



NovaRoam[™] EH900
Mobile Router

User Manual

Revision 1.1

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Introduction

About Nova Engineering

Nova Engineering, a 100% employee owned digital and wireless communication systems company, designs, develops, and manufactures high speed data processing and transmission equipment. Since 1989, Nova Engineering, Inc. has pioneered a variety of leading edge projects in both the commercial and government sectors.

Designs include miniature, low power RF communications equipment, waveform development software, high performance modems, ultra-low phase noise synthesizers, embedded real-time signal processing systems, and communication products development tools.

Nova supports the total development cycle from systems engineering, analysis, and computer simulation to printed circuit board design, prototyping, production, and automated testing.

Visit Nova Engineering's website [<http://www.nova-eng.com>] or contact us at 513-642-3000.

About this Manual

This manual introduces you to the capabilities, features, and operation of the NovaRoam. The manual describes how to install and configure the NovaRoam and how to facilitate efficient integration into a fully functional wireless network.

This document also explains how to troubleshoot problems that may arise during installation or operation.

This manual is designed for system managers, device installers, and network managers, and assumes a working knowledge of local area networking and routing functions.

Additional technical support is available either directly from Nova Engineering or partners.

Kit Contents

Each *NovaRoam EH900* Kit includes the following items:

Table 1: *NovaRoam EH900* Kit Contents

Item	Description	Part Number
<i>NovaRoam EH900</i>	Wireless router	NR-EH900
DC Power Cable	Power input cable	NR-AC12-1
Ethernet Cable	Ethernet crossover cable	NR-AC-1102
NovaRoam CD-ROM	Includes User Manual and NovaFind Software Utility	NR-CDEH-1

Introducing *NovaRoam EH900*

About *NovaRoam*

NovaRoam is a wireless IP router featuring unique ad hoc (mesh) networking capabilities for mobile and stationary applications. In a typical wireless network, the *NovaRoam* is as transparent as a hardwired router. Configuration of the *NovaRoam* is made simple through use of its embedded browser-based configuration software.



Figure 1: *NovaRoam EH900*

System Requirements

To begin configuring your *NovaRoam*, the following is required:

- An Ethernet connection point (10/100BaseT)
- Power connection
- Computer for configuration

NovaRoam Connections and LEDs

The rear panel of the *NovaRoam* has four connectors, one each for the antenna, DC Power, RS-232 serial port, and Ethernet. The NovaRoam Ethernet interface features “auto crossover”, which allows you make Ethernet connections using either straight or crossover Ethernet cables. The *NovaRoam* rear panel is shown in Figure 2.



Figure 2: NovaRoam EH900 Rear View

Name	Device	Description
Antenna	Connector	Antenna, TNC Connector
12 VDC	Connector	Power Connection, 12 VDC
RS-232	Connector	RS-232 Serial Port
Ethernet	Connector	10BaseT Connection

The front panel of the *NovaRoam* has five LEDs as shown in Figure 3. The Power LED denotes that power has been applied and the firmware is loaded. The Tx LED indicates that a packet is being sent over the wireless interface. The Link LED indicates the quality of the wireless link. This LED glows at four levels of brightness; each brighter level indicating a better link. If the LED is off, no wireless link is established. The Rx LED indicates that a packet was received

successfully over the wireless link. The Ethernet Link/Act LED indicates if an Ethernet connection is established and if there is any traffic on the link.

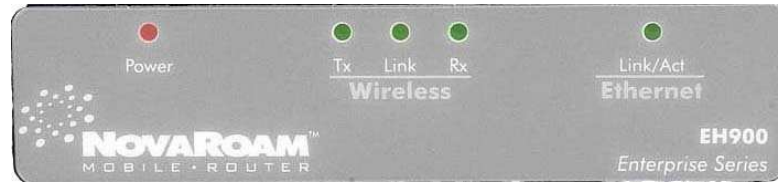


Figure 3: NovaRoam EH900 Front View

Name	Device	Description
Power	LED (Red)	Power Applied and firmware loaded
TX	LED (Green)	Active RF Transmit
Link	LED (Green/Yellow)	Active RF Link
RX	LED (Green)	Active RF Receive
Link/Act	LED (Green)	Active Ethernet Link/Activity

Security

NovaRoam uses Frequency Hopping Spread Spectrum (FHSS) technology. While FHSS makes it difficult for a casual interceptor or eavesdropper to gain access to the network data flows, a determined adversary can passively intercept or even actively disrupt your network using other *NovaRoam* transceivers or similar types of FHSS equipment. For this reason, if the value of the information flows is significant, the prudent network designer will implement additional mechanisms to authenticate messages and protect the network content from exploitation. One such mechanism for securing TCP/IP connections is the Secure Socket Layer (SSL) protocol. Other mechanisms and protocols can be implemented depending upon your needs.

Contact Nova Engineering for additional security options.

Table 2: NovaRoam EH900 Radio Frequency Modes

Mode	Data Rate (kbps)	Modulation Type	Transmitter Power (dBm)	Receiver Sensitivity with FEC (dBm)
1	100	GFSK	+30	-108
2	400	GFSK	+30	-103

The *NovaRoam EH900* operates in the 902-928 MHz frequency band, with 16 user selectable Network ID's.

Installing the *NovaRoam*

Installation Checklist

This device must be professionally installed. It is the responsibility of the installer to ensure that proper antenna and cable combinations are used in order to remain within FCC Part 15 limits.

- ☐ Unpack and inspect contents of the Kit.
- ☐ Connect an approved antenna to the *NovaRoam*.
- ☐ Connect power to the *NovaRoam*.
- ☐ Connect a computer and *NovaRoam* via the Ethernet cable.
- ☐ Configure the *NovaRoam* using its Browser-based Configuration Webpage. For configuration details, refer to the section titled *Configuring the NovaRoam* in this manual.

Preinstallation Planning

Choosing a Location

If operating in a mobile platform, the *NovaRoam* should be mounted firmly. Also, avoid locating the *NovaRoam* near a heat source or in a damp or dusty location.

CAUTION

For fixed installations, Nova Engineering recommends lightning protection.

General Planning

To install your *NovaRoam*, follow these general steps:

- Plan Network setup
- Plan *NovaRoam* configuration
- Connect antenna
- Connect cables
- Connect power

Network Planning

NovaRoams can be used in a wide variety of network configurations. Therefore, it would be impossible to explain how to plan for each configuration in this manual. Planning your network in advance is recommended. Doing so provides an opportunity to develop an IP addressing scheme that makes the most sense for your particular application. Depending on the type of network, several factors may influence your planning.

- Mobile vs. stationary network
- Point-to-point vs. mesh
- Standalone Network vs. Internet connection

Once the network topology is known, the *NovaRoams* can be configured appropriately.

Refer to Appendix A for an example *NovaRoam* network.

Planning *NovaRoam* Configuration

There are multiple router modes to choose from. The best router mode for any given situation depends on the particular needs of the wireless network. After obtaining details about the wireless network, the appropriate *NovaRoam* router mode can be determined.

Refer to Appendix B for more details about routing modes and operation of the *NovaRoam*.

Configuring the *NovaRoam*

Connecting to the *NovaRoam*

The *NovaRoam* provides web browser-based configuration. The *NovaRoam* can be configured using Internet Explorer 5.5 or later. To configure the *NovaRoam*:

- Open a web browser.
- In the browser's address field, enter the IP address of the *NovaRoam* to which you wish to connect. The default IP address is 192.168.200.1.
- Press Enter (or the Go button) to connect.

Note: Your computer must have an IP address from the same subnet as the *NovaRoam* to which you are attempting to connect.

Logging into the *NovaRoam*

Once connected to the *NovaRoam*, the logon page displays.



Figure 4: *NovaRoam* Configuration Software Logon Page

- Enter the password. The default password is **novaroam**. It is strongly recommended that you change the default password.
- Press the Logon button or the Enter key. The main configuration page is displayed.

Using the Setup Wizard

The Setup Wizard simplifies *NovaRoam* configuration by presenting common setup parameters in an easily understandable format. The Setup Wizard can be started by pressing the Setup Wizard button on the Main configuration page.

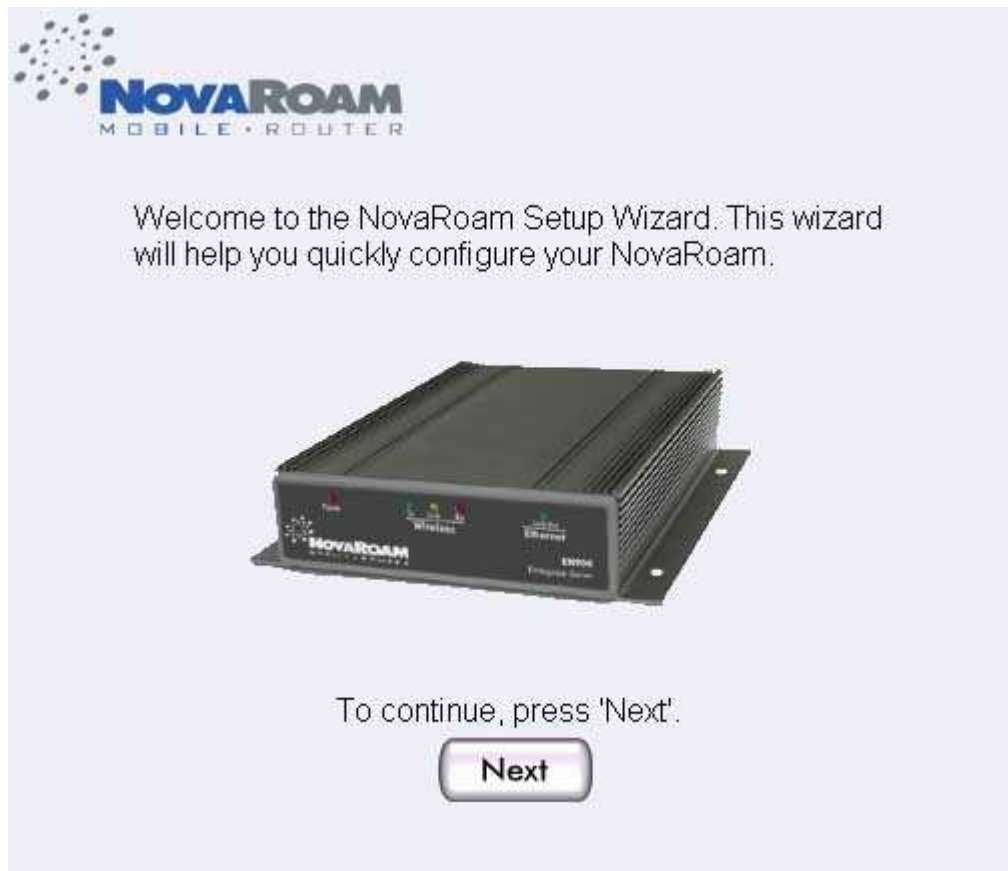


Figure 5: Setup Wizard Start page

At the opening screen of the setup wizard, press the Next button to start configuring the *NovaRoam*.



Figure 6: Setup Wizard Date Rate selection page

The *NovaRoam EH900* can be configured to one of two data rates: 100 kbps or 400 kbps. After specifying the Data Rate, press the Next button.

Note: All *NovaRoams* that are required to communicate with each other must specify the same data rate.



Figure 7: Setup Wizard Network ID selection page

Specify the Network ID for the NovaRoam. In order for NovaRoams to communicate with each other, they must use the same Network ID. Networks can be collocated by using a separate Network ID for each individual network.

After specifying the Network ID, press the Next button.



Specify Ethernet IP Address

Specify the IP address for the Ethernet Interface.

IP Address	<input type="text" value="192.168.200.1"/>
Subnet Mask	<input type="text" value="255.255.255.0"/>

Figure 8: Setup Wizard Ethernet IP Address configuration page

Specify the IP address and corresponding Subnet Mask for the Ethernet Interface. After specifying the address, press the Next button.



Specify Wireless IP Address

Specify the IP address for the Wireless Interface.

IP Address	<input type="text" value="192.168.202.1"/>
Subnet Mask	<input type="text" value="255.255.255.0"/>

Figure 9: Setup Wizard Wireless Interface IP Address configuration page

Specify the IP address and corresponding Subnet Mask for the Wireless Interface. After specifying the address, press the Next button.



Figure 10: Setup Wizard Finish page

Press the Finish button to complete the setup wizard and return to the main configuration page. If more detailed configuration is required, additional setup options are available from the main configuration page.

User Interface Configuration

Main Configuration Page

The Main configuration page allows you to start the Setup Wizard. Selecting one of the navigation buttons on the left side of the configuration page allows you to configure the various elements of the *NovaRoam*.



Figure 11: NovaRoam Configuration Main Page

Option Name	Description
Main	Opens the Main configuration page
Interfaces	Opens the Interfaces configuration page
IP Routing	Opens the IP Routing configuration page
QoS	Opens the QoS (Quality of Service) configuration page
Security	Opens the Security configuration page
Admin	Opens the Admin configuration page
Statistics	Opens the Statistics page
Setup Wizard	Starts <i>NovaRoam</i> Setup Wizard
NovaRoam Name	Displays the NovaRoam Name. The NovaRoam Name can be changed to best suit your application.

Interfaces Configuration Page

The Interfaces Configuration page allows configuration of the Ethernet, Wireless, and Serial interfaces of the *NovaRoam*.

The screenshot displays the NovaRoam configuration interface. On the left is a vertical sidebar with buttons for 'Main', 'Interfaces' (which is highlighted), 'IP Routing', 'QoS', 'Security', 'Admin', and 'Statistics'. The main panel on the right has three tabs: 'Ethernet', 'Wireless', and 'Serial'. The 'Ethernet' tab is active, showing configuration fields for 'IP Address' (192.168.0.18), 'Subnet Mask' (255.255.255.0), 'MTU' (1500), and 'MAC ID' (00:50:c2:02:bc:68). An 'Apply' button is located at the bottom right of the configuration area.

Figure 12: NovaRoam Configuration Interfaces Page

Option Name	Description
Main	Opens the Main configuration page
Interfaces	Opens the Interfaces configuration page
IP Routing	Opens the IP Routing configuration page
QoS	Opens the QoS (Quality of Service) configuration page
Security	Opens the Security configuration page
Admin	Opens the Admin configuration page
Statistics	Opens the Statistics page

Option Name	Description
Ethernet	Opens the Ethernet Interface Configuration tab
Wireless	Opens the Wireless Interfaces Configuration tab
Serial	Opens the Serial Interface Configuration tab
NovaRoam Name	Displays the NovaRoam Name. The NovaRoam Name can be assigned to best suit your application.

Ethernet Tab

The Ethernet tab lets you specify the IP address, subnet mask, and maximum transfer unit (MTU) for the Ethernet network interface.

Ethernet
Wireless
Serial

IP Address

Subnet Mask

MTU

MAC ID

192.168.0.18

255.255.255.0

1500

00:50:c2:02:bc:68

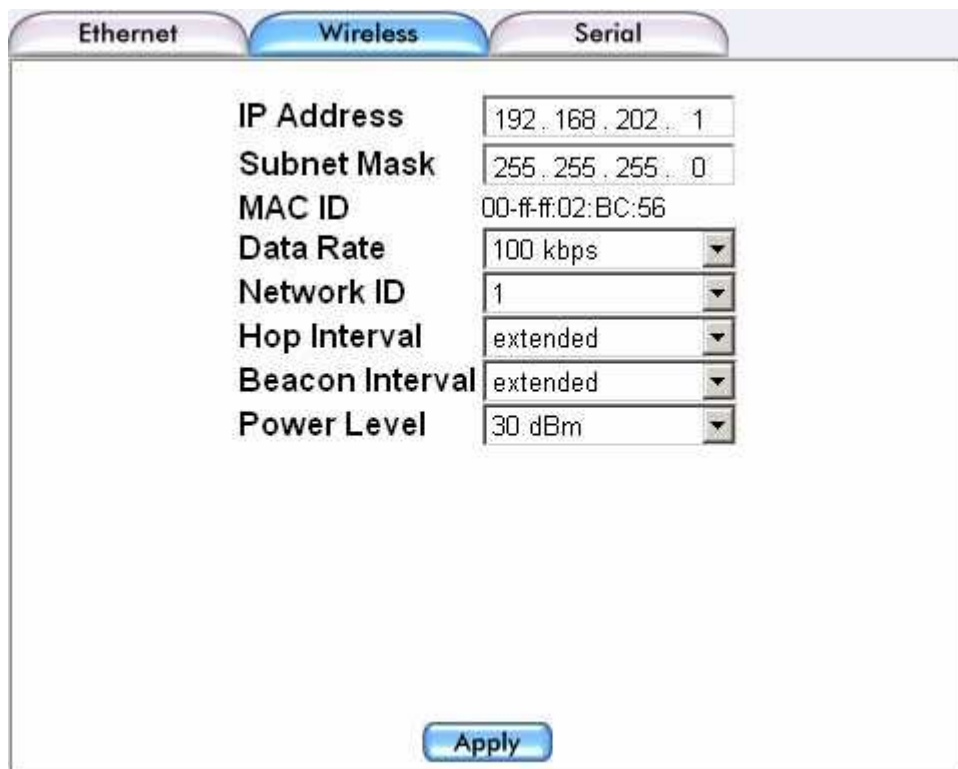
Apply

Figure 13: NovaRoam Configuration Ethernet Tab

Option Name	Description
IP Address	Specifies the IP address of the Ethernet Interface. The default IP address is 192.168.200.1.
Subnet Mask	Specifies the Subnet Mask of the Ethernet Interface
MTU	Maximum Transmit Unit. Specifies the maximum packet size able to be transmitted without being fragmented. This setting is specified in bytes. The default MTU is 1500 bytes.
MAC ID	This <i>read-only</i> field specifies the unique Media Access Control (MAC) address of the <i>NovaRoam</i> Ethernet interface.
Apply	Applies changes made to the Ethernet Interface configuration page

Wireless Tab

The Wireless tab lets you specify the IP address and subnet mask for the wireless network interface. This is also where the Network ID, data rate, and various wireless options are configured.



Option	Value
IP Address	192.168.202.1
Subnet Mask	255.255.255.0
MAC ID	00-ff-ff:02:BC:56
Data Rate	100 kbps
Network ID	1
Hop Interval	extended
Beacon Interval	extended
Power Level	30 dBm

Apply

Figure 14: NovaRoam Configuration Wireless Tab

Option Name	Description
IP Address	Specifies the IP address of the Wireless Interface. The default IP address is 192.168.202.1.
Subnet Mask	Specifies the Subnet Mask of the Wireless Interface.
MAC ID	The <i>read-only</i> field specifies the unique Media Access Control (MAC) address of the NovaRoam Wireless interface.

Option Name	Description
Data Rate	Specifies the over-the-air (burst) Data Rate of the NovaRoam. Data Rates can be specified as 100 kbps or 400 kbps. The default data rate is 100 kbps.
Network ID	Specifies the Network ID for the NovaRoam. In order to communicate with each other, NovaRoams must use the same Network ID. Networks can be collocated by using a separate Network ID for each individual network.
Hop Interval	The amount of time a NovaRoam will remain on a single hopping frequency. Options are short, medium, long, extended.
Beacon Interval	Amount of time between beacon transmissions. Options are short, medium, long, extended.
Power Level	Specifies the output power of the NovaRoam. Options are 10 dBm, 20 dBm, 25 dBm, and 30 dBm.
Apply	Applies changes made to the Wireless Interface configuration page

Serial Tab

The serial interface of a *NovaRoam* can be used to tunnel raw asynchronous serial data to another *NovaRoam*. The Serial tab allows you to configure the various port settings of the asynchronous serial interface as well as the destination *NovaRoam* address and port number.

Ethernet
Wireless
Serial

Serial Port Settings

Baud Rate

4800

Flow Control

None

Data Settings

8,N,1

Serial IP Settings

Port

6000

Destination

192.168.204.1

Apply

Figure 15: NovaRoam Configuration Serial Tab

Option Name	Description
Baud Rate	Specifies the baud rate of the serial interface. Available baud rates are 2400, 4800, 9600, 19200, 38400, 57600, 115200. The default setting is 4800.
Flow Control	Determines whether or not flow control is used on the <i>NovaRoam</i> serial interface. Options are None or Hardware. The default setting is None.
Data Settings	Specifies the data settings, specifically data bits, parity, and stop bits. Options are 8,N,1 / 7,E,1 / 7,O,1. The default setting is 8,N,1.

Option Name	Description
Port	Specifies the port that serial data is sent to and received from. The default port number is 6000. In order for multiple NovaRoams to communicate serial data, the same port must be specified on each NovaRoam
Destination IP Address	The Destination IP address to which all serial data is sent. The default Destination IP address is 192.168.204.1. Specifying the Wireless Interface of a NovaRoam will cause serial data to be sent out the serial port of the receiving NovaRoam. Specifying the Ethernet Interface of a NovaRoam or other device will cause serial data to be sent out the Ethernet Interface of the receiving NovaRoam
Apply	Applies changes made to the Serial Interface configuration page

IP Routing Configuration Page

The IP Routing configuration page allows configuration of the IP Routing settings, such as Ad Hoc Routing mode and AODV. Static routes and ARP entries can be viewed or modified on the IP Routing Configuration page.



Figure 16: NovaRoam Configuration IP Routing Page

Option Name	Description
Main	Opens the Main configuration page
Interfaces	Opens the Interfaces configuration page
IP Routing	Opens the IP Routing configuration page
QoS	Opens the QoS (Quality of Service) configuration page
Security	Opens the Security configuration page
Admin	Opens the Admin configuration page

Option Name	Description
Statistics	Opens the Statistics page
Ad Hoc Routing	Opens the Ad Hoc Routing Configuration page
Routes	Opens the Routes Configuration page
AODV	Opens the AODV Configuration page
ARP	Opens the ARP (Address Resolution Protocol) Configuration page
NovaRoam Name	Displays the NovaRoam Name. The NovaRoam Name can be assigned to best suit your application.

Ad Hoc Routing Tab

The Ad Hoc Routing tab lets you select the protocol to use for mobile ad hoc routing. Currently, AODV is the supported protocol.



Figure 17: NovaRoam Configuration Ad Hoc Routing Tab

Option Name	Description
Off	Specifies manual routing mode. In this mode, static routes must be entered manually. Routes can entered manually from the Routes tab.
AODV	Enables the AODV routing algorithm. AODV allows NovaRoam networks to become self-forming and self-healing. Routes are created, maintained, and deleted automatically. Refer to Appendix B for detailed information regarding AODV.
Apply	Applies changes made to the Ad Hoc Routing configuration page

Routes Tab

The Routes tab lets you view current routes in the *NovaRoam* routing table. It also allows you to add and remove static routes.

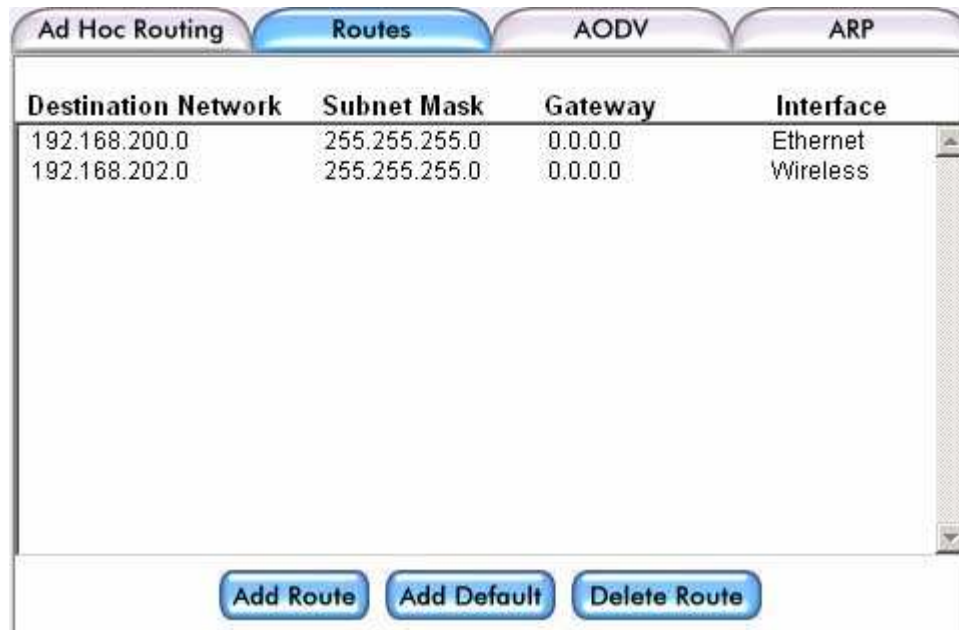


Figure 18: NovaRoam Configuration Routes Tab

Option Name	Description
Add Route	Opens the Add Route window. Used to manually enter static.
Add Default	Opens the Add Default window. Used to manually enter default gateways.
Delete Route	Used to manually delete routes. To delete a route, select the route from the route table. Once the route is highlighted, press the Delete Route button. The route will then be deleted from the route table.



The image shows a 'Add Route' configuration window. At the top is a blue button labeled 'Add Route'. Below it are three input fields: 'Network', 'Subnet Mask', and 'Gateway'. At the bottom are two blue buttons: 'Apply' and 'Cancel'.

 Figure 19: *NovaRoam* Configuration Add Route Window

Option Name	Description
Network	Specifies the destination network for the route being created
Subnet Mask	Specifies the subnet mask of the destination network for which the route is being created
Gateway	Specifies the next hop gateway of the destination network for which the route is being created
Apply	Adds the route to the route table. Static routes will remain in the route table until they are manually deleted.
Cancel	Closes the Add Route window without adding a route to the route table



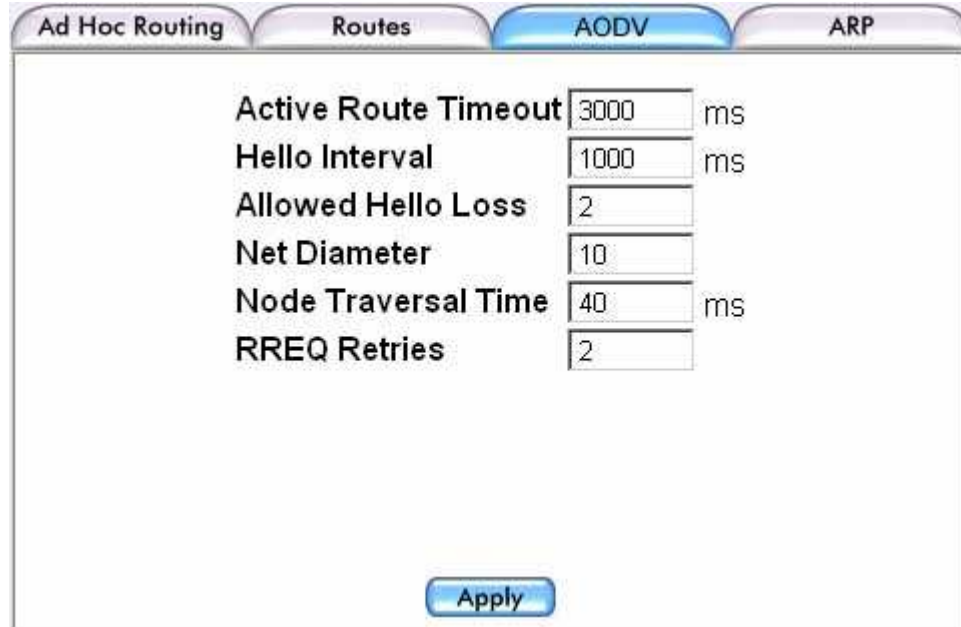
Figure 20: NovaRoam Configuration Add Default Window

Option Name	Description
Gateway	Specifies the default gateway. This is the IP address to which all data packets without an existing route are sent.
Apply	Adds the default gateway to the route table. The default gateway will remain in the route table until it is manually deleted.
Cancel	Closes the Add Default window without adding a default gateway to the route table

AODV Tab

The AODV tab lets you configure parameters associated with the operation of the AODV (Ad hoc On-demand Distance Vector) ad hoc routing algorithm. The default settings have been set for a typical mobile network environment and should not need to be changed. However, modification of these parameters is

supported in the event that your wireless network requires tweaking of the internal algorithm values to best match your network architecture.



Option Name	Value	Unit
Active Route Timeout	3000	ms
Hello Interval	1000	ms
Allowed Hello Loss	2	
Net Diameter	10	
Node Traversal Time	40	ms
RREQ Retries	2	

Figure 21: NovaRoam Configuration AODV Tab

Option Name	Description
Active Route Timeout	Determines the time period that a route will remain in the routing table when no traffic is being sent to the destination. The valid range of values is between 1000 and 100000 milliseconds. The default value is 3000 milliseconds.
Hello Interval	Time between “hello” beacon messages. This valid range of values is between 1000 and 100000 milliseconds. The default value is 1000 milliseconds.
Allowed Hello Loss	Specifies the number of “hello” messages which, when missed, determines a link failure. The valid range of values is from 1 to 10. The default value is 2.