be any string. It is recommended that you type an IP address other than 0.0.0.0 or use the Domain Name or E-mail ID type in the following situations: • When there is a NAT router between the two IPSec routers. • When you want the WiMAX Device to distinguish between VPN connection requests that come in from remote IPSec routers with dynamic WAN IP addresses.
IKE Phase 1	
Proposal	
#	This field is a sequential value, and it is not associated with a specific proposal. The sequence of proposals should not affect performance significantly.
Encryption	Select which key size and encryption algorithm to use in the IKE SA. Choices are: • DES - a 56-bit key with the DES encryption algorithm • 3DES - a 168-bit key with the DES encryption algorithm • AES128 - a 128-bit key with the AES encryption algorithm • AES192 - a 192-bit key with the AES encryption algorithm • AES256 - a 256-bit key with the AES encryption algorithm The WiMAX Device and the remote IPSec router must use the same key size and encryption algorithm. Longer keys require more processing power, resulting in increased latency and decreased throughput.
Authentication	Select which hash algorithm to use to authenticate packet data. Choices are SHA1 and MD5. SHA1 is generally considered stronger than MD5, but it is also slower.
Remove	Select an entry and click this to delete it.
Add	Click this to create a new entry.
OK	Click this to save the changes.
Key Group	Select which Diffie-Hellman key group (DHx) you want to use for encryption keys. Choices are: • DH1 - use a 768-bit random number • DH2 - use a 1024-bit random number • DH5 - use a 1536-bit random number The longer the key, the more secure the encryption, but also the longer it takes to encrypt and decrypt information. Both routers must use the same DH key group.

Table 60 IPSec VPN: Add (continued)

LABEL	DESCRIPTION
SA Life Time	Type the maximum number of seconds the IKE SA can last. When this time has passed, the WiMAX Device and remote IPSec router have to update the encryption and authentication keys and re-negotiate the IKE SA. This does not affect any existing IPSec SAs, however.
Dead Peer Detection (DPD)	Select this check box if you want the WiMAX Device to make sure the remote IPSec router is there before it transmits data through the IKE SA. The remote IPSec router must support DPD. If the remote IPSec router does not respond, the WiMAX Device shuts down the IKE SA. If the remote IPSec router does not support DPD, see if you can use the VPN connection connectivity check.
DPD Interval	Specify the time interval for the WiMAX Device to send a DPD message to the remote IPSec router.
DPD Idle Try	Specify the maximum number of times the WiMAX Device sends the DPD message.
Local Network	Local IP addresses must be static and correspond to the remote IPSec router's configured remote IP addresses. Two active SAs can have the same configured local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time. In order to have more than one active rule with the Remote Endpoint field set to 0.0.0.0, the ranges of the local IP addresses cannot overlap between rules. If you configure an active rule with 0.0.0.0 in the Remote Endpoint field and the LAN's full IP address range as the local IP address, then you cannot configure any other active rules with the Remote Endpoint field set to 0.0.0.0.
Address Type	Select Single address or Subnet address to specify if the VPN connection begins at an IP address or subnet.
Start IP Address	If Single address is selected, enter a (static) IP address on the LAN behind your WiMAX Device. If Subnet address is selected, specify IP addresses on a network by their subnet mask by entering a (static) IP address on the LAN behind your WiMAX Device. Then enter the subnet mask to identify the network address.
Subnet Mask	If Subnet address is selected, enter the subnet mask to identify the network address.
Local Port	Select how the WiMAX Device checks the connection. The peer must be configured to respond to the method you select. Select icmp to have the WiMAX Device regularly ping the address you specify to make sure traffic can still go through the connection. You may need to configure the peer to respond to pings. Select tcp or udp to have the WiMAX Device regularly perform a TCP or UDP handshake with the address you specify to make sure traffic can still go through the connection. You may need to configure the peer to accept the TCP or UDP connection. If you select tcp or udp, specify the port number to use for the connectivity check.
Remote Network	Remote IP addresses must be static and correspond to the remote IPSec router's configured local IP addresses. The remote fields do not apply when the Remote Endpoint field is configured to 0.0.0.0. In this case only the remote IPSec router can initiate the VPN. Two active SAs cannot both have the same local and remote IP address(es). Two active SAs can have the same local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time.

Table 60 IPSec VPN: Add (continued)

LABEL	DESCRIPTION
Address Type	Select Single address or Subnet address to specify if the VPN connection terminates at an IP address or subnet.
Start IP Address	If Single address is selected, enter a (static) IP address on the LAN behind the remote IPSec's router. If Subnet address is selected, specify IP addresses on a network by their subnet mask by entering a (static) IP address on the LAN behind the remote IPSec's router. Then enter the subnet mask to identify the network address.
Subnet Mask	If Subnet address is selected, enter the subnet mask to identify the network address.
Remote Port	Select how the WiMAX Device checks the connection. The peer must be configured to respond to the method you select. Select icmp to have the WiMAX Device regularly ping the address you specify to make sure traffic can still go through the connection. You may need to configure the peer to respond to pings. Select tcp or udp to have the WiMAX Device regularly perform a TCP or UDP handshake with the address you specify to make sure traffic can still go through the connection. You may need to configure the peer to accept the TCP or UDP connection. If you select tcp or udp, specify the port number to use for the connectivity check.
IPSec Proposal	
Encapsulation Mode	Select Tunnel mode or Transport mode from the drop-down list box.
Active Protocol	Select the security protocols used for an SA. Both AH and ESP increase processing requirements and communications latency (delay). If you select ESP here, you must select options from the Encryption Algorithm and Authentication Algorithm fields (described below).
Encryption Algorithm	Select which key size and encryption algorithm to use in the IPSec SA. Choices are: • DES - a 56-bit key with the DES encryption algorithm • 3DES - a 168-bit key with the DES encryption algorithm • AES128 - a 128-bit key with the AES encryption algorithm • AES192 - a 192-bit key with the AES encryption algorithm • AES256 - a 256-bit key with the AES encryption algorithm The WiMAX Device and the remote IPSec router must use the same key size and encryption algorithm. Longer keys require more processing power, resulting in increased latency and decreased throughput.
Authentication Algorithm	Select which hash algorithm to use to authenticate packet data. Choices are SHA1 and MD5 . SHA1 is generally considered stronger than MD5 , but it is also slower.
SA Life Time	Define the length of time before an IPSec SA automatically renegotiates in this field. A short SA Life Time increases security by forcing the two VPN gateways to update the encryption and authentication keys. However, every time the VPN tunnel renegotiates, all users accessing remote resources are temporarily disconnected.

Table 60 IPSec VPN: Add (continued)

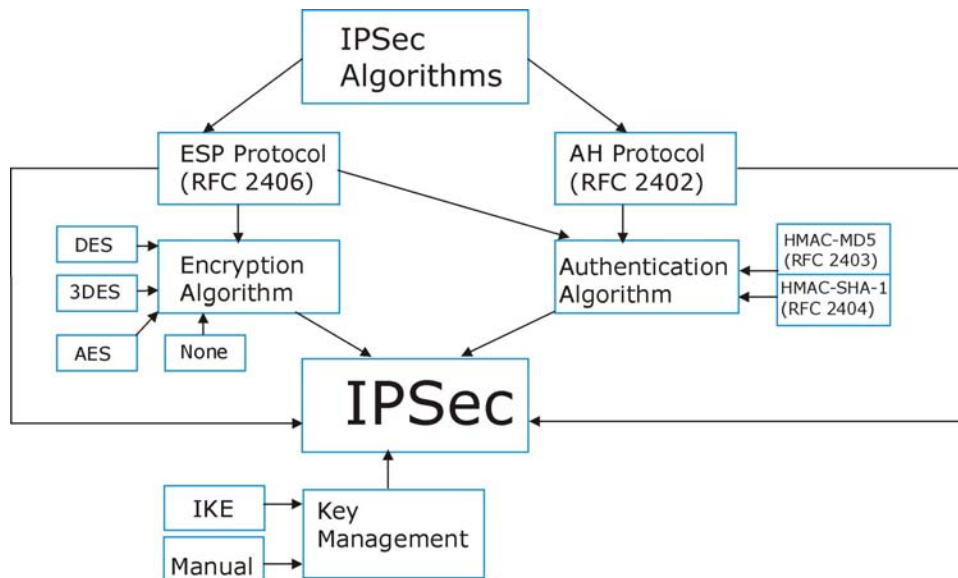
LABEL	DESCRIPTION
Perfect Forward Secrecy (PFS)	Select whether or not you want to enable Perfect Forward Secrecy (PFS). PFS changes the root key that is used to generate encryption keys for each IPSec SA. The longer the key, the more secure the encryption, but also the longer it takes to encrypt and decrypt information. Both routers must use the same DH key group.
Save	Click Apply to save your changes back to the WiMAX Device.
Cancel	Click Cancel to restore your previous settings.

8.12 Technical Reference

This section provides some technical background information about the topics covered in this section.

8.12.1 IPSec Architecture

The overall IPSec architecture is shown as follows.

Figure 80 IPSec Architecture

IPSec Algorithms

The **ESP** (Encapsulating Security Payload) Protocol (RFC 2406) and **AH** (Authentication Header) protocol (RFC 2402) describe the packet formats and the default standards for packet structure (including implementation algorithms).

The Encryption Algorithm describes the use of encryption techniques such as DES (Data Encryption Standard) and Triple DES algorithms.

The Authentication Algorithms, HMAC-MD5 (RFC 2403) and HMAC-SHA-1 (RFC 2404), provide an authentication mechanism for the **AH** and **ESP** protocols.

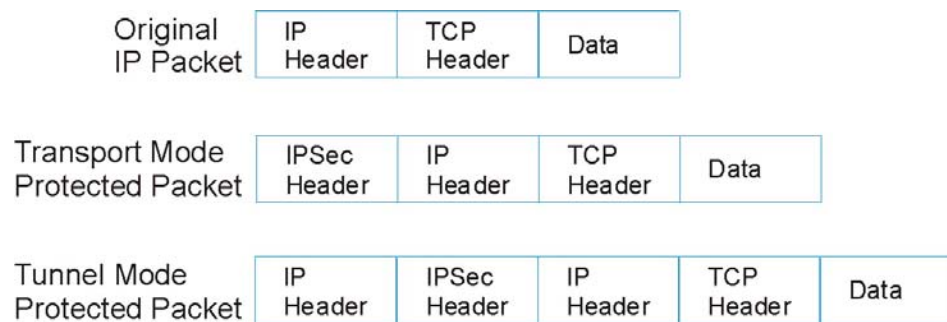
Key Management

Key management allows you to determine whether to use IKE (ISAKMP) or manual key configuration in order to set up a VPN.

8.12.2 Encapsulation

The two modes of operation for IPSec VPNs are **Transport** mode and **Tunnel** mode. At the time of writing, the WiMAX Device supports **Tunnel** mode only.

Figure 81 Transport and Tunnel Mode IPSec Encapsulation



Transport Mode

Transport mode is used to protect upper layer protocols and only affects the data in the IP packet. In **Transport** mode, the IP packet contains the security protocol (**AH** or **ESP**) located after the original IP header and options, but before any upper layer protocols contained in the packet (such as TCP and UDP).

With **ESP**, protection is applied only to the upper layer protocols contained in the packet. The IP header information and options are not used in the authentication process. Therefore, the originating IP address cannot be verified for integrity against the data.

With the use of **AH** as the security protocol, protection is extended forward into the IP header to verify the integrity of the entire packet by use of portions of the original IP header in the hashing process.

Tunnel Mode

Tunnel mode encapsulates the entire IP packet to transmit it securely. A **Tunnel** mode is required for gateway services to provide access to internal systems. **Tunnel** mode is fundamentally an IP tunnel with authentication and encryption. This is the most common mode of operation. **Tunnel** mode is required for gateway to gateway and host to gateway communications. **Tunnel** mode communications have two sets of IP headers:

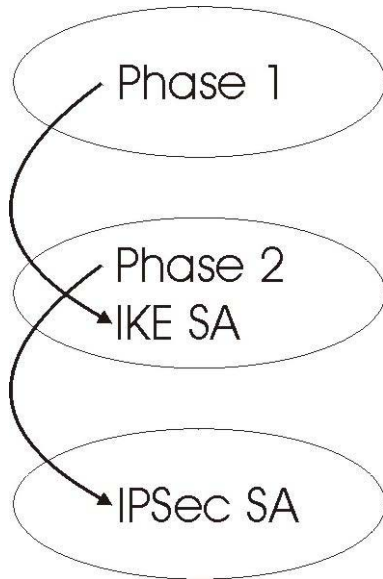
- **Outside header:** The outside IP header contains the destination IP address of the VPN gateway.

- **Inside header:** The inside IP header contains the destination IP address of the final system behind the VPN gateway. The security protocol appears after the outer IP header and before the inside IP header.

8.12.3 IKE Phases

There are two phases to every IKE (Internet Key Exchange) negotiation – phase 1 (Authentication) and phase 2 (Key Exchange). A phase 1 exchange establishes an IKE SA and the second one uses that SA to negotiate SAs for IPSec.

Figure 82 Two Phases to Set Up the IPSec SA



In phase 1 you must:

- Choose a negotiation mode.
- Authenticate the connection by entering a pre-shared key.
- Choose an encryption algorithm.
- Choose an authentication algorithm.
- Choose a Diffie-Hellman public-key cryptography key group (**DH1** or **DH2**).
- Set the IKE SA lifetime. This field allows you to determine how long an IKE SA should stay up before it times out. An IKE SA times out when the IKE SA lifetime period expires. If an IKE SA times out when an IPSec SA is already established, the IPSec SA stays connected.

In phase 2 you must:

- Choose an encryption algorithm.
- Choose an authentication algorithm
- Choose a Diffie-Hellman public-key cryptography key group.
- Set the IPSec SA lifetime. This field allows you to determine how long the IPSec SA should stay up before it times out. The WiMAX Device automatically renegotiates the IPSec SA if there is traffic when the IPSec SA lifetime period expires. If an IPSec SA times out, then the IPSec router must renegotiate the SA the next time someone attempts to send traffic.

8.12.4 Negotiation Mode

The phase 1 **Negotiation Mode** you select determines how the Security Association (SA) will be established for each connection through IKE negotiations.

- **Main Mode** ensures the highest level of security when the communicating parties are negotiating authentication (phase 1). It uses 6 messages in three round trips: SA negotiation, Diffie-Hellman exchange and an exchange of nonces (a nonce is a random number). This mode features identity protection (your identity is not revealed in the negotiation).
- **Aggressive Mode** is quicker than **Main Mode** because it eliminates several steps when the communicating parties are negotiating authentication (phase 1). However the trade-off is that faster speed limits its negotiating power and it also does not provide identity protection. It is useful in remote access situations where the address of the initiator is not known by the responder and both parties want to use pre-shared key authentication.

8.12.5 IPSec and NAT

Read this section if you are running IPSec on a host computer behind the WiMAX Device.

NAT is incompatible with the **AH** protocol in both **Transport** and **Tunnel** mode. An IPSec VPN using the **AH** protocol digitally signs the outbound packet, both data payload and headers, with a hash value appended to the packet. When using **AH** protocol, packet contents (the data payload) are not encrypted.

A NAT device in between the IPSec endpoints will rewrite either the source or destination address with one of its own choosing. The VPN device at the receiving end will verify the integrity of the incoming packet by computing its own hash value, and complain that the hash value appended to the received packet doesn't match. The VPN device at the receiving end doesn't know about the NAT in the middle, so it assumes that the data has been maliciously altered.

IPSec using **ESP** in **Tunnel** mode encapsulates the entire original packet (including headers) in a new IP packet. The new IP packet's source address is the outbound address of the sending VPN gateway, and its destination address is the inbound address of the VPN device at the receiving end. When using **ESP** protocol with authentication, the packet contents (in this case, the entire original packet) are encrypted. The encrypted contents, but not the new headers, are signed with a hash value appended to the packet.

Tunnel mode **ESP** with authentication is compatible with NAT because integrity checks are performed over the combination of the "original header plus original payload," which is unchanged by a NAT device.

Transport mode **ESP** with authentication is not compatible with NAT.

Table 61 VPN and NAT

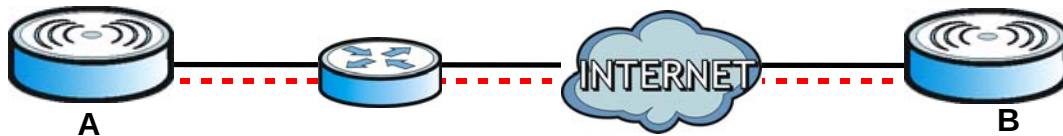
SECURITY PROTOCOL	MODE	NAT
AH	Transport	N
AH	Tunnel	N
ESP	Transport	N
ESP	Tunnel	Y

8.12.6 VPN, NAT, and NAT Traversal

NAT is incompatible with the AH protocol in both transport and tunnel mode. An IPsec VPN using the AH protocol digitally signs the outbound packet, both data payload and headers, with a hash value appended to the packet, but a NAT device between the IPsec endpoints rewrites the source or destination address. As a result, the VPN device at the receiving end finds a mismatch between the hash value and the data and assumes that the data has been maliciously altered.

NAT is not normally compatible with ESP in transport mode either, but the WiMAX Device's **NAT Traversal** feature provides a way to handle this. NAT traversal allows you to set up an IKE SA when there are NAT routers between the two IPsec routers.

Figure 83 NAT Router Between IPsec Routers



Normally you cannot set up an IKE SA with a NAT router between the two IPsec routers because the NAT router changes the header of the IPsec packet. NAT traversal solves the problem by adding a UDP port 500 header to the IPsec packet. The NAT router forwards the IPsec packet with the UDP port 500 header unchanged. In the above figure, when IPsec router **A** tries to establish an IKE SA, IPsec router **B** checks the UDP port 500 header, and IPsec routers **A** and **B** build the IKE SA.

For NAT traversal to work, you must:

- Use ESP security protocol (in either transport or tunnel mode).
- Use IKE keying mode.
- Enable NAT traversal on both IPsec endpoints.
- Set the NAT router to forward UDP port 500 to IPsec router **A**.

Finally, NAT is compatible with ESP in tunnel mode because integrity checks are performed over the combination of the "original header plus original payload," which is unchanged by a NAT device. The compatibility of AH and ESP with NAT in tunnel and transport modes is summarized in the following table.

Table 62 VPN and NAT

SECURITY PROTOCOL	MODE	NAT
AH	Transport	N
AH	Tunnel	N
ESP	Transport	Y*
ESP	Tunnel	Y

Y* - This is supported in the WiMAX Device if you enable NAT traversal.

8.12.7 ID Type and Content

With aggressive negotiation mode (see [Section 8.12.4 on page 147](#)), the WiMAX Device identifies incoming SAs by ID type and content since this identifying information is not encrypted. This

enables the WiMAX Device to distinguish between multiple rules for SAs that connect from remote IPSec routers that have dynamic WAN IP addresses.

Regardless of the ID type and content configuration, the WiMAX Device does not allow you to save multiple active rules with overlapping local and remote IP addresses.

With main mode (see [Section 8.12.4 on page 147](#)), the ID type and content are encrypted to provide identity protection. In this case the WiMAX Device can only distinguish between up to 12 different incoming SAs that connect from remote IPSec routers that have dynamic WAN IP addresses. The WiMAX Device can distinguish up to 48 incoming SAs because you can select between three encryption algorithms (DES, 3DES and AES), two authentication algorithms (MD5 and SHA1) and eight key groups when you configure a VPN rule (see [Section on page 137](#)). The ID type and content act as an extra level of identification for incoming SAs.

The type of ID can be a domain name, an IP address or an e-mail address. The content is the IP address, domain name, or e-mail address.

Table 63 Local ID Type and Content Fields

LOCAL ID TYPE=	CONTENT=
IP	Type the IP address of your computer.
DNS	Type a domain name (up to 31 characters) by which to identify this WiMAX Device.
E-mail	Type an e-mail address (up to 31 characters) by which to identify this WiMAX Device.
	The domain name or e-mail address that you use in the Local ID Content field is used for identification purposes only and does not need to be a real domain name or e-mail address.

8.12.7.1 ID Type and Content Examples

Two IPSec routers must have matching ID type and content configuration in order to set up a VPN tunnel.

The two WiMAX Devices in this example can complete negotiation and establish a VPN tunnel.

Table 64 Matching ID Type and Content Configuration Example

WiMAX Device A	WiMAX Device B
Local ID type: E-mail	Local ID type: IP
Local ID content: tom@yourcompany.com	Local ID content: 1.1.1.2
Remote ID type: IP	Remote ID type: E-mail
Remote ID content: 1.1.1.2	Remote ID content: tom@yourcompany.com

The two WiMAX Devices in this example cannot complete their negotiation because WiMAX Device B's **Local ID type** is **IP**, but WiMAX Device A's **Remote ID type** is set to **E-mail**. An "ID mismatched" message displays in the IPSEC LOG.

Table 65 Mismatching ID Type and Content Configuration Example

WIMAX DEVICE A	WIMAX DEVICE B
Local ID type: IP	Local ID type: IP
Local ID content: 1.1.1.10	Local ID content: 1.1.1.2
Remote ID type: E-mail	Remote ID type: IP
Remote ID content: aa@yahoo.com	Remote ID content: 1.1.1.0

8.12.8 Pre-Shared Key

A pre-shared key identifies a communicating party during a phase 1 IKE negotiation (see [Section 8.12.3 on page 146](#) for more on IKE phases). It is called “pre-shared” because you have to share it with another party before you can communicate with them over a secure connection.

8.12.9 Diffie-Hellman (DH) Key Groups

Diffie-Hellman (DH) is a public-key cryptography protocol that allows two parties to establish a shared secret over an unsecured communications channel. Diffie-Hellman is used within IKE SA setup to establish session keys. 768-bit, 1024-bit 1536-bit, 2048-bit, and 3072-bit Diffie-Hellman groups are supported. Upon completion of the Diffie-Hellman exchange, the two peers have a shared secret, but the IKE SA is not authenticated. For authentication, use pre-shared keys.

The VoIP General Screens

9.1 VoIP Overview

The features mentioned in this chapter are for models that has phone port(s) and you can make telephone calls over the Internet using the WiMAX Device.

The **VOICE > General** screens allow you to set up global SIP and Quality of Service (QoS) settings.

VoIP (Voice over IP) is the sending of voice signals over the Internet Protocol. This allows you to make phone calls and send faxes over the Internet at a fraction of the cost of using the traditional circuit-switched telephone network. You can also use servers to run telephone service applications like PBX services and voice mail. Internet Telephony Service Provider (ITSP) companies provide VoIP service. A company could alternatively set up an IP-PBX and provide it's own VoIP service.

Circuit-switched telephone networks require 64 kilobits per second (kbps) in each direction to handle a telephone call. VoIP can use advanced voice coding techniques with compression to reduce the required bandwidth.

9.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Voice Coding

A codec (coder/decoder) codes analog voice signals into digital signals and decodes the digital signals back into voice signals. The WiMAX Device supports the following codecs.

- **G.711** is a Pulse Code Modulation (PCM) waveform codec. PCM measures analog signal amplitudes at regular time intervals (sampling) and converts them into digital bits (quantization). Quantization “reads” the analog signal and then “writes” it to the nearest digital value. For this reason, a digital sample is usually slightly different from its analog original (this difference is known as “quantization noise”). G.711 provides excellent sound quality but requires 64kbps of bandwidth.
- **G.729** is an Analysis-by-Synthesis (AbS) hybrid waveform codec. It uses a filter based on information about how the human vocal tract produces sounds. The codec analyzes the incoming voice signal and attempts to synthesize it using its list of voice elements. It tests the synthesized signal against the original and, if it is acceptable, transmits details of the voice elements it used to make the synthesis. Because the codec at the receiving end has the same list, it can exactly recreate the synthesized audio signal. G.729 provides good sound quality and reduces the required bandwidth to 8kbps.

Quality of Service (QoS)

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay and the networking methods used to provide bandwidth for real-time multimedia applications.

Type Of Service (ToS)

Network traffic can be classified by setting the ToS (Type Of Service) values at the data source (for example, at the WiMAX Device) so a server can decide the best method of delivery, that is the least cost, fastest route and so on. The ToS field is consist of 8 bits. The first 3 bits indicate the priority of the packet.

DiffServ

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

DiffServ uses the first 6 bits of the 8-bit ToS value so that it can be backward compatible with non-DiffServ compliant but ToS-enabled network device. See [Section 9.6.1 on page 156](#) for more information.

SIP

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet. SIP signaling is separate from the media for which it handles sessions. The media that is exchanged during the session can use a different path from that of the signaling. SIP handles telephone calls and can interface with traditional circuit-switched telephone networks.

RTP

When you make a VoIP call using SIP, the RTP (Real time Transport Protocol) is used to handle voice data transfer. See RFC 1889 for details on RTP.

Speed Dial

Speed dial provides shortcuts for dialing frequently used phone numbers. You can map a phone number to a self-defined key(s) and then use that key(s) to call the phone number. For example, you can map 123456 to #01. When you press #01 it means that you press 123456.

9.1.2 Before you Begin

- Ensure that you have all of your voice account information on hand. If not, contact your voice account service provider to find out which settings in this chapter you should configure in order to use your telephone with the WiMAX Device.
- Connect your WiMAX Device to the Internet, as described in the Quick Start Guide. If you have not already done so, then you will not be able to test your VoIP settings.

9.2 Media

Click **VoIP > General > Media** to set up and maintain global VoIP settings.

Figure 84 Media

The screenshot shows the Media configuration interface. It is divided into three main sections: Port Range, Codec Packetization Time Settings, and Advanced. The Port Range section has two input fields: Media Port Start (40000) and Media Port End (50000), both with a range hint of (40000~50000). The Codec Packetization Time Settings section has two dropdown menus: G.711 (20) and G.729 (20), both with a unit of msec. The Advanced section has four settings: Voice Jitter Buffer Type (Dynamic), Voice Jitter Buffer Length (20 msec, range 20~500 ms), Packet Loss Concealment (checked), and T.38 Static Jitter Length (210 msec, range 80~500 ms). At the bottom right are Save and Cancel buttons.

The following table describes the labels in this screen.

Table 66 Media

LABEL	DESCRIPTION
Port Range	
Media Port Start Media Port End	Enter the listening port number(s) for RTP traffic on the WiMAX Device, if your VoIP service provider gave you this information. Otherwise, keep the default values. To enter one port number, enter the port number in the both Media Port Start and Media Port End fields. To enter a range of ports, enter the beginning port number of the range in the Media Port Start field and the ending port number in the Media Port End field.
Codec Packetization Time Settings	
G.711, G.729	Select how often (10 to 60 msec) the WiMAX Device sends an RTP packet for each type of voice coder/decoder (codec) G.711 and G.729 .
Advanced	
Voice Jitter Buffer Type	Voice jitter is a variation in delay of RTP packets delivery. This could cause strange sound effects. The WiMAX Device can utilize the following types of jitter buffer to minimize the effects of jitter. Dynamic - Jitter buffer size is dynamically changed by RTP packets delivery status. Static - Jitter buffer size is fixed.
Voice Jitter Buffer Length	Select the maximum number of milliseconds of voice traffic the WiMAX Device can help to smooth out the jitter in order to ensure good voice quality for your conversations.

Table 66 Media (continued)

LABEL	DESCRIPTION
Packet Loss Concealment	Packets may be dropped due to an overwhelming amount of traffic on the network. Some degree of packet loss will not be noticeable to the end user, but as packet loss increases the quality of sound degrades. Select this to have the WiMAX Device to improve the voice quality when packet loss occurs.
T.38 Static Jitter Length	T.38 is an ITU-T standard that VoIP devices use to send fax messages over the Internet. Select the number of milliseconds for the jitter buffer size used for transmitting T.38 fax messages.

9.3 QoS

This section describes the features of the Quality of Service (QoS) screen.

Click **VoIP > General > QoS** to set up Type of Service (ToS) and Differentiated Services (DiffServ) settings for voice traffic transmission through the WiMAX Device.

Figure 85 QoS

SIP ToS / DiffServ	0x2E (0x00~0x3F)
RTP ToS / DiffServ	0x38 (0x00~0x3F)

The following table describes the labels in this screen.

Table 67 QoS

LABEL	DESCRIPTION
SIP ToS/DiffServ	Enter the DSCP value you want to mark on all outgoing SIP packets generated by the WiMAX Device for DiffServ-enabled networks. Since DiffServ uses the first 6 bits of the 8-bit IP ToS field to represent the DSCP value, enter here the 6-bit DSCP value you want to mark in hexadecimal (in a format of 0x00), and the WiMAX Device will then automatically append 2 bits '0' to make a whole 8-bit ToS field value for all outgoing SIP packets. For example, if you enter 0x2E, it is 101110 in binary for DSCP. The WiMAX Device converts it to 101110 <u>00</u> in binary and marks on the IP ToS field of all the outgoing SIP packets.
RTP ToS/DiffServ	Enter the DSCP value you want to mark on all outgoing VoIP data packets (including both RTP and T.38 UDPTL packets) generated by the WiMAX Device for DiffServ-enabled networks.

9.4 SIP Settings

Click **VoIP > General > SIP** to set up session timer on the WiMAX Device. See [Section 10.8 on page 167](#) for more information on SIP.

Figure 86 SIP

The screenshot shows a configuration window titled 'Session Timer'. Inside, there is a label 'Session Timer Enable' followed by an unchecked checkbox. Below it is a label 'Refresh Method' followed by a dropdown menu that currently displays 'UPDATE'.

The following table describes the labels in this screen.

Table 68 SIP

LABEL	DESCRIPTION
Session Timer Enable	Select this to activate the WiMAX Device's SIP Session Timer. SIP Session Timer is a function used by both of the communication peers to determine if the call session is still active (alive) or not. It uses the method specified in the following Refresh Method field to periodically refresh the SIP sessions.
Refresh Method	Select the method to be used for periodically refreshing SIP sessions, to determine if the session is still active. Select UPDATE to use Update requests to refresh the session and select INVITE to use Re-Invite requests. You should use the same method as the peer device. The Update method uses less overhead than Re-Invite, but is not as widely supported as Re-Invite. By default the WiMAX Device is set to use the UPDATE method. When set to UPDATE , the WiMAX Device can also revert to using the INVITE method for SIP session refresh, depending on the method supported and allowed by the peer device.

9.5 Speed Dial

Speed dial allows you to use a shorter number for dialing frequently used phone numbers.

Click **VoIP > General > Speed Dial** to add, edit, or remove speed-dial rules.

Figure 87 Speed Dial

The screenshot shows a 'Speed Dial Rules' screen. At the top, there's a header 'Speed Dial Rules'. Below it is a table with columns: '#', 'Active', 'Short Number', 'Real Number', and 'Note'. Above the table, there are controls for '10 per page' and 'page' navigation. At the bottom left, it says 'Total Num: 0'. At the bottom right, there are 'Add' and 'OK' buttons.

The following table describes the labels in this screen.

Table 69 Speed Dial

LABEL	DESCRIPTION
Speed Dial Rules	This is a list of speed dial numbers. To edit an existing speed dial rule, you can click the row for the rule and editable fields will appear.
Active	This field displays whether the rule is activated or not.

Table 69 Speed Dial (continued)

LABEL	DESCRIPTION
Short Number	This field displays the abbreviated number you want to use to substitute for the real (actual) phone number in the following Real Number field. When the rule is activated, you can press the assigned Short Number to dial the Real Number .
Real Number	This field displays the actual phone number you want the WiMAX Device to call when you use the specified Short Number . Enter the actual phone number you want the WiMAX Device to call when you use the specified Short Number if you are editing the entry.
Notes	This field displays additional information for this speed-dial rule. Enter additional information or any remark for this speed-dial rule if your are editing the entry.
Remove	Click this to remove the rule.
Add	Click this to add a new speed-dial rule.
OK	Click this to save the changes you made in this table.

9.6 Technical Reference

The following section contains additional technical information about the WiMAX Device features described in this chapter.

9.6.1 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

Figure 88 DiffServ: Differentiated Service Field

DSCP (6-bit)	Unused (2-bit)
-----------------	-------------------

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

The VoIP Account Screens

10.1 Overview

The features mentioned in this chapter are for models with VoIP function.

Use the **VoIP > Account 1 (or Account 2)** screens to configure your VoIP account information on the WiMAX Device. You need to have a VoIP account set up first.

Note: If your WiMAX Device has only one phone port, there is only one account.

Note: You can identify the number of phone ports available on your WiMAX Device by its model name. See [Section 1.1 on page 17](#) for more information.

10.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

SIP Identities

A SIP account uses an identity (sometimes referred to as a SIP address). A complete SIP identity is called a SIP URI (Uniform Resource Identifier). A SIP account's URI identifies the SIP account in a way similar to the way an e-mail address identifies an e-mail account. The format of a SIP identity is SIP-Number@SIP-Service-Domain.

SIP Number

The SIP number is the part of the SIP URI that comes before the "@" symbol. A SIP number can use letters like in an e-mail address (johndoe@your-ITSP.com for example) or numbers like a telephone number (1122334455@VoIP-provider.com for example).

SIP Service Domain

The SIP service domain of the VoIP service provider (the company that lets you make phone calls over the Internet) is the domain name in a SIP URI. For example, if the SIP address is [1122334455@VoIP-provider.com](#), then "VoIP-provider.com" is the SIP service domain.

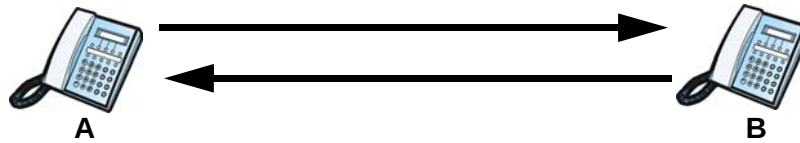
SIP Register Server

A SIP register server maintains a database of SIP identity-to-IP address (or domain name) mapping. The register server checks your user name and password when you register.

SIP User Agent

A SIP user agent can make and receive VoIP telephone calls. This means that SIP can be used for peer-to-peer communications even though it is a client-server protocol. In the following figure, either **A** or **B** can act as a SIP user agent client to initiate a call. **A** and **B** can also both act as a SIP user agent to receive the call.

Figure 89 SIP User Agent



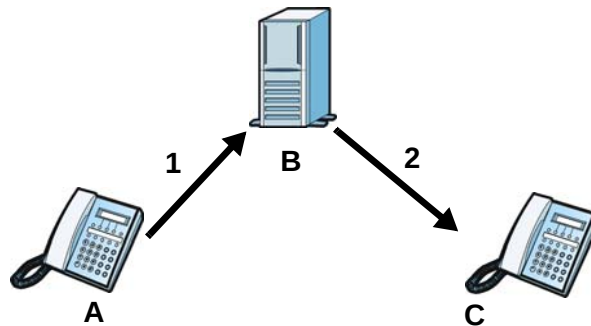
SIP Proxy Server

A SIP proxy server receives requests from clients and forwards them to another server.

In the following example, you want to use client device **A** to call someone who is using client device **C**.

- 1 The client device (**A** in the figure) sends a call invitation to the SIP proxy server (**B**).
- 2 The SIP proxy server forwards the call invitation to **C**.

Figure 90 SIP Proxy Server



STUN

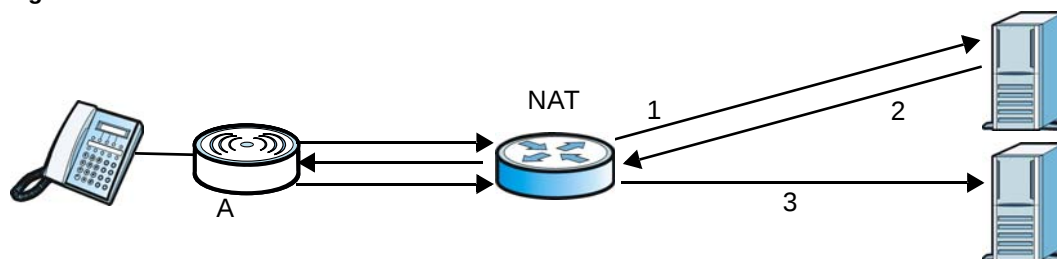
STUN (Simple Traversal of User Datagram Protocol (UDP) through Network Address Translators) allows the WiMAX Device to find the presence and types of NAT routers and/or firewalls between it and the public Internet. STUN also allows the WiMAX Device to find the public IP address that NAT assigned, so the WiMAX Device can embed it in the SIP data stream. STUN does not work with symmetric NAT routers or firewalls. See RFC 3489 for details on STUN.

The following figure shows how STUN works.

- 1 The WiMAX Device (**A**) sends SIP packets to the STUN server (**B**).
- 2 The STUN server (**B**) finds the public IP address and port number that the NAT router used on the WiMAX Device's SIP packets and sends them to the WiMAX Device.

- 3 The WiMAX Device uses the public IP address and port number in the SIP packets that it sends to the SIP server (C).

Figure 91 STUN



Outbound Proxy

Your VoIP service provider may host a SIP outbound proxy server to handle all of the WiMAX Device's VoIP traffic. This allows the WiMAX Device to work with any type of NAT router and eliminates the need for STUN or a SIP ALG. Turn off a SIP ALG on a NAT router in front of the WiMAX Device to keep it from retranslating the IP address (since this is already handled by the outbound proxy server).

NAT and SIP

The WiMAX Device must register its public IP address with a SIP register server. If there is a NAT router between the WiMAX Device and the SIP register server, the WiMAX Device probably has a private IP address. The WiMAX Device lists its IP address in the SIP message that it sends to the SIP register server. NAT does not translate this IP address in the SIP message. The SIP register server gets the WiMAX Device's IP address from inside the SIP message and maps it to your SIP identity. If the WiMAX Device has a private IP address listed in the SIP message, the SIP server cannot map it to your SIP identity.

Use a SIP ALG (Application Layer Gateway), STUN, or outbound proxy to allow the WiMAX Device to list its public IP address in the SIP messages.

DTMF

Dual-Tone Multi-Frequency (DTMF) telephone call signaling uses pairs of frequencies (one lower frequency and one higher frequency) to set up calls. It is also known as Touch Tone. Each of the keys on a DTMF telephone corresponds to a different pair of frequencies.

Supplementary Phone Services Overview

Supplementary services such as call hold, call waiting, call transfer, etc. are generally available from your VoIP service provider. The WiMAX Device supports the following services:

- Call Waiting
- Call Forwarding
- Caller ID

Note: To take full advantage of the supplementary phone services available through the WiMAX Device's phone port, you may need to subscribe to the services from your VoIP service provider.

10.2 Status

Click **VoIP > Account 1 (or Account 2) > Status** to view VoIP settings and current status.

Figure 92 Status

Server Status	
SIP Registrar	0.0.0.0:5060
SIP Service Domain	wimax:5060
Proxy Server	0.0.0.0:5060
Outbound Server	0.0.0.0:5060
Register Status	Disabled
Line Status	
Subscriber Number	1000
Account Status	Disable
Phone Status	Idle
Call History	
Received call	0
Missing call	0
Outgoing call	0
Connect Disconnect	

The following table describes the labels in this screen.

Table 70 Status

LABEL	DESCRIPTION
Server Status	
SIP Register	This field displays the IP address (or domain name) and service port number of the register server, if you have configured one.
SIP Service Domain	This field displays the SIP service domain and port number of the SIP server, if you have configured one.
Proxy Server	This field displays the IP address (or domain name) and service port number of the SIP proxy server, if you have configured one.
Outbound Server	This field displays the IP address (or domain name) and service port number of the outbound proxy server, if you have configured one.
Register Status	This field displays Disabled if the SIP account (set up in Section 10.4 on page 163) is disabled or de-registered from the registrar server. It displays Registering (or Unregistering) after sending out the SIP register (or unregister) message to make registration (or de-registration) at (or from) the SIP registrar server. If the registration fails, for example, rejected by SIP registrar server (due to wrong authentication data) or timeout to get response from the server, Error would be displayed. It displays Up if the SIP account is registered at the registrar server successfully.
Line Status	
Subscriber Number	This field displays the SIP phone number for the phone line.

Table 70 Status (continued)

LABEL	DESCRIPTION
Account Status	This indicates whether the SIP account is activated or not. Enable means activated and Disable means deactivated.
Phone Status	This field displays the phone status, such as Idle , Calling , Ringing , Connecting , InCall , Hold , and Disconnecting .
Call History	
Received call	This field displays the number of calls you have received through the connected phone since the WiMAX Device last restarted or was turned on.
Missing call	This field displays the number of calls you have missed since the WiMAX Device last restarted or was turned on.
Outgoing call	This field displays the number of calls you have made through the connected phone since the WiMAX Device last restarted or was turned on.
Connect	Click this to register the WiMAX Device to the specified register server.
Disconnect	Click this to de-register the WiMAX Device with the register server.

10.3 Server

Click **VoIP > Account 1 (or Account 2) > Server** to configure the registrar server, proxy server and outbound proxy server for this SIP account.

Figure 93 Server

The screenshot shows a configuration window titled "Server". It is divided into three sections: "Registrar Server", "Proxy Server", and "Outbound Server". Each section contains two input fields: "Server" (IP address or domain) and "Port Number". The "Registrar Server" section also includes a "SIP Service Domain" field and a "Register Period Time" field with a range constraint. At the bottom right are "Save" and "Cancel" buttons.

Section	Field	Value	Notes
Registrar Server	Registrar Server	0.0.0.0	
	Port Number	5060	
	SIP Service Domain	wimax	
	Register Period Time	900	seconds (60~65535)
Proxy Server	Proxy Server	0.0.0.0	
	Port Number	5060	
Outbound Server	Outbound Server	0.0.0.0	
	Port Number	5060	

The following table describes the labels in this screen.

Table 71 Server

LABEL	DESCRIPTION
Registrar Server	
Registrar Server	Enter the IP address or domain name of a register server. You can use up to 63 printable ASCII characters.
Port Number	Enter the SIP server's listening port number. Keep the default value, if you are not sure of this value.

Table 71 Server (continued)

LABEL	DESCRIPTION
SIP Service Domain	Enter the IP address or domain name of a SIP server, if your VoIP service provider gave you one. Otherwise, enter the same address that you have entered in the Registrar Server field. You can use up to 63 printable ASCII characters.
Register Period Time	Enter the registration expiry time in seconds for the SIP account specified in Section 10.4 on page 163. The allowable range is 60~65535 seconds. However, this value is just a default preference value by user, the actual registration expiry time used by the SIP account is determined by the registrar server after the registration process. Once the SIP account has registered at the registrar server successfully, the WiMAX Device will send a re-register message to keep alive the successfully registered status at every half of the registration expiry time determined by the registrar server. If the keep-alive action failed, the register status described in Section 10.2 on page 160 will become Error state and you can not make any call in this status. However, after 512 seconds (fixed value), the WiMAX Device will send a register message again to try to recover a successfully registered status.
Proxy Server	
Proxy Server	Enter the IP address or domain name of the SIP proxy server provided by your VoIP service provider. You can use up to 63 printable ASCII characters.
Port Number	Enter the SIP proxy server's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
Outbound Server	
Outbound Server	Enter the IP address or domain name of the outbound proxy server provided by your VoIP service provider. You can use up to 63 printable ASCII characters. If you choose not to use an outbound proxy server, set this to 0.0.0.0 .
Port Number	Enter the outbound proxy's listening port number, if your VoIP service provider gave you one. Otherwise, leave it as the default '5060'. If the outbound proxy is disabled (set to 0.0.0.0), then this port will be ignored.

10.4 SIP

Click **VoIP > Account 1 (or Account 2) > SIP** to configure SIP settings.

Figure 94 SIP

The screenshot shows the SIP configuration interface. It is divided into three main sections: SIP Account, Codec Settings, and Session Timer. The SIP Account section includes an 'Enable' checkbox, a 'SIP Local Port' text box with '5060', a 'Subscriber Number' text box with '1000', an 'Authentication Name' text box with '1000', and a 'Password' text box with four dots. The Codec Settings section has three dropdown menus for '1st Codec' (G.729), '2nd Codec' (G.711 aLaw), and '3rd Codec' (G.711 muLaw). The Session Timer section has two text boxes: 'Min Session Timer' with '90' and 'Session Timer' with '180', both with unit labels 'seconds (90~65535)' and 'seconds (120~65535)' respectively.

The following table describes the labels in this screen.

Table 72 SIP

LABEL	DESCRIPTION
SIP Account	
Enable	Select this if you want the WiMAX Device to use this account. Clear it if you do not want the WiMAX Device to use this account.
SIP Local Port	Enter the WiMAX Device's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
Subscriber Number	Enter your SIP number. In the full SIP URI, this is the part before the @ symbol. You can use up to 1-31 printable ASCII characters.
Authentication Name	Type the SIP user name associated with this account for authentication to the SIP register server. This field can be 1-31 printable characters (A-Z, a-z, 0-9).
Password	Type the SIP password associated with this account. This field can be 0-31 printable characters (A-Z, a-z, 0-9), underscores (_), pluses (+), periods (.), and "at" symbols (@).
Codec Settings	

Table 72 SIP (continued)

LABEL	DESCRIPTION
1st Codec, 2nd Codec, 3rd Codec	Select the WiMAX Device's first, second, and third choices of the type of voice coder/decoder (codec) that you want the phone line to use when communicating with the SIP server. The following codecs (shown in highest quality to lowest quality order) are supported by the WiMAX Device: • G.711 aLaw (typically used in Europe) • G.711 muLaw (typically used in North America and Japan) • G.729 You can also select NONE for the 2nd and 3rd codecs if your VoIP service provider only gave you one or two codec settings. When two SIP devices start a SIP session, they must agree on a codec.
Session Timer	
Min Session Timer	Enter the minimum session expiry time in seconds. The allowable range is 90~65535 seconds. When an incoming call requests a session expiry time that is lower than this value, the WiMAX Device will respond with a "423 session timer too small" message and tell the peer to use this value as the minimum bound.
Session Timer	Enter the session expiry time in seconds for all phone connections on this trunk. The allowable range is 120~65535 seconds. This value cannot be lower than the Min Session Timer. The WiMAX Device will use INVITE or UPDATE method to keep alive a session every half of the session expiry time during a call. If the keep-alive action is successful, the WiMAX Device will re-start the timer and do another keep-alive action after it reaches half of the session expiry time. If the keep-alive action failed, the call will terminate automatically. See Section 9.4 on page 155 to configure the Refresh Method with the INVITE or UPDATE method.

10.5 Feature

Click **VoIP > Account 1 (or Account 2) > Feature** to configure advanced VoIP features such as DTMF, Call Forwarding and Call Waiting.

Figure 95 Feature

Feature Settings

Block Anonymous Call ☐
Do Not Disturb (DND) ☐
Hide User ID (Make Anonymous Call) ☐
MWI (Message Waiting Indication) ☐

DTMF

DTMF

Out-of-band(RFC 2833)

SIP INFO ☐

Call Forward Setting

Unconditional CF ☐
Unconditional CF Target
Busy CF ☐
Busy CF Target
No Answer CF ☐
No Answer CF Target
No Answer CF Waiting Time

5

 seconds (5~180)

Call Waiting Setting

Call Waiting ☒
Call Waiting Reject Time

60

 seconds (5~180)

The following table describes the labels in this screen.

Table 73 Feature

LABEL	DESCRIPTION
Feature Settings	
Block Anonymous Call	Select this to have the WiMAX Device block all incoming calls from phone that do not send caller ID.
Do Not Disturb (DND)	Select this to have the WiMAX Device not forward calls to the phone line while processing incoming calls. Thus, for any incoming call, the remote peer can hear ringback tone, but the phone connected on the WiMAX Device would not ring. Meanwhile, the WiMAX Device can still make outgoing calls as usual. Note: The DND function should be used very carefully, since enabling DND makes the WiMAX Device not forward any incoming call to the phone line so the user would never know whether there are any incoming calls.
Hide User ID (Make Anonymous Call)	Select this to not have your Caller ID (number) displayed on the callee's screen.

Table 73 Feature (continued)

LABEL	DESCRIPTION
MWI (Message Waiting Indication)	Select this to enable Message Waiting Indicator (MWI) function for this SIP account specified in Section 10.4 on page 163 . When there is at least one new voice mail for the SIP account, the voice LED turns yellow and the WiMAX Device sends a beeping tone to the phone while user picks-up the phone to make calls.
DTMF	
DTMF	Control how the WiMAX Device handles the DTMF tone relay to the communication peer. The DTMF tone is generated by the phone when you push its digit buttons during a call. One application is to send numbers when trying to do IVR (Interactive Voice Response) service with server. You should use the same mode as your VoIP service provider. The choices are: • Out-of-band(RFC 2833) - Follow the RFC 2833 standard and send the DTMF tones in RTP packets. • In Band - Send the DTMF tones in the voice data stream. This works best when you are using a codec that does not use compression (like G.711). Codecs that use compression (like G.729) can distort the tones.
SIP INFO	Select this to have the WiMAX Device send the DTMF tones in SIP messages.
Call Forward Setting	
Unconditional CF, Unconditional CF Target	Select this if you want the WiMAX Device to forward all incoming calls to the specified phone number, regardless of other rules in this Call Forward Setting section. Specify the phone number in the Unconditional CF Target field. Note: The Unconditional CF function should be used very carefully, since enabling this function makes the WiMAX Device forward all incoming calls to another phone number, so the user would never know if there are any incoming calls.
Busy CF, Busy CF Target	Select this if you want the WiMAX Device to forward incoming calls to the specified phone number if the phone port is busy. Specify the phone number in the Busy CF Target field. If you have call waiting, the incoming call is forwarded to the specified phone number if you reject or ignore the second incoming call.
No Answer CF, No Answer CF Target, No Answer CF Waiting Time	Select this if you want the WiMAX Device to forward incoming calls to the specified phone number if the call is unanswered. Specify the phone number in the No Answer CF Target field on the right. Specify the time to wait before forwarding incoming calls in the No Answer CF Waiting Time field.
Call Waiting Setting	
Call Waiting	Select this to enable call waiting for this SIP account on the WiMAX Device.
Call Waiting Reject Time	Enter time to wait before rejecting a call when call waiting is enabled.

10.6 Dialing

Click **VoIP > Account 1 (or Account 2) > Dialing** to configure dialing timeout values.

Figure 96 Dialing

Inter-digit Timeout	3	seconds (1~5)
First-digit Timeout	8	seconds (5~30)

The following table describes the labels in this screen.

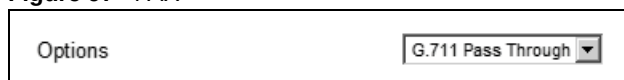
Table 74 Dialing

LABEL	DESCRIPTION
Inter-digit Timeout	Set the time in seconds (1~5) the WiMAX Device waits for each digit input of a complete callee number after you press the first key on the phone. If the WiMAX Device cannot receive the next digit entered within this time period, the WiMAX Device processes digits you have dialed.
First-digit Timeout	Set the number of seconds (5~30) for the WiMAX Device to wait for you to start dialing a number after you pick up the telephone receiver. If you do not dial any number within that time period, the dial tone becomes a busy signal. Put back the receiver and pick it up again if you want to make a new call.

10.7 FAX

Click **VoIP > Account 1 (or Account 2) > FAX** to configure which standard the account uses for fax services.

Figure 97 FAX



The screenshot shows a web interface for configuring fax services. It features a label 'Options' followed by a dropdown menu. The dropdown menu is currently displaying 'G.711 Pass Through'.

The following table describes the labels in this screen.

Table 75 FAX

LABEL	DESCRIPTION
Options	Select which standard the WiMAX Device uses to handle faxes. The peer devices must also use standard. G.711A Pass Through - Select this option to send and receive fax messages over the network or Internet using VoIP (G.711a). By encoding fax data as audio data, faxes may be susceptible to packet loss and other errors. However, as this standard is considerably older than T.38, it is more compatible with older obsolete systems. T.38 FAX Relay - WiMAX Device encodes fax messages to T.38 packets and sends as UDP packets through IP networks. This provides better quality, but it may have interoperability problems.

10.8 Technical Reference

The following section contains additional technical information about the WiMAX Device features described in this chapter.

10.8.1 SIP Call Progression with Session Timer

The following figure displays the basic steps in the setup and tear down of a SIP call with session timer supported by both peers. The UPDATE method is used to refresh the session. A calls B and

uses proxy server P. Messages include Session Expiry (SE) and Minimum Session Expiry (MSE) time values. When the duration of the call reaches half of the SE time period, the session is refreshed.

Table 76 SIP Call Progression

A	P	B
1. INVITE SE: 60 ----->		
	2. 422 MSE: 3600 <-----	
3. ACK ----->		
4. INVITE SE: 3600 MSE: 3600 ----->		
	5. INVITE SE: 3600 MSE: 3600 ----->	
		6. INVITE SE: 3600 MSE: 3600 ----->
		7. OK SE: 3600 <-----
	8. OK SE: 3600 <-----	
9. OK SE: 3600 <-----		
10. ACK ----->		
	11. ACK ----->	----->
	12. Dialogue (voice traffic)	

Table 76 SIP Call Progression (continued)

A	P	B
13. UPDATE SE: 3600 ----->		
	14. UPDATE SE:3600 ----->	----->
	<-----	15. OK SE: 3600 <-----
16. OK SE: 3600 <-----		
17. BYE ----->		
		18. OK <-----

- 1 A sends a SIP INVITE request. This message is an invitation for B to participate in a SIP telephone call. A's INVITE specifies a SE of 60 seconds.
- 2 A's request arrives at P but is below the minimum allowed value of 3600, so it is rejected with a 422 message, which contains the MSE of 3600.
- 3 A sends an ACK to acknowledge the message was received.
- 4 A retries the INVITE request with SE of 3600 and MSE of 3600.
- 5 The SE in the new INVITE is acceptable so P forwards it to B.
- 6 B receives the INVITE.
- 7 B responds with an OK message which includes the SE of 3600.
- 8 P forwards the OK message to A.
- 9 A receives the OK.
- 10 A then sends an ACK message to acknowledge that the call is established completely.
- 11 The proxy server forwards the ACK message to B.
- 12 Now A and B exchange voice media (talk).
- 13 After around half of the SE time period is reached, or 1800 seconds in this case, A sends an UPDATE request to refresh the session.

- 14 The UPDATE request is forwarded by P to B.
- 15 B receives the UPDATE request and responds with an OK message.
- 16 The OK message is received by A.
- 17 After talking, A hangs up and sends a BYE request.
- 18 B replies with an OK response confirming receipt of the BYE request and the call is terminated.

10.8.2 SIP Client Server

SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

When you use SIP to make a VoIP call, it originates at a client and terminates at a server. A SIP client could be a computer or a SIP phone. One device can act as both a SIP client and a SIP server.

For more information on the SIP protocol, please refer to RFC 3261.

The VoIP Line Screens

11.1 Overview

The features mentioned in this chapter are for models with VoIP function.

The **VoIP > Line 1 (or Line 2)** screens allow you to configure the volume, echo cancellation, VAD settings and custom tones for the phone port which maps to the SIP account (see [Chapter 10 on page 157](#)).

Note: If your WiMAX Device has only one phone port, there is only one line.

Note: You can identify the number of phone ports available on your WiMAX Device by its model name. See [Section 1.1 on page 17](#) for more information.

11.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Voice Activity Detection/Silence Suppression/Comfort Noise

Voice Activity Detection (VAD) detects whether or not speech is present. This lets the WiMAX Device reduce the bandwidth that a call uses by not transmitting “silent packets” when you are not speaking.

When using VAD, the WiMAX Device generates comfort noise when the other party is not speaking. The comfort noise lets you know that the line is still connected as total silence could easily be mistaken for a lost connection.

Echo Cancellation

G.168 is an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.

11.2 Phone

Click **VoIP > Line 1 (or Line 2) > Phone** to configure phone related settings.

Figure 98 Phone

Phone	
Hook Flash Detect Upper Bound	500 msec (100~2000 msec)
Hook Flash Detect Lower Bound	100 msec (100~2000 msec)
Voice Tx Level	5
Voice Rx Level	5

The following table describes the labels in this screen.

Table 77 Phone

LABEL	DESCRIPTION
Phone	
Hook Flash Detect Upper Bound	Enter the number of milliseconds for the upper bound of a quick on-hook and off-hook cycle in order to recognize a hook flash event.
Hook Flash Detect Lower Bound	Enter the number of milliseconds for the lower bound of a quick on-hook and off-hook cycle in order to recognize a hook flash event.
Voice Tx Level	Select the volume level transmitted by the WiMAX Device. -9 is the quietest, and 9 is the loudest.
Voice Rx Level	Select the volume level transmitted to the WiMAX Device. -9 is the quietest, and 9 is the loudest.

11.3 Voice

Click **VoIP > Line 1 (or Line 2) > Voice** to configure voice settings.

Figure 99 Voice

VAD	
Enable VAD	☐
LEC	
Line Echo Canceller Tail Length	16 msec

The following table describes the labels in this screen.

Table 78 Voice

LABEL	DESCRIPTION
VAD - Voice Activity Detection	
Enable VAD	Enable Voice Active Detector (VAD) to have the WiMAX Device stop transmitting voice traffic when you are not speaking using the detection method. This reduces the bandwidth the WiMAX Device uses.

Table 78 Voice (continued)

LABEL	DESCRIPTION
LEC - Line Echo Cancellation	
Line Echo Canceller Tail Length	Select the maximum number of milliseconds of an echo length (16 ms, 32 ms or 48 ms) the WiMAX Device can handle and eliminate the effect. An echo is normally caused by the sound of your voice reverberating in the telephone receiver while you talk. Select Disable to turn this feature off.

11.4 Region

Click **VoIP > Line 1 (or Line 2) > Region** to maintain settings that depend on which region of the world the WiMAX Device is in.

Figure 100 Region


The screenshot shows a configuration window titled "Country Profile". Inside the window, there is a label "Country Profile" followed by a dropdown menu. The dropdown menu is currently displaying "USA".

The following table describes the labels in this screen.

Table 79 Region

LABEL	DESCRIPTION
Country Profile	Select the place in which the WiMAX Device is located, USA (Default) or any other country.

Maintenance

12.1 Overview

Use these screens to manage and maintain your WiMAX Device.

12.1.1 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Remote Management Limitations

Remote management over LAN or WAN will not work when:

- 1 You have disabled that service in one of the remote management screens.
- 2 The IP address in the **Secured Client IP** field does not match the client IP address. If it does not match, the WiMAX Device will disconnect the session immediately.
- 3 There is already another remote management session with an equal or higher priority running. You may only have one remote management session running at one time.

Remote Management and NAT

When NAT is enabled:

- Use the WiMAX Device's WAN IP address when configuring from the WAN.
- Use the WiMAX Device's LAN IP address when configuring from the LAN.

System Timeout

There is a default system management idle timeout of five minutes. The WiMAX Device automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling.

SNMP

Simple Network Management Protocol (SNMP) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your WiMAX Device supports SNMP agent functionality, which allows a manager station to manage and monitor the WiMAX Device through the network. The WiMAX Device supports SNMP version one (SNMPv1) and version two (SNMPv2). The next figure illustrates an SNMP management operation.

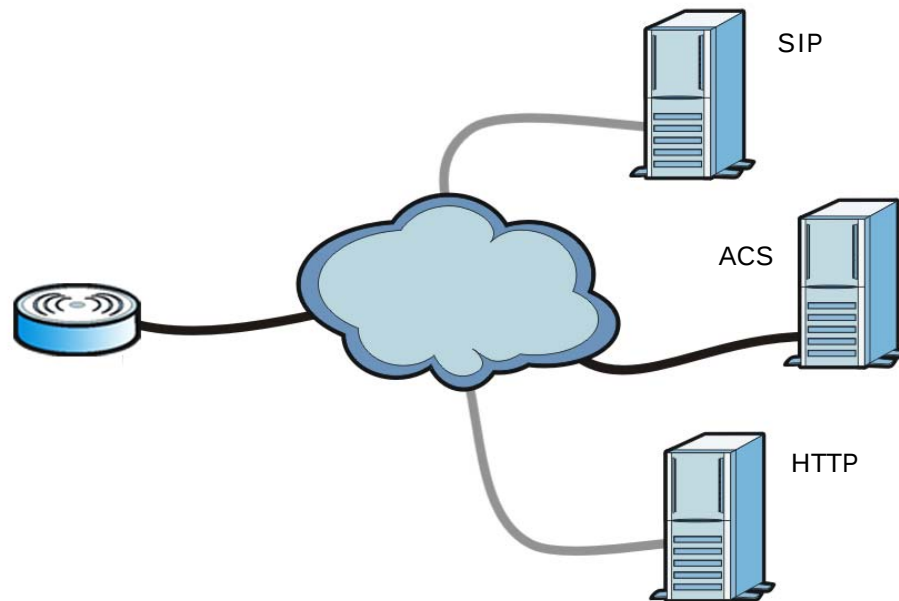
Note: SNMP is only available if TCP/IP is configured.

TR-069

TR-069 is an abbreviation of “Technical Reference 069”, a protocol designed to facilitate the remote management of Customer Premise Equipment (CPE), such as the WiMAX Device. It can be managed over a WAN by means of an Auto Configuration Server (ACS). TR-069 is based on sending Remote Procedure Calls (RPCs) between the ACS and the client device. RPCs are sent in Extensible Markup Language (XML) format over HTTP or HTTPS.

An administrator can use an ACS to remotely set up the WiMAX Device, modify its settings, perform firmware upgrades, and monitor and diagnose it. In order to do so, you must enable the TR-069 feature on your WiMAX Device and then configure it appropriately. (The ACS server which it will use must also be configured by its administrator.)

Figure 101 TR-069 Example



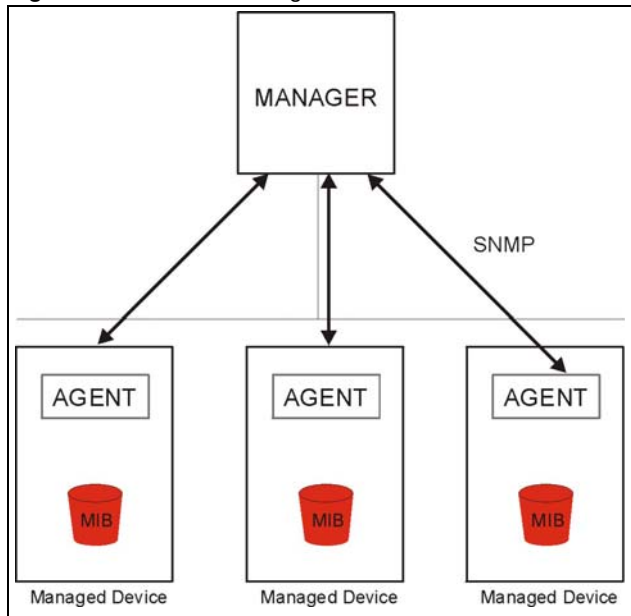
In this example, the WiMAX Device receives data from at least 3 sources: A SIP server for handling voice calls, an HTTP server for handling web services, and an ACS, for configuring the WiMAX Device remotely. All three servers are owned and operated by the client's Internet Service Provider. However, without the configuration settings from the ACS, the WiMAX Device cannot access the other two servers. Once the WiMAX Device receives its configuration settings and implements them, it can connect to the other servers. If the settings change, it will once again be unable to connect until it receives its updates from the ACS.

The WiMAX Device can be configured to periodically check for updates from the auto-configuration server so that the end user need not be worried about it.

SNMP

An SNMP managed network consists of two main types of component: agents and a manager.

Figure 102 SNMP Management Model



An agent is a management software module that resides in a managed device (the WiMAX Device). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects. The WiMAX Device supports MIB II that is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

The WiMAX Device sends traps to the SNMP manager when any of the following events occurs:

Table 80 SNMP Traps

TRAP #	TRAP NAME	DESCRIPTION
0	coldStart (defined in <i>RFC-1215</i>)	A trap is sent after booting (power on).
1	warmStart (defined in <i>RFC-1215</i>)	A trap is sent after booting (software reboot).
4	authenticationFailure (defined in <i>RFC-1215</i>)	A trap is sent to the manager when receiving any SNMP get or set requirements with the wrong community (password).
6	whyReboot	A trap is sent with the reason of restart before rebooting when the system is going to restart (warm start).
6a	For intentional reboot:	A trap is sent with the message "System reboot by user!" if reboot is done intentionally, (for example, download new files, CI command "sys reboot", etc.).
6b	For fatal error:	A trap is sent with the message of the fatal code if the system reboots because of fatal errors.

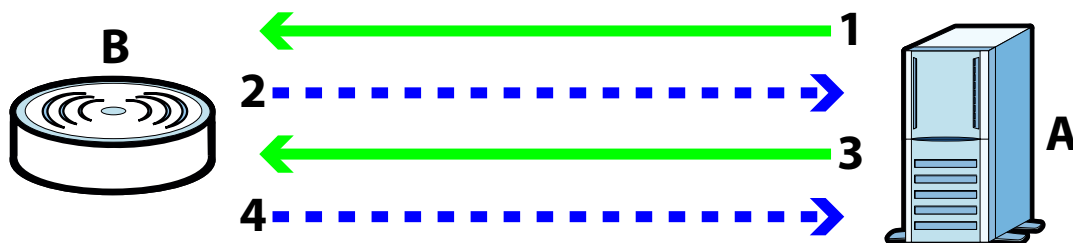
OMA-DM

When the WiMAX Device initiates communication with the server (often times at start up or after the first time you turn it on), the server uploads commands, new files (if any), and other information used by a service provider to customize the WiMAX Device's features.

Device management works as follows:

- 1 The server (A) sends out the query (1) to the WiMAX Device (B).
- 2 The WiMAX Device responds by sending back its credentials (2), to which the server responds with its credentials along with a string of management operations (3).
- 3 The client responds to the management operations (4), perhaps confirming file alterations or confirming receipt of file uploads and so on.
- 4 The server disconnects from the WiMAX Device once all of its management operations have been carried out.

Figure 103 OMA-DM Data Management



OMA-DM Authentication

In order to ensure the integrity of the connection between an OMA-DM server and the WiMAX Device, communication between the two is encoded using one of three common algorithms. They are not intended to be used in lieu of proper digital security, but instead as a means of transmitting

multiple disparate types of data over HTTP. Security encryption for communication is handled by different processes configured elsewhere in the WiMAX Device's web configurator

Basic Access Authentication — Sends a person's user name and password in Base64. This authentication protocol is supported by all browsers that are HTTP 1.0/1.1 compliant. Although converted to Base64 for the sake of cross-compatibility, credentials are nonetheless passed between the web browser and the server in plaintext, making it extremely easy to intercept and read. As such, it is rarely used anymore.

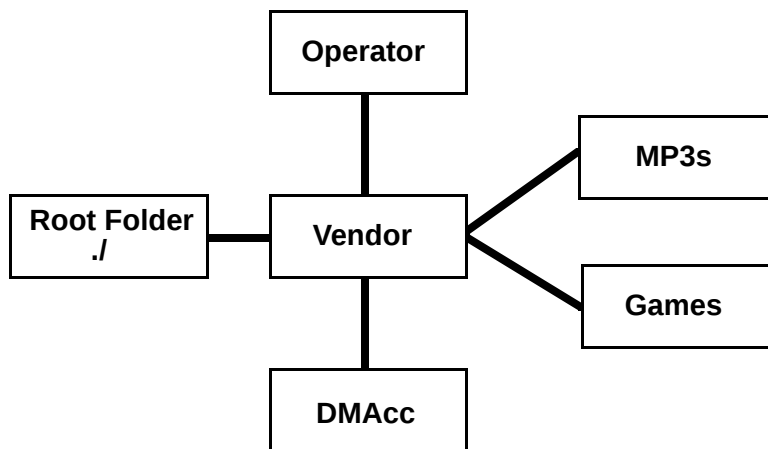
Digest Access Authentication — This protocol was designed to replace basic access authentication. Instead of encoding a user name and password in plaintext, this protocol uses what is known as an MD5 message authentication code. It allows the server to issue a single-use, randomly generated number (known as a 'nonce') to the client (in this case, the web browser), which then uses the number as the 'public key' for encrypting its data. When the server receives the encrypted data, it unlocks it using the 'key' that was just provided. While stronger than basic access authentication, this protocol is not as strong as, say, HMAC, or as secure as the client using a client-side private key encryption scheme.

Hash Message Authentication Code — Also known as HMAC, this code relies on cryptographic hash functions to bolster an existing protocol, such as MD5. It is a method for generating a stronger, significantly higher encryption key.

OMA-DM Data Model

Each device that conforms to the current OMA-DM standard has an identical data structure embedded in its controlling firmware. This allows a similarly conforming OMA-DM server to navigate the folder structure and to make file alterations where appropriate or required.

Figure 104 OMA-DM Data Model



In the example data model shown here, the parent folders must conform to the OMA-DM standard. The child folders, on the other hand, can be customized on an individual basis. This allows the parent folders to all maintain a consistent URI (Uniform Resource Identifier) across all devices that meet the OMA-DM standard's requirements.

For example, in the preceding figure the URI for the "Games" folder is `./Vendor/Games/`. The `./Vendor/` portion of the URI exists on all devices that conform to the OMA-DM standard. The "Games" folder, however, may or may not exist depending on the services provided by the company managing the device.

Daytime

A network protocol used by devices for debugging and time measurement. A computer can use this protocol to set its internal clock but only if it knows in which order the year, month, and day are returned by the server. Not all servers use the same format.

Time

A network protocol for retrieving the current time from a server. The computer issuing the command compares the time on its clock to the information returned by the server, adjusts itself automatically for time zone differences, then calculates the difference and corrects itself if there has been any temporal drift.

NTP

NTP stands for Network Time Protocol. It is employed by devices connected to the Internet in order to obtain a precise time setting from an official time server. These time servers are accurate to within 200 microseconds.

12.2 Password

Use this screen to set up admin and guest accounts for logging into and managing the WiMAX Device. The “admin” user can access and configure all screens. The “guest” user can only perform some basic settings such as viewing the system status information, configuring LAN, NAT, DDNS, and Firewall settings and reset the WiMAX Device to factory defaults and restart the WiMAX Device.

Click **Maintenance > Password** to open this screen as shown next.

Figure 105 Password Screen

Change Password

Group

admin

▼

Old Password

New Password

Retype

This screen contains the following fields:

Table 81 Password

LABEL	DESCRIPTION
Group	Select the group for which you want to change the login password.
Old Password	Enter the old password for the login group.
New Password	Enter the new password for the login group.
Retype	Retype the new password for the login group.

12.3 HTTP

Use this screen to allow remote access to the WiMAX Device from a network connection over HTTP.

Click **Maintenance > Remote MGMT > HTTP** to open this screen as shown next.

Figure 106 HTTP Screen

HTTP Server

Enable ☒

Port Number

HTTPS Server

Enable ☒

Port Number

HTTP and HTTPS

Allow Connection from WAN ☒

HTTP Session Timeout

Session Timeout minutes (0~99, 0 means disabled)

This screen contains the following fields:

Table 82 HTTP

LABEL	DESCRIPTION
HTTP Server	
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the WiMAX Device. The computer must use the same port number.
HTTPS Server	
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the WiMAX Device. The computer must use the same port number.
HTTP and HTTPS	
Allow Connection from WAN	Select this to allow incoming connections from the WAN over either HTTP or HTTPS.
HTTP Session Timeout	
Session Timeout	Enter the number of minutes (0-99) the WiMAX Device waits to delete an inactive web connection (HTTP or HTTPS).

12.4 Telnet

Use this screen to allow remote access to the WiMAX Device from a network connection over Telnet.

Click **Maintenance > Remote MGMT > Telnet** to open this screen as shown next.

Figure 107 Telnet Screen

Enable	☒
Port Number	23
Allow Connection from WAN	☒
Allow Connection from LAN	☒

This screen contains the following fields:

Table 83 Telnet

LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the WiMAX Device. The computer must use the same port number.
Allow Connection from WAN	Select this to allow connections using this service that originate on the WAN.
Allow Connection from LAN	Select this to allow connection using this service that originate on the LAN.

12.5 SSH

Use this screen to allow remote access to the WiMAX Device from a network connection over SSH.

Click **Maintenance > Remote MGMT > SSH** to open this screen as shown next.

Figure 108 SSH Screen

Enable	☒
Port Number	22
Allow Connection from WAN	☒
Allow Connection from LAN	☒

This screen contains the following fields:

Table 84 SSH

LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the WiMAX Device. The computer must use the same port number.
Allow Connection from WAN	Select this to allow connections using this service that originate on the WAN.
Allow Connection from LAN	Select this to allow connection using this service that originate on the LAN.

12.6 SNMP

Use this screen to allow remote access to the WiMAX Device from a network connection over SNMP.

Click **Maintenance > Remote MGMT > SNMP** to open this screen as shown next.

Figure 109 SNMP Screen

Enable	☐
Location	
Contact	
Read Community	public
Write Community	private
Trap Server	192.168.0.1
Trap Community	test

This screen contains the following fields:

Table 85 SNMP

LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Location	Enter the location of the SNMP server (for example, "Engineering Dept., Floor 6, Building A, New York City").
Contact	Enter contact information for the administrator managing the SNMP server (for example, "Bill Smith, IT Dept., (555) 555-5454").
Read Community	Enter the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Write Community	Enter the password for incoming Set requests from the management station. The default is public and allows all requests.
Trap Server	Enter the IP address of the station to send your SNMP traps to.
Trap Community	Enter the trap community, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.

12.7 CWMP

Use this screen to allow CWMP connections for remote management, firmware upgrades and troubleshooting.

Click **Maintenance > Remote MGMT > CWMP** to open this screen as shown next.

Figure 110 CWMP Screen

This screen contains the following fields:

Table 86 CWMP

LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
ACS Server URL	Enter the URL or IP address of the auto-configuration server.
Bootstrap Enable	Select this to enable bootstrap events.
ACS Username	Enter the user name sent when the WiMAX Device connects to the ACS and which is used for authentication. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed.
ACS Password	Enter the password sent when the WiMAX Device connects to an ACS and which is used for authentication. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed.
Periodical Inform Enable	Select this to allow the WiMAX Device to periodically connect to the ACS and check for configuration updates. If you do not enable this feature then the WiMAX Device can only be updated automatically when the ACS initiates contact with it and if you selected the checkbox on this screen.
Periodical Inform Interval	Enter the time interval (in seconds) at which the WiMAX Device connects to the auto-configuration server.
Connection Request Username	Enter the connection request user name that the ACS must send to the WiMAX Device when it requests a connection. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed. Note: This must be provided by the ACS administrator.

Table 86 CWMP (continued)

LABEL	DESCRIPTION
Connection Request Password	Enter the connection request password that the ACS must send to the WiMAX Device when it requests a connection. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed. Note: This must be provided by the ACS administrator.
CA Certificate File	Click Browse to upload a Certificate Authority (CA) certificate to the WiMAX Device.
CA Certificate Info	This displays information about the currently active CA certificate.
Client Certificate File	Click Browse to upload a client certificate to the WiMAX Device.
Client Certificate Info	This displays information about the currently active client certificate.

12.8 OMA-DM

Use this screen to allow remote access to the WiMAX Device from a network connection over OMA-DM.

Click **Maintenance > Remote MGMT > OMA-DM** to open this screen as shown next.

Figure 111 OMA-DM Screen

Enable	☐
Server URL	
Server Port	80
Server Auth Type	MD5
Server ID	
Server Password	
Server Nonce	
Client Auth Type	MD5
Client ID	
Client Password	
Client Nonce	
Periodical Client-initiated Enable	☒
Periodical Client-initiated Interval	3600 seconds

This screen contains the following fields:

Table 87 OMA-DM

LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Server URL	Enter the IP address or URL of the OMA-DM server that you intend to use to manage this device.

Table 87 OMA-DM (continued)

LABEL	DESCRIPTION
Server Port	Enter the port number for the IP address of the OMA-DM server set up in the preceding field.
Server Auth Type	Select the encryption algorithm scheme used by the OMA-DM server to communicate with client devices. If the scheme selected here does not match the actual scheme used by the server, then server will challenge the WiMAX Device to automatically update its settings. • None - No authentication. • Basic - Server ID and Password are encoded using a Basic Access Authentication Code. • Digest (MD5) - Server ID and Password are encoded using a Digest Access Authentication Code. • HMAC - Server ID and Password are encoded using a keyed Hash Message Authentication Code.
Server ID	Enter the identification code for the server. This is used by the WiMAX Device during the communication handshake process to identify the server.
Server Password	Enter the password for the server's identification code. This shared public key is used by the WiMAX Device during the communication handshake process to identify the server.
Server Nonce	The WiMAX Device and the OMA-DM server use nonces to authenticate each other if you select MD5 as the authentication algorithm in the Server Auth Type field. Nonce is an abbreviation of 'number used once'. It is normally a random or pseudo-random number applied in an authentication protocol to protect existing communications from being reused in 'replay attacks'. Type up to 20 digits for the OMA-DM server nonce.
Client Auth Type	Select the encryption algorithm scheme used by the OMA-DM server to communicate with client devices. If the scheme selected here does not match the actual scheme used by the server, then server will challenge the WiMAX Device to automatically update its settings. • None - No authentication. • Basic - Server ID and Password are encoded using a Basic Access Authentication Code. • Digest (MD5) - Server ID and Password are encoded using a Digest Access Authentication Code. • HMAC - Server ID and Password are encoded using a keyed Hash Message Authentication Code. Note: Make sure that the scheme selected here matches the Server Auth Type.
Client ID	Enter the client name for the WiMAX Device.
Client Password	Enter the password for the WiMAX Device's client name.
Client Nonce	The WiMAX Device and the OMA-DM server use nonces to authenticate each other if you select MD5 as the authentication algorithm in the Client Auth Type field. Type up to 20 digits for the OMA-DM client nonce.
Periodical Client-Initiated Enable	Select this to allow the WiMAX Device to periodically connect to the OMA-DM server and check for configuration updates. If you do not enable this feature then the WiMAX Device can only be updated automatically when the OMA-DM server initiates contact with it and if you selected the checkbox on this screen.
Periodical Client-Initiated Interval	Enter the time interval (in seconds) at which the WiMAX Device connects to the OMA-DM server.

12.9 Date/Time

Use these settings to set the system time or configure an NTP server for automatic time synchronization.

Click **Maintenance > Date/Time > Date** to open this screen as shown next.

Figure 112 Date Screen

This screen contains the following fields:

Table 88 Date

LABEL	DESCRIPTION
Manual	
New Time	Enter the new time in this field.
New Date	Enter the new date in this field.
Get from Time Server	
Time Protocol	Select the time service protocol that your time server uses. Check with your ISP or network administrator, or use trial-and-error to find a protocol that works. NTP (RFC 1305) - This format is similar to Time (RFC 868).
Time Server Address 1~4	Enter the IP address or URL of your time server. Check with your ISP or network administrator if you are unsure of this information.

12.10 Time Zone

Use this screen to set the time zone in which the WiMAX device is physically located.

Click **Maintenance > Date/Time > Time Zone** to open this screen as shown next.

Figure 113 Time Zone Screen

Time Zone: (GMT+08:00) Kuala Lumpur, Singapore

Enable Daylight Saving: ☐

Start Date: First Sunday of April at 2 o'clock

End Date: Last Sunday of October at 2 o'clock

This screen contains the following fields:

Table 89 Time Zone

LABEL	DESCRIPTION
Time Zone	Select the time zone at your location.
Enable Daylight Savings Time	Select this if your location uses daylight savings time. Daylight savings is a period from late spring to early fall when many places set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
Start Date	Enter which hour on which day of which week of which month daylight-savings time starts.
End Date	Enter which hour on the which day of which week of which month daylight-savings time ends.

12.11 Upgrade File

Use this screen to browse to a firmware file on a local computer and upload it to the WiMAX Device. Firmware files usually use the system model name with a ".bin" extension, such as "WiMAX Device.bin". The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system restarts.

Contact your service provider for information on available firmware upgrades.

Note: Only use firmware for your WiMAX Device's specific model.

Click **Maintenance > Firmware Upgrade > Upgrade File** to open this screen as shown next.

Figure 114 Upgrade File Screen

Upgrade File:

This screen contains the following fields:

Table 90 Upgrade File

LABEL	DESCRIPTION
Upgrade File	Click Browse then browse to the location of a firmware upgrade file and select it.
Upgrade	Click this to begin uploading the selected file. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

12.11.1 The Firmware Upload Process

When the WiMAX Device uploads new firmware, the process usually takes about two minutes. The device also automatically restarts in this time. This causes a temporary network disconnect.

Note: Do not turn off the device while firmware upload is in progress!

After two minutes, log in again, and check your new firmware version in the **Status** screen. You might have to open a new browser window to log in.

If the upload is not successful, you will be notified by error message.

12.12 Upgrade Link

Use this screen to set the URL of a firmware file on a remote computer and upload it to the WiMAX Device.

Click **Maintenance > Firmware Upgrade > Upgrade Link** to open this screen as shown next.

Figure 115 Upgrade Link Screen



The screenshot shows a web interface for the 'Upgrade Link' screen. It features a text input field with the placeholder text 'Upgrade Link' and an 'Upgrade' button located below the input field.

This screen contains the following fields:

Table 91 Upgrade Link

LABEL	DESCRIPTION
Upgrade Link	Enter the URL or IP address of the firmware's upgrade location on the network.
Upgrade	Click this to begin uploading the selected file. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

12.13 CWMP Upgrade

Use this screen to upgrade the firmware on the WiMAX Device using CWMP Request Download.

Click **Maintenance > Firmware Upgrade > CWMP Upgrade** to open this screen as shown next.

Figure 116 CWMP Upgrade Screen



This screen contains the following fields:

Table 92 CWMP Upgrade

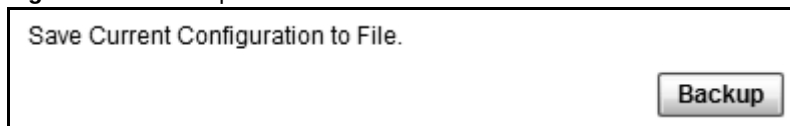
LABEL	DESCRIPTION
Upgrade	Click this to begin upgrading firmware using CWMP Request. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

12.14 Backup/Restore

Use this screen to backup your current WiMAX Device settings to a local computer.

Click **Maintenance > Backup/Restore > Backup** to open this screen as shown next.

Figure 117 Backup Screen



This screen contains the following fields:

Table 93 Backup

LABEL	DESCRIPTION
Backup	Click this to save the WiMAX Device's current configuration to a file on your computer. Once your device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file is useful if you need to return to your previous settings.

12.15 Restore

Use this screen to restore your WiMAX Device settings from a backup file on a local computer.

Click **Maintenance > Backup/Restore > Restore** to open this screen as shown next.

Figure 118 Restore Screen

This screen contains the following fields:

Table 94 Restore

LABEL	DESCRIPTION
Configuration File	Click Browse... then browse to the location of a firmware upgrade file and select it. Click File Restore to upload the specified configuration to the WiMAX Device and replace the current settings.
Backup Configuration File URL	Enter the URL or IP address of the backup configuration file's location on the network. Click URL Restore to upload the specified configuration to the WiMAX Device and replace the current settings.

12.15.1 The Restore Configuration Process

When the WiMAX Device restores a configuration file, the device automatically restarts. This causes a temporary network disconnect.

Note: Do not turn off the device while configuration file upload is in progress.

If the WiMAX Device's IP address is different in the configuration file you selected, you may need to change the IP address of your computer to be in the same subnet as that of the default management IP address (192.168.5.1). See the Quick Start Guide or the appendices for details on how to set up your computer's IP address.

You might have to open a new browser to log in again.

If the upload was not successful, you are notified with an error message.

12.16 Factory Defaults

Use this screen to restore the WiMAX Device to its factory default settings.

Click **Maintenance > Backup/Restore > Factory Defaults** to open this screen as shown next.

Figure 119 Factory Defaults Screen

Clear configuration and return to factory defaults.

Reset

This screen contains the following fields:

Table 95 Factory Defaults

LABEL	DESCRIPTION
Reset	Click this to clear all user-entered configuration information and return the WiMAX Device to its factory defaults. There is no warning screen.

12.17 Log Setting

Use this screen to configure which type of events on the WiMAX Device are logged.

Click **Maintenance > LOG > Log Setting** to open this screen as shown next.

Figure 120 Log Setting Screen

Enable Log

☒

Log Level

Info

Enable Remote Log

☐

Remote Log Host

Remote Log Port

514

This screen contains the following fields:

Table 96 Log Setting

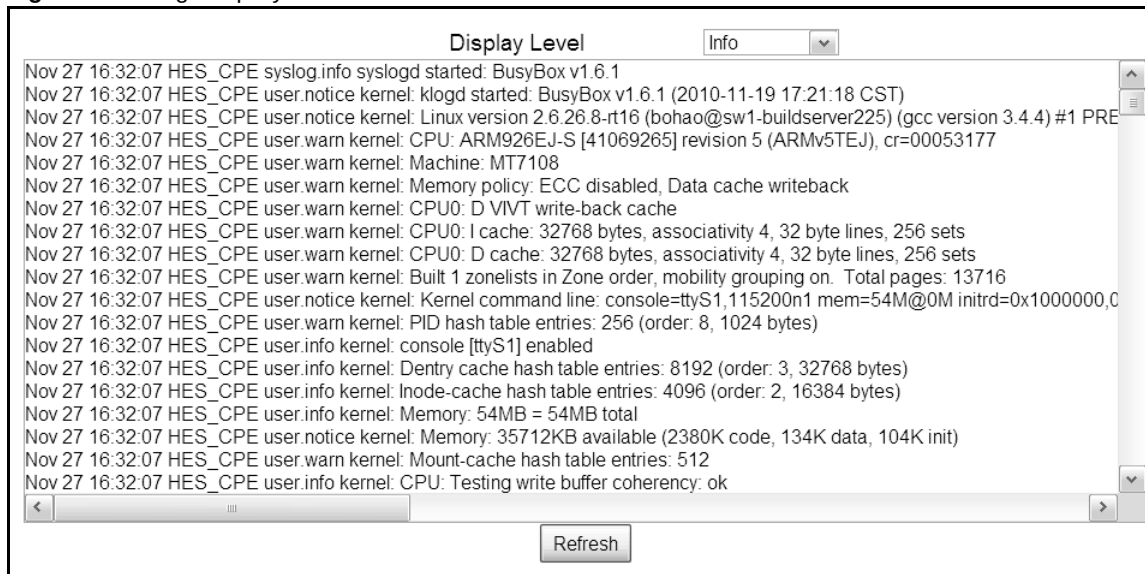
LABEL	DESCRIPTION
Enable Log	Select this to have the WiMAX Device log network activity according to the selected Log Level .
Log Level	Select the type of logs to record.
Enable Remote Log	Select this to allow logs to be recorded and stored on a remote logs server.
Remote Log Host	Enter the remote log host IP address if Enable Remote Log is selected.
Remote Log Port	Enter the remote log host port if Enable Remote Log is selected.

12.18 Log Display

Use this screen to view the log messages of the WiMAX Device.

Click **Maintenance > LOG > Log Display** to open this screen as shown next.

Figure 121 Log Display Screen



This screen contains the following fields:

Table 97 Log Display

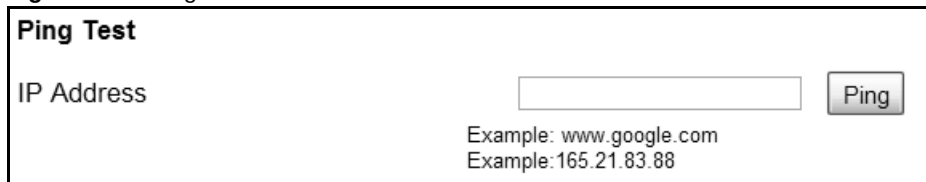
LABEL	DESCRIPTION
Display Level	Select the type of logs to display from this menu.
Refresh	Click this to refresh the logs in the display window.

12.19 Network Test

Use this screen to test network connectivity using ping.

Click **Maintenance > Network Test > Ping** to open this screen as shown next.

Figure 122 Ping Screen



This screen contains the following fields:

Table 98 Ping

LABEL	DESCRIPTION
IP Address	Enter the IP address or domain name of a target device to which this test will send.
Ping	Click this to start the test. The result will show at the bottom of the screen.

12.20 Traceroute

Use this screen to test network connectivity using traceroute.

Click **Maintenance > Network Test > Traceroute** to open this screen as shown next.

Figure 123 Traceroute Screen

Traceroute Test

IP Address

Traceroute

Example: www.google.com

Example:165.21.83.88

This screen contains the following fields:

Table 99 Traceroute

LABEL	DESCRIPTION
IP Address	Enter the IP address or domain name of a target device to which this test will send.
Traceroute	Click this to start the test. The result will show at the bottom of the screen.

12.21 About

This screen displays information about the WiMAX Device that can be useful when upgrading firmware, considering deployment options, and working with technical support if the device encounters difficulties.

Click **Maintenance > About** to open this screen as shown next.

Figure 124 About Screen

**Wimax**

System Model Name

Software Version

2.00(UUB.2)04142011A_1388

CROM Version

D0

Firmware Version

v2.10.12 (255) (EX_REL_MT711x_V_3_11_10_CPE , 2011/03/28 16:49:19 , CPE 2.5G , Cali-s1/0/0-v7/0/0-m8/0/0 , 0394A91F0731C7A158E4B6FAFB7C405C , ext[3:1/3]ext[3:1/3])

Firmware Date

Thu Apr 14 11:24:36 AM 2011

Bootloader Version

88100511-20100818-03931810

This screen contains the following fields:

Table 100 About

LABEL	DESCRIPTION
System Model Name	This field displays the WiMAX Device system name. It is used for identification.
Software Version	This field displays the Web Configurator software version that the WiMAX Device is currently running.
CROM Version	This field displays the CROM version number.
Firmware Version	This field displays the current version of the firmware inside the device.
Firmware Date	This field displays the date the firmware version was created.
Bootloader Version	This field displays the bootloader version.

12.22 Reboot

Use this screen to perform a software restart of the WiMAX Device. You may log in again within a few minutes of using the reboot button.

Click **Maintenance > Reboot** to open this screen as shown next.

Figure 125 Reboot Screen



This screen contains the following fields:

Table 101 Reboot

LABEL	DESCRIPTION
Reboot	Click this button to have the device perform a software restart. The Power LED blinks as it restarts and the shines steadily if the restart is successful. Note: Wait one minute before logging back into the WiMAX Device after a restart.

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories:

- [Power, Hardware Connections, and LEDs](#)
- [WiMAX Device Access and Login](#)
- [Internet Access](#)
- [Reset the WiMAX Device to Its Factory Defaults](#)

13.1 Power, Hardware Connections, and LEDs

[The WiMAX Device does not turn on. None of the LEDs turn on.](#)

- 1 Make sure you are using the power adapter or cord included with the WiMAX Device.
- 2 Make sure the power adapter or cord is connected to the WiMAX Device and plugged in to an appropriate power source. Make sure the power source is turned on.
- 3 Disconnect and re-connect the power adapter or cord to the WiMAX Device.
- 4 If the problem continues, contact the vendor.

[One of the LEDs does not behave as expected.](#)

- 1 Make sure you understand the normal behavior of the LED. See [Chapter 14 on page 203](#) for more information.
- 2 Check the hardware connections. See the Quick Start Guide.
- 3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.
- 4 Disconnect and re-connect the power adapter to the WiMAX Device.
- 5 If the problem continues, contact the vendor.

13.2 WiMAX Device Access and Login

I forgot the IP address for the WiMAX Device.

- 1 The default IP address is **192.168.1.1**[http://192.168.1.1](#).
- 2 If you changed the IP address and have forgotten it, you might get the IP address of the WiMAX Device by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the WiMAX Device (it depends on the network), so enter this IP address in your Internet browser.
- 3 If this does not work, you have to reset the WiMAX Device to its factory defaults. See [Section 13.6 on page 202](#).

I forgot the password.

- 1 The default password is **1234**.
- 2 If this does not work, you have to reset the WiMAX Device to its factory defaults. See [Section 13.6 on page 202](#).

I cannot see or access the **Login** screen in the web configurator.

- 1 Make sure you are using the correct IP address.
 - The default IP address is **http://192.168.1.1**.
 - If you changed the IP address ([Section 7.6 on page 98](#)), use the new IP address.
 - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for [I forgot the IP address for the WiMAX Device](#).
- 2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and [Chapter 14 on page 203](#).
- 3 Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled.
- 4 If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. Your WiMAX Device is a DHCP server by default.

If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the WiMAX Device.
- 5 Reset the WiMAX Device to its factory defaults, and try to access the WiMAX Device with the default IP address. See [Section 13.6 on page 202](#).

- 6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Try to access the WiMAX Device using another service, such as Telnet. If you can access the WiMAX Device, check the remote management settings and firewall rules to find out why the WiMAX Device does not respond to HTTP.
- If your computer is connected wirelessly, use a computer that is connected to a **LAN/ETHERNET** port.

I can see the **Login** screen, but I cannot log in to the WiMAX Device.

- 1 Make sure you have entered the user name and password correctly. The default user name is **admin**, and the default password is **1234**. These fields are case-sensitive, so make sure [Caps Lock] is not on.
- 2 You cannot log in to the web configurator while someone is using Telnet to access the WiMAX Device. Log out of the WiMAX Device in the other session, or ask the person who is logged in to log out.
- 3 Disconnect and re-connect the power adapter or cord to the WiMAX Device.
- 4 If this does not work, you have to reset the WiMAX Device to its factory defaults. See [Section 13.6 on page 202](#).

I cannot Telnet to the WiMAX Device.

See the troubleshooting suggestions for [I cannot see or access the Login screen in the web configurator](#). Ignore the suggestions about your browser.

13.3 Internet Access

I cannot access the Internet.

- 1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and [Chapter 14 on page 203](#).
- 2 Make sure you entered your ISP account information correctly in the wizard. These fields are case-sensitive, so make sure [Caps Lock] is not on.
- 3 Check your security settings. See [Chapter 8 on page 125](#).

- 4 Check your WiMAX settings. The WiMAX Device may have been set to search the wrong frequencies for a wireless connection. See [Chapter 6 on page 72](#). If you are unsure of the correct values, contact your service provider.
- 5 Disconnect all the cables from your WiMAX Device, and follow the directions in the Quick Start Guide again.
- 6 If the problem continues, contact your ISP.

[I cannot access the Internet any more. I had access to the Internet \(with the WiMAX Device\), but my Internet connection is not available any more.](#)

- 1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and [Chapter 14 on page 203](#).
- 2 Disconnect and re-connect the power adapter to the WiMAX Device.
- 3 If the problem continues, contact your ISP.

[The Internet connection is slow or intermittent.](#)

- 1 The quality of the WiMAX Device's wireless connection to the base station may be poor. Poor signal reception may be improved by moving the WiMAX Device away from thick walls and other obstructions, or to a higher floor in your building.
- 2 There may be radio interference caused by nearby electrical devices such as microwave ovens and radio transmitters. Move the WiMAX Device away or switch the other devices off. Weather conditions may also affect signal quality.
- 3 There might be a lot of traffic on the network. Look at the LEDs, and check [Chapter 14 on page 203](#). If the WiMAX Device is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.
- 4 Disconnect and re-connect the power adapter to the WiMAX Device.
- 5 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

[The Internet connection disconnects.](#)

- 1 Check your WiMAX link and signal strength using the **Strength Indicator** LEDs on the device.
- 2 Contact your ISP if the problem persists.

13.4 Wireless Internet Access (for Models with WiFi)

What factors may cause intermittent or unstabled wireless connection? How can I solve this problem?

The following factors may cause interference:

- Obstacles: walls, ceilings, furniture, and so on.
- Building Materials: metal doors, aluminum studs.
- Electrical devices: microwaves, monitors, electric motors, cordless phones, and other wireless devices.

To optimize the speed and quality of your wireless connection, you can:

- Move your WiMAX Device closer to the AP if the signal strength is low.
- Reduce wireless interference that may be caused by other wireless networks or surrounding wireless electronics such as cordless phones.
- Place the AP where there are minimum obstacles (such as walls and ceilings) between the AP and the wireless client.
- Reduce the number of wireless clients connecting to the same AP simultaneously, or add additional APs if necessary.
- Try closing some programs that use the Internet, especially peer-to-peer applications. If the wireless client is sending or receiving a lot of information, it may have too many programs open that use the Internet.

13.5 Phone Calls and VoIP (for Models with Phone Ports)

The telephone port won't work or the telephone lacks a dial tone.

Check the telephone connections and telephone wire.

I can access the Internet, but cannot make VoIP calls.

- 1 The **PHONE** LED should come on. Make sure that your telephone is connected to the **PHONE** port.
- 2 You can also check the VoIP status in the **VoIP > Account > Status** screen.
- 3 Make sure your settings for your VoIP account are correct. If your phone still cannot work, contact your VoIP service provider to make sure the account is active.

13.6 Reset the WiMAX Device to Its Factory Defaults

If you forget your password or cannot access the Web Configurator, you will need to use the **Reset** button to reload the factory-default configuration file. This means that you will lose all configurations that you had previously and the password will be reset to **1234**.

You will lose all of your changes when you push the **Reset** button.

To reset the WiMAX Device,

- 1 Make sure the **Power LED** is on and not blinking.
- 2 Press and hold the **Reset** button for five to ten seconds. Release the **Reset** button when the **Power** LED begins to blink. The default settings have been restored.

If the WiMAX Device restarts automatically, wait for the WiMAX Device to finish restarting, and log in to the web configurator. The password is "1234".

If the WiMAX Device does not restart automatically, disconnect and reconnect the WiMAX Device's power. Then, follow the directions above again.

13.6.1 Pop-up Windows, JavaScript and Java Permissions

Please see [Appendix C on page 233](#).

Product Specifications

Table 102 LEDs Status for Indoor Device

LED	STATE	DESCRIPTION
	Off	The WiMAX Device is not receiving power.
	Red	The WiMAX Device is receiving power but has been unable to start up correctly or is not receiving enough power. See the Troubleshooting section for more information.
	Green	Solid: The WiMAX Device is receiving power and functioning correctly. Flashing: the device is self-testing (startup).
	Off	The WiMAX Device is not connected to a wireless (WiMAX) network.
	Green	The WiMAX Device is successfully connected to a wireless (WiMAX) network.
	Green (Blinking Slowly)	The WiMAX Device is searching for a wireless (WiMAX) network.
	Green (Blinking Quickly)	The WiMAX Device has found a wireless (WiMAX) network and is connecting.
	The Strength Indicator LEDs display the Interference-plus-Noise Ratio (CINR) of the wireless (WiMAX) connection.	
	No Signal LEDs On	There is no WiMAX connection.
	Signal 1 On	The signal strength is between -80dBm and -90dBm.
	Signal 1 and 2 On	The signal strength is between -70dBm and -80dBm.
	Signal 1, 2 and 3 On	The signal strength is greater than or equal to -70dBm.
Phone 1,2 (for models with VoIP feature) 	Off	No SIP account is registered, or the WiMAX Device is not receiving power.
	Green	A SIP account is registered.
	Green (Blinking)	A SIP account is registered, and the phone attached to the VoIP port is in use (off the hook).
	Yellow	A SIP account is registered and has a voice message on the SIP server.
	Yellow (Blinking)	A SIP account is registered and has a voice message on the SIP server, and the phone attached to the VoIP port is in use (off the hook).
WLAN (for models with WLAN feature) 	Off	The Wi-Fi network is not operational.
	Green	The Wi-Fi network is operational.
	Green (Blinking)	The WiMAX Device is sending and receiving data across the Wi-Fi network.

Table 103 LEDs Status for Outdoor Device

LED	STATE	DESCRIPTION
Strength Indicator	The Strength Indicator LEDs display the Received Signal Strength Indication (RSSI) of the wireless (WiMAX) connection.	
	5 Signal LEDs	The signal strength is greater than or equal to -50 dBm.
	4 Signal LEDs	The signal strength is between -50 and -60 dBm.
	3 Signal LEDs	The signal strength is between -60 and -70 dBm.
	2 Signal LEDs	The signal strength is between -70 and -80 dBm.
	1 Signal LED	The signal strength is between -80 and -90 dBm.
	0 Signal LEDs	The signal strength is less than -90 dBm.
Buzzer Behavior	The buzzer uses sound to alert users to the Received Signal Strength Indication (RSSI) of the wireless (WiMAX) connection.	
	5 Counts (5 sec.)	The signal strength is greater than or equal to -50 dBm.
	4 Counts (4 sec.)	The signal strength is between -50 and -60 dBm.
	3 Counts (3 sec.)	The signal strength is between -60 and -70 dBm.
	2 Counts (2 sec.)	The signal strength is between -70 and -80 dBm.
	1 Count (1 sec.)	The signal strength is between -80 and -90 dBm.
	0 Counts	The signal strength is less than -90 dBm.
Activity Indicator	Off	The WiMAX Device is not ready.
	Green	The WiMAX Device is connected to the network.
	Blinking	The WiMAX Device system is seeking a viable signal.

The following table is for models with VoIP feature.

Table 104 Voice Features

Call Park and Pickup	Call park and pickup lets you put a call on hold (park) and then continue the call (pickup). The caller must still pay while the call is parked. When you park the call, you enter a number of your choice (up to eight digits), which you must enter again when you pick up the call. If you do not enter the correct number, you cannot pickup the call. This means that only someone who knows the number you have chosen can pick up the call. You can have more than one call on hold at the same time, but you must give each call a different number.
Call Return	With call return, you can place a call to the last number that called you (either answered or missed). The last incoming call can be through either SIP or PSTN.
Country Code	Phone standards and settings differ from one country to another, so the settings on your WiMAX Device must be configured to match those of the country you are in. The country code feature allows you to do this by selecting the country from a list rather than changing each setting manually. Configure the country code feature when you move the WiMAX Device from one country to another.
Do not Disturb (DnD)	This feature allows you to set your phone not to ring when someone calls you. You can set each phone independently using its keypad, or configure global settings for all phones using the command line interpreter.
Auto Dial	You can set the WiMAX Device to automatically dial a specified number immediately whenever you lift a phone off the hook. Use the Web Configurator to set the specified number. Use the command line interpreter to have the WiMAX Device wait a specified length of time before dialing the number.

Table 104 Voice Features

Phone config	The phone configuration table allows you to customize the phone keypad combinations you use to access certain features on the WiMAX Device, such as call waiting, call return, call forward, etc. The phone configuration table is configurable in command interpreter mode.
Firmware update enable / disable	If your service provider uses this feature, you hear a recorded message when you pick up the phone when new firmware is available for your WiMAX Device. Enter *99# in your phone's keypad to have the WiMAX Device upgrade the firmware, or enter #99# to not upgrade. If your service provider gave you different numbers to use, enter them instead. If you enter the code to not upgrade, you can make a call as normal. You will hear the recording again each time you pick up the phone, until you upgrade.
Call waiting	This feature allows you to hear an alert when you are already using the phone and another person calls you. You can then either reject the new incoming call, put your current call on hold and receive the new incoming call, or end the current call and receive the new incoming call.
Call forwarding	With this feature, you can set the WiMAX Device to forward calls to a specified number, either unconditionally (always), when your number is busy, or when you do not answer. You can also forward incoming calls from one specified number to another.
Caller ID	The WiMAX Device supports caller ID, which allows you to see the originating number of an incoming call (on a phone with a suitable display).
REN	A Ringer Equivalence Number (REN) is used to determine the number of devices (like telephones or fax machines) that may be connected to the telephone line. Your device has a REN of three, so it can support three devices per telephone port.
QoS (Quality of Service)	Quality of Service (QoS) mechanisms help to provide better service on a per-flow basis. Your device supports Type of Service (ToS) tagging and Differentiated Services (DiffServ) tagging. This allows the device to tag voice frames so they can be prioritized over the network.
SIP ALG	Your device is a SIP Application Layer Gateway (ALG). It allows VoIP calls to pass through NAT for devices behind it (such as a SIP-based VoIP software application on a computer).
Other Voice Features	SIP version 2 (Session Initiating Protocol RFC 3261) SDP (Session Description Protocol RFC 2327) RTP (RFC 1889) RTCP (RFC 1890) Voice codecs (coder/decoders) G.711, G.726, G.729 Fax and data modem discrimination DTMF Detection and Generation DTMF: In-band and Out-band traffic (RFC 2833),(PCM), (SIP INFO) Point-to-point call establishment between two IADs Quick dialing through predefined phone book, which maps the phone dialing number and destination URL. Flexible Dial Plan (RFC3525 section 7.1.14)

Table 105 Star (*) and Pound (#) Code Support

*0	Wireless Operator Services
*2	Customer Care Access
*66	Repeat Dialing
*67	Plus the 10 digit phone number to block Caller ID on a single call basis

Table 105 Star (*) and Pound (#) Code Support

*69	Return last call received
*70	Followed by the 10 digit phone number to cancel Call Waiting on a single call basis
*72	Activate Call Forwarding (*72 followed by the 10 digit phone number that is requesting call forwarding service)
*720	Activate Call Forwarding (*720 followed by the 10 digit phone number that is requesting deactivation of call forwarding service)
*73	Plus the forward to phone number to activate Call Forwarding No Answer (no VM service plan)
*730	Deactivate Call Forwarding No Answer
*740	Plus the forward to phone number to activate Call Forwarding Busy (no VM service plan)
*911/911	Emergency phone number (same as dialing 911)
*411/411	Wireless Information Services

Note: To take full advantage of the supplementary phone services available through the WiMAX Device's phone port, you may need to subscribe to the services from your voice account service provider.

Not all features are supported by all service providers. Consult your service provider for more information.

WiMAX Security

Wireless security is vital to protect your wireless communications. Without it, information transmitted over the wireless network would be accessible to any networking device within range.

User Authentication and Data Encryption

The WiMAX (IEEE 802.16) standard employs user authentication and encryption to ensure secured communication at all times.

User authentication is the process of confirming a user's identity and level of authorization. Data encryption is the process of encoding information so that it cannot be read by anyone who does not know the code.

WiMAX uses PKMv2 (Privacy Key Management version 2) for authentication, and CCMP (Counter Mode with Cipher Block Chaining Message Authentication Protocol) for data encryption.

WiMAX supports EAP (Extensible Authentication Protocol, RFC 2486) which allows additional authentication methods to be deployed with no changes to the base station or the mobile or subscriber stations.

PKMv2

PKMv2 is a procedure that allows authentication of a mobile or subscriber station and negotiation of a public key to encrypt traffic between the MS/SS and the base station. PKMv2 uses standard EAP methods such as Transport Layer Security (EAP-TLS) or Tunneled TLS (EAP-TTLS) for secure communication.

In cryptography, a 'key' is a piece of information, typically a string of random numbers and letters, that can be used to 'lock' (encrypt) or 'unlock' (decrypt) a message. Public key encryption uses key pairs, which consist of a public (freely available) key and a private (secret) key. The public key is used for encryption and the private key is used for decryption. You can decrypt a message only if you have the private key. Public key certificates (or 'digital IDs') allow users to verify each other's identity.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The base station is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication
Determines the identity of the users.

- Authorization

Determines the network services available to authenticated users once they are connected to the network.

- Accounting

Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your base station acts as a message relay between the MS/SS and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the base station and the RADIUS server for user authentication:

- Access-Request

Sent by an base station requesting authentication.

- Access-Reject

Sent by a RADIUS server rejecting access.

- Access-Accept

Sent by a RADIUS server allowing access.

- Access-Challenge

Sent by a RADIUS server requesting more information in order to allow access. The base station sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the base station and the RADIUS server for user accounting:

- Accounting-Request

Sent by the base station requesting accounting.

- Accounting-Response

Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Diameter

Diameter (RFC 3588) is a type of AAA server that provides several improvements over RADIUS in efficiency, security, and support for roaming.

Security Association

The set of information about user authentication and data encryption between two computers is known as a security association (SA). In a WiMAX network, the process of security association has three stages.

- Authorization request and reply

The MS/SS presents its public certificate to the base station. The base station verifies the certificate and sends an authentication key (AK) to the MS/SS.

- Key request and reply

The MS/SS requests a transport encryption key (TEK) which the base station generates and encrypts using the authentication key.

- Encrypted traffic

The MS/SS decrypts the TEK (using the authentication key). Both stations can now securely encrypt and decrypt the data flow.

CCMP

All traffic in a WiMAX network is encrypted using CCMP (Counter Mode with Cipher Block Chaining Message Authentication Protocol). CCMP is based on the 128-bit Advanced Encryption Standard (AES) algorithm.

'Counter mode' refers to the encryption of each block of plain text with an arbitrary number, known as the counter. This number changes each time a block of plain text is encrypted. Counter mode avoids the security weakness of repeated identical blocks of encrypted text that makes encrypted data vulnerable to pattern-spotting.

'Cipher Block Chaining Message Authentication' (also known as CBC-MAC) ensures message integrity by encrypting each block of plain text in such a way that its encryption is dependent on the block before it. This series of 'chained' blocks creates a message authentication code (MAC or CMAC) that ensures the encrypted data has not been tampered with.

Authentication

The WiMAX Device supports EAP-TTLS authentication.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection (with EAP-TLS digital certifications are needed by both the server and the wireless clients for mutual authentication). Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

Importing Certificates

This appendix shows you how to import public key certificates into your web browser.

Public key certificates are used by web browsers to ensure that a secure web site is legitimate. When a certificate authority such as VeriSign, Comodo, or Network Solutions, to name a few, receives a certificate request from a website operator, they confirm that the web domain and contact information in the request match those on public record with a domain name registrar. If they match, then the certificate is issued to the website operator, who then places it on the site to be issued to all visiting web browsers to let them know that the site is legitimate.

Many ZyXEL products issue their own public key certificates. These can be used by web browsers on a LAN or WAN to verify that they are in fact connecting to the legitimate device and not one masquerading as it. However, because the certificates were not issued by one of the several organizations officially recognized by the most common web browsers, you will need to import the ZyXEL-created certificate into your web browser and flag that certificate as a trusted authority.

Note: You can see if you are browsing on a secure website if the URL in your web browser's address bar begins with `https://` or there is a sealed padlock icon () somewhere in the main browser window (not all browsers show the padlock in the same location.)

In this appendix, you can import a public key certificate for:

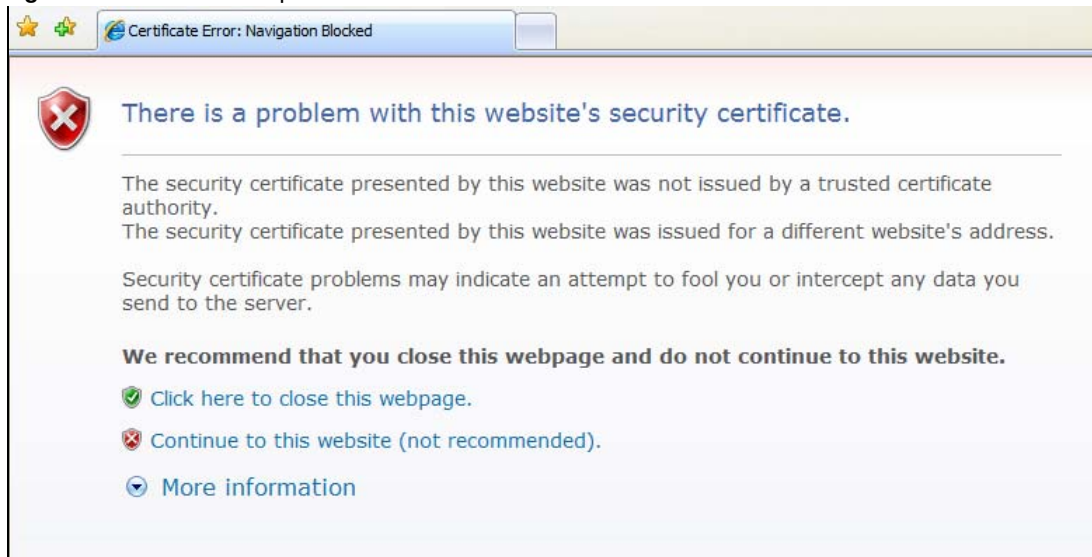
- Internet Explorer on [page 212](#)
- Firefox on [page 220](#)
- Opera on [page 225](#)
- Konqueror on [page 232](#)

Internet Explorer

The following example uses Microsoft Internet Explorer 7 on Windows XP Professional; however, they can also apply to Internet Explorer on Windows Vista.

- 1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.

Figure 126 Internet Explorer 7: Certification Error



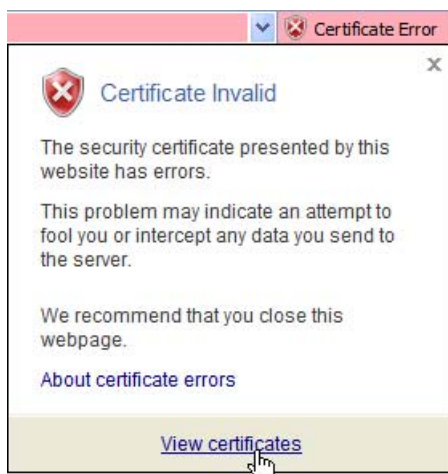
- 2 Click **Continue to this website (not recommended)**.

Figure 127 Internet Explorer 7: Certification Error



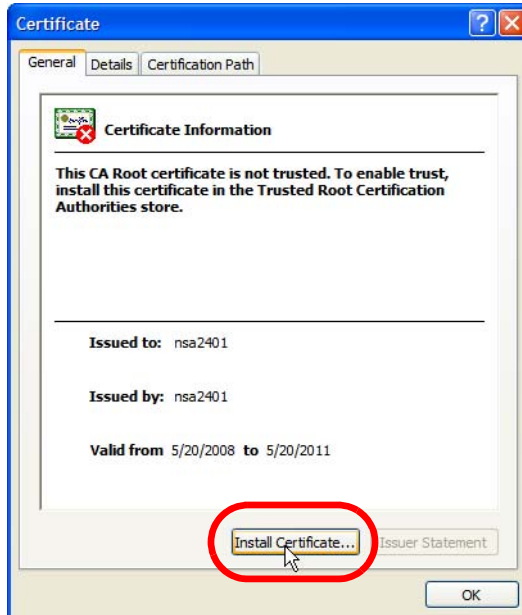
- 3 In the **Address Bar**, click **Certificate Error > View certificates**.

Figure 128 Internet Explorer 7: Certificate Error



- 4 In the **Certificate** dialog box, click **Install Certificate**.

Figure 129 Internet Explorer 7: Certificate



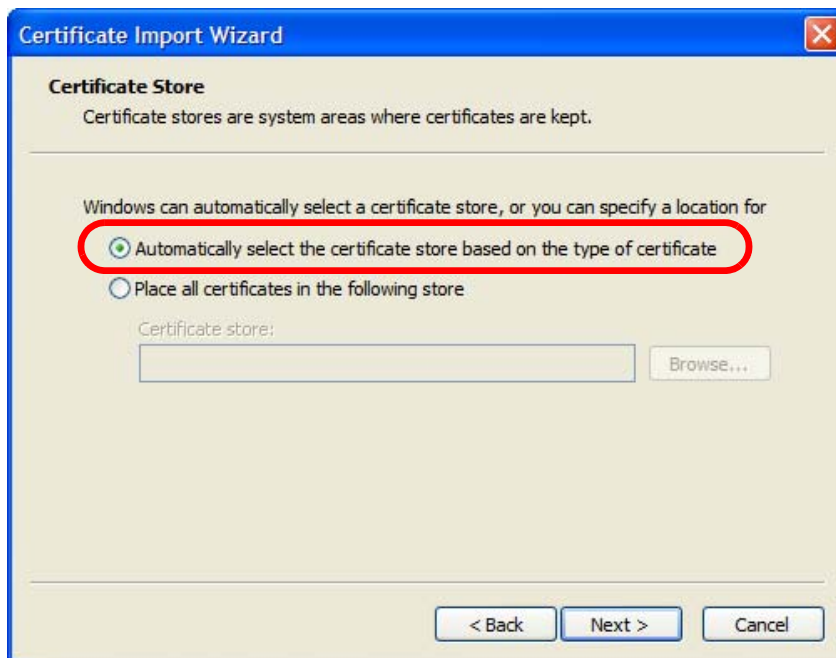
- 5 In the **Certificate Import Wizard**, click **Next**.

Figure 130 Internet Explorer 7: Certificate Import Wizard



- 6 If you want Internet Explorer to **Automatically select certificate store based on the type of certificate**, click **Next** again and then go to step 9.

Figure 131 Internet Explorer 7: Certificate Import Wizard



- 7 Otherwise, select **Place all certificates in the following store** and then click **Browse**.

Figure 132 Internet Explorer 7: Certificate Import Wizard



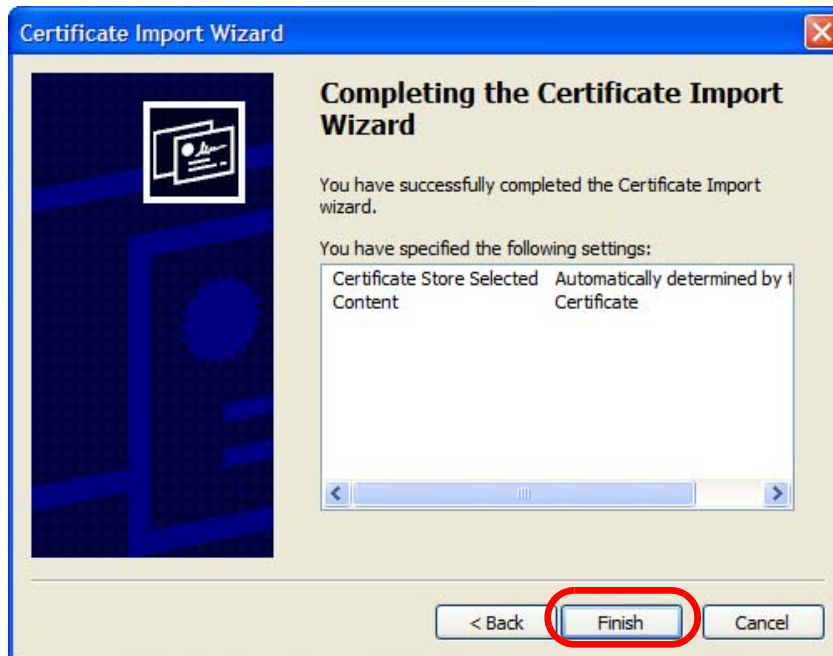
- 8 In the **Select Certificate Store** dialog box, choose a location in which to save the certificate and then click **OK**.

Figure 133 Internet Explorer 7: Select Certificate Store



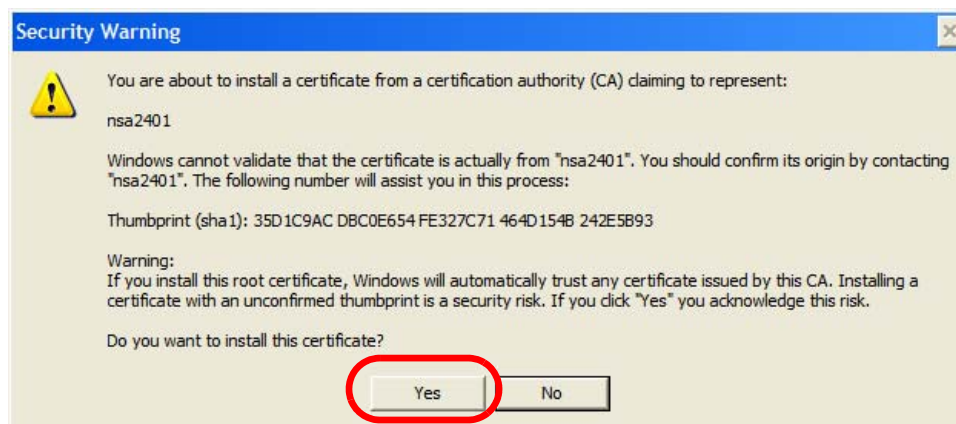
- 9 In the **Completing the Certificate Import Wizard** screen, click **Finish**.

Figure 134 Internet Explorer 7: Certificate Import Wizard



- 10 If you are presented with another **Security Warning**, click **Yes**.

Figure 135 Internet Explorer 7: Security Warning



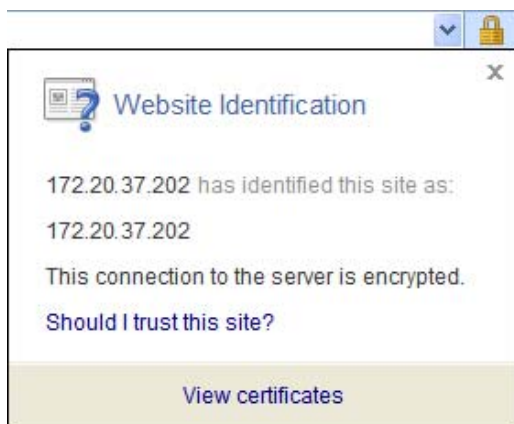
- 11 Finally, click **OK** when presented with the successful certificate installation message.

Figure 136 Internet Explorer 7: Certificate Import Wizard



- 12 The next time you start Internet Explorer and go to a ZyXEL web configurator page, a sealed padlock icon appears in the address bar. Click it to view the page's **Website Identification** information.

Figure 137 Internet Explorer 7: Website Identification



Installing a Stand-Alone Certificate File in Internet Explorer

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

- 1 Double-click the public key certificate file.

Figure 138 Internet Explorer 7: Public Key Certificate File



- 2 In the security warning dialog box, click **Open**.

Figure 139 Internet Explorer 7: Open File - Security Warning



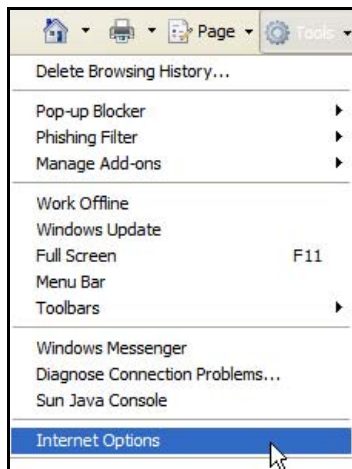
- 3 Refer to steps 4-12 in the Internet Explorer procedure beginning on [page 212](#) to complete the installation process.

Removing a Certificate in Internet Explorer

This section shows you how to remove a public key certificate in Internet Explorer 7.

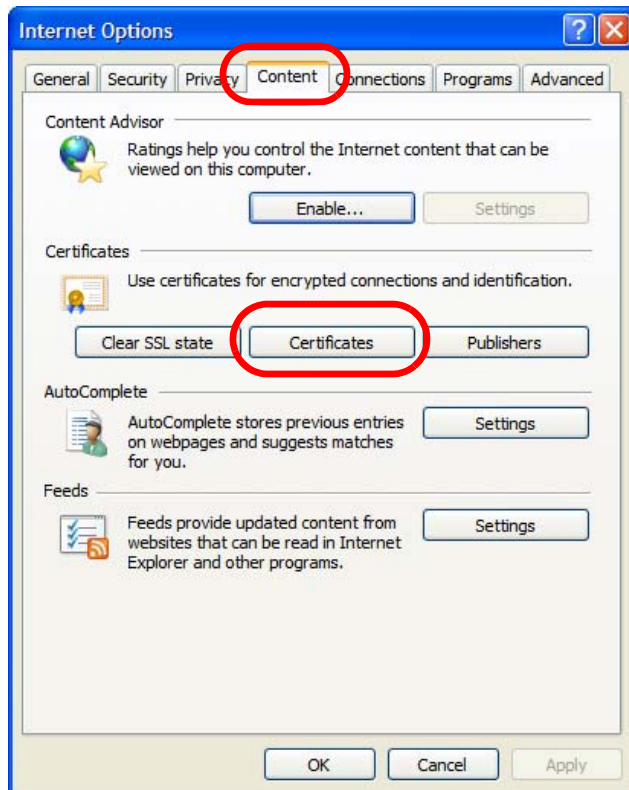
- 1 Open **Internet Explorer** and click **TOOLS > Internet Options**.

Figure 140 Internet Explorer 7: Tools Menu



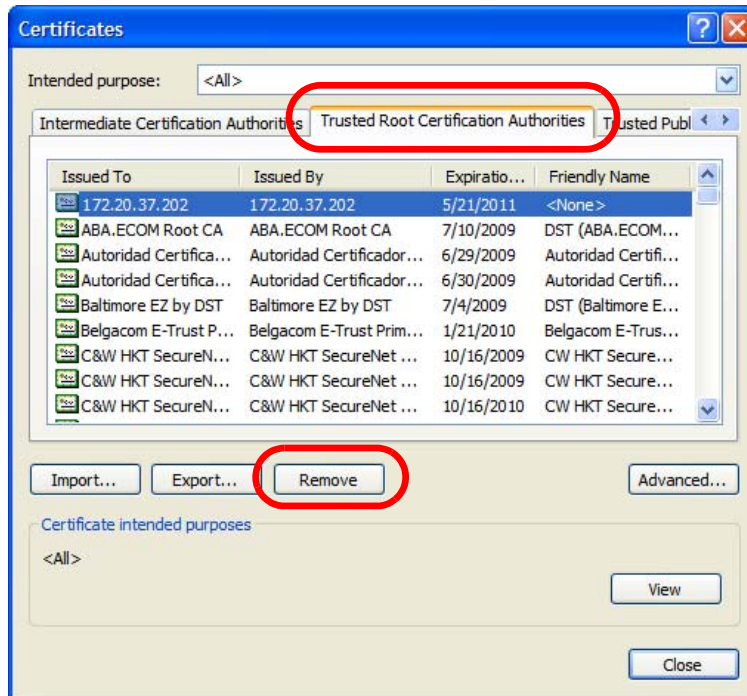
- 2 In the **Internet Options** dialog box, click **Content > Certificates**.

Figure 141 Internet Explorer 7: Internet Options



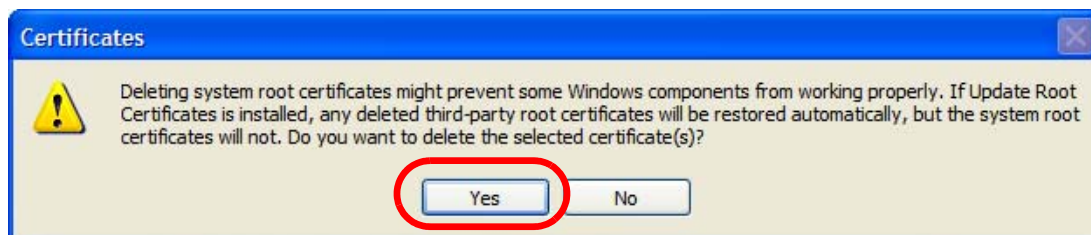
- 3 In the **Certificates** dialog box, click the **Trusted Root Certificates Authorities** tab, select the certificate that you want to delete, and then click **Remove**.

Figure 142 Internet Explorer 7: Certificates



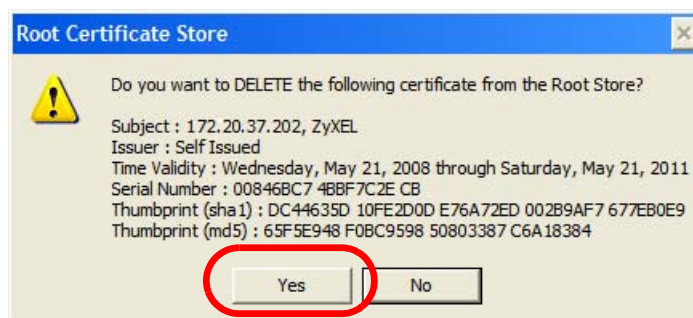
- 4 In the **Certificates** confirmation, click **Yes**.

Figure 143 Internet Explorer 7: Certificates



- 5 In the **Root Certificate Store** dialog box, click **Yes**.

Figure 144 Internet Explorer 7: Root Certificate Store



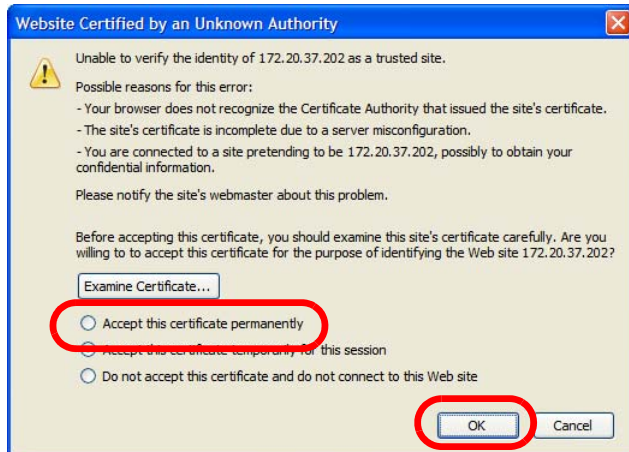
- 6 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Firefox

The following example uses Mozilla Firefox 2 on Windows XP Professional; however, the screens can also apply to Firefox 2 on all platforms.

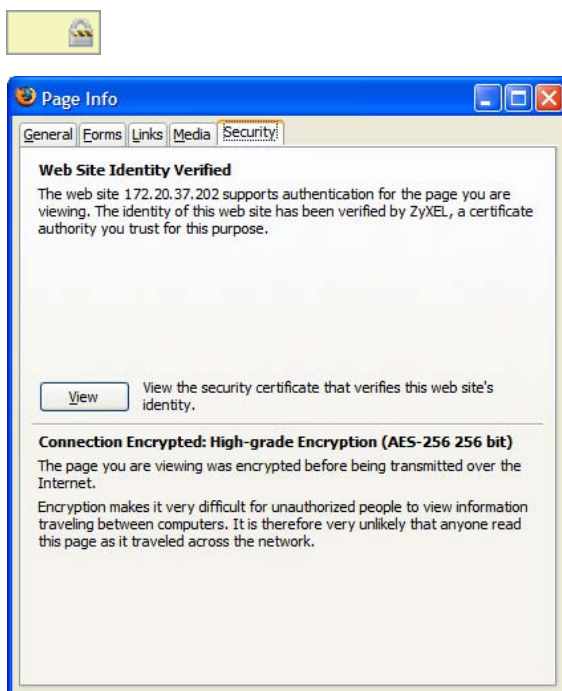
- 1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.
- 2 Select **Accept this certificate permanently** and click **OK**.

Figure 145 Firefox 2: Website Certified by an Unknown Authority



- 3 The certificate is stored and you can now connect securely to the web configurator. A sealed padlock appears in the address bar, which you can click to open the **Page Info > Security** window to view the web page's security information.

Figure 146 Firefox 2: Page Info

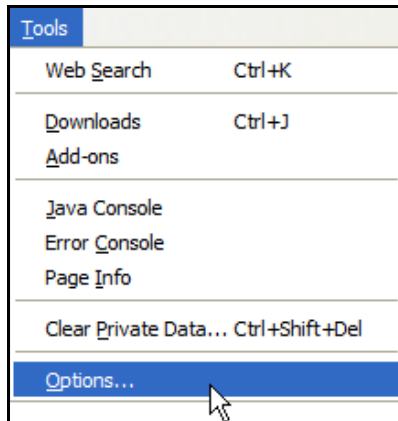


Installing a Stand-Alone Certificate File in Firefox

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

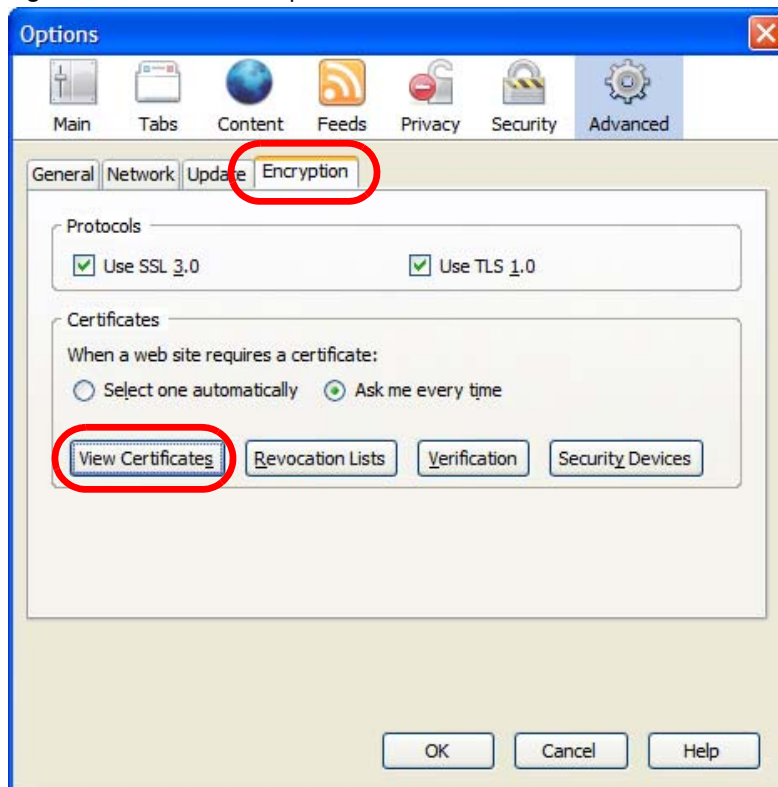
- 1 Open **Firefox** and click **TOOLS > Options**.

Figure 147 Firefox 2: Tools Menu



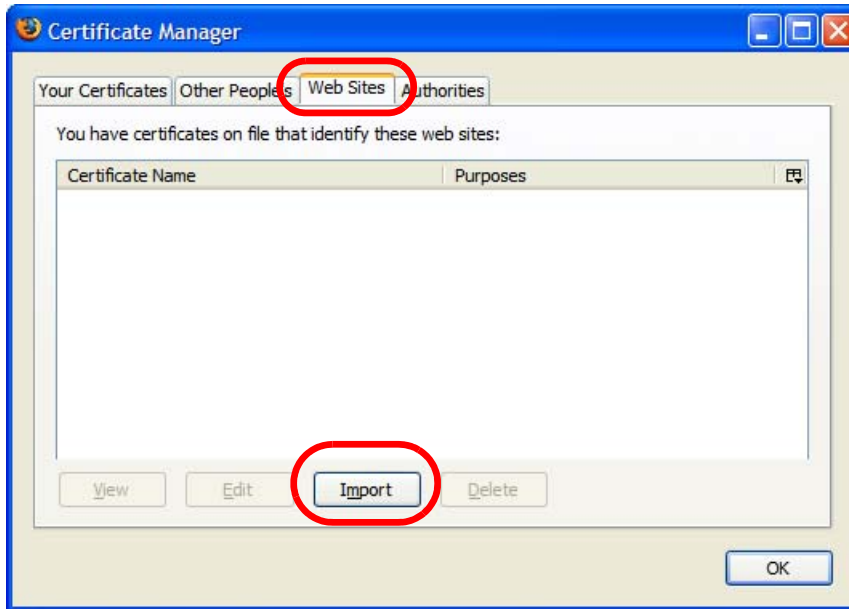
- 2 In the **Options** dialog box, click **ADVANCED > Encryption > View Certificates**.

Figure 148 Firefox 2: Options



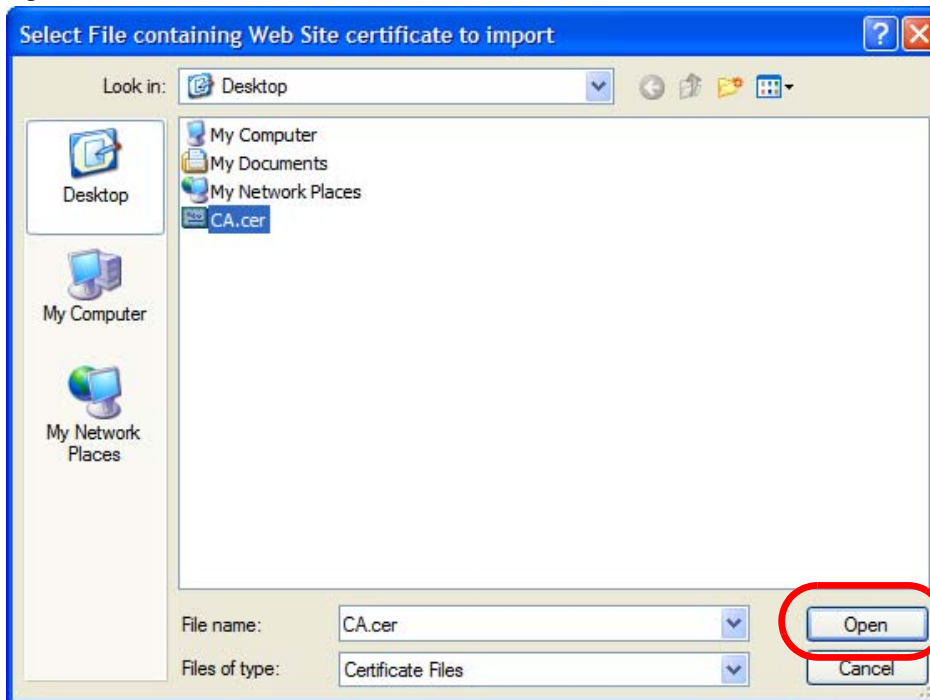
- 3 In the **Certificate Manager** dialog box, click **Web Sites > Import**.

Figure 149 Firefox 2: Certificate Manager



- 4 Use the **Select File** dialog box to locate the certificate and then click **Open**.

Figure 150 Firefox 2: Select File



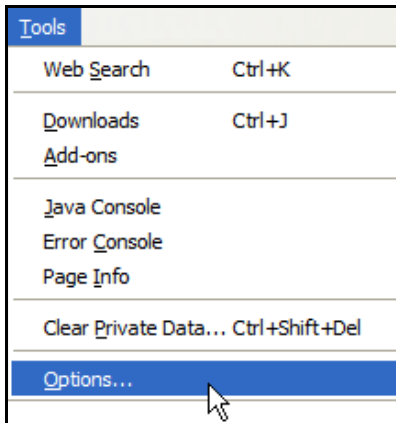
- 5 The next time you visit the web site, click the padlock in the address bar to open the **Page Info > Security** window to see the web page's security information.

Removing a Certificate in Firefox

This section shows you how to remove a public key certificate in Firefox 2.

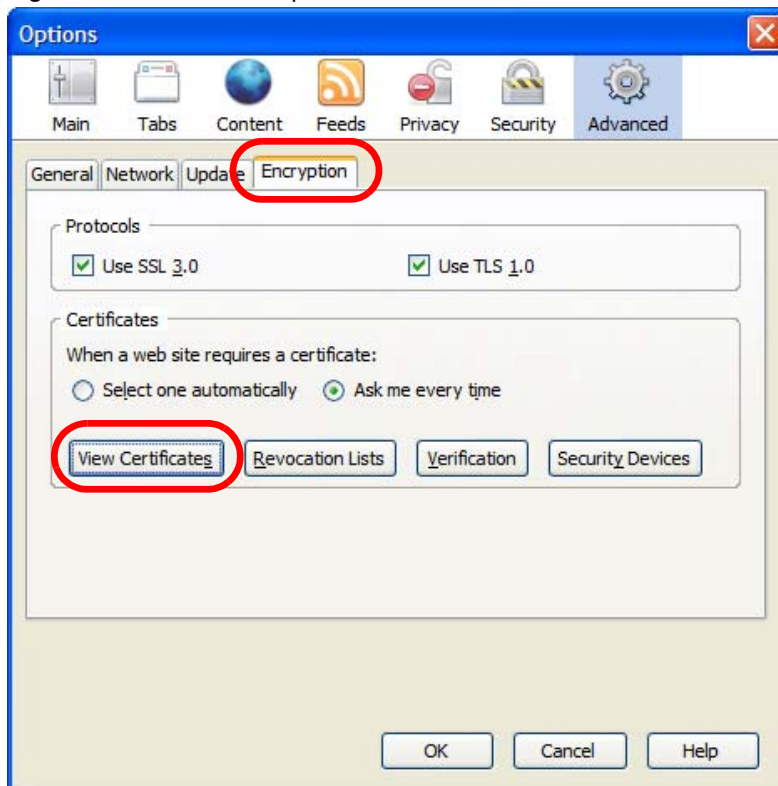
- 1 Open **Firefox** and click **TOOLS > Options**.

Figure 151 Firefox 2: Tools Menu



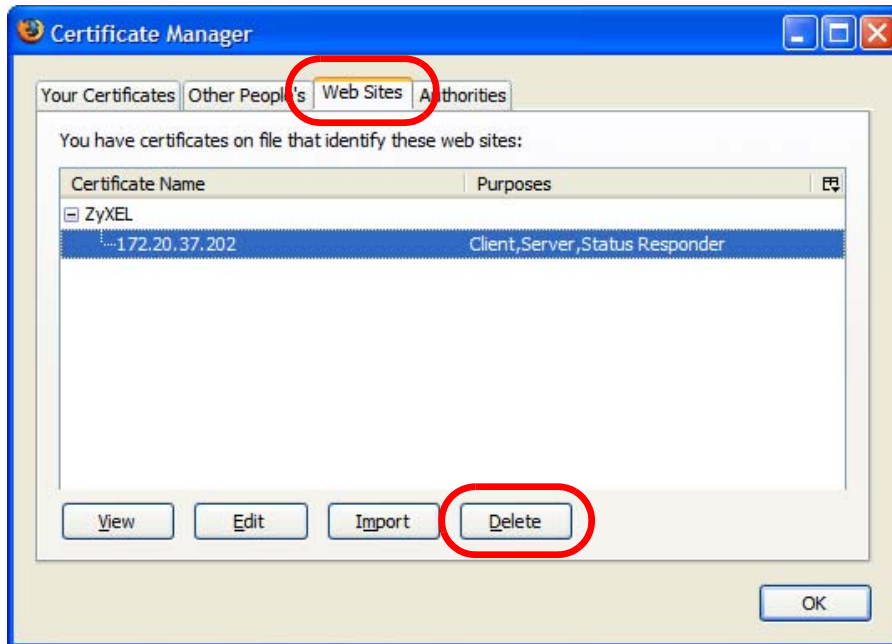
- 2 In the **Options** dialog box, click **ADVANCED > Encryption > View Certificates**.

Figure 152 Firefox 2: Options



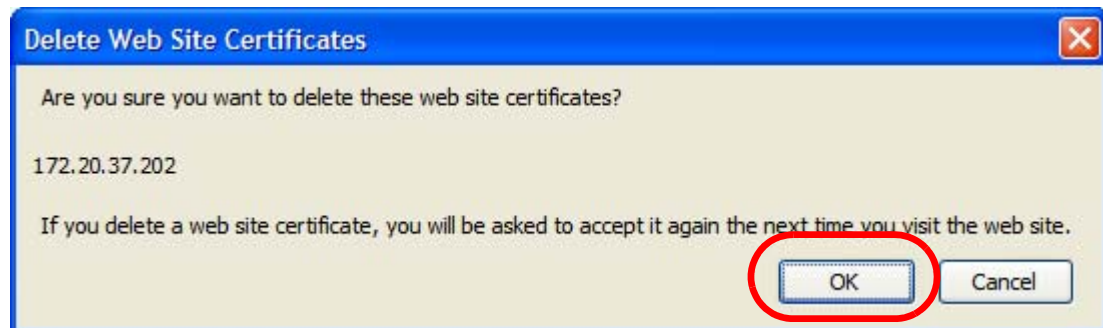
- 3 In the **Certificate Manager** dialog box, select the **Web Sites** tab, select the certificate that you want to remove, and then click **Delete**.

Figure 153 Firefox 2: Certificate Manager



- 4 In the **Delete Web Site Certificates** dialog box, click **OK**.

Figure 154 Firefox 2: Delete Web Site Certificates



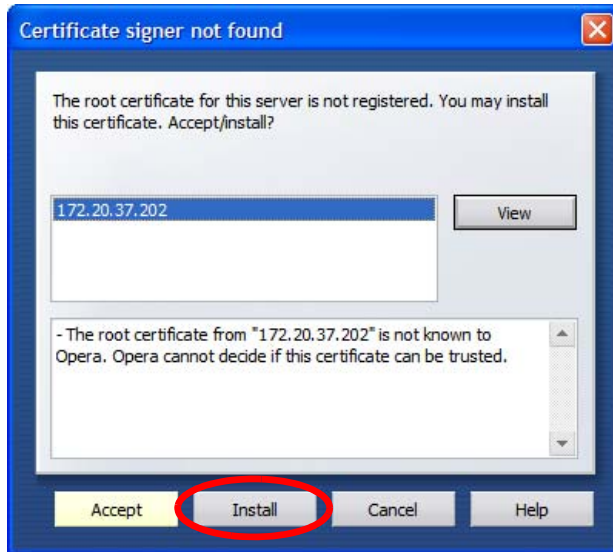
- 5 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Opera

The following example uses Opera 9 on Windows XP Professional; however, the screens can apply to Opera 9 on all platforms.

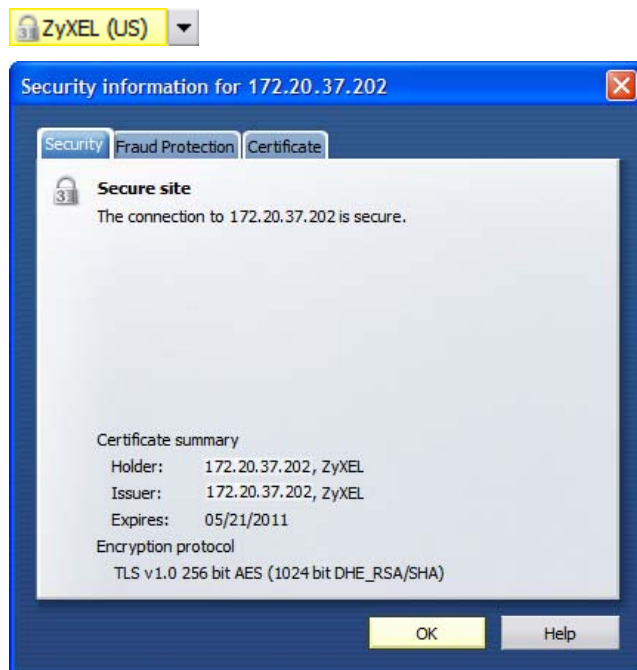
- 1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.
- 2 Click **Install** to accept the certificate.

Figure 155 Opera 9: Certificate signer not found



- 3 The next time you visit the web site, click the padlock in the address bar to open the **Security information** window to view the web page's security details.

Figure 156 Opera 9: Security information

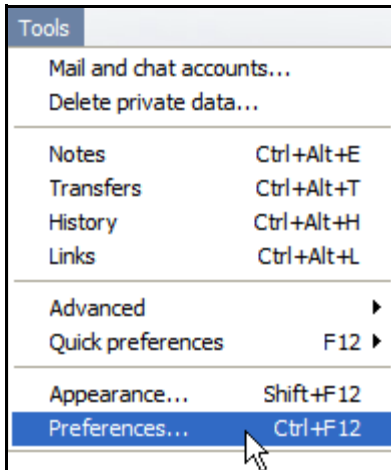


Installing a Stand-Alone Certificate File in Opera

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

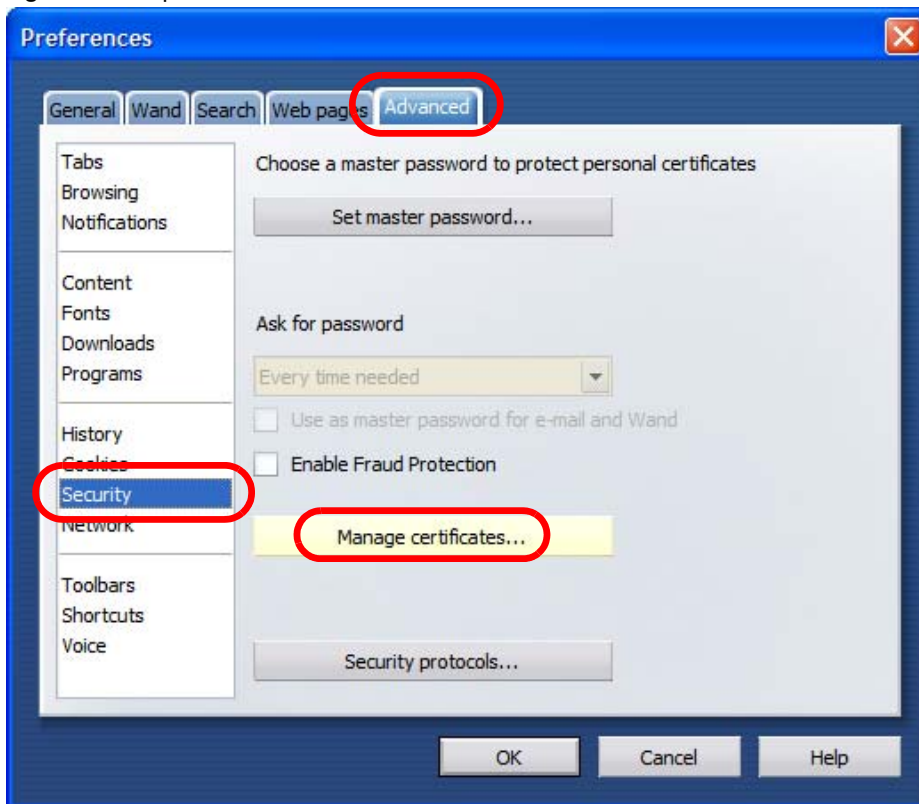
- 1 Open **Opera** and click **TOOLS > Preferences**.

Figure 157 Opera 9: Tools Menu



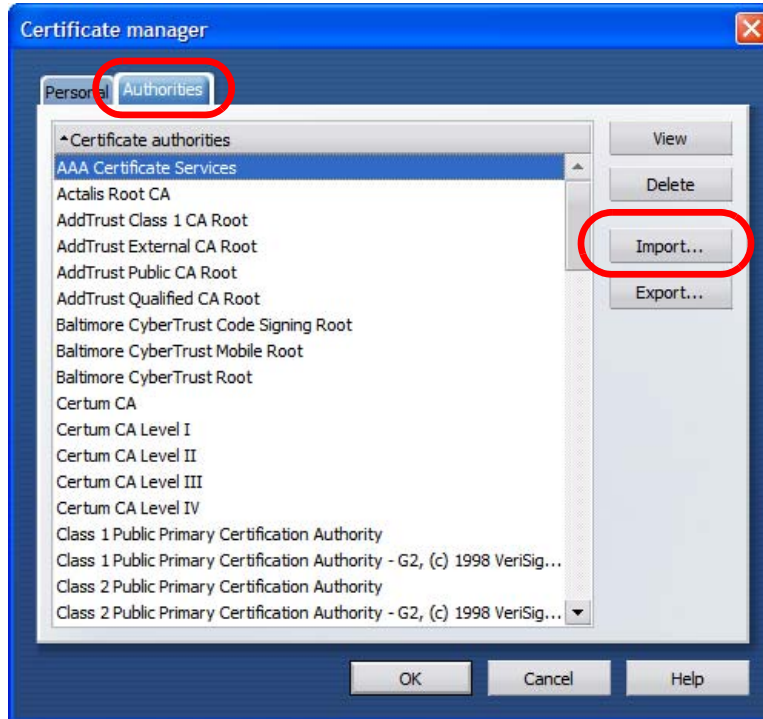
- 2 In **Preferences**, click **ADVANCED > Security > Manage certificates**.

Figure 158 Opera 9: Preferences



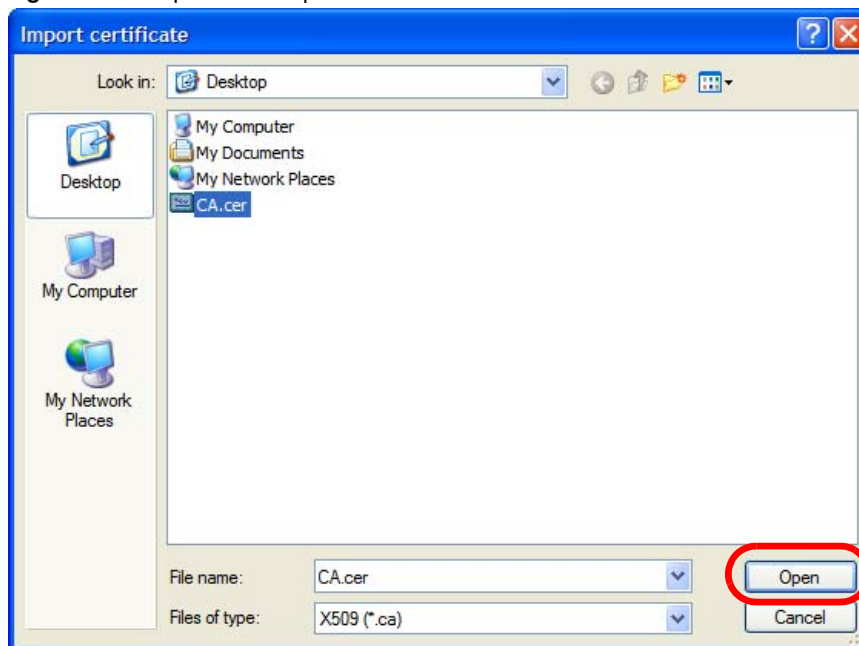
- 3 In the **Certificates Manager**, click **Authorities > Import**.

Figure 159 Opera 9: Certificate manager



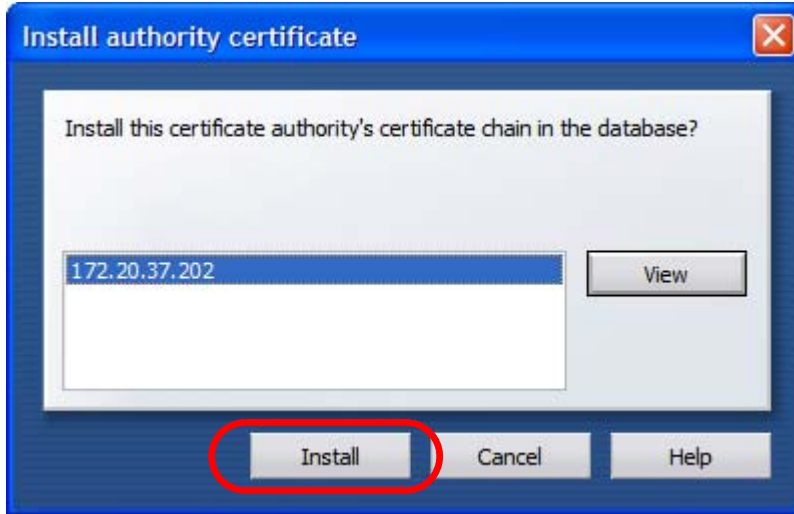
- 4 Use the **Import certificate** dialog box to locate the certificate and then click **Open**.

Figure 160 Opera 9: Import certificate



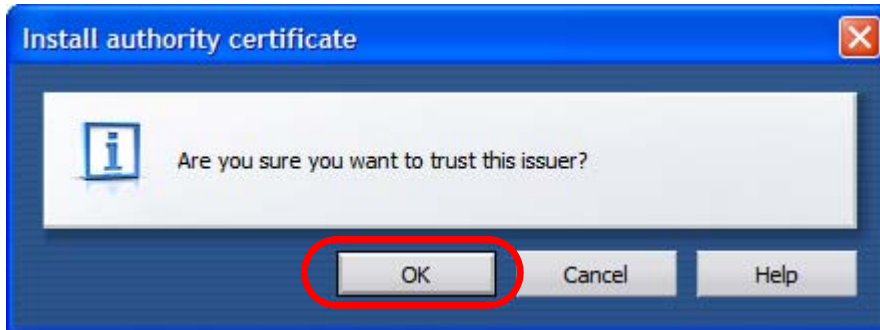
- 5 In the **Install authority certificate** dialog box, click **Install**.

Figure 161 Opera 9: Install authority certificate



- 6 Next, click **OK**.

Figure 162 Opera 9: Install authority certificate



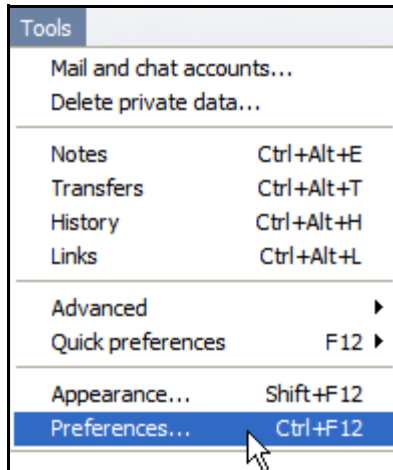
- 7 The next time you visit the web site, click the padlock in the address bar to open the **Security information** window to view the web page's security details.

Removing a Certificate in Opera

This section shows you how to remove a public key certificate in Opera 9.

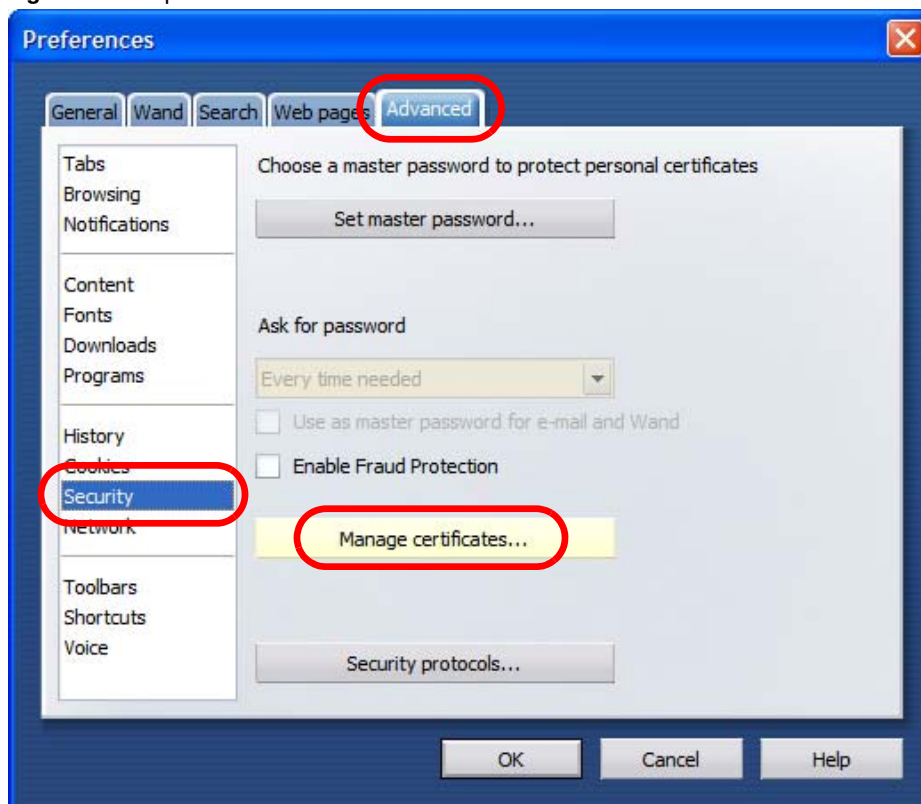
- 1 Open **Opera** and click **TOOLS > Preferences**.

Figure 163 Opera 9: Tools Menu



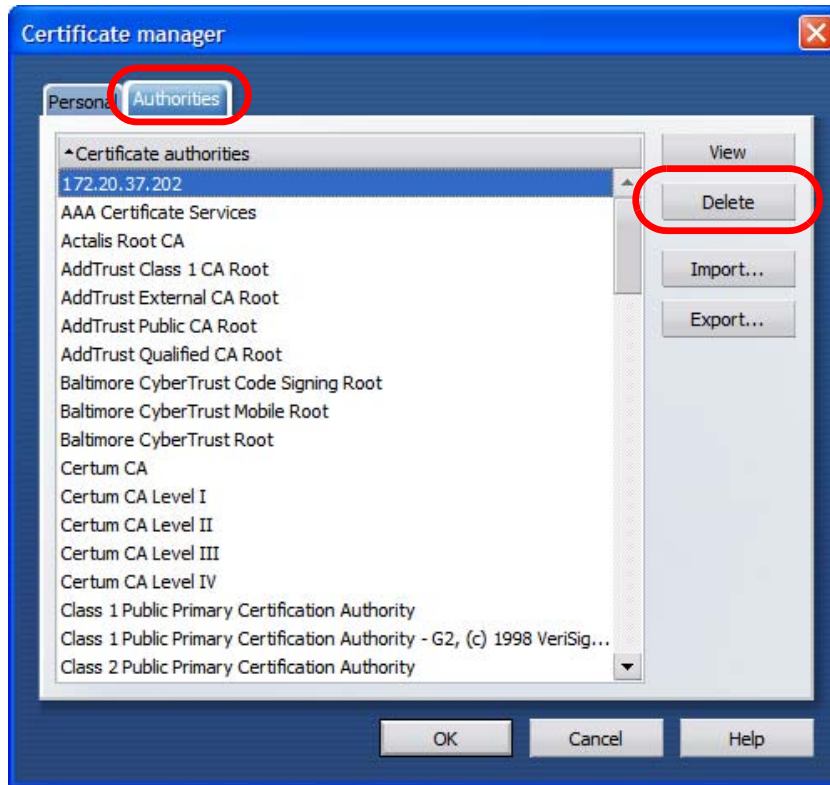
- 2 In **Preferences**, **ADVANCED > Security > Manage certificates**.

Figure 164 Opera 9: Preferences



- 3 In the **Certificates manager**, select the **Authorities** tab, select the certificate that you want to remove, and then click **Delete**.

Figure 165 Opera 9: Certificate manager



- 4 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Note: There is no confirmation when you delete a certificate authority, so be absolutely certain that you want to go through with it before clicking the button.

Konqueror

The following example uses Konqueror 3.5 on openSUSE 10.3, however the screens apply to Konqueror 3.5 on all Linux KDE distributions.

- 1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.
- 2 Click **Continue**.

Figure 166 Konqueror 3.5: Server Authentication



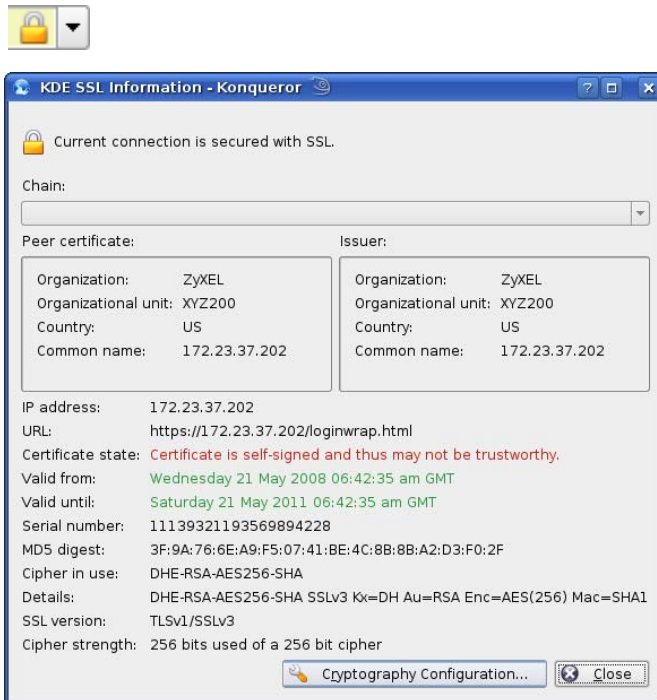
- 3 Click **Forever** when prompted to accept the certificate.

Figure 167 Konqueror 3.5: Server Authentication



- 4 Click the padlock in the address bar to open the **KDE SSL Information** window and view the web page's security details.

Figure 168 Konqueror 3.5: KDE SSL Information



Installing a Stand-Alone Certificate File in Konqueror

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

- 1 Double-click the public key certificate file.

Figure 169 Konqueror 3.5: Public Key Certificate File



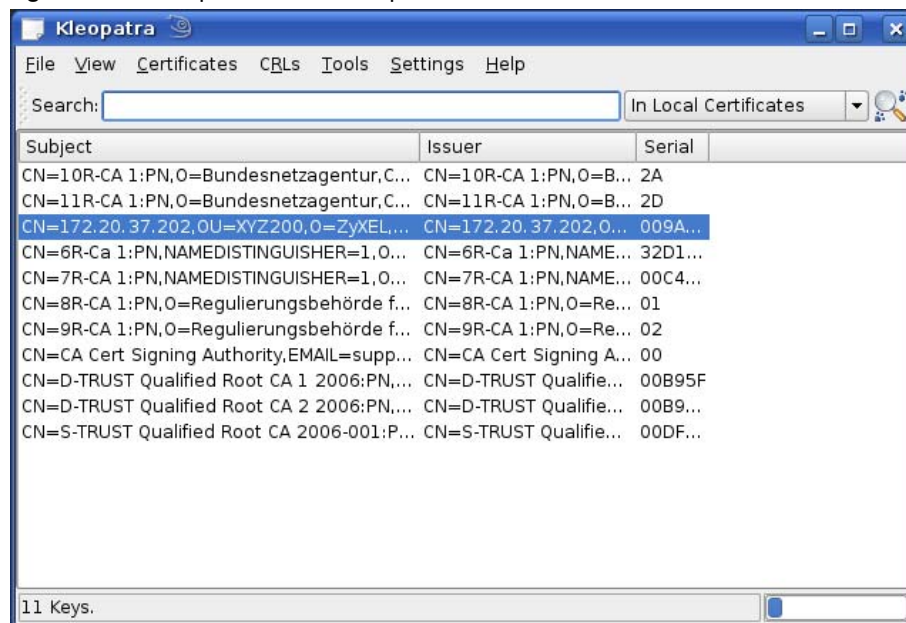
- 2 In the **Certificate Import Result - Kleopatra** dialog box, click **OK**.

Figure 170 Konqueror 3.5: Certificate Import Result



The public key certificate appears in the KDE certificate manager, **Kleopatra**.

Figure 171 Konqueror 3.5: Kleopatra



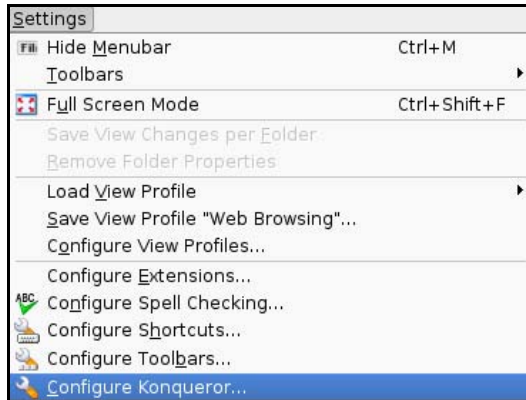
- 3 The next time you visit the web site, click the padlock in the address bar to open the **KDE SSL Information** window to view the web page's security details.

Removing a Certificate in Konqueror

This section shows you how to remove a public key certificate in Konqueror 3.5.

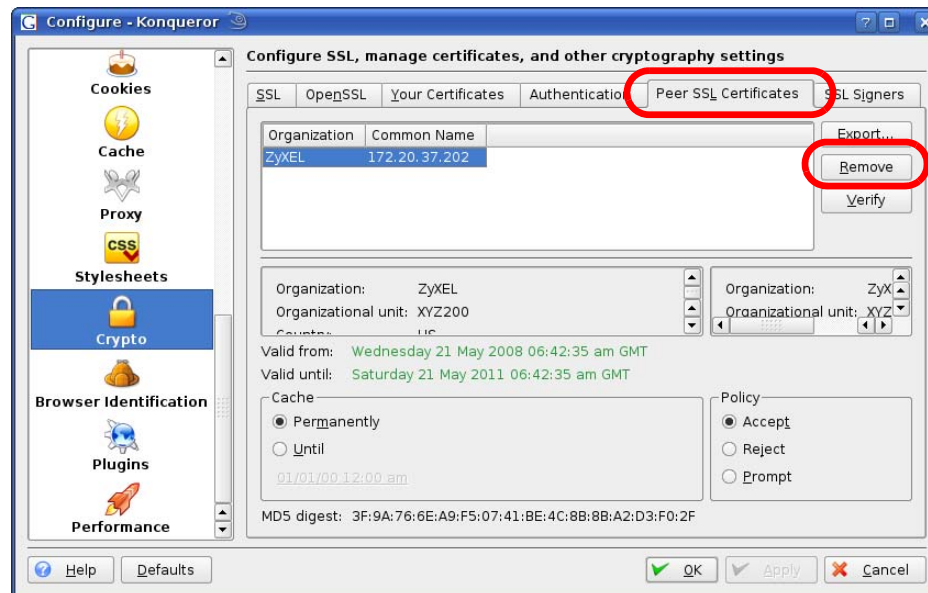
- 1 Open **Konqueror** and click **Settings > Configure Konqueror**.

Figure 172 Konqueror 3.5: Settings Menu



- 2 In the **Configure** dialog box, select **Crypto**.
- 3 On the **Peer SSL Certificates** tab, select the certificate you want to delete and then click **Remove**.

Figure 173 Konqueror 3.5: Configure



- 4 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Note: There is no confirmation when you remove a certificate authority, so be absolutely certain you want to go through with it before clicking the button.

Common Services

The following table lists some commonly-used services and their associated protocols and port numbers. For a comprehensive list of port numbers, ICMP type/code numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

- **Name:** This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol:** This is the type of IP protocol used by the service. If this is **TCP / UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s):** This value depends on the **Protocol**. Please refer to RFC 1700 for further information about port numbers.
 - If the **Protocol** is **TCP, UDP, or TCP / UDP**, this is the IP port number.
 - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description:** This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 106 Commonly Used Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM/New-ICQ	TCP	5190	AOL's Internet Messenger service. It is also used as a listening port by ICQ.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for example www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.

Table 106 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic or routing purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet Internet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	Simple File Transfer Protocol.

Table 106 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP	7000	Another videoconferencing solution.

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English	Hereby, ZyXEL declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
[Spanish]	Por medio de la presente ZyXEL declara que el equipo cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
[Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ ΖΥΧΕΛ ΔΗΛΩΝΕΙ ΟΤΙ ΕΞΟΠΛΙΣΜΟΣ ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕC.
[French]	Par la présente ZyXEL déclare que l'appareil équipements est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/EC.

[Italian]	Con la presente ZyXEL dichiara che questo attrezzatura è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
[Latvian]	Ar šo ZyXEL deklarē, ka iekārtas atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
[Lithuanian]	Šiuo ZyXEL deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
[Dutch]	Hierbij verklaart ZyXEL dat het toestel uitrusting in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EC.
[Maltese]	Hawnhekk, ZyXEL, jiddikjara li dan tagħmir jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn rilevanti li hemm fid-Dirrettiva 1999/5/EC.
[Hungarian]	Alulírott, ZyXEL nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EK irányelv egyéb előírásainak.
[Polish]	Niniejszym ZyXEL oświadcza, że sprzęt jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
[Portuguese]	ZyXEL declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/EC.
[Slovenian]	ZyXEL izjavlja, da je ta oprema v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/EC.
[Slovak]	ZyXEL týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/EC.
[Finnish]	ZyXEL vakuuttaa täten että laitteet tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
[Swedish]	Härmed intygar ZyXEL att denna utrustning står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EC.
[Bulgarian]	С настоящото ZyXEL декларира, че това оборудване е в съответствие със съществените изисквания и другите приложими разпоредбите на Директива 1999/5/EC.

[Icelandic]	Hér með lýsir, ZyXEL því yfir að þessi búnaður er í samræmi við grunnkröfur og önnur viðeigandi ákvæði tilskipunar 1999/5/EC.
[Norwegian]	Erklærer herved ZyXEL at dette utstyret er i samsvar med de grunnleggende kravene og andre relevante bestemmelser i direktiv 1999/5/EF.
[Romanian]	Prin prezenta, ZyXEL declară că acest echipament este în conformitate cu cerințele esențiale și alte prevederi relevante ale Directivei 1999/5/EC.



National Restrictions

This product may be used in all EU countries (and other countries following the EU directive 1999/5/EC) without any limitation except for the countries mentioned below:

Ce produit peut être utilisé dans tous les pays de l'UE (et dans tous les pays ayant transposés la directive 1999/5/CE) sans aucune limitation, excepté pour les pays mentionnés ci-dessous:

Questo prodotto è utilizzabile in tutte i paesi EU (ed in tutti gli altri paesi che seguono le direttive EU 1999/5/EC) senza nessuna limitazione, eccetto per i paesi menzionati di seguito:

Das Produkt kann in allen EU Staaten ohne Einschränkungen eingesetzt werden (sowie in anderen Staaten die der EU Direktive 1995/5/CE folgen) mit Ausnahme der folgenden aufgeführten Staaten:

In the majority of the EU and other European countries, the 2,4- and 5-GHz bands have been made available for the use of wireless local area networks (LANs). Later in this document you will find an overview of countries in which additional restrictions or requirements or both are applicable.

The requirements for any country may evolve. ZyXEL recommends that you check with the local authorities for the latest status of their national regulations for both the 2,4- and 5-GHz wireless LANs.

The following countries have restrictions and/or requirements in addition to those given in the table labeled “*Overview of Regulatory Requirements for Wireless LANs*”:

Overview of Regulatory Requirements for Wireless LANs

Frequency Band (MHz)	Max Power Level (EIRP) ¹ (mW)	Indoor ONLY	Indoor and Outdoor
2400-2483.5	100		V
5150-5350	200	V	
5470-5725	1000		V

Belgium

The Belgian Institute for Postal Services and Telecommunications (BIPT) must be notified of any outdoor wireless link having a range exceeding 300 meters. Please check <http://www.bipt.be> for more details.

Draadloze verbindingen voor buitengebruik en met een reikwijdte van meer dan 300 meter dienen aangemeld te worden bij het Belgisch Instituut voor postdiensten en telecommunicatie (BIPT). Zie <http://www.bipt.be> voor meer gegevens.

Les liaisons sans fil pour une utilisation en extérieur d'une distance supérieure à 300 mètres doivent être notifiées à l'Institut Belge des services Postaux et des Télécommunications (IBPT). Visitez <http://www.ibpt.be> pour de plus amples détails.

Denmark

In Denmark, the band 5150 - 5350 MHz is also allowed for outdoor usage.

I Danmark må frekvensbåndet 5150 - 5350 også anvendes udendørs.

France

For 2.4 GHz, the output power is restricted to 10 mW EIRP when the product is used outdoors in the band 2454 - 2483.5 MHz. There are no restrictions when used indoors or in other parts of the 2.4 GHz band. Check <http://www.arcep.fr/> for more details.

Pour la bande 2.4 GHz, la puissance est limitée à 10 mW en p.i.r.e. pour les équipements utilisés en extérieur dans la bande 2454 - 2483.5 MHz. Il n'y a pas de restrictions pour des utilisations en intérieur ou dans d'autres parties de la bande 2.4 GHz. Consultez <http://www.arcep.fr/> pour de plus amples détails.

R&TTE 1999/5/EC
WLAN 2.4 – 2.4835 GHz
IEEE 802.11 b/g/n

Location	Frequency Range(GHz)	Power (EIRP)
Indoor (No restrictions)	2.4 – 2.4835	100mW (20dBm)
Outdoor	2.4 – 2.454	100mW (20dBm)
	2.454 – 2.4835	10mW (10dBm)

Italy

This product meets the National Radio Interface and the requirements specified in the National Frequency Allocation Table for Italy. Unless this wireless LAN product is operating within the boundaries of the owner's property, its use requires a “general authorization.” Please check <http://www.sviluppoeconomico.gov.it/> for more details.

Questo prodotto è conforme alla specifiche di Interfaccia Radio Nazionali e rispetta il Piano Nazionale di ripartizione delle frequenze in Italia. Se non viene installato all'interno del proprio fondo, l'utilizzo di prodotti Wireless LAN richiede una “Autorizzazione Generale”. Consultare <http://www.sviluppoeconomico.gov.it/> per maggiori dettagli.

Latvia

The outdoor usage of the 2.4 GHz band requires an authorization from the Electronic Communications Office. Please check <http://www.esd.lv> for more details.

2.4 GHz frekvenču joslas izmantošanai ārpus telpām nepieciešama atļauja no Elektronisko sakaru direkcijas. Vairāk informācijas: <http://www.esd.lv>.

Notes:

1. Although Norway, Switzerland and Liechtenstein are not EU member states, the EU Directive 1999/5/EC has also been implemented in those countries.
2. The regulatory limits for maximum output power are specified in EIRP. The EIRP level (in dBm) of a device can be calculated by adding the gain of the antenna used (specified in dBi) to the output power available at the connector (specified in dBm).

Index

A

AAA [68](#)
AbS [151](#)
accounting server
 see AAA
ACK message [169](#)
activity [68](#)
Advanced Encryption Standard
 see AES
AES [209](#)
AH [144](#)
ALG [93](#)
algorithms [144](#)
analysis-by-synthesis [151](#)
Application Layer Gateway
 see ALG
authentication [68](#), [207](#)
 inner [209](#)
 key
 server [68](#)
 types [209](#)
authorization [207](#)
 request and reply [209](#)
 server [68](#)
auto-discovery
 UPnP [115](#)

B

base station
 see BS
BS [67–68](#)
 links [68](#)
BYE request [170](#)

C

CA [69](#), [70](#)
CBC-MAC [209](#)
CCMP [207](#), [209](#)
cell [67](#)
certificates [207](#)
 CA [69](#)
 formats [69](#)
 verification [209](#)
certification
 notices [278](#)
 viewing [279](#)
Certification Authority, see CA
chaining [209](#)
chaining message authentication
 see CCMP
circuit-switched telephone networks [151](#)
Class of Service (CoS) [152](#)
client-server
 protocol [170](#)
 SIP [170](#)
CMAC
 see MAC
codec [151](#)
comfort noise [171](#)
copyright [277](#)
CoS [152](#)
counter mode
 see CCMP
coverage area [67](#)
cryptography [207](#)

D

data [207–208](#)
 decryption [207](#)
 encryption [207](#)
 flow [209](#)

DH [150](#)
DHCP [91](#)
 server [91](#)
diameter [68](#)
Differentiated Services
 see DiffServ
Diffie-Hellman key groups [150](#)
DiffServ [152](#)
 DiffServ Code Point (DSCP) [152](#)
 marking rule [156](#)
digital ID [70](#), [207](#)
DS field [156](#)
DSCP
 see DiffServ
DTMF [159](#)
dual-tone multi-frequency
 see DTMF
Dynamic Host Configuration Protocol
 see DHCP

E

EAP [68](#)
EAP (Extensible Authentication Protocol) [70](#)
EAP-TLS [70](#)
EAP-TTLS [70](#)
echo cancellation [171](#)
encapsulation [145](#)
encryption [207–208](#), [209](#)
 traffic [209](#)
ESP [144](#)
Ethernet
 encapsulation [92](#)
Extensible Authorization Protocol
 see EAP

F

FCC interference statement [277](#)
firewall [125](#)
FTP [175](#)
 restrictions [175](#)

G

G.168 [171](#)
G.711 [151](#)
G.729 [151](#)

H

hybrid waveform codec [151](#)

I

ID type and content [148](#)
identity [68](#), [207](#)
idle timeout [175](#)
IEEE 802.16 [67](#), [207](#)
IEEE 802.16e [67](#)
IGD 1.0 [94](#)
IKE phases [146](#)
inner authentication [209](#)
inside header [146](#)
Internet
 access [68](#)
 gateway device [94](#)
Internet Key Exchange [146](#)
Internet Telephony Service Provider
 see ITSP
interoperability [67](#)
IP-PBX [151](#)
IPSec
 algorithms [144](#)
 architecture [144](#)
 NAT [147](#)
IPSec VPN [137](#)
ITSP [151](#)
ITU-T [171](#)

K

key [207](#)
 request and reply [209](#)

L

L2TP VPN [133](#)
Layer 2 Tunneling Protocol VPN
 see L2TP VPN

M

MAC [209](#)
MAN [67](#)
Management Information Base (MIB) [177](#)
Message Authentication Code
 see MAC
message integrity [209](#)
Metropolitan Area Network
 see MAN
microwave [67, 68](#)
mobile station
 see MS
MS [68](#)
multimedia [152](#)

N

NAT
 and remote management [175](#)
 IPSec [147](#)
 server sets [92](#)
 traversal [94, 148](#)
NAT routers [158](#)
ND&S [77](#)
negotiation mode [147](#)
network
 activity [68](#)
 services [68](#)
network address translators [158](#)
Network Discovery and Selection
 see ND&S

O

outbound proxy [159](#)
 SIP [159](#)
outbound proxy server [159](#)
outside header [145](#)

P

pattern-spotting [209](#)
PBX services [151](#)
PCM [151](#)
per-hop behavior [156](#)
PHB (per-hop behavior) [156](#)
phone
 services [159](#)
PKMv2 [68, 207, 209](#)
plain text encryption [209](#)
Point to Point Tunneling Protocol VPN
 see PPTP VPN
PPTP VPN [129](#)
pre-shared key [150](#)
Privacy Key Management
 see PKM
private key [207](#)
product registration [279](#)
proxy server
 SIP [158](#)
public certificate [209](#)
public key [207](#)
pulse code modulation [151](#)
push button [103](#)

Q

QoS [151](#)
quality of service

R

RADIUS [68, 70, 207](#)

- Message Types [208](#)
- Messages [208](#)
- Shared Secret Key [208](#)
- Real-time Transport Protocol
 - see RTP
- register server
 - SIP [157](#)
- registration
 - product [279](#)
- related documentation [3](#)
- remote management and NAT [175](#)
- remote management limitations [175](#)
- required bandwidth [151](#)
- RFC 1889 [152](#)
- RFC 3489 [158](#)
- RTP [152](#)

S

- secure communication [207](#)
- secure connection [68](#)
- security [207](#)
- security association [208](#)
 - see SA
- see QoS
- server, outbound proxy [159](#)
- services [68](#)
- Session Initiation Protocol
 - see SIP
- silence suppression [171](#)
- silent packets [171](#)
- SIP [152](#)
 - account [157](#)
 - ACK message [169](#)
 - ALG [93](#), [159](#)
 - Application Layer Gateway, see ALG
 - BYE request [170](#)
 - call progression [167](#)
 - client [170](#)
 - client server [170](#)
 - identities [157](#)
 - INVITE request [169](#)
 - number [157](#)
 - proxy server [158](#)
 - register server [157](#)

- servers [170](#)
- service domain [157](#)
- URI [157](#)
 - user agent [158](#)
- SIP outbound proxy [159](#)
- SNMP [175](#)
 - manager [177](#)
- sound quality [151](#)
- SS [67](#), [68](#)
- STUN [158](#), [159](#)
- subscriber station
 - see SS
- supplementary phone services [159](#)
- system timeout [175](#)

T

- tampering
- TCP/IP configuration [91](#)
- TEK [209](#)
- TFTP restrictions [175](#)
- TLS [207](#)
- ToS [152](#)
- Touch Tone® [159](#)
- transport encryption key
 - see TEK
- transport layer security
 - see TLS
- transport mode [145](#)
- trigger port forwarding
 - process [111](#)
- TTLS [207](#), [209](#)
- tunnel mode [145](#)
- tunneled TLS
 - see TTLS
- Type of Service [152](#)

U

- unauthorized device [207](#)
- uniform resource identifier [157](#)
- Universal Plug and Play

- see UPnP
- UPnP [93](#)
 - application [94](#)
 - auto-discovery [115](#)
 - security issues [94](#)
 - Windows XP [114](#)
- use NAT [158](#)
- user authentication [207](#)
- wizard setup [25](#)
- WPS [102](#)
 - adding stations [103](#)
 - push button [103](#)

V

- VAD [171](#)
- verification [209](#)
- virtual LAN
 - see VLAN
- VLAN [119](#)
 - examples [50](#)
- voice
 - activity detection [171](#)
 - coding [151](#)
 - mail [151](#)
- Voice over IP
 - see VoIP
- VoIP [151](#)

W

- waveform codec [151](#)
- WiFi Protected Setup, see WPS
- WiMAX [67–68](#)
 - security [208](#)
 - WiMAX Forum [67](#)
- Wireless Interoperability for Microwave Access
 - see WiMAX
- wireless LAN
 - WPS [102](#)
 - adding stations [103](#)
 - push button [103](#)
- Wireless Metropolitan Area Network
 - see MAN
- wireless network
 - access [67](#)
 - standard [67](#)
- wireless security [207](#)

