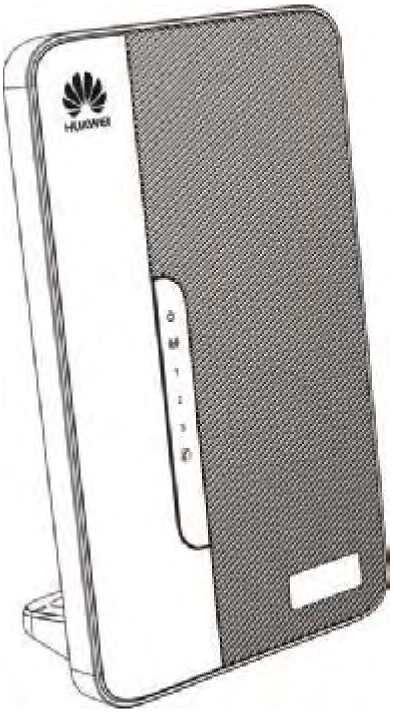
HES-209M1H
BM2022

WiMAX IEEE 802.16 Indoor CPE

User's Guide



Default Login Details

IP Address:	http://192.168.1.1
Username	admin
Password	1234

Firmware Version V2.00
Edition 1, 4/2011

www.huawei.com

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About This User's Guide

Intended Audience

This manual is intended for people who want to configure the Huawei BM2022 using the Huawei Web Configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide

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

  Refer to the included CD for support documents.
- Huawei Web Site

  Please refer to www.huawei.com for additional support documentation and product certifications.
- 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 BM2022.

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

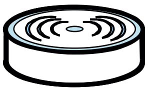
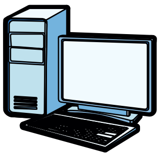
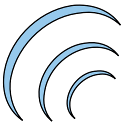
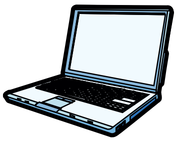
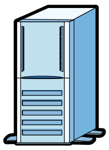
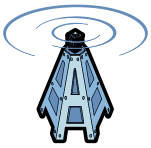
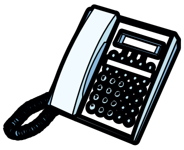
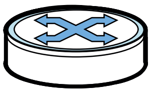
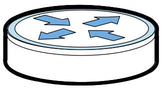
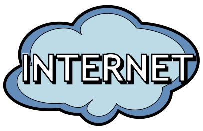
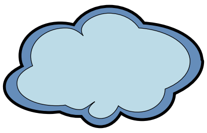
Syntax Conventions

- The product(s) described in this book may be referred to as the "BM2022", the "device", the "system" or the "product" 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, **TOOLS > Logs > Log Settings** means you first click **Tools** in the navigation panel, then the **Logs** sub menu and finally the **Log Settings** 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 BM2022 icon is not an exact representation of your product.

Table 1 Common Icons

BM2022 	Computer 	Wireless Signal 
Notebook 	Server 	Base Station 
Telephone 	Switch 	Router 
Internet Cloud 	Network Cloud 	

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- 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.
- 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 it 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 device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.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

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PART I

User's Guide

1

Getting Started

1.1 About Your BM2022

The BM2022 allows you to access the Internet by connecting to a WiMAX wireless network. You can use a traditional analog telephone to make Internet calls using the BM2022'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.

See Chapter 14 on page 199 for a complete list of features for your model.

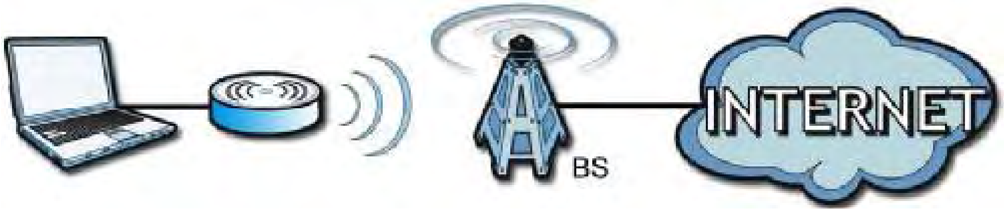
1.1.1 WiMAX Internet Access

Connect your computer or network to the BM2022 for WiMAX Internet access. See the Quick Start Guide for instructions on hardware connection.

In a wireless metropolitan area network (MAN), the BM2022 connects to a WiMAX base station (BS) for Internet access.

The following diagram shows a notebook computer equipped with the BM2022 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.

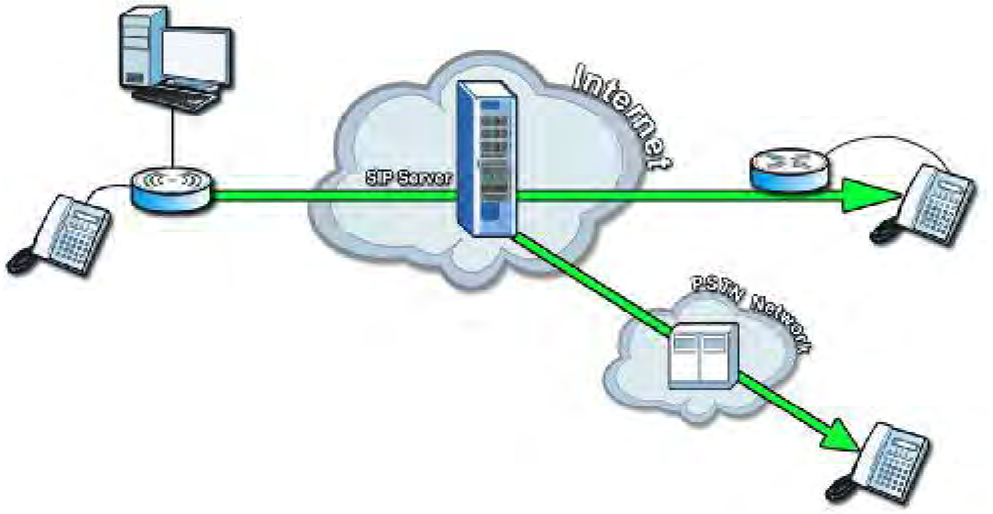
Use content filtering to block access to web sites with URLs containing keywords that you specify. You can define time periods and days during which content filtering is enabled and include or exclude particular computers on your network from content filtering. For example, you could block access to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

1.1.2 Make Calls via Internet Telephony Service Provider

In a home or small office environment, you can use the BM2022 to make and receive the following type of VoIP telephone calls:

- Calls via a VoIP service provider - The BM2022 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



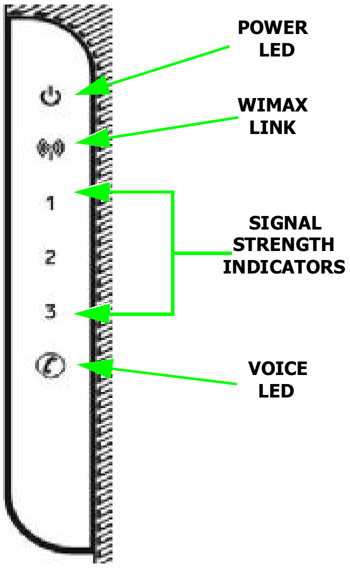
1.2 BM2022 Hardware

Follow the instructions in the Quick Start Guide to make hardware connections.

1.2.1 LEDs

The following figure shows the LEDs (lights) on the BM2022.

Figure 3 The BM2022's LEDs



The following table describes your BM2022's LEDs (from top to bottom).

Table 2 The BM2022 LEDs behavior

LED	STATE	DESCRIPTION
Power	Off	The BM2022 is not receiving power.
	Red	The BM2022 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 BM2022 is receiving power and functioning correctly. **Flashing**: the device is self-testing (startup)
WiMAX Link	Off	The BM2022 is not connected to a wireless (WiMAX) network.
	Green	The BM2022 is successfully connected to a wireless (WiMAX) network.
	Green (Blinking Slowly)	The BM2022 is searching for a wireless (WiMAX) network.
	Green (Blinking Quickly)	The BM2022 has found a wireless (WiMAX) network and is connecting.
Signal Strength Indicator	The Strength Indicator LEDs display the Interference-plus-Noise Ratio (CINR) of the wireless (WiMAX) connection.	
	No Signal LEDs On	Ths signal strength is less than -90dBm
	Signal 1 On	The signal strength is between -89dBm and -80dBm.
	Signal 1 and 2 On	The signal strength is between -79dBm and -70dBm.
	Signal 1, 2 and 3 On	The signal strength is greater than or equal to -69dBm.

Table 2 The BM2022 LEDs behavior

LED	STATE	DESCRIPTION
Voice	Off	No SIP account is registered, or the BM2022 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).

1.3 Good Habits for Managing the BM2022

Do the following things regularly to make the BM2022 more secure and to manage the BM2022 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 BM2022 becomes unstable or even crashes. If you forget your password, you will have to reset the BM2022 to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the BM2022. You could simply restore your last configuration.

2

Introducing 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

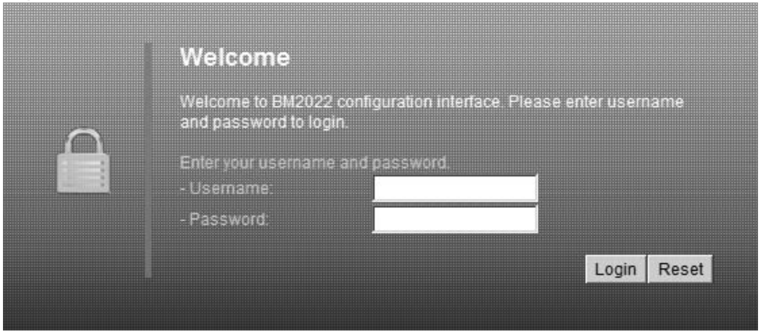
1 Make sure your BM2022 hardware is properly connected (refer to the Quick Start Guide for more information).

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



Welcome

Welcome to BM2022 configuration interface. Please enter username and password to login.

Enter your username and password.

- Username:

- Password:

Note: For security reasons, the BM2022 automatically logs you out if you do not use the Web Configurator for five minutes. If this happens, log in again.

2.1.2 The Reset Button

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”.

2.1.2.1 Using The Reset Button

1 Make sure the **Power** light is on (not blinking).

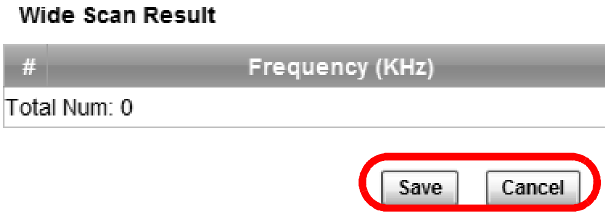
2 To set the device back to the factory default settings, press the **Reset** button for five seconds or until all LED lights blink one time, then release it. The device restarts when the defaults have been restored.

3 Reconfigure the BM2022 following the steps in your Quick Start Guide.

2.1.3 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 BM2022, you can cancel those changes and start over.

Figure 5 Saving and Canceling Changes



Wide Scan Result

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

This screen contains the following fields:

Table 3 Saving and Canceling Changes

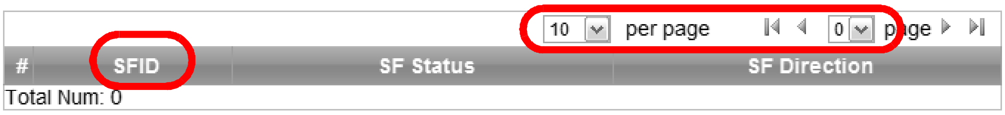
LABEL	DESCRIPTION
Save	Click this to save your changes.
Cancel	Click this to restore the settings on this page to their last saved values.

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.

2.1.4 Working with Tables

Many screens in the BM2022 contain tables to provide information or additional configuration options.

Figure 6 Tables Example



This screen contains the following fields:

Table 4 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.
◀	Previous Page Click this to go to the previous page in the table.
0 ▾ 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.

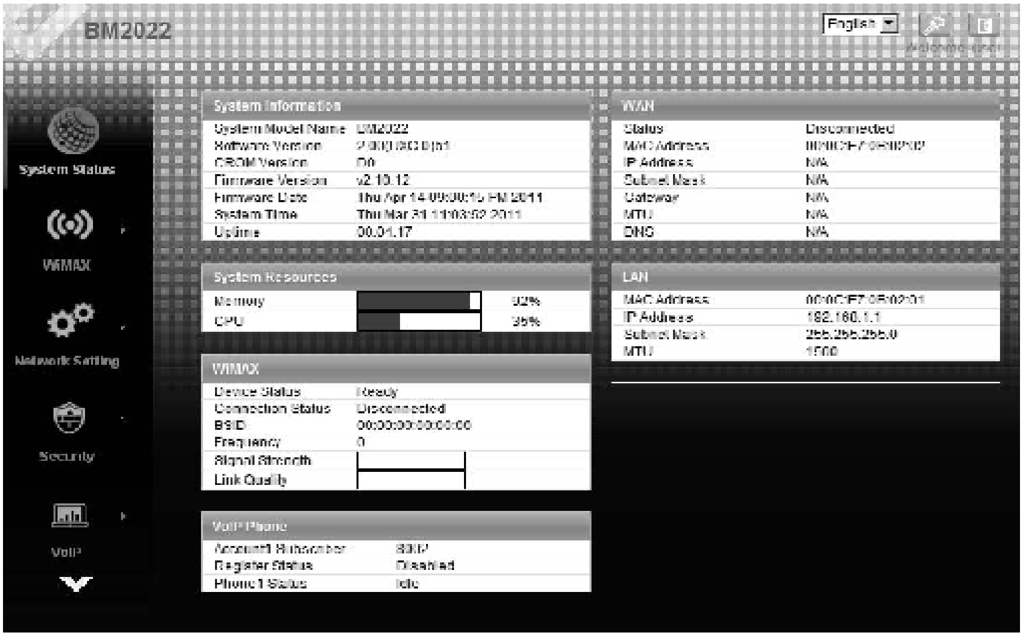
2.2 The Main Screen

When you first log into the Web Configurator, the Main screen appears. Here you can view a summary of your BM2022’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 firmware version and/or configuration.

Note: The available menus and screens vary depending on the user account you use for login.

Figure 7 Main Screen



System Information

System Model Name	BM2022
Software Version	[illegible]
CROM Version	D0
Firmware Version	v2.10.12
Firmware Date	Thu Apr 14 09:00:15 PM 2011
System Time	Thu Mar 31 11:03:52 2011
Uptime	00.01.17

WAN

Status	Disconnected
MAC Address	[illegible]
IP Address	N/A
Subnet Mask	N/A
Gateway	N/A
MTU	N/A
DNS	N/A

System Resources

Memory	92%
CPU	35%

LAN

MAC Address	00:0C:F7:0F:02:01
IP Address	192.168.1.1
Subnet Mask	255.255.255.0
MTU	1500

WiMAX

Device Status	Ready
Connection Status	Disconnected
BSID	00:00:00:00:00:00
Frequency	0
Signal Strength	
Link Quality	

VoIP Phone

Account1 Subscriber	[illegible]
Register Status	Disabled
Phone1 Status	Idle

The following table describes the icons in this screen.

Table 5 Main > Icons

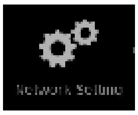
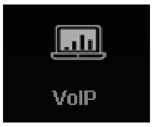
ICON	DESCRIPTION
	System Status Click this to open the Main screen, which shows your BM2022 status and other information.
	WiMAX Click this to open the WiMAX menu, which gives you options for configuring your WiMAX settings.
	Network Setting Click this to open the Network menu, which gives you options for configuring your 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 use the device to make phone calls.

Table 5 Main > Icons (continued)

ICON	DESCRIPTION
Maintenance	Maintenance Click this to open the Maintenance menu, which gives you options for maintaining your BM2022 and performing basic network connectivity tests.
English ▾	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 BM2022 to work.
	Logout Click this to log out of the Web Configurator.

Setup Wizard

3.1 Overview

This chapter provides information on the Huawei 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:

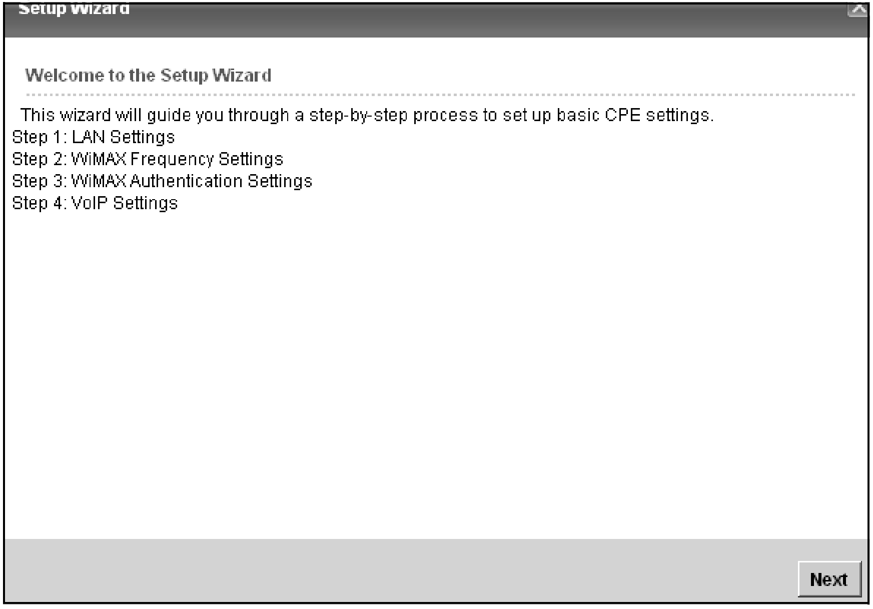
1 Set up your Local Area Network (LAN) options, which determine how the devices in your home or office connect to the BM2022.

2 Set up your BM2022's broadcast frequency, which is the radio channel it uses to communicate with the ISP's base station.

3 Set up your BM2022's login options, which are used to connect your LAN to the ISP's network and verify your account.

4 Set up your BM2022's VoIP Settings, which will allow you to make calls over the Internet.

Figure 8 Setup Wizard > Welcome



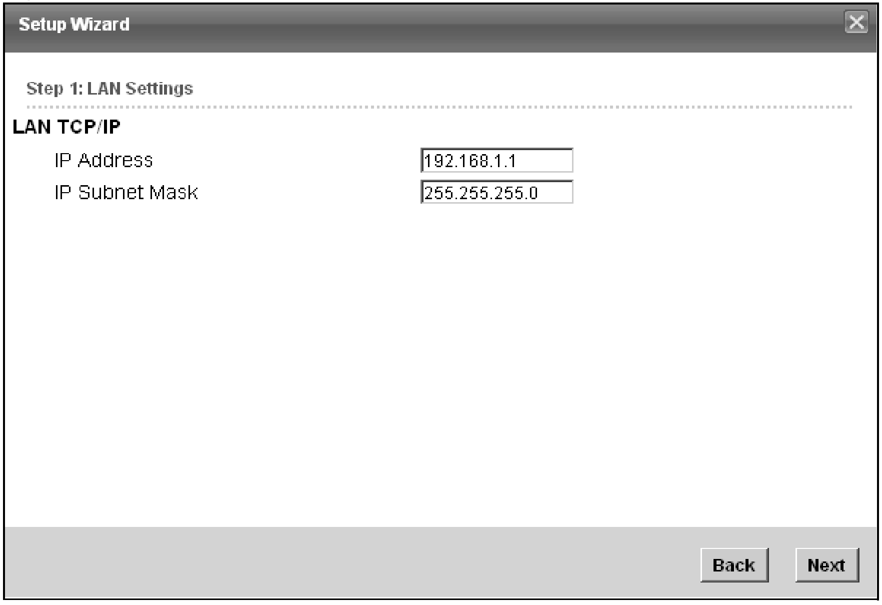
Welcome to the Setup Wizard

This wizard will guide you through a step-by-step process to set up basic CPE settings.
Step 1: LAN Settings
Step 2: WiMAX Frequency Settings
Step 3: WiMAX Authentication Settings
Step 4: VoIP Settings

3.1.2 LAN Settings

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

Figure 9 Setup Wizard > LAN Settings



LAN TCP/IP

IP Address: 192.168.1.1

IP Subnet Mask: 255.255.255.0

The following table describes the labels in this screen.

Table 6 Setup Wizard > LAN Settings

LABEL	DESCRIPTION
LAN TCP/IP	
IP Address	Enter the IP address of the BM2022 on the LAN. Note: This field is the IP address you use to access the BM2022 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 BM2022 to be the DHCP server on the LAN. As a DHCP server, the BM2022 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 BM2022 begins allocating IP addresses.
End IP	Enter the IP address at which the BM2022 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 BM2022 provides these IP addresses to DHCP clients.

Table 6 Setup Wizard > LAN Settings (continued)

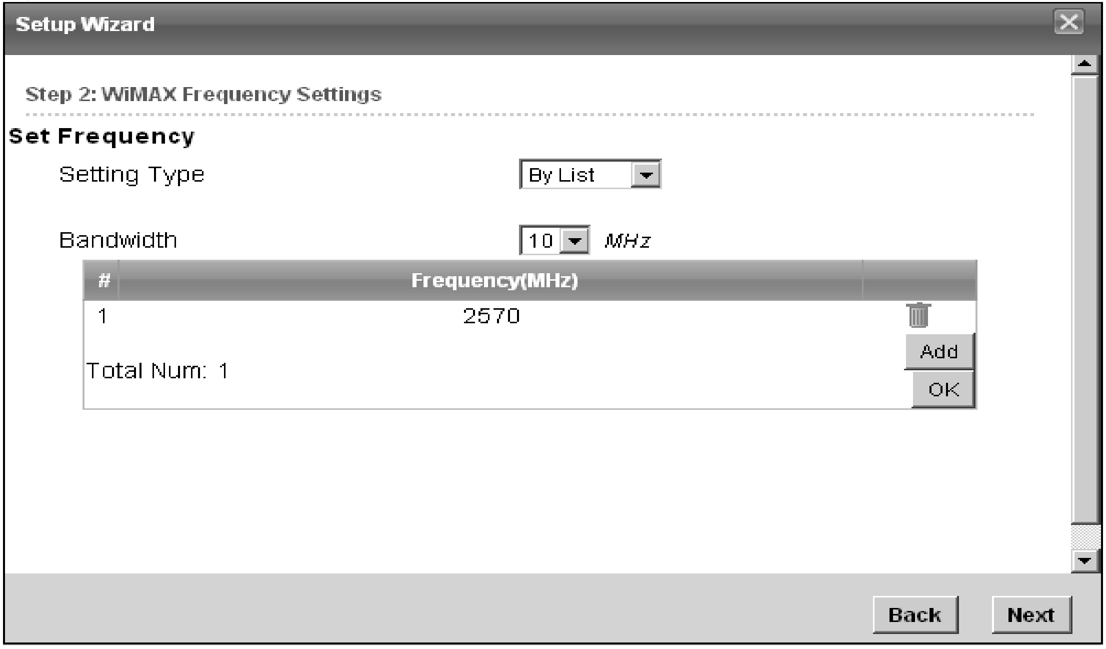
LABEL	DESCRIPTION
Second DNS Server	Specify the second IP address of three DNS servers that the network can use. The BM2022 provides these IP addresses to DHCP clients.
Third DNS Server	Specify the third IP address of three DNS servers that the network can use. The BM2022 provides these IP addresses 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 BM2022.

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: By List

Bandwidth: 10 MHz

#	Frequency(MHz)
1	2570

Total Num: 1

1

The following table describes the labels in this screen.

Table 7 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 BM2022 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.

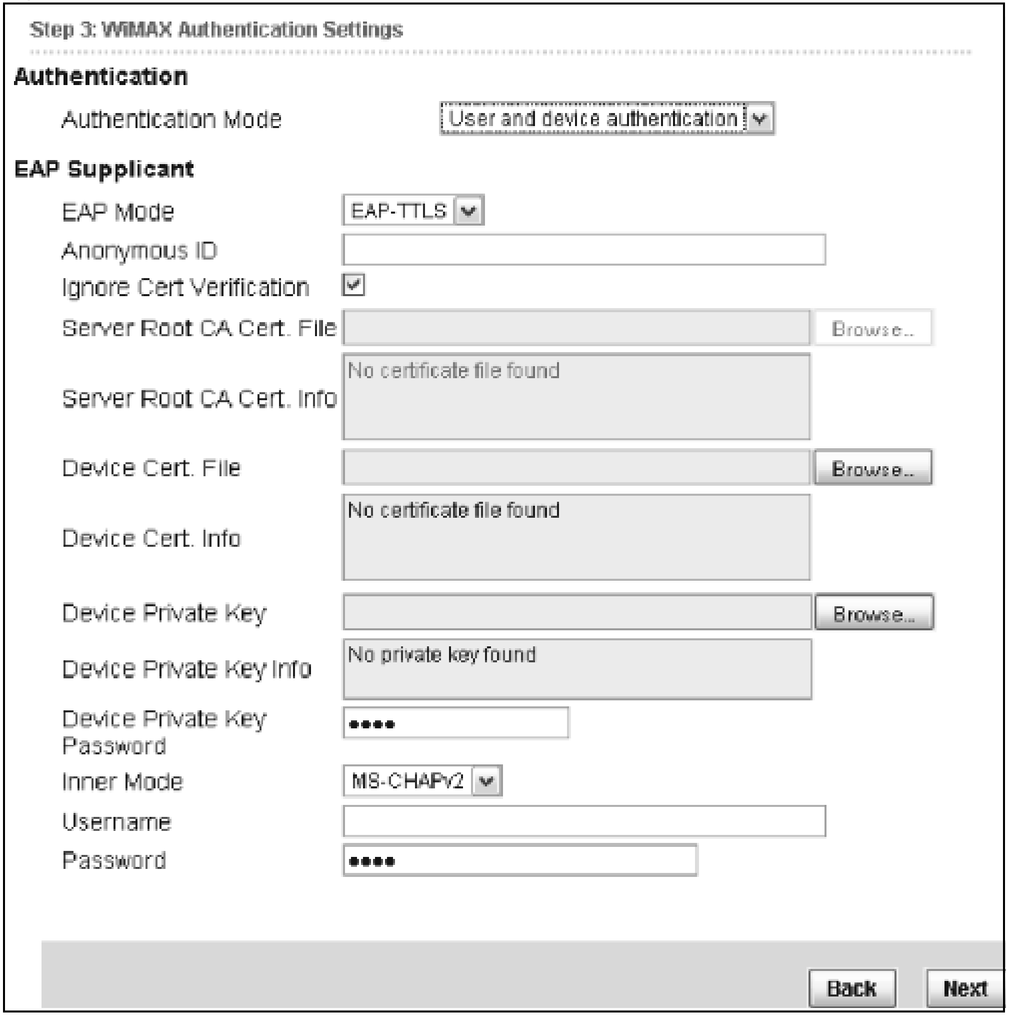
3.1.4 WiMAX Authentication Settings

The WiMAX Authentication Settings screen allows you to configure how your BM2022 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 your select.

Figure 11 Setup Wizard > WiMAX Authentication Settings



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:

Server Root CA Cert. Info: No certificate file found

Device Cert. File:

Device Cert. Info: No certificate file found

Device Private Key:

Device Private Key Info: No private key found

Device Private Key Password: ●●●●

Inner Mode: MS-CHAPv2

Username:

Password: ●●●●

The following table describes the labels in this screen.

Table 8 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 13 on page 74 if you need more information.

Table 8 Setup Wizard > WiMAX Authentication Settings (continued)

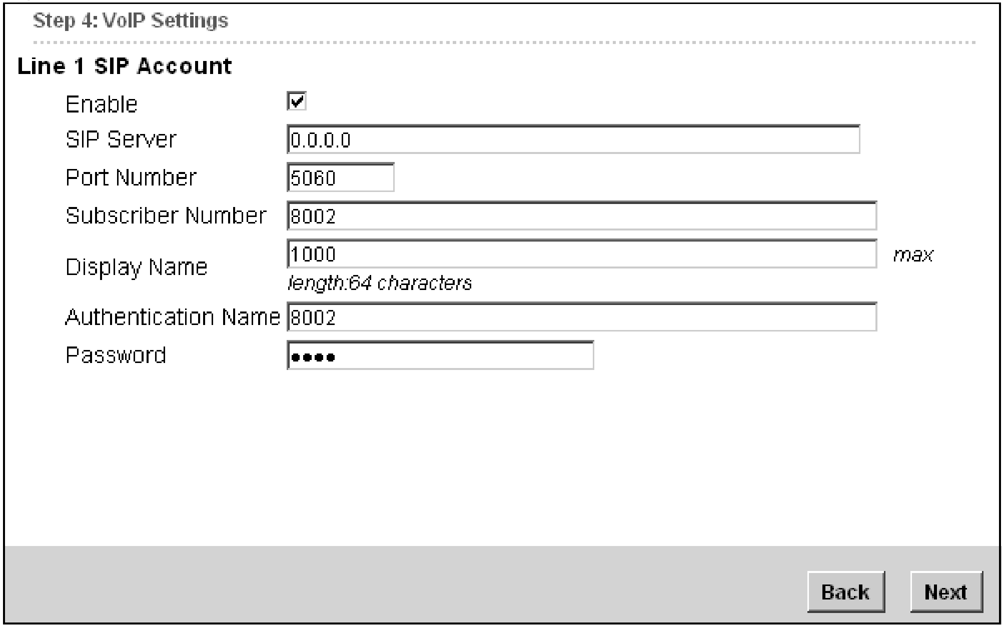
LABEL	DESCRIPTION
Anonymous Id	Enter your anonymous ID. Note: Some modes may not require this.
Ignore Cert Verification	Select this to ignore base station certification verification when a certificate is received during EAP-TLS or EAP-TTLS.
Server Root CA Cert. File	Browse for and choose a server root 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. 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.
Inner Mode	Select an inner authentication mode (MS-CHAP, MS-CHAPV2, CHAP, MD5, PAP. See Table 13 on page 74 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

The VoIP Settings screen allows you to configure how your BM2022 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



Step 4: VoIP Settings

Line 1 SIP Account

Enable ☑

SIP Server 0.0.0.0

Port Number 5060

Subscriber Number 8002

Display Name 1000 *max length:64 characters*

Authentication Name 8002

Password ●●●●

The following table describes the labels in this screen.

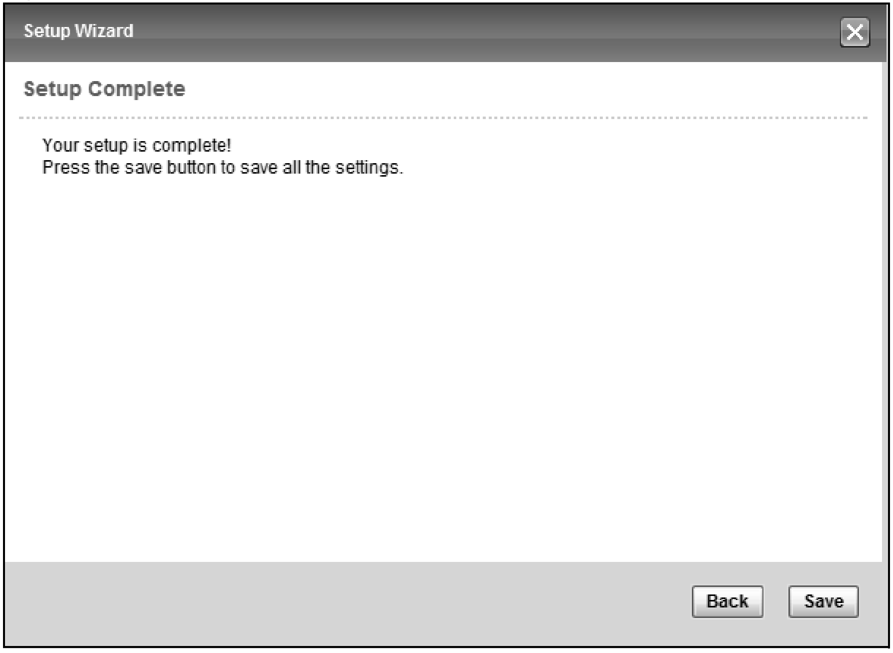
Table 9 Setup Wizard > VoIP Settings

LABEL	DESCRIPTION
Line 1 SIP Account - Configure this section to use the **PHONE 1** 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 Setup Complete

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

Figure 13 Setup Wizard > Setup Complete



Your setup is complete!
Press the save button to save all the settings.

Launch your web browser and navigate to www.huawei.com. 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 BM2022 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.

4

Tutorials

4.1 Overview

This chapter shows you how to configure some of the BM2022’s features.

Note: Be sure to read Introducing the Web Configurator on page 21 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
- Configuring LAN DHCP on page 36
- Changing Certificate on page 38
- Blocking Web Access on page 39
- Configuring the MAC Address Filter, see page 39
- Setting Up NAT Port Forwarding, see page 41
- Access the BM2022 Using DDNS, see page 43
- Configuring Static Route for Routing to Another Network, see page 45
- Remotely Managing Your BM2022 on page 47
- VLAN Configuration Examples on page 48

4.2 WiMAX Connection Settings

This tutorial provides you with pointers for configuring the BM2022 to connect to an ISP.

1 Connect the BM2022 to the ISP’s nearest base station. See Section 6.2 on page 68.

2 Configure the BM2022’s broadcast frequency. Section 6.3 on page 70.

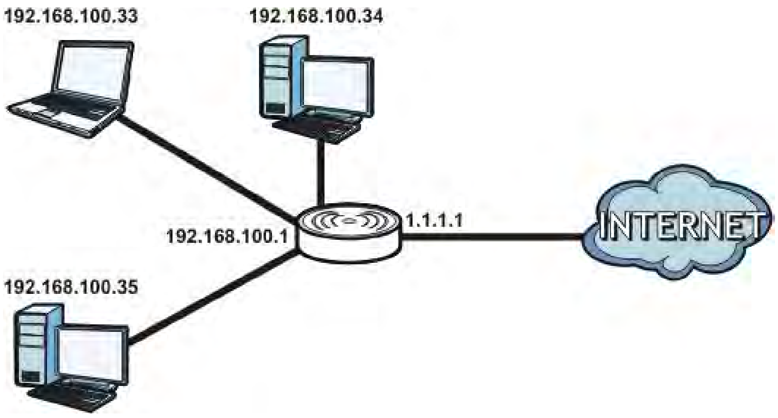
3 Configure the BM2022 to connect securely to the ISP’s authentication servers. See Section 6.4 on page 72.

4 Check the BM2022’s connection status to ensure everything is working properly. See Section 6.11 on page 86.

4.3 Configuring LAN DHCP

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

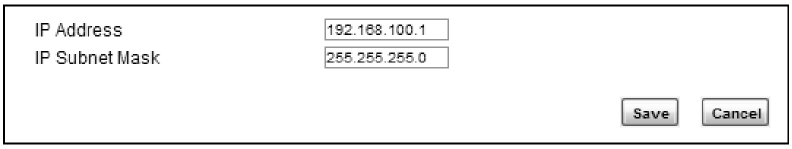
Goal: Connect three computers to your BM2022 to form a small network.



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**.

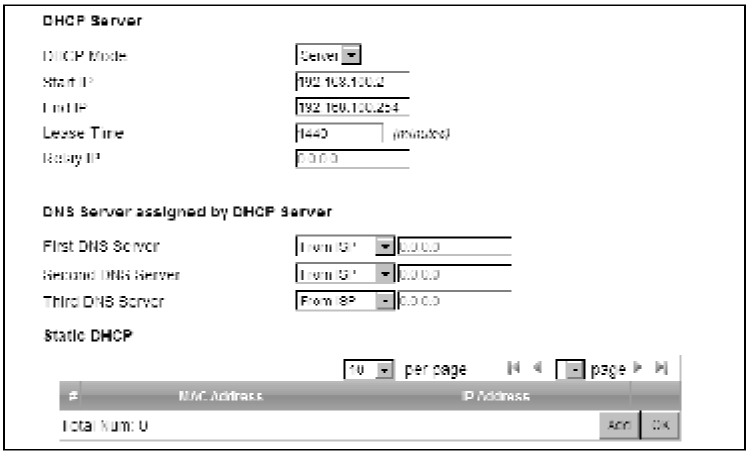


IP Address 192.168.100.1
IP Subnet Mask 255.255.255.0

2 Manually change the IP address of your computer that your 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 BM2022 finishes starting up completely.

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



DHCP Server

DHCP Mode	Server
Start IP	192.168.100.2
End IP	192.168.100.254
Lease Time	1440 (minutes)
Relay IP	0.0.0.0

DNS Server assigned by DHCP Server

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

Static DHCP

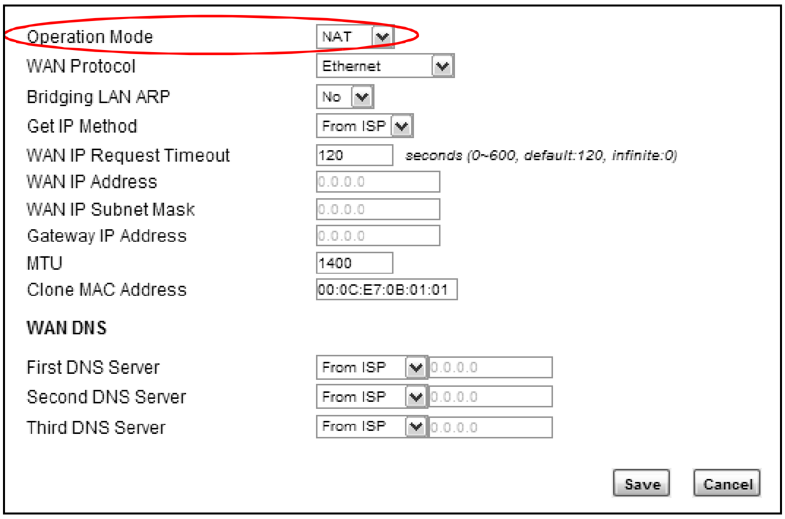
#	MAC Address	IP Address

Total Num: 0

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	NAT
WAN Protocol	Ethernet
Bridging LAN ARP	No
Get IP Method	From ISP
WAN IP Request Timeout	120 *seconds (0~600, default:120, 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	00:0C:E7:0B:01:01

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

8 Connect your computers to the BM2022’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 27), which walks you through the process.

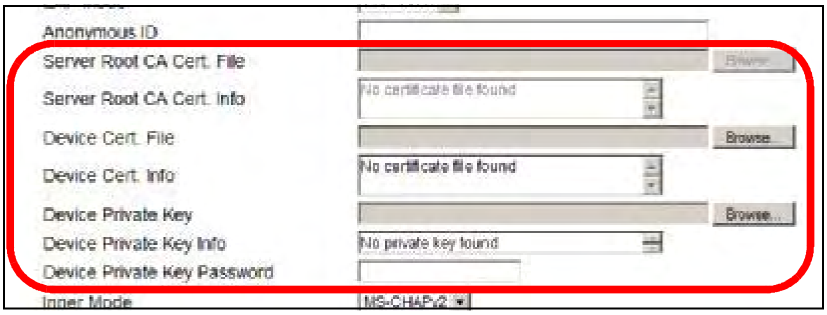
4.4 Changing Certificate

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

Goal: Import a new security certificate into the BM2022.

See Also: Appendix E on page 253.

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.



Anonymous ID

Server Root CA Cert. File

Server Root CA Cert. Info: No certificate file found

Device Cert. File

Device Cert. Info: No certificate file found

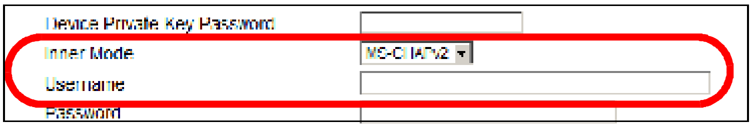
Device Private Key

Device Private Key Info: No private key found

Device Private Key Password

Inner Mode: MS-CHAPv2

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



Device Private Key Password

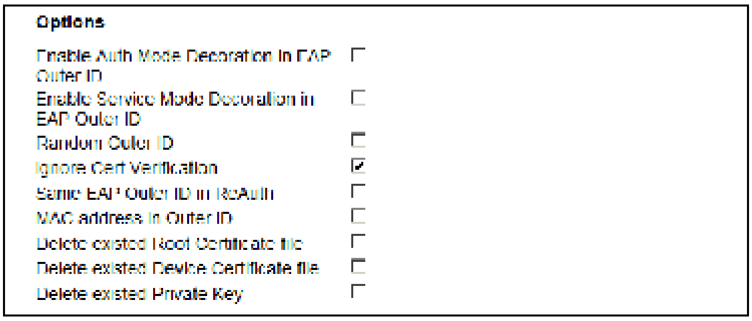
Inner Mode: MS-CHAPv2

Username

Password

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 Outer ID in ReAuth	☐
MAC address in Outer ID	☐
Delete existed Root Certificate file	☐
Delete existed Device Certificate file	☐
Delete existed Private Key	☐

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

4.5 Blocking Web Access

If your BM2022 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 BM2022’s content filter to block a website with a domain name www.example.com.

See Also: Section 7.20 on page 119.

1 Open the **Network Setting > Content Filter**.

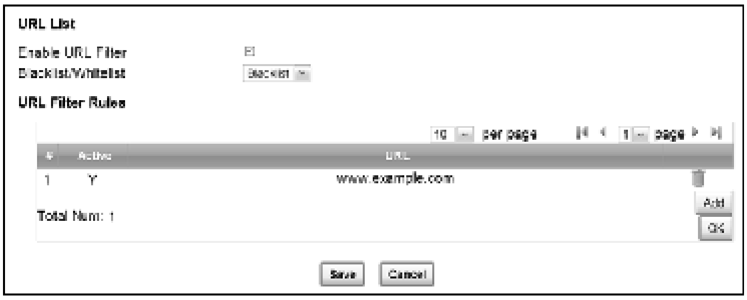
2 Select **Enable URL Filter**.

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

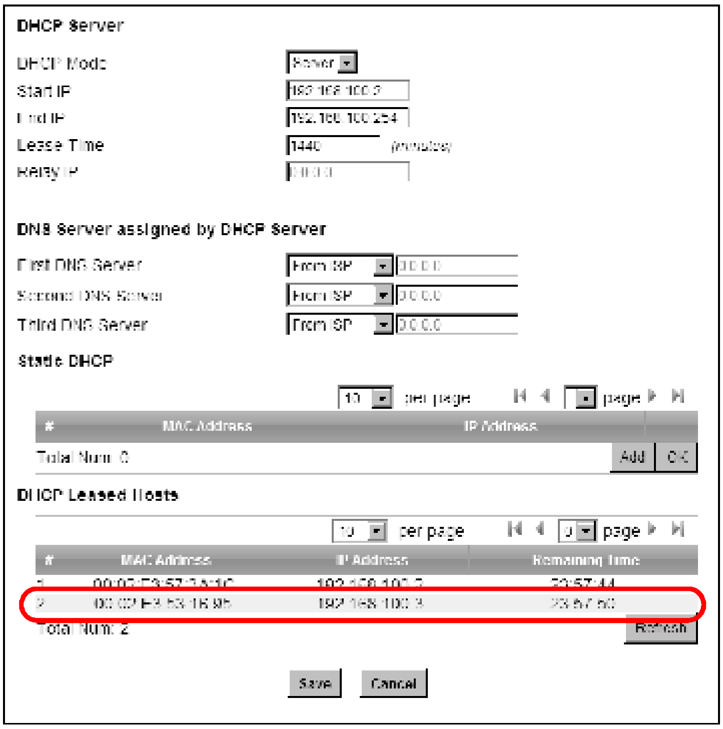
Total Num: 1

Open a browser from your computer in the BM2022’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 Configuring the MAC Address Filter

This tutorial shows you how to use the MAC filter to block a DHCP client’s access to hosts and 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	Server
Start IP	192.168.100.2
End IP	192.168.100.254
Lease Time	1440 (minutes)
Relay IP	0.0.0.0

DNS Server assigned by DHCP Server

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

Static DHCP

10 per page

#	MAC Address	IP Address

Total Num: 0

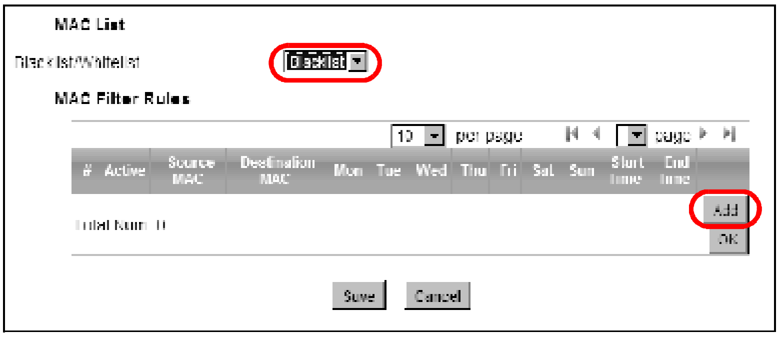
DHCP Leased Hosts

10 per 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: Blacklist

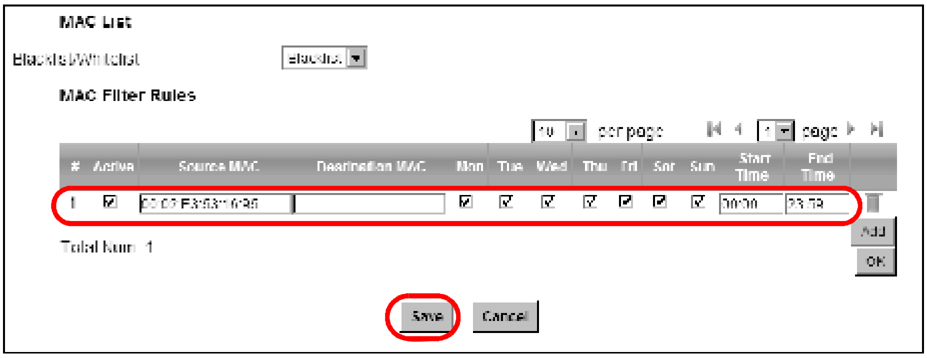
MAC Filter Rules

10 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

The computer will no longer be able to access any host on the WiMAX network through the BM2022.

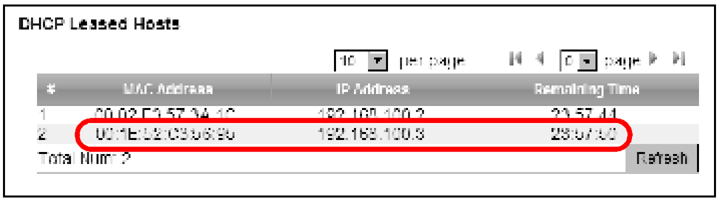
4.7 Setting Up NAT Port Forwarding

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 BM2022.

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 BM2022 if the BM2022 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.



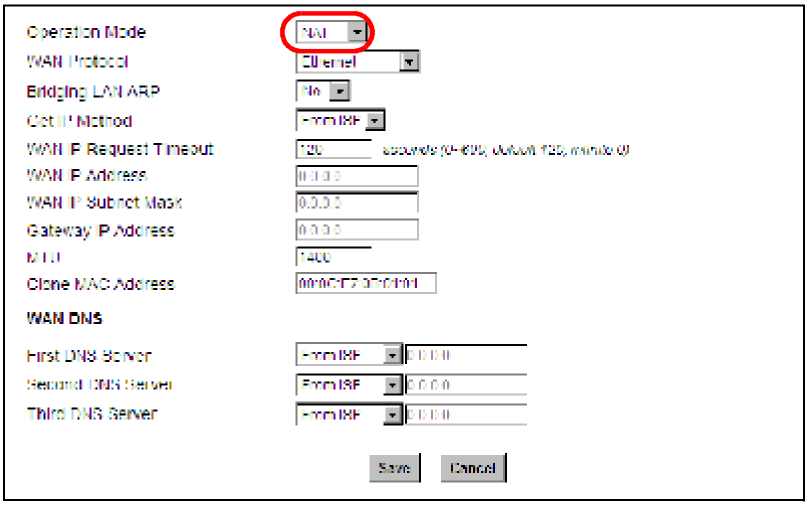
DHCP Leased Hosts

10 per page — 0 page

#	MAC Address	IP Address	Remaining Time
1	00:02:E3:57:34:1C	192.168.100.2	23:57:44
2	00:1E:52:C3:56:96	192.168.100.3	23:57:50

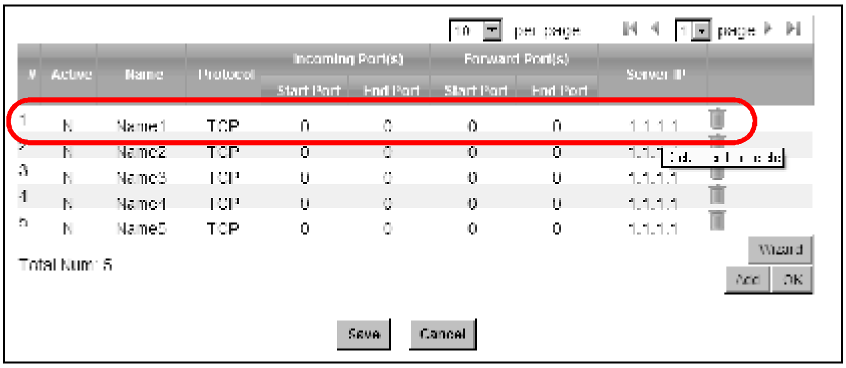
Total Num: 2

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, default 120, manual 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	00:0C:F7:07:01:01
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

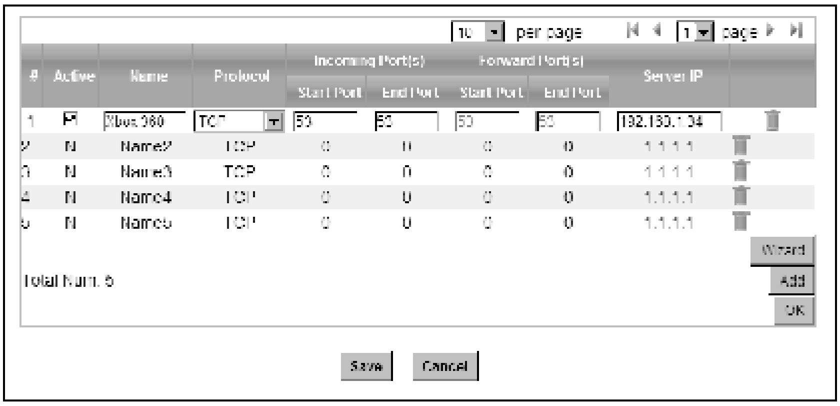
3 Click **Network Setting** > **NAT** > **Port Forwarding** and then click the first entry to edit the rule.



#	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

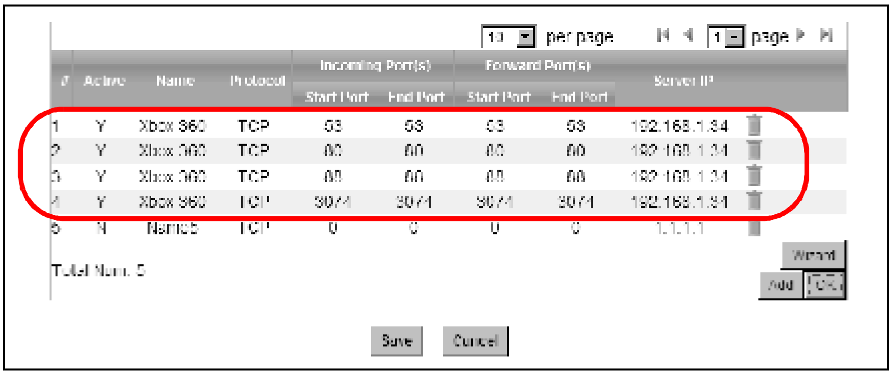
4 Configure the screen as follows to open TCP/UDP port 53 for the Xbox 360. Click **OK**.



#	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

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.



10 per page | 1 page

#	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

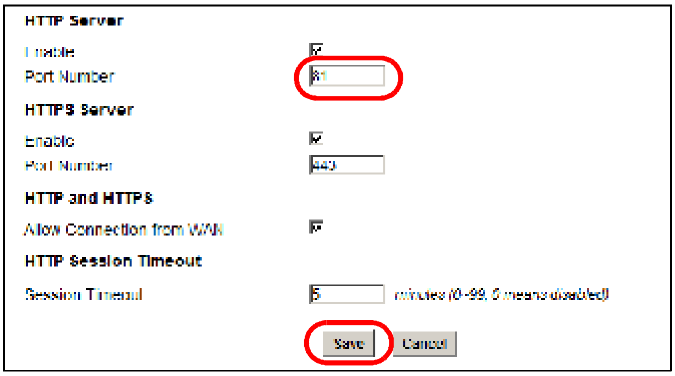
Total Num: 5

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 BM2022 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**.



HTTP Server

Enable ☑

Port Number 81

HTTPS Server

Enable ☑

Port Number 443

HTTP and HTTPS

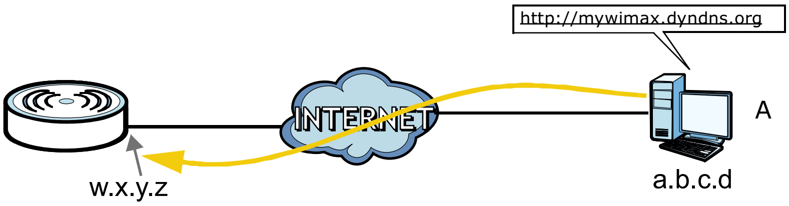
Allow Connection from WAN ☑

HTTP Session Timeout

Session Timeout 5 minutes (0-99, 0 means disabled)

4.8 Access the BM2022 Using DDNS

If you connect your BM2022 to the Internet and it uses a dynamic WAN IP address, it is inconvenient for you to manage the device from the Internet. The BM2022's WAN IP address changes dynamically. Dynamic DNS (DDNS) allows you to access the BM2022 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
- Configuring DDNS on Your BM2022
- 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 BM2022 is currently using. You can find the IP address on the BM2022's Web Configurator **Status** page.

Then you will need to configure the same account and host name on the BM2022 later.

4.8.2 Configuring DDNS on Your BM2022

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

1 Select **Enable Dynamic DNS**.

2 Select **dyndns.org** for the service provider.

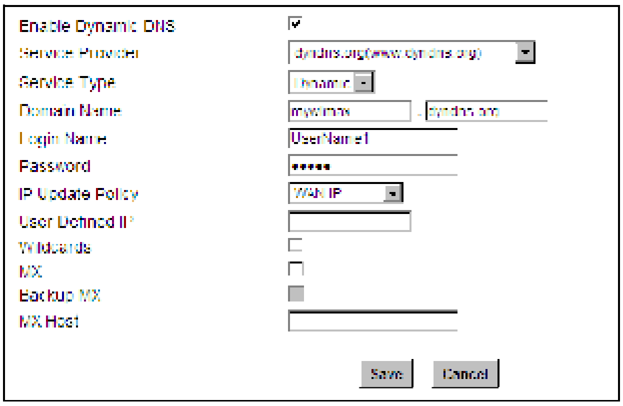
3 Select **Dynamic** for the service type.

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**.



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	

4.8.3 Testing the DDNS Setting

Now you should be able to access the BM2022 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.

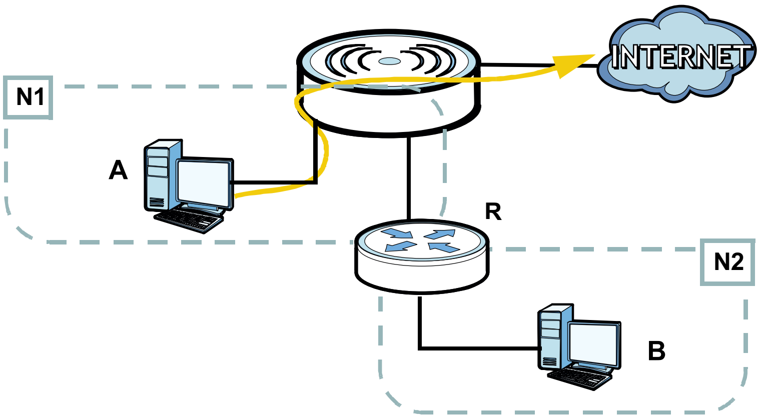
2 Type **http://mywimax.dyndns.org** and press [Enter].

3 The BM2022's login page should appear. You can then log into the BM2022 and manage it.

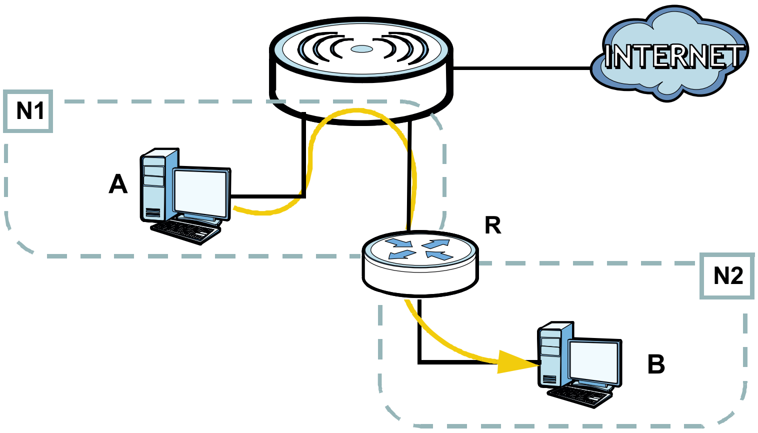
4.9 Configuring Static Route for Routing to Another Network

In order to extend your Intranet and control traffic flowing directions, you may connect a router to the BM2022'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 BM2022'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 BM2022'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 BM2022 to specify **R** as the router in charge of forwarding traffic to **N2**. In this case, the BM2022 routes traffic from computer **A** to **R** and then **R** routes the traffic to computer **B**.



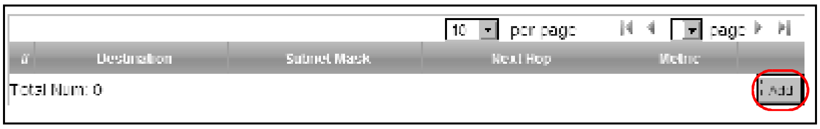
This tutorial uses the following example IP settings:

DEVICE / COMPUTER	IP ADDRESS
The BM2022's WAN	172.16.1.1
The BM2022's LAN	192.168.1.1
A	192.168.1.34
R's IP address on N1	192.168.1.253
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.



10 per page | page

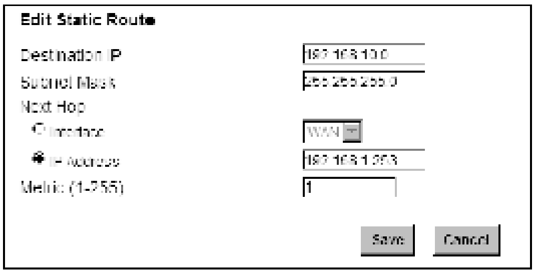
#	Destination	Subnet Mask	Next Hop	Metric

Total Num: 0

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**.



Edit Static Route

Destination IP: 192.168.10.0

Subnet Mask: 255.255.255.0

Next Hop

○ Interface: WAN

● IP Address: 192.168.1.253

Metric (1-255): 1

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.

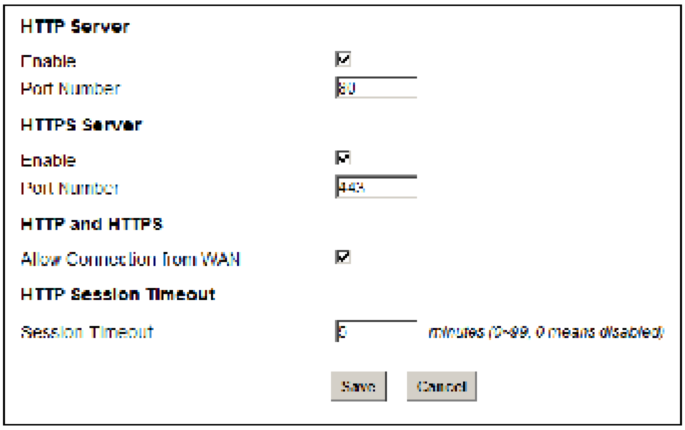
4.10 Remotely Managing Your BM2022

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

Goal: Set up the BM2022 to allow management requests from the WAN (Internet).

See Also: Section 12.3 on page 177.

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



HTTP Server

Enable ☑

Port Number 80

HTTPS Server

Enable ☑

Port Number 443

HTTP and HTTPS

Allow Connection from WAN ☑

HTTP Session Timeout

Session Timeout 5 minutes (0~99, 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**.

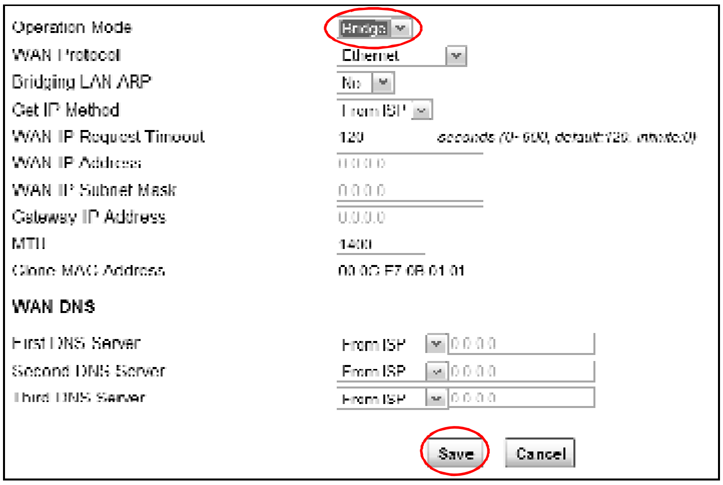
4.11 VLAN Configuration Examples

This section shows VLAN configuration scenarios.

See Section 7.17 on page 115 if you need more information about VLAN.

Before enabling VLANs you will need to change the BM2022 to bridge mode.

Click **Network Setting** > **WAN**. Change the BM2022 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**.



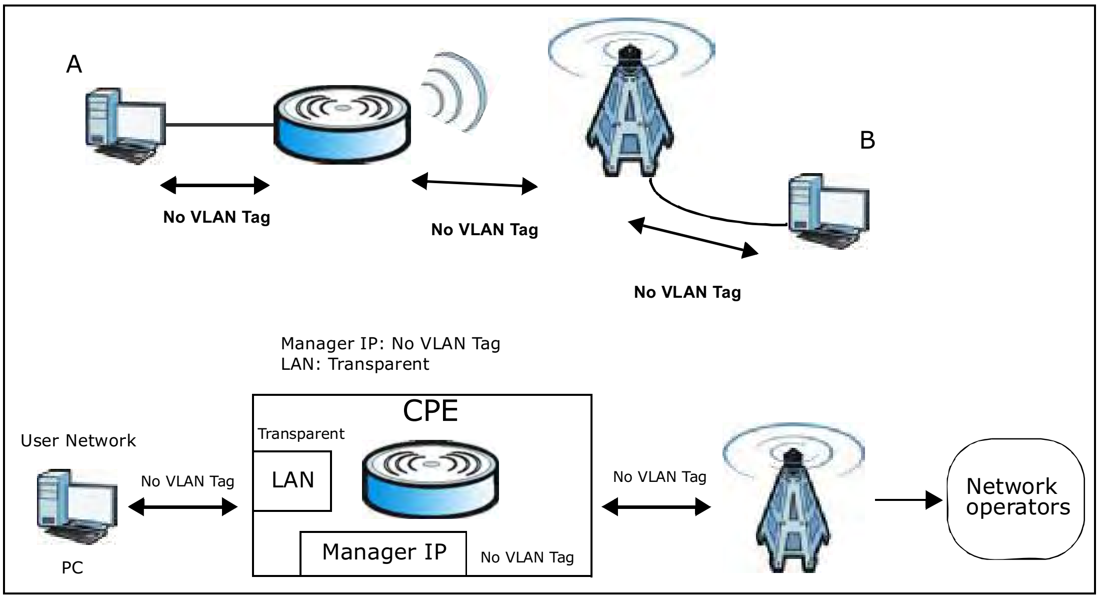
Operation Mode	Bridge
WAN Protocol	Ethernet
Bridging LAN ARP	No
Get IP Method	From ISP
WAN IP Request Timeout	120 *seconds (0- 600, default:120, infinite:0)*
WAN IP Address	0.0.0.0
WAN IP Subnet Mask	0.0.0.0
Gateway IP Address	0.0.0.0
MTU	1400
Clone MAC Address	00:0C:F7:0B:01:01

WAN DNS

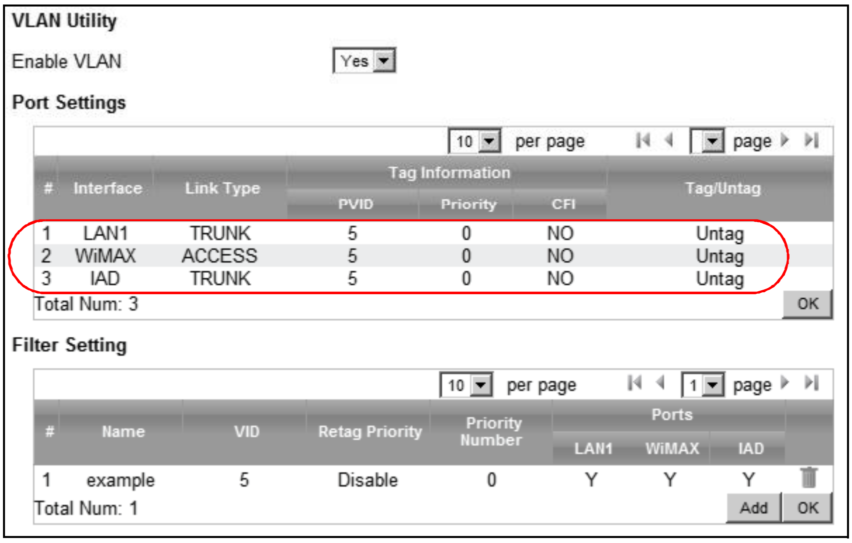
First DNS Server	From ISP 0.0.0.0
Second DNS Server	From ISP 0.0.0.0
Third DNS Server	From ISP 0.0.0.0

4.11.1 Scenario 1

In this scenario, PC A is connected directly to interface LAN1 on the BM2022. PC B is connected to interface WiMAX and interface IAD for managing the BM2022.



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: Yes

Port Settings

#	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

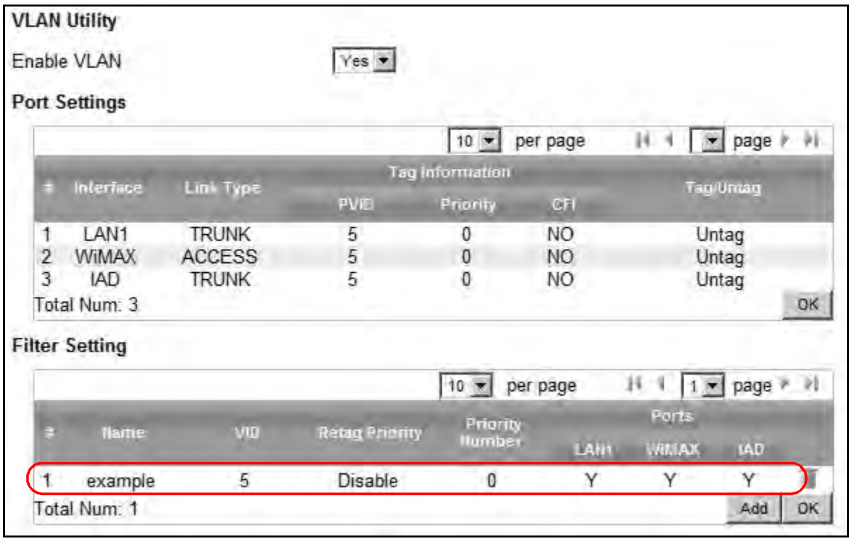
Total Num: 3

Filter Setting

#	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 BM2022 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: Yes

Port Settings

#	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

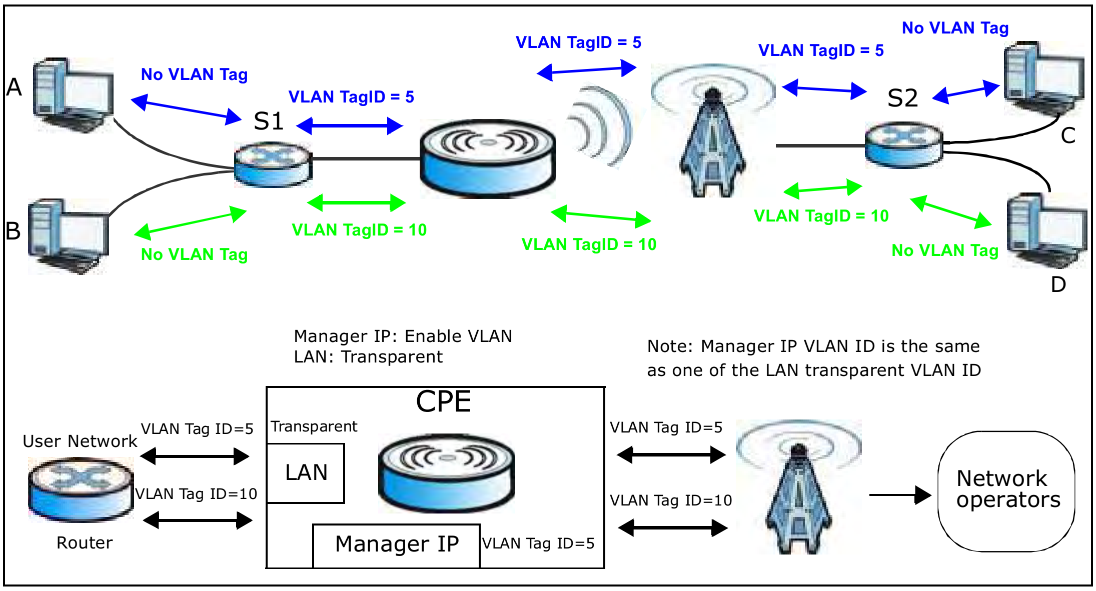
#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y

Total Num: 1

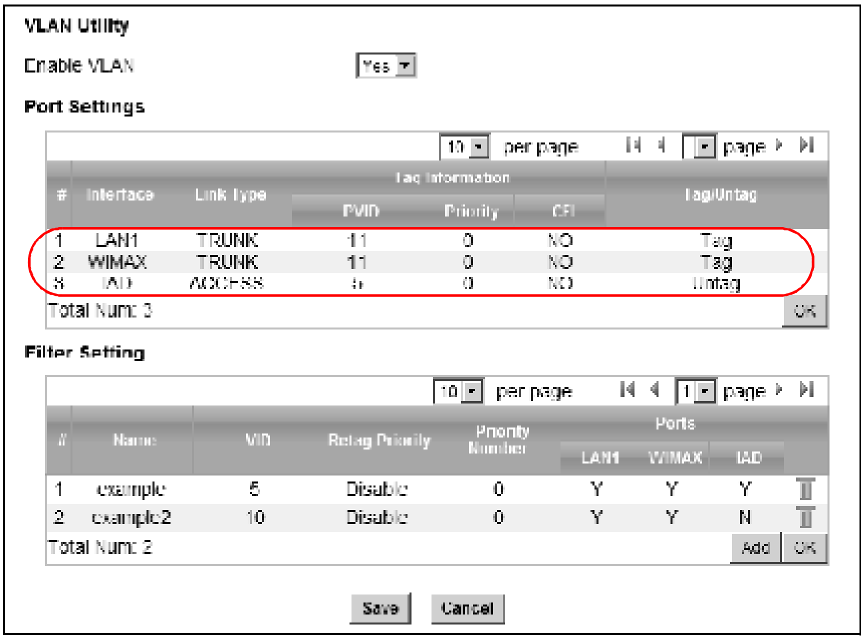
4.11.2 Scenario 2

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 BM2022, 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.



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: Yes

Port Settings

10 per page | 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

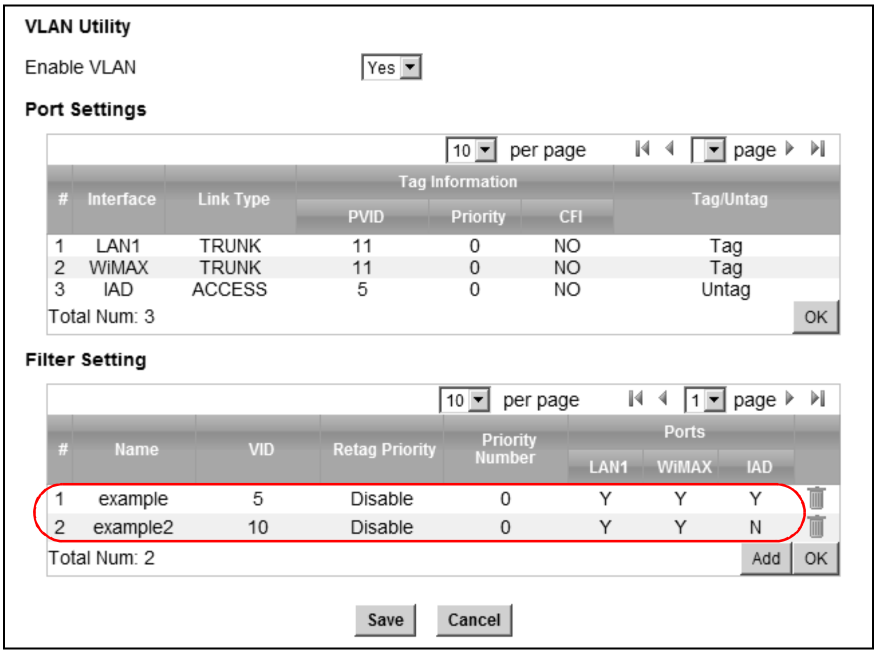
Filter Setting

10 per page | 1 page

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

Total Num: 2

2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links, so the BM2022 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: Yes

Port Settings

#	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

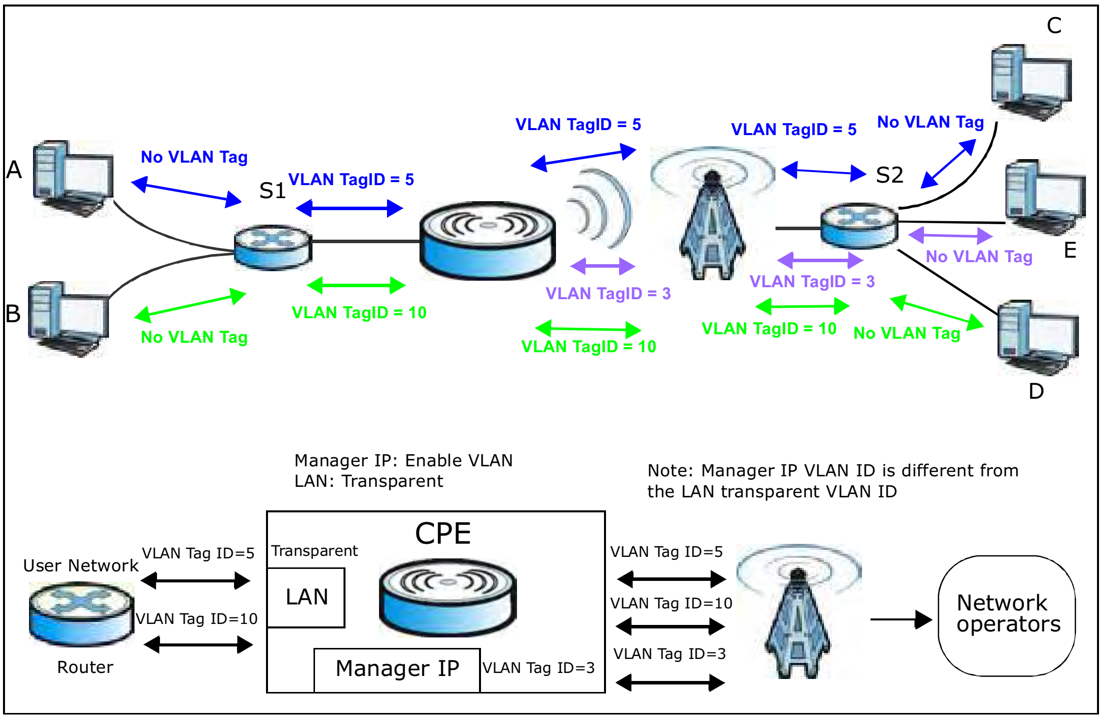
#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y
2	example2	10	Disable	0	Y	Y	N

Total Num: 2

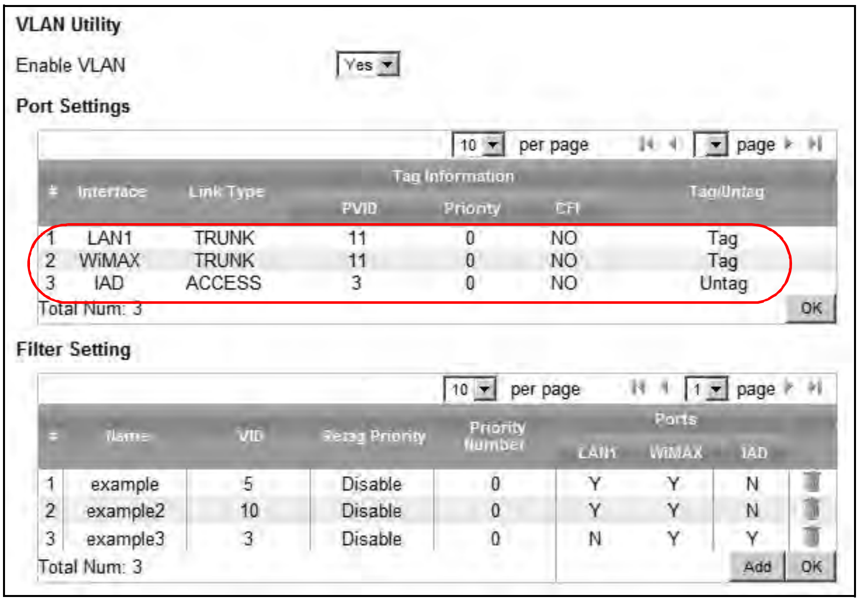
4.11.3 Scenario 3

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 BM2022.

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.



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: Yes

Port Settings

10 per page, 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

OK

Filter Setting

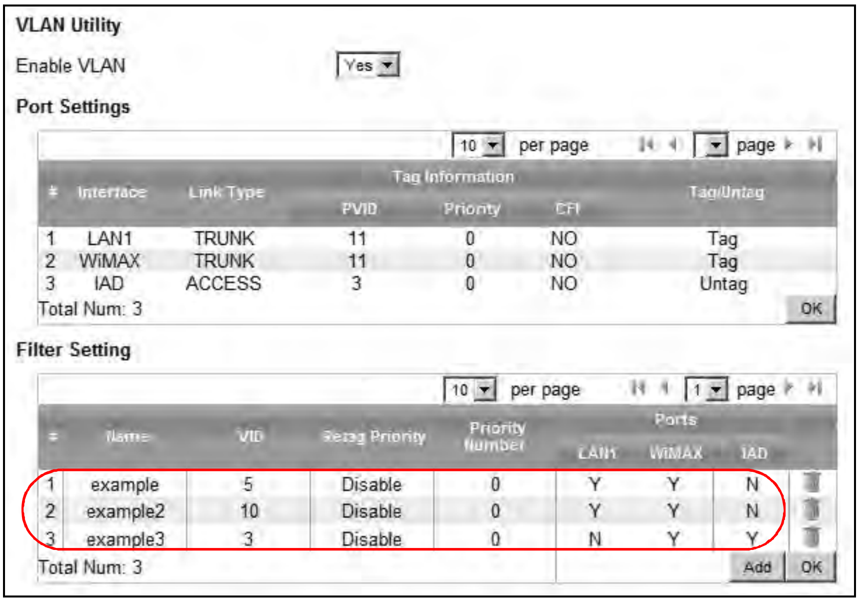
10 per page, 1 page

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

Total Num: 3

Add OK

2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links, so the BM2022 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: Yes

Port Settings

10 per page · 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 · 1 page

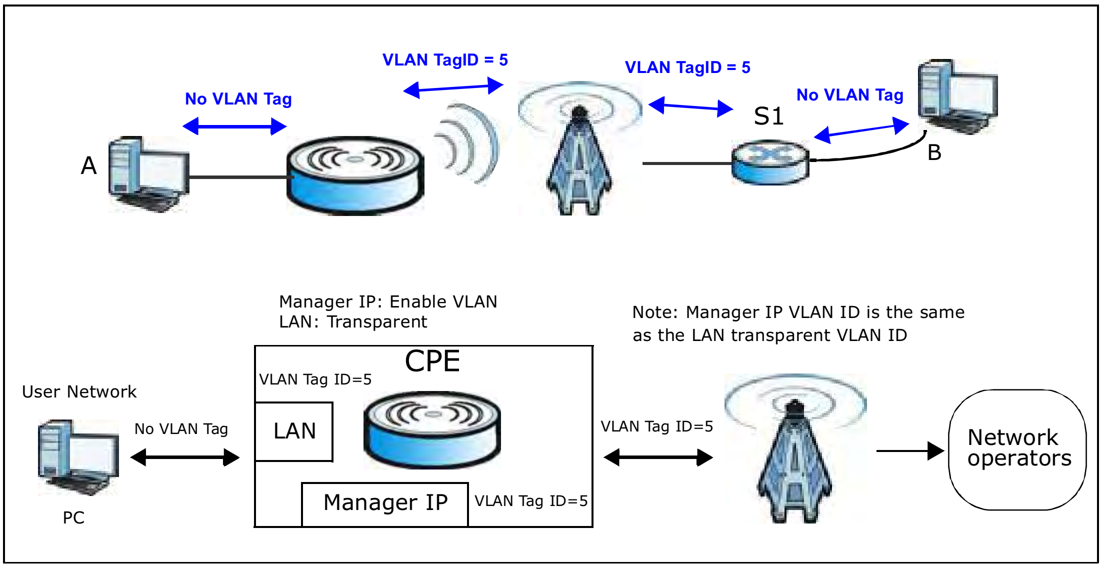
#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	N
2	example2	10	Disable	0	Y	Y	N
3	example3	3	Disable	0	N	Y	Y

Total Num: 3

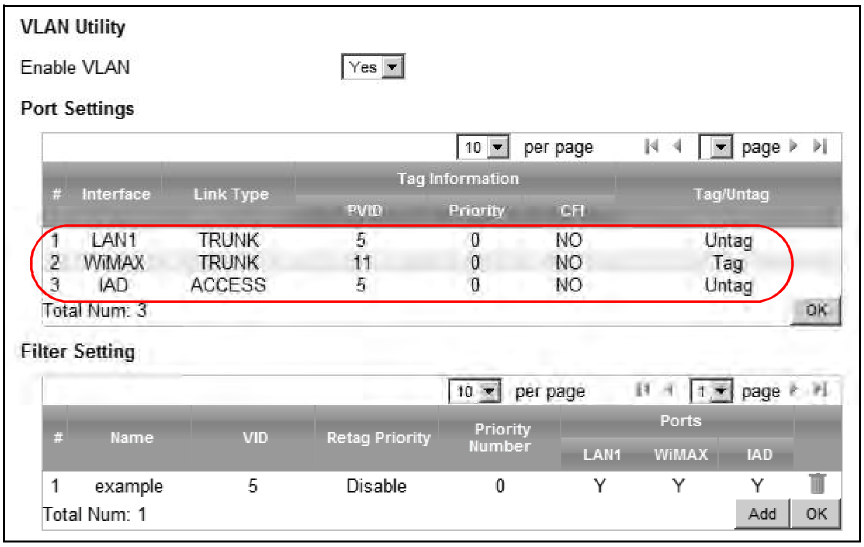
4.11.4 Scenario 4

In this scenario, PC A is connected directly to interface LAN1 on the BM2022, while PC B is on VLAN 5. PC B is connected to interface WiMAX and interface IAD for managing the BM2022, 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.



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: Yes

Port Settings

10 per page | 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

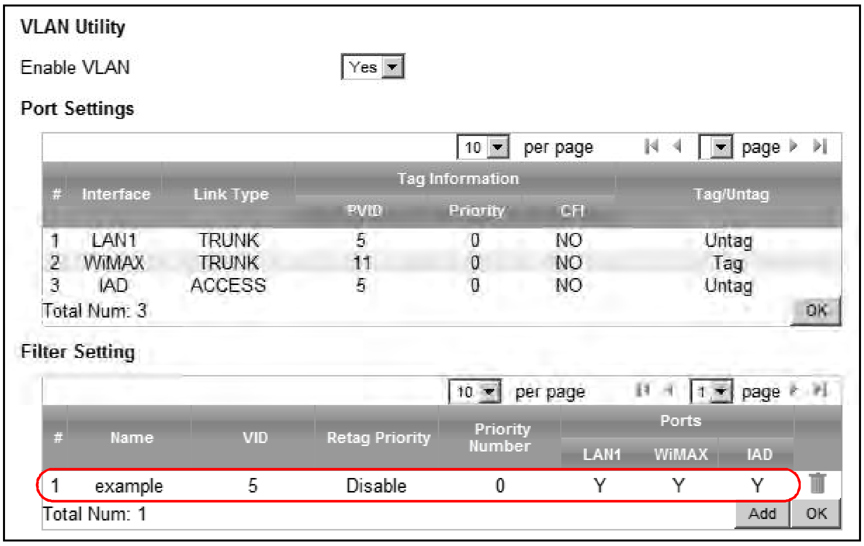
Filter Setting

10 per page | 1 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**. Interfaces **LAN1** and **WiMAX** are Trunk links. On the WiMAX interface, the BM2022 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 BM2022 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

#	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

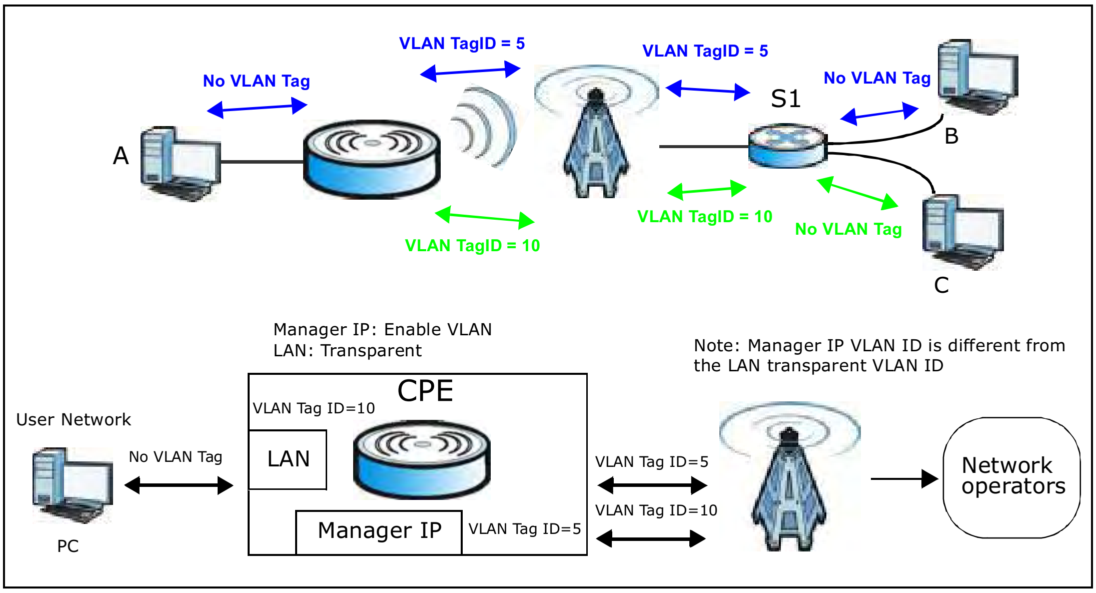
#	Name	VID	Retag Priority	Priority Number	Ports		
					LAN1	WiMAX	IAD
1	example	5	Disable	0	Y	Y	Y

Total Num: 1

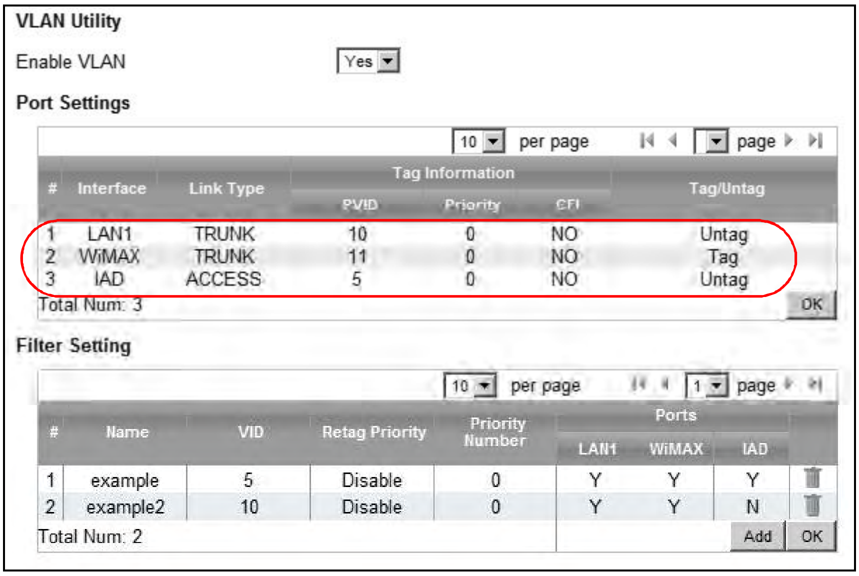
4.11.5 Scenario 5

In this scenario, PC A is directly connected to interface LAN1 on the BM2022. 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 BM2022, 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.



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: Yes

Port Settings

10 per page | 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 OK

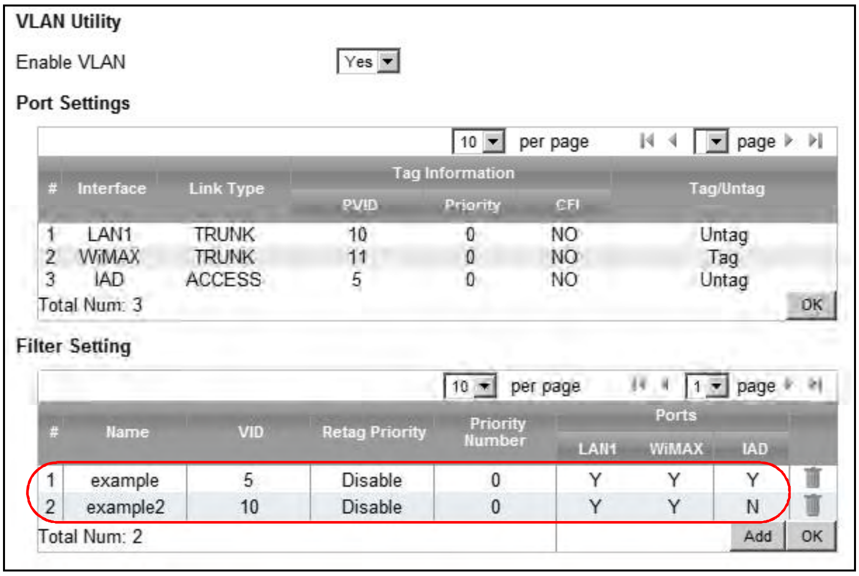
Filter Setting

10 per page | 1 page

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

Total Num: 2 Add OK

2 Next, configure the **Name**, **VID** and **Ports** for the **Filter Setting**. Interfaces **LAN1** and **WiMAX** are Trunk links. On the WiMAX interface the BM2022 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 BM2022 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: Yes

Port Settings

#	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

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

Total Num: 2

PART II
Technical Reference

5

System Status

5.1 Overview

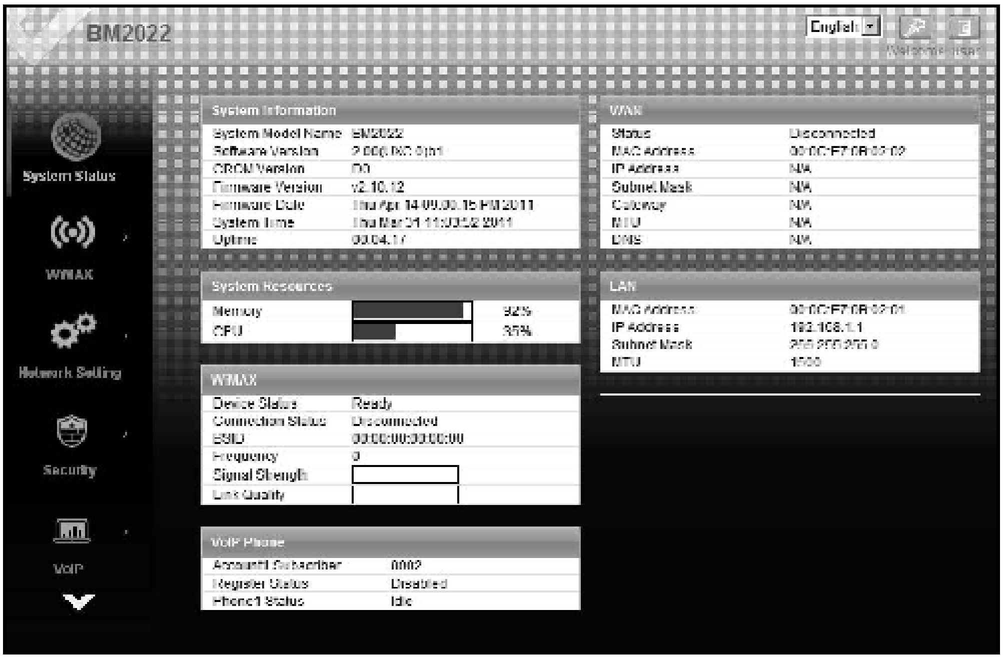
Use this screen to view a summary of your BM2022 connection status.

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 14 System Status



System Information

System Model Name	BM2022
Software Version	2.00(.IXC.0)b1
CROM Version	D0
Firmware Version	v2.10.12
Firmware Date	Thu Apr 14 09:00:15 PM 2011
System Time	Thu Mar 31 11:03:52 2011
Uptime	00:04:17

WAN

Status	Disconnected
MAC Address	00:0C:F7:0B:02:02
IP Address	N/A
Subnet Mask	N/A
Gateway	N/A
MTU	N/A
DNS	N/A

System Resources

Memory	92%
CPU	35%

LAN

MAC Address	00:0C:F7:0B:02:01
IP Address	192.168.1.1
Subnet Mask	255.255.255.0
MTU	1500

WiMAX

Device Status	Ready
Connection Status	Disconnected
BSID	00:00:00:00:00:00
Frequency	0
Signal Strength	
Link Quality	

VoIP Phone

Account1 Subscriber	0002
Register Status	Disabled
Phone1 Status	Idle

The following tables describe the labels in this screen.

Table 10 Status

LABEL	DESCRIPTION
System Information	
System Model Name	This field displays the BM2022 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 BM2022 has been running since it last started up.
System Resources	
Memory	This field displays what percentage of the BM2022's memory is currently used. The higher the memory usage, the more likely the BM2022 is to slow down. Some memory is required just to start the BM2022 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 BM2022's CPU is currently used. The higher the CPU usage, the more likely the BM2022 is to slow down.
WiMAX	
Device Status	This field displays the BM2022 current status for connecting to the selected base station. **Scanning** - The BM2022 is scanning for available base stations. **Ready** - The BM2022 has finished a scanning and you can connect to a base station. **Connecting** - The BM2022 attempts to connect to the selected base station. **Connected** - The BM2022 has successfully connected to the selected base station.
Connection Status	This field displays the status of the WiMAX connection between the BM2022 and the base station. **Network Search** - The BM2022 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 BM2022 is using.
Signal Strength	This field indicates the strength of the connection that the BM2022 has with the base station.
Link Quality	This field indicates the relative quality of the link the BM2022 has with the base station.

Table 10 Status (continued)

LABEL	DESCRIPTION
WAN	
Status	This field indicates the status of the WAN connection to the BM2022.
MAC Address	This field indicates the MAC address of the port making the WAN connection on the BM2022.
IP Address	This field indicates the current IP address of the BM2022 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 BM2022 is connected.
MTU	This field indicates the Maximum Transmission Unit (MTU) between the BM2022 and the ISP servers to which it is connected.
DNS	This field indicates the Domain Name Server (DNS) to which your BM2022 is connected.
LAN	
MAC Address	This field indicates the MAC address of the port making the LAN connection on the BM2022.
IP Address	This field displays the current IP address of the BM2022 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 BM2022 and the client devices to which it is connected.
VOIP Phone	
Account1 Subscriber	This field displays the SIP number for the SIP account.
Registered Status	This field displays whether the SIP account is already registered with a SIP server (**Up** or **Disabled**).
Phone1 Status	This field displays whether the phone line (mapping to the **VoIP** port) is in use or not (idle).

6

WiMAX

6.1 Overview

This chapter shows you how to set up and manage the connection between the BM2022 and your ISP's base stations.

6.1.1 What You Need to Know

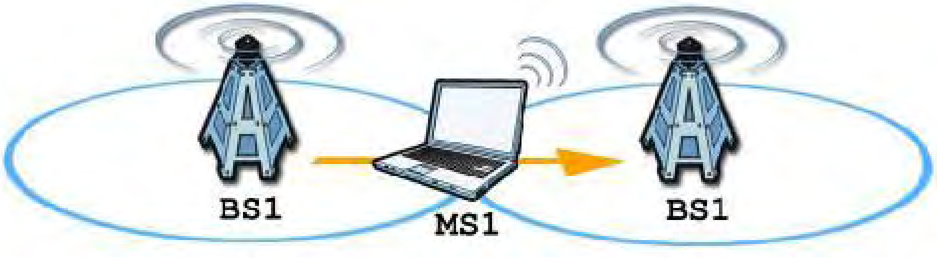
The following terms and concepts may help as you read through this chapter.

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). Huawei is a member of the WiMAX Forum, the industry group dedicated to promoting and certifying interoperability of wireless broadband products.

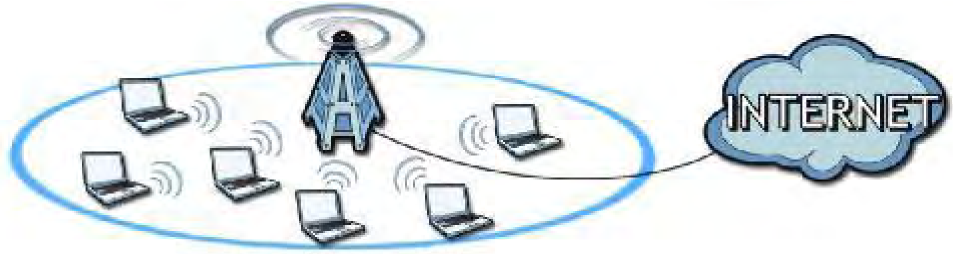
In a wireless MAN, a wireless-equipped computer is known either as a mobile station (MS) or a subscriber station (SS). Mobile stations use the IEEE 802.16e standard and are able to maintain connectivity while switching their connection from one base station to another base station (handover) while subscriber 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 15 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 16 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.

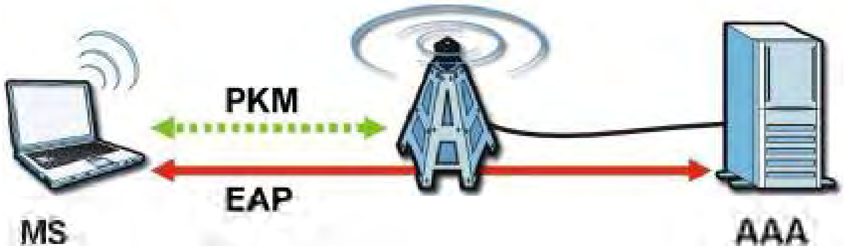
The radio frequency and bandwidth of the link between the BM2022 and the base station are controlled by the base station. The BM2022 follows the base station's configuration.

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 17 Using an AAA Server

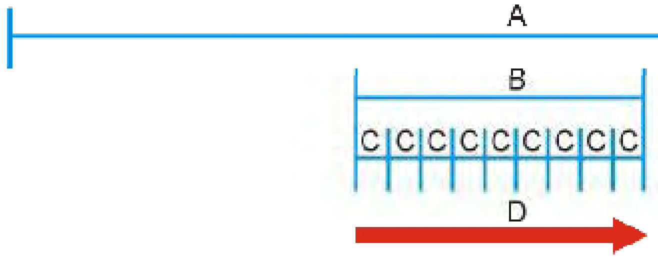


In this figure, the dashed arrow shows the PKM (Privacy Key Management) secured connection between the mobile station and the base station, and the solid arrow shows the EAP secured connection between the mobile station, the base station and the AAA server. See the WiMAX security appendix for more details.

Frequency Ranges

The following figure shows the BM2022 searching a range of frequencies to find a connection to a base station.

Figure 18 Frequency Ranges



In this figure, **A** is the WiMAX frequency range. “WiMAX frequency range” refers to the entire range of frequencies the BM2022 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 BM2022 searching for a connection.

Have the BM2022 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 BM2022 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 BM2022 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 BM2022 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 BM2022 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 BM2022 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.

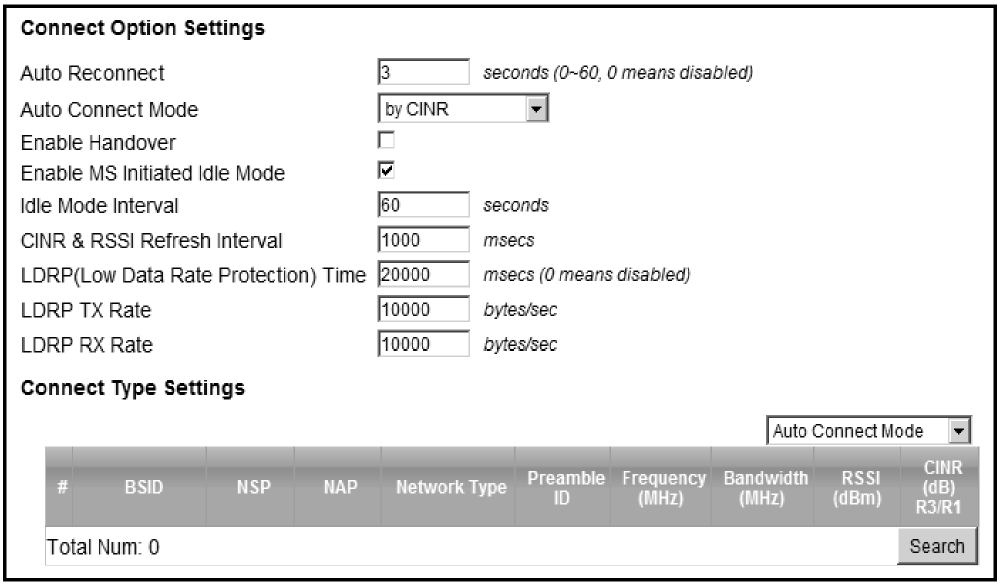
The BM2022 supports EAP-TLS and EAP-TTLS (at the time of writing, TTLS is not available in Windows Vista). For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). Certificates (also called digital IDs) can 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 BM2022 connects to the base stations on the WiMAX network.

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

Figure 19 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	*msecs*
LDRP(Low Data Rate Protection) Time	20000	*msecs (0 means disabled)*
LDRP TX Rate	10000	*bytes/sec*
LDRP RX Rate	10000	*bytes/sec*

Connect Type Settings

Auto Connect Mode ▾

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

Total Num: 0

This screen contains the following fields:

Table 11 Connection Settings

LABEL	DESCRIPTION
Connection Option Settings	
Auto Reconnect	Select the interval in seconds that the BM2022 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 BM2022. • **By CINR** - Auto connects to the base station if the signal-to-noise ratio is sufficient for the BM2022.
Enable Handover	Select this to maintain connectivity while the BM2022 switches its connection from one base station to another base station.
Enable MS Initiated Idle Mode	Select this to have the BM2022 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 BM2022 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 BM2022.
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 BM2022 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 11 Connection Settings (continued)

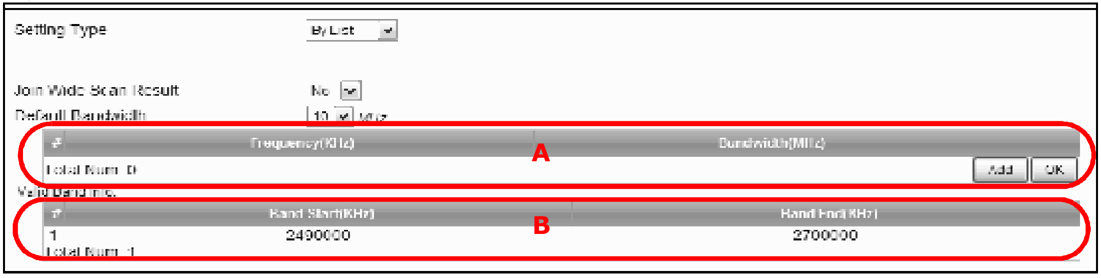
LABEL	DESCRIPTION
Mode Select	Select how the BM2022 connects to the base station. • **Auto Connect Mode** - The device connects automatically to the first base station in range. • **Network Search Mode** - The device scans for available base stations then connects to the best one it can.
BSID	This displays the MAC address of a base station within range of the BM2022.
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 BM2022'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 BM2022 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.

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

Figure 20 Frequency Settings Screen (By List)



Setting Type By List

Join Wide Scan Result No

Default Bandwidth 10 MHz

#	Frequency(KHz)	Bandwidth(MHz)

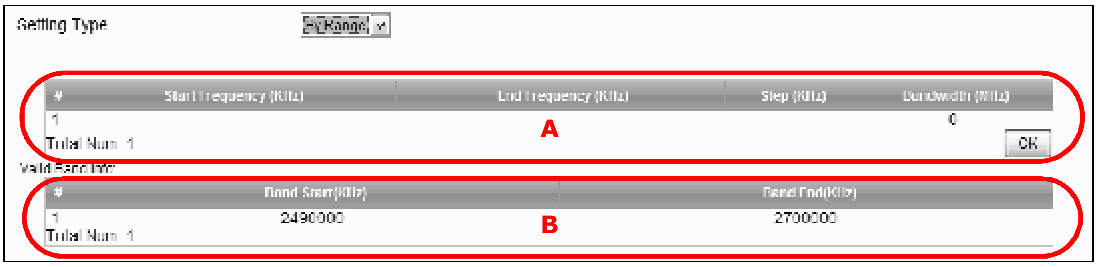
Total Num: 0

Valid Band Info:

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

Total Num: 1

Figure 21 Frequency Settings Screen (By Range)



Setting Type By Range

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

Total Num: 1

Valid Band Info:

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

Total Num: 1

This screen contains the following fields:

Table 12 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.
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.

Table 12 Frequency Settings (continued)

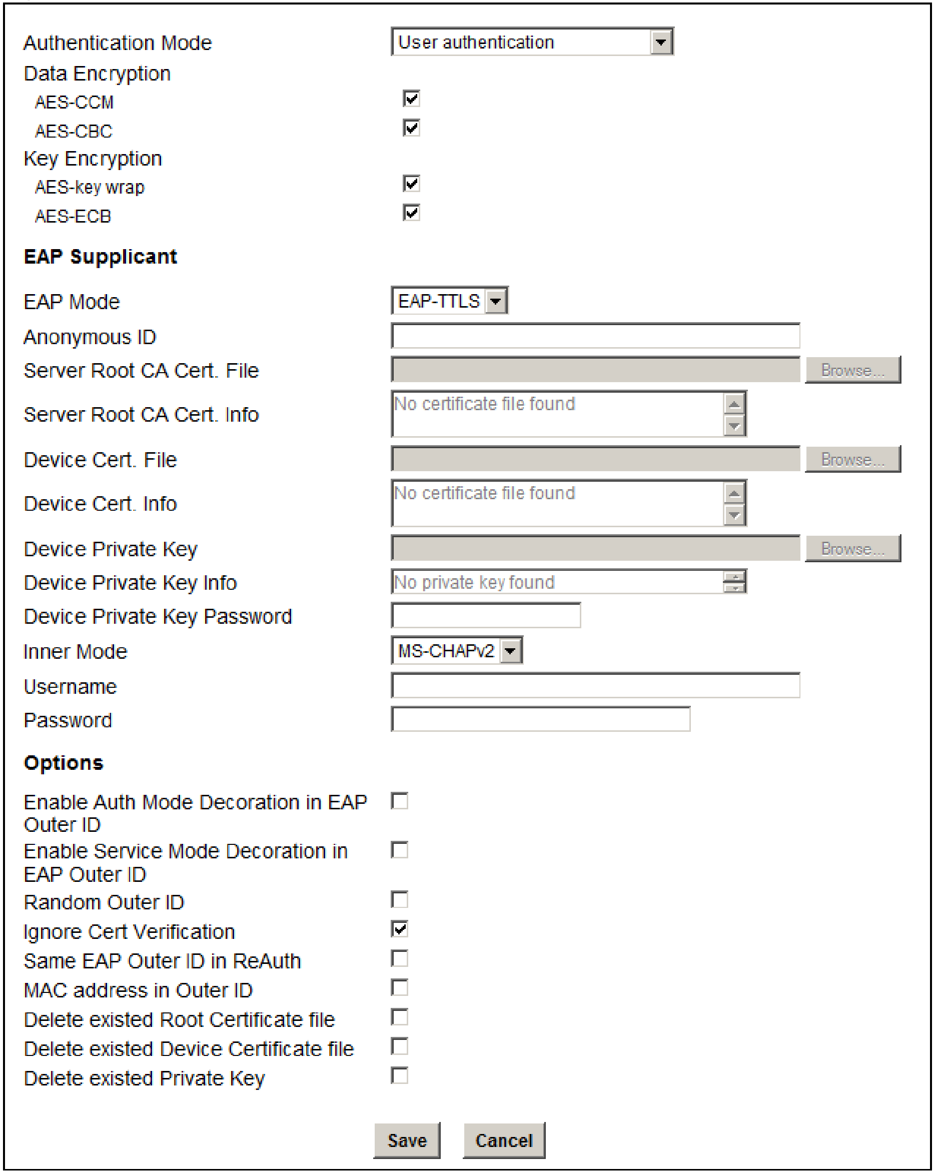
LABEL	DESCRIPTION
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
OK	Click this button to save any changes made to the list.
A (When **By Range** is selected in the **Setting Type** field)	
Start Frequency (KHz)	This indicates the beginning 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 BM2022 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 22 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	No certificate file found
Device Cert. File	Browse...
Device Cert. Info	No certificate file found
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 13 Authentication Settings

LABEL	DESCRIPTION
Authentication Mode	Select the authentication mode from the list. The BM2022 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 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 BM2022 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 13 Authentication Settings (continued)

LABEL	DESCRIPTION
Inner Mode	Sets the EAP-TTLS inner mode. The BM2022 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 BM2022 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 BM2022 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 BM2022.
Delete existed Device Certificate file	Select this to delete an existing device certificate file from the BM2022.
Delete existed Private Key	Select this to delete an existing private key from the BM2022.

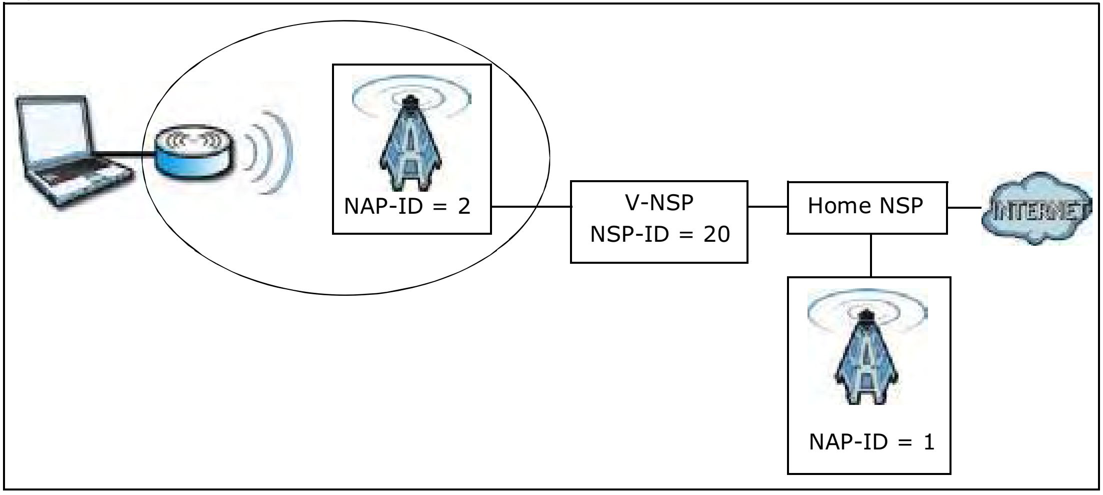
6.5 Channel Plan Settings

This screen allows you to specify channel plan settings for Network Discovery and Selection (ND&S). The BM2022 uses ND&S to establish connections when it is roaming. To do this, the BM2022 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 BM2022 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 BM2022 cannot reach a base station owned by his Home NSP (base station with NAP-ID = 1). The BM2022 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.

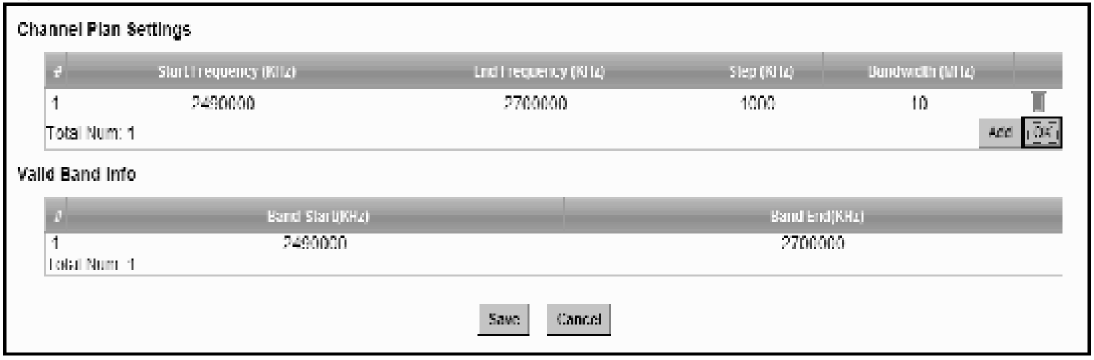
Figure 23 ND&S Scenario



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 24 Channel Plan Settings



Channel Plan Settings

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

Total Num: 1

Valid Band Info

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

Total Num: 1

This screen contains the following fields:

Table 14 Channel Plan Settings

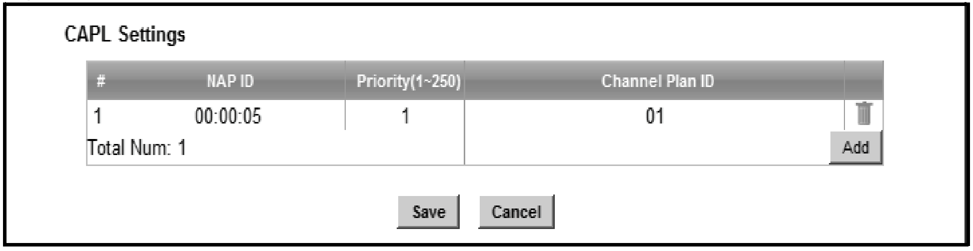
LABEL	DESCRIPTION
Channel Plan Settings - You can configure multiple ranges of frequencies to scan for different NAPs. The configured frequency ranges to scan must be within the Valid Band. Specify the Channel Plan to scan for each NAP on the CAPL Settings: Add screen (Section 6.6.1 on page 78).	
Start 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 BM2022 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 25 CAPL Settings



CAPL Settings

#	NAP ID	Priority(1~250)	Channel Plan ID	
1	00:00:05	1	01	

Total Num: 1

This screen contains the following fields:

Table 15 CAPL Settings

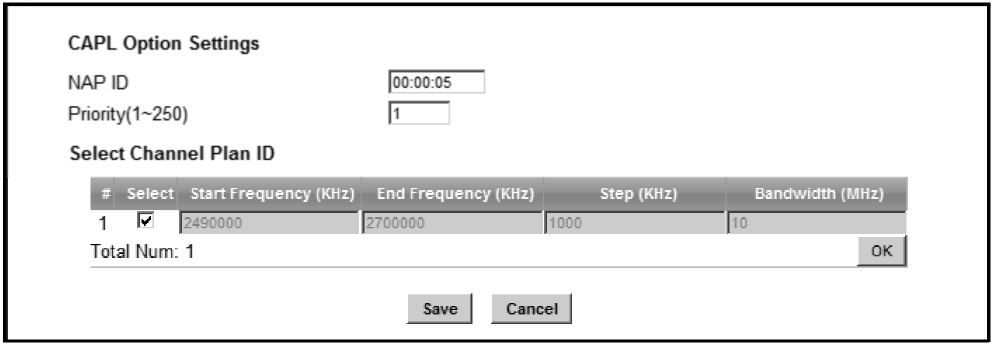
LABEL	DESCRIPTION
NAP ID	This displays the NAP ID.
Priority	This displays the priority for the NAP ID.
Channel Plan ID	This displays the Channel Plan ID.
Delete	Click this button to remove an item from the list.
Add	Click this button to add an item to the list.
Save	Click this to save the changes made.
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 26 CAPL Settings: Add



CAPL Option Settings

NAP ID: 00:00:05

Priority(1~250): 1

Select Channel Plan ID

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

Total Num: 1

This screen contains the following fields:

Table 16 CAPL Settings: Add

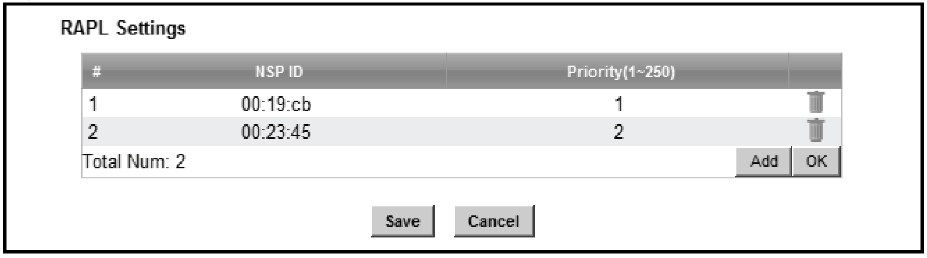
LABEL	DESCRIPTION
NAP ID	Specify the NAP ID in the format XX:XX:XX where X is a hexadecimal character. The NAP ID is typically the first three blocks of the BSID of the base station.
Priority	Specify the priority for the NAP ID. Enter 1-250 where 1 is the highest priority. The BM2022 will search for 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 BM2022 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).
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 27 RAPL Settings



RAPL Settings

#	NSP ID	Priority(1~250)	
1	00:19:cb	1	🗑
2	00:23:45	2	🗑

Total Num: 2

This screen contains the following fields:

Table 17 RAPL Settings

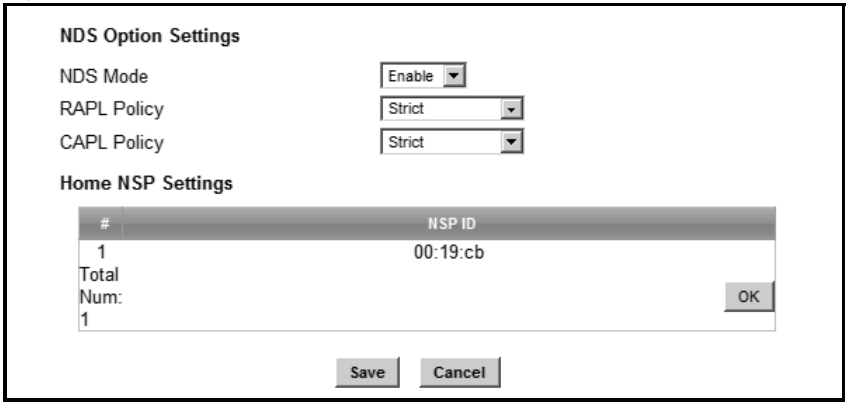
LABEL	DESCRIPTION
NSP ID	Specify the Network Service Provider (NSP) ID in the format XX:XX:XX where X is a hexadecimal character. If the Home NSP ID is entered in this list, the BM2022 will try to use it to establish a connection.
Priority	Specify the priority for the NSP. Enter 1-250 where 1 is the 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 28 Home NSP Settings



NDS Option Settings

NDS Mode: Enable

RAPL Policy: Strict

CAPL Policy: Strict

Home NSP Settings

#	NSP ID
1	00:19:cb

Total Num: 1

This screen contains the following fields:

Table 18 Home NSP Settings

LABEL	DESCRIPTION
NDS Option Settings	
NDS Mode	Select **Enable** to use NDS to establish connections to the Home NSP.

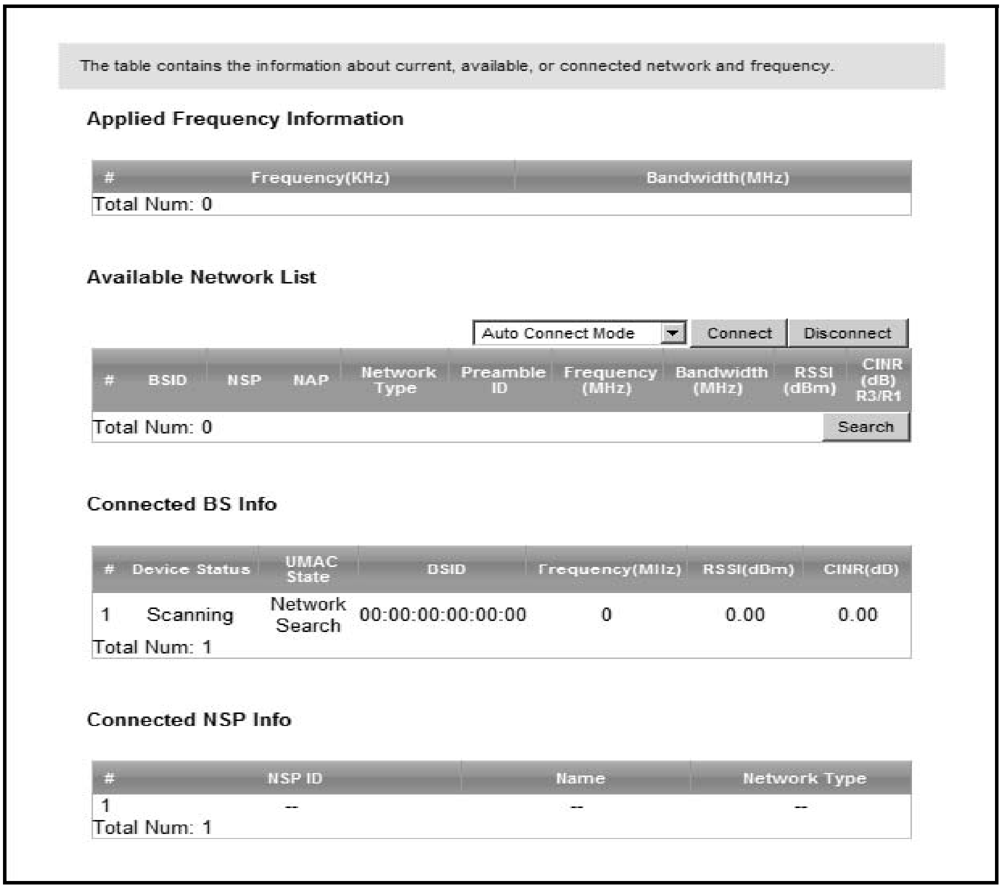
Table 18 Home NSP Settings (continued)

LABEL	DESCRIPTION
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 BM2022 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 BM2022 will first try the V-NSPs specified in the RAPL to connect to the H-NSP. Select **Flexible** to allow the BM2022 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 BM2022 to use NAPs not specified in the CAPL to connect to the H-NSP. Before attempting NAPs not specified in the CAPL the BM2022 will first try the NAPs specified in the CAPL to connect to the H-NSP. Select **Flexible** to allow the BM2022 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.
Save	Click this button to save any changes made to the list. Note: If you change the **NDS Mode**, the BM2022 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 BM2022 found through scanning and choose a base station to which to connect.

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



The table contains the information about current, available, or connected network and frequency.

Applied Frequency Information

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

Available Network List

#	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)
1	Scanning	Network Search	00:00:00:00:00:00	0	0.00	0.00
Total Num: 1						

Connected NSP Info

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

Figure 29 Connect Screen

This screen contains the following fields:

Table 19 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.	
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	

Table 19 Connect (continued)

LABEL	DESCRIPTION
Connected Mode	Select a connect mode: • **Auto Connect Mode** - This allows the BM2022 to connect to any of the base stations on the list automatically. • **Network Search Mode** - This allows the BM2022 to connect to a user-specified base station. Select this option, choose a base station, click **Connect**. • **NSP Mode** - This allows the BM2022 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 BM2022 will automatically connect to a base station with the same NSP ID, and the best CINR or RSSI. • **NSP/NAP Mode** - This allows the BM2022 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 BM2022 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 BM2022 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 BM2022 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).
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 BM2022 scan for base stations in the frequency band(s) listed in the **Applied Frequency Information** table.
Connected BS Info	

Table 19 Connect (continued)

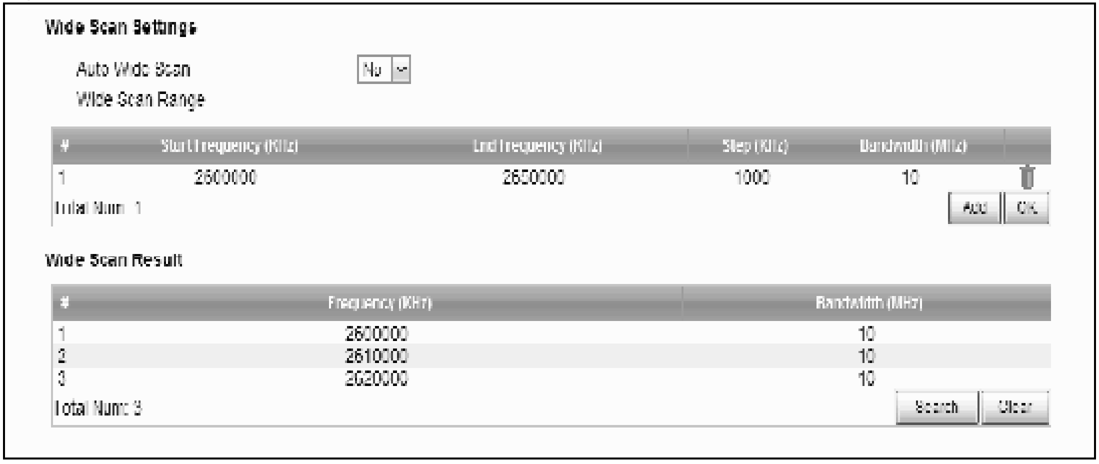
LABEL	DESCRIPTION
Device Status	This field displays the BM2022 current status for connecting to the selected base station. **Scanning** - The BM2022 is scanning for available base stations. **Ready** - The BM2022 has finished scanning and you can connect to a base station. **Connecting** - The BM2022 attempts to connect to the selected base station. **Connected** - The BM2022 has successfully connected to the selected base station.
UMAC State	This field displays the status of the WiMAX connection between the BM2022 and the base station. **Network Search** - The BM2022 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 BM2022 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 30 Wide Scan Screen



Wide Scan Settings

Auto Wide Scan: No

Wide Scan Range

#	Start Frequency (KHz)	End Frequency (KHz)	Step (KHz)	Bandwidth (MHz)
1	2600000	2650000	1000	10

Total Num: 1

Wide Scan Result

#	Frequency (KHz)	Bandwidth (MHz)
1	2600000	10
2	2610000	10
3	2620000	10

Total Num: 3

This screen contains the following fields:

Table 20 Wide Scan

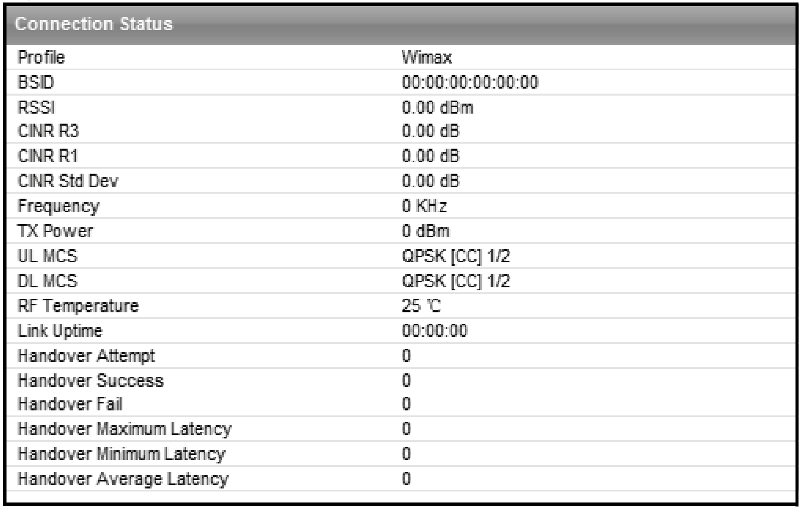
LABEL	DESCRIPTION
Wide Scan Settings	
Auto Wide Scan	Use this to enable (**Yes**) or disable (**No**) automatically scanning for base stations.
Wide Scan Range	
Start Frequency (KHz)	Enter the start frequency in kilohertz (KHz) for a wide scan range.
End Frequency (KHz)	Enter the end frequency in kilohertz (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 31 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 ℃
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 21 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 BM2022 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 BM2022 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 BM2022's RF circuit.
Link Uptime	This field displays the length of time the current connection has been up.

Table 21 Link Status (continued)

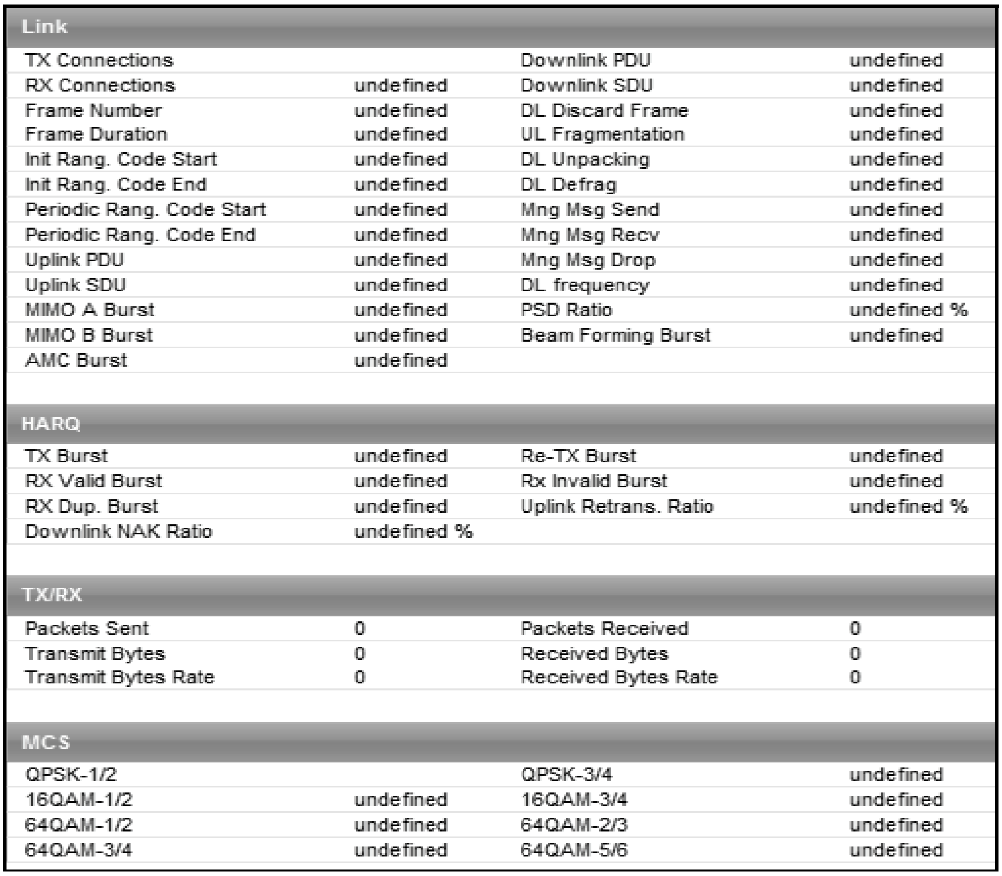
LABEL	DESCRIPTION
Handover Success	This field displays how many times the BM2022 had ever successfully switched its connection from one base station to another base station, since the BM2022 last restarted.
Handover Fail	This field displays how many times the BM2022 had been failed to switch its connection from one base station to another base station, since the BM2022 last restarted.
Handover Maximum Latency	This field displays the maximum latency for switching connections from one base station to another base station, since the BM2022 last restarted.
Handover Minimum Latency	This field displays the minimum latency for switching connections from one base station to another base station, since the BM2022 last restarted.
Handover Average Latency	This field displays the average latency for switching connections from one base station to another base station, since the BM2022 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 32 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:

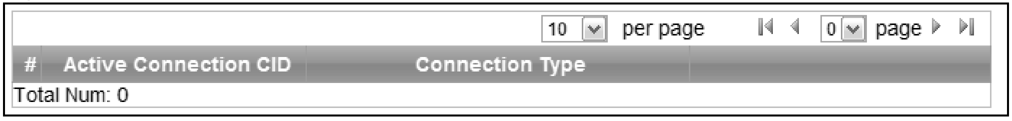
Table 22 Link Statistics

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.



#	Active Connection CID	Connection Type

Total Num: 0

Figure 33 Connection Info Screen

This screen contains the following fields:

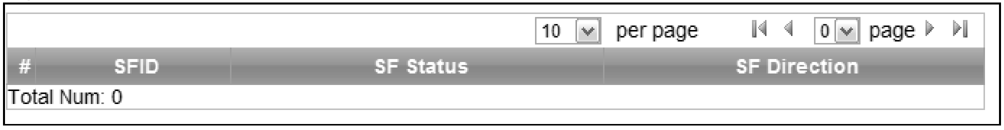
Table 23 Connection Info

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.



#	SFID	SF Status	SF Direction

Total Num: 0

Figure 34 Service Flow Screen

This screen contains the following fields:

Table 24 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.

7

Network Setting

7.1 Overview

This chapter shows you how to configure the BM2022'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 BM2022 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 BM2022 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 BM2022 tells the DHCP clients that it itself is the DNS server. When a computer sends a DNS query to the BM2022, the BM2022 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 BM2022 can pass the DNS servers to the computers and the computers can query the DNS server directly without the BM2022'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 BM2022 will broadcast its routing table periodically and incorporate the RIP information that it receives.
- **RX Only -** the BM2022 will not send any RIP packets but will accept all RIP packets received.
- **TX Only -** the BM2022 will send out RIP packets but will not accept any RIP packets received.
- **None -** the BM2022 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 BM2022 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.

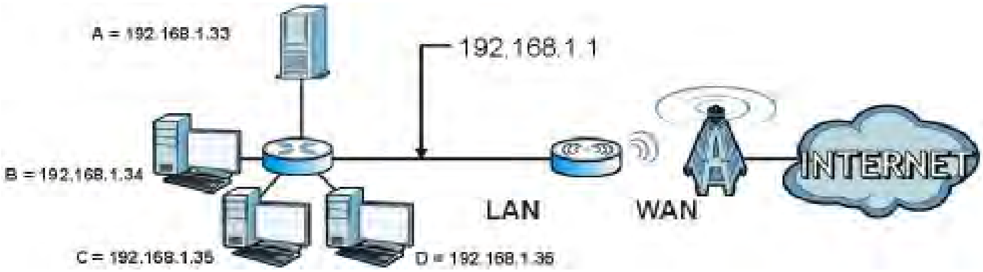
With port forwarding, you can forward incoming service requests to the server(s) on your local network. You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 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 35 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 BM2022 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 BM2022's WAN port receives a response with a specific port number and protocol ("incoming" port), the BM2022 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 Huawei

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

The BM2022 only sends UPnP multicasts to the LAN.

Content Filter

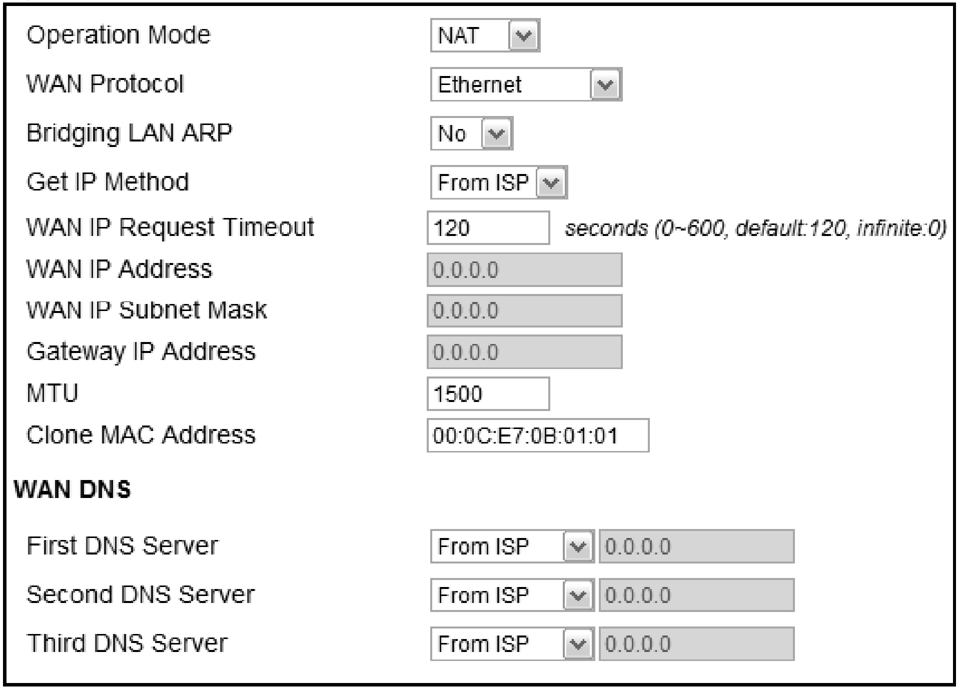
Internet content filtering allows you to create and enforce Internet access policies tailored to their needs. Content filtering is the ability to block certain specific URL keywords.

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 36 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, default:120, 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	1500
Clone MAC Address	00:0C:E7:0B:01:01

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

This screen contains the following fields:

Table 25 WAN

LABEL	DESCRIPTION
Operation Mode	Select the BM2022's operational mode. • **Bridge** - This puts the BM2022 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 BM2022 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 BM2022 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** - 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 BM2022.
Get IP Method	Select how the BM2022 receives its IP address. • **User** - Select this to manually enter the IP address the BM2022 uses. • **From ISP** - Select to automatically get the IP address the BM2022 uses from the ISP.

Table 25 WAN (continued)

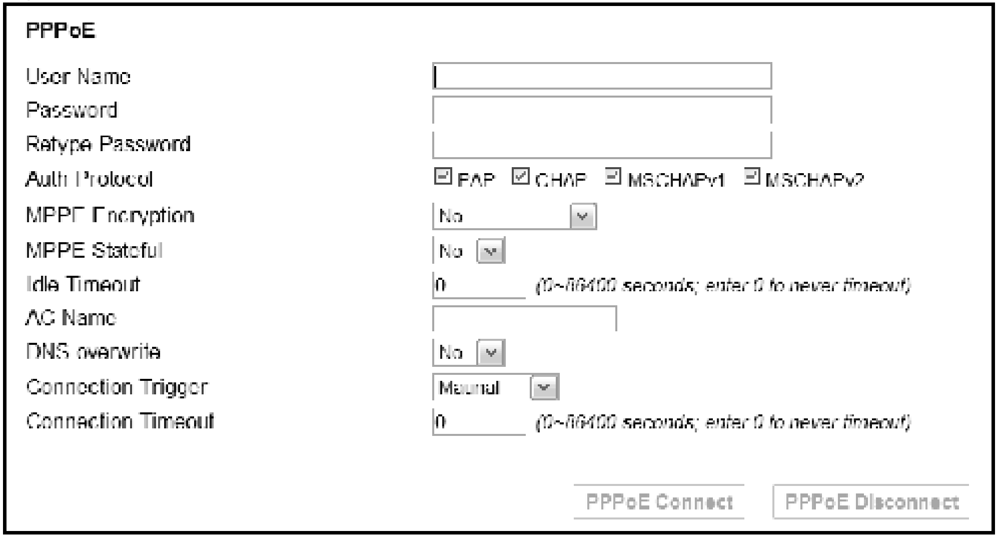
LABEL	DESCRIPTION
WAN IP Request Timeout	Enter the number of seconds the BM2022 waits for an IP from the ISP before it times out.
WAN IP Address	If the BM2022 gets its IP from the user, enter the IP address it is to use.
WAN IP Subnet Mask	If the BM2022 gets its IP from the ISP, enter the IP address it is to use.
Gateway IP Address	If the BM2022 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 BM2022. This is the largest protocol unit that the BM2022 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.
First~Third DNS Server	Select how the BM2022 acquires its DNS server address. • **From ISP** - Select this to have the BM2022 acquire its DNS server address from the ISP. • **User Define** - Select this to manually enter the DNS server used by the BM2022.

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 37 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	Maunal
Connection Timeout	0 (0~86400 seconds; enter 0 to never timeout)

This screen contains the following fields:

Table 26 PPPoE

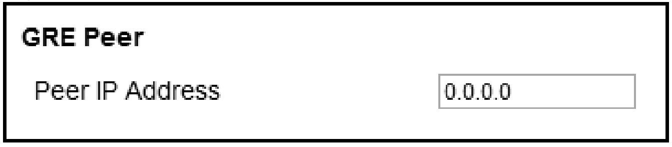
LABEL	DESCRIPTION
User Name	Enter the username for PPPoE login into the WAN network.
Password	Enter the password for PPPoE login into the WAN network.
Retype Password	Retype the password to confirm it.
Auth Protocol	Select a PPPoE authentication protocol. The BM2022 supports the following: • **CHAP** - The Challenge Handshake Authentication Protocol (CHAP) uses PPP to authenticate remote devices using a three-way handshake and shared secret verification. • **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. • **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 BM2022 to use the Microsoft Point-To-Point Encryption (MPPE) protocol for stateful peer negotiation.
Idle Timeout	Enter the number of second the BM2022 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 BM2022 to overwrite DNS static DNS entries on client devices.
Connection Trigger	Set whether the BM2022 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 BM2022 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 38 GRE Screen



GRE Peer

Peer IP Address: 0.0.0.0

This screen contains the following fields:

Table 27 GRE

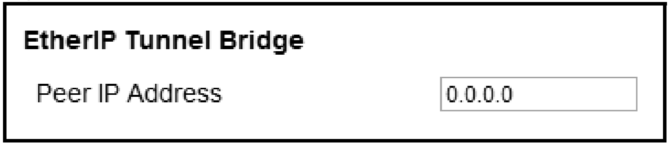
LABEL	DESCRIPTION
Peer IP Address	Enter the IP address of the GRE peer.

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 39 EtherIP Screen



EtherIP Tunnel Bridge

Peer IP Address 0.0.0.0

This screen contains the following fields:

Table 28 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 40 IP Screen

IP Address 192.168.1.1

IP Subnet Mask 255.255.255.0

This screen contains the following fields:

Table 29 IP

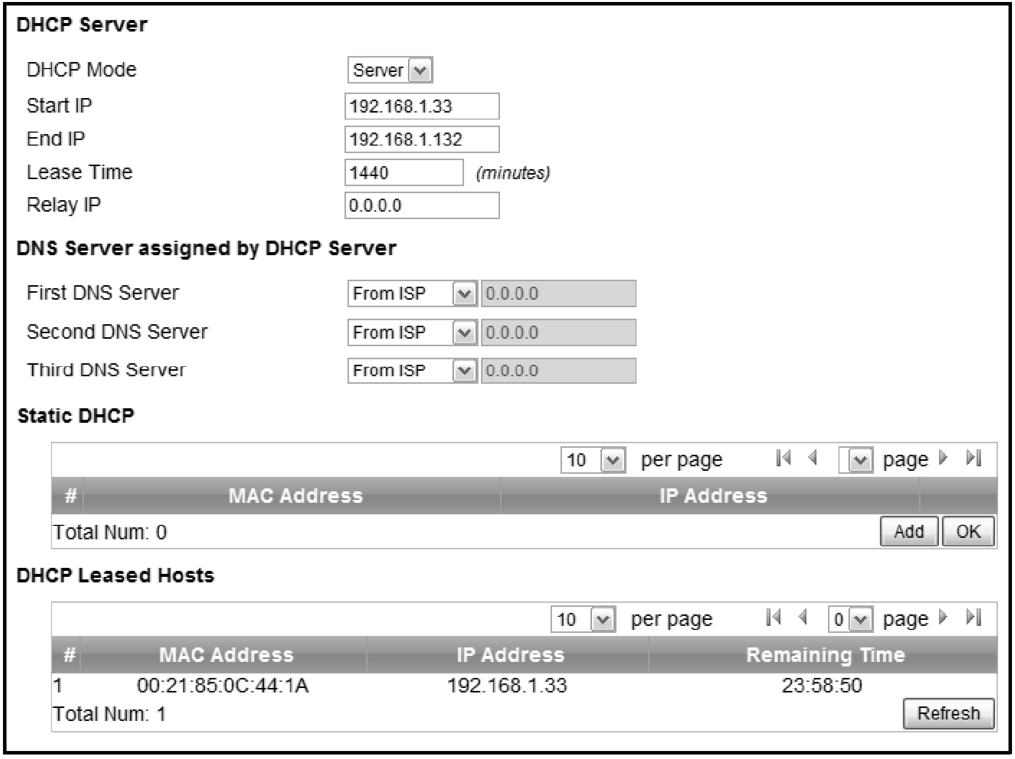
LABEL	DESCRIPTION
IP address	Enter the IP address of the LAN interface for the BM2022.
IP Subnet Mask	Enter the IP subnet mask of the LAN interface for the BM2022.

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 41 DHCP Screen



DHCP Server

DHCP Mode	Server
Start IP	192.168.1.33
End IP	192.168.1.132
Lease Time	1440 *(minutes)*
Relay IP	0.0.0.0

DNS Server assigned by DHCP Server

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

Static DHCP

10 per page page

#	MAC Address	IP Address

Total Num: 0

DHCP Leased Hosts

10 per page 0 page

#	MAC Address	IP Address	Remaining Time
1	00:21:85:0C:44:1A	192.168.1.33	23:58:50

Total Num: 1

This screen contains the following fields:

Table 30 DHCP

LABEL	DESCRIPTION
DHCP Server	
DHCP Mode	Select this if you want the BM2022 to be the DHCP server on the LAN. As a DHCP server, the BM2022 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 BM2022. • **Server** - This sets the BM2022 as a DHCP server for the LAN. • **Relay** - This sets the BM2022 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 BM2022 begins allocating IP addresses.
End IP	Enter the end IP address at which the BM2022 ceases allocating IP addresses.

Table 30 DHCP (continued)

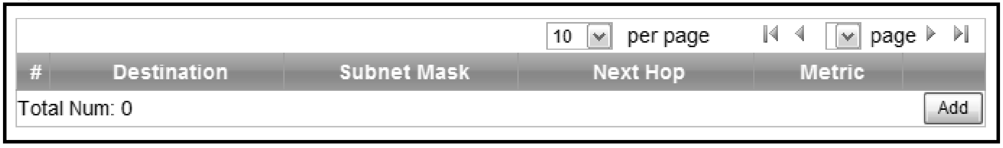
LABEL	DESCRIPTION
Lease Time	Enter the duration in minutes that devices on the LAN retain their DHCP-issued IP addresses. At the end of the lease time, they poll the BM2022 for a renewed or replacement IP.
Relay IP	Enter the name of the IP address to be used.
DNS Server Assigned by the DHCP Server	
First~Third DNS Server	Select how the BM2022 acquires its DNS server address. • **None** - Select this to not use a DNS server. • **From ISP** - Select this to have the BM2022 acquire its DNS server address from the ISP. • **User Define** - Select this to manually enter the DNS server used by the BM2022.
Static DHCP	
MAC Address	This field displays the MAC address of the static DHCP client connected to the BM2022.
IP Address	This field displays the IP address of the static DHCP client connected to the BM2022.
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 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 42 Static Route Screen



This screen contains the following fields:

Table 31 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.

Table 31 Static Route (continued)

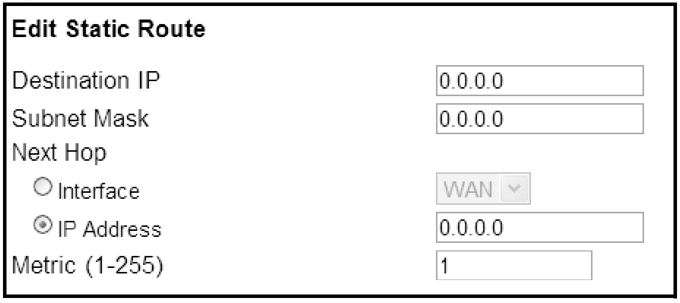
LABEL	DESCRIPTION
Metric	This field displays the static route metric.
Add	Click this to add a new static route to the list.

7.9 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 43 Static Route Screen



Edit Static Route

Destination IP	0.0.0.0
Subnet Mask	0.0.0.0
Next Hop	
○ Interface	WAN
● IP Address	0.0.0.0
Metric (1-255)	1

This screen contains the following fields:

Table 32 Static Route

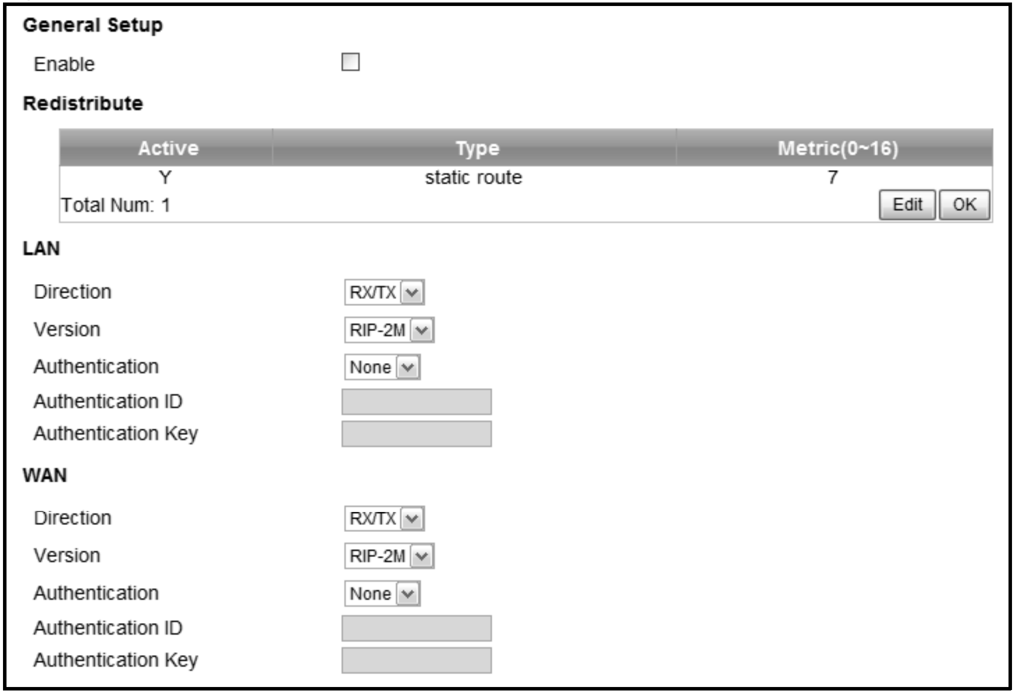
LABEL	DESCRIPTION
Destination IP	Enter the destination IP address of the static route.
Subnet Mask	Enter the subnet mask of the static route.
Next Hop	Select **Interface** and then select **WAN** or **LAN** for the next hop of the static route. If the next hop is an IP address rather than an interface on the BM2022, select **IP Address** and enter the IP address.
Metric	Enter the static route metric.

7.10 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 44 RIP Screen



General Setup

Enable □

Redistribute

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

Total Num: 1

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

This screen contains the following fields:

Table 33 RIP

LABEL	DESCRIPTION
General Setup	
Enable	Select this to enable RIP on the BM2022.
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 33 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.

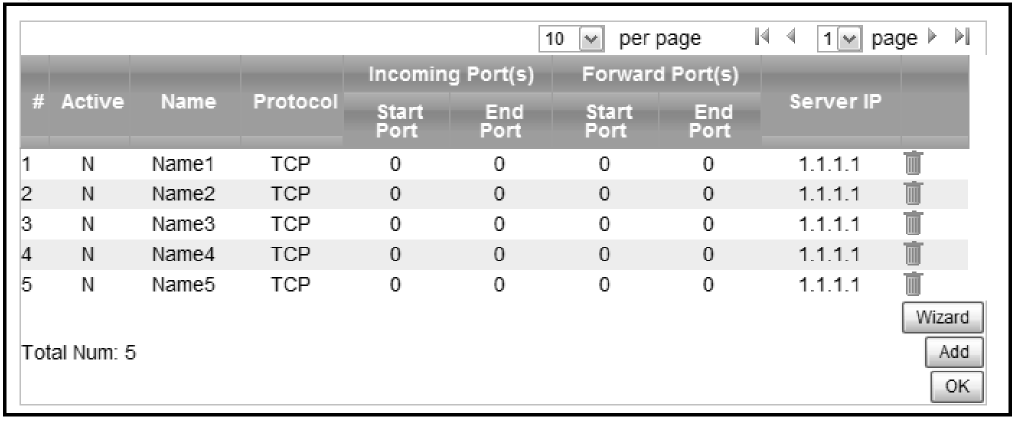
7.11 Port Forwarding

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 45 Port Forwarding Screen



#	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

This screen contains the following fields:

Table 34 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.

Table 34 Port Forwarding (continued)

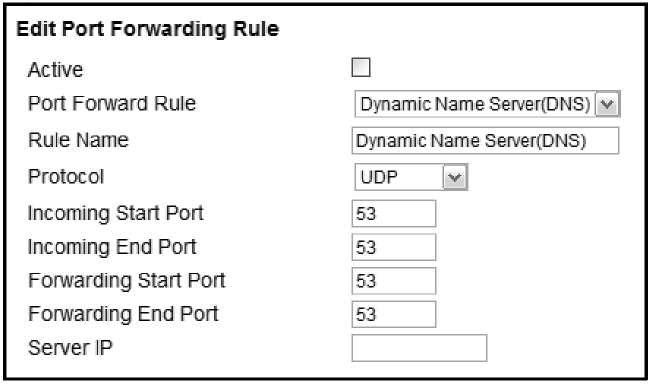
LABEL	DESCRIPTION
Server IP	This displays the IP address of the server to which packet for the selected port(s) are forwarded.
Delete	Click this to delete a specified rule.
Wizard	Click this to open the port forwarding "wizard".
Add	Click this to add a new port forwarding rule.
OK	Click this to save any changes made to the port forwarding list.

7.11.1 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 46 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 35 Port Forwarding Wizard

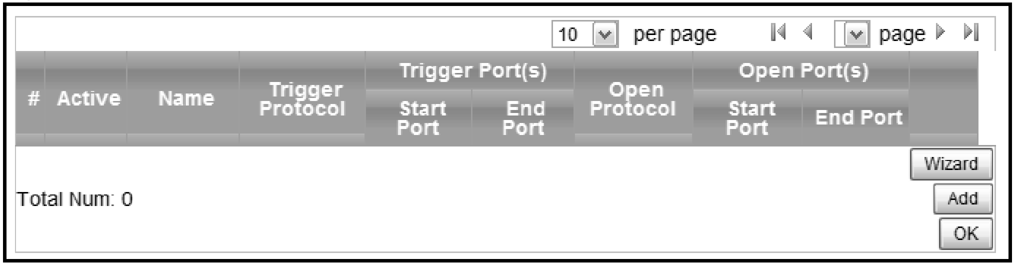
LABEL	DESCRIPTION
Active	Select this to make this port forwarding rule active.
Port Forward Rule	Select the type of port forwarding rule.
Rule Name	Enter a name for the port forwarding rule.
Protocol	Select the port forwarding protocol.
Incoming Start Port	Enter the starting port number for incoming 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.

7.12 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 47 Port Trigger Screen



Total Num: 0

This screen contains the following fields:

Table 36 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 BM2022 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 BM2022 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.

Table 36 Port Trigger (continued)

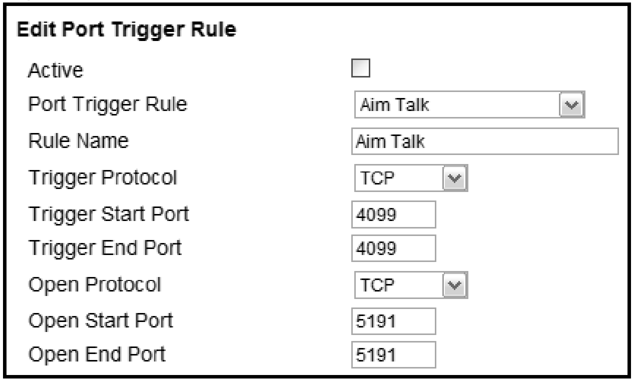
LABEL	DESCRIPTION
Delete	Click this to delete a specified rule.
Wizard	Click this to open the port trigger "wizard".
Add	Click this to add a new port trigger rule.
OK	Click this to save any changes made to the port trigger list.

7.12.1 Port Trigger Wizard

Use the wizard to create a port trigger rules that will allow the BM2022 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 48 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:

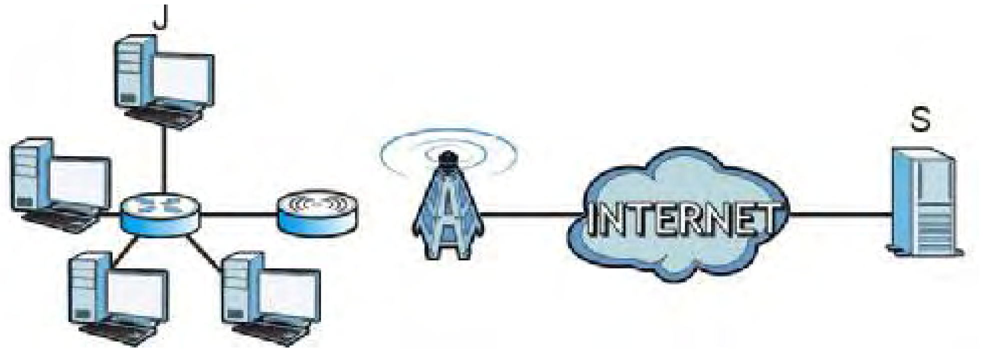
Table 37 Port Trigger Wizard

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.

7.12.2 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 49 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 BM2022 to record Jane's computer IP address. The BM2022 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 BM2022 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 BM2022 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 BM2022 and going to the outside.

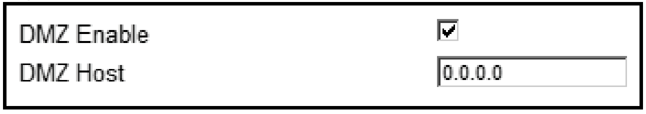
2 If an application needs a continuous data stream, that port (range) will be tied up so that another computer on the LAN can't trigger it.

7.13 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 BM2022'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.



DMZ Enable ☑

DMZ Host 0.0.0.0

Figure 50 DMZ Screen

This screen contains the following fields:

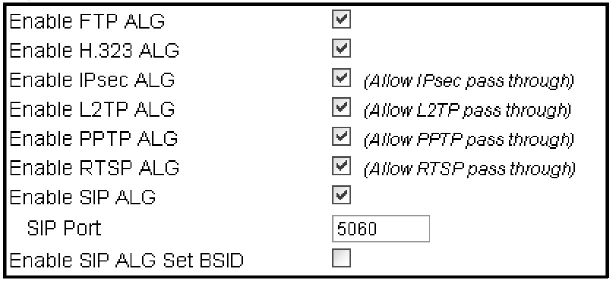
Table 38 DMZ

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.

7.14 ALG

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

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



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 □

Figure 51 ALG Screen

This screen contains the following fields:

Table 39 Network Setting > NAT **>** 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 BM2022'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 BM2022's NAT.
Enable IPsec ALG	Turns on the IPsec ALG to detect IPsec traffic and helps build IPsec sessions through the BM2022's NAT.
Enable L2TP ALG	Turns on the L2TP ALG to detect L2TP traffic and helps build L2TP sessions through the BM2022's NAT.
Enable PPTP ALG	Turns on the PPTP ALG to detect PPTP traffic and helps build PPTP sessions through the BM2022's NAT.

Table 39 Network Setting > NAT **>** ALG (continued)

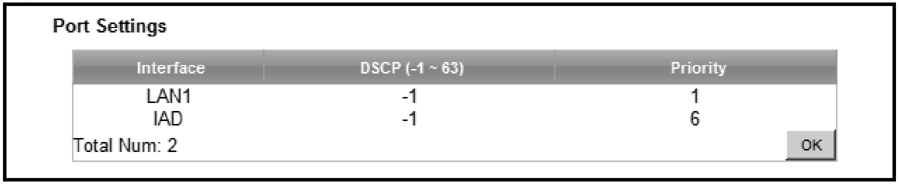
LABEL	DESCRIPTION
Enable RTSP ALG	Turns on the RTSP ALG to detect RTSP traffic and helps build RTSP sessions through the BM2022's NAT.
Enable SIP ALG	Turns on the SIP ALG to detect SIP traffic and helps build SIP sessions through the BM2022's NAT.
SIP Port	If you are using a custom UDP port number (not 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.

7.15 QoS

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

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

Figure 52 QoS Screen



Port Settings

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

Total Num: 2

This screen contains the following fields:

Table 40 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.

7.16 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.

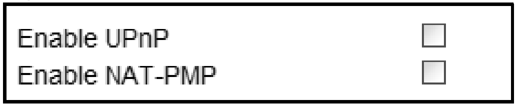


Figure 53 UPnP Screen

Enable UPnP ☐

Enable NAT-PMP ☐

This screen contains the following fields:

Table 41 UPnP

LABEL	DESCRIPTION
Enable UPnP	Select this to enable UPnP on the BM2022.
Enable NAT-PMP	Select this to enable NAT Port Mapping Protocol on the BM2022.

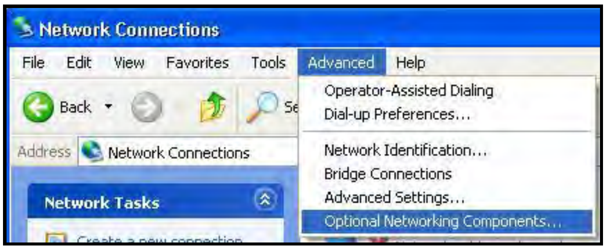
7.16.1 Installing UPnP in Windows XP

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

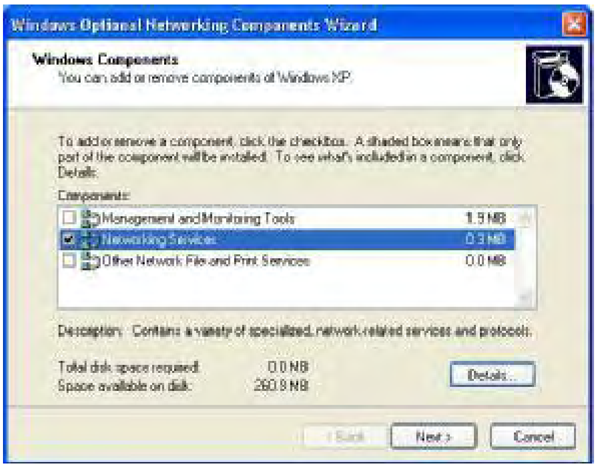
1 Click **Start** > **Control Panel**.

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**.



Windows Optional Networking Components Wizard

Windows Components

You can add or remove components of Windows XP.

To add or remove a component, click the checkbox. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.

Components:

☐ Management and Monitoring Tools 1.9 MB

☑ Networking Services 0.3 MB

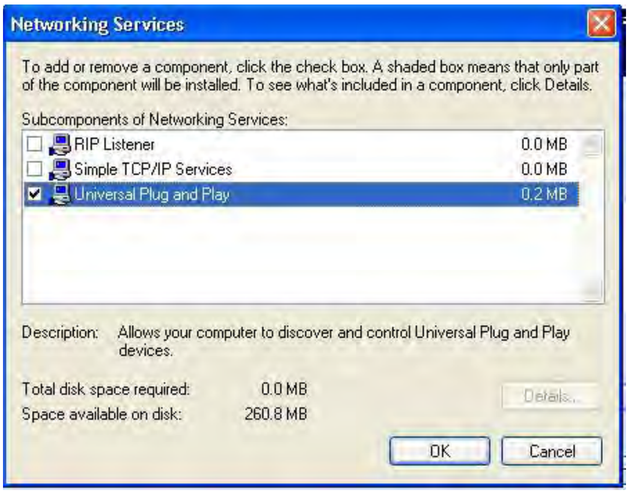
☐ Other Network File and Print Services 0.0 MB

Description: Contains a variety of specialized, network-related services and protocols.

Total disk space required: 0.0 MB

Space available on disk: 260.8 MB

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



Networking Services

To add or remove a component, click the check box. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.

Subcomponents of Networking Services:

☐ RIP Listener 0.0 MB

☐ Simple TCP/IP Services 0.0 MB

☑ Universal Plug and Play 0.2 MB

Description: Allows your computer to discover and control Universal Plug and Play devices.

Total disk space required: 0.0 MB

Space available on disk: 260.8 MB

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

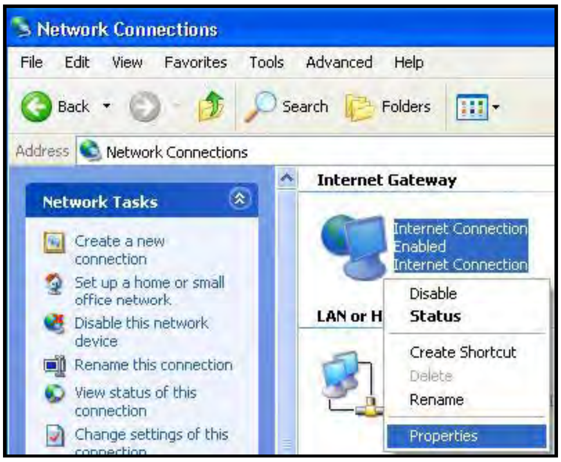
7.16.1.1 Auto-discover Your UPnP-enabled Network Device in Windows XP

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 BM2022.

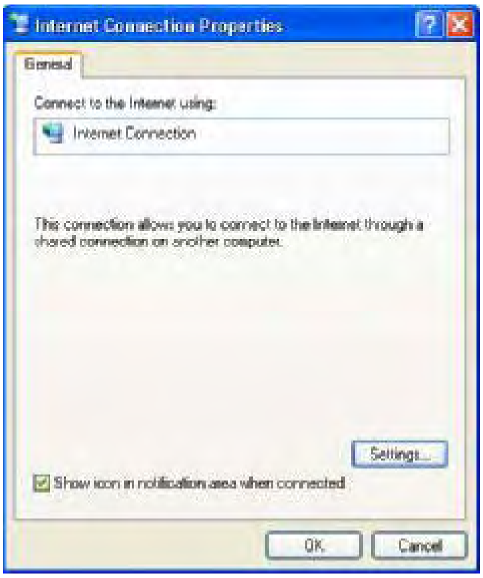
Make sure the computer is connected to a LAN port of the BM2022. Turn on your computer and the BM2022.

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

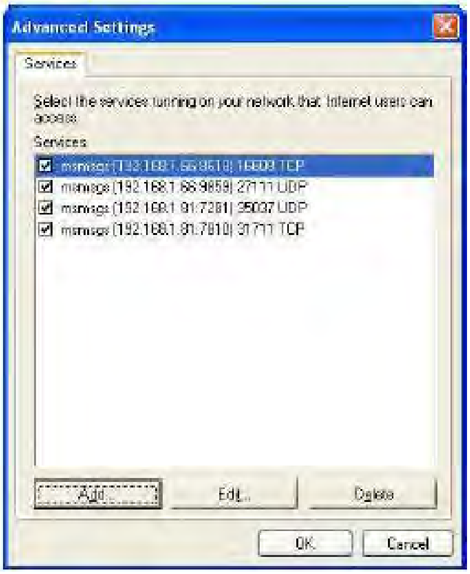
2 Right-click the icon and select **Properties**.



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


Internet Connection Properties
General
Connect to the Internet using:
Internet Connection
This connection allows you to connect to the Internet through a shared connection on another computer.
Settings...
☑ Show icon in notification area when connected
OK
Cancel

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



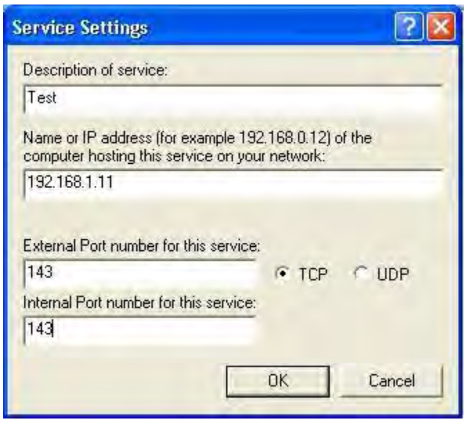
Advanced Settings

Services

Select the services running on your network that Internet users can access.

Services

☑ msmsgs (192.168.1.66:8618) 16808 TCP
☑ msmsgs (192.168.1.66:9859) 27111 UDP
☑ msmsgs (192.168.1.91:7281) 35037 UDP
☑ msmsgs (192.168.1.91:7810) 31711 TCP



Service Settings

Description of service:

Test

Name or IP address (for example 192.168.0.12) of the computer hosting this service on your network:

192.168.1.11

External Port number for this service:

143

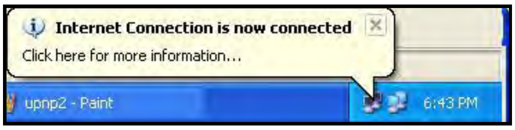
● TCP ○ UDP

Internal Port number for this service:

143

5 When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.

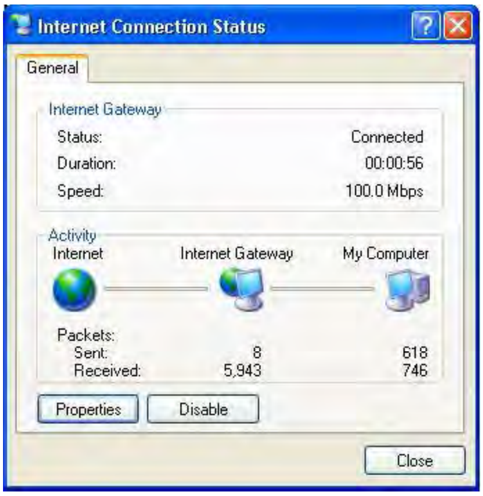
6 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.



Internet Connection is now connected

Click here for more information...

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



Internet Connection Status

General

Internet Gateway

Status: Connected
Duration: 00:00:56
Speed: 100.0 Mbps

Activity

Internet	Internet Gateway	My Computer
Packets:		
Sent:	8	618
Received:	5,943	746

7.16.2 Web Configurator Easy Access

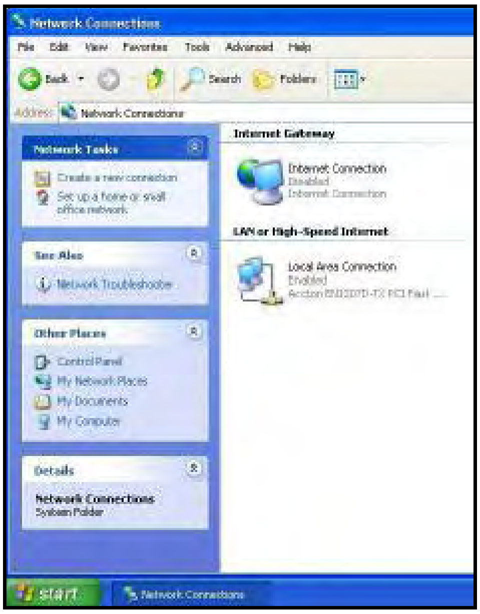
With UPnP, you can access the web-based configurator on the BM2022 without finding out the IP address of the BM2022 first. This becomes helpful if you do not know the IP address of the BM2022.

Follow the steps below to access the web configurator:

1 Click **Start** and then **Control Panel**.

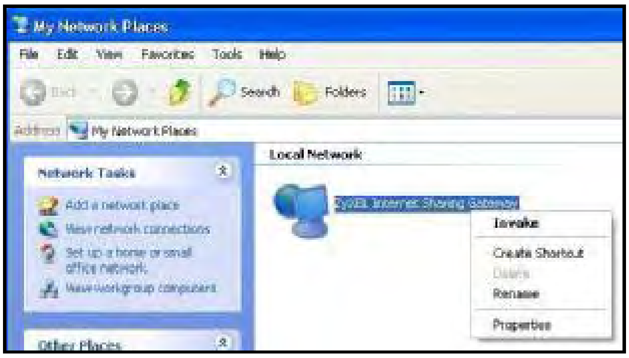
2 Double-click **Network Connections**.

3 Select **My Network Places** under **Other Places**.

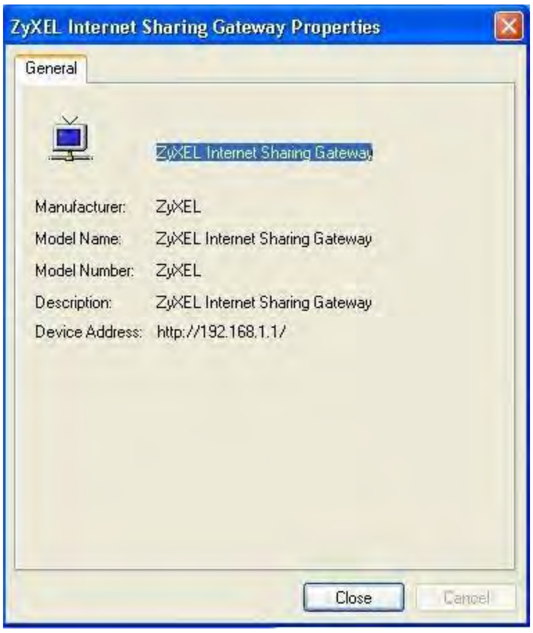


4 An icon with the description for each UPnP-enabled device displays under **Local Network**.

5 Right-click on the icon for your BM2022 and select **Invoke**. The web configurator login screen displays.



6 Right-click on the icon for your BM2022 and select **Properties**. A properties window displays with basic information about the BM2022.


ZyXEL Internet Sharing Gateway Properties
General
ZyXEL Internet Sharing Gateway
Close
Cancel

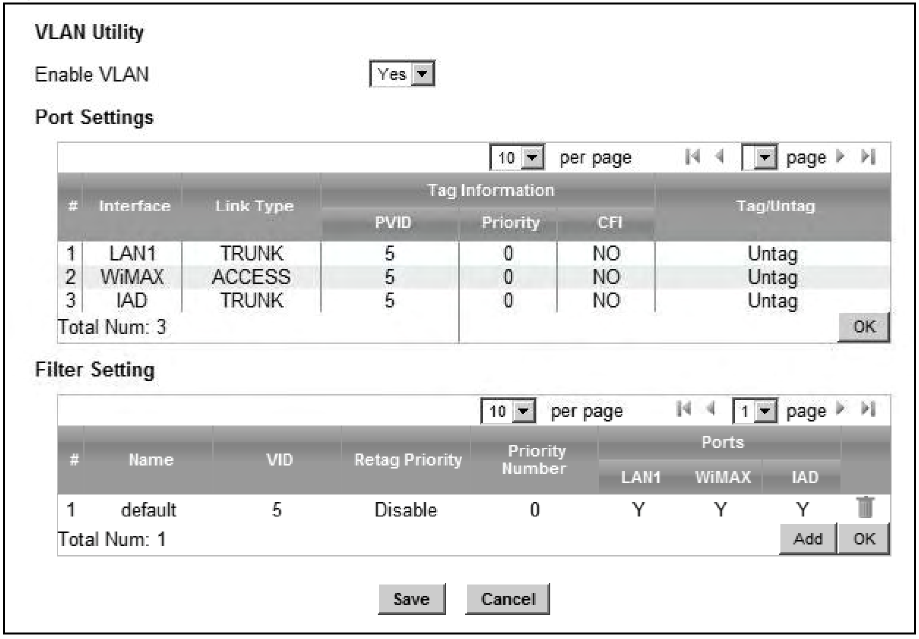
Manufacturer: ZyXEL
Model Name: ZyXEL Internet Sharing Gateway
Model Number: ZyXEL
Description: ZyXEL Internet Sharing Gateway
Device Address: http://192.168.1.1/

7.17 VLAN

Use this screen to configure port-based VLAN settings on the BM2022. This screen allows you to assign port(s) to specific virtual LAN(s) in order to isolate traffic from different VLAN groups. See Section 4.11 on page 48 for example configurations for VLANs.

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

Figure 54 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	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 | 1 page

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

Total Num: 1

This screen contains the following fields:

Table 42 VLAN

LABEL	DESCRIPTION
VLAN Utility	
Enable VLAN	Select **Yes** to enable the VLAN function on the BM2022. Note: To use VLAN on the BM2022, 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 BM2022 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 BM2022 will tag them with the PVID. Select **Hybrid** to allow the port to function as an access port and trunk port.

Table 42 VLAN

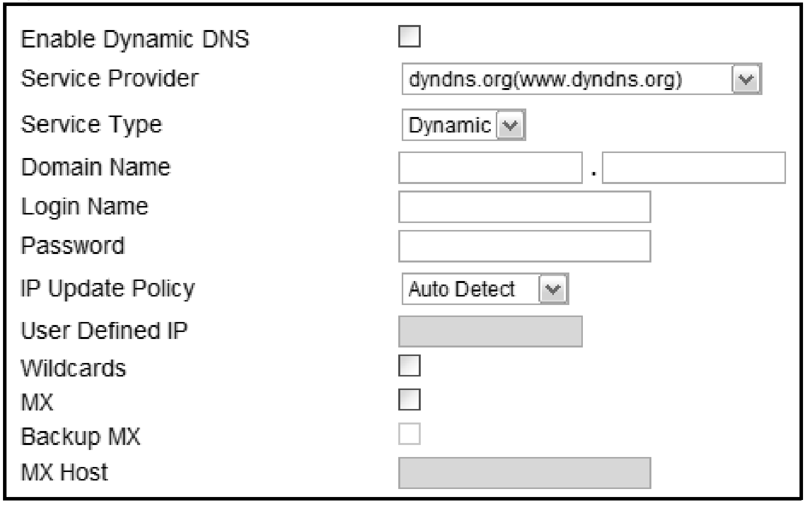
LABEL	DESCRIPTION
PVID	A **PVID** (Port VLAN ID) is a tag that adds to incoming untagged packets received on a port so that the packets are forwarded to the VLAN group that the tag defines. Enter a number between 1and 4094 as the port VLAN ID.
Priority	Enter a priority level (1~7) that the BM2022 assigns 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 BM2022 will receive and forward VLAN tagged packets. Untagged packets will be tagged with the PVID. If you select **Untag** the BM2022 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 BM2022 will add tags to untagged packets it receives and drop tagged packets it receives. If the port is a **Trunk** port, the BM2022 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.

7.18 DDNS

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

Click Network Setting > DDNS

Figure 55 DDNS Screen



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

This screen contains the following fields:

Table 43 DDNS

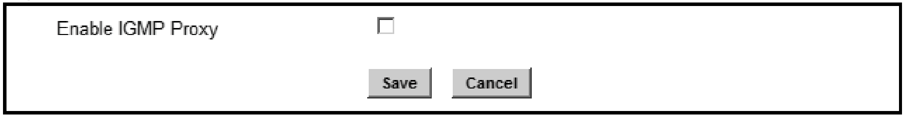
LABEL	DESCRIPTION
Enable Dynamic DNS	Select this to enable dynamic DNS on the BM2022.
Service Provider	Select the dynamic DNS service provider for the BM2022.
Service Type	Select the dynamic DNS service type.
Domain Name	Enter the domain name.
Login Name	Enter the user name.
Password	Enter the password.
IP Update Policy	Select the policy used by the BM2022. 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.

7.19 IGMP Proxy

Use this page to enable IGMP Proxy on the WiMAX Device.

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

Figure 56 IGMP Proxy



Enable IGMP Proxy □

This screen contains the following fields:

Table 44 IGMP Proxy

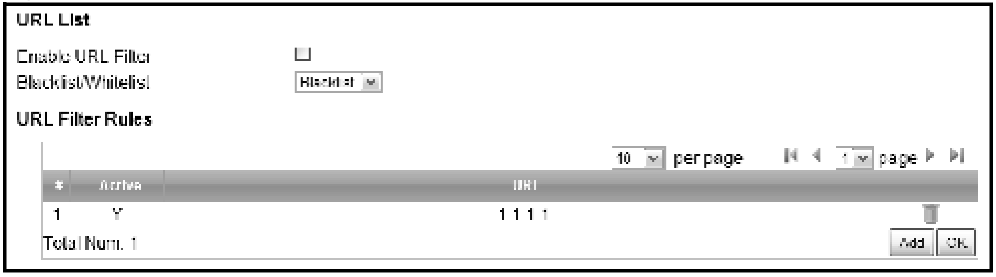
LABEL	DESCRIPTION
Enable IGMP Proxy	Internet Group Multicast Protocol (IGMP) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. Select this option to have the BM2022 act as an IGMP proxy. This allows the BM2022 to get subscribing information 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.

7.20 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 57 Content Filter Screen



URL List

Enable URL Filter □

Blacklist/Whitelist Blacklist

URL Filter Rules

10 per page 1 page

#	Active	URL
1	Y	1.1.1.1

Total Num: 1

This screen contains the following fields:

Table 45 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 BM2022.
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.

Table 45 Content Filter (continued)

LABEL	DESCRIPTION
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

Security

8.1 Overview

This chapter shows you how to configure the BM2022'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 BM2022's Security Features

The BM2022 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 BM2022 can be used to prevent theft, destruction and modification of data.

The BM2022 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.

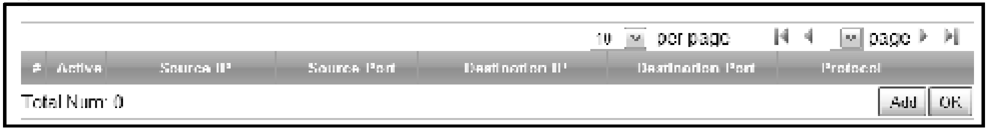
The BM2022 has one Ethernet (LAN) port. The LAN (Local Area Network) port attaches to a network of computers, which needs security from the outside world. These computers will have access to Internet services such as e-mail, FTP and the World Wide Web. However, "inbound access" is not allowed (by default) 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 58 IP Filter Screen



10 per page

page

#	Active	Source IP	Source Port	Destination IP	Destination Port	Protocol

Total Num: 0

This screen contains the following fields:

Table 46 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 BM2022 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 BM2022 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 BM2022 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 BM2022 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 BM2022 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.

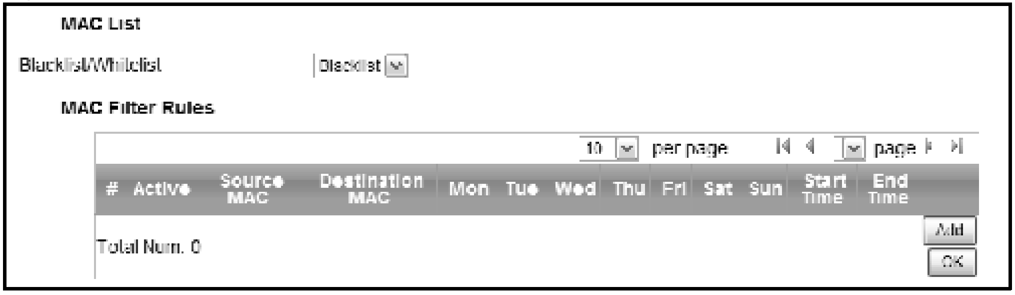
8.3 MAC Filter

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 BM2022 is in bridge mode.

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

Figure 59 MAC Filter Screen



MAC List

Blacklist/Whitelist: Blacklist

MAC Filter Rules

10 per page page

#	Active	Source MAC	Destination MAC	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Start Time	End Time

Total Num. 0

This screen contains the following fields:

Table 47 MAC Filter

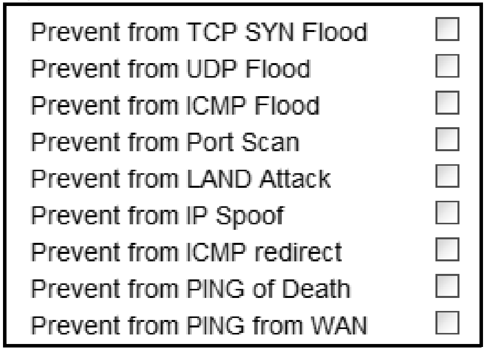
LABEL	DESCRIPTION
Blacklist/Whitelist	Select either whitelist or blacklist for viewing and editing.
Source MAC	This displays the source MAC for the MAC filter rule. Click **Add** to create a new, empty rule, then enter the incoming MAC address for the BM2022 to block. If you want to delete this rule, 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 BM2022 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 60 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 48 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 48 DDOS (continued)

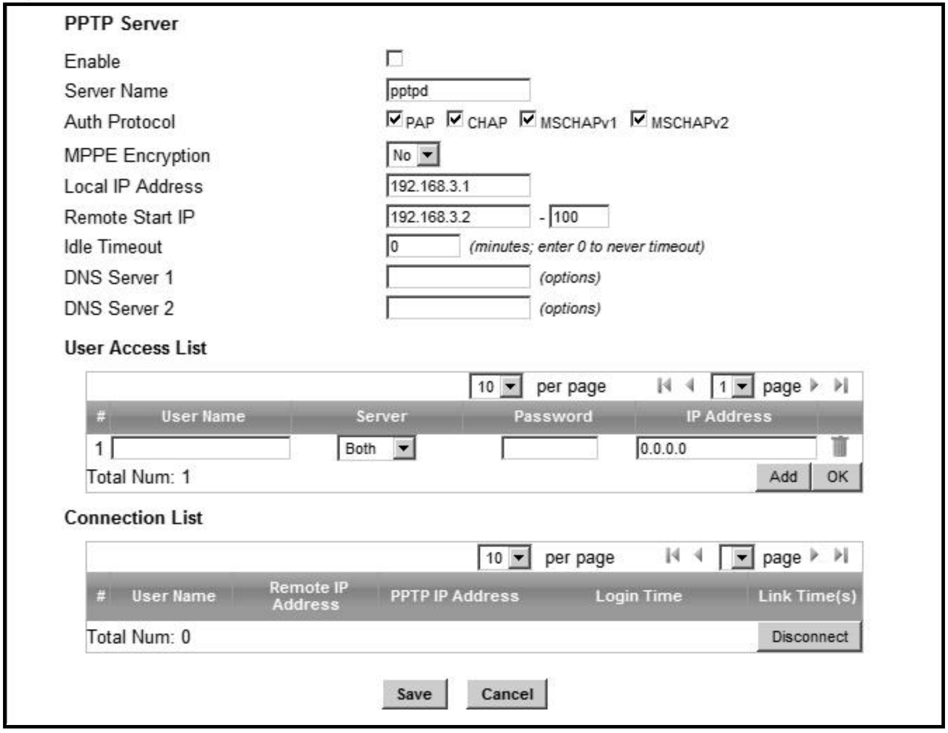
LABEL	DESCRIPTION
Prevent from PING of Death	Select this to monitor for and block ping of death attacks. A Ping of Death (POD) attack is one where larger-than-allowed ping packets are fragmented then sent against a client device. This results in the client device suffering from a buffer overflow and 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 61 PPTP Server



PPTP Server

Enable	□
Server Name	pptpd
Auth Protocol	☑ PAP ☑ CHAP ☑ MSCHAPv1 ☑ MSCHAPv2
MPPE Encryption	No
Local IP Address	192.168.3.1
Remote Start IP	192.168.3.2 - 100
Idle Timeout	0 *(minutes; enter 0 to never timeout)*
DNS Server 1	*(options)*
DNS Server 2	*(options)*

User Access List

10 per page 1 page

#	User Name	Server	Password	IP Address
1		Both		0.0.0.0

Total Num: 1

Connection List

10 per page page

#	User Name	Remote IP Address	PPTP IP Address	Login Time	Link Time(s)

Total Num: 0

This screen contains the following fields:

Table 49 PPTP Server

LABEL	DESCRIPTION
PPTP Server	
Enable	Use this field to turn the BM2022'S PPTP VPN function on or off.
Server Name	Enter the server name for the PPTP VPN connection.

Table 49 PPTP Server

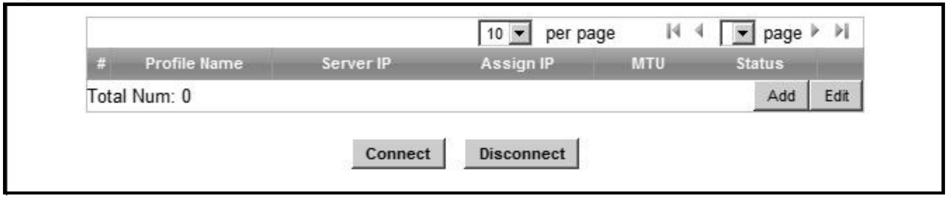
LABEL	DESCRIPTION
Auth Protocol	Select the Authentication Protocol allowed for the connection. Options are: **PAP** - Password Authentication Protocol (PAP) authentication occurs in clear text and does not use encryption. It's probably not a good idea to rely on this for security. **CHAP** - Challenge 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 -** 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 PPTP connection.
Remote Start IP	Enter the local IP address range the BM2022 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 BM2022 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 62 PPTP Client



This screen contains the following fields:

Table 50 PPTP Client

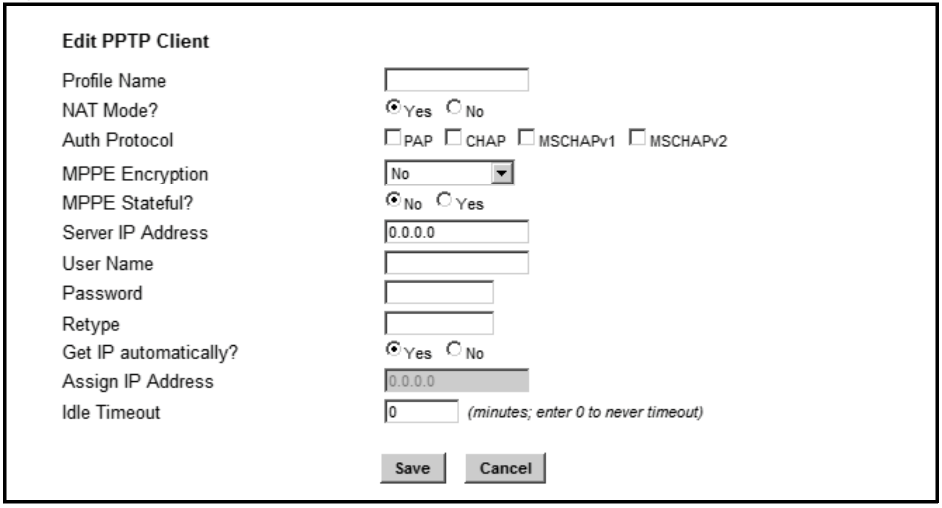
LABEL	DESCRIPTION
#	This is the index number of the connection.
Profile Name	This is the name of this client connection.
Server IP	This is the IP address of the PPTP VPN server.
Assign IP	This is the local IP address the client assigns to itself or is assigned by the server.
MTU	This field indicates 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 63 PPTP Client: Add



Edit PPTP Client

Profile Name	
NAT Mode?	● Yes ○ No
Auth Protocol	□ PAP □ CHAP □ MSCHAPv1 □ MSCHAPv2
MPPE Encryption	No
MPPE Stateful?	● No ○ Yes
Server IP Address	0.0.0.0
User Name	
Password	
Retype	
Get IP automatically?	● Yes ○ No
Assign IP Address	0.0.0.0
Idle Timeout	0 *(minutes; enter 0 to never timeout)*

This screen contains the following fields:

Table 51 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.

Table 51 PPTP Client: Add

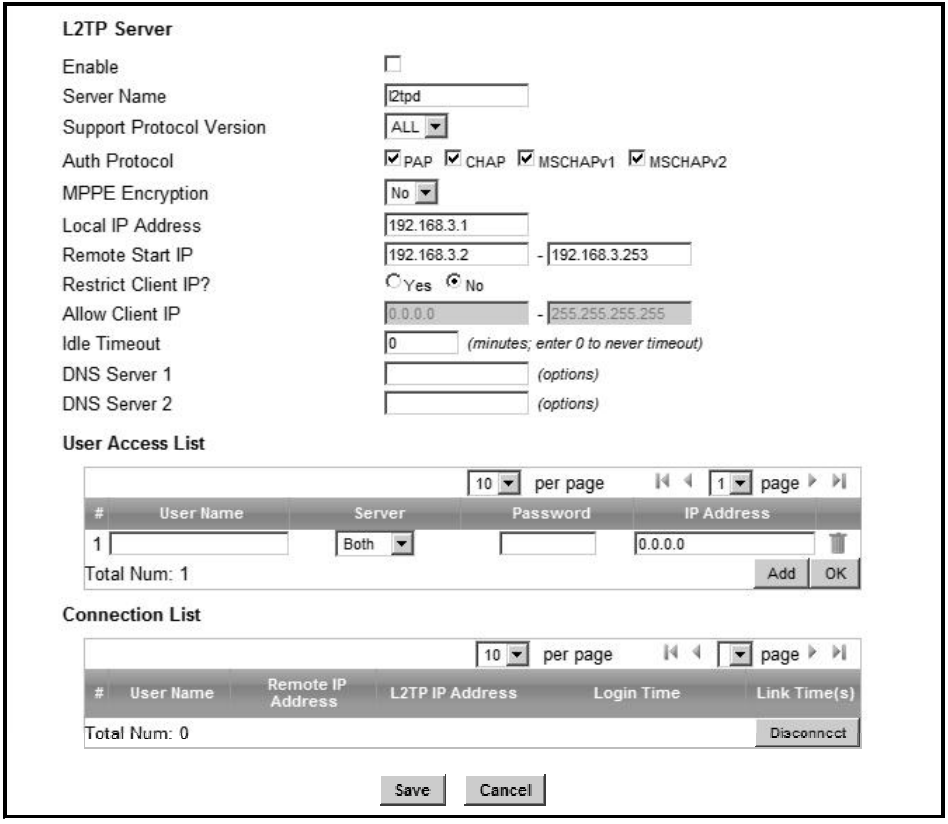
LABEL	DESCRIPTION
Password	Enter the password for connecting to the PPTP server.
Retype	Retype the password for connecting to the PPTP server.
Get IP automatically	Select **Yes** to have the PPTP server assign a local IP address to the client.
Assign IP Address	Enter the IP address for the client. Ensure 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 64 L2TP Server



L2TP Server

Enable	□
Server Name	l2tpd
Support Protocol Version	ALL
Auth Protocol	☑ PAP ☑ CHAP ☑ MSCHAPv1 ☑ MSCHAPv2
MPPE Encryption	No
Local IP Address	192.168.3.1
Remote Start IP	192.168.3.2 - 192.168.3.253
Restrict Client IP?	○ Yes ● No
Allow Client IP	0.0.0.0 - 255.255.255.255
Idle Timeout	0 *(minutes; enter 0 to never timeout)*
DNS Server 1	*(options)*
DNS Server 2	*(options)*

User Access List

10 per page 1 page

#	User Name	Server	Password	IP Address
1		Both		0.0.0.0

Total Num: 1

Connection List

10 per page page

#	User Name	Remote IP Address	L2TP IP Address	Login Time	Link Time(s)

Total Num: 0

This screen contains the following fields:

Table 52 L2TP Server

LABEL	DESCRIPTION
L2TP Server	
Enable	Use this field to turn the BM2022'S L2TP VPN function on or off.
Server Name	Enter the server name for the L2TP VPN connection.
Support 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.
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 BM2022 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 BM2022 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.

Table 52 L2TP Server

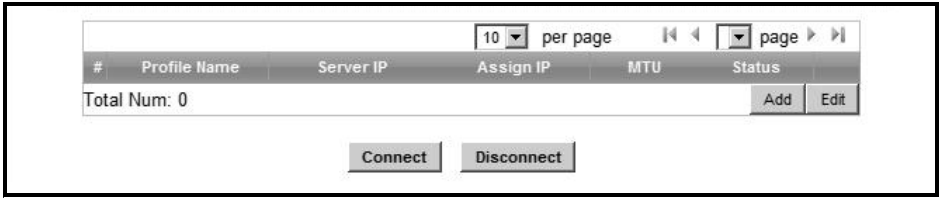
LABEL	DESCRIPTION
Connection List	
User Name	This displays the user name for the remote user.
Remote IP Address	This displays the remote endpoint IP address of the remote user.
L2TP IP Address	This displays the local IP address of the L2TP server.
Login Time	This displays the time the L2TP connection started.
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 65 L2TP Client



Total Num: 0

This screen contains the following fields:

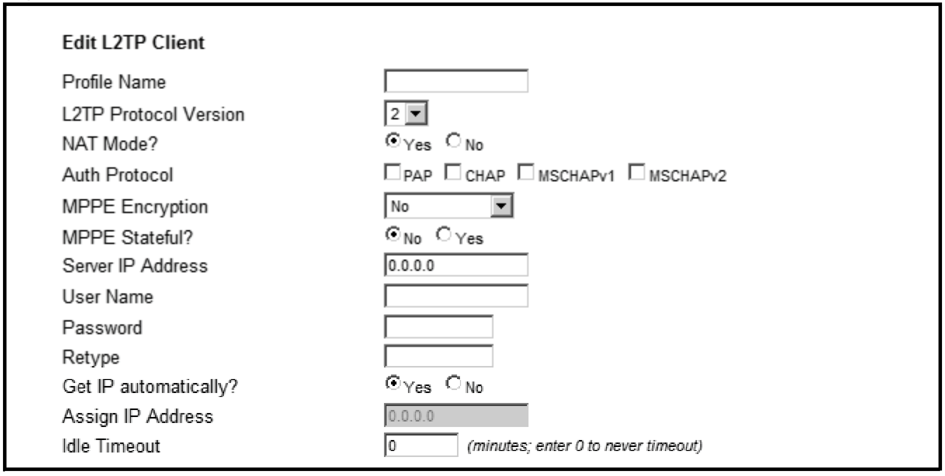
Table 53 L2TP Client

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.



Edit L2TP Client

Profile Name	
L2TP Protocol Version	2
NAT Mode?	● Yes ○ No
Auth Protocol	□ PAP □ CHAP □ MSCHAPv1 □ MSCHAPv2
MPPE Encryption	No
MPPE Stateful?	● No ○ Yes
Server IP Address	0.0.0.0
User Name	
Password	
Retype	
Get IP automatically?	● Yes ○ No
Assign IP Address	0.0.0.0
Idle Timeout	0 *(minutes; enter 0 to never timeout)*

Figure 66 L2TP Client: Add

This screen contains the following fields:

Table 54 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 -** 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 L2TP server.

Table 54 L2TP Client: Add

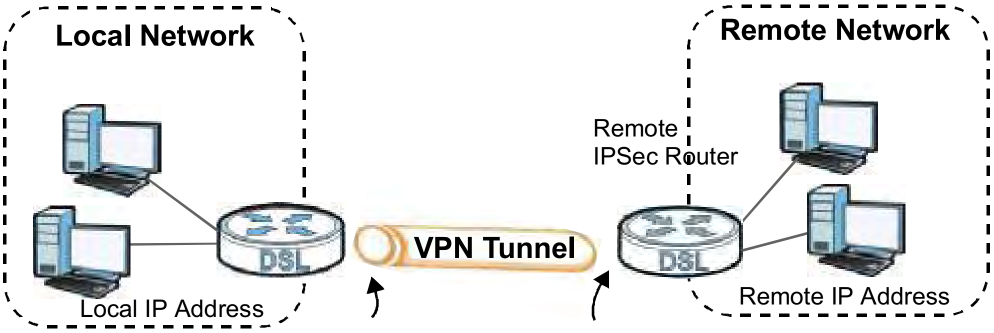
LABEL	DESCRIPTION
User Name	Enter the user name for connecting to the L2TP server.
Password	Enter the password for connecting to the L2TP server.
Retype	Retype the password for connecting to the L2TP server.
Get IP automatically	Select **Yes** to have the L2TP server assign a local IP address to the 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

8.11.1 The General Screen

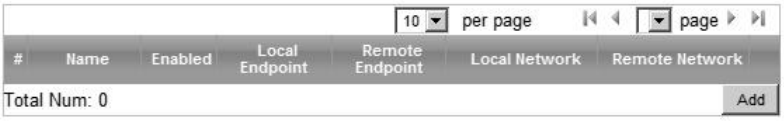
The following figure helps explain the main fields in the web configurator.

Figure 67 IPSec Fields Summary



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

Figure 68 IPSec VPN


10 per page | page

#	Name	Enabled	Local Endpoint	Remote Endpoint	Local Network	Remote Network

Total Num: 0

This screen contains the following fields:

Table 55 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.

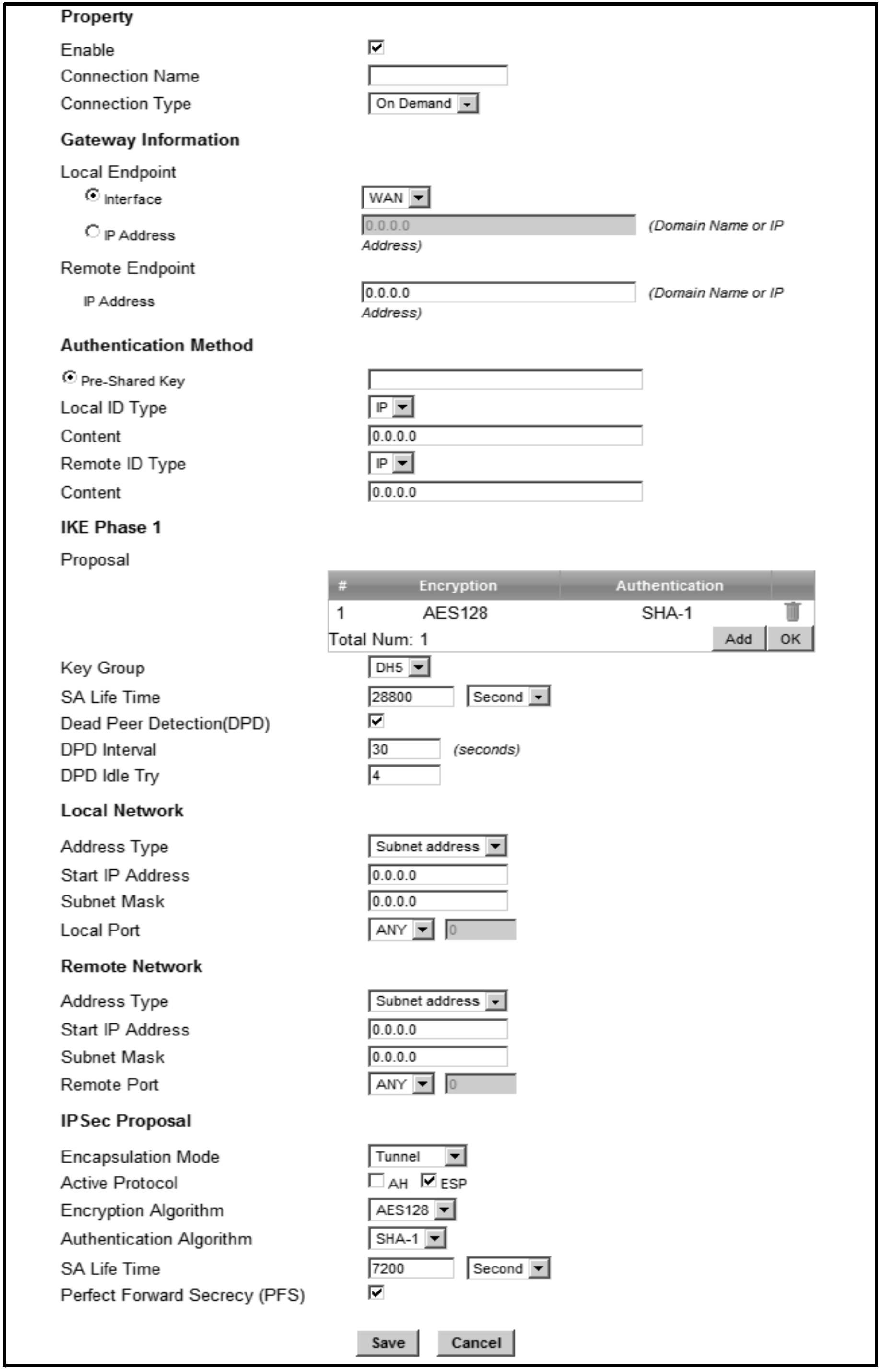
Table 55 IPSec VPN

LABEL	DESCRIPTION
Local Endpoint	This displays the IP address of the BM2022.
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 BM2022 or the IP address and subnet mask of a network behind your BM2022.
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.

8.11.2 IPSec VPN: Add

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

Figure 69 IPSec VPN: Add



Property

Enable	☑
Connection Name	
Connection Type	On Demand ▾

Gateway Information

Local Endpoint

● Interface	WAN ▾
○ IP Address	0.0.0.0 *(Domain Name or IP Address)*

Remote Endpoint

IP Address	0.0.0.0 *(Domain Name or IP Address)*

Authentication Method

● Pre-Shared Key	
Local ID Type	IP ▾
Content	0.0.0.0
Remote ID Type	IP ▾
Content	0.0.0.0

IKE Phase 1

Proposal

#	Encryption	Authentication	
1	AES128	SHA-1	🗑

Total Num: 1 Add OK

Key Group	DH5 ▾
SA Life Time	28800 Second ▾
Dead Peer Detection(DPD)	☑
DPD Interval	30 *(seconds)*
DPD Idle Try	4

Local Network

Address Type	Subnet address ▾
Start IP Address	0.0.0.0
Subnet Mask	0.0.0.0
Local Port	ANY ▾ 0

Remote Network

Address Type	Subnet address ▾
Start IP Address	0.0.0.0
Subnet Mask	0.0.0.0
Remote Port	ANY ▾ 0

IPSec Proposal

Encapsulation Mode	Tunnel ▾
Active Protocol	□ AH ☑ ESP
Encryption Algorithm	AES128 ▾
Authentication Algorithm	SHA-1 ▾
SA Life Time	7200 Second ▾
Perfect Forward Secrecy (PFS)	☑

Save Cancel

This screen contains the following fields:

Table 56 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 BM2022 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 BM2022 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 BM2022 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 BM2022 by its IP address. Select **Domain Name** to identify this BM2022 by a domain name. Select **E-mail** to identify this BM2022 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 BM2022 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 BM2022 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 56 IPSec VPN: Add

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 BM2022 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 BM2022 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 BM2022 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 56 IPSec VPN: Add

LABEL	DESCRIPTION
SA Life Time	Type the maximum number of seconds the IKE SA can last. When this time has passed, the BM2022 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 BM2022 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 BM2022 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 BM2022 to send a DPD message to the remote IPSec router.
DPD Idle Try	Specify the maximum number of times the BM2022 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 BM2022. 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 BM2022. 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 BM2022 checks the connection. The peer must be configured to respond to the method you select. Select **icmp** to have the BM2022 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 BM2022 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 56 IPSec VPN: Add

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 BM2022 checks the connection. The peer must be configured to respond to the method you select. Select **icmp** to have the BM2022 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 BM2022 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 BM2022 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 56 IPSec VPN: Add

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 BM2022.
Cancel	Click **Cancel** to restore your previous settings.

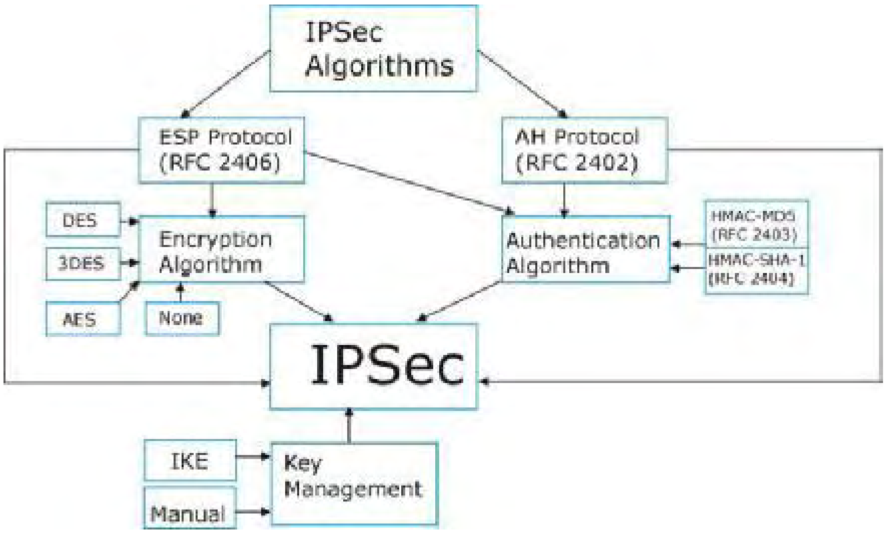
8.12 Technical Reference

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 70 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.

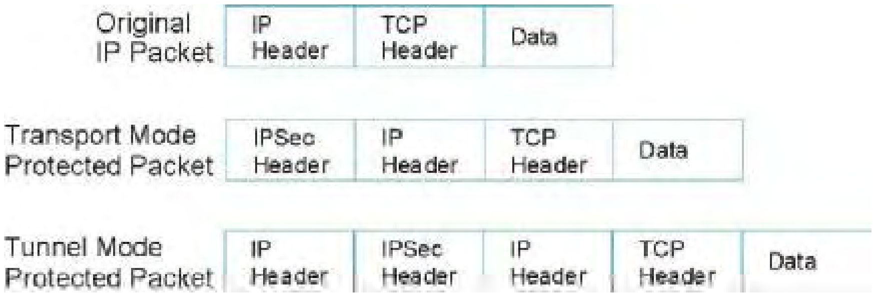
Key Management

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 BM2022 supports **Tunnel** mode only.

Figure 71 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:

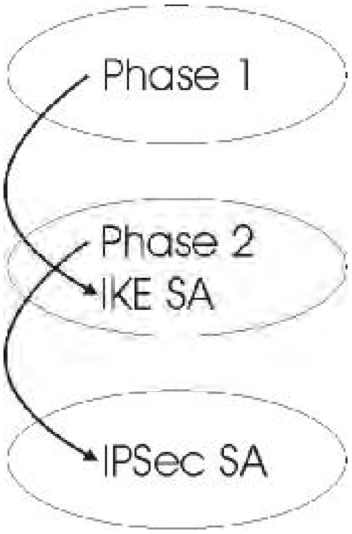
- **Outside header**: The outside IP header contains the destination IP address of the VPN gateway.

- **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 72 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 BM2022 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 know 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 BM2022.

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 57 VPN and NAT

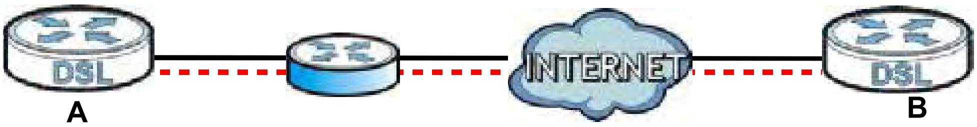
SECURITY PROTOCOL	MODE	NAT
AH	Transport	N
AH	Tunnel	N
ESP	Transport	N
ESP	Tunnel	Y

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 BM2022'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 73 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 58 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 BM2022 if you enable NAT traversal.

8.12.7 ID Type and Content

With aggressive negotiation mode (see Section 8.12.4 on page 143), the BM2022 identifies incoming SAs by ID type and content since this identifying information is not encrypted. This enables the BM2022 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 BM2022 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 143), the ID type and content are encrypted to provide identity protection. In this case the BM2022 can only distinguish between up to 12 different incoming SAs that connect from remote IPSec routers that have dynamic WAN IP addresses. The BM2022 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 8.11.1 on page 133). 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 59 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 BM2022.
E-mail	Type an e-mail address (up to 31 characters) by which to identify this BM2022.
	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 BM2022s in this example can complete negotiation and establish a VPN tunnel.

Table 60 Matching ID Type and Content Configuration Example

BM2022 A	BM2022 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 BM2022s in this example cannot complete their negotiation because BM2022 B's **Local ID type** is **IP**, but BM2022 A's **Remote ID type** is set to **E-mail**. An "ID mismatched" message displays in the IPSEC LOG.

Table 61 Mismatching ID Type and Content Configuration Example

BM2022 A	BM2022 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 142 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.

9

The VoIP General Screens

9.1 VoIP Overview

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 Can Do in This Chapter

- The **Media** screen (Section 9.2 on page 149) lets you set up and maintain global VoIP settings on the BM2022.
- The **QoS** screen (Section 9.3 on page 150) lets you set up and maintain QoS settings for voice traffic flowing through the BM2022.
- The **SIP** screen (Section 9.4 on page 151) lets you enable session timer and select the SIP session refresh method.
- The **Speed Dial** screen (Section 9.5 on page 151) lets you add, edit, or remove speed-dial entries for the phone line.

9.1.2 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 BM2022 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 BM2022) 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 152 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.

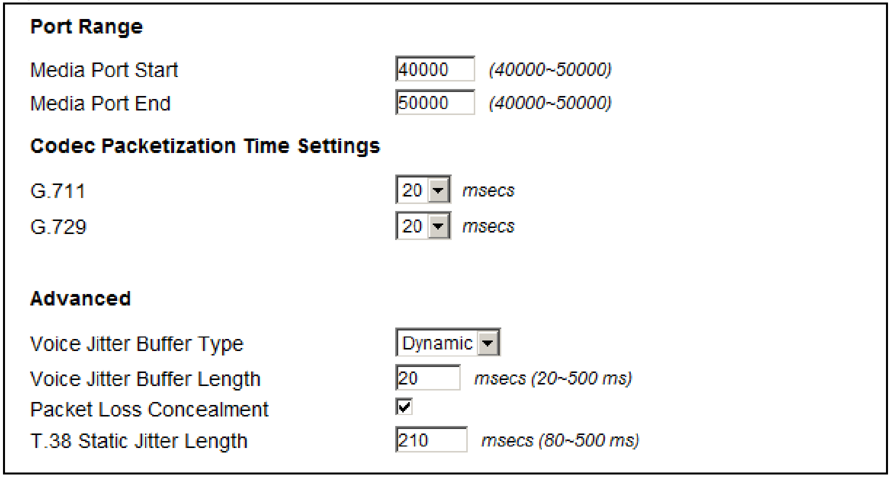
9.1.3 Before you Begin

- 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 BM2022.
- Connect your BM2022 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 74 VoIP > General > Media



Port Range

Media Port Start: 40000 (40000~50000)

Media Port End: 50000 (40000~50000)

Codec Packetization Time Settings

G.711: 20 msecs

G.729: 20 msecs

Advanced

Voice Jitter Buffer Type: Dynamic

Voice Jitter Buffer Length: 20 msecs (20~500 ms)

Packet Loss Concealment: ☑

T.38 Static Jitter Length: 210 msecs (80~500 ms)

The following table describes the labels in this screen.

Table 62 VoIP > General > Media

LABEL	DESCRIPTION
Port Range	
Media Port Start Media Port End	Enter the listening port number(s) for RTP traffic on the BM2022, 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** msecs) the BM2022 sends an RTP packet for each type of voice coder/decoder (codec) **G.711** and **G.729**.
Advanced	

Table 62 VoIP > General > Media (continued)

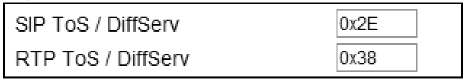
LABEL	DESCRIPTION
Voice Jitter Buffer Type	Voice jitter is a variation in delay of RTP packets delivery. This could cause strange sound effects. The BM2022 can utilize the following types of jitter buffer to minimize the effects of jitter. **Dynamic** - Jitter buffer size is dynamically changed by RTP packets delivery status. **Static** - Jitter buffer size is fixed.
Voice Jitter Buffer Length	Select the maximum number of milliseconds of voice traffic the BM2022 can help to smooth out the jitter in order to ensure good voice quality for your conversations.
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 BM2022 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 BM2022.

Figure 75 VoIP > General > QoS



SIP ToS / DiffServ: 0x2E

RTP ToS / DiffServ: 0x38

The following table describes the labels in this screen.

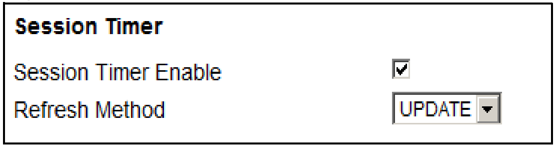
Table 63 VoIP > General > QoS

LABEL	DESCRIPTION
SIP ToS/DiffServ	Enter the DSCP value you want to mark on all outgoing SIP packets generated by the BM2022 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 BM2022 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 BM2022 converts it to 10111000 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 BM2022 for DiffServ-enabled networks.

9.4 SIP Settings

Click **VoIP > General > SIP** to set up session timer on the BM2022. See Section 10.8 on page 163 for more information on SIP.

Figure 76 VoIP > General > SIP



Session Timer

Session Timer Enable ☑

Refresh Method UPDATE

The following table describes the labels in this screen.

Table 64 VoIP > General > SIP

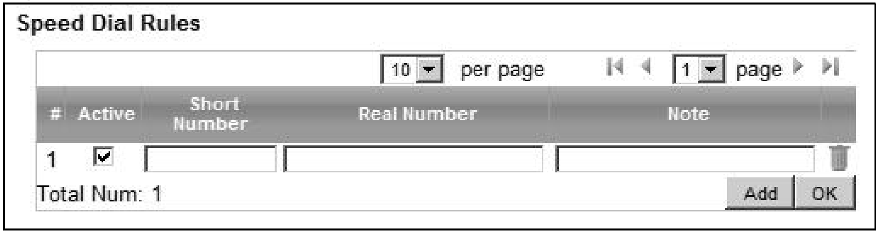
LABEL	DESCRIPTION
Session Timer Enable	Select this to activate the BM2022's SIP Session Timer. SIP Session Timer is a function used by both of the communication peers to determine if the call session is still active (alive) or not. It uses the method specified in the following **Refresh Method** field 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 BM2022 is set to use the **UPDATE** method. When set to **UPDATE**, the BM2022 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 77 VoIP > General > Speed Dial



Speed Dial Rules

10 per page | 1 page

#	Active	Short Number	Real Number	Note
1	☑			

Total Num: 1

The following table describes the labels in this screen.

Table 65 VoIP > General > 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.
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 BM2022 to call when you use the specified **Short Number**. Enter the actual phone number you want the BM2022 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 BM2022 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 78 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.

10

The VoIP Account Screens

10.1 Overview

Use the **VoIP > Account** screens to configure SIP servers, authentication, additional VoIP features, dialing timeout values and how to handle fax messages for the account on the BM2022.

10.1.1 What You Can Do in This Chapter

- The **Status** screen (Section 10.2 on page 156) lets you view the current status of the SIP server, and selected phone line and call history. You can also manually disconnect the VoIP connection or request the SIP server for a new connection.
- The **Server** screen (Section 10.3 on page 158) lets you configure the SIP server, proxy server and outbound server settings for the phone line.
- The **SIP** screen (Section 10.4 on page 159) lets you configure the SIP account, codec and SIP settings for the phone line.
- The **Feature** screen (Section 10.5 on page 161) lets you configure the SIP additional functions such as DTMF, call forward and call waiting for the phone line.
- The **Dialing** screen (Section 10.6 on page 162) lets you configure some timeout setting for the phone line.
- The **FAX** screen (Section 10.7 on page 163) lets you configure which standard the phone line uses for sending faxes.

10.1.2 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.

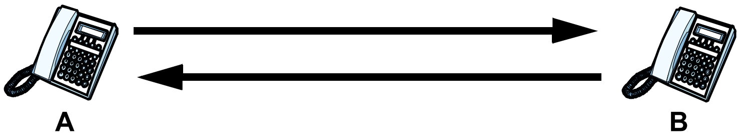
SIP Register Server

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 79 SIP User Agent



SIP Proxy Server

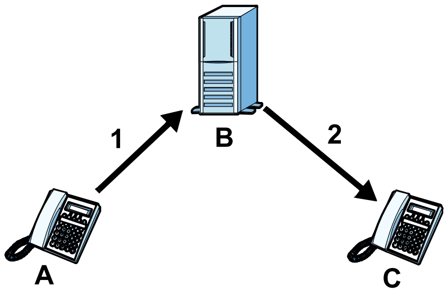
A SIP proxy server receives requests from clients and forwards them to another server.

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 80 SIP Proxy Server



STUN

STUN (Simple Traversal of User Datagram Protocol (UDP) through Network Address Translators) allows the BM2022 to find the presence and types of NAT routers and/or firewalls between it and the public Internet. STUN also allows the BM2022 to find the public IP address that NAT assigned, so the BM2022 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.

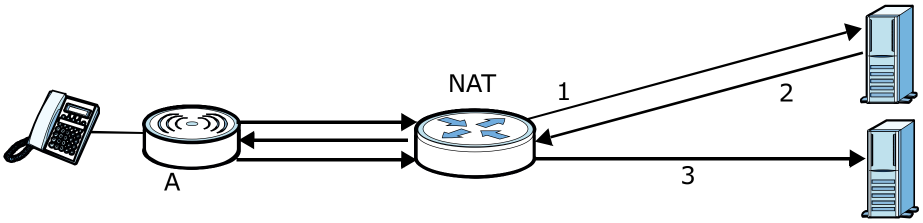
The following figure shows how STUN works.

1 The BM2022 (**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 BM2022's SIP packets and sends them to the BM2022.

3 The BM2022 uses the public IP address and port number in the SIP packets that it sends to the SIP server (**C**).

Figure 81 STUN



Outbound Proxy

Your VoIP service provider may host a SIP outbound proxy server to handle all of the BM2022's VoIP traffic. This allows the BM2022 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 BM2022 to keep it from retranslating the IP address (since this is already handled by the outbound proxy server).

NAT and SIP

The BM2022 must register its public IP address with a SIP register server. If there is a NAT router between the BM2022 and the SIP register server, the BM2022 probably has a private IP address. The BM2022 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 BM2022's IP address from inside the SIP message and maps it to your SIP identity. If the BM2022 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 BM2022 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 BM2022 supports the following services:

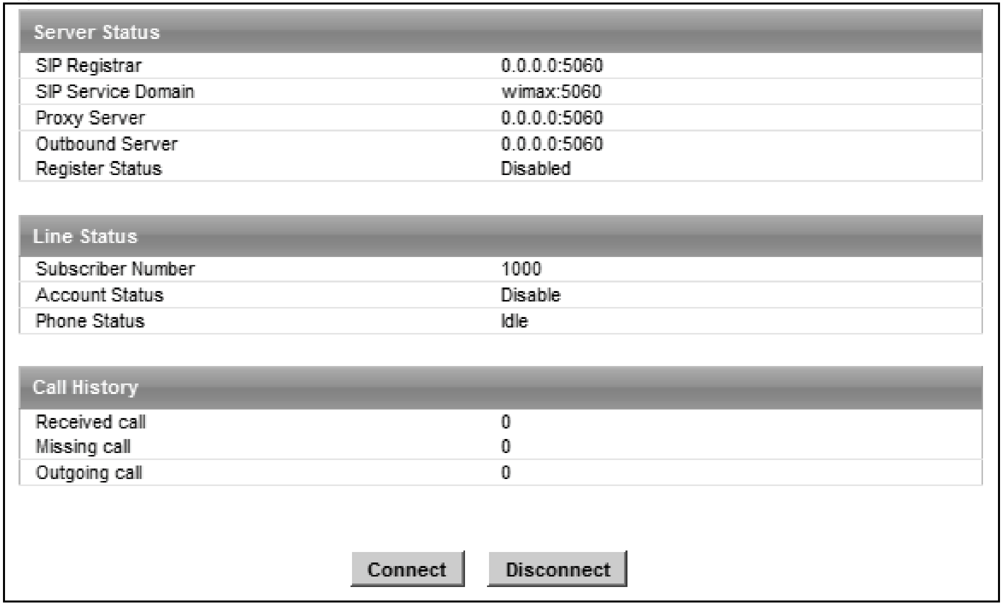
- Call Waiting
- Call Forwarding
- Caller ID

Note: To take full advantage of the supplementary phone services available though the BM2022's phone port, you may need to subscribe to the services from your VoIP service provider.

10.2 Status

Click **VoIP > Account > Status** to view VoIP settings and current status.

Figure 82 VoIP > Account > 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

The following table describes the labels in this screen.

Table 66 VoIP > Account > 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.

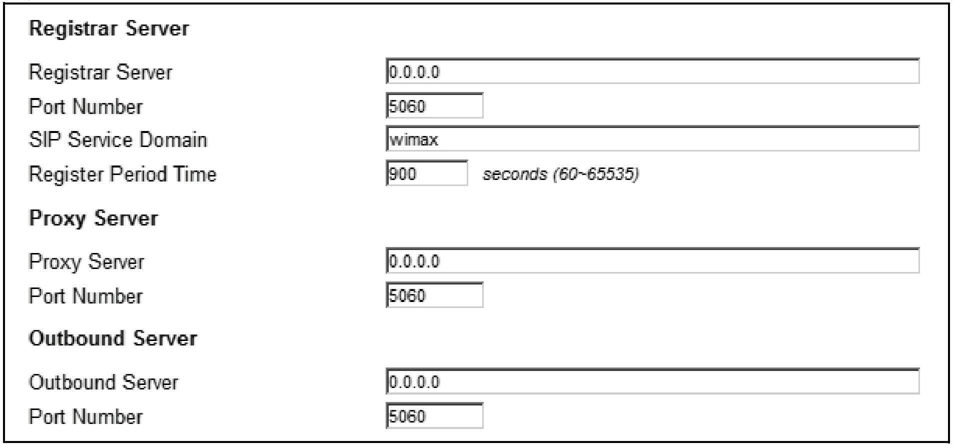
Table 66 VoIP > Account > Status

LABEL	DESCRIPTION
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 159) 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.
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 BM2022 last restarted or was turned on.
Missing call	This field displays the number of calls you have missed since the BM2022 last restarted or was turned on.
Outgoing call	This field displays the number of calls you have made through the connected phone since the BM2022 last restarted or was turned on.
Connect	Click this to register the BM2022 to the specified register server.
Disconnect	Click this to de-register the BM2022 with the register server.

10.3 Server

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

Figure 83 VoIP > Account > Server



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 67 VoIP > Account > 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.
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 159. 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 BM2022 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 156 will become **Error** state and you can not make any call in this status. However, after 512 seconds (fixed value), the BM2022 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.

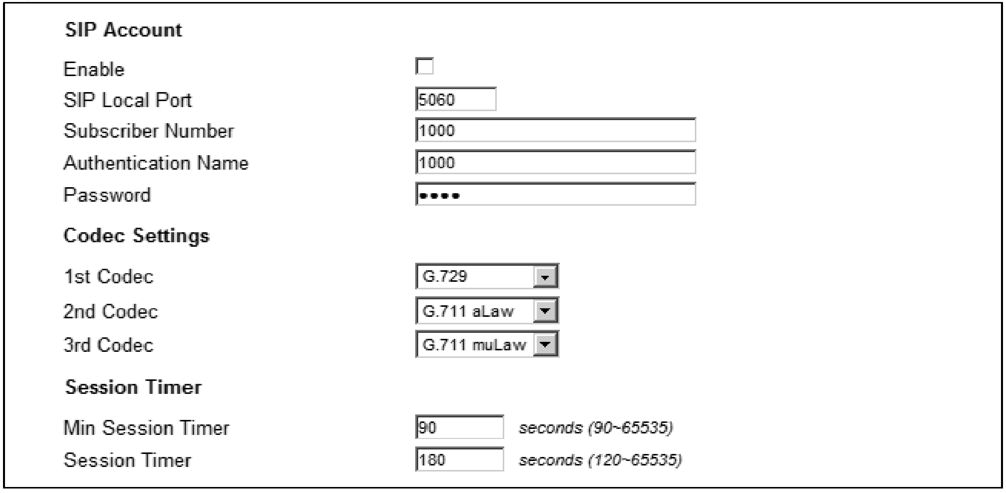
Table 67 VoIP > Account > Server

LABEL	DESCRIPTION
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 > SIP** to configure SIP settings.

Figure 84 VoIP > Account > SIP



SIP Account

Enable	□
SIP Local Port	5060
Subscriber Number	1000
Authentication Name	1000
Password	••••

Codec Settings

1st Codec	G.729
2nd Codec	G.711 aLaw
3rd Codec	G.711 muLaw

Session Timer

Min Session Timer	90 seconds (90~65535)
Session Timer	180 seconds (120~65535)

The following table describes the labels in this screen.

Table 68 VoIP > Account > SIP

LABEL	DESCRIPTION
SIP Account	
Enable	Select this if you want the BM2022 to use this account. Clear it if you do not want the BM2022 to use this account.
SIP Local Port	Enter the BM2022'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).

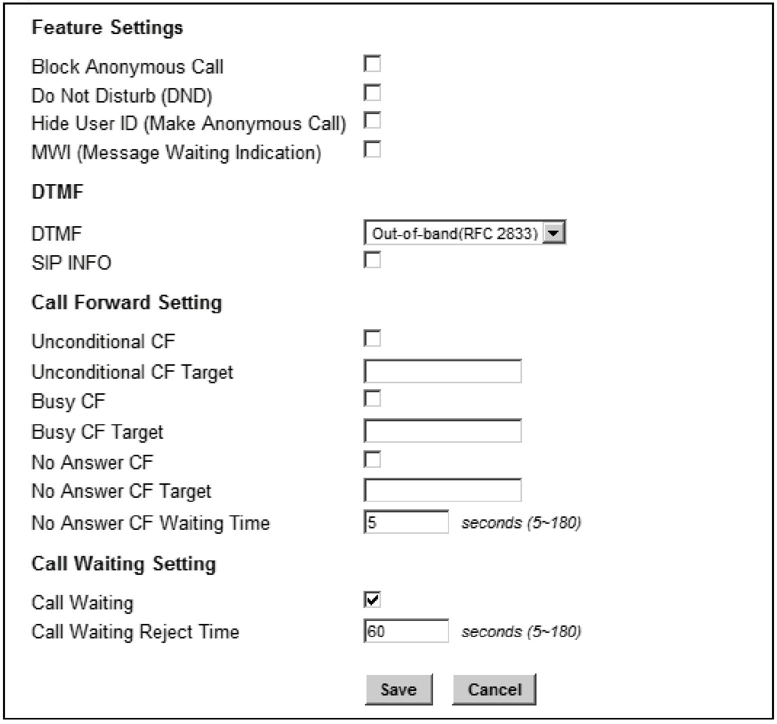
Table 68 VoIP > Account > SIP

LABEL	DESCRIPTION
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	
1st Codec, 2nd Codec, 3rd Codec	Select the BM2022’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 BM2022: • **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 BM2022 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 BM2022 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 BM2022 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 151 to configure the Refresh Method with the INVITE or UPDATE method.

10.5 Feature

Click **VoIP > Account > Feature** to configure advanced VoIP features such as DTMF, Call Forwarding and Call Waiting.

Figure 85 VoIP > Account > 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 69 VoIP > Account > Feature

LABEL	DESCRIPTION
Feature Settings	
Block Anonymous Call	Select this to have the BM2022 block all incoming calls from phone that do not send caller ID.
Do Not Disturb (DND)	Select this to have the BM2022 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 BM2022 would not ring. Meanwhile, the BM2022 can still make outgoing calls as usual. Note: The DND function should be used very carefully, since enabling DND makes the BM2022 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.

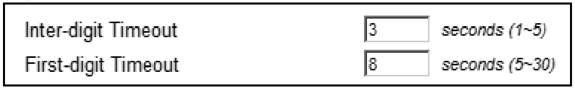
Table 69 VoIP > Account > Feature

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 159. When there is at least one new voicemail for the SIP account, the voice LED (described in Section 1.2.1 on page 19) turns yellow and the BM2022 sends a beeping tone to the phone while user picks-up the phone to make calls.
DTMF	
DTMF	Control how the BM2022 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 BM2022 send the DTMF tones in SIP messages.
Call Forward Setting	
Unconditional CF, Unconditional CF Target	Select this if you want the BM2022 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 BM2022 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 BM2022 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 BM2022 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 BM2022.
Call Waiting Reject Time	Enter time to wait before rejecting a call when call waiting is enabled.

10.6 Dialing

Click **VoIP > Account > Dialing** to configure dialing timeout values.

Figure 86 VoIP > Account > 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 70 VoIP > Account > Dialing

LABEL	DESCRIPTION
Inter-digit Timeout	Set the time in seconds (1~5) the BM2022 waits for each digit input of a complete callee number after you press the first key on the phone. If the BM2022 cannot receive the next digit entered within this time period, the BM2022 processes digits you have dialed.
First-digit Timeout	Set the number of seconds (5~30) for the BM2022 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 > FAX** to configure which standard the account uses for fax services.

Figure 87 VoIP > Account > FAX

Options G.711 Pass Through

The following table describes the labels in this screen.

Table 71 VoIP > Account > FAX

LABEL	DESCRIPTION
Options	Select which standard the BM2022 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** - BM2022 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 BM2022 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 72 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 72 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.

11

The VoIP Line Screens

11.1 Overview

The **VoIP > Line** 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 153).

11.1.1 What You Can Do in This Chapter

- The **Phone** screen (Section 11.2 on page 168) lets you configure phone settings.
- The **Voice** screen (Section 11.3 on page 168) lets you configure voice settings.

11.1.2 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 BM2022 reduce the bandwidth that a call uses by not transmitting "silent packets" when you are not speaking.

When using VAD, the BM2022 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.

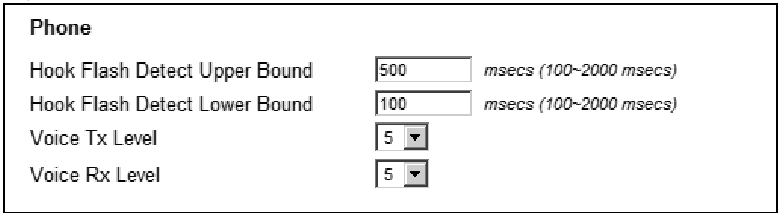
Echo Cancellation

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 > Phone** to configure phone related settings.

Figure 88 VoIP > Line > Phone



Phone

Hook Flash Detect Upper Bound 500 msecs (100~2000 msecs)

Hook Flash Detect Lower Bound 100 msecs (100~2000 msecs)

Voice Tx Level 5

Voice Rx Level 5

The following table describes the labels in this screen.

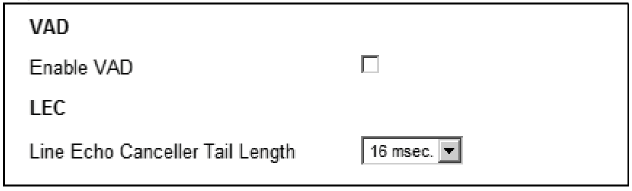
Table 73 VoIP > Line > Phone

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 BM2022. -9 is the quietest, and 9 is the loudest.
Voice Rx Level	Select the volume level transmitted to the BM2022. -9 is the quietest, and 9 is the loudest.

11.3 Voice

Click **VoIP > Line > Voice** to configure voice settings.

Figure 89 VoIP > Line > Voice



VAD

Enable VAD □

LEC

Line Echo Canceller Tail Length 16 msec.

The following table describes the labels in this screen.

Table 74 VoIP > Line > Voice

LABEL	DESCRIPTION
VAD - Voice Activity Detection	
Enable VAD	Enable Voice Active Detector (VAD) to have the BM2022 stop transmitting voice traffic when you are not speaking using the detection method. This reduces the bandwidth the BM2022 uses.

Table 74 VoIP > Line > Voice

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 BM2022 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.

12

Maintenance

12.1 Overview

Use these screens to manage and maintain your BM2022.

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 BM2022 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 BM2022’s WAN IP address when configuring from the WAN.
- Use the BM2022’s LAN IP address when configuring from the LAN.

System Timeout

There is a default system management idle timeout of five minutes. The BM2022 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 BM2022 supports SNMP agent functionality, which allows a manager station to manage and monitor the BM2022 through the network. The BM2022 supports SNMP version one (SNMPv1) and version two (SNMPv2). The next figure illustrates an SNMP management operation.

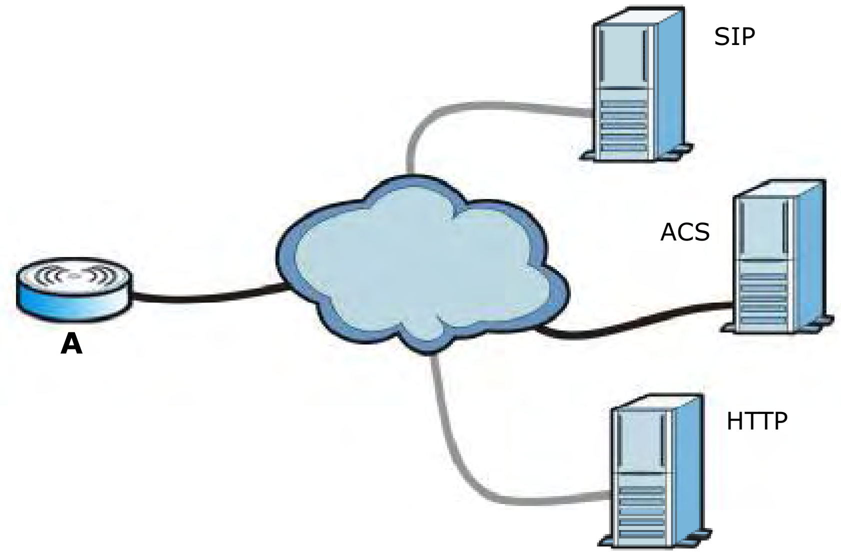
Note: SNMP is only available if TCP/IP is configured.

TR-069

TR-069 is an abbreviation of "Technical Reference 069", a protocol designed to facilitate the remote management of Customer Premise Equipement (CPE), such as the BM2022. 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 BM2022, 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 BM2022 and then configure it appropriately. (The ACS server which it will use must also be configured by its administrator.)

Figure 91 TR-069 Example



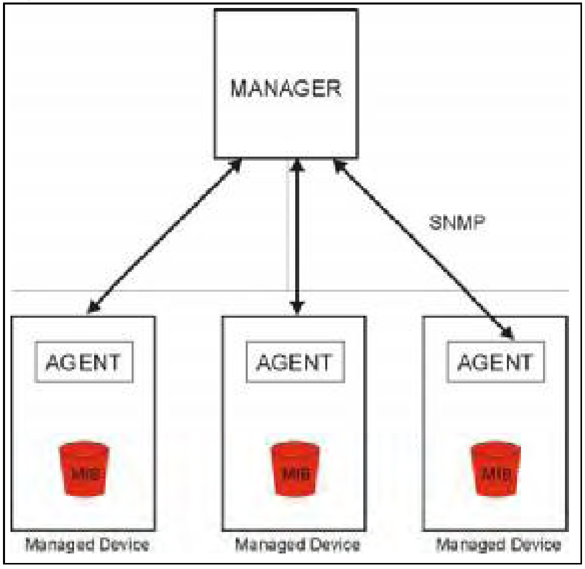
In this example, the BM2022 (A) receives data from at least 3 sources: A SIP server for handling voice calls, an HTTP server for handling web services, and an ACS, for configuring the BM2022 remotely. All three servers are owned and operated by the client's Internet Service Provider. However, without the configuration settings from the ACS, the BM2022 cannot access the other two servers. Once the BM2022 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 BM2022 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 92 SNMP Management Model



An agent is a management software module that resides in a managed device (the BM2022). 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 BM2022 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 BM2022 sends traps to the SNMP manager when any of the following events occurs:

Table 76 SNMP Traps

TRAP #	TRAP NAME	DESCRIPTION
0	coldStart (defined in *RFC-1215*)	A trap is sent after booting (power on).
1	warmStart (defined in *RFC-1215*)	A trap is sent after booting (software reboot).
4	authenticationFailure (defined in *RFC-1215*)	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 BM2022 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 BM2022’s features.

Device management works as follows:

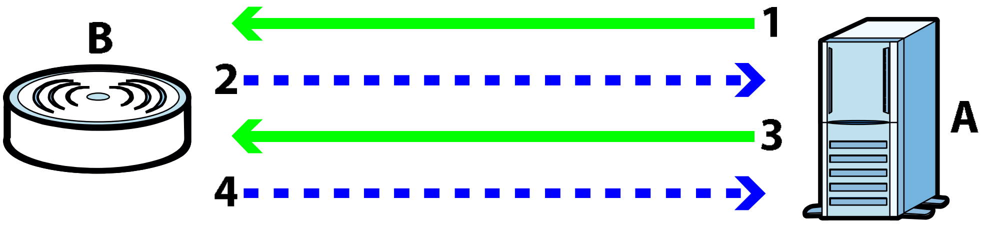
1 The server (**A**) sends out the query (**1**) to the BM2022 (**B**).

2 The BM2022 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 BM2022 once all of its management operations have been carried out.

Figure 93 OMA-DM Data Management



OMA-DM Authentication

In order to ensure the integrity of the connection between an OMA-DM server and the BM2022, 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 BM2022'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.

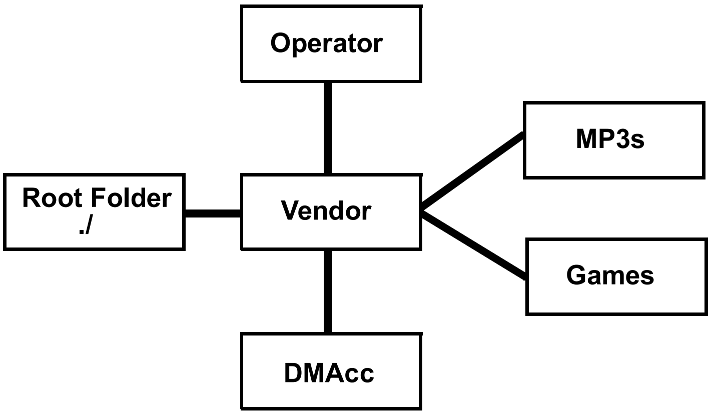
Digest Access Authentication – This protocol was designed to replace basic access authentication. Instead of encoding a user name and password in plaintext, this protocol uses what is known as an MD5 message authentication code. It allows the server to issue a single-use, randomly generated number (known 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 94 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

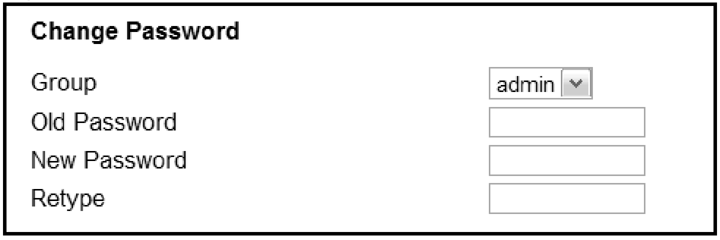
NTP stands for Network Time Protocol. It is employed by devices connected to the Internet in order to obtain a precise time setting from an official time server. These time servers are accurate to within 200 microseconds.

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 BM2022 to factory defaults and restart the BM2022.

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

Figure 95 Password Screen



Change Password

Group: admin

Old Password

New Password

Retype

This screen contains the following fields:

Table 77 Password

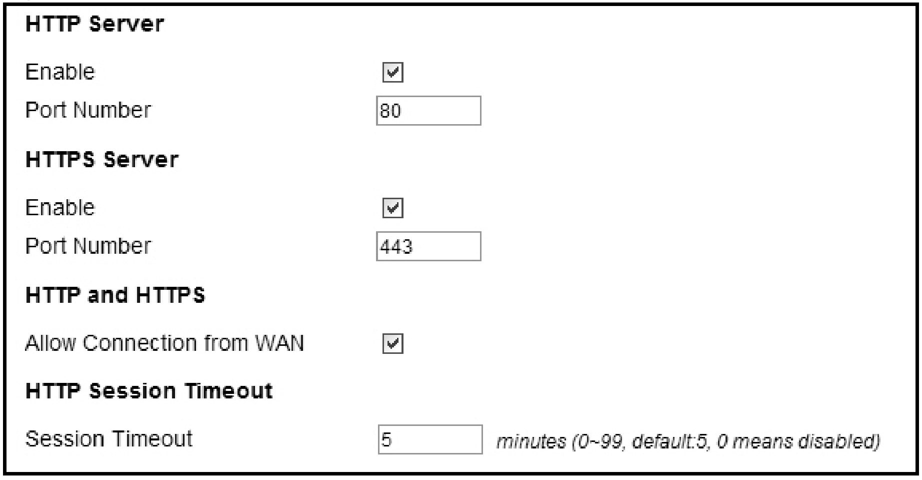
LABEL	DESCRIPTION
Group	Select the group for which you want to change the login password.
Old Password	Enter the old password for the login group.
New Password	Enter the new password for the login group.
Retype	Retype the new password for the login group.

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 96 HTTP Screen



HTTP Server

Enable ☑

Port Number 80

HTTPS Server

Enable ☑

Port Number 443

HTTP and HTTPS

Allow Connection from WAN ☑

HTTP Session Timeout

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

This screen contains the following fields:

Table 78 HTTP

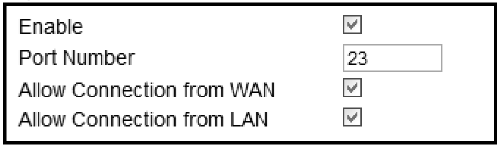
LABEL	DESCRIPTION
HTTP Server	
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the BM2022. The computer must use the same port number.
HTTPS Server	
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the BM2022. 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 BM2022 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 97 Telnet Screen



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

This screen contains the following fields:

Table 79 Telnet

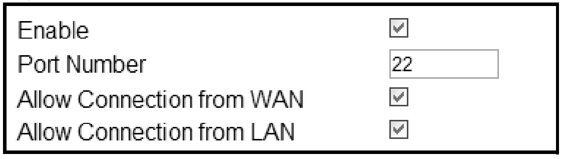
LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the BM2022. The computer must use the same port number.
Allow Connection from WAN	Select this to allow connections using this service that originate on 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 98 SSH Screen



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

This screen contains the following fields:

Table 80 SSH

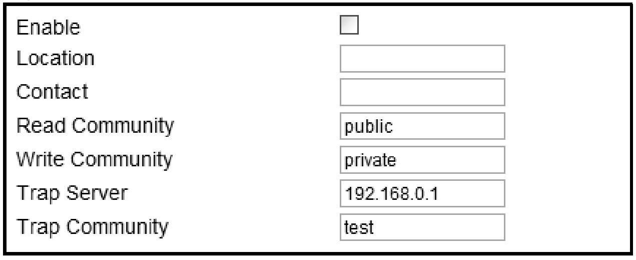
LABEL	DESCRIPTION
Enable	Select this to enable remote management using this service.
Port Number	Enter the port number this service can use to access the BM2022. The computer must use the same port number.
Allow Connection from WAN	Select this to allow connections using this service that originate on 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 99 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:

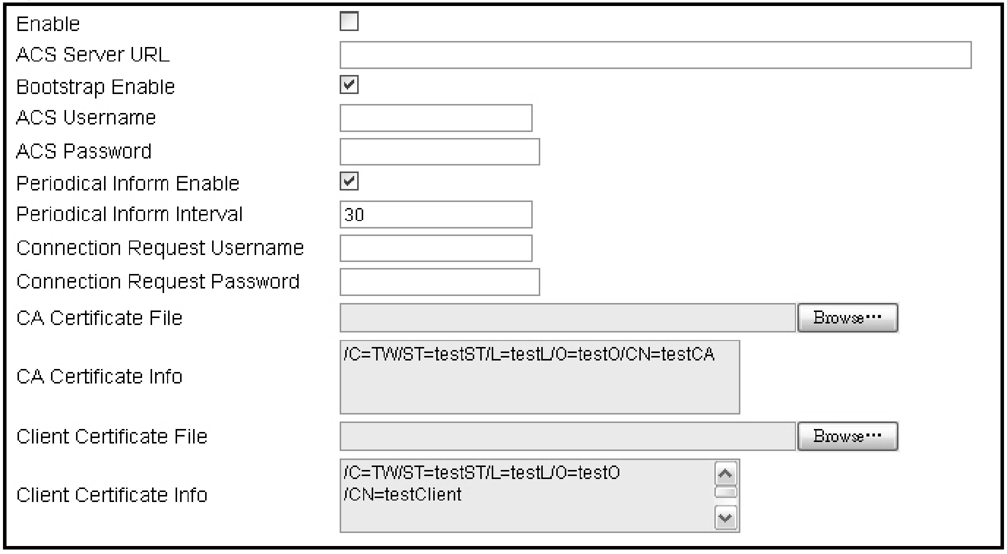
Table 81 SNMP

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.



Enable	□
ACS Server URL	
Bootstrap Enable	☑
ACS Username	
ACS Password	
Periodical Inform Enable	☑
Periodical Inform Interval	30
Connection Request Username	
Connection Request Password	
CA Certificate File	Browse...
CA Certificate Info	/C=TW/ST=testST/L=testL/O=testO/CN=testCA
Client Certificate File	Browse...
Client Certificate Info	/C=TW/ST=testST/L=testL/O=testO /CN=testClient

Figure 100 CWMP Screen

This screen contains the following fields:

Table 82 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 BM2022 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 BM2022 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 BM2022 to periodically connect to the ACS and check for configuration updates. If you do not enable this feature then the BM2022 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 BM2022 connects to the auto-configuration server.
Connection Request Username	Enter the connection request user name that the ACS must send to the BM2022 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 82 CWMP (continued)

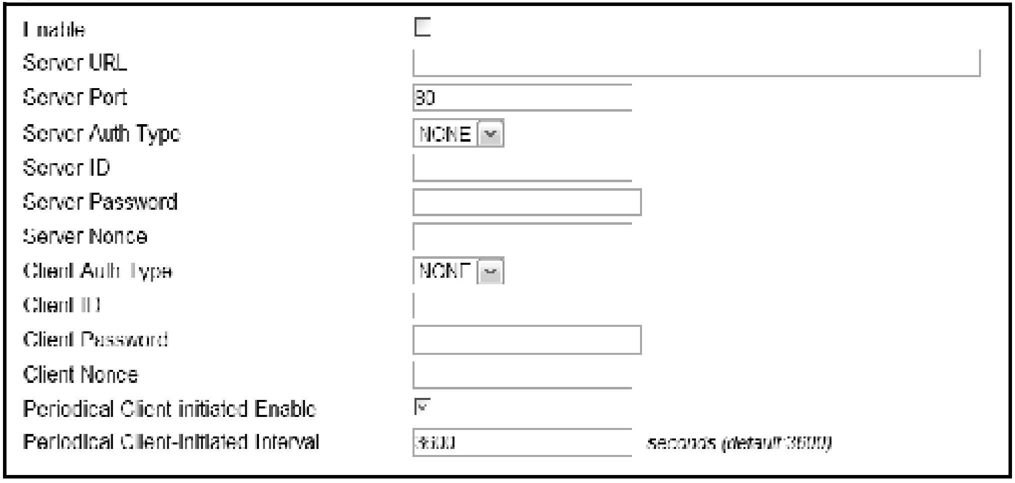
LABEL	DESCRIPTION
Connection Request Password	Enter the connection request password that the ACS must send to the BM2022 when it requests a connection. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed. Note: This must be provided by the ACS administrator.
CA Certificate File	Click **Browse** to upload a Certificate Authority (CA) certificate to the BM2022.
CA Certificate Info	This displays information about the currently active CA certificate.
Client Certificate File	Click **Browse** to upload a client certificate to the BM2022.
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 101 OMA-DM Screen



Enable	□
Server URL	
Server Port	80
Server Auth Type	NONE
Server ID	
Server Password	
Server Nonce	
Client Auth Type	NONE
Client ID	
Client Password	
Client Nonce	
Periodical Client initiated Enable	☑
Periodical Client-Initiated Interval	3600 seconds (default:3600)

This screen contains the following fields:

Table 83 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.
Server Port	Enter the port number for the IP address of the OMA-DM server set up in the preceding field.

Table 83 OMA-DM (continued)

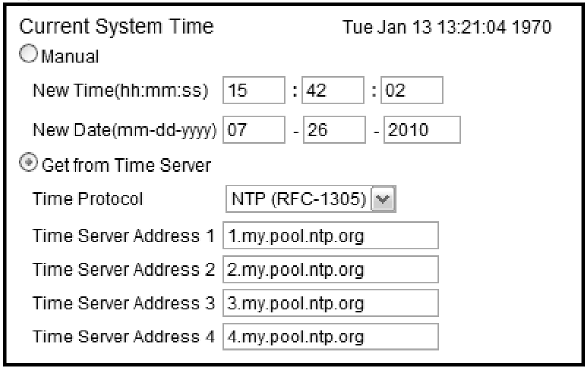
LABEL	DESCRIPTION
Server Auth Type	Select the encryption algorithm scheme used by the OMA-DM server to communicate with client devices. If the scheme selected here does not match the actual scheme used by the server, then server will challenge the BM2022 to automatically update its settings. • **None** - 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 BM2022 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 BM2022 during the communication handshake process to identify the server.
Server Nonce	The BM2022 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 BM2022 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 the **Server Auth Type**.
Client ID	Enter the client name for the BM2022.
Client Password	Enter the password for the BM2022's client name.
Client Nonce	The BM2022 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 BM2022 to periodically connect to the OMA-DM server and check for configuration updates. If you do not enable this feature then the BM2022 can only be updated automatically when the OM-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 BM2022 connects to the OMA-DM server.

12.9 Date

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 102 Date Screen



Current System Time Tue Jan 13 13:21:04 1970

○ Manual

New Time(hh:mm:ss) 15 : 42 : 02

New Date(mm-dd-yyyy) 07 - 26 - 2010

● Get from Time Server

Time Protocol NTP (RFC-1305)

Time Server Address 1 1.my.pool.ntp.org

Time Server Address 2 2.my.pool.ntp.org

Time Server Address 3 3.my.pool.ntp.org

Time Server Address 4 4.my.pool.ntp.org

This screen contains the following fields:

Table 84 Date

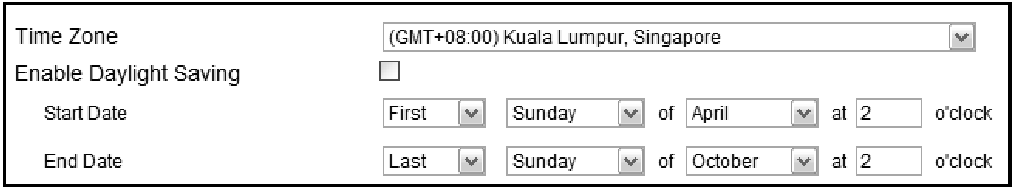
LABEL	DESCRIPTION
Manual	
New Time	Enter the new time in this field.
New Date	Enter the new date in this field.
Get from Time Server	
Time Protocol	Select the time service protocol that your time server uses.Check with your ISP or network administrator, or use trial-and-error to find a protocol that 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 103 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 85 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

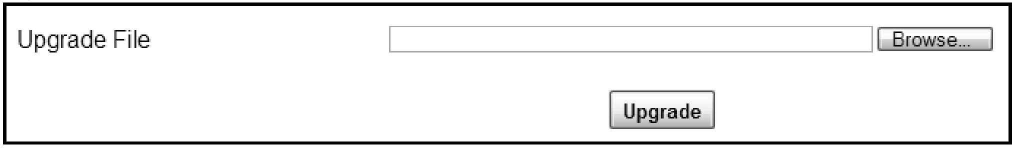
Use this screen to browse to a firmware file on a local computer and upload it to the WiMAX Device. Firmware files usually use the system model name with a "*.bin" extension, such as "BM2022.bin". The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system restarts.

Contact your service provider for information on available firmware upgrades.

Note: Only use firmware for your BM2022's specific model.

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

Figure 104 Upgrade File Screen



This screen contains the following fields:

Table 86 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 BM2022 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.

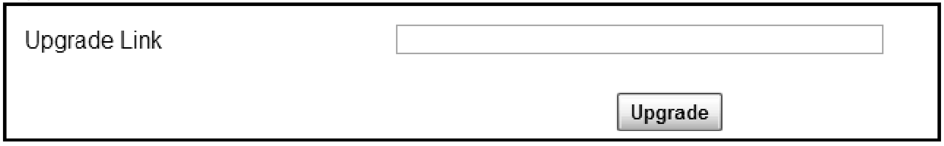
If the upload is not successful, you will be notified by error message.

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 105 Upgrade Link Screen



This screen contains the following fields:

Table 87 Upgrade Link

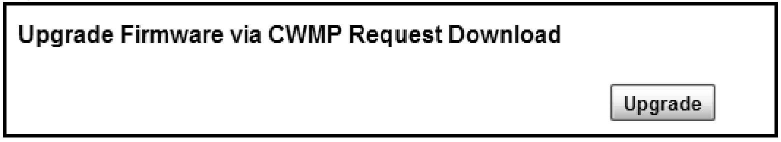
LABEL	DESCRIPTION
Upgrade Link	Enter the URL or IP address of the firmware's upgrade location on the network.
Upgrade	Click this to begin uploading the selected file. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

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 106 CWMP Upgrade Screen



This screen contains the following fields:

Table 88 CWMP Upgrade

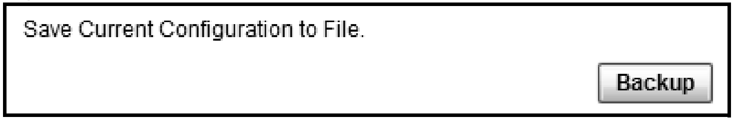
LABEL	DESCRIPTION
Upgrade	Click this to begin upgrading firmware using CWMP Request. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

12.14 Backup

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 107 Backup/Restore Screen



Save Current Configuration to File.

This screen contains the following fields:

Table 89 Backup/Restore

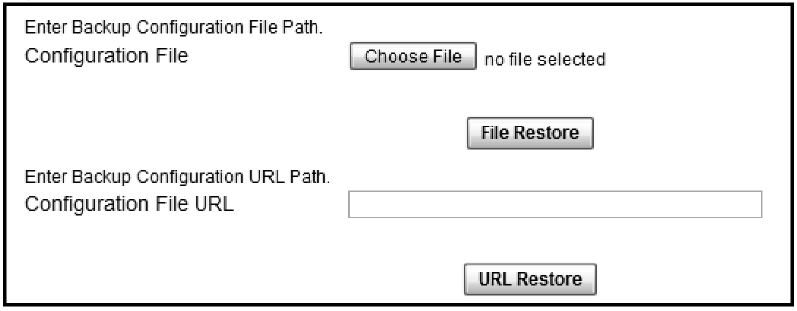
LABEL	DESCRIPTION
Backup	Click this to save the BM2022's current configuration to a file on your computer. Once your device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file is useful 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 108 Restore Screen



Enter Backup Configuration File Path.

Configuration File: no file selected

Enter Backup Configuration URL Path.

Configuration File URL:

This screen contains the following fields:

Table 90 Restore

LABEL	DESCRIPTION
Configuration File	Click **Choose File** then browse to the location of a firmware upgrade file and select it. Click **File Restore** to upload the specified configuration to the BM2022 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 BM2022 and replace the current settings.

12.15.1 The Restore Configuration Process

When the BM2022 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 BM2022'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.

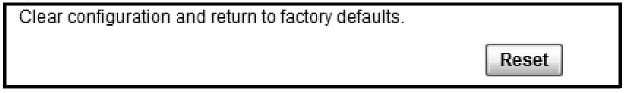
If the upload was not successful, you are notified with an error message.

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 109 Factory Defaults Screen



Clear configuration and return to factory defaults.

This screen contains the following fields:

Table 91 Factory Defaults

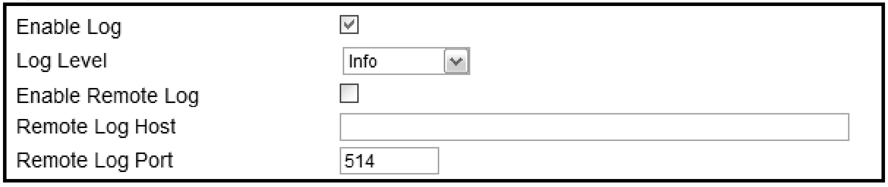
LABEL	DESCRIPTION
Reset	Click this to clear all user-entered configuration information and return the BM2022 to its factory defaults. There is no warning screen.

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 110 Log Setting Screen



Enable Log	☑
Log Level	Info
Enable Remote Log	□
Remote Log Host	
Remote Log Port	514

This screen contains the following fields:

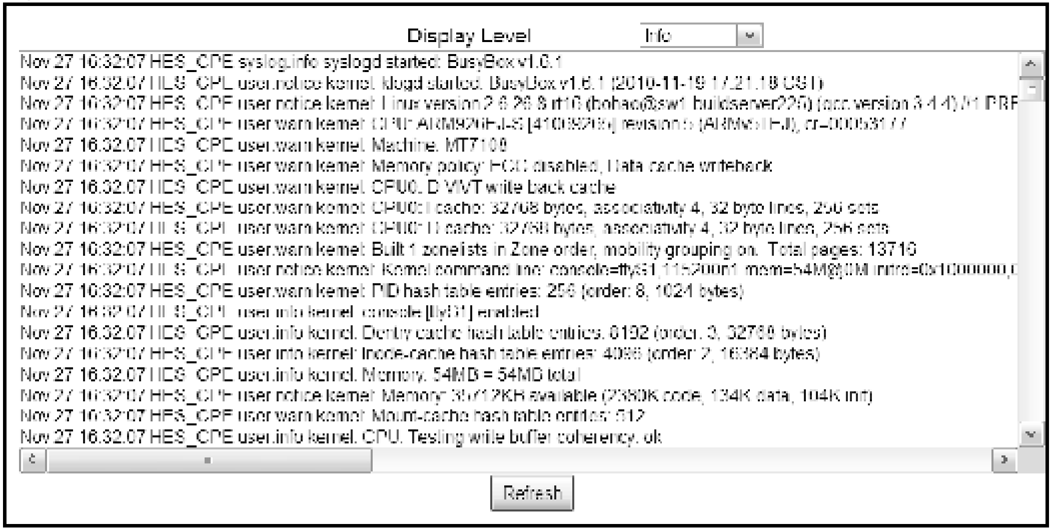
Table 92 Log Setting

LABEL	DESCRIPTION
Enable Log	Select this to have the BM2022 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.



Display Level: Info

```
Nov 27 16:32:07 HES_CPE syslog.info syslogd started: BusyBox v1.6.1
Nov 27 16:32:07 HES_CPE user.notice kernel: klogd started: BusyBox v1.6.1 (2010-11-19 17:21:18 CST)
Nov 27 16:32:07 HES_CPE user.notice kernel: Linux version 2.6.26.8-rt16 (bohao@sw1_buildserver225) (gcc version 3.4.4) #1 PRE
Nov 27 16:32:07 HES_CPE user.warn kernel: CPU: ARM926EJ-S [41069265] revision 5 (ARMv5TEJ), cr=00053177
Nov 27 16:32:07 HES_CPE user.warn kernel: Machine: MT7108
Nov 27 16:32:07 HES_CPE user.warn kernel: Memory policy: ECC disabled, Data cache writeback
Nov 27 16:32:07 HES_CPE user.warn kernel: CPU0: D VIVT write back cache
Nov 27 16:32:07 HES_CPE user.warn kernel: CPU0: I cache: 32768 bytes, associativity 4, 32 byte lines, 256 sets
Nov 27 16:32:07 HES_CPE user.warn kernel: CPU0: D cache: 32768 bytes, associativity 4, 32 byte lines, 256 sets
Nov 27 16:32:07 HES_CPE user.warn kernel: Built 1 zonelists in Zone order, mobility grouping on.  Total pages: 13716
Nov 27 16:32:07 HES_CPE user.notice kernel: Kernel command line: console=ttyS1,115200n1 mem=54M@0M initrd=0x1000000,
Nov 27 16:32:07 HES_CPE user.warn kernel: PID hash table entries: 256 (order: 8, 1024 bytes)
Nov 27 16:32:07 HES_CPE user.info kernel: console [ttyS1] enabled
Nov 27 16:32:07 HES_CPE user.info kernel: Dentry cache hash table entries: 8192 (order: 3, 32768 bytes)
Nov 27 16:32:07 HES_CPE user.info kernel: Inode-cache hash table entries: 4096 (order: 2, 16384 bytes)
Nov 27 16:32:07 HES_CPE user.info kernel: Memory: 54MB = 54MB total
Nov 27 16:32:07 HES_CPE user.notice kernel: Memory: 50712KB available (2380K code, 134K data, 104K init)
Nov 27 16:32:07 HES_CPE user.warn kernel: Mount-cache hash table entries: 512
Nov 27 16:32:07 HES_CPE user.info kernel: CPU: Testing write buffer coherency: ok
```

Figure 111 Log Display Screen

This screen contains the following fields:

Table 93 Log Display

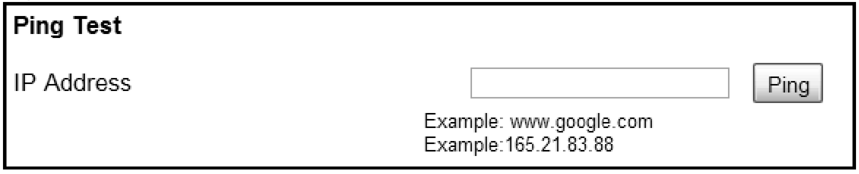
LABEL	DESCRIPTION
Display Level	Select the type of logs to display from this menu.
Refresh	Click this to refresh the logs in the display window.

12.19 Ping Test

Use this screen to test network connectivity using ping.

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

Figure 112 Ping Screen



Ping Test

IP Address

Example: www.google.com
Example:165.21.83.88

This screen contains the following fields:

Table 94 Ping

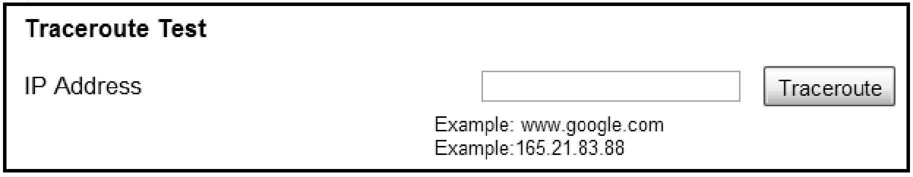
LABEL	DESCRIPTION
IP Address	Enter the IP address or domain name of a target device to which this test will send.
Ping	Click this to start the test. The result will show at the bottom of the screen.

12.20 Traceroute Test

Use this screen to test network connectivity using traceroute.

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

Figure 113 Traceroute Screen



Traceroute Test

IP Address

Example: www.google.com
Example:165.21.83.88

This screen contains the following fields:

Table 95 Traceroute

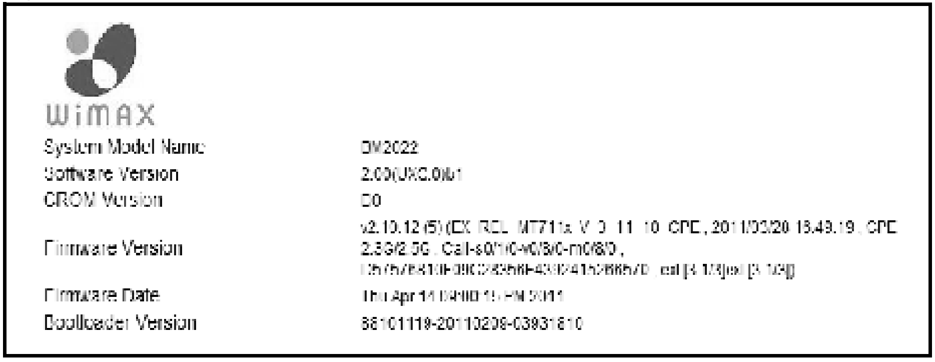
LABEL	DESCRIPTION
IP Address	Enter the IP address or domain name of a target device to which this test will send.
Traceroute	Click this to start the test. The result will show at the bottom of the screen.

12.21 About

This screen displays information about the BM2022 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 114 About Screen



System Model Name	BM2022
Software Version	2.00(UXC.0)b1
CROM Version	D0
Firmware Version	v2.10.12 (5) (EX REL MT711x V 0 11 10 CPE , 2011/03/20 18.43.19 , CPE 2.3G/2.5G , Cali-s0/1/0-v0/3/0-m0/8/0 , [illegible] , cal [8.1/3]exl [3.1/3])
Firmware Date	Thu Apr 14 04:00:19 PM 2011
Bootloader Version	88101119-20110208-03931810

This screen contains the following fields:

Table 96 About

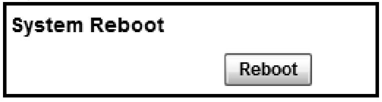
LABEL	DESCRIPTION
System Model Name	This field displays the BM2022 system name. It is used for identification.
Software Version	This field displays the Web Configurator software version that the BM2022 is currently running.
CROM Version	This field displays the CROM version number.
Firmware Version	This 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 115 Reboot Screen



This screen contains the following fields:

Table 97 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 BM2022 after a restart.

13

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
- BM2022 Access and Login
- Internet Access
- Reset the BM2022 to Its Factory Defaults

13.1 Power, Hardware Connections, and LEDs

The BM2022 does not turn on. None of the LEDs turn on.

1. Make sure you are using the power adapter or cord included with the BM2022.
2. Make sure the power adapter or cord is connected to the BM2022 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 BM2022.
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 Section 1.2.1 on page 19 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 BM2022.
5. If the problem continues, contact the vendor.

13.2 BM2022 Access and Login

I forgot the IP address for the BM2022.

1. The default IP address is **192.168.1.1**.
2. If you changed the IP address and have forgotten it, you might get the IP address of the BM2022 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 BM2022 (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 BM2022 to its factory defaults. See Section 12.16 on page 187.

I forgot the password.

1. The default password is **1234**.
2. If this does not work, you have to reset the BM2022 to its factory defaults. See Section 12.16 on page 187.

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 **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 BM2022.
2. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2.1 on page 19.
3. Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled. See Appendix C on page 233.
4. If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. Your BM2022 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 BM2022. See Appendix D on page 243.
5. Reset the BM2022 to its factory defaults, and try to access the BM2022 with the default IP address. See Chapter 2 on page 21.

6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Try to access the BM2022 using another service, such as Telnet. If you can access the BM2022, check the remote management settings and firewall rules to find out why the BM2022 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 BM2022.

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 BM2022. Log out of the BM2022 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 BM2022.

4 If this does not work, you have to reset the BM2022 to its factory defaults. See Section 12.16 on page 187.

I cannot Telnet to the BM2022.

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 Section 1.2.1 on page 19.

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 121.

4 Check your WiMAX settings. The BM2022 may have been set to search the wrong frequencies for a wireless connection. See Chapter 6 on page 65. If you are unsure of the correct values, contact your service provider.

5 Disconnect all the cables from your BM2022, 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 BM2022), 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 Section 1.2.1 on page 19.

2 Disconnect and re-connect the power adapter to the BM2022.

3 If the problem continues, contact your ISP.

The Internet connection is slow or intermittent.

1 The quality of the BM2022's wireless connection to the base station may be poor. Poor signal reception may be improved by moving the BM2022 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 BM2022 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 Section 1.2.1 on page 19. If the BM2022 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 BM2022.

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 Reset the BM2022 to Its Factory Defaults

If you reset the BM2022, you lose all of the changes you have made. The BM2022 re-loads its default settings, and the password resets to **1234**. You have to make all of your changes again.

You will lose all of your changes when you push the **Reset** button.

To reset the BM2022,

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 BM2022 restarts automatically, wait for the BM2022 to finish restarting, and log in to the web configurator. The password is "1234".

If the BM2022 does not restart automatically, disconnect and reconnect the BM2022's power. Then, follow the directions above again.

13.4.1 Pop-up Windows, JavaScript and Java Permissions

Please see Appendix C on page 233.

14

Product Specifications

This chapter gives details about your BM2022's hardware and firmware features.

Table 98 Environmental and Hardware Specifications

FEATURE	DESCRIPTION
Operating Temperature	0°C to 45°C
Storage Temperature	-25°C to 55°C
Operating Humidity	10% to 95% (non-condensing)
Storage Humidity	10% to 95% (non-condensing)
Power Supply	12V DC, 1A
Power consumption	Less than 12W
Ethernet Interface	One auto-negotiating, auto-MDI/MDI-X NWay 10/100 Mbps RJ-45 Ethernet port
Telephony Interface	One analog ATA interface for standard telephones through RJ-11 FXS (Foreign Exchange Subscriber) analog connector
Antenna	6 +/- 0.5dBi internal antenna
Weight	600 g
Dimensions	165 mm (W) x 25 mm (D) x 260 mm (H)
Certification	• FCC • CNC • Comply with WiMAX Forum Wave II standard. • EEE (Proposal for Directive on Environmental Impacts of Electrical and Electronic Equipment). • EMC ○ EN 301 489-1 and EN 301 489-17. Emission class B. • Transportation Shock and Vibration ○ EN 300 019-2-2, Public transportation • 2002/95/EC (RoHS) Restriction of Hazardous Substances Directive • 2002/96/EC (WEEE) (WEEE) Waste Electrical and Electronic Equipment Directive • European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste

Table 99 Radio Specifications

FEATURE	DESCRIPTION
Media Access Protocol	IEEE 802.16e-2005
WiMAX Bandwidth	2.5 GHz
Data Rate	Aggregate throughput: up to 20 mbps Upload: 5 mbps

Table 99 Radio Specifications (continued)

Modulation	QPSK (uplink and downlink) 16-QAM (uplink and downlink) 64-QAM (downlink only)
Output Power	Typically 26.5 dBm with internal antennas
Duplex mode	Time Division Duplex (TDD)
Security	PKMv2 EAP TLS based device authentication EAP-TTLS/CHAP/PAP/MSCHAP/MSCHAPv2 CMAC message autentication CCM mode 128-bit AES data ciphering Device authentication WiMAX Forum X.509 certificates

Table 100 Firmware Specifications

FEATURE	DESCRIPTION
Web-based Configuration and Management Tool	Also known as "the web configurator", this is a firmware-based management solution for the BM2022. You must connect using a compatible web browser in order to use it.
High Speed Wireless Internet Access	The BM2022 is ideal for high-speed wireless Internet browsing. WiMAX (Worldwide Interoperability for Microwave Access) is a wireless networking standard providing high-bandwidth, wide-range secured wireless service. The BM2022 is a WiMAX mobile station (MS) compatible with the IEEE 802.16e standard.
Firewall	The BM2022 is a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The BM2022's firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.
Content Filtering	The BM2022 can block access to web sites containing specified keywords. You can define time periods and days during which content filtering is enabled and include or exclude a range of users on the LAN from content filtering.
Network Address Translation (NAT)	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network (for example a private IP address used in a local network) to a different IP address known within another network (for example a public IP address used on the Internet).
Universal Plug and Play (UPnP)	Your device and other UPnP enabled devices can use the standard TCP/IP protocol to dynamically join a network, obtain an IP address and convey their capabilities to each other.
Dynamic DNS Support	With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service with a Dynamic DNS service provider.

Table 100 Firmware Specifications (continued)

FEATURE	DESCRIPTION
DHCP	DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. Your device has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. Your device can also act as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.
IP Alias	IP alias allows you to partition a physical network into logical networks over the same Ethernet interface. Your device supports three logical LAN interfaces via its single physical Ethernet interface with the your device itself as the gateway for each LAN network.
Multiple SIP Accounts	You can configure multiple voice (SIP) accounts.
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).
Dynamic Jitter Buffer	The built-in adaptive buffer helps to smooth out the variations in delay (jitter) for voice traffic (up to 60 ms). This helps ensure good voice quality for your conversations.
Voice Activity Detection/ Silence Suppression	Voice Activity Detection (VAD) reduces the bandwidth that a call uses by not transmitting when you are not speaking.
Comfort Noise Generation	Your device generates background noise to fill moments of silence when the other device in a call stops transmitting because the other party is not speaking (as total silence could easily be mistaken for a lost connection).
Echo Cancellation	You device supports G.168 of at least 24 ms. This an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
Time and Date	Get the current time and date from an external server when you turn on your BM2022. You can also set the time manually.
Logging	Use the BM2022's logging feature to view connection history, surveillance logs, and error messages.
Codecs	G.711 (PCM ì-law and a-law), G729, G.729a
Fax Support	T.38 FAX relay (FAX over UDP). G.711 fax relay for fax calls and be able to renegotiate codec to G.711 if a fax call is detected.
Ring Tones	Supports different distinctive ring tones on each line.
Call Prioritization	Prioritize VoIP traffic originating from the RJ-11 ports over any other traffic.

Table 101 Standards Supported

STANDARD	DESCRIPTION
RFC 768	User Datagram Protocol
RFC 791	Internet Protocol v4
RFC 792	Internet Control Message Protocol
RFC 792	Transmission Control Protocol
RFC 826	Address Resolution Protocol
RFC 854	Telnet Protocol
RFC 1112	IGMPv2
RFC 1349	Type of Service Protocol

Table 101 Standards Supported (continued)

STANDARD	DESCRIPTION
RFC 1706	DNS NSAP Resource Records
RFC 1889	Real-time Transport Protocol (RTP)
RFC 1890	Real-time Transport Control Protocol (RTCP)
RFC 2030	Simple Network Time Protocol
RFC 2104	HMAC: Keyed-Hashing for Message Authentication
RFC 2236	IGMPv2
RFC 2131	Dynamic Host Configuration Protocol
RFC 2401	Security Architecture for the Internet Protocol
RFC 2409	Internet Key Exchange
RFC 2475	Architecture for Differentiated Services (Diffserv)
RFC 2543	SIP Protocol
RFC 2617	Hypertext Transfer Protocol (HTTP) Authentication: Basic and Digest Access Authentication
RFC 2782	A DNS RR for specifying the location of services (DNS SRV)
RFC 2833	Real-time Transport Protocol Payload for DTMF Digits, Telephony Tones and Telephony Signals
RFC 2976	The SIP INFO Method
RFC 3261	Session Initiation Protocol (SIP version 2)
RFC 3262	Reliability of Provisional Responses in the Session Initiation Protocol (SIP).
RFC 3263	Session Initiation Protocol (SIP): Locating SIP Servers
RFC 3264	An Offer/Answer Model with the Session Description Protocol (SDP)
RFC 3265	Session Initiation Protocol (SIP)-Specific Event Notification
RFC 3323	A Privacy Mechanism for SIP
RFC 3325	Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks
RFC 3489	NAT Traversal - STUN
RFC 3550	RTP - A Real Time Protocol for Real-Time Applications
RFC 3581	An Extension to the Session Initiation Protocol (SIP) for Symmetric Response Routing
RFC 3611	RTP Control Protocol Extended Reports (RTCP XR)-XR
RFC 3715	IP Sec/NAT Compatibility
RFC 3842	A Message Summary and Message Waiting Indication Event Package for the Session Initiation Protocol (SIP)
IEEE 802.3	10BASE5 10 Mbit/s (1.25 MB/s)
IEEE 802.3u	100BASE-TX, 100BASE-T4, 100BASE-FX Fast Ethernet at 100 Mbit/s (12.5 MB/s) with auto-negotiation

Table 102 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 BM2022 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 BM2022 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 BM2022 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 BM2022 wait a specified length of time before dialing the number.
Phone config	The phone configuration table allows you to customize the phone keypad combinations you use to access certain features on the BM2022, 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 BM2022. Enter *99# in your phone’s keypad to have the BM2022 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 BM2022 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 BM2022 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.

Table 102 Voice Features

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 103 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
*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 BM2022'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.

A

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 BM2022 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.

B

Setting Up Your Computer's IP Address

Note: Your specific Huawei device may not support all of the operating systems described in this appendix. See the product specifications for more information about which operating systems are supported.

This appendix shows you how to configure the IP settings on your computer in order for it to be able to communicate with the other devices on your network. Windows Vista/XP/2000, Mac OS 9/OS X, and all versions of UNIX/LINUX include the software components you need to use TCP/IP on your computer.

If you manually assign IP information instead of using a dynamic IP, make sure that your network's computers have IP addresses that place them in the same subnet.

In this appendix, you can set up an IP address for:

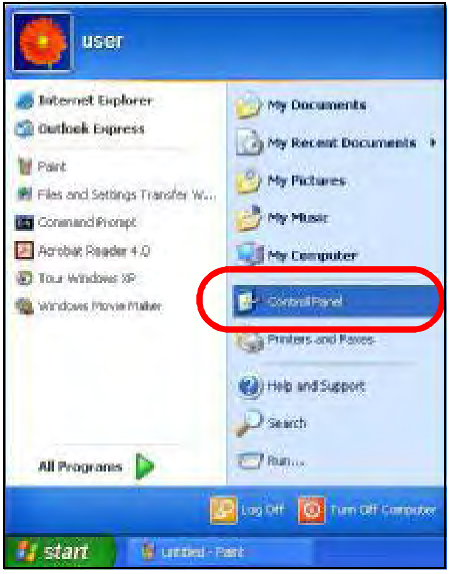
- Windows XP/NT/2000 on page 210
- Windows Vista on page 213
- Mac OS X: 10.3 and 10.4 on page 217
- Mac OS X: 10.5 on page 220
- Linux: Ubuntu 8 (GNOME) on page 223
- Linux: openSUSE 10.3 (KDE) on page 228

Windows XP/NT/2000

The following example uses the default Windows XP display theme but can also apply to Windows 2000 and Windows NT.

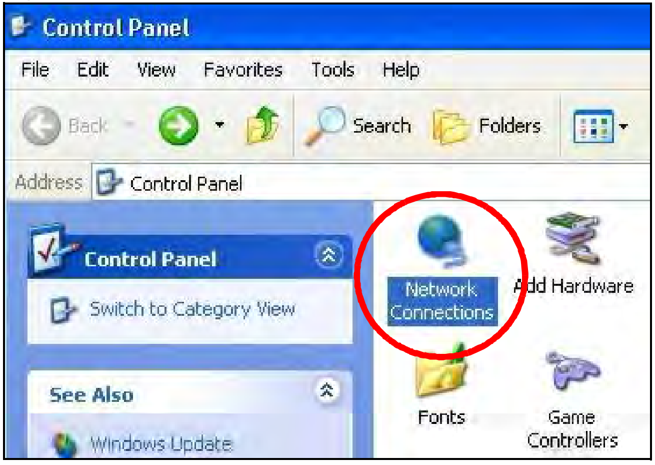
1 Click **Start** > **Control Panel**.

Figure 116 Windows XP: Start Menu



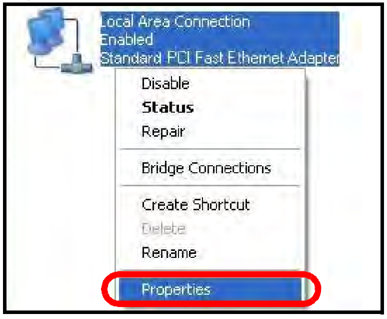
2 In the **Control Panel**, click the **Network Connections** icon.

Figure 117 Windows XP: Control Panel



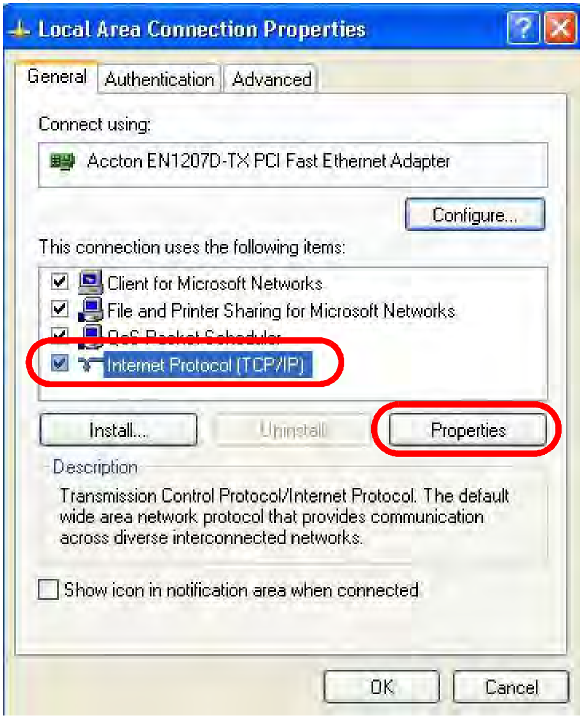
3 Right-click **Local Area Connection** and then select **Properties**.

Figure 118 Windows XP: Control Panel > Network Connections > Properties



4 On the **General** tab, select **Internet Protocol (TCP/IP)** and then click **Properties**.

Figure 119 Windows XP: Local Area Connection Properties



Connect using:

Accton EN1207D-TX PCI Fast Ethernet Adapter

This connection uses the following items:

☑ Client for Microsoft Networks
☑ File and Printer Sharing for Microsoft Networks
☑ QoS Packet Scheduler
☑ Internet Protocol (TCP/IP)

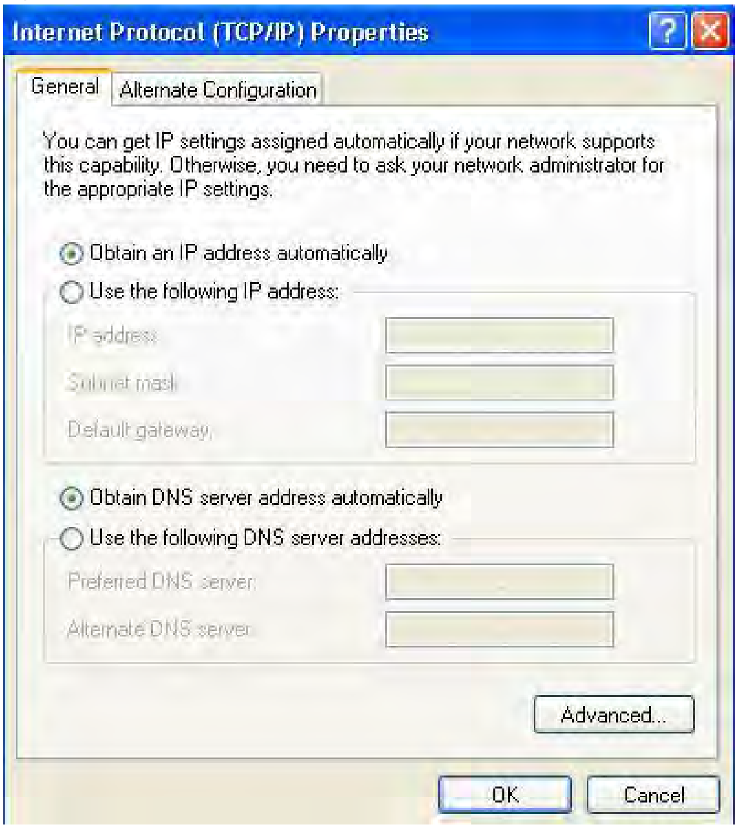
Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

□ Show icon in notification area when connected

5 The **Internet Protocol TCP/IP Properties** window opens.

Figure 120 Windows XP: Internet Protocol (TCP/IP) Properties



Internet Protocol (TCP/IP) Properties

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

6 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.

7 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

Click **OK** to close the **Local Area Connection Properties** window.**Verifying Settings**

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

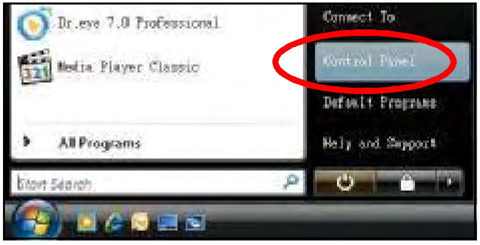
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Windows Vista

This section shows screens from Windows Vista Professional.

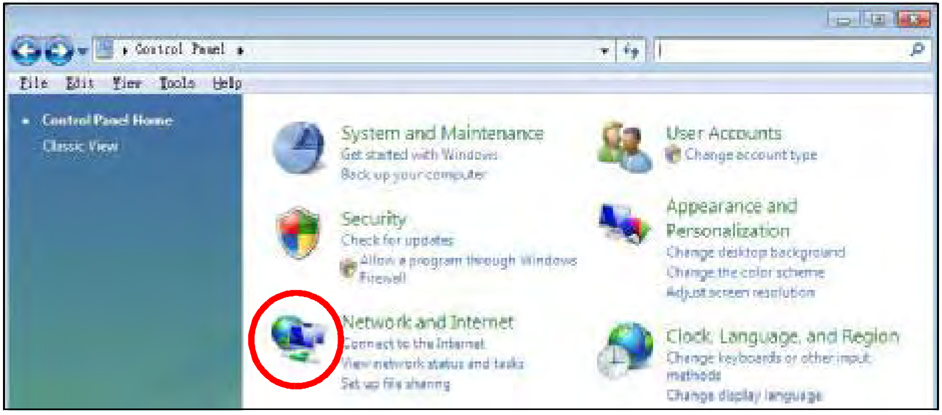
1 Click **Start** > **Control Panel**.

Figure 121 Windows Vista: Start Menu



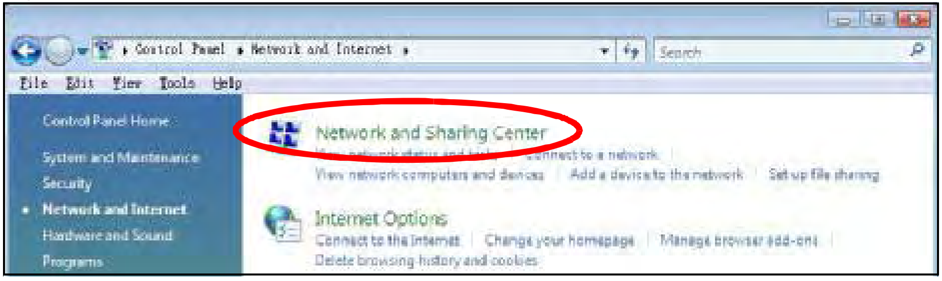
2 In the **Control Panel**, click the **Network and Internet** icon.

Figure 122 Windows Vista: Control Panel



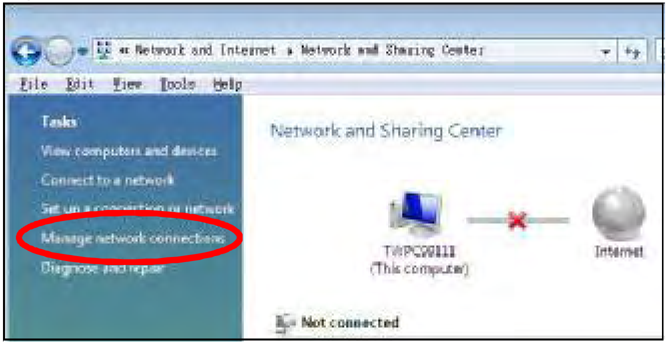
3 Click the **Network and Sharing Center** icon.

Figure 123 Windows Vista: Network And Internet



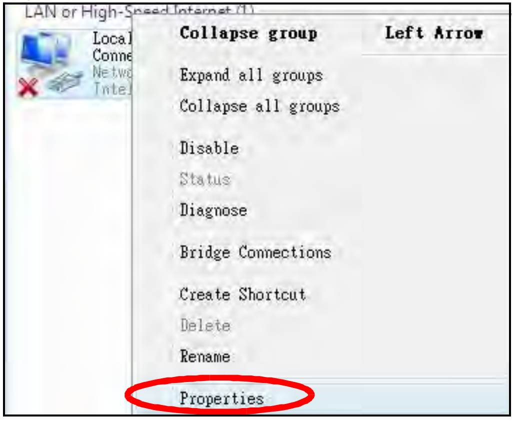
4 Click **Manage network connections**.

Figure 124 Windows Vista: Network and Sharing Center


Network and Internet ▸ Network and Sharing Center
File Edit View Tools Help
Tasks
View computers and devices
Connect to a network
Set up a connection or network
Manage network connections
Diagnose and repair
Network and Sharing Center
TWPC00111
(This computer)
Internet
Not connected

5 Right-click **Local Area Connection** and then select **Properties**.

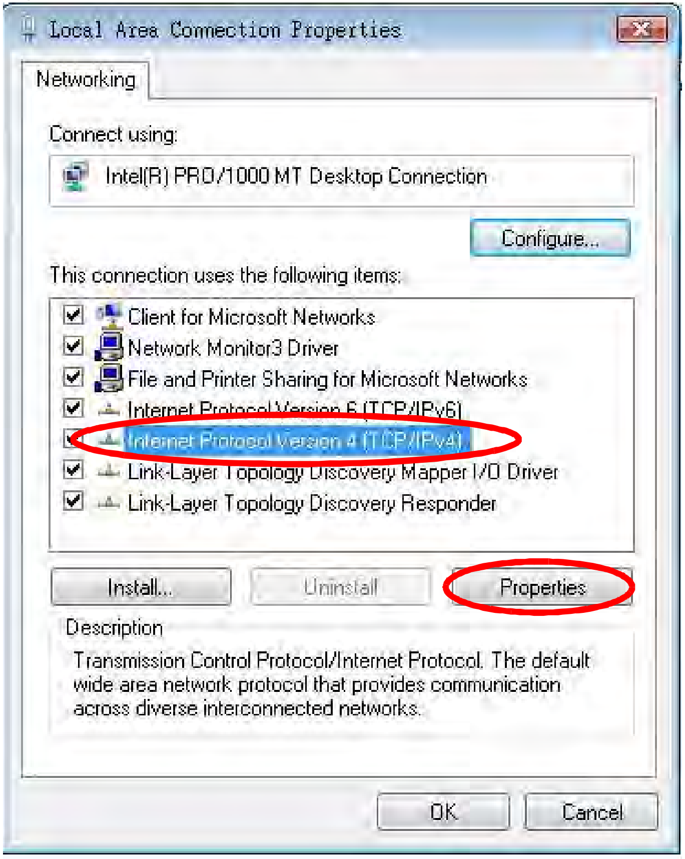
Figure 125 Windows Vista: Network and Sharing Center



Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

6 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.

Figure 126 Windows Vista: Local Area Connection Properties



Local Area Connection Properties

Networking

Connect using:

Intel(R) PRO/1000 MT Desktop Connection

Configure...

This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ Network Monitor3 Driver
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Install... Uninstall Properties

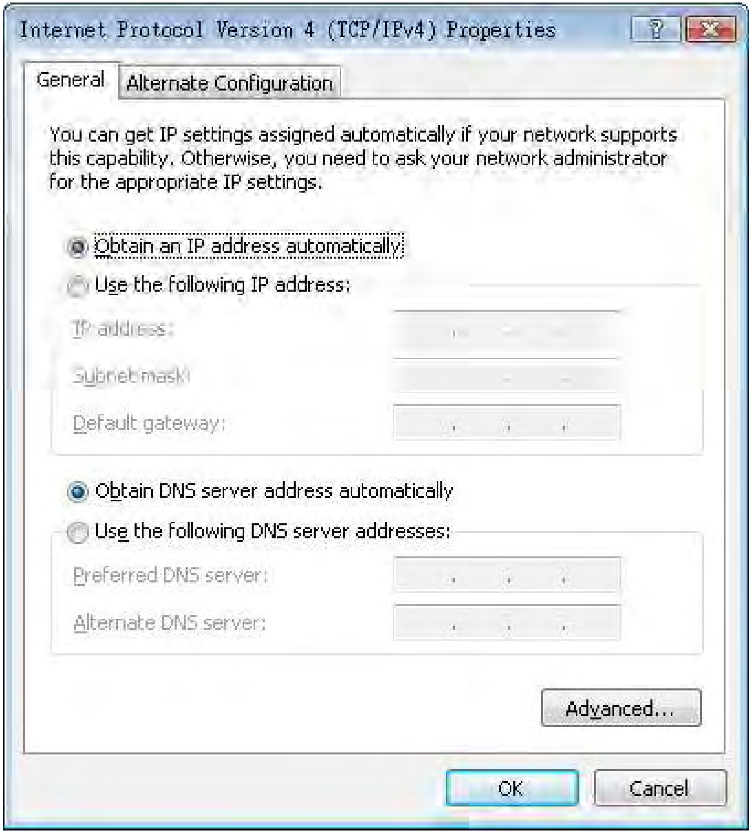
Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

OK Cancel

7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.

Figure 127 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties



Internet Protocol Version 4 (TCP/IPv4) Properties

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address:

Subnet mask:

Default gateway:

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server:

Alternate DNS server:

8 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.Click **Advanced**.

9 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

Click **OK** to close the **Local Area Connection Properties** window.**Verifying Settings**

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

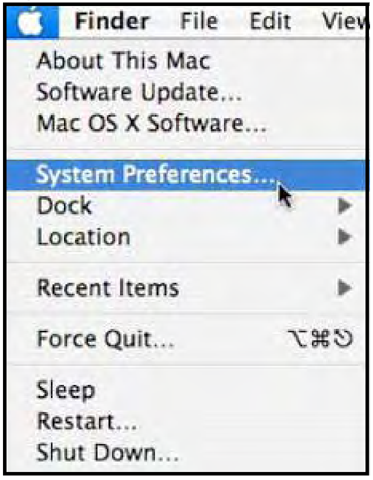
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Mac OS X: 10.3 and 10.4

The screens in this section are from Mac OS X 10.4 but can also apply to 10.3.

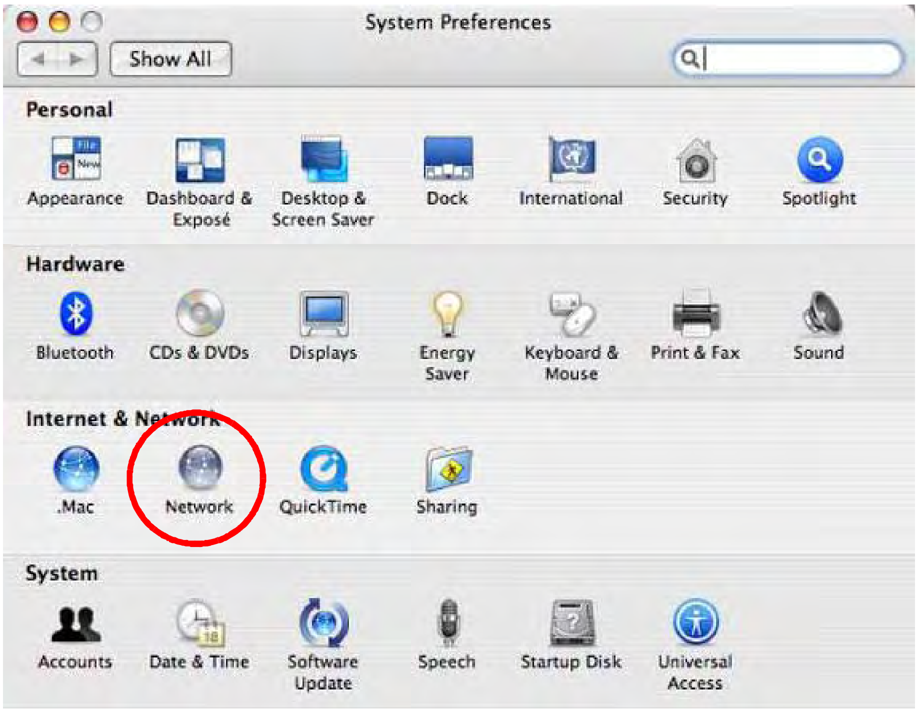
1 Click **Apple** > **System Preferences**.

Figure 128 Mac OS X 10.4: Apple Menu



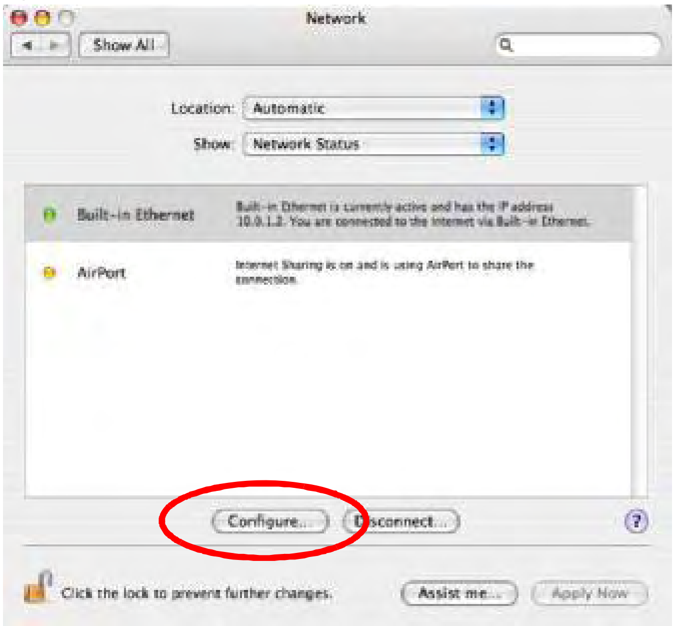
2 In the **System Preferences** window, click the **Network** icon.

Figure 129 Mac OS X 10.4: System Preferences



3 When the **Network** preferences pane opens, select **Built-in Ethernet** from the network connection type list, and then click **Configure.**

Figure 130 Mac OS X 10.4: Network Preferences



Location: Automatic

Show: Network Status

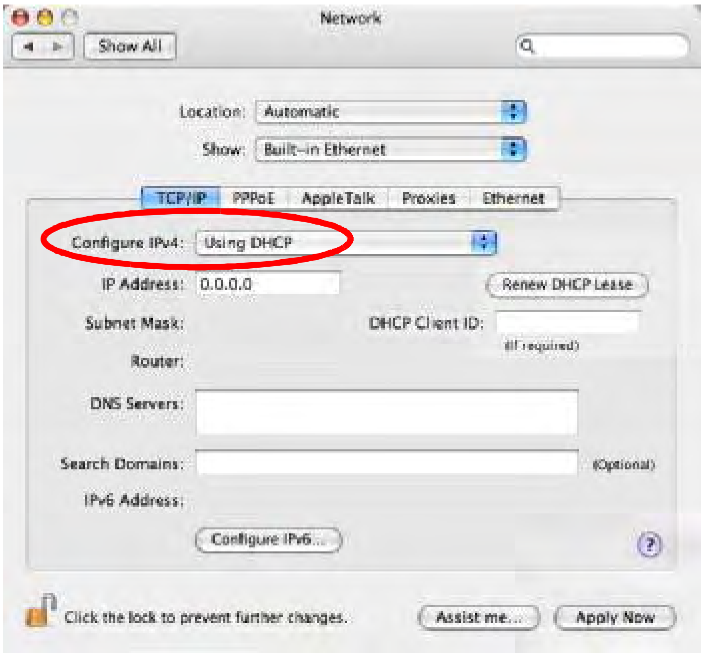
Built-in Ethernet — Built-in Ethernet is currently active and has the IP address 10.0.1.2. You are connected to the Internet via Built-in Ethernet.

AirPort — Internet Sharing is on and is using AirPort to share the connection.

Click the lock to prevent further changes.

4 For dynamically assigned settings, select **Using DHCP** from the **Configure IPv4** list in the **TCP/IP** tab.

Figure 131 Mac OS X 10.4: Network Preferences > TCP/IP Tab.



Location: Automatic

Show: Built-in Ethernet

Configure IPv4: Using DHCP

IP Address: 0.0.0.0

Subnet Mask:

Router:

DHCP Client ID: (If required)

DNS Servers:

Search Domains: (Optional)

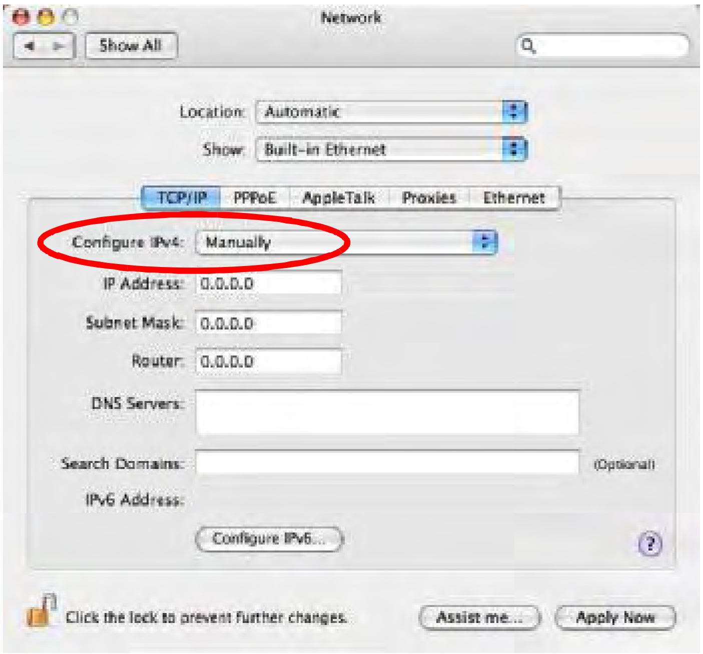
IPv6 Address:

Click the lock to prevent further changes.

5 For statically assigned settings, do the following:

- From the **Configure IPv4** list, select **Manually**.
- In the **IP Address** field, type your IP address.
- In the **Subnet Mask** field, type your subnet mask.
- In the **Router** field, type the IP address of your device.

Figure 132 Mac OS X 10.4: Network Preferences > Ethernet



Location: Automatic

Show: Built-in Ethernet

Configure IPv4: Manually

IP Address: 0.0.0.0

Subnet Mask: 0.0.0.0

Router: 0.0.0.0

DNS Servers:

Search Domains: (Optional)

IPv6 Address:

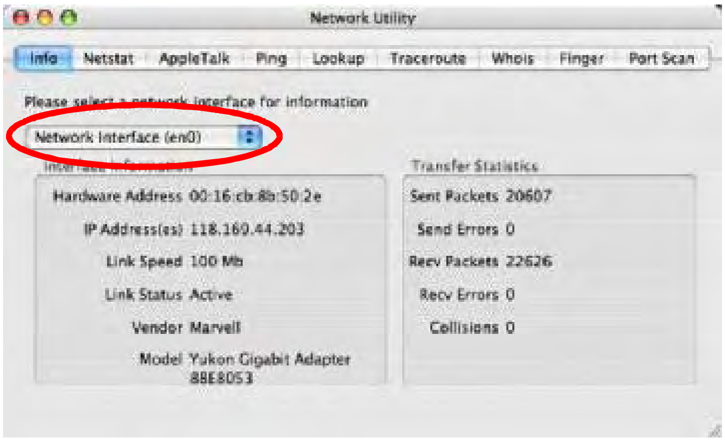
Click the lock to prevent further changes.

Click **Apply Now** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network Interface** from the **Info** tab.

Figure 133 Mac OS X 10.4: Network Utility



Please select a network interface for information

Network Interface (en0)

Interface Information

Hardware Address 00:16:cb:8b:50:2e

IP Address(es) 118.169.44.203

Link Speed 100 Mb

Link Status Active

Vendor Marvell

Model Yukon Gigabit Adapter 88E8053

Transfer Statistics

Sent Packets 20607

Send Errors 0

Recv Packets 22626

Recv Errors 0

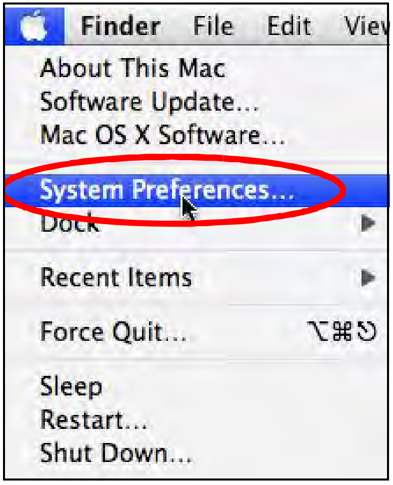
Collisions 0

Mac OS X: 10.5

The screens in this section are from Mac OS X 10.5.

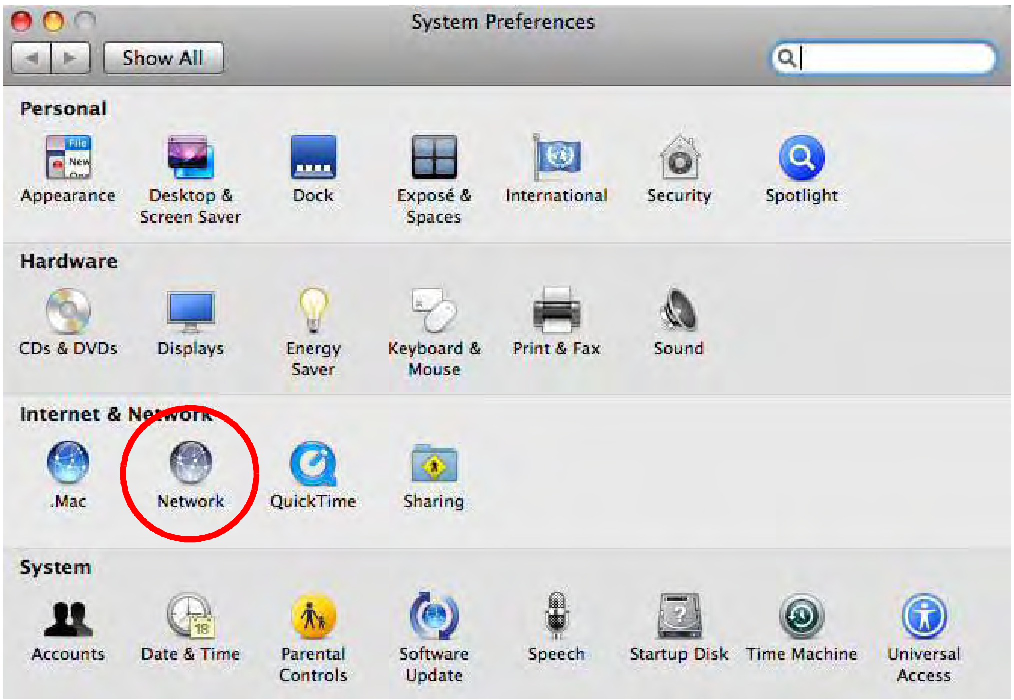
1 Click **Apple** > **System Preferences**.

Figure 134 Mac OS X 10.5: Apple Menu



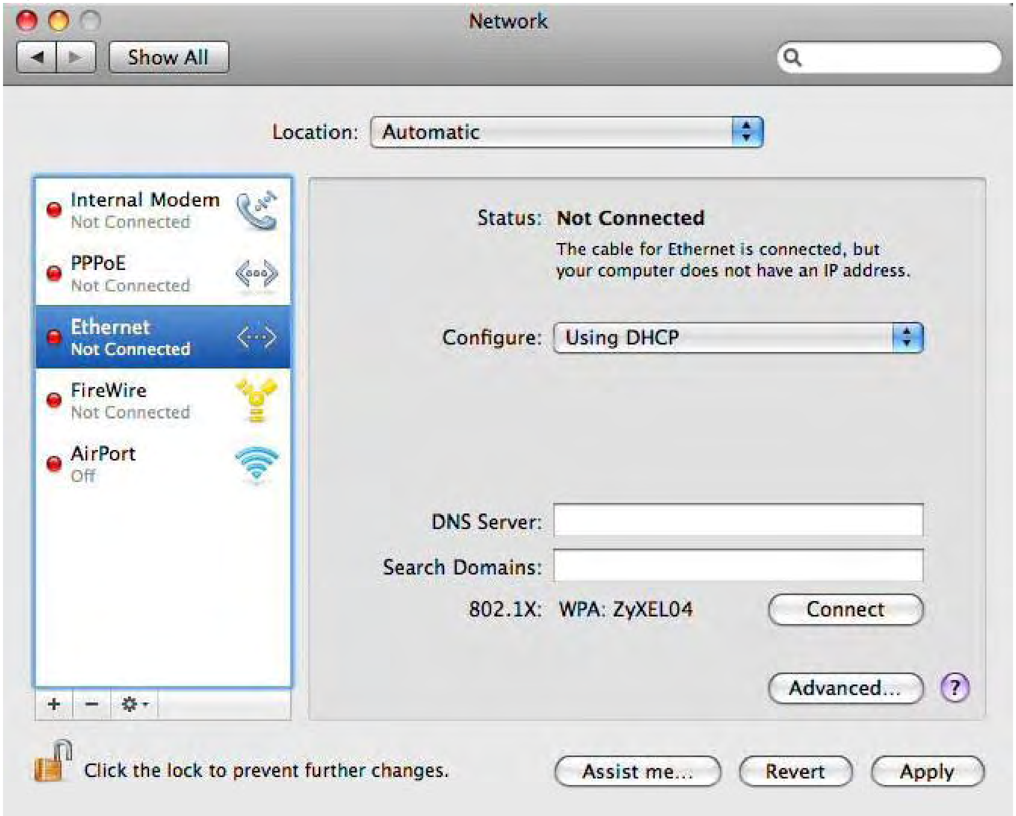
2 In **System Preferences**, click the **Network** icon.

Figure 135 Mac OS X 10.5: Systems Preferences



3 When the **Network** preferences pane opens, select **Ethernet** from the list of available connection types.

Figure 136 Mac OS X 10.5: Network Preferences > Ethernet



Location: Automatic

- Internal Modem — Not Connected
- PPPoE — Not Connected
- Ethernet — Not Connected
- FireWire — Not Connected
- AirPort — Off

Status: **Not Connected**

The cable for Ethernet is connected, but your computer does not have an IP address.

Configure: Using DHCP

DNS Server:

Search Domains:

802.1X: WPA: ZyXEL04

Click the lock to prevent further changes.

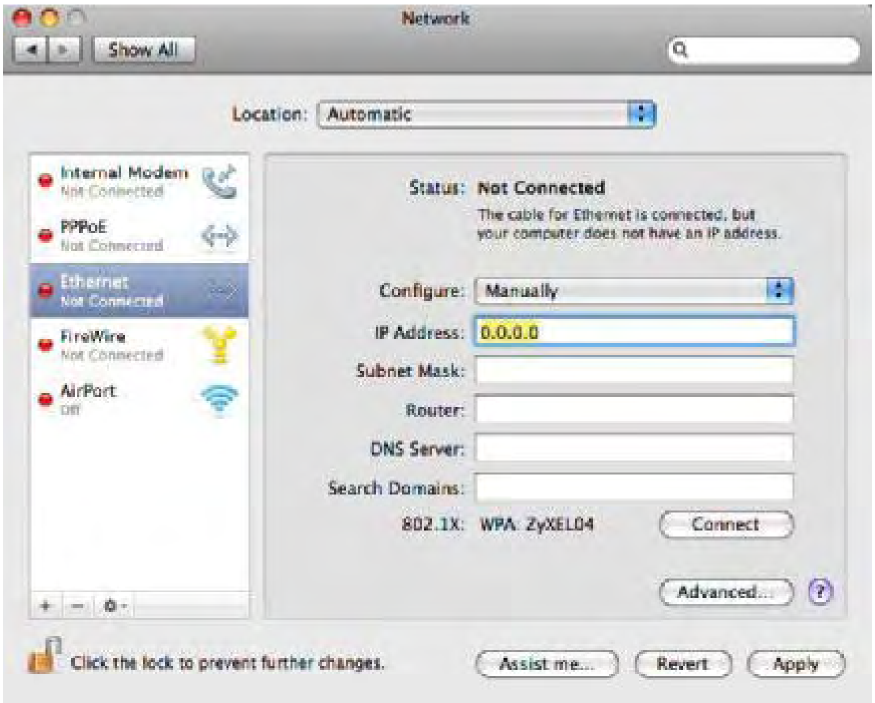
4 From the **Configure** list, select **Using DHCP** for dynamically assigned settings.

5 For statically assigned settings, do the following:

- From the **Configure** list, select **Manually**.
- In the **IP Address** field, enter your IP address.
- In the **Subnet Mask** field, enter your subnet mask.

- In the **Router** field, enter the IP address of your BM2022.

Figure 137 Mac OS X 10.5: Network Preferences > Ethernet



Network

Location: Automatic

Internal Modem
Not Connected

PPPoE
Not Connected

Ethernet
Not Connected

FireWire
Not Connected

AirPort
Off

Status: Not Connected
The cable for Ethernet is connected, but your computer does not have an IP address.

Configure: Manually

IP Address: 0.0.0.0

Subnet Mask:

Router:

DNS Server:

Search Domains:

802.1X: WPA: ZyXEL04

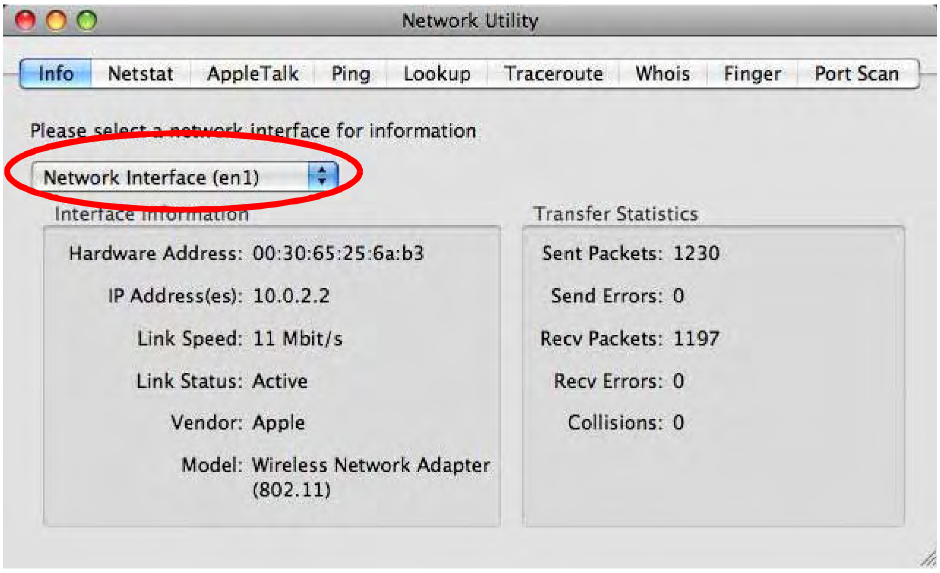
Click the lock to prevent further changes.

6 Click **Apply** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network interface** from the **Info** tab.

Figure 138 Mac OS X 10.5: Network Utility



Please select a network interface for information

Network Interface (en1)

Interface Information

Hardware Address: 00:30:65:25:6a:b3

IP Address(es): 10.0.2.2

Link Speed: 11 Mbit/s

Link Status: Active

Vendor: Apple

Model: Wireless Network Adapter (802.11)

Transfer Statistics

Sent Packets: 1230

Send Errors: 0

Recv Packets: 1197

Recv Errors: 0

Collisions: 0

Linux: Ubuntu 8 (GNOME)

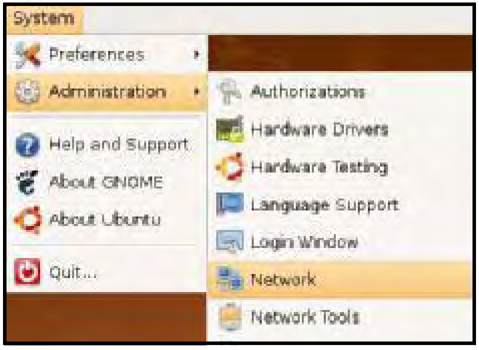
This section shows you how to configure your computer's TCP/IP settings in the GNU Object Model Environment (GNOME) using the Ubuntu 8 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default Ubuntu 8 installation.

Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in GNOME:

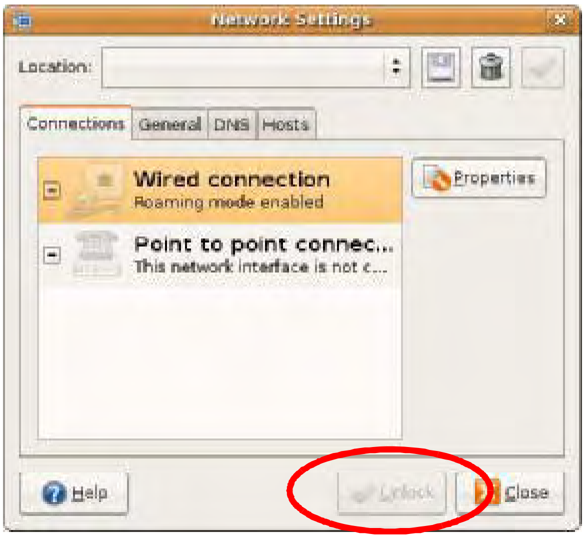
1 Click **System > Administration > Network**.

Figure 139 Ubuntu 8: System > Administration Menu



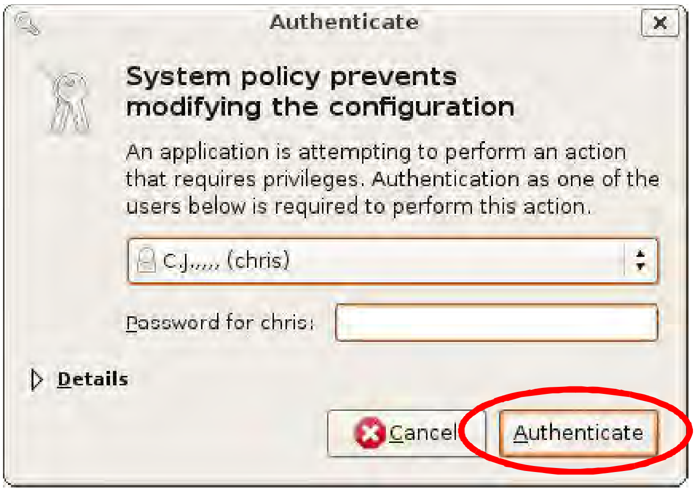
2 When the **Network Settings** window opens, click **Unlock** to open the **Authenticate** window. (By default, the **Unlock** button is greyed out until clicked.) You cannot make changes to your configuration unless you first enter your admin password.

Figure 140 Ubuntu 8: Network Settings > Connections



3 In the **Authenticate** window, enter your admin account name and password then click the **Authenticate** button.

Figure 141 Ubuntu 8: Administrator Account Authentication



Authenticate

System policy prevents modifying the configuration

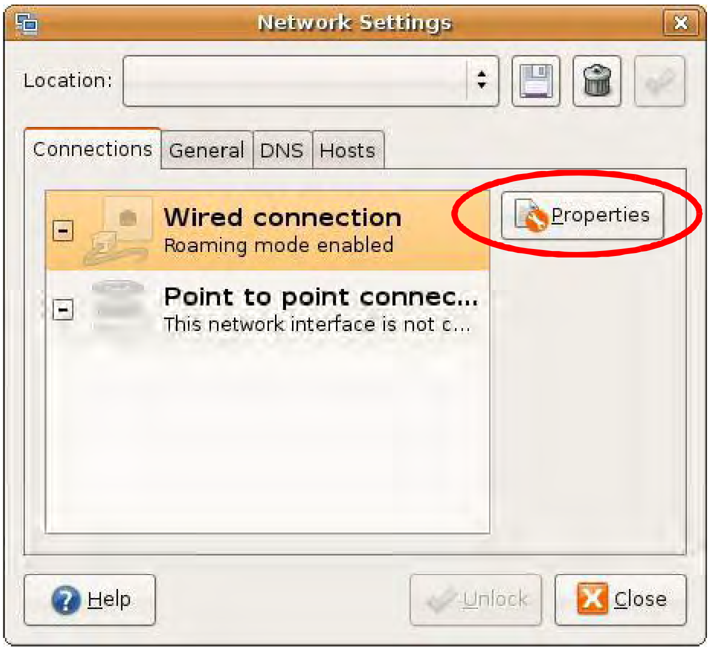
An application is attempting to perform an action that requires privileges. Authentication as one of the users below is required to perform this action.

C.J..,,, (chris)

Password for chris:

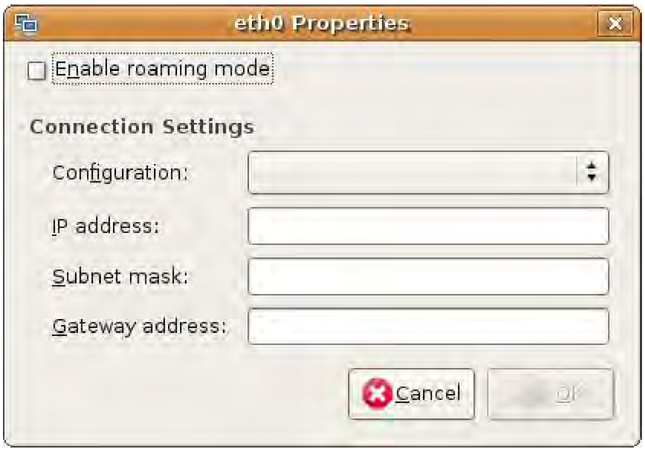
4 In the **Network Settings** window, select the connection that you want to configure, then click **Properties**.

Figure 142 Ubuntu 8: Network Settings > Connections



5 The **Properties** dialog box opens.

Figure 143 Ubuntu 8: Network Settings > Properties

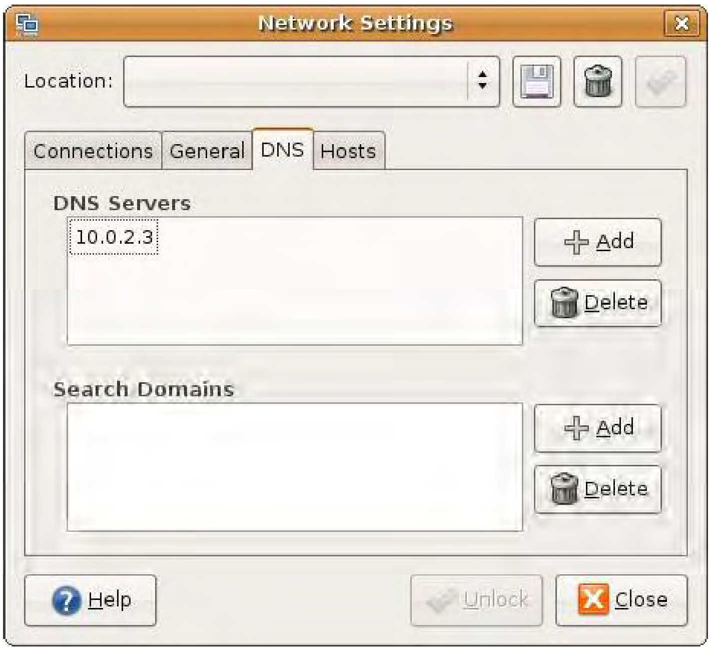


- In the **Configuration** list, select **Automatic Configuration (DHCP)** if you have a dynamic IP address.
- In the **Configuration** list, select **Static IP address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Gateway address** fields.

6 Click **OK** to save the changes and close the **Properties** dialog box and return to the **Network Settings** screen.

7 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Settings** window and then enter the DNS server information in the fields provided.

Figure 144 Ubuntu 8: Network Settings > DNS



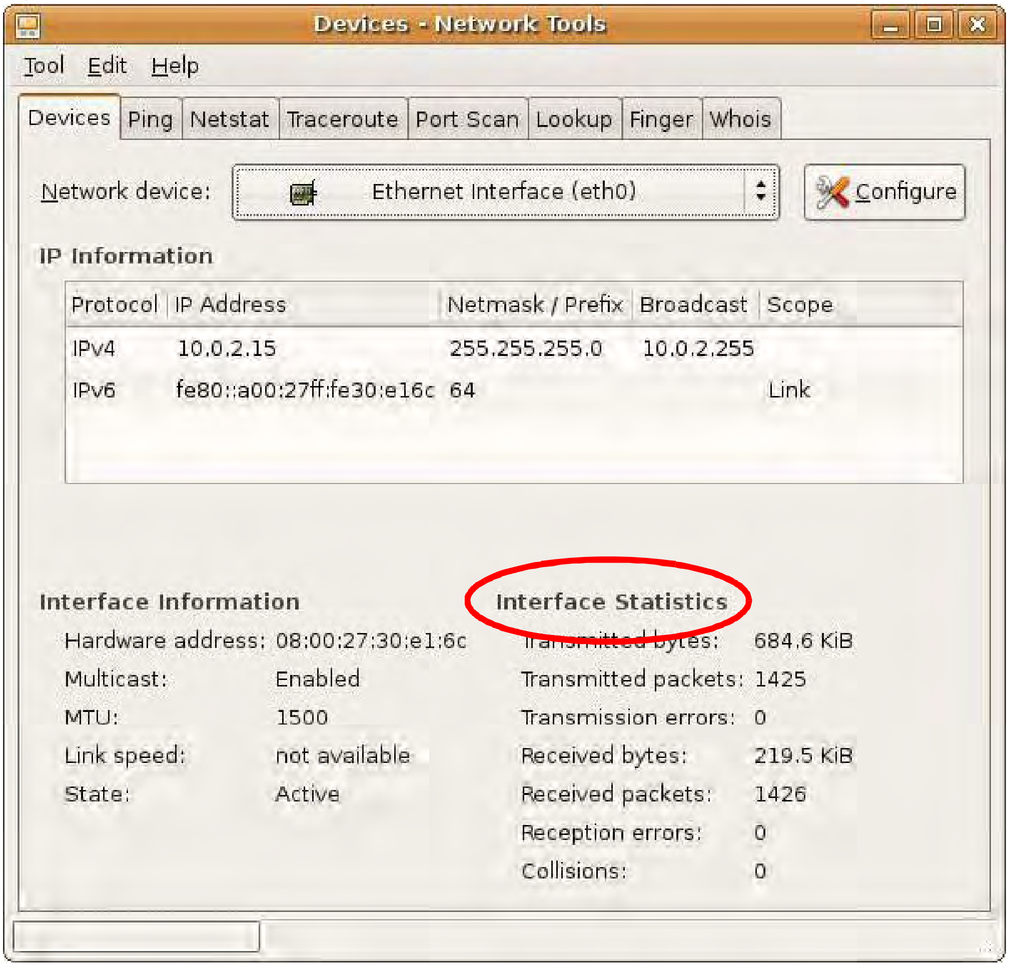
DNS Servers: 10.0.2.3

8 Click the **Close** button to apply the changes.

Verifying Settings

Check your TCP/IP properties by clicking **System > Administration > Network Tools**, and then selecting the appropriate **Network device** from the **Devices** tab. The **Interface Statistics** column shows data if your connection is working properly.

Figure 145 Ubuntu 8: Network Tools


Devices - Network Tools
Tool Edit Help
Devices Ping Netstat Traceroute Port Scan Lookup Finger Whois
Configure

Network device: Ethernet Interface (eth0)

IP Information

Protocol	IP Address	Netmask / Prefix	Broadcast	Scope
IPv4	10.0.2.15	255.255.255.0	10.0.2.255	
IPv6	fe80::a00:27ff:fe30:e16c	64		Link

Interface Information

Hardware address:	08:00:27:30:e1:6c
Multicast:	Enabled
MTU:	1500
Link speed:	not available
State:	Active

Interface Statistics

Transmitted bytes:	684.6 KiB
Transmitted packets:	1425
Transmission errors:	0
Received bytes:	219.5 KiB
Received packets:	1426
Reception errors:	0
Collisions:	0

Linux: openSUSE 10.3 (KDE)

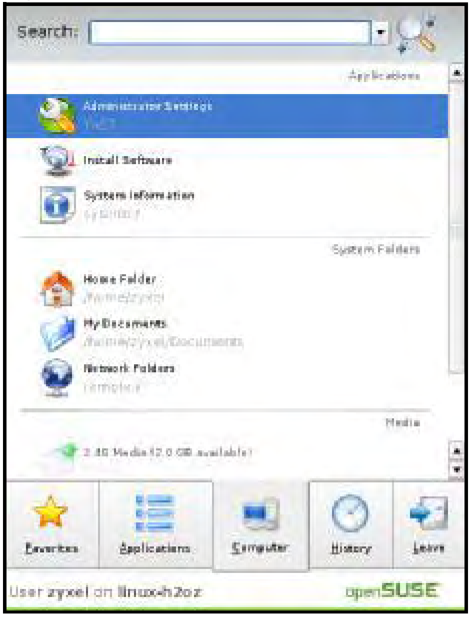
This section shows you how to configure your computer’s TCP/IP settings in the K Desktop Environment (KDE) using the openSUSE 10.3 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default openSUSE 10.3 installation.

Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in the KDE:

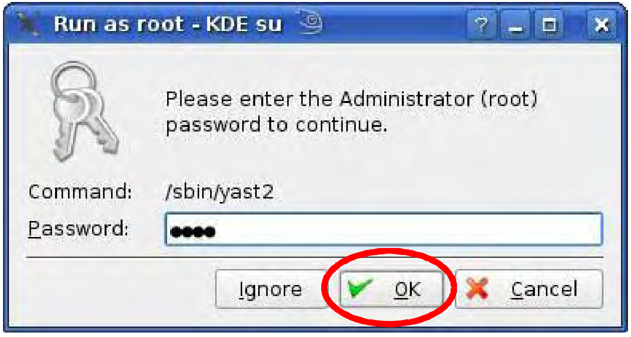
1 Click **K Menu > Computer > Administrator Settings (YaST)**.

Figure 146 openSUSE 10.3: K Menu > Computer Menu



2 When the **Run as Root - KDE su** dialog opens, enter the admin password and click **OK**.

Figure 147 openSUSE 10.3: K Menu > Computer Menu



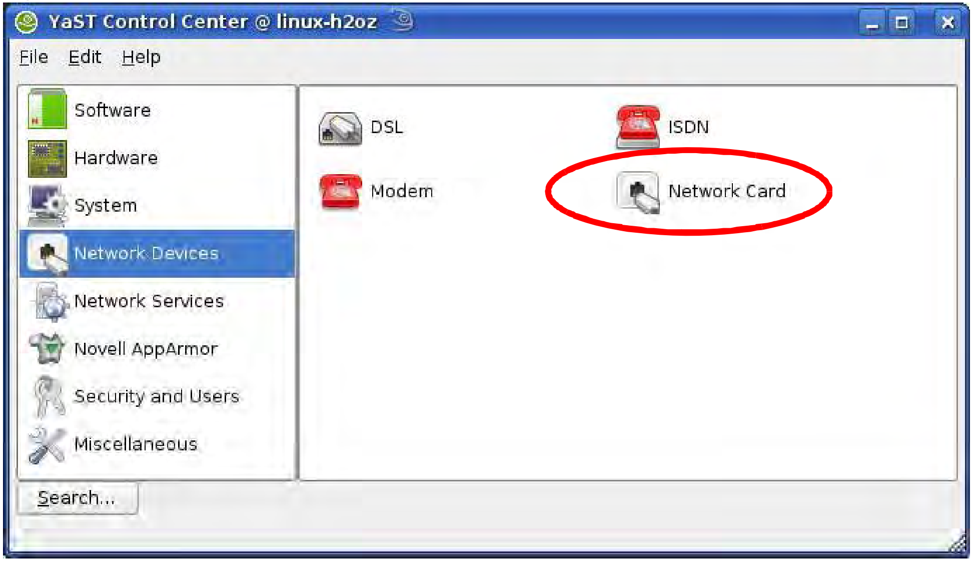
Please enter the Administrator (root) password to continue.

Command: /sbin/yast2

Password: ●●●●

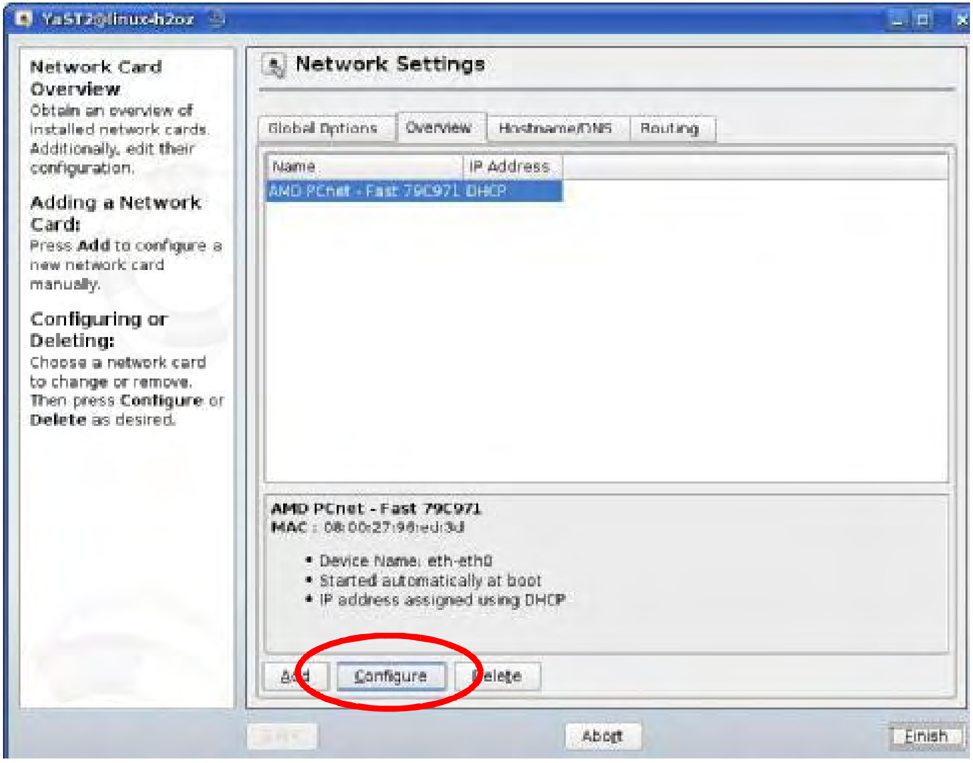
3 When the **YaST Control Center** window opens, select **Network Devices** and then click the **Network Card** icon.

Figure 148 openSUSE 10.3: YaST Control Center



4 When the **Network Settings** window opens, click the **Overview** tab, select the appropriate connection **Name** from the list, and then click the **Configure** button.

Figure 149 openSUSE 10.3: Network Settings



Network Card Overview
Obtain an overview of installed network cards. Additionally, edit their configuration.

Adding a Network Card:
Press **Add** to configure a new network card manually.

Configuring or Deleting:
Choose a network card to change or remove. Then press **Configure** or **Delete** as desired.

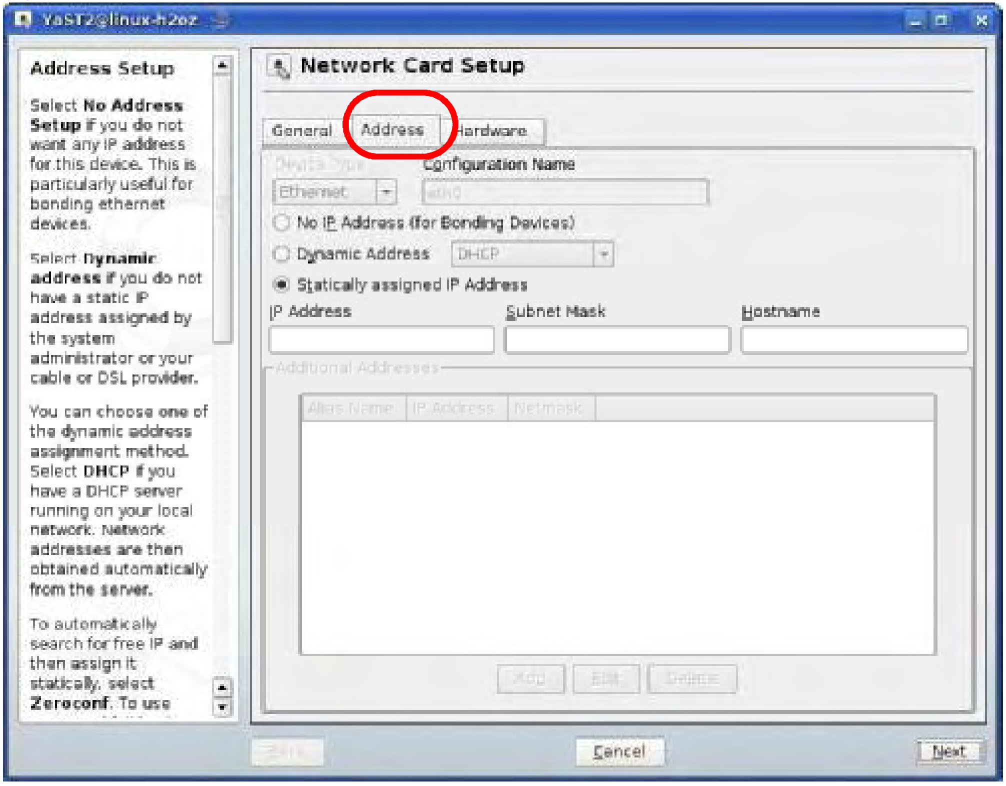
Name	IP Address
AMD PCnet - Fast 79C971	DHCP

AMD PCnet - Fast 79C971
MAC : 08:00:27:98:ed:3d

- Device Name: eth-eth0
- Started automatically at boot
- IP address assigned using DHCP

5 When the **Network Card Setup** window opens, click the **Address** tab

Figure 150 openSUSE 10.3: Network Card Setup



Address Setup

Select **No Address Setup** if you do not want any IP address for this device. This is particularly useful for bonding ethernet devices.

Select **Dynamic address** if you do not have a static IP address assigned by the system administrator or your cable or DSL provider.

You can choose one of the dynamic address assignment method. Select **DHCP** if you have a DHCP server running on your local network. Network addresses are then obtained automatically from the server.

To automatically search for free IP and then assign it statically, select **Zeroconf**. To use

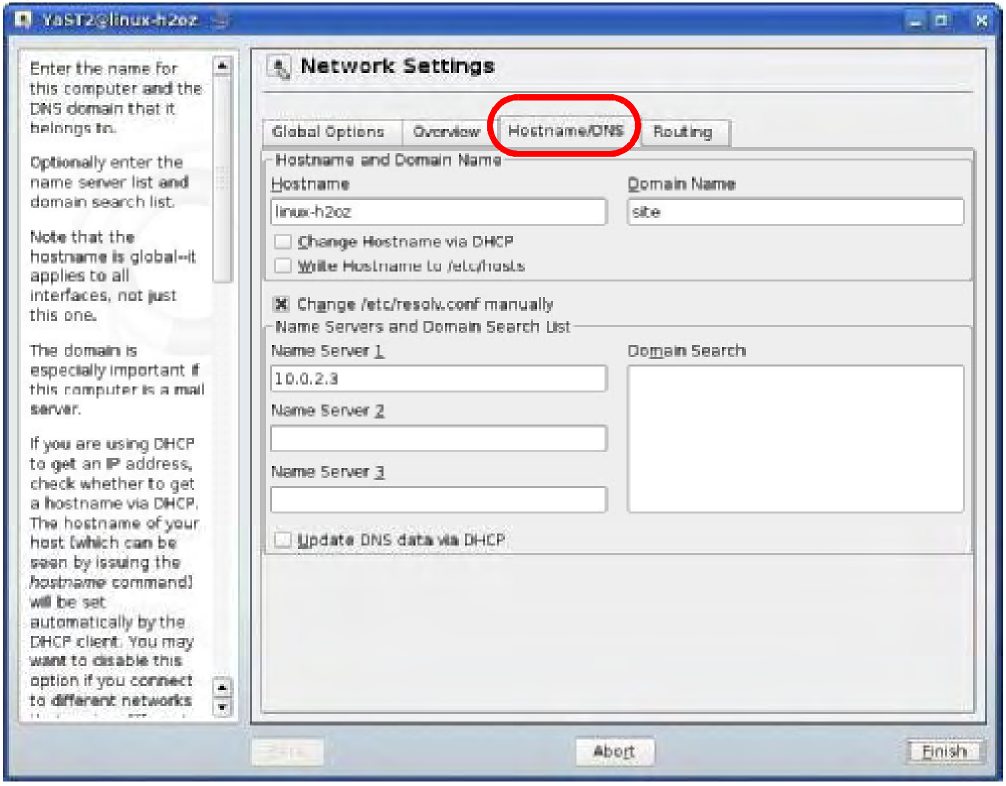
6 Select **Dynamic Address (DHCP)** if you have a dynamic IP address.

Select **Statically assigned IP Address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Hostname** fields.

7 Click **Next** to save the changes and close the **Network Card Setup** window.

8 If you know your DNS server IP address(es), click the **Hostname/DNS** tab in **Network Settings** and then enter the DNS server information in the fields provided.

Figure 151 openSUSE 10.3: Network Settings



Enter the name for this computer and the DNS domain that it belongs to.

Optionally enter the name server list and domain search list.

Note that the hostname is global--it applies to all interfaces, not just this one.

The domain is especially important if this computer is a mail server.

If you are using DHCP to get an IP address, check whether to get a hostname via DHCP. The hostname of your host (which can be seen by issuing the hostname command) will be set automatically by the DHCP client. You may want to disable this option if you connect to different networks

Hostname and Domain Name

Hostname: linux-h2oz

Domain Name: site

□ Change Hostname via DHCP

□ Write Hostname to /etc/hosts

☒ Change /etc/resolv.conf manually

Name Servers and Domain Search List

Name Server 1: 10.0.2.3

Name Server 2:

Name Server 3:

Domain Search:

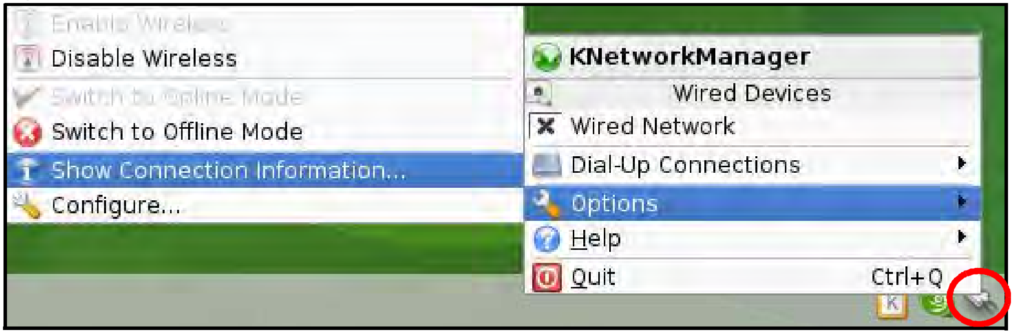
□ Update DNS data via DHCP

9 Click **Finish** to save your settings and close the window.

Verifying Settings

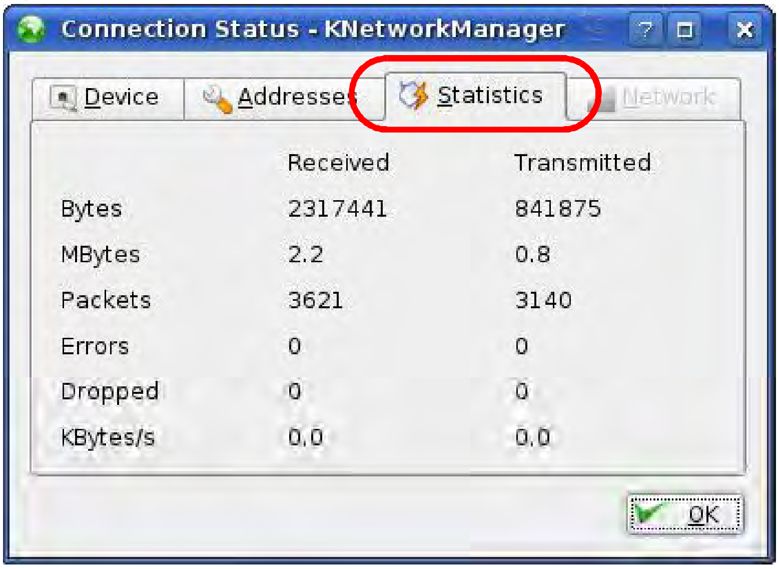
Click the **KNetwork Manager** icon on the **Task bar** to check your TCP/IP properties. From the **Options** sub-menu, select **Show Connection Information**.

Figure 152 openSUSE 10.3: KNetwork Manager



When the **Connection Status - KNetwork Manager** window opens, click the **Statistics tab** to see if your connection is working properly.

Figure 153 openSUSE: Connection Status - KNetwork Manager



	Received	Transmitted
Bytes	2317441	841875
MBytes	2.2	0.8
Packets	3621	3140
Errors	0	0
Dropped	0	0
KBytes/s	0.0	0.0

Pop-up Windows, JavaScript and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScript (enabled by default).
- Java permissions (enabled by default).

Note: Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

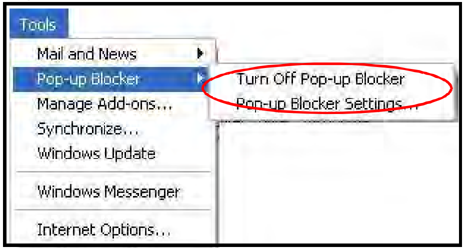
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable Pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 154 Pop-up Blocker

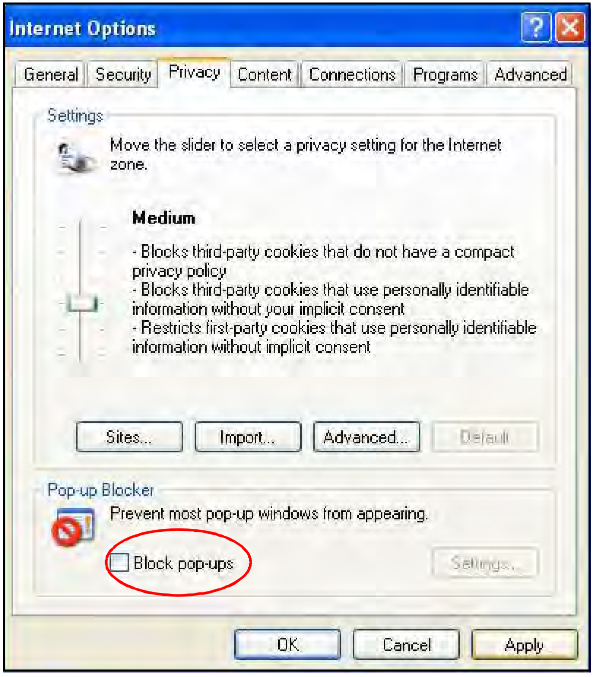


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 155 Internet Options: Privacy



Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Prevent most pop-up windows from appearing.

□ Block pop-ups

3 Click **Apply** to save this setting.

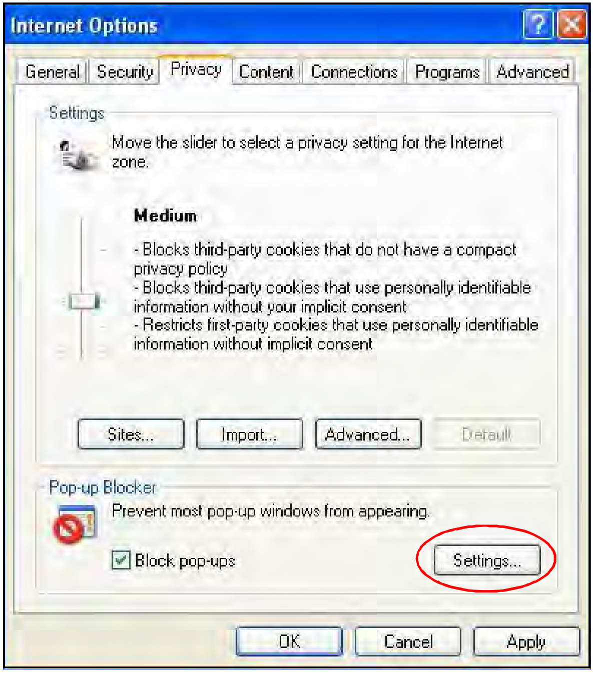
Enable Pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings...**to open the **Pop-up Blocker Settings** screen.

Figure 156 Internet Options: Privacy



Settings

Move the slider to select a privacy setting for the Internet zone.

Medium

- Blocks third-party cookies that do not have a compact privacy policy
- Blocks third-party cookies that use personally identifiable information without your implicit consent
- Restricts first-party cookies that use personally identifiable information without implicit consent

Pop-up Blocker

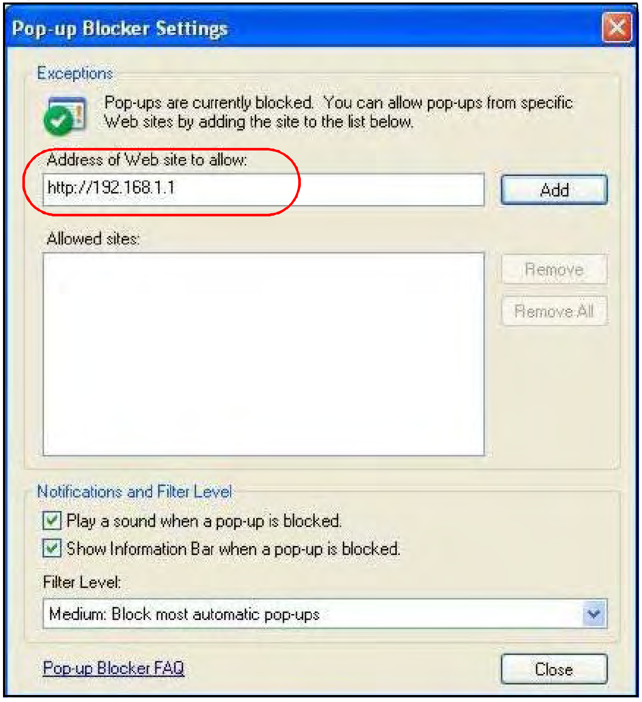
Prevent most pop-up windows from appearing.

☑ Block pop-ups

3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix “http://”. For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 157 Pop-up Blocker Settings



Pop-up Blocker Settings

Exceptions

Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.

Address of Web site to allow: http://192.168.1.1

Allowed sites:

Notifications and Filter Level

☑ Play a sound when a pop-up is blocked.

☑ Show Information Bar when a pop-up is blocked.

Filter Level: Medium: Block most automatic pop-ups

5 Click **Close** to return to the **Privacy** screen.

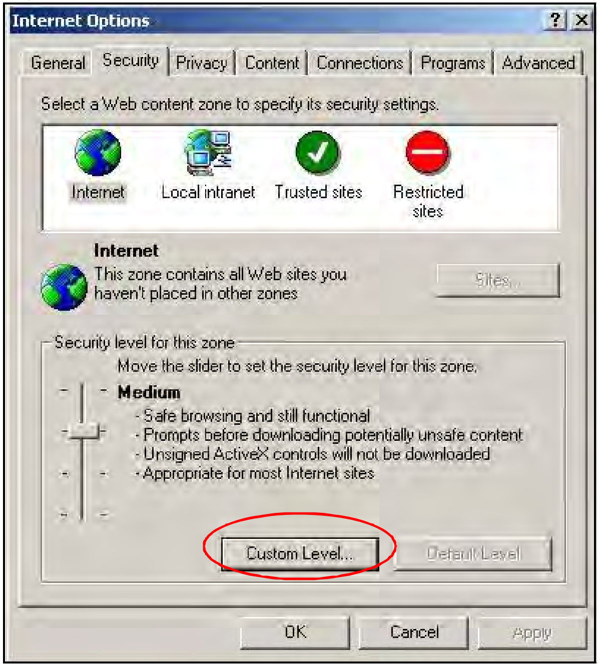
6 Click **Apply** to save this setting.

JavaScript

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScript is allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 158 Internet Options: Security



Select a Web content zone to specify its security settings.

Internet
This zone contains all Web sites you haven't placed in other zones

Security level for this zone

Move the slider to set the security level for this zone.

Medium
- Safe browsing and still functional
- Prompts before downloading potentially unsafe content
- Unsigned ActiveX controls will not be downloaded
- Appropriate for most Internet sites

2 Click the **Custom Level...** button.

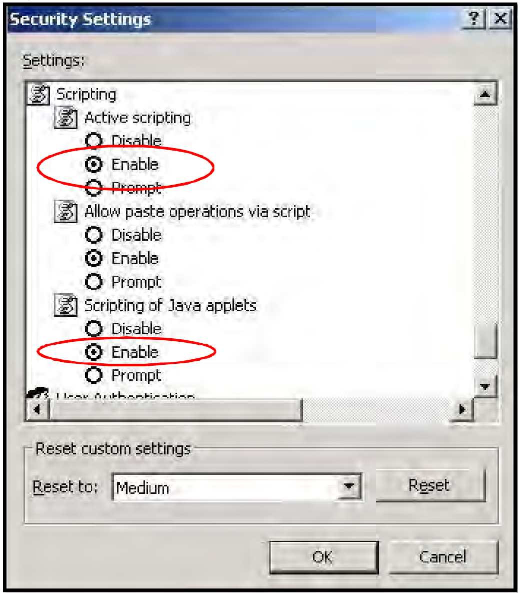
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

Figure 159 Security Settings - Java Scripting



Settings:

Scripting
- Active scripting
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Allow paste operations via script
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Scripting of Java applets
  - ○ Disable
  - ● Enable
  - ○ Prompt

User Authentication

Reset custom settings

Reset to: Medium

Java Permissions

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

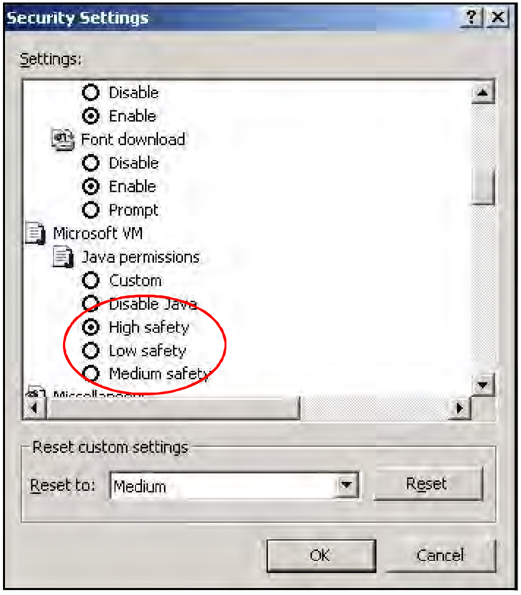
2 Click the **Custom Level...** button.

3 Scroll down to **Microsoft VM**.

4 Under **Java permissions** make sure that a safety level is selected.

5 Click **OK** to close the window.

Figure 160 Security Settings - Java



Security Settings

Settings:

- ○ Disable
- ● Enable
- Font download
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Microsoft VM
  - Java permissions
    - ○ Custom
    - ○ Disable Java
    - ● High safety
    - ○ Low safety
    - ○ Medium safety

Reset custom settings

Reset to: Medium

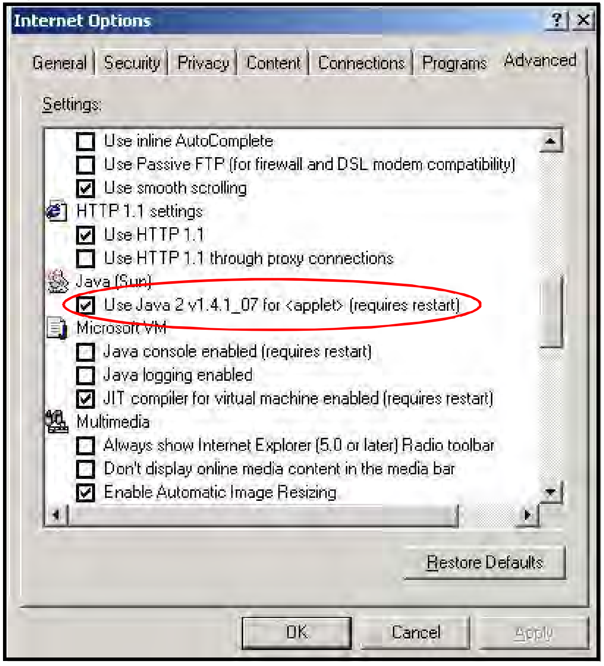
JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.

2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.

3 Click **OK** to close the window.

Figure 161 Java (Sun)



- □ Use inline AutoComplete
- □ Use Passive FTP (for firewall and DSL modem compatibility)
- ☑ Use smooth scrolling

HTTP 1.1 settings

- ☑ Use HTTP 1.1
- □ Use HTTP 1.1 through proxy connections

Java (Sun)

- ☑ Use Java 2 v1.4.1_07 for <applet> (requires restart)

Microsoft VM

- □ Java console enabled (requires restart)
- □ Java logging enabled
- ☑ JIT compiler for virtual machine enabled (requires restart)

Multimedia

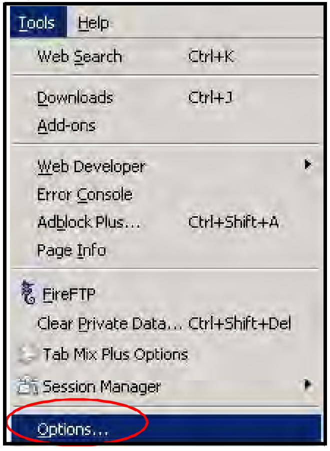
- □ Always show Internet Explorer (5.0 or later) Radio toolbar
- □ Don't display online media content in the media bar
- ☑ Enable Automatic Image Resizing

Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary.

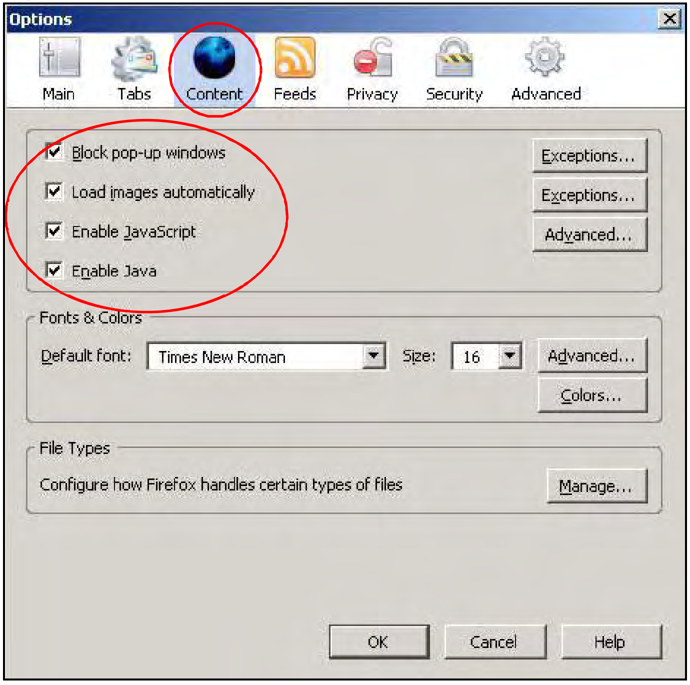
You can enable Java, Javascript and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 162 Mozilla Firefox: TOOLS > Options



Click **Content**.to show the screen below. Select the check boxes as shown in the following screen.

Figure 163 Mozilla Firefox Content Security



☑ Block pop-up windows

☑ Load images automatically

☑ Enable JavaScript

☑ Enable Java

Fonts & Colors

Default font: Times New Roman Size: 16

File Types

Configure how Firefox handles certain types of files

D

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

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

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

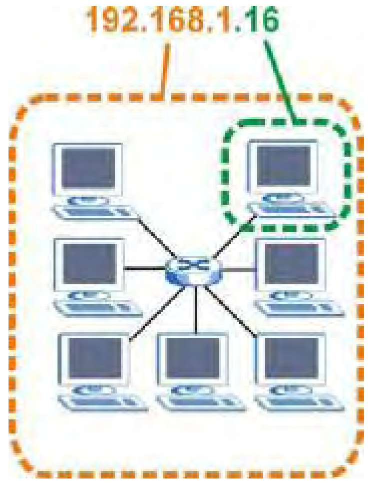
Structure

An IP address is made up of four parts, written in dotted decimal notation. Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 164 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 104 IP Address Network Number and Host ID Example

	1ST OCTET: **(192)**	**2ND OCTET:** **(168)**	**3RD OCTET:** **(1)**	**4TH OCTET** **(2)**
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 105 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 106 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} – 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} – 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} – 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} – 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 107 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

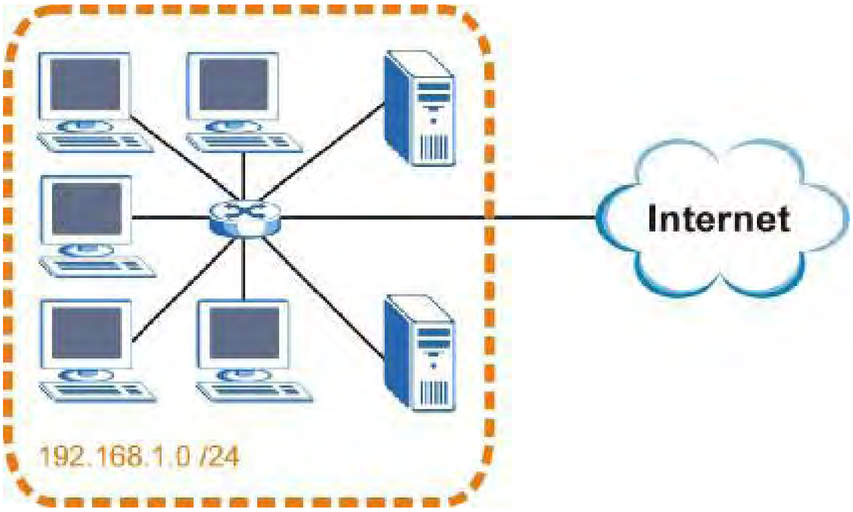
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of 2^8 – 2 or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 165 Subnetting Example: Before Subnetting

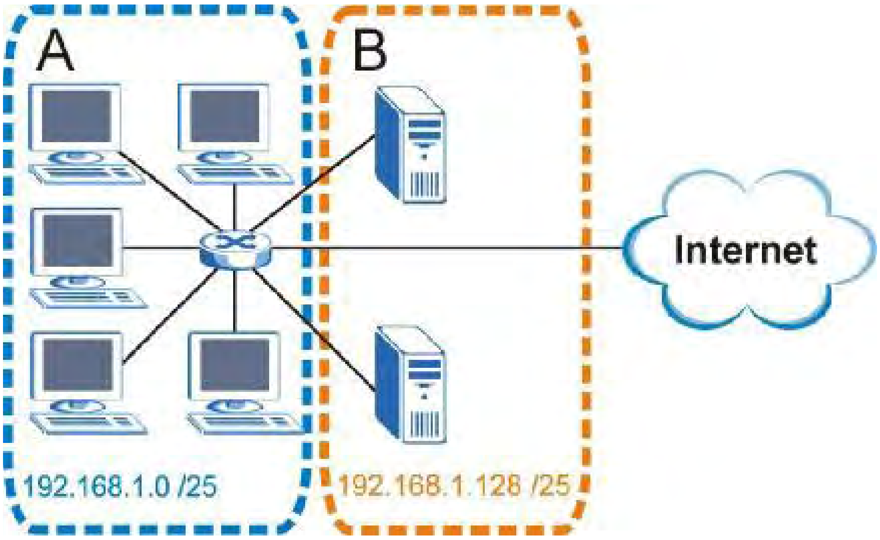


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 166 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of 2^7 – 2 or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 108 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000

Table 108 Subnet 1 (continued)

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 109 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 110 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 111 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 112 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 113 24-bit Network Number Subnet Planning

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 114 16-bit Network Number Subnet Planning

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14

Table 114 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
13	255.255.255.248 (/29)	8192	6
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the BM2022.

Once you have decided on the network number, pick an IP address for your BM2022 that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your BM2022 will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the BM2022 unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

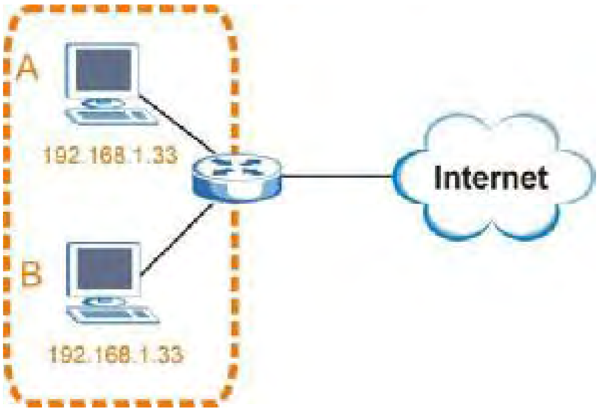
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

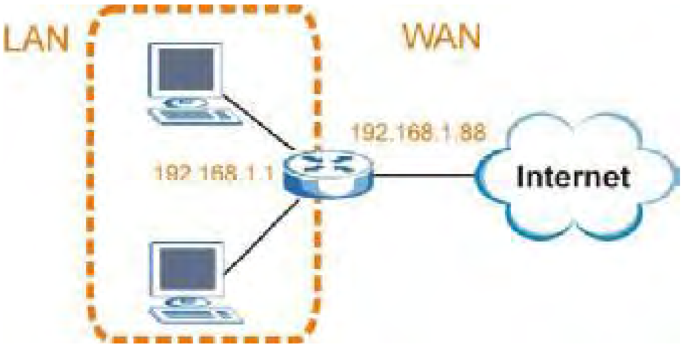
Figure 167 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

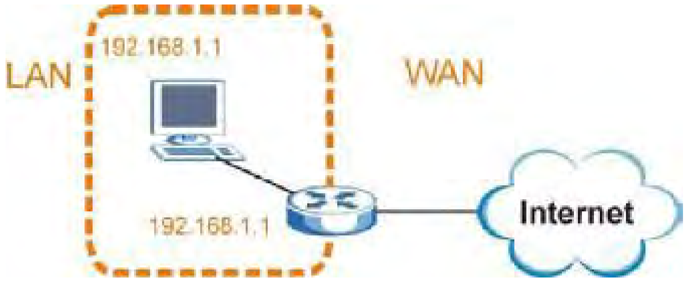
Figure 168 Conflicting Computer IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router’s LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router’s LAN port.

Figure 169 Conflicting Computer and Router IP Addresses Example



E

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 Huawei 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 Huawei-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:

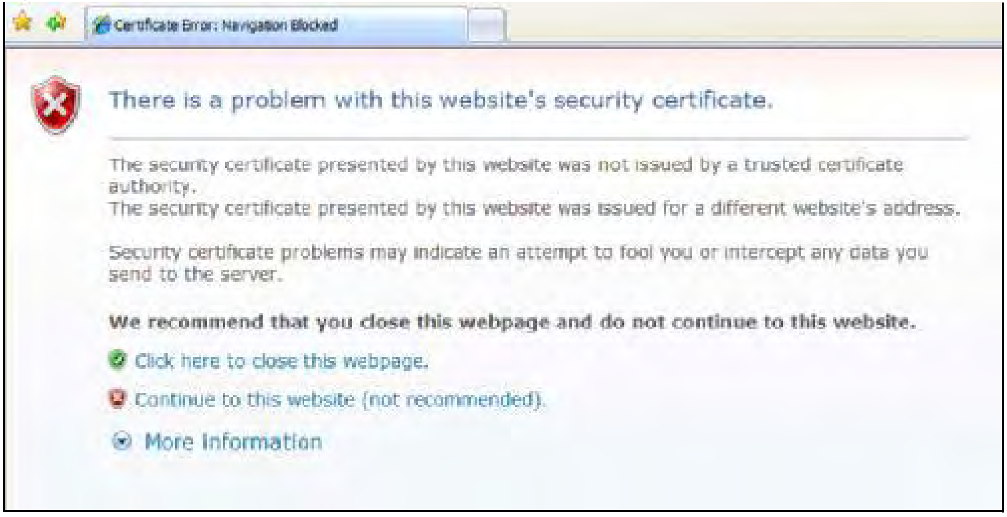
- Internet Explorer on page 254
- Firefox on page 262
- Opera on page 267
- Konqueror on page 274

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 170 Internet Explorer 7: Certification Error



Certificate Error: Navigation Blocked

There is a problem with this website's security certificate.

The security certificate presented by this website was not issued by a trusted certificate authority.
The security certificate presented by this website was issued for a different website's address.

Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.

We recommend that you close this webpage and do not continue to this website.

Click here to close this webpage.

Continue to this website (not recommended).

More information

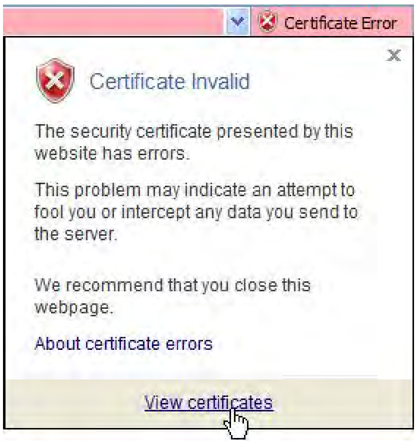
2 Click **Continue to this website (not recommended)**.

Figure 171 Internet Explorer 7: Certification Error

Continue to this website (not recommended).

3 In the **Address Bar**, click **Certificate Error** > **View certificates**.

Figure 172 Internet Explorer 7: Certificate Error



Certificate Error

Certificate Invalid

The security certificate presented by this website has errors.

This problem may indicate an attempt to fool you or intercept any data you send to the server.

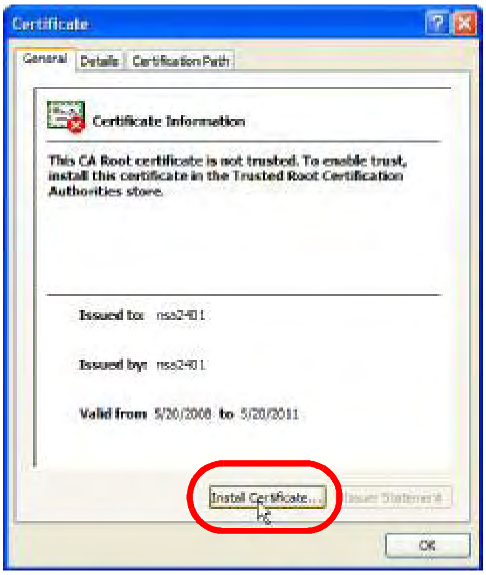
We recommend that you close this webpage.

About certificate errors

View certificates

4 In the **Certificate** dialog box, click **Install Certificate**.

Figure 173 Internet Explorer 7: Certificate



Certificate Information

This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.

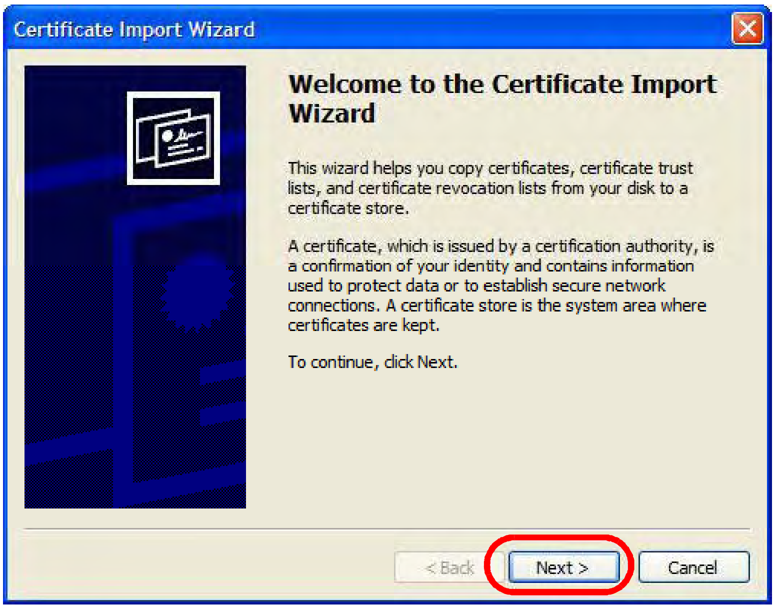
Issued to: nsa2401

Issued by: nsa2401

Valid from 5/20/2008 to 5/20/2011

5 In the **Certificate Import Wizard**, click **Next**.

Figure 174 Internet Explorer 7: Certificate Import Wizard



Welcome to the Certificate Import Wizard

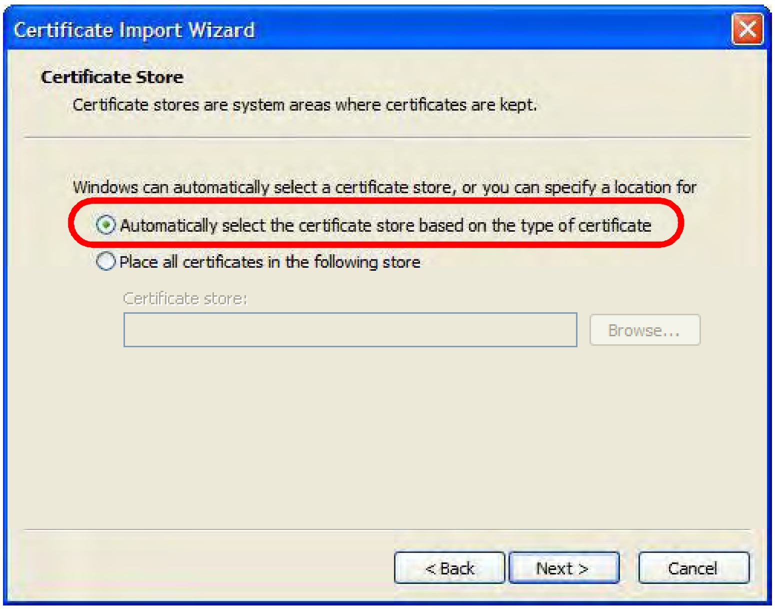
This wizard helps you copy certificates, certificate trust lists, and certificate revocation lists from your disk to a certificate store.

A certificate, which is issued by a certification authority, is a confirmation of your identity and contains information used to protect data or to establish secure network connections. A certificate store is the system area where certificates are kept.

To continue, click Next.

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 175 Internet Explorer 7: Certificate Import Wizard



Certificate Import Wizard

Certificate Store

Certificate stores are system areas where certificates are kept.

Windows can automatically select a certificate store, or you can specify a location for

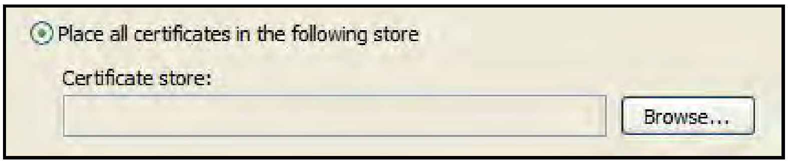
● Automatically select the certificate store based on the type of certificate

○ Place all certificates in the following store

Certificate store:

7 Otherwise, select **Place all certificates in the following store** and then click **Browse**.

Figure 176 Internet Explorer 7: Certificate Import Wizard

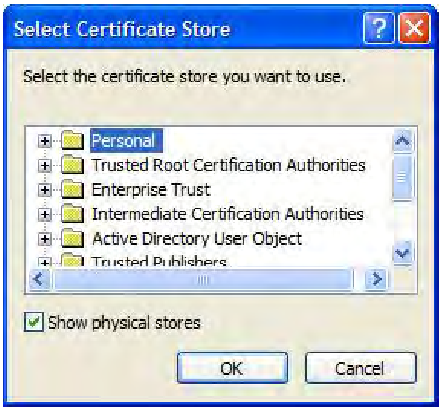


● Place all certificates in the following store

Certificate store:

8 In the **Select Certificate Store** dialog box, choose a location in which to save the certificate and then click **OK**.

Figure 177 Internet Explorer 7: Select Certificate Store



Select Certificate Store

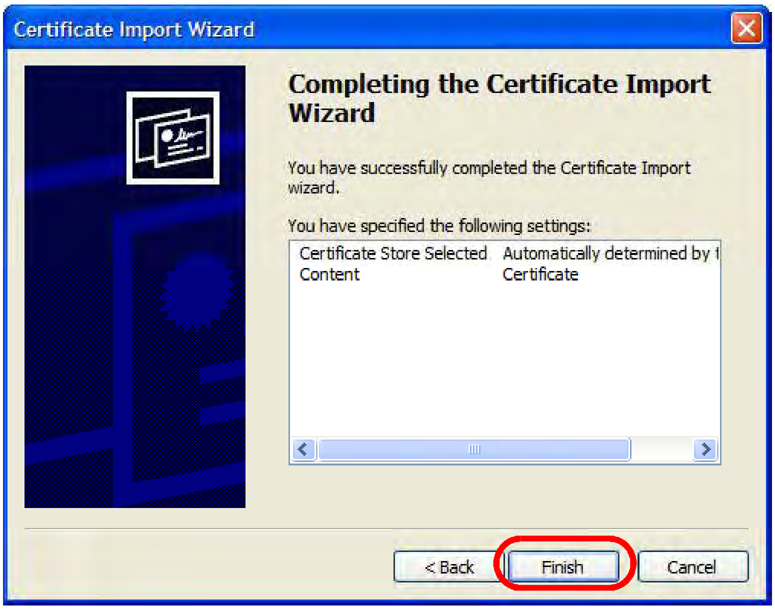
Select the certificate store you want to use.

- Personal
- Trusted Root Certification Authorities
- Enterprise Trust
- Intermediate Certification Authorities
- Active Directory User Object
- Trusted Publishers

☑ Show physical stores

9 In the **Completing the Certificate Import Wizard** screen, click **Finish**.

Figure 178 Internet Explorer 7: Certificate Import Wizard



Completing the Certificate Import Wizard

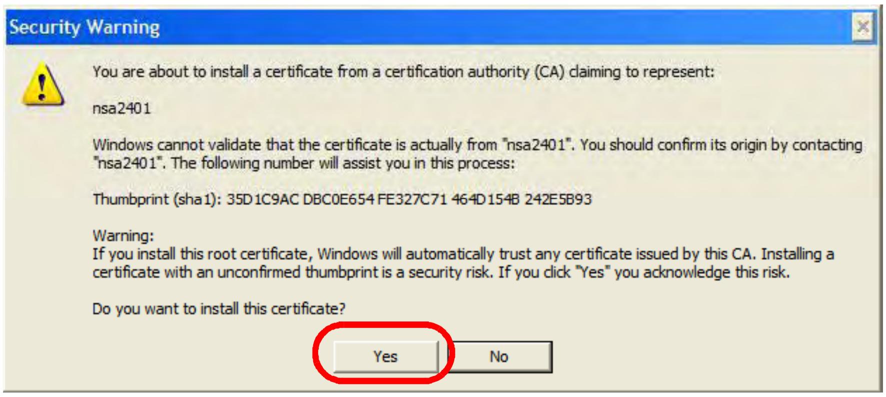
You have successfully completed the Certificate Import wizard.

You have specified the following settings:

Certificate Store Selected	Automatically determined by t
Content	Certificate

10 If you are presented with another **Security Warning**, click **Yes**.

Figure 179 Internet Explorer 7: Security Warning



You are about to install a certificate from a certification authority (CA) claiming to represent:

nsa2401

Windows cannot validate that the certificate is actually from "nsa2401". You should confirm its origin by contacting "nsa2401". The following number will assist you in this process:

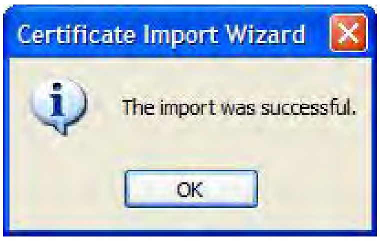
Thumbprint (sha1): 35D1C9AC DBC0E654 FE327C71 464D154B 242E5B93

Warning:
If you install this root certificate, Windows will automatically trust any certificate issued by this CA. Installing a certificate with an unconfirmed thumbprint is a security risk. If you click "Yes" you acknowledge this risk.

Do you want to install this certificate?

11 Finally, click **OK** when presented with the successful certificate installation message.

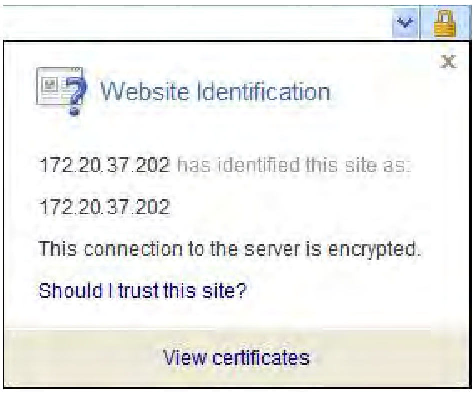
Figure 180 Internet Explorer 7: Certificate Import Wizard



The import was successful.

12 The next time you start Internet Explorer and go to a Huawei web configurator page, a sealed padlock icon appears in the address bar. Click it to view the page's **Website Identification** information.

Figure 181 Internet Explorer 7: Website Identification



Website Identification

172.20.37.202 has identified this site as:

172.20.37.202

This connection to the server is encrypted.

Should I trust this site?

Installing a Stand-Alone Certificate File in Internet Explorer

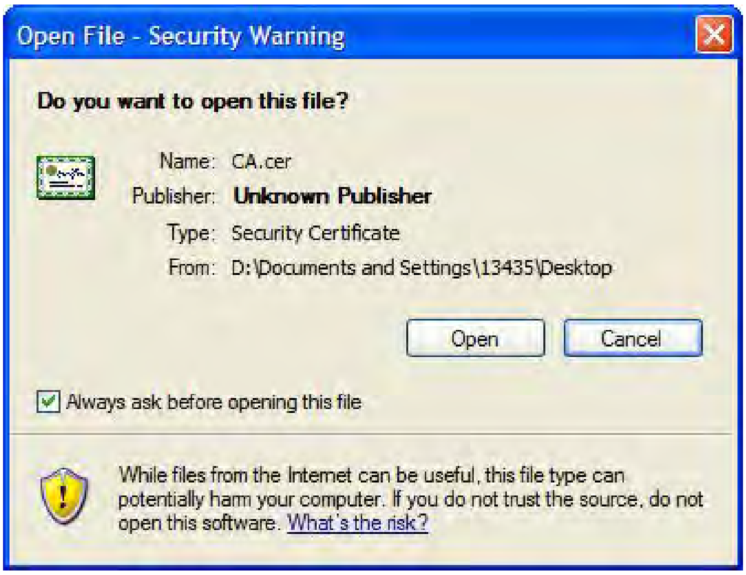
Rather than browsing to a Huawei web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.

Figure 182 Internet Explorer 7: Public Key Certificate File

2 In the security warning dialog box, click **Open**.

Figure 183 Internet Explorer 7: Open File - Security Warning



Open File - Security Warning

Do you want to open this file?

Name: CA.cer

Publisher: **Unknown Publisher**

Type: Security Certificate

From: D:\Documents and Settings\13435\Desktop

☑ Always ask before opening this file

While files from the Internet can be useful, this file type can potentially harm your computer. If you do not trust the source, do not open this software. What's the risk?

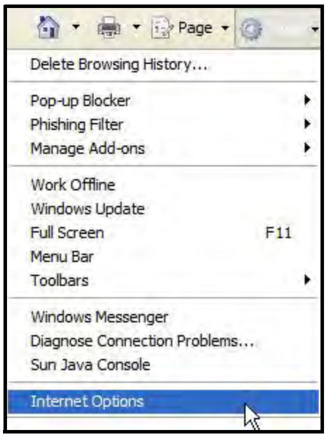
3 Refer to steps 4-12 in the Internet Explorer procedure beginning on page 254 to complete the installation process.

Removing a Certificate in Internet Explorer

This section shows you how to remove a public key certificate in Internet Explorer 7.

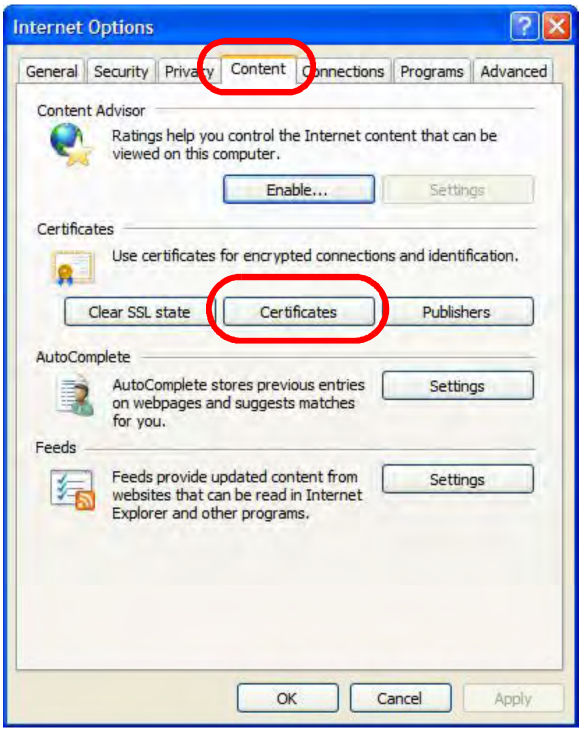
1 Open **Internet Explorer** and click **TOOLS > Internet Options**.

Figure 184 Internet Explorer 7: Tools Menu



2 In the **Internet Options** dialog box, click **Content** > **Certificates**.

Figure 185 Internet Explorer 7: Internet Options



Ratings help you control the Internet content that can be viewed on this computer.

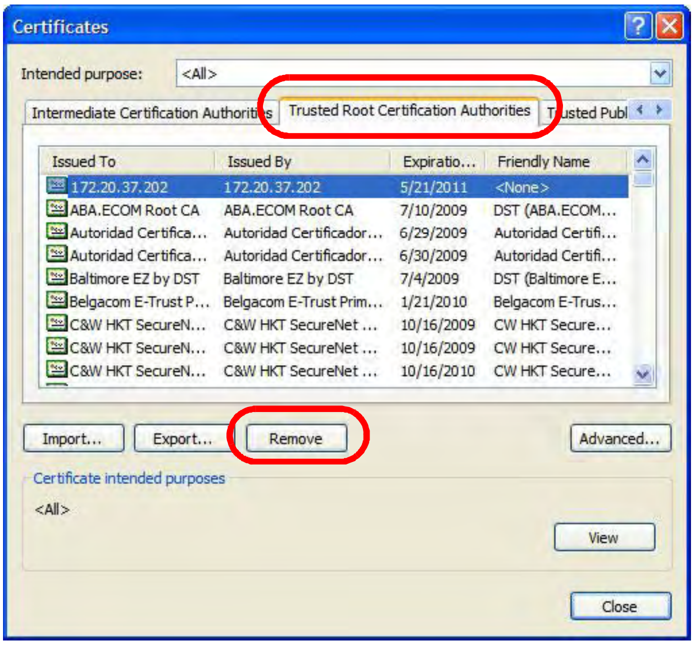
Use certificates for encrypted connections and identification.

AutoComplete stores previous entries on webpages and suggests matches for you.

Feeds provide updated content from websites that can be read in Internet Explorer and other programs.

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 186 Internet Explorer 7: Certificates


Certificates
Intermediate Certification Authorities
Trusted Root Certification Authorities
Trusted Publ
Import...
Export...
Remove
Advanced...
Certificate intended purposes
View
Close

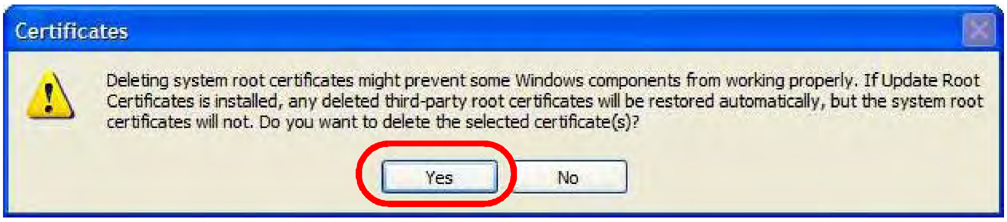
Intended purpose: <All>

Issued To	Issued By	Expiratio...	Friendly Name
172.20.37.202	172.20.37.202	5/21/2011	<None>
ABA.ECOM Root CA	ABA.ECOM Root CA	7/10/2009	DST (ABA.ECOM...
Autoridad Certifica...	Autoridad Certificador...	6/29/2009	Autoridad Certifi...
Autoridad Certifica...	Autoridad Certificador...	6/30/2009	Autoridad Certifi...
Baltimore EZ by DST	Baltimore EZ by DST	7/4/2009	DST (Baltimore E...
Belgacom E-Trust P...	Belgacom E-Trust Prim...	1/21/2010	Belgacom E-Trus...
C&W HKT SecureN...	C&W HKT SecureNet ...	10/16/2009	CW HKT Secure...
C&W HKT SecureN...	C&W HKT SecureNet ...	10/16/2009	CW HKT Secure...
C&W HKT SecureN...	C&W HKT SecureNet ...	10/16/2010	CW HKT Secure...

<All>

4 In the **Certificates** confirmation, click **Yes**.

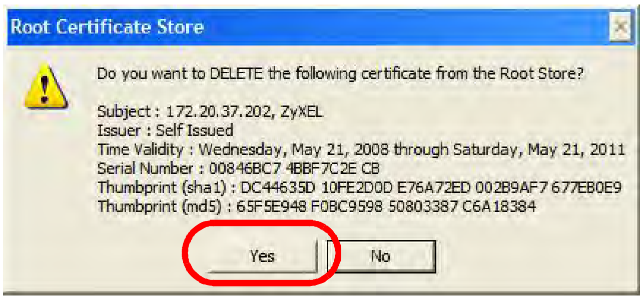
Figure 187 Internet Explorer 7: Certificates



Deleting system root certificates might prevent some Windows components from working properly. If Update Root Certificates is installed, any deleted third-party root certificates will be restored automatically, but the system root certificates will not. Do you want to delete the selected certificate(s)?

5 In the **Root Certificate Store** dialog box, click **Yes**.

Figure 188 Internet Explorer 7: Root Certificate Store



Do you want to DELETE the following certificate from the Root Store?

Subject : 172.20.37.202, ZyXEL
Issuer : Self Issued
Time Validity : Wednesday, May 21, 2008 through Saturday, May 21, 2011
Serial Number : 00846BC7 4BBF7C2E CB
Thumbprint (sha1) : DC44635D 10FE2D0D E76A72ED 002B9AF7 677EB0E9
Thumbprint (md5) : 65F5E948 F0BC9598 50803387 C6A18384

6 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

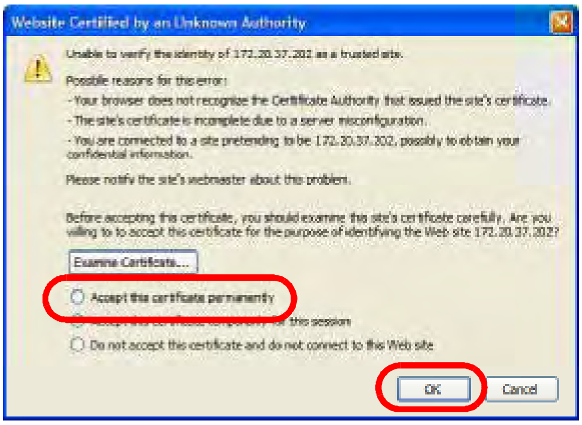
Firefox

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 189 Firefox 2: Website Certified by an Unknown Authority



Unable to verify the identity of 172.20.37.202 as a trusted site.

Possible reasons for this error:

- Your browser does not recognize the Certificate Authority that issued the site's certificate.

- The site's certificate is incomplete due to a server misconfiguration.

- You are connected to a site pretending to be 172.20.37.202, possibly to obtain your confidential information.

Please notify the site's webmaster about this problem.

Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site 172.20.37.202?

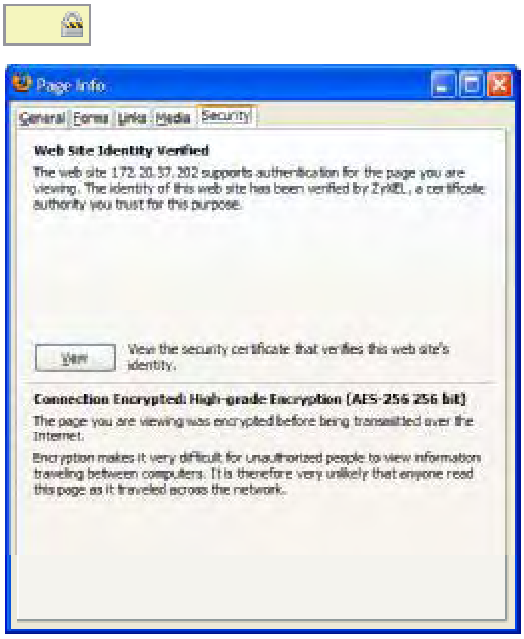
○ Accept this certificate permanently

○ Accept this certificate temporarily for this session

○ Do not accept this certificate and do not connect to this Web site

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 190 Firefox 2: Page Info



Web Site Identity Verified

The web site 172.20.37.202 supports authentication for the page you are viewing. The identity of this web site has been verified by ZyXEL, a certificate authority you trust for this purpose.

View the security certificate that verifies this web site's identity.

Connection Encrypted: High-grade Encryption (AES-256 256 bit)

The page you are viewing was encrypted before being transmitted over the Internet.

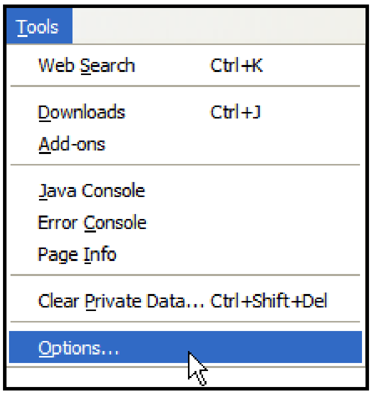
Encryption makes it very difficult for unauthorized people to view information traveling between computers. It is therefore very unlikely that anyone read this page as it traveled across the network.

Installing a Stand-Alone Certificate File in Firefox

Rather than browsing to a Huawei 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.

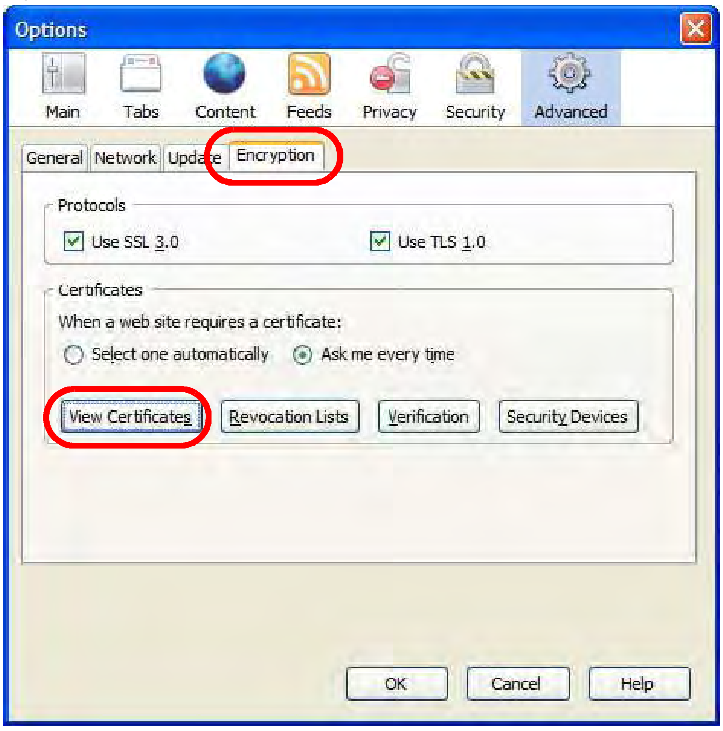
1 Open **Firefox** and click **TOOLS > Options**.

Figure 191 Firefox 2: Tools Menu



2 In the **Options** dialog box, click **ADVANCED > Encryption** > **View Certificates**.

Figure 192 Firefox 2: Options



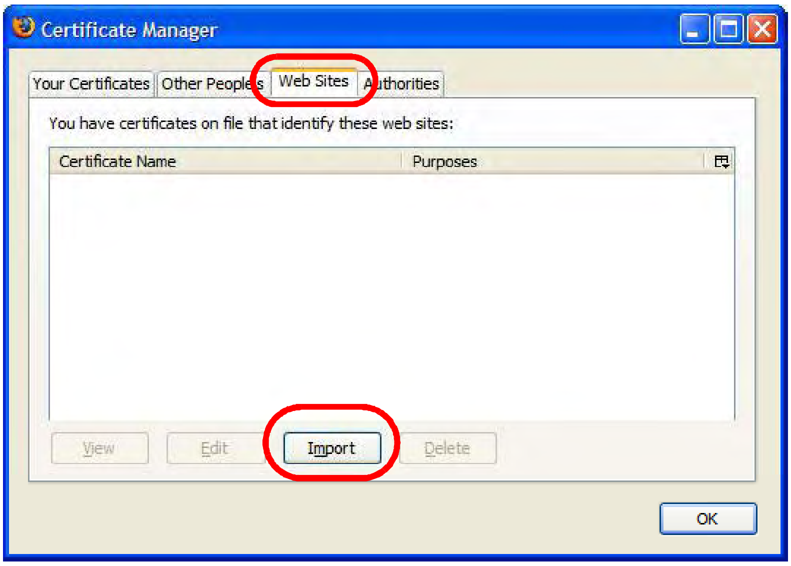
☑ Use SSL 3.0 ☑ Use TLS 1.0

When a web site requires a certificate:

○ Select one automatically ● Ask me every time

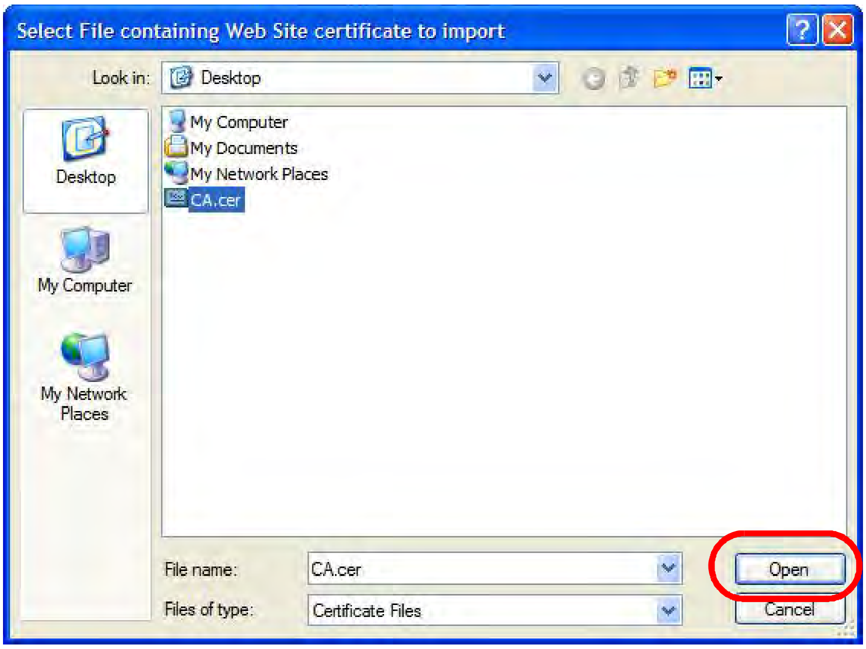
3 In the **Certificate Manager** dialog box, click **Web Sites** > **Import**.

Figure 193 Firefox 2: Certificate Manager



4 Use the **Select File** dialog box to locate the certificate and then click **Open**.

Figure 194 Firefox 2: Select File



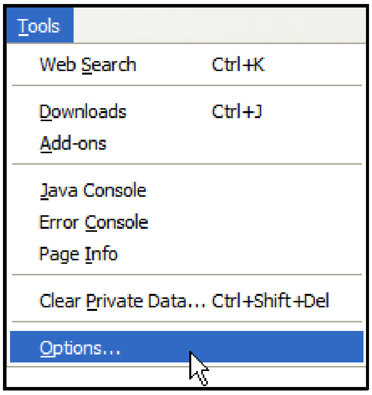
5 The next time you visit the web site, click the padlock in the address bar to open the **Page Info > Security** window to see the web page's security information.

Removing a Certificate in Firefox

This section shows you how to remove a public key certificate in Firefox 2.

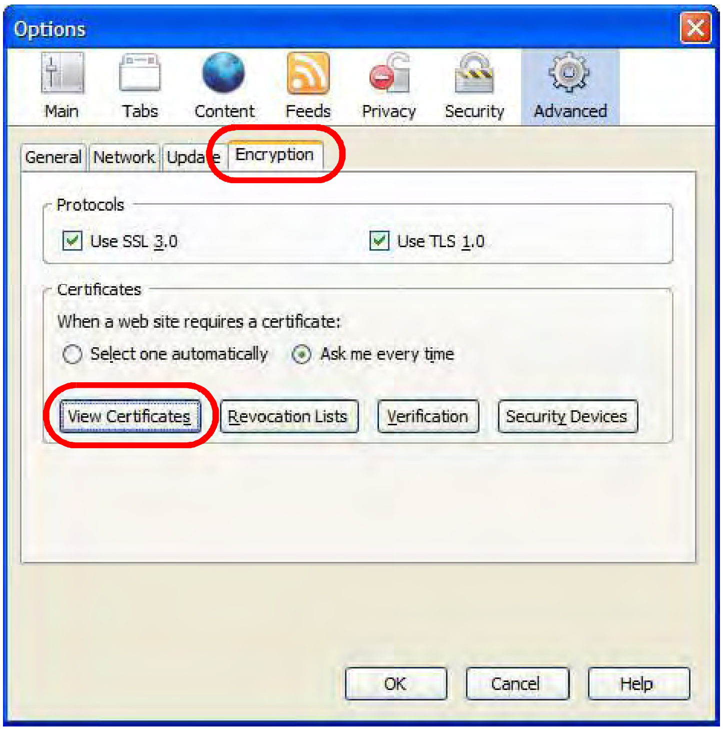
1 Open **Firefox** and click **TOOLS > Options**.

Figure 195 Firefox 2: Tools Menu



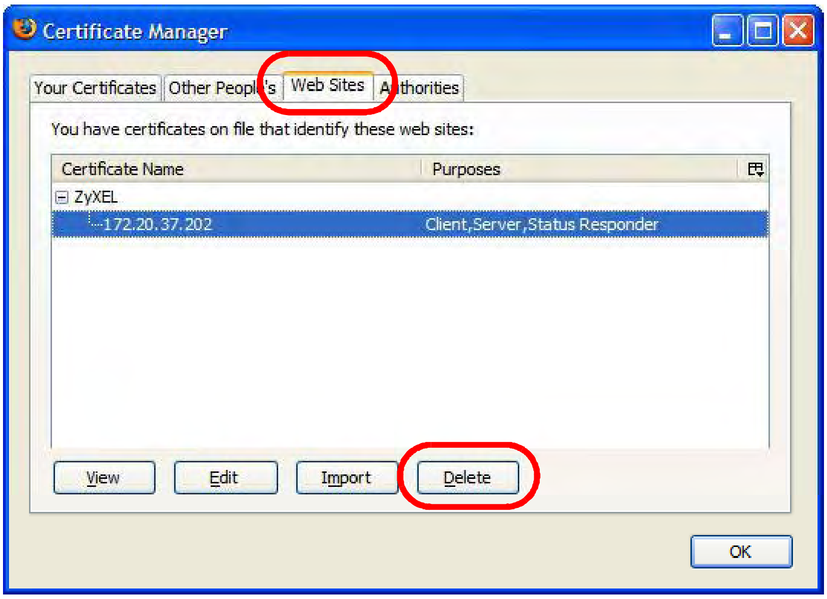
2 In the **Options** dialog box, click **ADVANCED > Encryption** > **View Certificates**.

Figure 196 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 197 Firefox 2: Certificate Manager

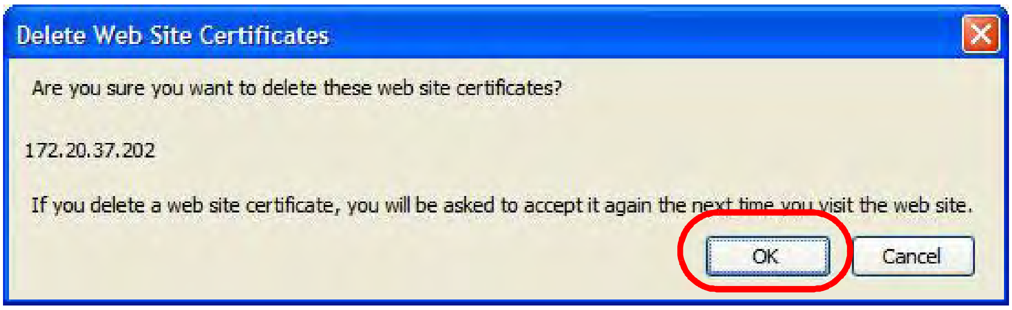


You have certificates on file that identify these web sites:

Certificate Name	Purposes
⊟ ZyXEL	
172.20.37.202	Client,Server,Status Responder

4 In the **Delete Web Site Certificates** dialog box, click **OK**.

Figure 198 Firefox 2: Delete Web Site Certificates



Are you sure you want to delete these web site certificates?

172.20.37.202

If you delete a web site certificate, you will be asked to accept it again the next time you visit the web site.

5 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

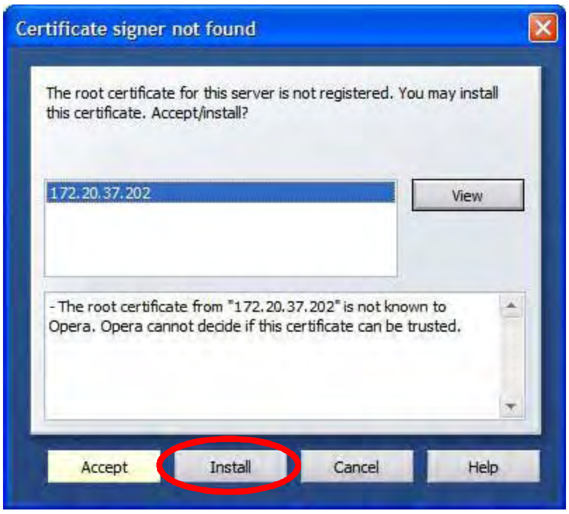
Opera

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 199 Opera 9: Certificate signer not found



Certificate signer not found

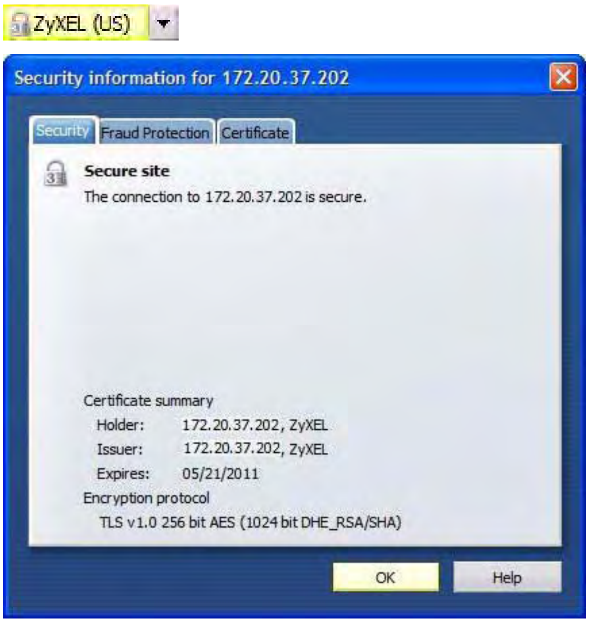
The root certificate for this server is not registered. You may install this certificate. Accept/install?

172.20.37.202

- The root certificate from "172.20.37.202" is not known to Opera. Opera cannot decide if this certificate can be trusted.

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 200 Opera 9: Security information



Security information for 172.20.37.202

Secure site

The connection to 172.20.37.202 is secure.

Certificate summary

Holder:	172.20.37.202, ZyXEL
Issuer:	172.20.37.202, ZyXEL
Expires:	05/21/2011

Encryption protocol

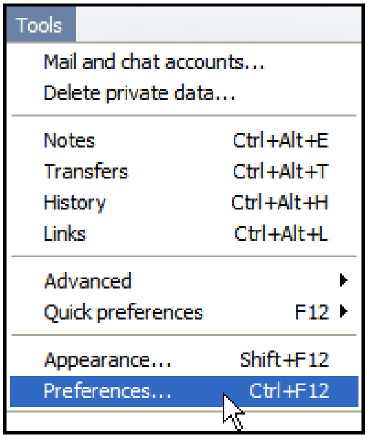
TLS v1.0 256 bit AES (1024 bit DHE_RSA/SHA)

Installing a Stand-Alone Certificate File in Opera

Rather than browsing to a Huawei 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.

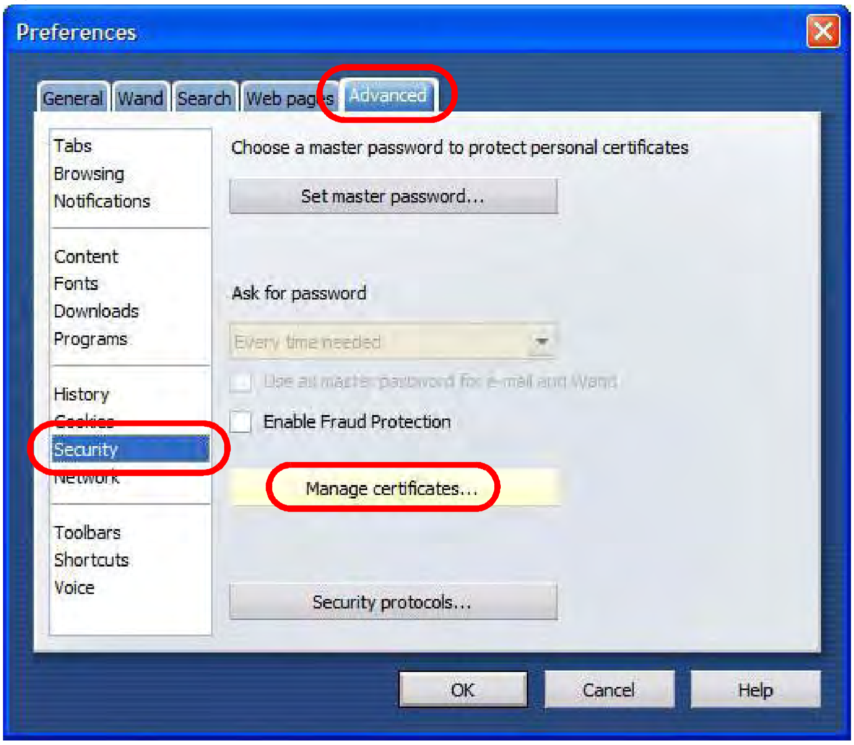
1 Open **Opera** and click **TOOLS > Preferences**.

Figure 201 Opera 9: Tools Menu



2 In **Preferences**, click **ADVANCED > Security** > **Manage certificates**.

Figure 202 Opera 9: Preferences



Choose a master password to protect personal certificates

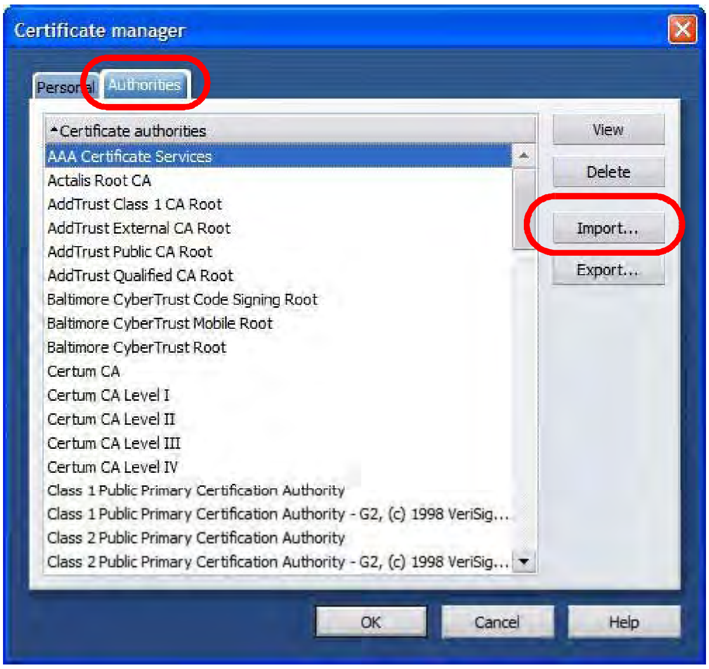
Ask for password: Every time needed

□ Use as master password for e-mail and Wand

□ Enable Fraud Protection

3 In the **Certificates Manager**, click **Authorities** > **Import**.

Figure 203 Opera 9: Certificate manager

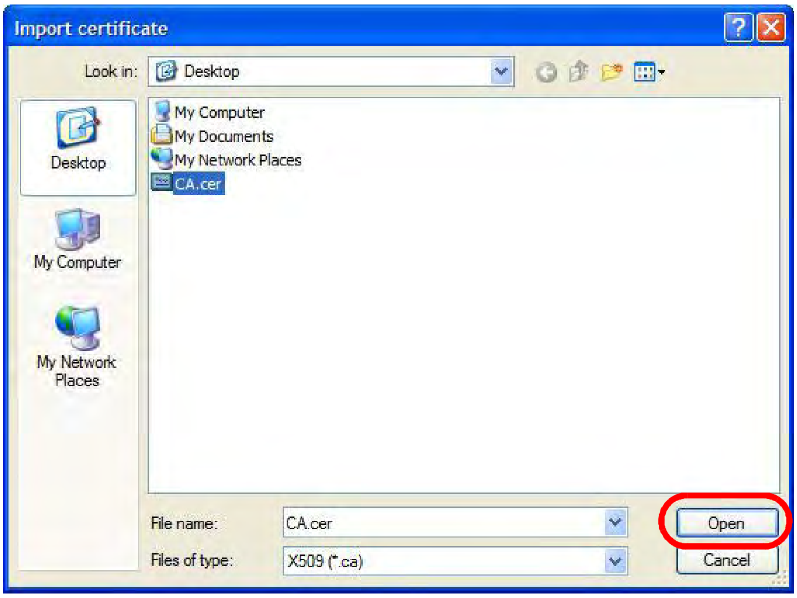


Certificate authorities

- AAA Certificate Services
- Actalis Root CA
- AddTrust Class 1 CA Root
- AddTrust External CA Root
- AddTrust Public CA Root
- AddTrust Qualified CA Root
- Baltimore CyberTrust Code Signing Root
- Baltimore CyberTrust Mobile Root
- Baltimore CyberTrust Root
- Certum CA
- Certum CA Level I
- Certum CA Level II
- Certum CA Level III
- Certum CA Level IV
- Class 1 Public Primary Certification Authority
- Class 1 Public Primary Certification Authority - G2, (c) 1998 VeriSig...
- Class 2 Public Primary Certification Authority
- Class 2 Public Primary Certification Authority - G2, (c) 1998 VeriSig...

4 Use the **Import certificate** dialog box to locate the certificate and then click **Open.**

Figure 204 Opera 9: Import certificate



Look in: Desktop

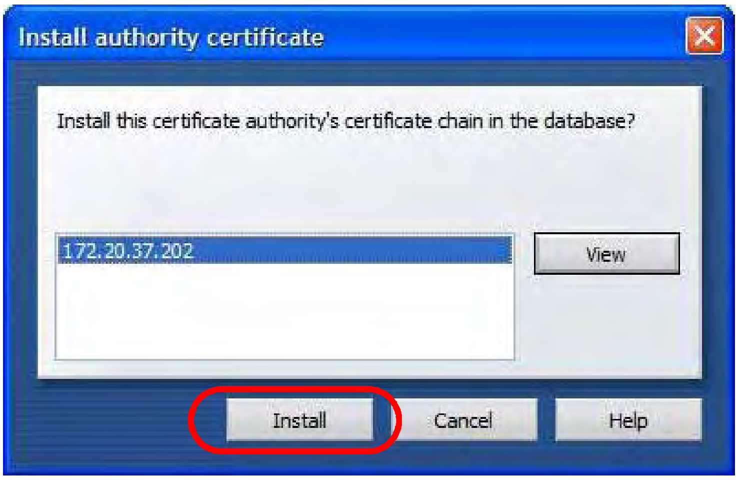
- My Computer
- My Documents
- My Network Places
- CA.cer

File name: CA.cer

Files of type: X509 (*.ca)

5 In the **Install authority certificate** dialog box, click **Install**.

Figure 205 Opera 9: Install authority certificate



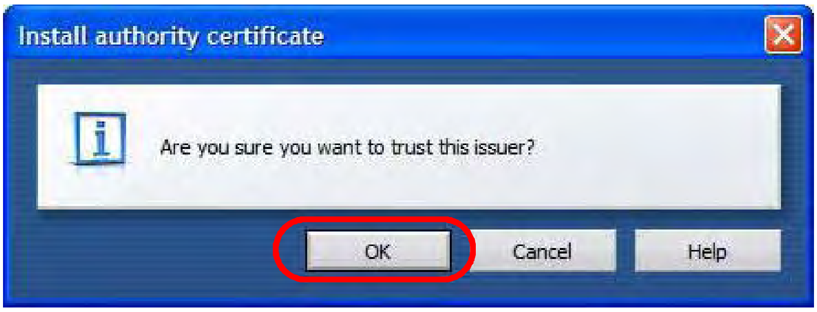
Install authority certificate

Install this certificate authority's certificate chain in the database?

172.20.37.202

6 Next, click **OK**.

Figure 206 Opera 9: Install authority certificate



Install authority certificate

Are you sure you want to trust this issuer?

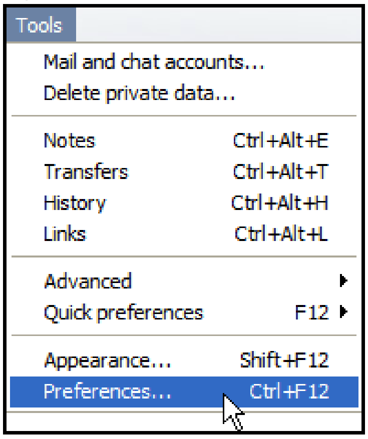
7 The next time you visit the web site, click the padlock in the address bar to open the **Security information** window to view the web page's security details.

Removing a Certificate in Opera

This section shows you how to remove a public key certificate in Opera 9.

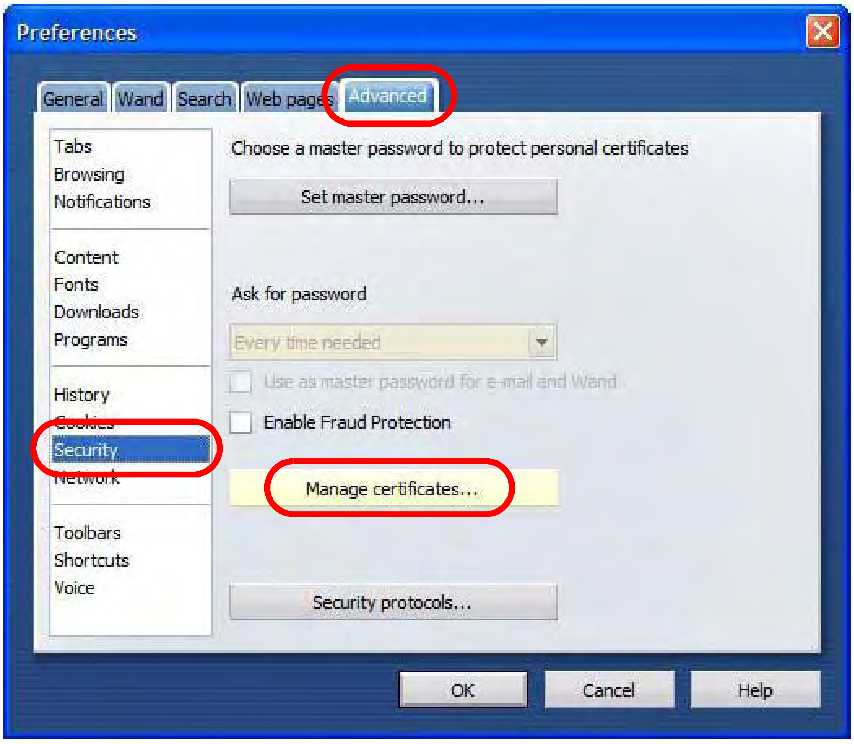
1 Open **Opera** and click **TOOLS > Preferences**.

Figure 207 Opera 9: Tools Menu



2 In **Preferences**, **ADVANCED > Security** > **Manage certificates**.

Figure 208 Opera 9: Preferences



Choose a master password to protect personal certificates

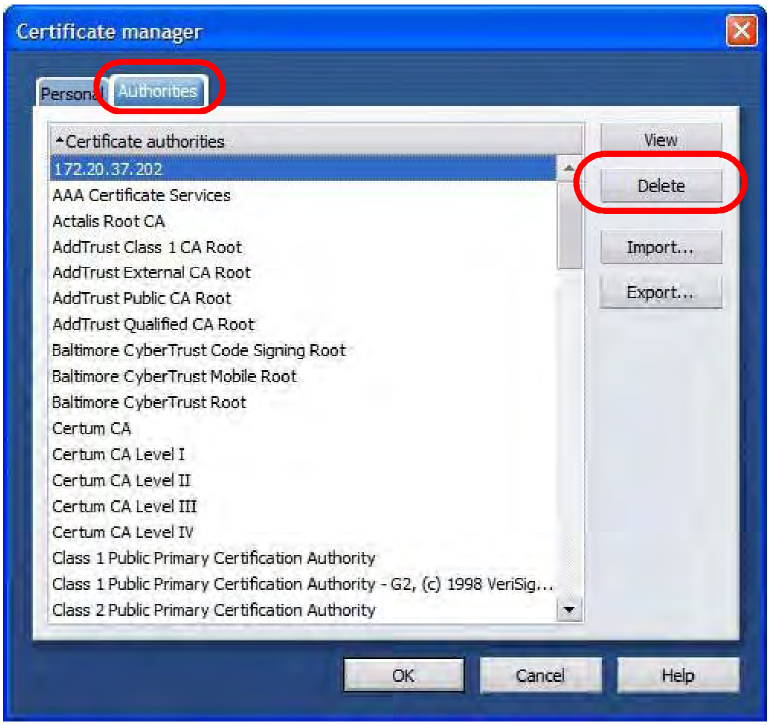
Ask for password: Every time needed

□ Use as master password for e-mail and Wand

□ Enable Fraud Protection

3 In the **Certificates manager**, select the **Authorities** tab, select the certificate that you want to remove, and then click **Delete**.

Figure 209 Opera 9: Certificate manager



Certificate authorities

172.20.37.202
AAA Certificate Services
Actalis Root CA
AddTrust Class 1 CA Root
AddTrust External CA Root
AddTrust Public CA Root
AddTrust Qualified CA Root
Baltimore CyberTrust Code Signing Root
Baltimore CyberTrust Mobile Root
Baltimore CyberTrust Root
Certum CA
Certum CA Level I
Certum CA Level II
Certum CA Level III
Certum CA Level IV
Class 1 Public Primary Certification Authority
Class 1 Public Primary Certification Authority - G2, (c) 1998 VeriSig...
Class 2 Public Primary Certification Authority

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.

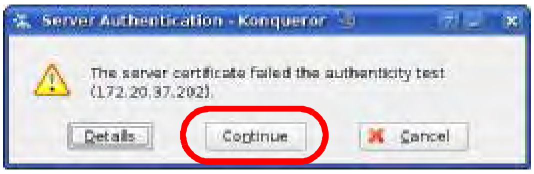
Konqueror

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**.

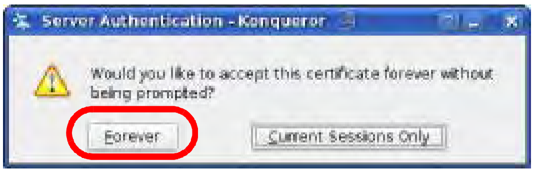
Figure 210 Konqueror 3.5: Server Authentication



The server certificate failed the authenticity test (172.20.37.202).

3 Click **Forever** when prompted to accept the certificate.

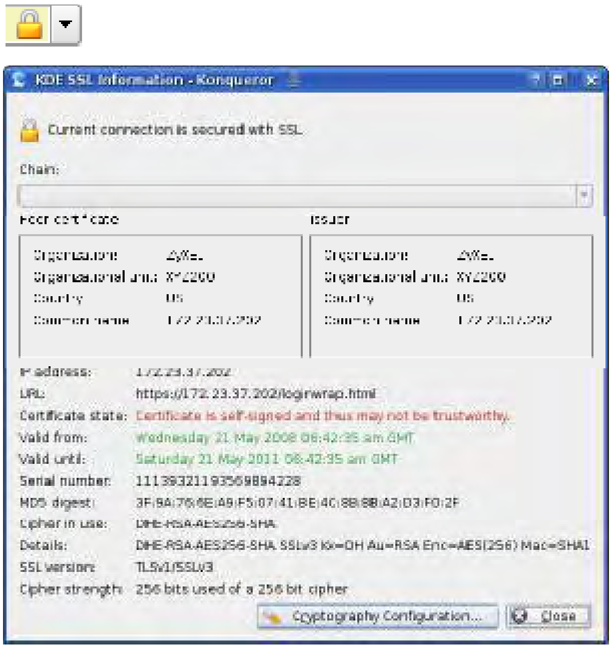
Figure 211 Konqueror 3.5: Server Authentication



Would you like to accept this certificate forever without being prompted?

4 Click the padlock in the address bar to open the **KDE SSL Information** window and view the web page’s security details.

Figure 212 Konqueror 3.5: KDE SSL Information



KDE SSL Information - Konqueror
Cryptography Configuration...
Close

Current connection is secured with SSL.

Chain:

Peer certificate

Organization: ZyXEL
Organizational unit: XY2200
Country: US
Common name: 172.23.37.202

Issuer

Organization: ZyXEL
Organizational unit: XY2200
Country: US
Common name: 172.23.37.202

IP address: 172.23.37.202
URL: https://172.23.37.202/loginwrap.html
Certificate state: Certificate is self-signed and thus may not be trustworthy.
Valid from: Wednesday 21 May 2008 08:42:35 am GMT
Valid until: Saturday 21 May 2011 08:42:35 am GMT
Serial number: 111393211935698894228
MD5 digest: 3F:9A:76:6E:A9:F5:07:41:BE:4C:8B:8B:A2:D3:F0:2F
Cipher in use: DHE-RSA-AES256-SHA
Details: DHE-RSA-AES256-SHA SSLv3 Kx=DH Au=RSA Enc=AES(256) Mac=SHA1
SSL version: TLSv1/SSLv3
Cipher strength: 256 bits used of a 256 bit cipher

Installing a Stand-Alone Certificate File in Konqueror

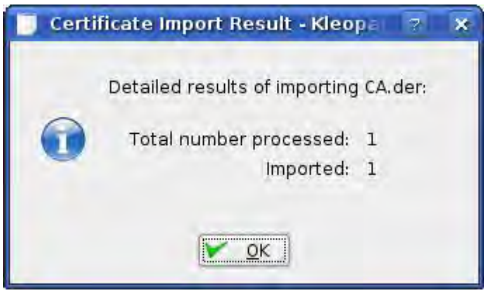
Rather than browsing to a Huawei web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.

Figure 213 Konqueror 3.5: Public Key Certificate File

2 In the **Certificate Import Result - Kleopatra** dialog box, click **OK**.

Figure 214 Konqueror 3.5: Certificate Import Result



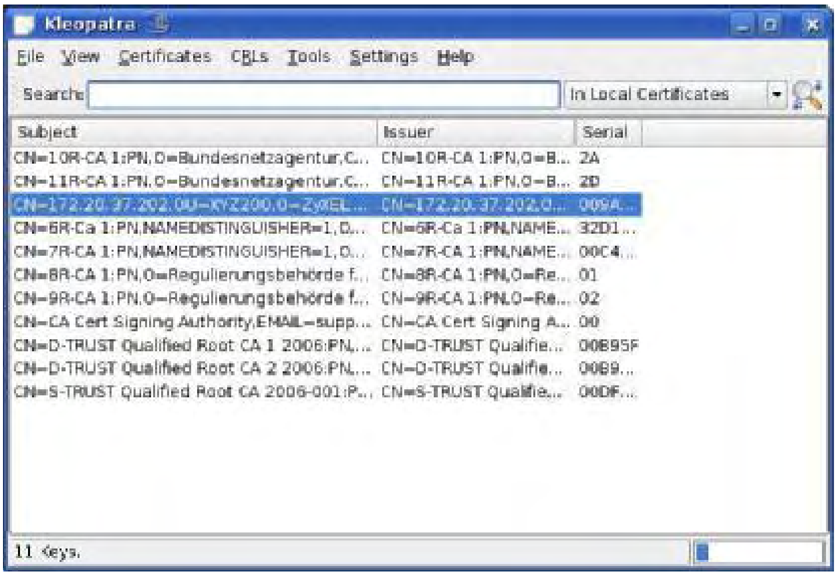
Detailed results of importing CA.der:

Total number processed: 1

Imported: 1

The public key certificate appears in the KDE certificate manager, **Kleopatra**.

Figure 215 Konqueror 3.5: Kleopatra



Subject	Issuer	Serial
CN=10R-CA 1:PN,O=Bundesnetzagentur,C...	CN=10R-CA 1:PN,O=B...	2A
CN=11R-CA 1:PN,O=Bundesnetzagentur,C...	CN=11R-CA 1:PN,O=B...	2D
CN=172.20.37.202,OU=XYZ200,O=ZyXEL...	CN=172.20.37.202,O...	009A...
CN=6R-Ca 1:PN,NAMEDISTINGUISHER=1,O...	CN=6R-Ca 1:PN,NAME...	32D1...
CN=7R-CA 1:PN,NAMEDISTINGUISHER=1,O...	CN=7R-CA 1:PN,NAME...	00C4...
CN=8R-CA 1:PN,O=Regulierungsbehörde f...	CN=8R-CA 1:PN,O=Re...	01
CN=9R-CA 1:PN,O=Regulierungsbehörde f...	CN=9R-CA 1:PN,O=Re...	02
CN=CA Cert Signing Authority,EMAIL=supp...	CN=CA Cert Signing A...	00
CN=D-TRUST Qualified Root CA 1 2006:PN,...	CN=D-TRUST Qualifie...	00B95F
CN=D-TRUST Qualified Root CA 2 2006:PN,...	CN=D-TRUST Qualifie...	00B9...
CN=S-TRUST Qualified Root CA 2006-001:P...	CN=S-TRUST Qualifie...	00DF...

11 keys.

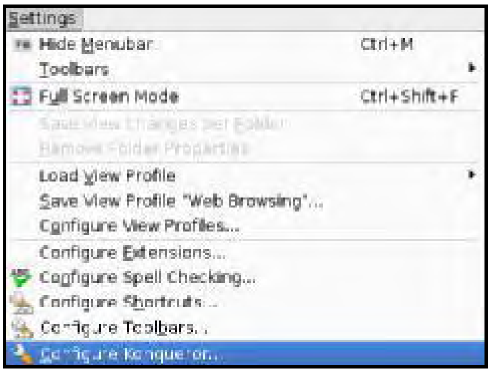
3 The next time you visit the web site, click the padlock in the address bar to open the **KDE SSL Information** window to view the web page's security details.

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**.

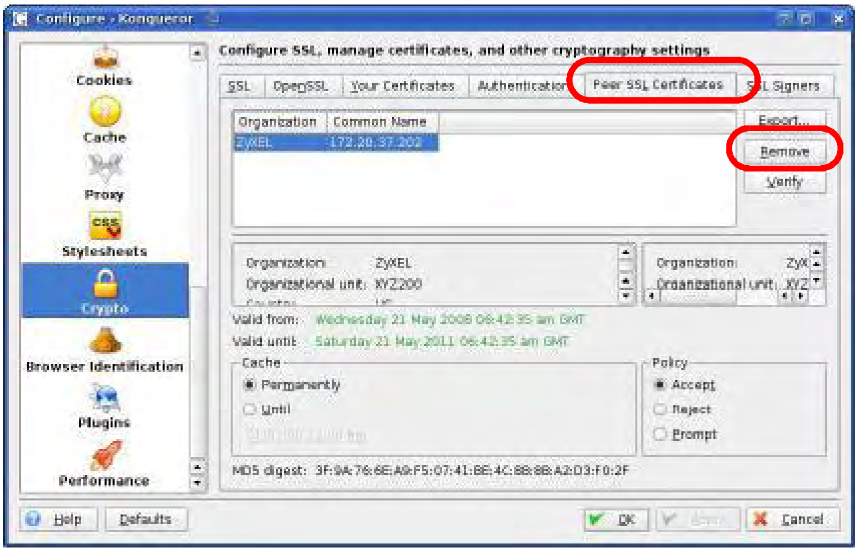
Figure 216 Konqueror 3.5: Settings Menu



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 217 Konqueror 3.5: Configure



Configure SSL, manage certificates, and other cryptography settings

Organization	Common Name
ZyXEL	172.20.37.202

Organization: ZyXEL
Organizational unit: XYZ200

Valid from: Wednesday 21 May 2008 06:42:35 am GMT
Valid until: Saturday 21 May 2011 06:42:35 am GMT

● Permanently ○ Until

● Accept ○ Reject ○ Prompt

MD5 digest: 3F:9A:76:6E:A9:F5:07:41:BE:4C:8B:8B:A2:D3:F0:2F

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.

F

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 115 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.huawei.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 115 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 115 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.

Index

Federal Communication Commission Interference Statement

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

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

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

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

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

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