Setup

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NOTICE

SpeedNet ME Radio Software and Instruction Sheets can be downloaded at **sandc.com/support/automation-customer-support-portal.asp** If you need assistance, please contact customerportal@sandc.com or phone (800) 621-5546.

Supersedes Instruction Sheet dated December 15, 2014

August 14, 2017

Instruction Sheet 1074-530

Qualified Persons

⚠ WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from non live parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

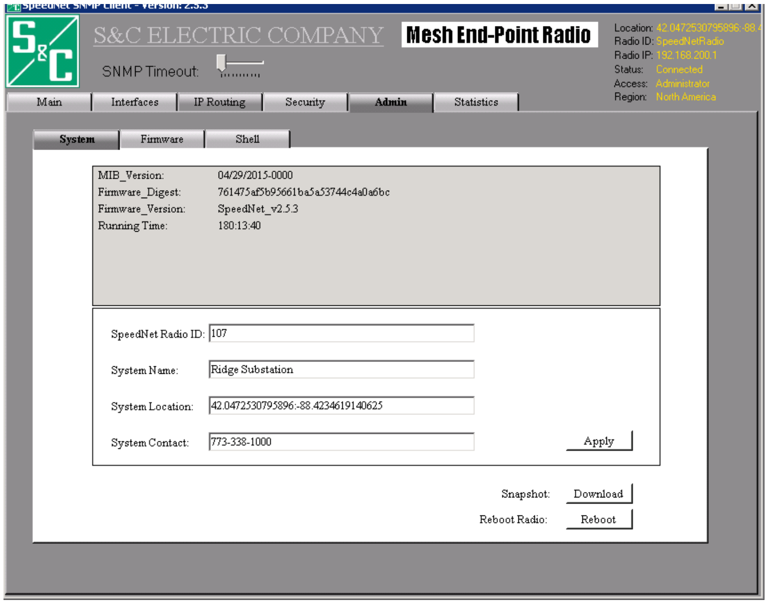
These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C IntelliRupter fault interrupter. Familiarize yourself with the Safety Information and Safety Precautions on pages 3 through 5. The latest version of this publication is available online in PDF format at **sandc.com/Support/Product-Literature.asp**.

These instructions apply to SpeedNet ME Radio Firmware Version v2.5.2. The version number can be found on the **Admin–System** window of the SpeedNet Client Tool version 2.5.2, as shown in Figure 1.



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

MIB_Version: 04/29/2015-0000
Firmware_Digest: 761475af5b95661ba5a53744c4a0a6bc
Firmware_Version: SpeedNet_v2.5.3
Running Time: 180:13:40

SpeedNet Radio ID: 107
System Name: Ridge Substation
System Location: 42.0472530795896:-88.4234619140625
System Contact: 773-338-1000

Snapshot: Download
Reboot Radio: Reboot

Figure 1. Admin–System window in the SpeedNet Client Tool.

Retain this Instruction Sheet

This instruction sheet should be available for reference wherever SpeedNet ME Radio is to be used. Retain this instruction sheet in a location where you can easily retrieve and refer to it.

Proper Application

⚠ WARNING

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the selected equipment.

Regulatory Information

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.

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada exempts de licence (s) standard RSS. Son fonctionnement est soumis aux deux conditions suivantes: (1) ce dispositif ne doit pas causer d'interférences, et (2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil.

IMPORTANT! Changes or modifications not expressly approved by S&C Electric Company could void the user's authority to operate the equipment.

NOTICE

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 or more 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.

CAN ICES-3 (B)/NMB-3(B)

Warranty

The warranty and/or obligations described in S&C's Price Sheet 150 "Standard Conditions of Sale – Immediate Purchasers in the United States" (or Price Sheet 153, Standard Conditions of Sale – Immediate Purchasers Outside the United States) plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute the immediate purchaser's or end user's exclusive remedy and a fulfillment of the entire seller's liability. In no event shall the seller's liability to immediate purchaser or end user exceed the price of the specific product which gives rise to immediate purchaser's or end user's claim. All other warranties whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150, (or Price Sheet 153) and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 (OR PRICE SHEET 153) IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150 (or PRICE SHEET 153.)

Safety Information

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet as well as on labels attached to crate, packing, and equipment. Familiarize yourself with these types of messages and the importance of these various signal words:

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards that *will likely* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices that *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that *can* result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that *can* result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website **sandc.com**, or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

⚠ DANGER

Read this instruction sheet thoroughly and carefully before installing or operating your S&C SpeedNet ME Radio.

Replacement Instructions and Labels

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Overview

SpeedNet ME Radios serve as a communication end point for SCADA devices. They can connect to a SpeedNet ME Radio mesh network. They can be installed in a variety of network configurations. Plan your network in advance, and develop a logical IP addressing scheme for your particular application. Depending on your network type, several factors may influence your design:

- Point-to-point vs. end-point within a mesh
- Stand-alone network connection

When network topology has been determined, the SpeedNet ME Radios can be configured appropriately.

SpeedNet ME Radios route IP data between separate Ethernet subnets to their next hop neighbor. Data are routed between the Ethernet subnets over a common IP-based wireless network. Route information can be entered manually, or it can be handled automatically by Ad hoc On demand Distance Vector (AODV) routing protocol.

AODV is a routing protocol for mobile ad hoc networks and other wireless ad hoc networks. SpeedNet ME Radios use a proprietary AODV routing system that works dynamically to maintain message routing. It generates fewer transmissions and conserves network capacity. In the case of SpeedNet ME Radios, AODV is limited to discovering and establishing the best possible point-to-point link. SpeedNet ME Radios will not act as message relays for other nodes in the network.

Prior to implementing a SpeedNet ME Radio network, you should plan the IP addressing scheme. The use of private IP addresses is recommended when designing a SpeedNet network. The diagram shown in Figure 2 shows a sample IP address scheme for a simple three-node network using private IP addresses.

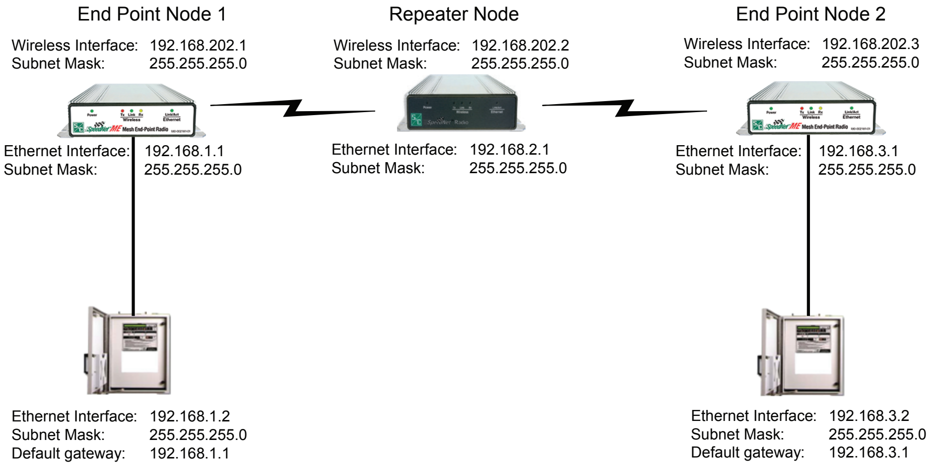

End Point Node 1
Wireless Interface: 192.168.202.1
Subnet Mask: 255.255.255.0
Ethernet Interface: 192.168.1.1
Subnet Mask: 255.255.255.0
Ethernet Interface: 192.168.1.2
Subnet Mask: 255.255.255.0
Default gateway: 192.168.1.1
Repeater Node
Wireless Interface: 192.168.202.2
Subnet Mask: 255.255.255.0
Ethernet Interface: 192.168.2.1
Subnet Mask: 255.255.255.0
End Point Node 2
Wireless Interface: 192.168.202.3
Subnet Mask: 255.255.255.0
Ethernet Interface: 192.168.3.1
Subnet Mask: 255.255.255.0
Ethernet Interface: 192.168.3.2
Subnet Mask: 255.255.255.0
Default gateway: 192.168.3.1

Figure 2. Multi-node SpeedNet network.

The SpeedNet ME Radio network in this example contains three Ethernet segments. The first segment uses the 192.168.1.0 Class C subnet, encompassing a range of addresses from 192.168.1.1 to 192.168.1.254. The second segment uses the 192.168.2.0 Class C subnet, encompassing a range of addresses from 192.168.2.1 to 192.168.2.254. The third segment uses the 192.168.3.0 Class C subnet, encompassing a range of addresses from 192.168.3.1 to 192.168.3.254.

The wireless network in the example uses the 192.168.202.0 Class C subnet. This subnet is different from the subnets used for the Ethernet segments. The wireless interface of the SpeedNet ME Radio from the End Point Node 1 is assigned an address of 192.168.202.1. The wireless interface of the SpeedNet ME Radio from the Repeater Node is assigned an address of 192.168.202.2. The wireless interface of the SpeedNet ME Radio from End Point Node 2 is assigned an address of 192.168.202.3.

In this example, each SpeedNet ME Radio host ID is 1 (as in 192.168.3.1), while the connected application device uses a host ID of 2 (as in 192.168.3.2). Following a numbering scheme such as this will make it easier to keep track of which IP addresses are assigned to each device.

NOTE: All SpeedNet ME Radios, regardless of their role within the network, must use unique IP addresses for their Ethernet and wireless interfaces. All of the SpeedNet ME Radios on the same mesh should have wireless IP addresses in the same subnet. All the SpeedNet ME Radios on the same mesh should have different Ethernet subnets.

Refer to S&C Instruction Sheet 1074-510 for additional information about network planning.

SpeedNet Security Information

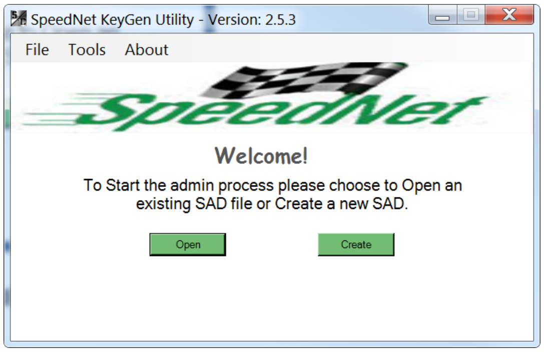
SpeedNet ME Radios use a comprehensive security suite to prevent unauthorized network access and to protect sensitive data. The security features include user access controls, network data encryption, node access revocation, and anti-spoofing measures. These security features should be incorporated as part of a complete security policy, which should include application-level user authentication and stringent password policies. For example, a policy requiring user password changes at a defined interval.

KeyGen Utility

Administrative control of SpeedNet ME Radio security configuration is provided by the SpeedNet KeyGen Utility, an application that generates security keys, updates user access and radio revocation lists, and saves updated security profiles within a Security Association Database (SAD). The KeyGen Utility also allows generation of a common configuration file to load into multiple radios, easing configuration overhead.

Creating a Security Association Database

STEP 1. Launch the KeyGen application. The main window will open. See Figure 3.



Welcome!

To Start the admin process please choose to Open an existing SAD file or Create a new SAD.

Figure 3. KeyGen application launch window.

STEP 2. Click the **Create** button to create a Security Association Database (SAD). The SAD dialog box will open. See Figure 4.

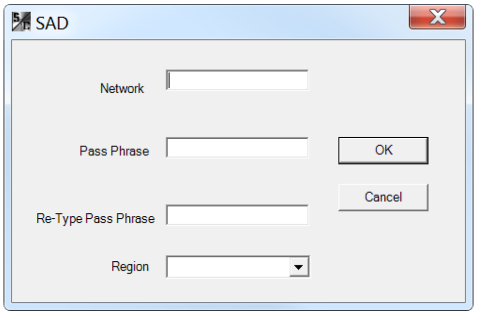


Figure 4. Security Association Database dialog box.

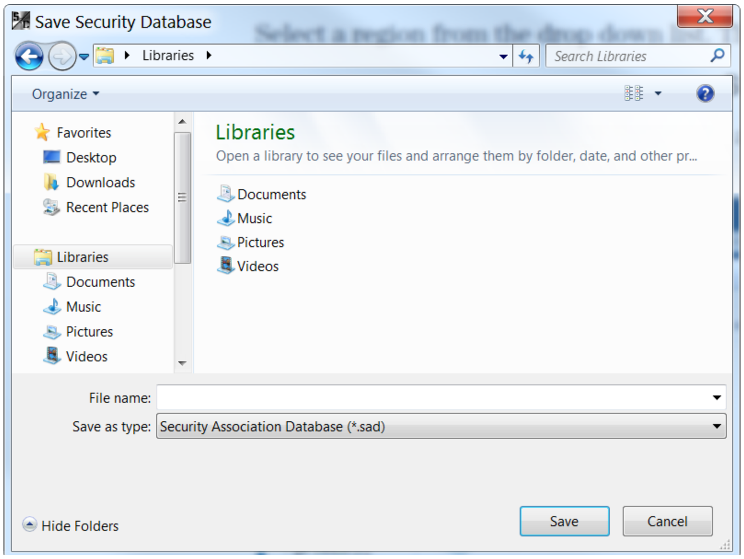
STEP 3. Enter a network name that is 4 to 64 characters in length. Use the Tab key on your keyboard to proceed to the next field.

STEP 4. Enter a pass phrase that is 8 to 64 characters in length. Use the Tab key on your keyboard to proceed to the next field.

STEP 5. Retype the pass phrase to confirm the previously entered pass phrase.

STEP 6. Select a region from the drop down list. Then click the OK button.

STEP 7. Save the Security Association Database file as a .sad file. See Figure 5. The User Management window will open. See Figure 6.



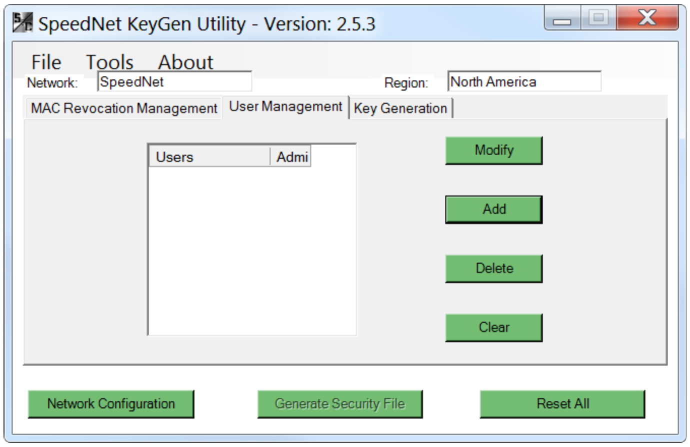
Save as type: Security Association Database (*.sad)

Figure 5. Security Association Database save dialog.

NOTICE

The Security Association Database, stored in a .sad file, is encrypted and protected by the network name and pass phrase combination specified at the creation of the database. Loss of the network name and pass phrase combination means the Security Association Database becomes unusable. This may imply that a new database would need to be created and all radios reset to factory settings and re-programmed with security files derived from a new database. As such, it is vital to keep track of the network name and pass phrase credentials associated with the database.

User Management Window



Network: SpeedNet

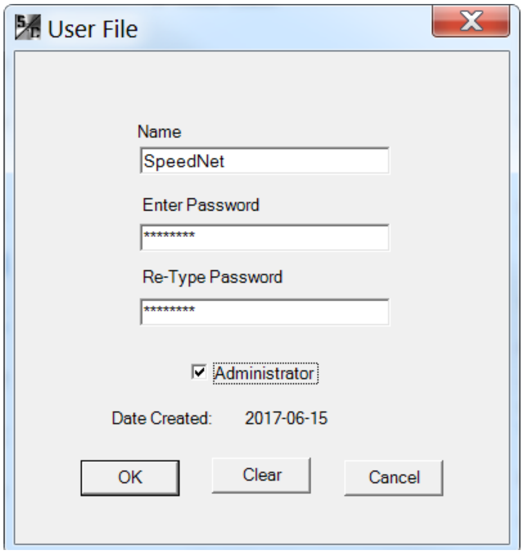
Region: North America

Figure 6. KeyGen User Management window.

The **User Management** window allows the administrator to add up to six users to the system. Any users with a checkmark entered in the Admin column will have full security access. Users created without this checkmark entered have limited, read-oriented privileges when accessing the radios. Admin-level access is required to configure the radios.

Adding a User

STEP 1. Click the **Add** button on the **User Management** window. The User File dialog box will open. See Figure 7.



Name: SpeedNet

Enter Password: ********

Re-Type Password: ********

☑ Administrator

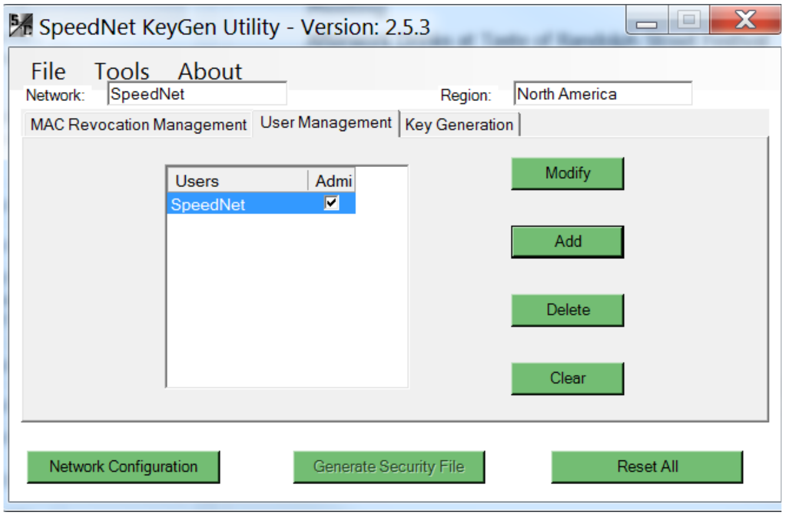
Date Created: 2017-06-15

Figure 7. KeyGen User File dialog box.

STEP 2. Enter a username that is 8 to 16 characters in length. Valid case-sensitive characters are a-z, A-Z, and 0-9. Use the **Tab** key on your keyboard to proceed to the next field.

STEP 3. Enter a password that is 8 to 16 characters in length. Valid case-sensitive characters are a-z, A-Z, and 0-9. Use the **Tab** key on your keyboard to proceed to the next field.

STEP 4. Retype the password to confirm the previously entered password. Click to check the **Administrator** checkbox if the user will be an administrator. Click the **OK** button. See Figure 7. The newly added user will appear in the KeyGen **User Management** window. See Figure 8.



Network: SpeedNet

Region: North America

Users	Admi
SpeedNet	☑

Figure 8. KeyGen User added.

Deleting a User

To delete a user from the users list, highlight that user's name. Then, click the **Delete** button. See Figure 9.

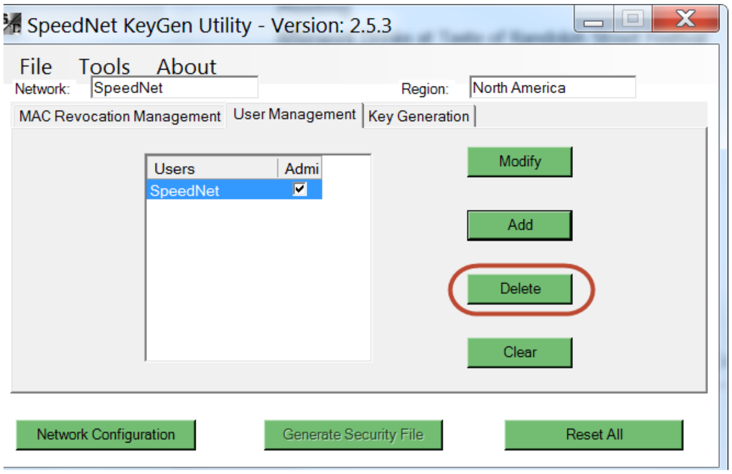
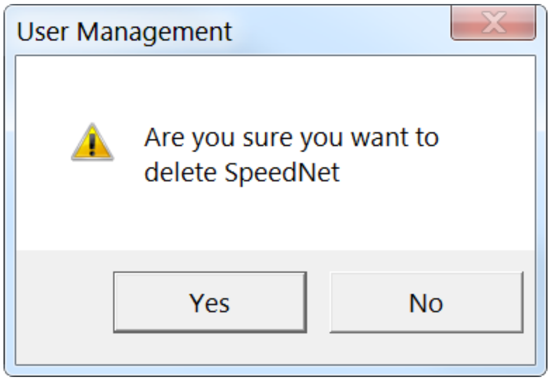


Figure 9. KeyGen User Management window Delete button.

The User Management dialog box will open. See Figure 10.


User Management

Are you sure you want to delete SpeedNet

Figure 10. User Management dialog box.

Click the **Yes** button to delete the selected user from the user list.

Modifying a User

To modify a user name and/or password, first select the user from the User Management list. Then, click the **Modify** button. See Figure 11.

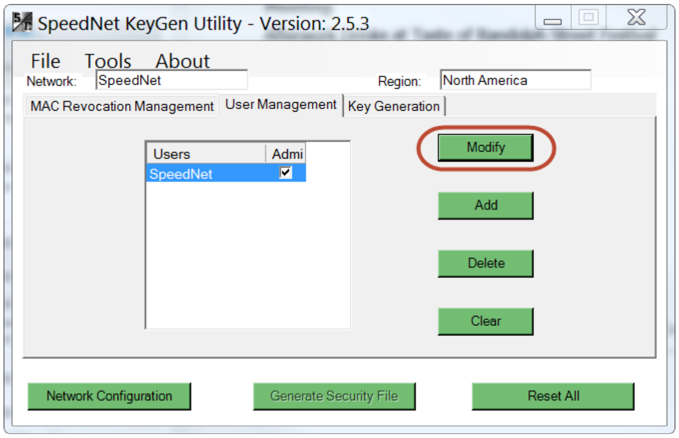
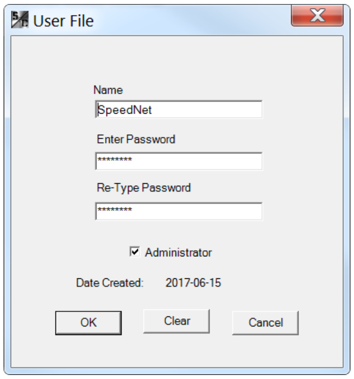


Figure 11. KeyGen User Management window.

The User File dialog box will open and includes user details. See Figure 12.



User File

Name: SpeedNet

Enter Password: ********

Re-Type Password: ********

☑ Administrator

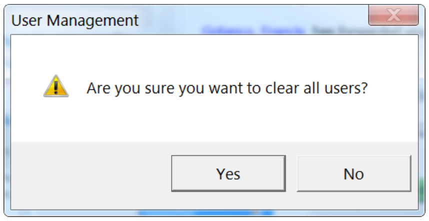
Date Created: 2017-06-15

Figure 12. KegGen User File dialog box.

Clearing All Users

To clear all users, click the **Clear** button on the **User Management** window. The User Management confirmation dialog box will be displayed. See Figure 13.

Make the appropriate changes. Then, click the **OK** button.



User Management

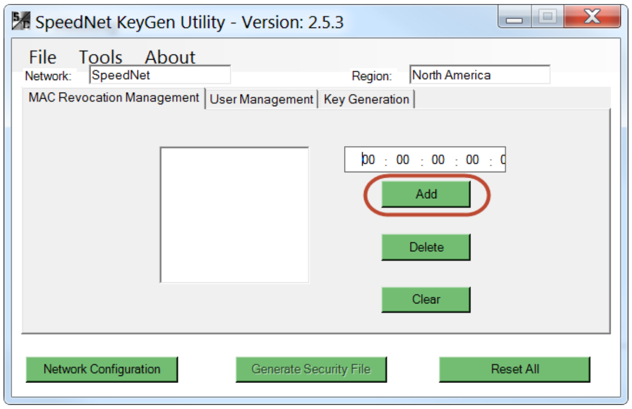
Are you sure you want to clear all users?

Figure 13. User Management dialog box

Click the **Yes** button to delete all users from the User Management list. Further management of the radios will require at least one admin account and a person possessing that account's login credentials (user name and password).

Adding a MAC Address to the Revocation List

The **Mac Revocation Management** window is used to update the revocation list for the Media Access Control (MAC) address filter. See Figure 14. The MAC address is factory-programmed into SpeedNet ME Radios. Thus, revoking a MAC address is a means to exclude radios. For example, if a SpeedNet ME Radio were stolen, then it would be wise to exclude that radio's MAC address as one means to prevent the radio from joining a mesh and breaching SpeedNet ME Radio network security.



SpeedNet KeyGen Utility - Version: 2.5.3

Network: SpeedNet

Region: North America

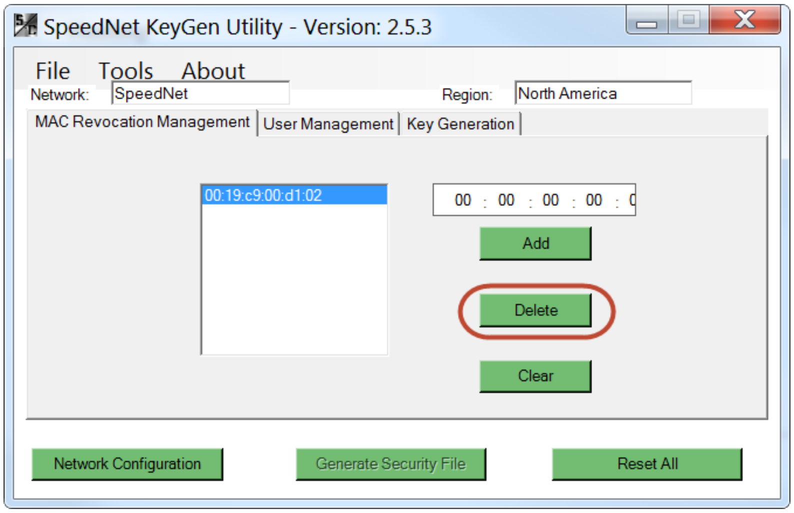
00 : 00 : 00 : 00 : 0

Figure 14. Mac Revocation Management window.

To add a new MAC address to the revocation list, switch to the **MAC Revocation Management** window. Enter the MAC address of the SpeedNet ME Radio to be excluded from communicating with the radio being configured. The valid hexadecimal characters are a-f and 0-9. Click the **Add** button.

Deleting a MAC Address from the Revocation List

To delete a MAC address from the revocation list, highlight the address on the **Mac Revocation Management** window. Then, click the **Delete** button. See Figure 15.



Network: SpeedNet

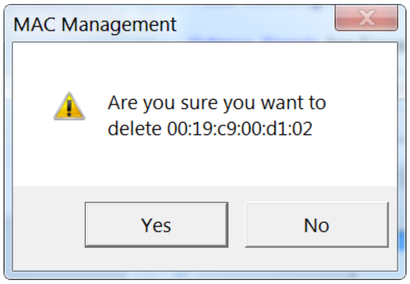
Region: North America

00:19:c9:00:d1:02

00 : 00 : 00 : 00 : 0

Figure 15. Mac Revocation Management window.

The Mac Management dialog box will be displayed. See Figure 16.



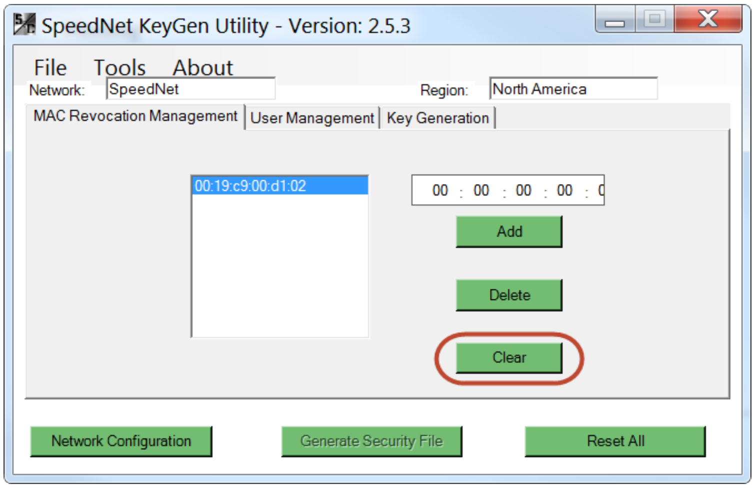
Are you sure you want to delete 00:19:c9:00:d1:02

Figure 16. Mac Management dialog box.

Click the **Yes** button to delete the MAC address.

Clearing the Revocation List

To clear all addresses, click the **Clear** button on the **Mac Revocation Management** window. See Figure 17.



Network: SpeedNet

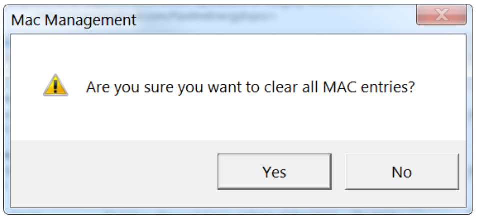
Region: North America

00:19:c9:00:d1:02

00 : 00 : 00 : 00 : 0

Figure 17. Mac Revocation Management window.

The Mac Management dialog box will open. See Figure 18.



Mac Management

Are you sure you want to clear all MAC entries?

Figure 18. Clear all MAC entries dialog box.

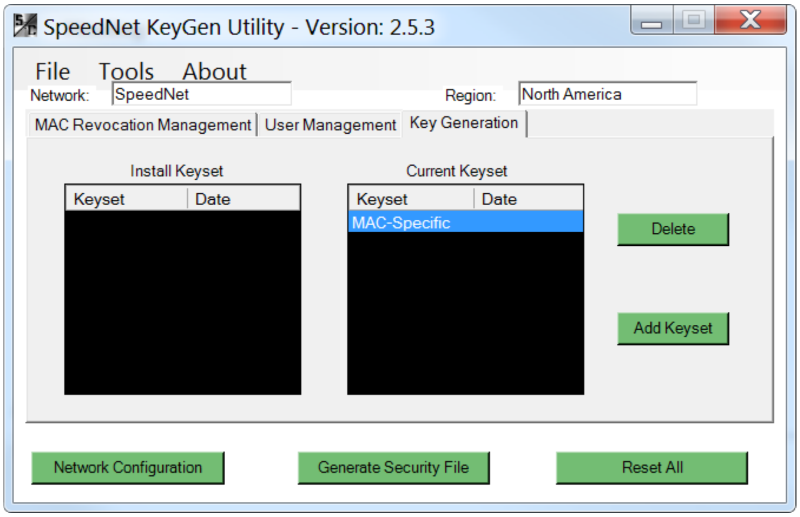
Click the **Yes** button to clear the Mac Revocation List.

Key Generation

The keyset is a common credential that all radios use when optionally encrypting UDP/IP and TCP/IP data over a SpeedNet network. Keysets are thus used when AES 128-bit encryption is enabled (SpeedNet Client tools' **Security > Encryption** tab using the Enable Encryption check box). Keysets must be installed on all participating radios to be available for use; it is not sufficient to merely generate them in the KeyGen tool. The KeyGen tool generates keysets randomly without user input; the user does not provide seeds or other data. The **Key Generation** window is used to update keysets. For a network or security configuration to be applied to the radio, the configuration file must be encrypted and authenticated with a current keyset. Up to six keysets can be loaded into a radio at a given time. At most one keyset is active at any given time. Radios can "roll forward" to new keysets upon prompting by users or when data of a newer keyset is received from another radio. Radios do not "roll backward" to previous keysets.

Adding a Keyset

To add a new keyset, open the **Key Generation** tab and click the **Add Keyset** button. See Figure 19.



SpeedNet KeyGen Utility - Version: 2.5.3

Network: SpeedNet

Region: North America

Install Keyset

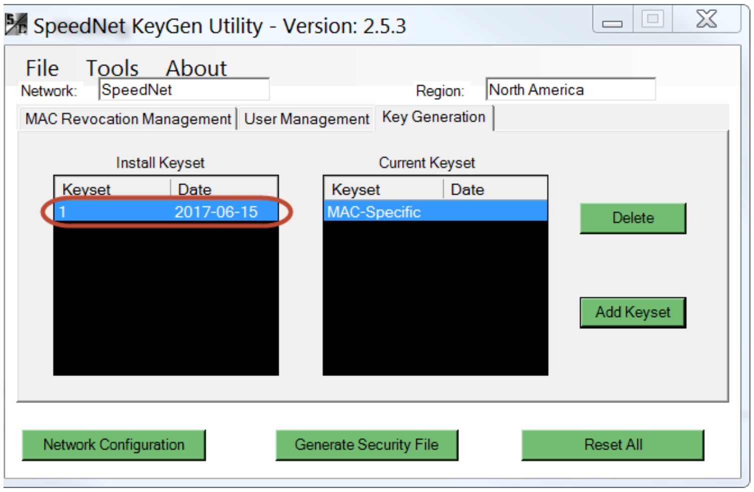
Keyset	Date

Current Keyset

Keyset	Date
MAC-Specific	

Figure 19. Key Generation window.

Each time the **Add Keyset** button is clicked, the next consecutive keyset number will be automatically added to the Install Keyset list as shown in Figure 20 on page 14.



Network: SpeedNet

Region: North America

Install Keyset

Keyset	Date
1	2017-06-15

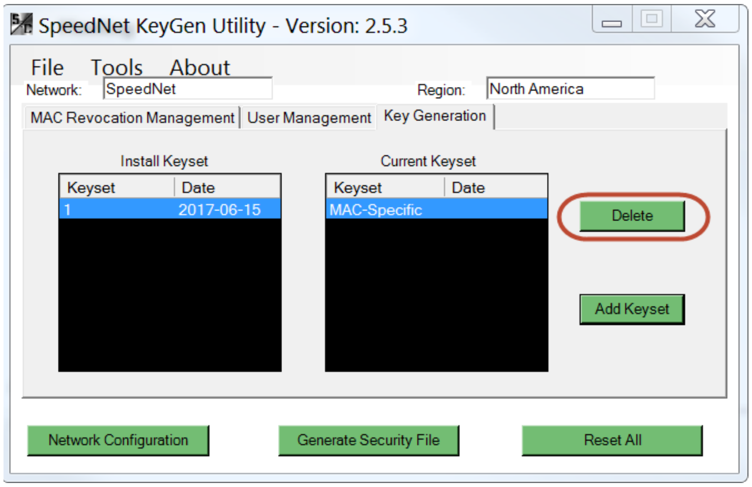
Current Keyset

Keyset	Date
MAC-Specific	

Figure 20. New keyset number available on the Install Keyset list.

Deleting a Keyset

To delete a keyset, open the **Key Generation** tab and highlight the keyset. Then, click the **Delete** button. See Figure 21.



Network: SpeedNet

Region: North America

Install Keyset

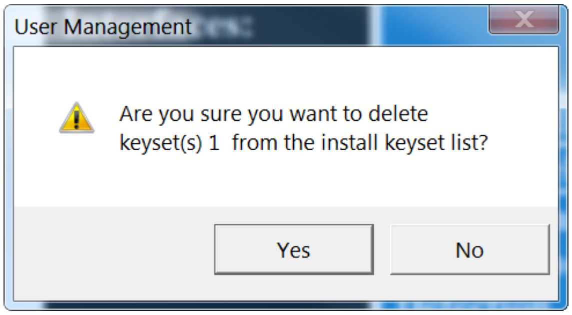
Keyset	Date
1	2017-06-15

Current Keyset

Keyset	Date
MAC-Specific	

Figure 21. Key Generation window.

The confirmation dialog will open. See Figure 22. Click the **Yes** button to delete the keyset.



Are you sure you want to delete keyset(s) 1 from the install keyset list?

Figure 22. Delete keyset(s) confirmation dialog box.

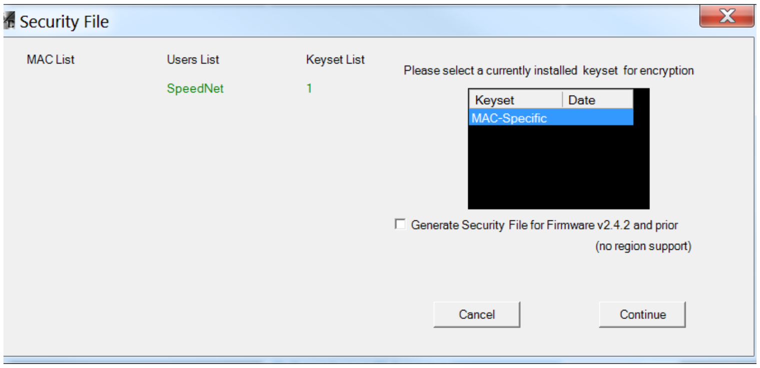
NOTICE

The current keyset list will not be updated until a new security file is generated. Security configuration files can still be encrypted to a recently deleted keyset because the old keyset is still stored in the current keyset list. If, after deleting a keyset, you add a keyset with the same tag as the deleted keyset, the keyset in the Install Keyset list will contain a different key than the keyset with the same tag in the current keyset list. Care must be taken to avoid this since all radios must have the same keyset installed in order to communicate UDP/IP and TCP/IP data. ICMP data used for pings is not encrypted in the SpeedNet Radio, so pings may work even in the case of mismatched keysets on radios with encryption enabled. SpeedNet Client Tool logins use SNMPv3, which is transported over UDP/IP, so logins will not work over wireless links in the case of mismatched keysets on radios with encryption enabled.

Generating a Security File

STEP 1. Select up to six keysets from the installed Keyset list.

STEP 2. Click the **Generate Security File** button on the **Key Generation** window. The **Security File** window will open with all selections listed. See Figure 23.

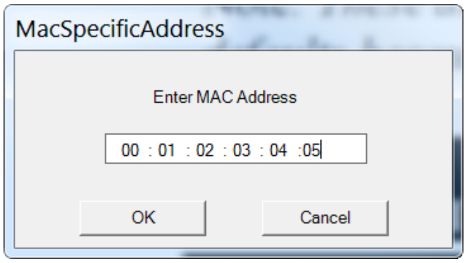

Security File
MAC List
Users List
Keyset List
Please select a currently installed keyset for encryption
Keyset
Date
☐ Generate Security File for Firmware v2.4.2 and prior
(no region support)
Cancel
Continue

Users List: SpeedNet; Keyset List: 1

Keyset: MAC-Specific

Figure 23. Security File window.

STEP 3. Verify all the data to be included and select a current keyset to encrypt the file. Then, click the **Continue** button. If a MAC specific key is used to encrypt the file the following dialog box will be displayed. See Figure 24.

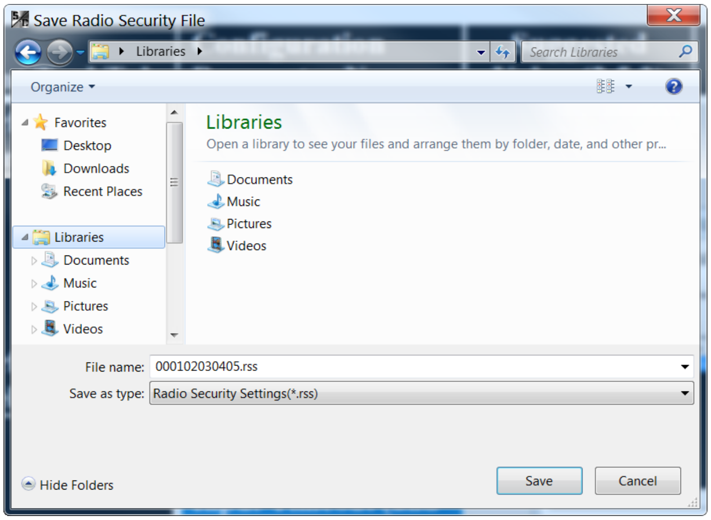


00 : 01 : 02 : 03 : 04 :05

Figure 24. Enter Mac Specific Address dialog box.

STEP 4. Enter the MAC address of the radio for which this file is intended and then click the **OK** button.

STEP 5. Enter a file name for the security file. See Figure 25 on page 16. Then, click the **Save** button. It's good practice to use the MAC address of the target radio as the filename or part of the filename for the security file.



Libraries

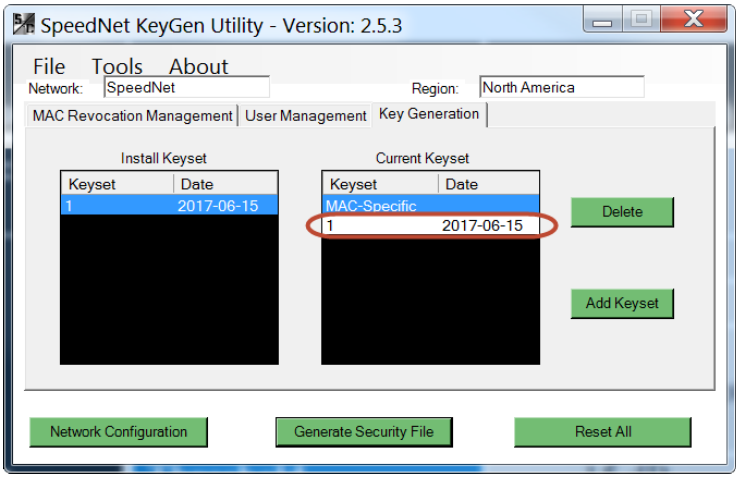
Open a library to see your files and arrange them by folder, date, and other pr...

File name: 000102030405.rss

Save as type: Radio Security Settings(*.rss)

Figure 25. Save Radio Security File dialog box.

After the security file is generated, the current keyset list will be updated with all the installed keysets, as shown in Figure 26.



Network: SpeedNet

Region: North America

Install Keyset

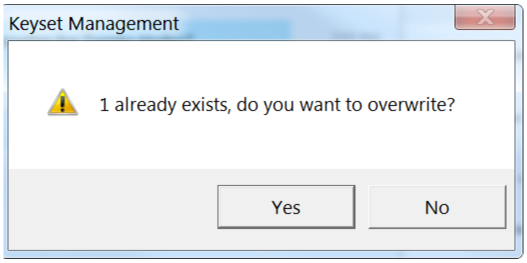
Keyset	Date
1	2017-06-15

Current Keyset

Keyset	Date
MAC-Specific	
1	2017-06-15

Figure 26. Updated Current Keyset list in the dialog box.

The maximum number of keyset tags allowed is 63. If you attempt to add another keyset after 63 keyset tags have been entered, the dialog box shown in Figure 27 will be displayed requesting permission to overwrite an existing keyset.

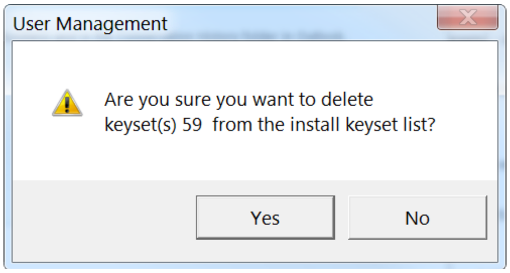


1 already exists, do you want to overwrite?

Figure 27. Permission to overwrite an existing keyset.

STEP 6. Click the **Yes** button to overwrite keyset 1.

To delete a specific keyset, highlight the keyset (in this example it is keyset 59). See Figure 28 on page 17. Then, click the **Delete** button. The configuration dialog box shown in Figure 28 on page 17 will be displayed.



User Management

Are you sure you want to delete keyset(s) 59 from the install keyset list?

Figure 28. Permission to delete a keyset.

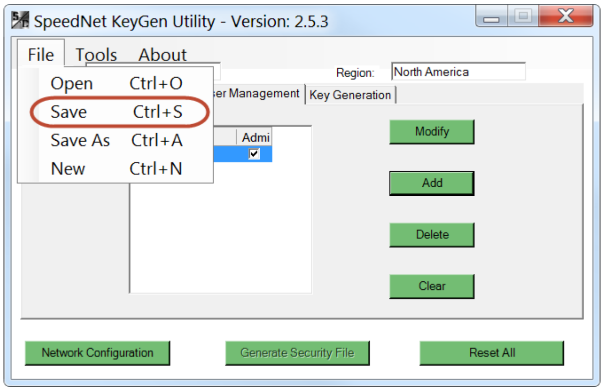
STEP 7. Click the **Yes** button to delete keyset 59.

The deleted keyset will not be deleted from the Current Keyset List until a new security file is generated.

Saving a Security Association Database

Follow these steps to save a Security Association Database:

STEP 1. Open the **File** menu in the upper-left corner of the SpeedNet KeyGen Utility window, and scroll down and select the **Save** button. See Figure 29.

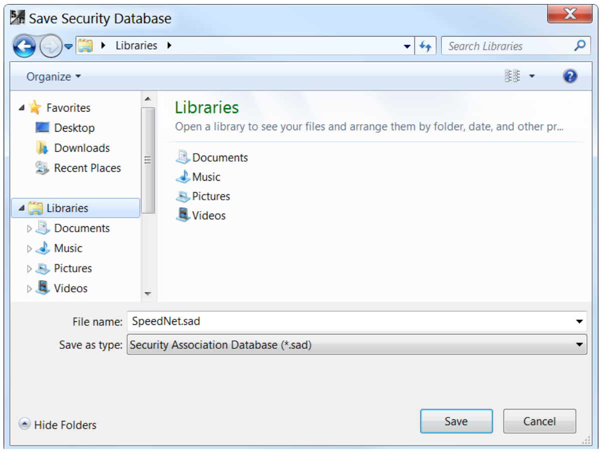


SpeedNet KeyGen Utility - Version: 2.5.3

Region: North America

Figure 29. SpeedNet KeyGen Utility window save SAD.

STEP 2. The Save Security Database window will open. See Figure 30. Enter a file name for the database, and click the **Save** button.



Save Security Database

Libraries

Open a library to see your files and arrange them by folder, date, and other pr...

File name: SpeedNet.sad

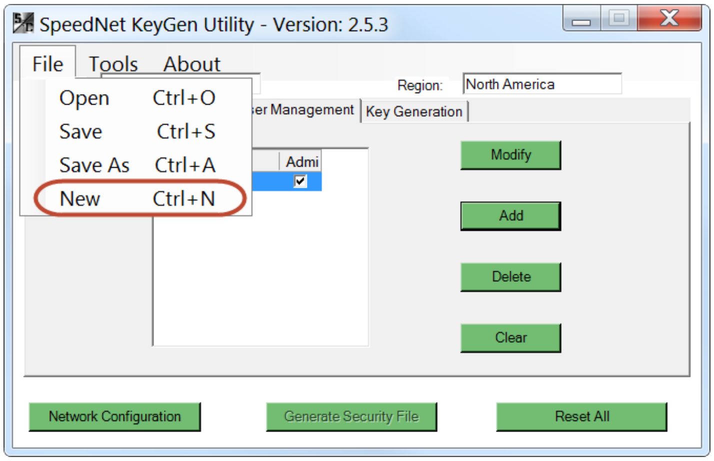
Save as type: Security Association Database (*.sad)

Figure 30. Save Security Database window.

The database will be encrypted with the pass phrase that was provided when the SAD was created. It is important to retain the pass phrase and network name to preserve access to the security information for the radios.

Creating Another Security Association Database

Open the **File** menu in the upper-left corner of the **SpeedNet KeyGen Utility** window. Scroll down and select the **New** button. See Figure 31.



Region: North America

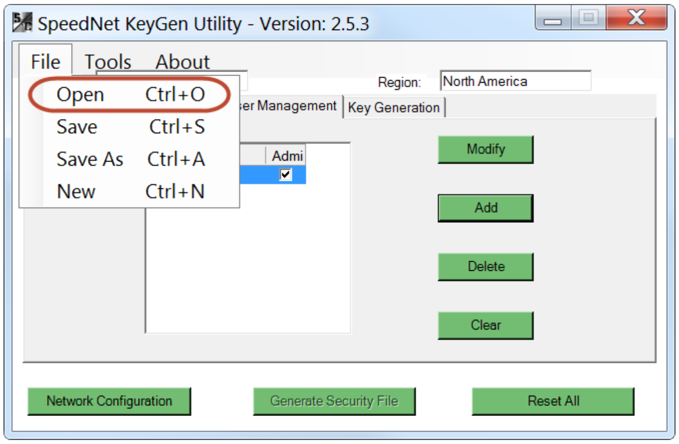
Figure 31. SpeedNet KeyGen Utility window new SAD.

A new **SAD** window will open with all entries cleared.

Opening a Security Association Database

Follow these steps to open a Security Association Database:

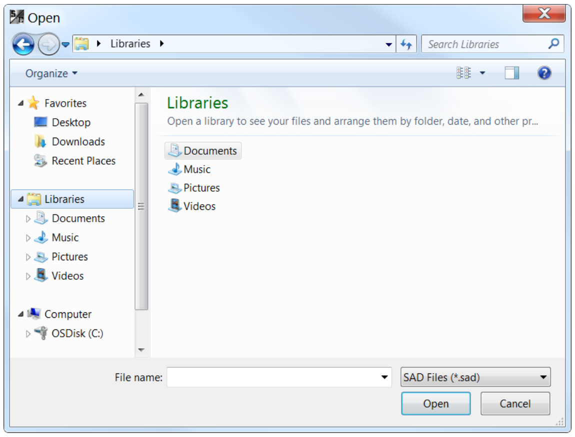
STEP 1. Open the **File** menu in the upper-left corner of the **SpeedNet KeyGen Utility** window. Scroll down and select the **Open** button. See Figure 32.



Region: North America

Figure 32. SpeedNet KeyGen Utility window open SAD.

STEP 2. The **Open Security Database** window will open. See Figure 33 on page 19. Enter the file name of the SAD database, and click the **Open** button.



SAD Files (*.sad)

Figure 33. Open Security Database window.

The SAD dialog box will open. See Figure 34.

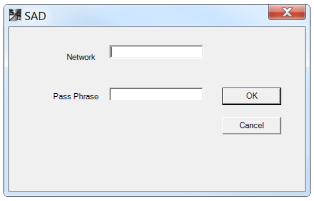


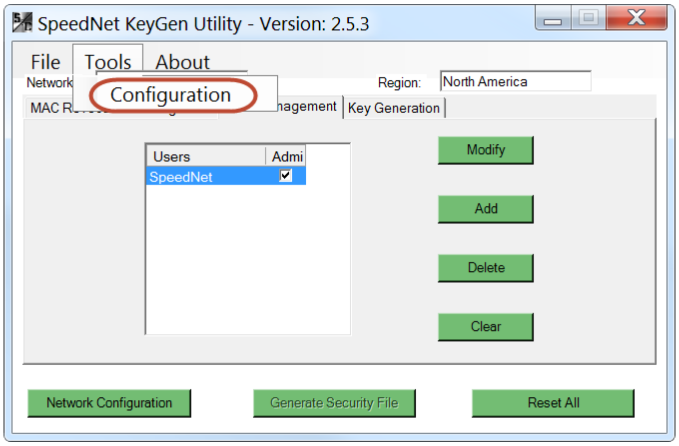
Figure 34. SAD dialog box.

STEP 3. Enter the network name and pass phrase, then click on the **OK** button.

NOTICE

The SAD is encrypted with a key derived from the pass phrase. If you forget the pass phrase used when you created the SAD, data in the SAD will not be accessible and will be lost. There is no back door or other key recovery method. To update secured radios without a valid SAD, you will first need to return them to their factory default configuration.

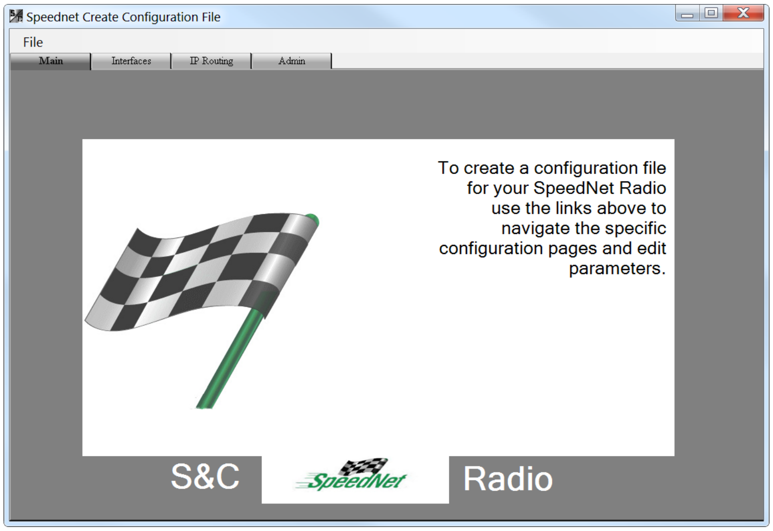
Once the SAD file is open, the configuration can be edited by opening the **Tools** menu at the top of the window. See Figure 35. Then, select the **Configuration** option, or simply click on the **Network Configuration** button located at the bottom of the **SpeedNet KeyGen Utility** window. The SpeedNet KeyGen Utility will open the **Main** window shown in Figure 36 on page 20.


SpeedNet KeyGen Utility - Version: 2.5.3

Region: North America

Users	Admi
SpeedNet	☑

Figure 35. SpeedNet KeyGen Utility—Network Configuration button.

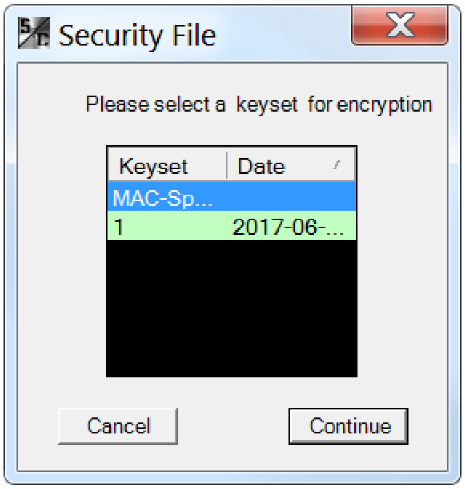


To create a configuration file for your SpeedNet Radio use the links above to navigate the specific configuration pages and edit parameters.

Figure 36. SpeedNet Network Configuration Main Window.

The **File** menu allows the user to open an existing network configuration, Save the current working network configuration, Save As to edit the file name before saving, and Reset to Defaults to restore the current working network configuration to factory default values.

When opening a network configuration file, the window shown in Figure 37 will open and list all currently installed keysets. Select the keyset that was used to encrypt the file. Click on the **Continue** button. The data from the file will be displayed in the configuration dialog. When saving a file, the same window will prompt you for the keyset to use to encrypt the file.

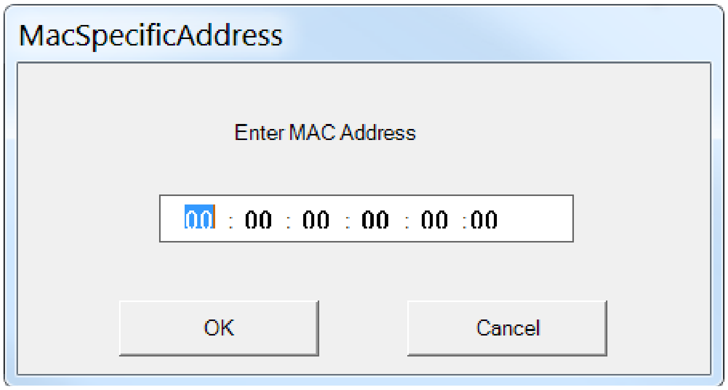


Please select a keyset for encryption

Keyset	Date
MAC-Sp...	
1	2017-06-...

Figure 37. Configuration File Keyset selection window.

The dialog shown in Figure 38 will open when a MAC-specific key is used to encrypt or decrypt the configuration file. A network configuration file should only be encrypted with a MAC address once when the radio is initially deployed. If the radio has already been deployed, then a different encryption/decryption key should be used.



MacSpecificAddress

Enter MAC Address

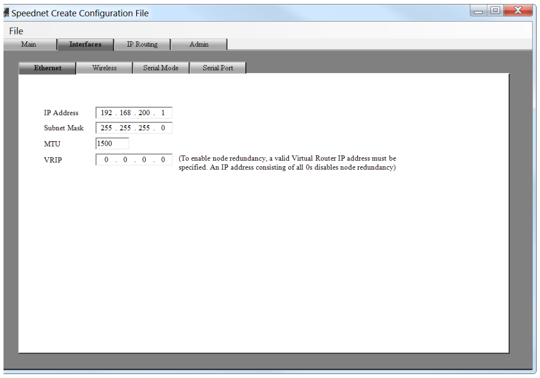
00 : 00 : 00 : 00 : 00 :00

Figure 38. Configuration File MAC Address specification for MAC-specific encryption/ decryption.

Configuration files are always encrypted to prevent tampering with radio configuration and to prevent snooping radio configurations during configuration uploads. When a keyset is used to encrypt/decrypt the configuration, the target radio must have that same keyset loaded to successfully upload and implement the network configuration.

Click on any of the tabs shown in Figure 36 on page 20 to setup the network configuration for the area listed in that tab. Network configuration functions parallel the corresponding tabs in the SpeedNet Client Tool, but instead of applying to the radio the client is connected to, the settings developed in the network configuration are saved in a file that can be uploaded and applied to the corresponding radio by using the client tool's **Set Network Configuration** function described in the "Security Window, Encryption Tab" section on page 41.

The network configuration areas are described below.



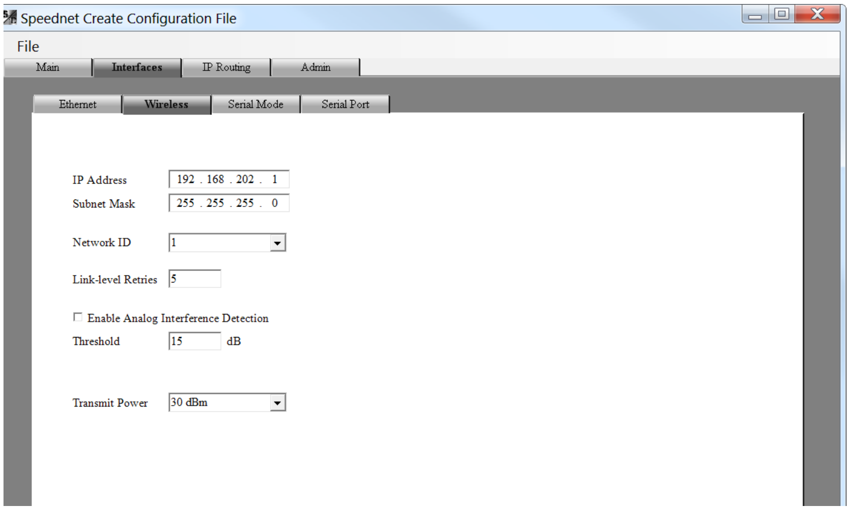
Speednet Create Configuration File

IP Address 192 . 168 . 200 . 1
Subnet Mask 255 . 255 . 255 . 0
MTU 1500
VRIP 0 . 0 . 0 . 0 (To enable node redundancy, a valid Virtual Router IP address must be specified. An IP address consisting of all 0s disables node redundancy)

Figure 39. Network Configuration of Ethernet Interface.

Figure 39 shows the **Network Configuration** window for configuring the Ethernet interface. The **IP Address**, **Subnet Mask,** and **MTU** settings function the same as in the corresponding **SpeedNet Client** window as described in the "Interfaces Window, Ethernet Tab" section starting on page 29. There is no **Apply** button on this window since application to a radio is deferred until uploaded using the SpeedNet Client tool.

Please note that on a given SpeedNet ME Radio mesh, the configurations of all the Ethernet interfaces should differ such that there is no overlap between the Ethernet port subnets or between the Ethernet port subnets and the wireless subnet.



IP Address 192 . 168 . 202 . 1

Subnet Mask 255 . 255 . 255 . 0

Network ID 1

Link-level Retries 5

□ Enable Analog Interference Detection

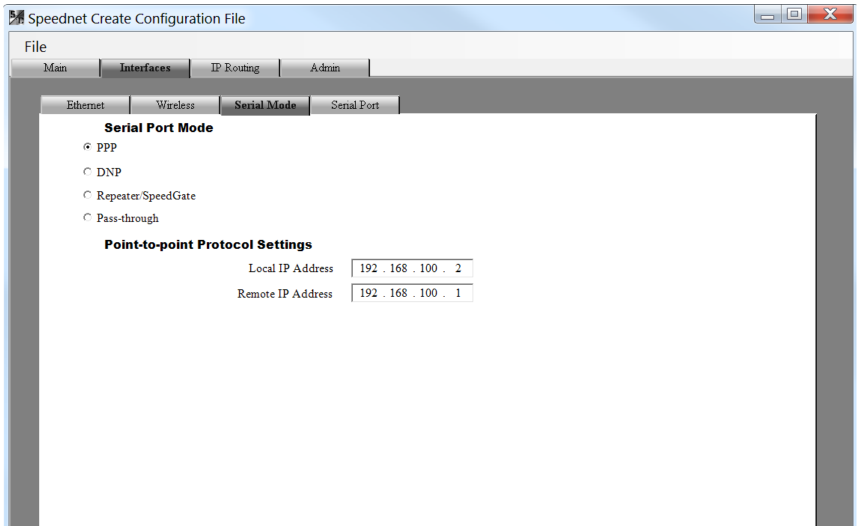
Threshold 15 dB

Transmit Power 30 dBm

Figure 40. Network Configuration of the Wireless Interface.

Figure 40 shows the network configuration window for the Wireless Interface. The **IP Address**, **Subnet Mask**, **Network ID**, **Link-level Retries**, **Analog Interference Detection**, and Threshold and Transmit Power settings function the same as in the corresponding SpeedNet Client window as described in the "Interfaces Window, Wireless Tab" section starting on page 30. There is no **Apply** button on this window because application to a radio is deferred until uploaded using the SpeedNet Client tool.

Please note that on a given SpeedNet ME Radio mesh, all the wireless interfaces of the radios should be on the same subnet but should use different individual addresses on that subnet.



Serial Port Mode

● PPP
○ DNP
○ Repeater/SpeedGate
○ Pass-through

Point-to-point Protocol Settings

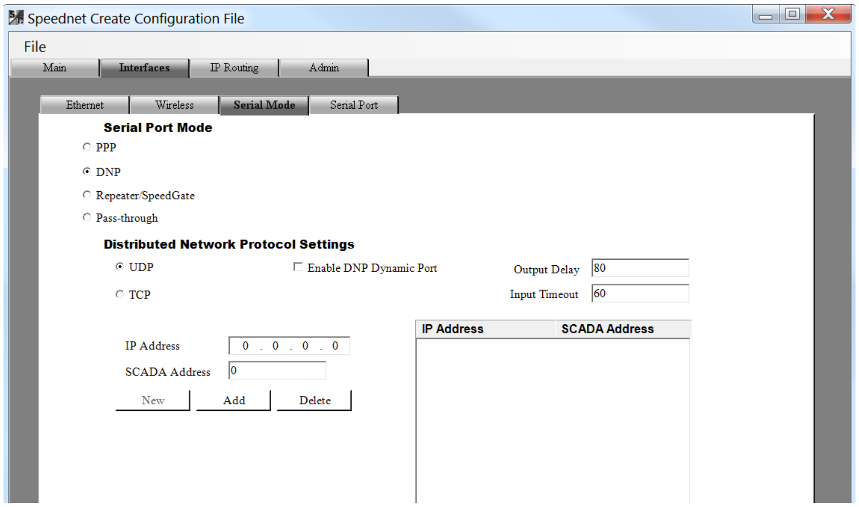
Local IP Address 192 . 168 . 100 . 2
Remote IP Address 192 . 168 . 100 . 1

Figure 41. Network Configuration of Serial Port's PPP Mode Settings.

Three serial port modes are available as described in the "Interfaces Window, Serial Mode Tab" section on page 32.

The Point-to-Point Protocol (*PPP*) provides a standard way to establish a network connection over a serial link. The radio runs PPP over the serial link at a baud rate of 115.2 Kbps allowing the user to configure the radio in the same way as the standard method over the Ethernet port.

Figure 41 shows the *Point-to-Point Protocol Settings*. These settings are described in the same "Interfaces Window, Serial Mode Tab" section on page 32. There is no **Apply** button on this window because application to a radio is deferred until uploaded using the SpeedNet Client tool.



Serial Port Mode

○ PPP
● DNP
○ Repeater/SpeedGate
○ Pass-through

Distributed Network Protocol Settings

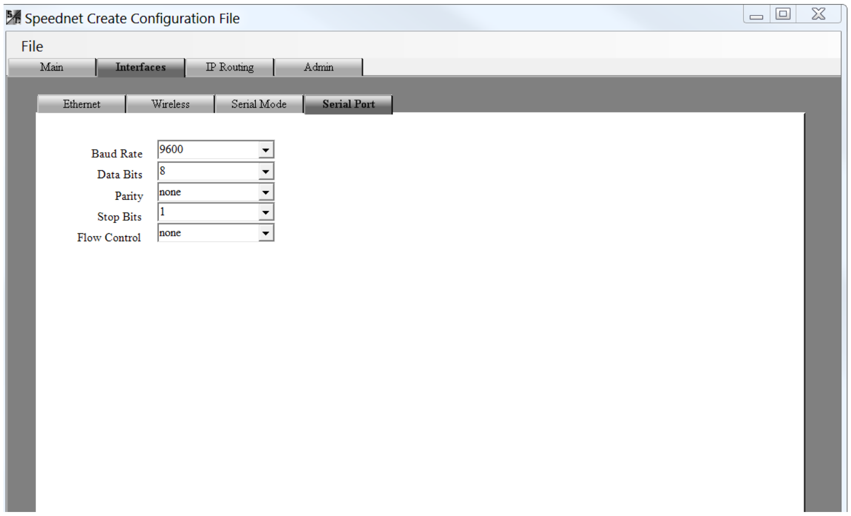
● UDP
○ TCP
□ Enable DNP Dynamic Port
Output Delay 80
Input Timeout 60

IP Address 0 . 0 . 0 . 0
SCADA Address 0

IP Address	SCADA Address

Figure 42. Network Configuration of Serial Port's DNP Mode Settings.

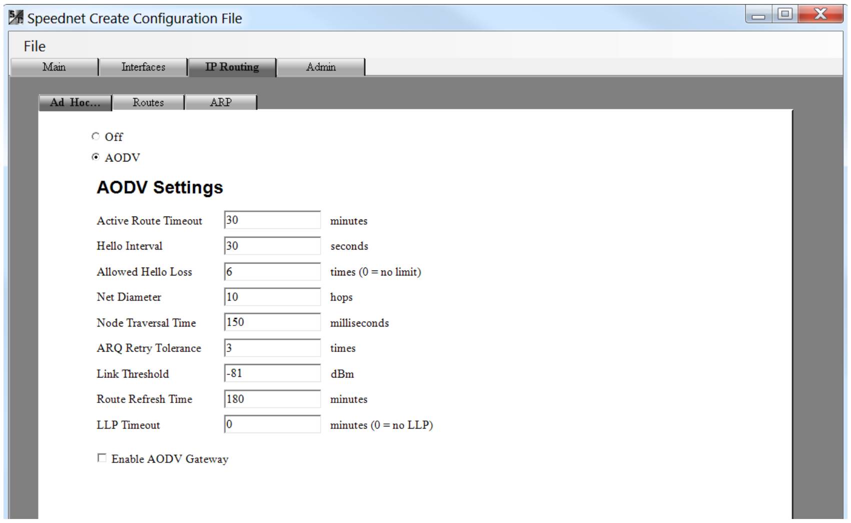
Figure 42 shows network configuration of the Distributed Network Protocol Settings. These settings correspond to those in the SpeedNet Client tool described in the "DNP Serial Mode" section on page 33. The **Repeater/SpeedGate Mode** settings should not be used with the SpeedNet ME because that functionality is not supported on the ME platform. There is no **Apply** button on this window because application to a radio is deferred until uploaded using the SpeedNet Client tool.



Baud Rate 9600
Data Bits 8
Parity none
Stop Bits 1
Flow Control none

Figure 43. Network Configuration of Serial Port's Settings.

Figure 43 shows the **Serial Port** settings. These settings correspond to those in the SpeedNet Client Tool described in the "Interfaces Window, Serial Port Tab" section on page 34. There is no **Apply** button on this window since application to a radio is deferred until uploaded using the SpeedNet Client tool.



○ Off
● AODV

AODV Settings

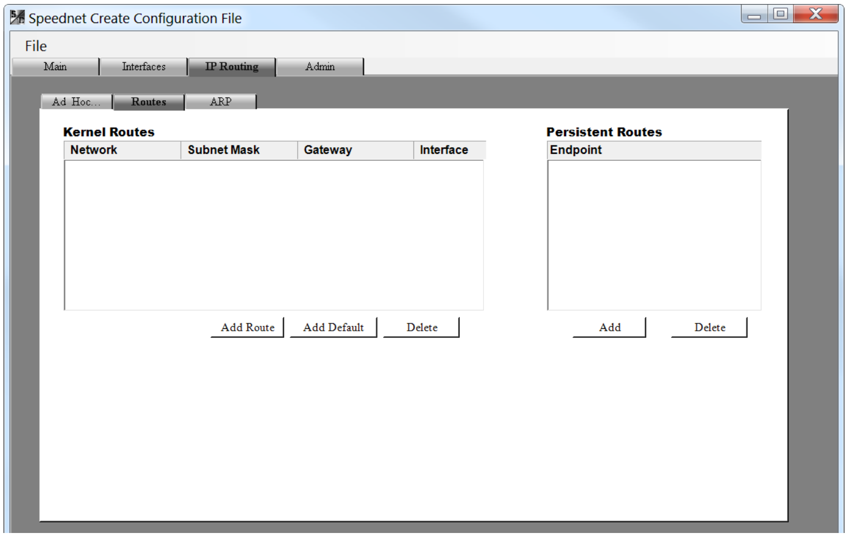
Active Route Timeout 30 minutes
Hello Interval 30 seconds
Allowed Hello Loss 6 times (0 = no limit)
Net Diameter 10 hops
Node Traversal Time 150 milliseconds
ARQ Retry Tolerance 3 times
Link Threshold -81 dBm
Route Refresh Time 180 minutes
LLP Timeout 0 minutes (0 = no LLP)

☐ Enable AODV Gateway

Figure 44. Network Configuration of AODV Settings.

Figure 44 shows configuration of the AODV Settings. These settings correspond to those in the SpeedNet Client Tool described in the "IP Routing Window, Ad Hoc Routing Tab" section on page 35. There is no **Apply** button on this window because application to a radio is deferred until uploaded using the SpeedNet Client tool.

The Enable AODV Gateway checkbox should not be used with the SpeedNet ME because that functionality is not supported on the ME platform.



Kernel Routes

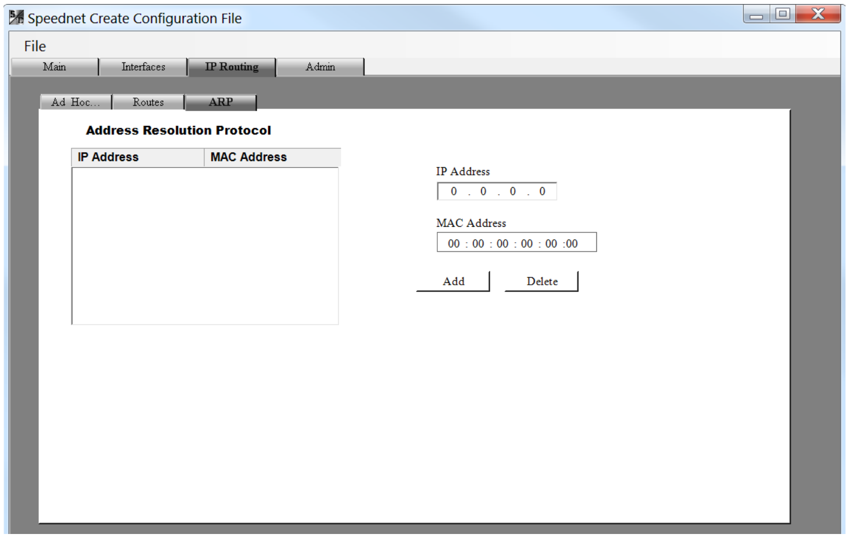
Network	Subnet Mask	Gateway	Interface

Persistent Routes

Endpoint

Figure 45. Network Configuration of Routes.

Figure 45 shows network configuration of Routes. These settings correspond to those in the SpeedNet Client Tool described in the “IP Routing Window, Routes Tab” section on page 38.



Address Resolution Protocol

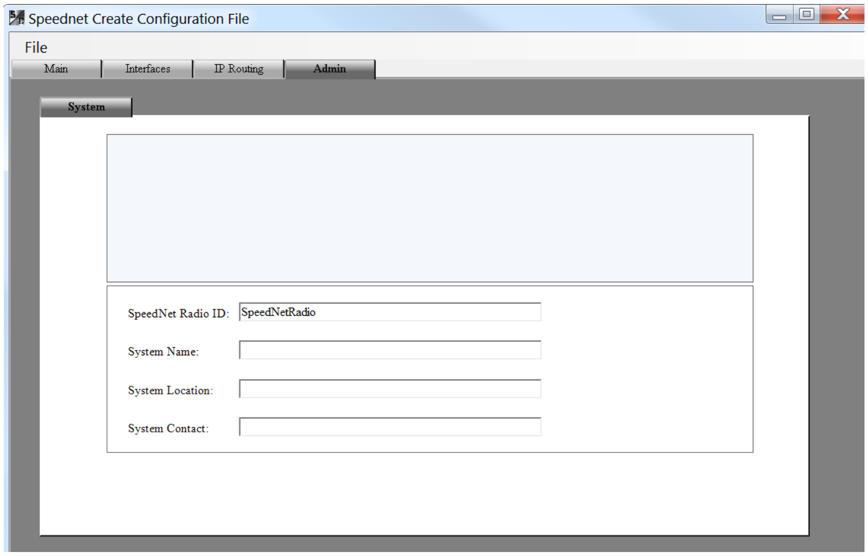
IP Address	MAC Address

IP Address: 0 . 0 . 0 . 0

MAC Address: 00 : 00 : 00 : 00 : 00 :00

Figure 46. Network Configuration of Address Resolution Protocol.

Figure 46 shows the network configuration of Address Resolution Protocol (ARP). These settings correspond to those in the SpeedNet Client Tool described in the “IP Routing Window, ARP Tab” section on page 39.



SpeedNet Radio ID: SpeedNetRadio

System Name:

System Location:

System Contact:

Figure 47. Network Configuration of System Information.

Figure 47 shows the network configuration of System information. These settings correspond to those in the SpeedNet Client Tool in the “Admin Window, System Tab” section on page 43.

Overview

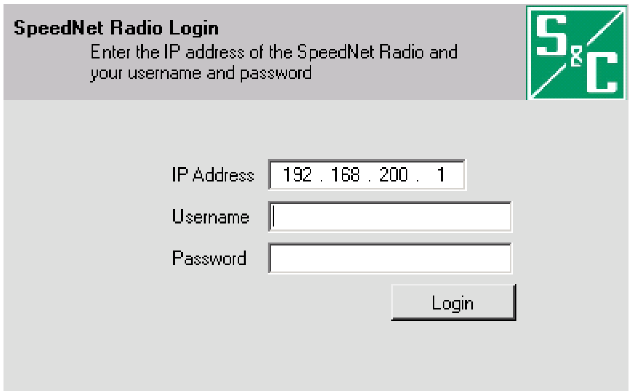
The configuration and management of a SpeedNet ME Radio network is achieved using the SpeedNet ME Radio Client Tool application and the IntelliTeam® CNMS Communication Management System. The Client Tool, based on the Simple Network Management Protocol (SNMP), provides a secure method for viewing or modifying SpeedNet ME Radio configuration parameters. The Client Tool can also update SpeedNet ME Radio firmware.

Logging In

Follow these steps to log in to the SpeedNet Client Tool:

STEP 1. Launch the SpeedNet Client Tool, and the Login page will open.

STEP 2. In the IP Address field, enter the IP address of the SpeedNet ME Radio's Ethernet interface; the default is 192.168.200.1. When the radio mesh has been configured, you can also log in using the wireless IP address. When logging into a SpeedNet ME Radio for the first time after a factory reset, the user name will be initial and the factory password will be the radio's unique MAC address listed as MAC ID on the radio label. The MAC address must be entered with all lowercase characters and without any separators (for example: 00c919eea1b2). The login window and label are shown in Figures 48 and 49. As shipped from S&C, SpeedNet ME Radios are configured using a standard SAD file, which includes a default username and password. Contact S&C to obtain these credentials.



SpeedNet Radio Login
Enter the IP address of the SpeedNet Radio and
your username and password

IP Address 192 . 168 . 200 . 1
Username
Password

Figure 48. SpeedNet Login dialog box.

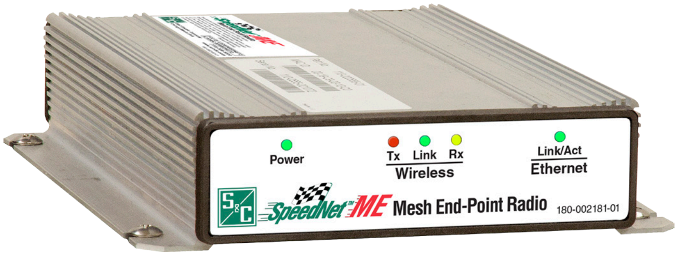
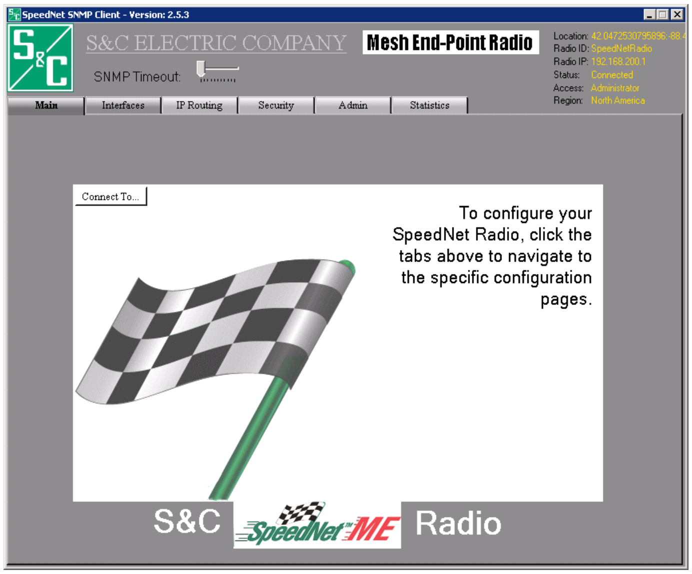


Figure 49. SpeedNet ME Radio MAC address label.

STEP 3. After entering the appropriate login information, click the **Login** button to connect to the SpeedNet ME Radio. The **Main** window will be displayed. See Figure 50 on page 28.

Main Window


SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

To configure your SpeedNet Radio, click the tabs above to navigate to the specific configuration pages.

Figure 50. SpeedNet Client Main window.

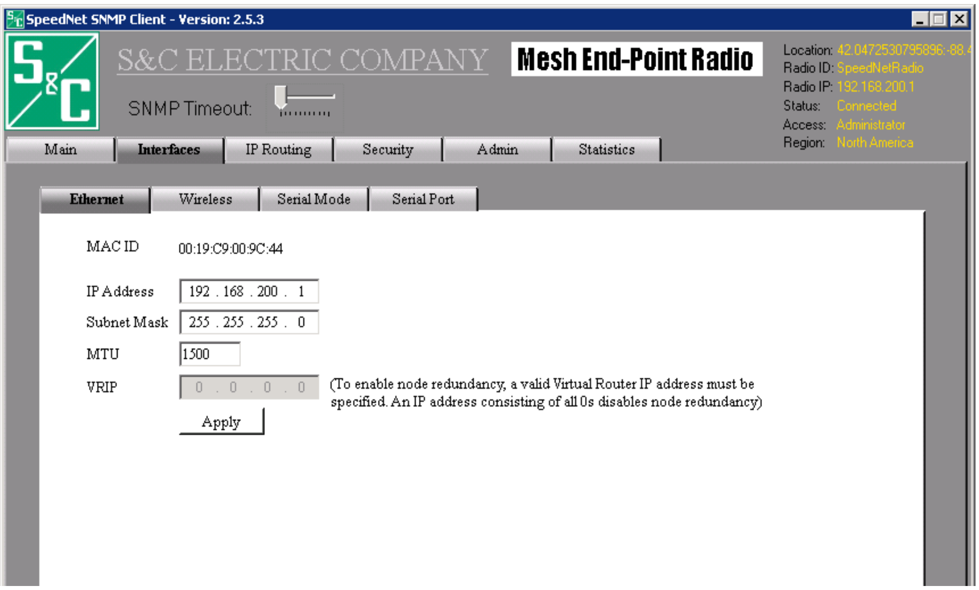
The **Login** button submitted the username and password supplied to the radio specified by the IP address and causes the client tool to fetch the configuration information from the radio. Further transactions through the client tool tabs use this same information (IP address, username and password) to get and set data in the radio. Note that "logging in" from the client tool does not produce a persistent session or state change in the specified radio. Further, logging in from one client tool does not preclude logging in from other client tools on other PCs, provided they also have the valid login information (IP address, username and password). See Figure 50.

- The display in the upper-right corner of the **Main** window, see Figure 50, shows the Location, the Radio ID (node name), Radio IP address, Radio Status, and user's security access level.
- **SNMP Timeout**—The SNMP protocol automatically resends control data after a period of time. The **SNMP Timeout** control is used to adjust the timeout value. In the case of a busy network and/or when traversing many wireless hops, you may wish to increase the SNMP timeout. The default value will work in most situations.
- **Connect To**—The **Connect To…** button allows you to connect to a different SpeedNet ME Radio by opening the SpeedNet ME Radio **Login** window. Other configuration functions are accessed by clicking on the appropriate tabs, as follows:
- **Interfaces**—The Interfaces page is used to configure the Ethernet, wireless, and serial interfaces.
- **IP Routing**—The IP Routing page is used to configure the routing settings for the wireless network, including the use of mesh networking or static routes.
- **Security**—The Security page is used to configure wireless network encryption and view the MAC Address Revocation list.
- **Admin**—The Admin page is used to assign the Radio ID (radio node name), upload security and network configuration files, reboot the radio, and install new radio firmware.
- **Statistics**—This window provides detailed information regarding radio performance.

NOTICE

A login from the SpeedNet Client Tool is somewhat different from other logins, such as telnet or remote desktop sessions. The communication between the client tool and the radio is fundamentally transactional. When the user logs in using the SpeedNet Client Tool, the client tool contacts the radio via SNMPv3/UDP/IP using the username and password credentials provided, and it attempts to fetch the radio's configuration information. If the credentials are incorrect, the client tool informs the user that the login failed. If the credentials are correct, the client tool displays basic configuration information just fetched in the upper right corner of the **Main** window, and shows the Status as being connected. Each subsequent transaction, until the client tool is directed to a new radio, is individually authenticated via SNMPv3 using the credentials provided by the user at the start of the session and stored in the client tool. No state of the SpeedNet Client Tool session is stored in the radio, and the client tool does not poll the radio to update displayed information between user transactions. Thus, the radio can have several client tools from different PCs logged in at the same time. Also, the radio can undergo changes such as a reboot behind the client tool session with no impact on the client tool, except that transaction attempts (e.g. changing to another client tool tab or clicking an **Apply** button) during the reboot will not function.

Interfaces Window, Ethernet Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

MAC ID 00:19:C9:00:9C:44

IP Address 192 . 168 . 200 . 1

Subnet Mask 255 . 255 . 255 . 0

MTU 1500

VRIP 0 . 0 . 0 . 0 (To enable node redundancy, a valid Virtual Router IP address must be specified. An IP address consisting of all 0s disables node redundancy)

Figure 51. Configuration of the Ethernet interface.

Figure 51 shows the **Ethernet Interface** configuration window. On a given SpeedNet ME Radio mesh, the configurations of all the Ethernet interfaces should differ such that there is no overlap between the Ethernet port subnets nor between the Ethernet port subnets and the wireless subnet.

The **Interfaces** window provides tabs that can be used to configure each interface of the SpeedNet ME Radio. The tab will provide a list of configurable options for the selected interface.

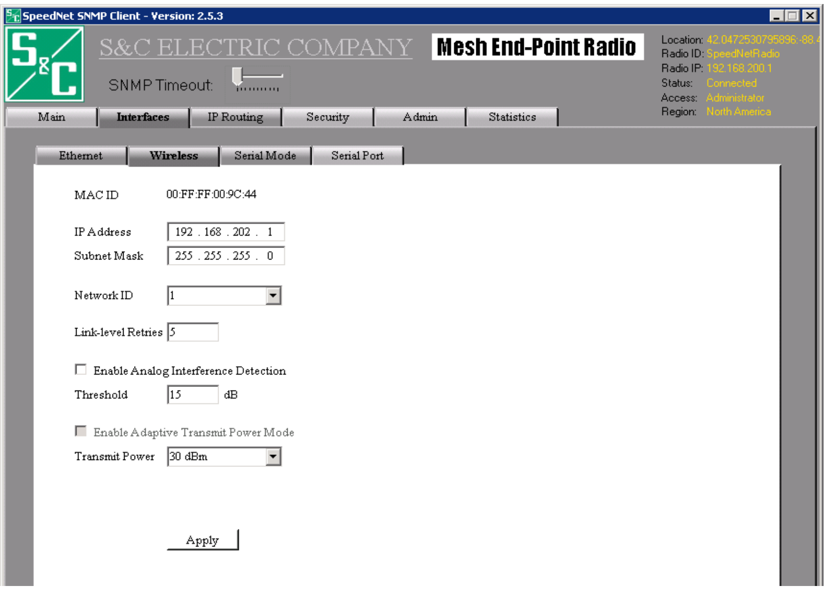
The **Ethernet** tab, shown in Figure 51, is used to configure the SpeedNet ME Radio's Ethernet interface. The following parameters can be configured:

- **MAC ID**—This read-only field displays the unique Media Access Control (MAC) address of the SpeedNet ME Radio. No two network devices will use the same MAC address.
- **IP Address**—Specifies the IP address of the Ethernet interface of the SpeedNet ME Radio. The default IP address is 192.168.200.1.

- **Subnet Mask**—Specifies the subnet mask of the Ethernet interface. The default subnet mask is 255.255.255.0.
- **MTU**—The Maximum Transmit Unit (MTU) specifies the maximum Ethernet packet size (in bytes) that can be transmitted without being fragmented. The default value of 1500 bytes should be appropriate for most applications.
- **Apply**—Saves changes made to the configuration of the **Ethernet** tab. Changes will not be saved if you change to a different configuration tab without first clicking the **Apply** button.

  Note: Redundancy is not supported on the SpeedNet ME; therefore, the **VRIP** field is not available.

Interfaces Window, Wireless Tab



SpeedNet SNMP Client - Version: 2.5.3

S&C ELECTRIC COMPANY

Mesh End-Point Radio

SNMP Timeout:

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

MAC ID 00:FF:FF:00:9C:44

IP Address 192 . 168 . 202 . 1

Subnet Mask 255 . 255 . 255 . 0

Network ID 1

Link-level Retries 5

□ Enable Analog Interference Detection

Threshold 15 dB

□ Enable Adaptive Transmit Power Mode

Transmit Power 30 dBm

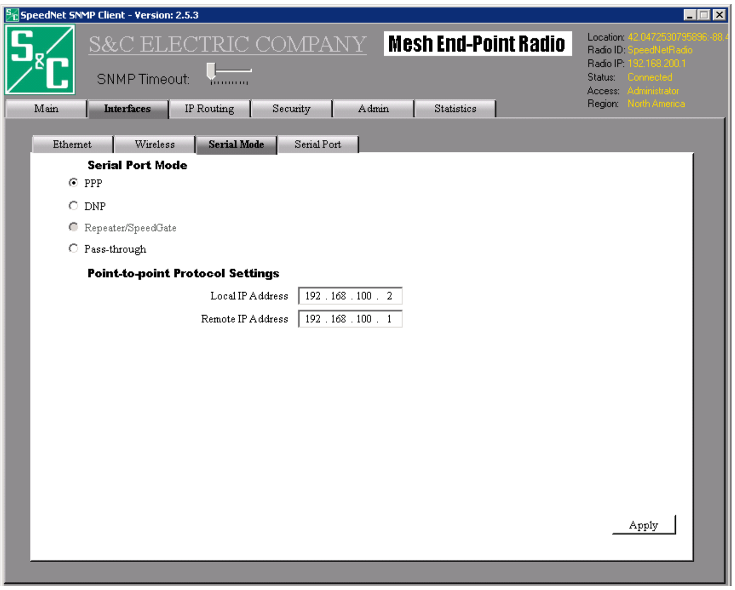
Figure 52. Wireless interface configuration window.

The **Wireless** tab, shown in Figure 52, is used to configure the SpeedNet ME Radio wireless interface. Note that several features are for reference only and will appear grayed out in the client tool. Some of the following parameters can be configured:

- **MAC ID**—This read-only field displays the unique Media Access Control (MAC) address of the SpeedNet ME Radio wireless interface. The wireless MAC ID is based on the Ethernet interface MAC ID but with the second and third sets of digits replaced with "FF."
- **IP Address**—This parameter specifies the IP address of the wireless interface of the SpeedNet ME Radio. The default IP address is 192.168.202.1. This address must be unique for each radio on the wireless network.
- **Subnet Mask**—This parameter specifies the subnet mask of the wireless interface. The default subnet mask is 255.255.255.0.
- **Network ID**—This parameter specifies the frequency hopping pattern that will be used by the SpeedNet ME Radio. To communicate with each other, SpeedNet ME Radios in the same wireless network must use the same network ID setting. Note that SpeedNet networks can be located close to each other with minimal network interference by configuring a separate network ID for each network. The network ID parameter has a value range of 1-16, with a default value of 1.

- **Link-level Retries**—This parameter specifies the number of retries this radio should send when a positive acknowledgement has not been received for a packet. Setting this parameter too low will cause packets to be dropped unnecessarily in the presence of temporary interference or other errors. Setting this parameter too high could cause flooding of retries on the radio mesh when none will succeed, for example if the intended receiver's antenna breaks. The recommended value is 5.
- **Enable Analog Interference Detection**—This feature detects analog radio interference with the 902-928 MHz frequency band, allowing the SpeedNet ME Radio to temporarily avoid transmitting on frequency channels that have interference levels above the average received in those channels.
- **Threshold**—This parameter determines the number of dB above the average signal in a particular frequency channel that will cause the **Analog Interference Detection** function to start functioning to skip that channel in the hopping sequence. The default value is 15 dB.
- **Enable Adaptive Transmit Power Mode**—(Reference only) This feature causes the SpeedNet ME Radio to adjust the output power level to the minimum level required to achieve a solid link. The output power level will vary between each radio link. When this feature is enabled, the Transmit Power parameter will be replaced with "min" and "max." These options are used to determine the minimum and maximum output power levels to be used when the **Adaptive Transmit Power Mode** setting is enabled.
- **Transmit Power**—This setting determines the maximum output power level to be used for wireless transmissions by the SpeedNet ME Radio. Options are: 10 dBm, 20 dBm, 25 dBm, and 30 dBm. The default value is 30 dBm.
- **Apply**—Saves changes made to the wireless configuration. Changes will not be saved if you change to a different configuration tab without first clicking the **Apply** button.

Interfaces Window, Serial Mode Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Serial Port Mode

● PPP
○ DNP
○ Repeater/SpeedGate
○ Pass-through

Point-to-point Protocol Settings

Local IP Address 192 . 168 . 100 . 2
Remote IP Address 192 . 168 . 100 . 1

Figure 53. Serial Mode interface configuration window.

The following serial port modes are available: See Figure 53.

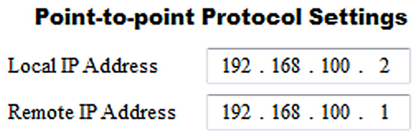
- **PPP**—The Point-to-Point Protocol (PPP) mode is used for emulating an Ethernet connection over a serial interface. This is currently used for communication with a SpeedNet ME Radio in an IntelliRupter® PulseCloser® Fault Interrupter through the IntelliRupter fault interrupter Wi-Fi interface. SpeedNet ME Radios do not route traffic to other radios from the PPP interface due to security concerns.
- **DNP**—The Distributed Network Protocol (DNP) mode is used for transferring DNP data between the SpeedNet ME Radio serial port and other Ethernet devices.

  Note: The **Repeater/SpeedGate Mode** setting is not available because that functionality is not supported on the ME platform.
- **Apply**—Saves changes made to the **Serial Mode** window. Changes will not be saved if you select a different configuration tab without first clicking the **Apply** button.

PPP Serial Mode

The following options are available when PPP is the selected serial port mode, as shown in Figure 54:

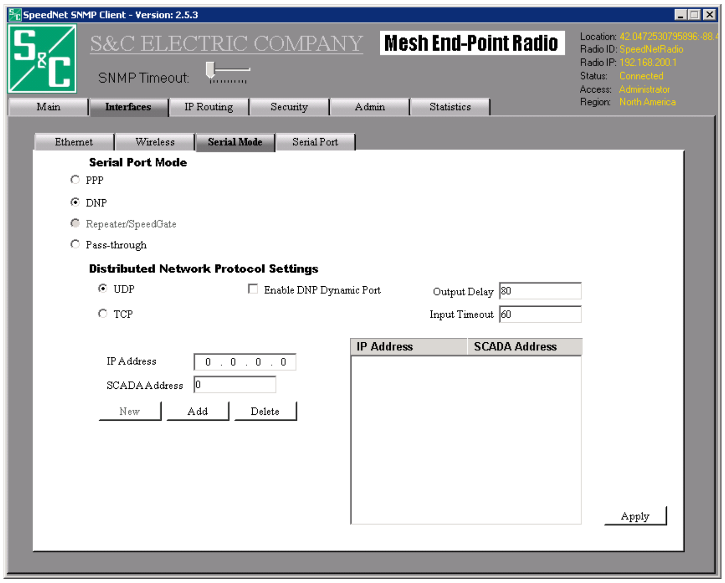
- **Local IP Address**—This is the IP address (Ethernet interface) assigned to the SpeedNet Radio's end of the PPP link.
- **Remote IP Address**— This is the IP address assigned to the remote device of the PPP link.



Point-to-point Protocol Settings

Local IP Address 192 . 168 . 100 . 2
Remote IP Address 192 . 168 . 100 . 1

Figure 54. Point-to-point Protocol settings.



SpeedNet SNMP Client - Version: 2.5.3

SNMP Timeout:

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Serial Port Mode

○ PPP
● DNP
○ Repeater/SpeedGate
○ Pass-through

Distributed Network Protocol Settings

● UDP
○ TCP
□ Enable DNP Dynamic Port
Output Delay 80
Input Timeout 60

IP Address 0 . 0 . 0 . 0
SCADA Address 0

IP Address	SCADA Address

Figure 55. Distributed Network Protocol settings.

DNP Serial Mode

The following options are available when DNP is the selected serial port mode, as shown in Figure 55:

- **UDP/TCP**—Determines which transport control protocol, TCP or UDP, will be used for DNP communication. UDP is the default setting.
- **Enable DNP Dynamic Port**—Enabling the DNP Dynamic Port feature causes the SpeedNet ME Radio to monitor SCADA traffic to determine the source port for each data stream. Port information is stored internally, allowing the SpeedNet ME Radio to know which port to send received packets to on the SCADA master. While many SCADA masters use port 20,000 for SCADA communications, some of them use a different port for each device.
- **IP Address**—When creating a DNP table entry, this value is the IP address.
- **SCADA Address**—When creating a DNP table entry, this value is the SCADA address. The valid range of SCADA addresses is 0-65536.
- **Add**—After entering an IP address and the corresponding SCADA address, click the **Add** button to add the entry to the DNP table.
- **Delete**—To delete an entry from the DNP table, select the entry in the table and then click the **Delete** button.
- **Output Delay**—This value defines the amount of time (in milliseconds) between transmitting DNP packets to the SpeedNet ME Radio's serial interface after they are received over the wireless interface. This feature has been added to accommodate legacy equipment that cannot receive back-to-back data packets as quickly as a SpeedNet ME Radio can deliver them. The default value is 80 milliseconds.
- **Input Timeout**—This value defines the amount of time (in milliseconds) that the serial interface will wait before sending a packet after data is received. The default value is 60 milliseconds.

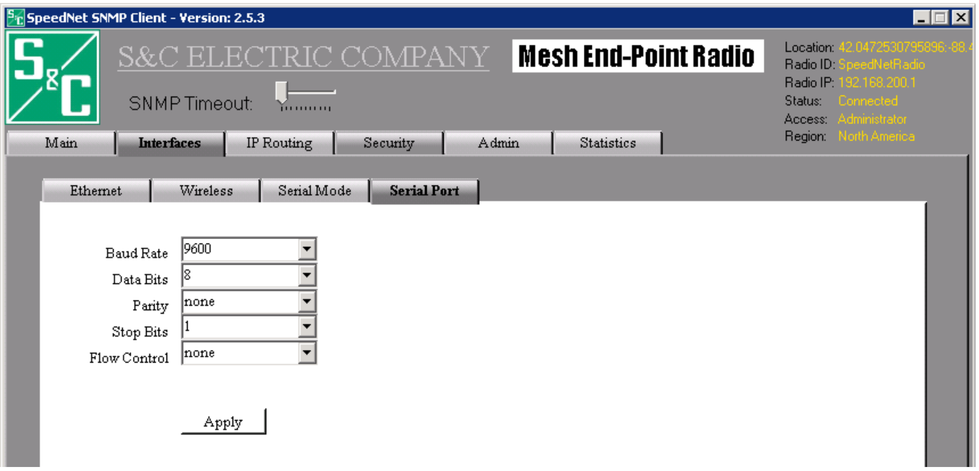
Multiple SCADA Masters

SpeedNet ME Radios have a feature that allows multiple SCADA masters that use the same SCADA address to connect to a single SpeedNet ME Radio. When this feature is enabled, the connected SpeedNet ME Radio continually monitors DNP traffic. For multiple SCADA masters using the same SCADA address, the SpeedNet ME Radio will consider the master to be the device that sent the most recent data packet. If the active SCADA master experiences a failure, the SpeedNet ME Radio will automatically forward packets from the backup SCADA master.

Configuring this feature is simple. When building the SCADA table using the UDP/IP transport option, each SCADA master is assigned the same SCADA address, and each SCADA master has a unique IP address.

For example, assume there are two SCADA master devices, one with an IP address of 192.168.200.20 (primary SCADA master) and one with an IP address of 192.168.200.30 (secondary SCADA master). To create the table entry for the primary SCADA master, enter 192.168.200.20 into the **IP Address** field. Enter 25 into the **SCADA Address** field. To create the table entry for the secondary SCADA master, enter 192.168.200.30 into the **IP Address** field. Enter 25 into the **SCADA Address** field.

Interfaces Window, Serial Port Tab


SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

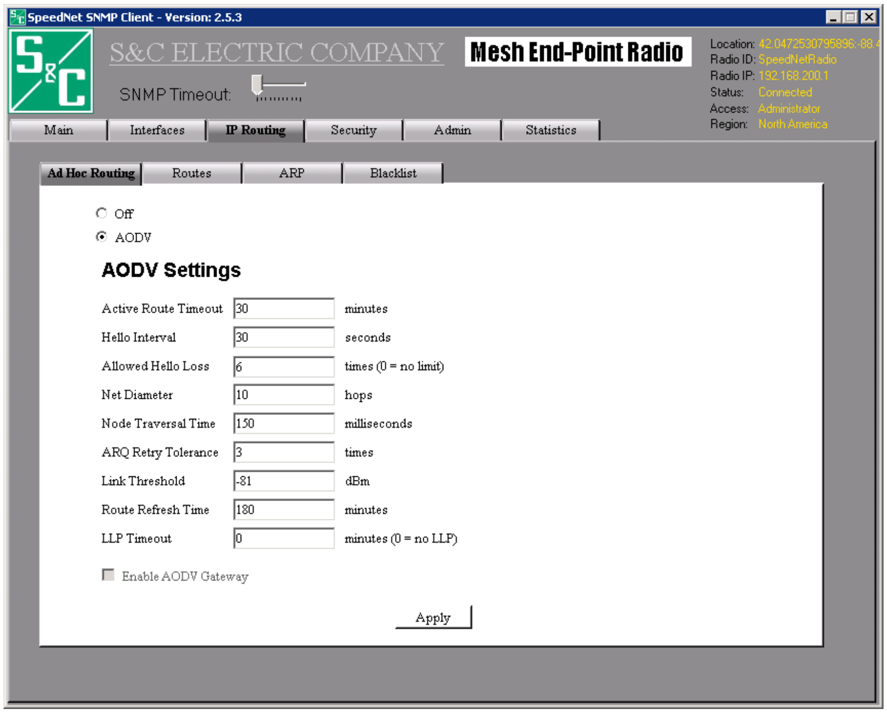
Baud Rate 9600
Data Bits 8
Parity none
Stop Bits 1
Flow Control none

Figure 56. Serial Port interface configuration window.

The **Serial Port** tab is only available when DNP is selected as the serial port mode. As shown in Figure 56, the **Serial Port** tab is used to configure the communication parameters for the SpeedNet ME Radio's serial port. The following parameters can be configured:

- **Baud Rate**—This determines the bit rate used for serial communications. The default value is 9600.
- **Data Bits**—This determines the number of data bits within each character. The default value is 8.
- **Parity**—This determines the setting for the parity bit within each character. The default value is none.
- **Stop Bits**—This determines the number of stop bits that follow each character. The default value is 1.
- **Flow Control**—This configures the type of flow control that is used for serial data communication. The default value is none.

IP Routing Window, Ad Hoc Routing Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

○ Off
● AODV

AODV Settings

Active Route Timeout	30	minutes
Hello Interval	30	seconds
Allowed Hello Loss	6	times (0 = no limit)
Net Diameter	10	hops
Node Traversal Time	150	milliseconds
ARQ Retry Tolerance	3	times
Link Threshold	-81	dBm
Route Refresh Time	180	minutes
LLP Timeout	0	minutes (0 = no LLP)

□ Enable AODV Gateway

Figure 57. Ad Hoc Routing IP configuration window.

The **IP Routing** window provides a list of tabs that can be used to configure the routing performance of a SpeedNet ME Radio. Selecting a tab will provide a list of configurable options.

The **Ad Hoc Routing** tab, shown in Figure 57, is used to enable, disable, or configure the embedded ad hoc (mesh) routing protocol. The embedded ad hoc routing protocol is a customized version of Ad-Hoc On-Demand Distance Vector (AODV). The following parameters can be configured:

- **Off**—Selecting the **Off** setting will disable the automated mesh networking protocol. When disabled, static routes must be entered manually on the **Routes** tab for all endpoints this radio needs to reach. No combination of automatic AODV routing and static routing is supported.
- **AODV**—Selecting the **AODV** setting will enable the embedded mesh networking protocol allowing network routes to be created and maintained automatically to the best next hop neighbor from the SpeedNet ME Radio. All radios in the network must enable the **AODV** function to use the feature. Selecting the AODV setting is recommended for ease of configuration, robustness to radios going down, and ease of adding radios to the mesh. The remaining configuration options on the **Ad Hoc Routing** tab pertain specifically to the mesh networking protocol.
- **Active Route Timeout**—The Active Route Timeout parameter determines how long a SpeedNet ME Radio should wait for an inactive data communication route to be removed from the route table. Each time an IP packet is sent over a specific route, a timer begins counting down. If the timer expires before another packet is sent, the route is considered inactive and is removed from the radio's route table. The **Active Route Timeout** value determines the length of this timer. In SCADA polling applications, a timeout value greater than the polling interval is recommended. Note that a route is defined by the IP address of the two endpoints. A given pair of SpeedNet ME Radios may have several separate routes between them—for example, serving different devices on the radios' Ethernet ports. As such, activity on one route between two radios does not preserve other routes between the two radios for traffic with different source/destination IP addresses. The value of this parameter is measured in minutes and the recommended value is 30 minutes.

- **Hello Interval**—The **Hello** interval setting determines how frequently the SpeedNet ME Radio broadcasts a neighbor beacon message (hello message). Smaller **Hello** interval values increase the wireless network's responsiveness to routing changes but do so at the expense of creating additional network communication overhead. Larger **Hello** interval values decrease the wireless network's responsiveness to routing changes but reduce excessive wireless traffic in the process. This value is measured in seconds and the recommended value is 30 seconds.
- **Allowed Hello Loss**—The **Allowed Hello Loss** value determines the number of consecutive Hello messages that, when missed, constitutes a link failure that will lead to a new route request for routes incorporating the link that failed. Setting this value too low can cause unnecessary route generation when a Hello message was lost because of a temporary circumstance (e.g. a burst of interference or a packet collision). Setting this value too high can cause excessive data loss in a route that is no longer viable because of the persistent failure of a link in the route. The recommended value is 6.
- **Net Diameter**—The Net Diameter parameter determines the maximum of number of wireless hops between the source and destination nodes, specifically, the maximum number of hops that a route request message can travel. The Net Diameter should be set to at least the maximum number of hops expected for application traffic. If the Net Diameter is set too low, then route creation may fail because of route requests never reaching the desired endpoint. If the Net Diameter is set marginally too low, then primary route creation may succeed but creation of a secondary route may not succeed in the case of a link failure along the primary route. If the Net Diameter is set too high, then route requests may propagate needlessly to too many radios generating excessive overhead. Setting the Net Diameter too high is a more critical issue in high density connected mesh deployments than in linear deployments. In mesh deployments, the overhead incurred by the Net Diameter can increase as the square of the diameter. Do not set this value to the number of radios in the mesh. Set it to the lowest possible value that allows for redundancy. The recommended value is 10 hops.
- **Node Traversal Time**—The **Node Traversal Time** value provides an estimate of the time required for a packet to traverse one wireless hop. This value affects how long a SpeedNet ME Radio waits before resending a route request packet. This value is measured in milliseconds and the recommended value is 150 msec.
- **ARQ Retry Tolerance**—The ARQ Retry Tolerance parameter allows a configurable number of successive, unique packet delivery retries before terminating a route. When this number of successive retries is reached, a radio node is able to know more quickly that its next hop radio neighbor is no longer available to route packets, and a route will be built around that unavailable neighbor if there is another valid neighbor.

  This configuration parameter is useful to balance the identification of an unavailable neighbor with packet delivery success rates so more expedient routing may be performed around an unavailable node. The recommended value is 3.
- **Link Threshold**—SpeedNet ME Radio only considers a neighboring radio node valid if its signal strength is above a configured threshold, called the grayzone threshold.

  A radio neighbor with signal strength above the grayzone threshold is considered viable to build routes through, and a neighbor below this threshold will not be used for routing from that specific radio.

  The grayzone threshold removes excessive neighbors from a SpeedNet network. The recommended number of neighbors is between 2 and 25. If more than 25 neighbors are visible, setting the "grayzone threshold" to a stronger signal strength value reduces the number of neighbors and their routing protocol maintenance traffic. Excessive neighbors can lead to network congestion. The grayzone threshold configuration parameter name is Link Threshold.

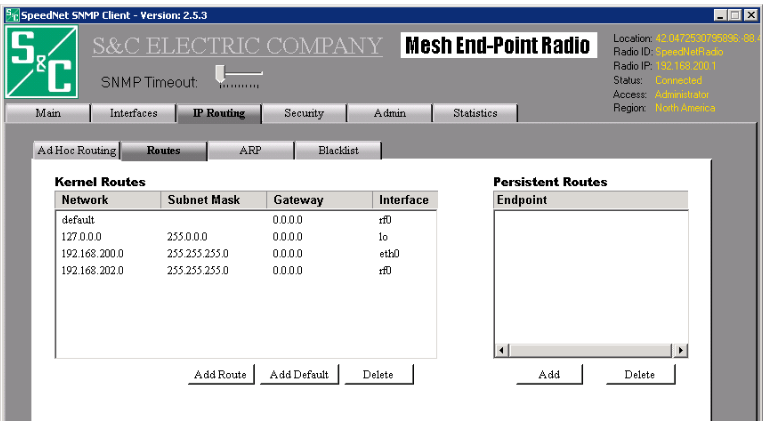
- **Route Refresh Time**—Once a route has been established, periodic route updates are broadcast to the wireless network. The **Route Refresh Time function** determines how frequently route update messages are broadcast. If the **Route Refresh Time** setting is too short, then there may be excessive overhead on the radio network in carrying the route updates. If the **Route Refresh Time** setting is too long, then the network may be slow to optimize routes when better routes become available (e.g. when a new repeater is added or when temporary interference abates). The recommended value is 180 minutes.
- **LLP Timeout**—SpeedNet Radios normally attempts to find the path between nodes that has the fewest number of hops. However, sometimes the shortest path is not always the optimal one because of conditions such as RF interference, line-of-sight impediments, multipath propagation, and network congestion. If the **Local Link Preference** setting is enabled and a radio experiences an inability to deliver messages through a given neighboring node, SpeedNet Radios will attempt to avoid that neighbor if alternate neighbors are available to deliver the messages.

  LLP can co-exist with the **Blacklisting f**eature introduced in SpeedNet Revision 2.4.7. Radios can be added to the blacklist and not used for routes. With LLP on these neighbors won't be used and LLP will search for alternate routes if the radio is unable to deliver messages through a neighboring mode.

  The LLP Timeout parameter specifies when a neighbor who had been put in the LLP blacklist, is made available as a routing option. Setting the **LLP Timeout** function to 0 effectively disables LLP. When LLP is enabled, the recommended value for LLP Timeout is 1440 minutes (1 day).
- **Apply**—This button saves changes made to the configuration of the **Ad Hoc Routing** tab. Changes will not be saved if you change to a different configuration tab without first clicking the **Apply b**utton.

  Note: the Enable AODV Gateway checkbox is not available on the SpeedNet ME because that functionality is not supported on the ME platform.

IP Routing Window, Routes Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Kernel Routes

Network	Subnet Mask	Gateway	Interface
default		0.0.0.0	rf0
127.0.0.0	255.0.0.0	0.0.0.0	lo
192.168.200.0	255.255.255.0	0.0.0.0	eth0
192.168.202.0	255.255.255.0	0.0.0.0	rf0

Persistent Routes

Endpoint

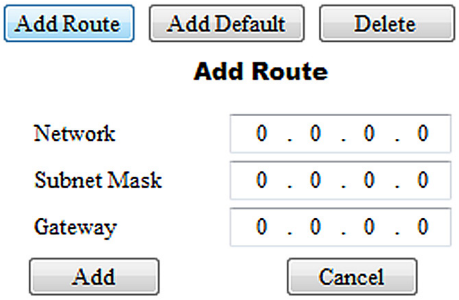
Figure 58. Routes IP routing configuration window.

The **Routes** tab, shown in Figure 58, is used to view or delete existing data communication route table entries, and to add new route table entries. The following parameters can be configured:

- **Route Table**—The Route Table parameter displays a list of current routes within the SpeedNet ME Radio route table. If mesh networking is used, the route table entries will be updated dynamically to reflect changes to the network.
- **Add Route**—The **Add Route** button is used to add static routes to the route table and is described below.
- **Add Default**—The **Add Default** button is used to add a static default gateway to the route table and is described below.
- **Delete**—To delete a route from the route table, first select the route. Then click the Delete button to remove the route from the route table.

Adding Static Routes

Clicking the **Add Route** button will add an Add Route section to the ***Routing*** tab. See Figure 59.



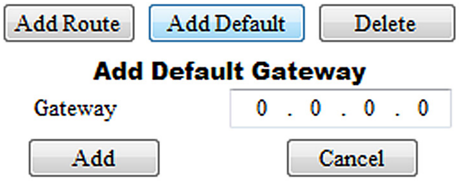
Network: 0 . 0 . 0 . 0
Subnet Mask: 0 . 0 . 0 . 0
Gateway: 0 . 0 . 0 . 0

Figure 59. Add Route settings.

- **Network**—This is the destination network for the route that is being created. To enter a static route for a device with an address of 192.168.200.1 and a subnet mask of 255.255.255.0, the Network portion of the route entry should be 192.168.200.0.
- **Subnet Mask**— This is the subnet mask for the destination network for which the route is being created.
- **Gateway**— This is the next-hop gateway of the destination network for which the route is being created. The gateway will be the IP address of the wireless interface of a SpeedNet ME Radio.
- **Add**—After entering the details of the static route, click the **Add** button to add the route to the route table.
- **Cancel**—Click the **Cancel** button to cancel the route creation process.

Adding a Static Default Gateway

Clicking the **Add Default** button will add an Add Default Gateway section to the **Routing** tab. See Figure 60.



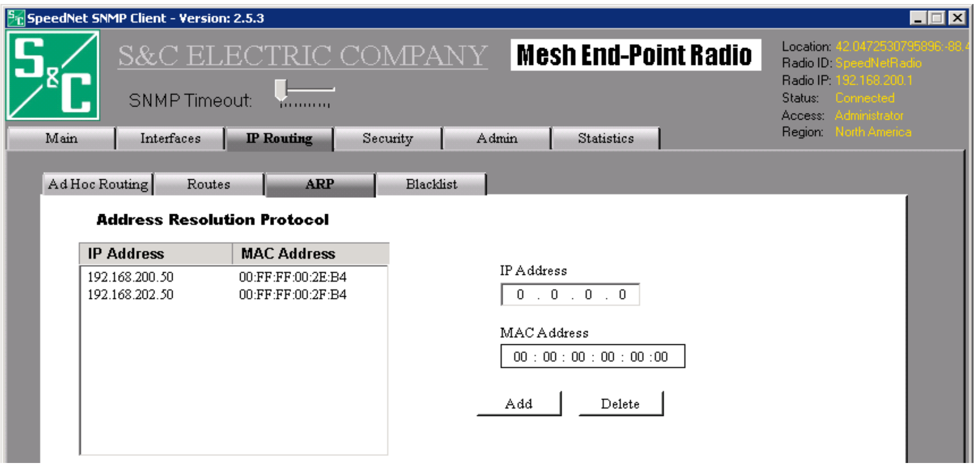
Add Default Gateway

Gateway 0 . 0 . 0 . 0

Figure 60. Add Default Gateway settings.

- **Gateway**—Enter the IP address of the next-hop gateway that will act as the default gateway for this SpeedNet ME Radio. The gateway will be the IP address of the wireless interface of a SpeedNet ME Radio.
- **Add**—After entering the details of the default gateway, click the **Add** button to add the default gateway to the route table.
- **Cancel**—Click the **Cancel** button to cancel the default gateway creation process.

IP Routing Window, ARP Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Address Resolution Protocol

IP Address	MAC Address
192.168.200.50	00:FF:FF:00:2E:B4
192.168.202.50	00:FF:FF:00:2F:B4

IP Address 0 . 0 . 0 . 0

MAC Address 00 : 00 : 00 : 00 : 00 :00

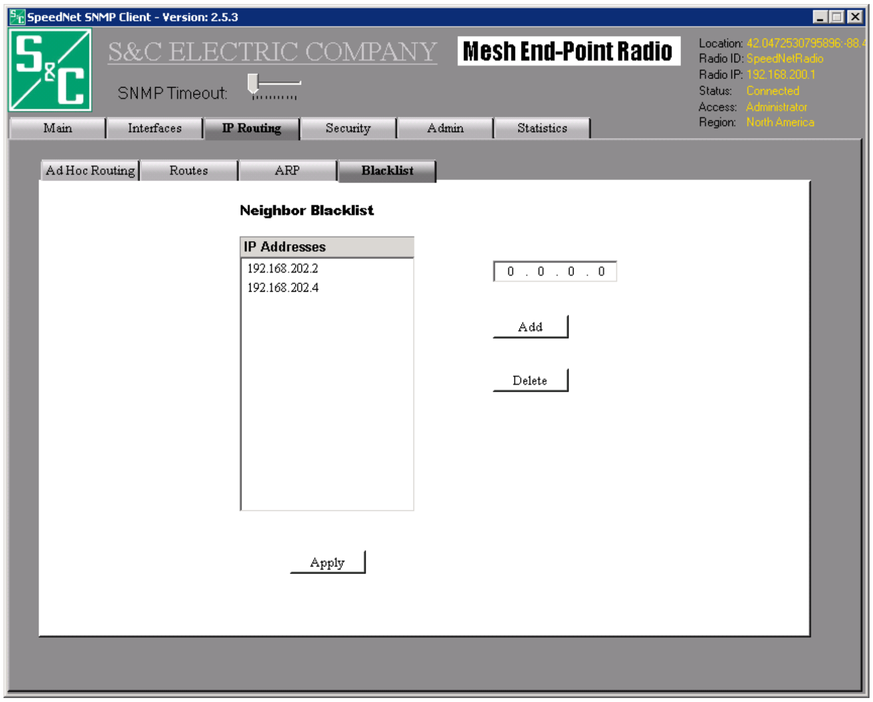
Figure 61. Address Resolution Protocol IP routing configuration window.

The Address Resolution Protocol (ARP) is used to associate an IP address to a device's corresponding MAC address. The **ARP** tab, shown in Figure 61, is used to view existing ARP table entries, as well as to add or delete ARP table entries. The following parameters can be configured:

- **Address Resolution Protocol Table**—The Address Resolution Protocol table provides a list of current ARP entries. An ARP entry consists of two pieces of information: an IP address and a MAC address.
- **IP Address**—To create a static ARP entry, enter the IP address of the device into the IP Address field.
- **MAC Address**—Enter the MAC address of the device into the **MAC Address** field.
- **Add**—After entering the IP address and MAC address into the corresponding fields, click the **Add** button to add the ARP entry to the Address Resolution Protocol.
- **Delete**—To delete an ARP entry from the table, first select the entry. Then, click the **Delete** button to remove the entry from the ARP table.

Note that most devices attached to a SpeedNet Ethernet port will automatically participate in ARP exchanges with the radio to associate their IP addresses with their MAC addresses. As such, it is unusual for SpeedNet ME Radio users to edit this table. The edit capability exists to enable IP communication from the SpeedNet Radios to/from devices that do not support ARP.

IP Routing Window, Blacklist Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Neighbor Blacklist

IP Addresses
192.168.202.2
192.168.202.4

0 . 0 . 0 . 0

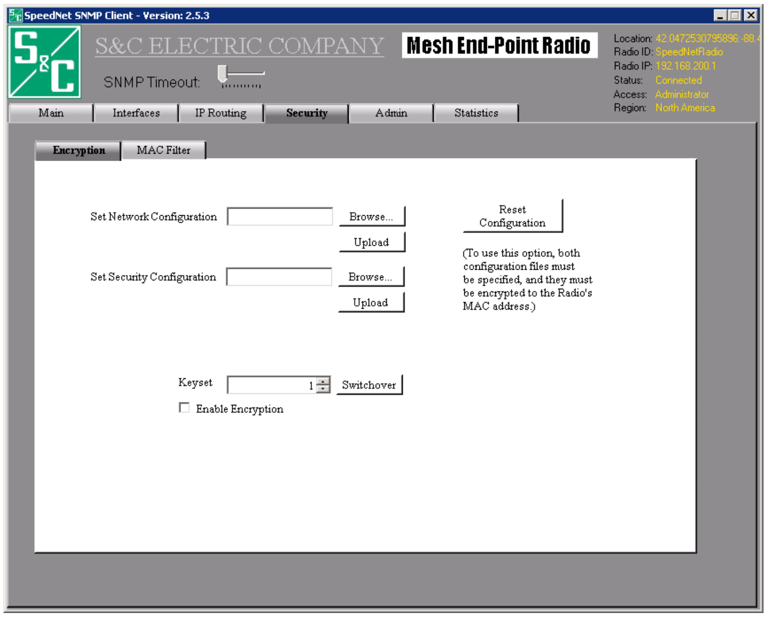
Figure 62. IP routing configuration window.

The **Neighbor Blacklist** feature shown in Figure 62 allows SpeedNet Client Tool to add, delete, and retrieve a blacklisted radio by using its IP address. A SpeedNet ME Radio address listed in the **Neighbor Blacklist** will not be considered a valid neighbor to build routes through. The Neighbor Blacklist feature is used to prevent routing through SpeedNet ME Radios that qualify as valid neighbors, but they are neighbors that you do not want to use as next hop links for that particular radio address. One reason to exclude a neighbor is that it may have a permanent or transient line-of-sight impediment that results in poor packet delivery success over a given radio link. Further, that radio may not have a transmission problem from a different neighbor.

The Blacklist Neighbor address table is limited to a total 36 radio addresses.

- **Add**—After entering an IP address, click on the **Add** button to add the IP address to Neighbor Blacklist.
- **Delete**—After selecting an IP address, click the **Delete** button to delete the IP address from the Neighbor Blacklist.

Security Window, Encryption Tab



SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4

Radio ID: SpeedNetRadio

Radio IP: 192.168.200.1

Status: Connected

Access: Administrator

Region: North America

Keyset 1

□ Enable Encryption

(To use this option, both configuration files must be specified, and they must be encrypted to the Radio's MAC address.)

Figure 63. Security encryption configuration window.

The **Security** window provides a list of tabs that can be used to view and setup the security configuration of the SpeedNet ME Radio. Selecting a tab will provide a list of configurable options.

The **Encryption** tab, shown in Figure 63, can be used to enable or disable encryption, change encryption keysets, and upload network and security configuration files. The following parameters can be configured.

- **Set Network Configuration**—After creating a network configuration file using the SpeedNet KeyGen Utility (see the “Network Configuration” section on page 20), this option allows administrators to upload the network configuration file to the SpeedNet ME Radio. Click the **Browse** button to locate the network configuration file, which will have a .dat file extension. Then, click the **Upload** button to insert the network configuration into the SpeedNet ME Radio. Note that the network configuration file loaded into a particular radio must either be encrypted with that radio’s MAC address (for initial configuration) or with a keyset loaded into that radio. You will be prompted to login to the SpeedNet Client Tool after the network configuration has been applied. Note that after a radio is reset to the factory setting, the network configuration and/or setting the security configuration are the only actions allowed on that radio.

- **Set Security Configuration**—After creating a security configuration (.rss) file using the SpeedNet KeyGen Utility (see “Generating a Security File” on page 15), this option allows administrators to upload the security configuration file to the SpeedNet ME Radio. Click the **Browse** button to locate the security configuration file, which will have an .rss file extension. Then, click the **Upload** button to insert the security configuration into the SpeedNet ME Radio. You will be prompted to login after the security configuration has been applied. Note that after a radio is reset to factory settings, network configuration and/or setting security configuration are the only actions allowed for that radio.

- **Keyset**—This specifies the encrypted keyset that is currently being used. All SpeedNet ME Radios within the network must use the same keyset in order to communicate with each other.

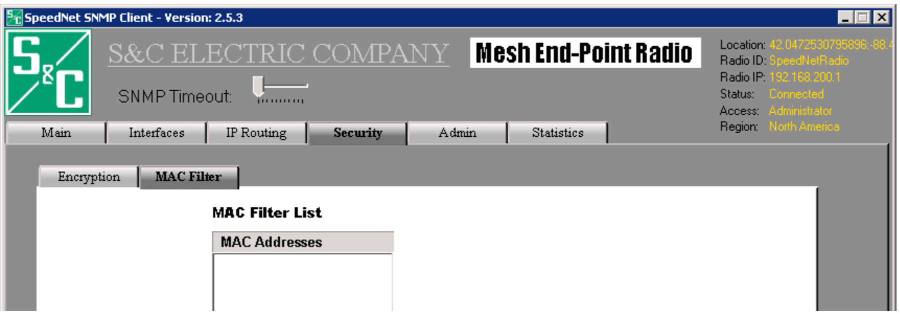
- **Use Latest**—Click the **Use Latest** button to use the keyset with the highest keyset number. All radios must use the same keyset in order to communicate.

- **Switchover**—Enter the desired keyset number into the Keyset field, and then click the **Switchover** button to use the new key.

  SpeedNet ME Radios include an **Auto Switchover** feature that allows the network to automatically update to a more recent key. If a SpeedNet ME Radio receives a packet that was encrypted using a new keyset, and the receiving radio has the new keyset installed, it will automatically switch to the new keyset. When switching keysets it is recommended to change the farthest radios first and work your way back to the closest radios.

- **Enable Encryption**—Placing a check mark in the Enable Encryption checkbox enables wireless network encryption on the SpeedNet ME Radio.
- **Reset Configuration**—This feature is used to reset the configuration of a SpeedNet ME Radio.

Security Window, MAC Filter Tab



SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4

Radio ID: SpeedNetRadio

Radio IP: 192.168.200.1

Status: Connected

Access: Administrator

Region: North America

MAC Filter List

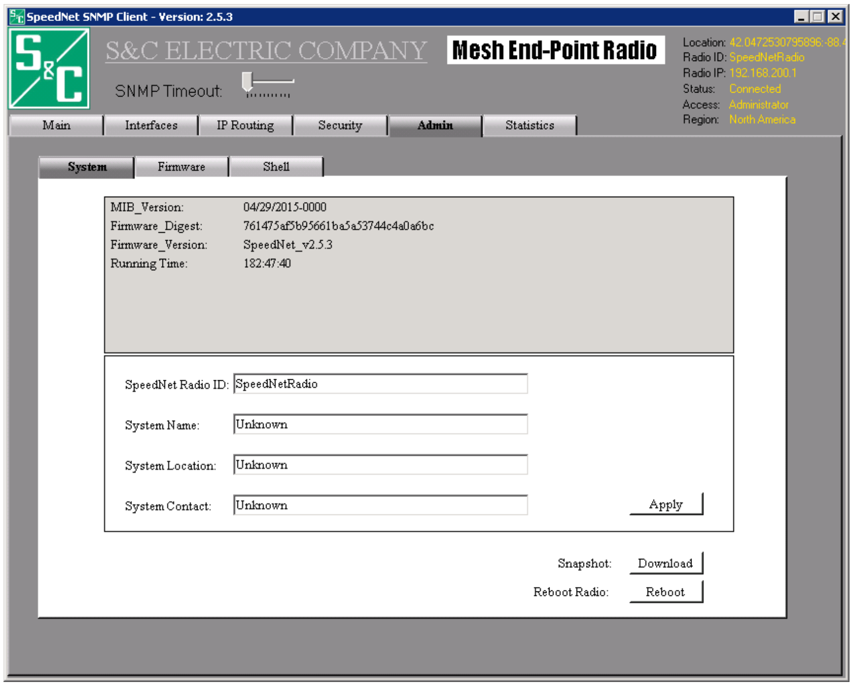
MAC Addresses

Figure 64. MAC Filter security configuration window.

The **MAC Filter** window, shown in Figure 64, can be used to view the list of MAC addresses that have been added to the MAC Address Revocation list using the SpeedNet KeyGen Utility. There are no configurable parameters on the **MAC Filter** tab. All changes to the MAC Revocation list must be made using the SpeedNet KeyGen Utility and uploaded to the SpeedNet ME Radio as part of a new security configuration file.

- **Network**—Destination network for the route that is being created. To enter a static route for a device with an address of 192.168.200.1 and a subnet mask of 255.255.255.0, the Network portion of the route entry should be 192.168.200.0.
- **Subnet Mask**—Subnet mask for the destination network for which the route is being created.
- **Gateway**—Next-hop gateway of the destination network for which the route is being created. The gateway will be the IP address of the wireless interface of a SpeedNet ME Radio.
- **Add**—After entering the details of the static route, click the Add button to add the route to the route table.
- **Cancel**—Click the Cancel button to cancel the route creation process.

Admin Window, System Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

MIB_Version: 04/29/2015-0000
Firmware_Digest: 761475af5b95661ba5a53744c4a0a6bc
Firmware_Version: SpeedNet_v2.5.3
Running Time: 182:47:40

SpeedNet Radio ID: SpeedNetRadio
System Name: Unknown
System Location: Unknown
System Contact: Unknown

Snapshot: Download
Reboot Radio: Reboot

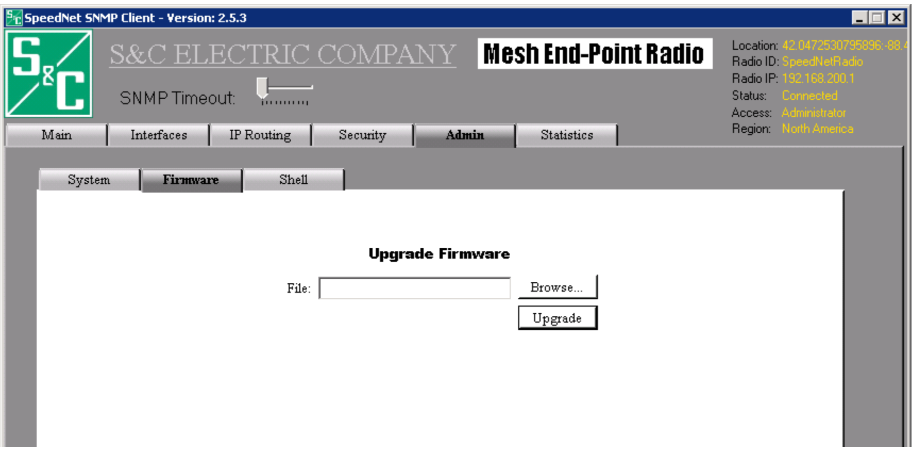
Figure 65. System admin configuration window.

The **Admin** window has tabs that can be used to perform administrative tasks for the SpeedNet ME Radio that include upgrading firmware and determining system information. Selecting a tab will provide a list of configurable options.

The **System** tab, shown in Figure 65, is used to view system information, such as the current firmware version. System information, including radio ID and location, can be entered by the administrator. The following parameters can be configured:

- **MIB_Version**—This read-only field provides information regarding the current Management Information Base (MIB) that is being used by the SNMP protocol.
- **Firmware_Version**—This read-only field displays the current firmware version that is installed on the SpeedNet ME Radio.
- **Running Time**—This read-only field displays the elapsed time since the last time the SpeedNet ME Radio was rebooted.
- **SpeedNet Radio ID**—This field can be used by administrators to assign a descriptive name to the SpeedNet ME Radio. The SpeedNet ME Radio ID must consist of ASCII values but cannot contain spaces or the following characters: $, ^, &, (, or).
- **System Name**—This field can be used by Administrators to assign a descriptive name to the entire network. The System ID must consist of ASCII values.
- **System Location**—This field can be used by administrators to note the location of the network. The System ID Location must consist of ASCII values. The convention for location is for the system location to be in the form <signed decimal latitude>:<signed decimal longitude>. For example, a system location of **33.578014746144: -101.865234375** is in Lubbock, Texas USA.
- **System Contact**—This field can be used by administrators to list the point of contact for the SpeedNet ME Radio network. The System ID must consist of ASCII values.
- **Apply**—Saves changes made to the configuration of the **System** tab. Changes will not be saved if you change to a different configuration tab without first clicking the **Apply** button.
- **Reboot**—Clicking the **Reboot** button will cause the SpeedNet ME Radio to reboot.

Admin Window, Firmware Tab



SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Upgrade Firmware

File:

Figure 66. Firmware admin configuration window.

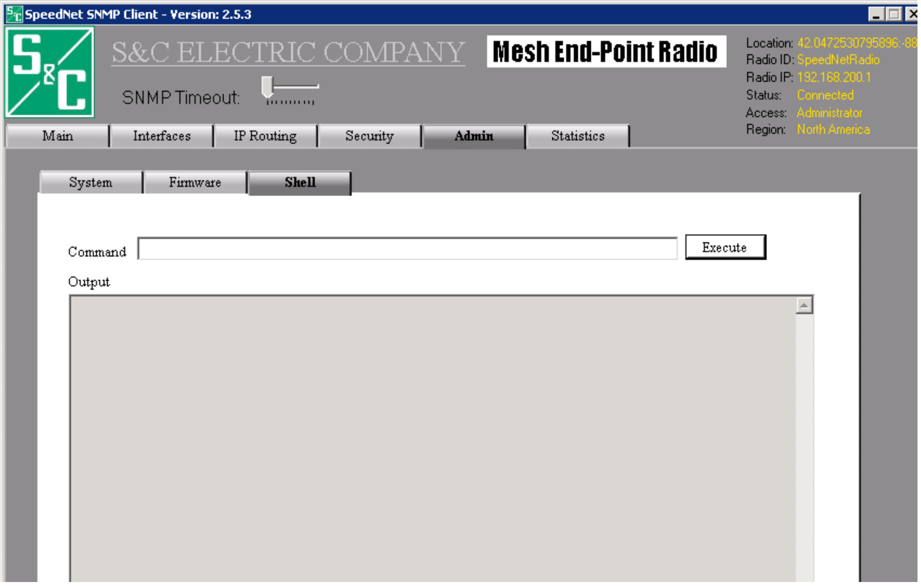
The **Firmware** tab, shown in Figure 66, is used to upgrade the firmware that is installed on the SpeedNet ME Radio. The following parameters can be configured:

- **File**—Use the **Browse** button to specify the location of the firmware file to be uploaded.
- **Upgrade**—After selecting the firmware file, click the **Upgrade** button to initiate an immediate firmware upgrade. The SpeedNet ME Radio will prompt for reboot at the conclusion of the upgrade. Power should not be cycled while a radio is upgrading firmware. You will need to log in to the radio again once the post-upgrade reboot is completed to do further work with the radio. It is recommended that users log in to the radio after the post-upgrade reboot and confirm that the new firmware has loaded by accessing the configuration window shown in Figure 63 on page 41.

NOTICE

If the radio loses power during a firmware upgrade process, the radio will continue to use the firmware version that was installed before the attempted firmware upgrade.

Admin Window, Shell Tab



SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Command

Output

Figure 67. Shell admin configuration window.

The **Shell** tab, shown in Figure 67 on page 44, is provided to support advanced integrator troubleshooting and is not used for configuration of a SpeedNet ME Radio network. A limited selection of LINUX shell commands (e.g. cat, cd, ls) can be executed. Execution of shell commands is performed in a batch manner, waiting for the output to complete before returning a result. As such, execution of commands that produce continuing output (e.g. default LINUX ping command) will "hang" the shell command in the client tool without ever returning a result.

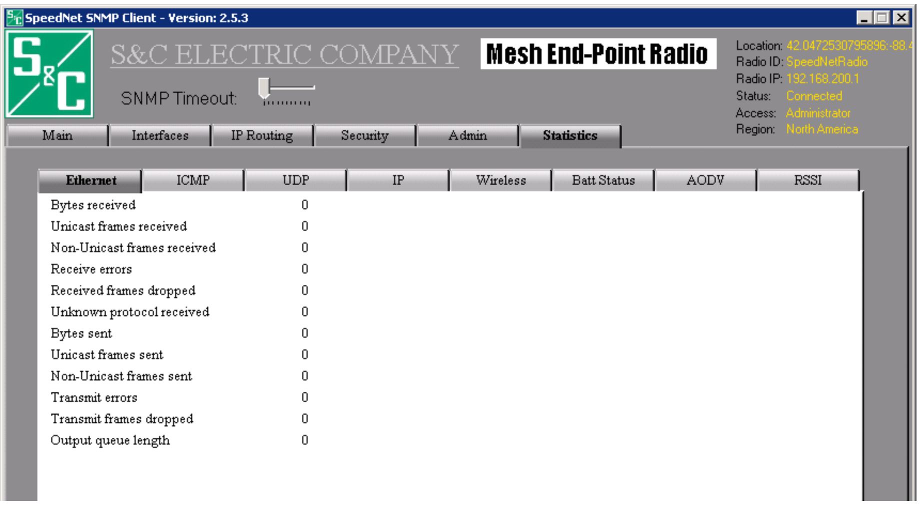
Here are some useful shell commands and their descriptions. Note that shell commands are for advanced users, and they are not guaranteed to carry forward into future versions of SpeedNet ME Radio firmware. These shell commands lack the automated range and other check features of the SpeedNet Client Tool GUI.

NOTE: Shell commands have the potential to lock up radios in a state that requires power cycling or (worse) a state that prevents them from rebooting successfully. Because of this, shell commands should be used with caution.

- **cat /etc/config/config.dat—**This command prints the configuration file. Users can copy and paste the result into another tool (e.g. Windows Notepad) to create a record of radio configurations.
- **cat /proc/aodv/neighbor—**This command prints the AODV neighbor list. Users can copy and paste the result into another tool (e.g. Windows Notepad) to create a record of radio neighbors which can greatly aid in determining the connectivity in the SpeedNet mesh.
- **head -n <count> /etc/config/config.dat—**This command views the first few <count> lines of the configuration file.
- **tail -n <count> /etc/config/config.dat—**This command views the last <count> lines of the configuration file.
- **ping -c <count> <host IP>—**Ping the host indicated by <host IP>. The number of ping requests sent is controlled by <count>. The SpeedNet ME Radio does not use DNS, so <host IP> must be a standard dotted-number notation IP address (e.g., 192.168.200.1).

  It is important that a value for <count> actually be set. Until the ping command has completed execution (approximately <count> seconds), the radio will not respond to further SNMP requests. If <count> is not set (i.e., if the -c option is not provided) then the ping command will not return and the radio will not answer SNMP requests until it is rebooted. Because the radio cannot answer SNMP requests (such as reboot requests), the only way to reboot will be to cycle power physically at the radio. Power cycling radios installed in the field is a significant effort.
- **/sbin/route | grep <host IP>—**This command will print the route to <host IP>, if it exists. If this command returns nothing, it means no route to the indicated host exists. The line between "route" and "grep" is a vertical bar and, on most keyboards, is generated by holding the Shift key and pressing the backslash key.

Statistics Window, Ethernet Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Bytes received	0
Unicast frames received	0
Non-Unicast frames received	0
Receive errors	0
Received frames dropped	0
Unknown protocol received	0
Bytes sent	0
Unicast frames sent	0
Non-Unicast frames sent	0
Transmit errors	0
Transmit frames dropped	0
Output queue length	0

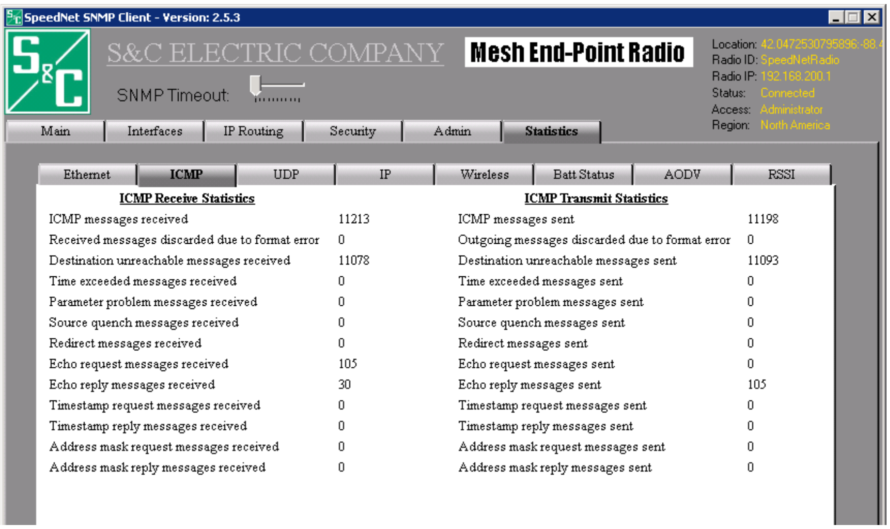
Figure 68. Ethernet statistics window.

The **Statistics** window has several tabs that provide statistical information regarding interface traffic, protocol data, and routing. This section contains descriptions of each statistic that is available through the SpeedNet Client Tool.

The **Ethernet** tab, shown in Figure 68, provides the following statistical information regarding performance of the SpeedNet ME Radio's Ethernet interface.

- **Bytes received**—This is the total number of bytes received by the SpeedNet ME Radio's Ethernet interface. The bytes received, together with the bytes sent, represent the total data transfer of all communications links involving the Ethernet interface.
- **Unicast frames received**—This is the total net interface.
- **Non-Unicast frames received**—Total number of non-unicast frames sent to the SpeedNet ME Radio's Ethernet interface.
- **Receive errors**—This is the total number of receive errors.
- **Received frames dropped**—This is the total number of frames received by the SpeedNet ME Radio's Ethernet interface that were discarded.
- **Unknown protocol received**—This is the total number of frames received by the SpeedNet ME Radio's Ethernet interface with unidentified protocol errors.
- **Bytes sent**—This is the total number of bytes sent by the SpeedNet ME Radio's Ethernet interface.
- **Unicast frames sent**—This is the total number of single destination (unicast) frames sent from the SpeedNet ME Radio's Ethernet interface.
- **Non-Unicast frames sent**—This is the total number of non-unicast frames sent from the SpeedNet ME Radio's Ethernet interface.
- **Transmit errors**—This is the total number of transmit errors. This error is received from the application device and may indicate a problem with the IntelliRupter fault interrupter.
- **Transmit frames dropped**—This is the total number of frames transmitted and then discarded. This error is received from the application device and may indicate a problem with the IntelliRupter fault interrupter.
- **Output queue length**—This is the error received from the application device that may indicate a problem with the IntelliRupter fault interrupter.

Statistics Window, ICMP Tab



SpeedNet SNMP Client - Version: 2.5.3

S&C ELECTRIC COMPANY

Mesh End-Point Radio

SNMP Timeout:

Location:	42.0472530795896:-88.4
Radio ID:	SpeedNetRadio
Radio IP:	192.168.200.1
Status:	Connected
Access:	Administrator
Region:	North America

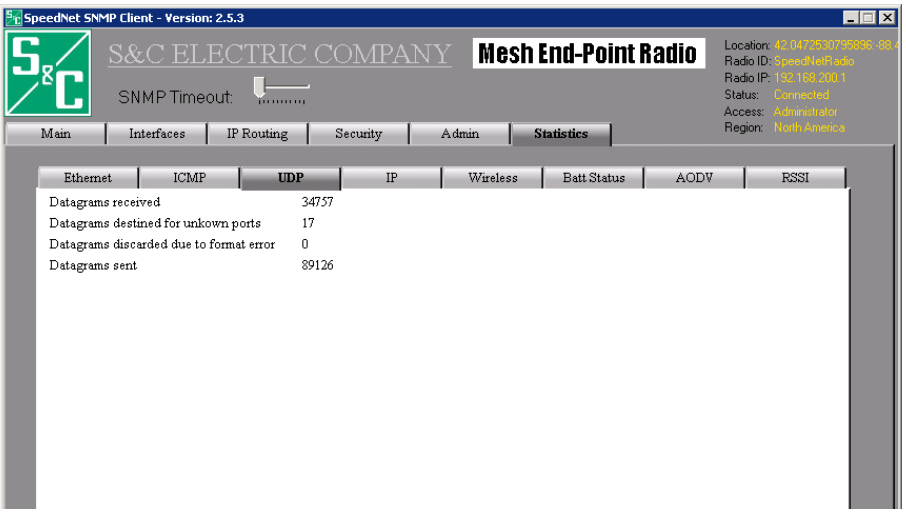
ICMP Receive Statistics		ICMP Transmit Statistics	
ICMP messages received	11213	ICMP messages sent	11198
Received messages discarded due to format error	0	Outgoing messages discarded due to format error	0
Destination unreachable messages received	11078	Destination unreachable messages sent	11093
Time exceeded messages received	0	Time exceeded messages sent	0
Parameter problem messages received	0	Parameter problem messages sent	0
Source quench messages received	0	Source quench messages sent	0
Redirect messages received	0	Redirect messages sent	0
Echo request messages received	105	Echo request messages sent	0
Echo reply messages received	30	Echo reply messages sent	105
Timestamp request messages received	0	Timestamp request messages sent	0
Timestamp reply messages received	0	Timestamp reply messages sent	0
Address mask request messages received	0	Address mask request messages sent	0
Address mask reply messages received	0	Address mask reply messages sent	0

Figure 69. Internet Control Message Protocol statistics window.

The **ICMP** tab, as shown in Figure 69, provides the following statistical information regarding the Internet Control Message Protocol:

- **ICMP messages sent**—This is the total number of ICMP messages sent by the radio.
- **Outgoing messages discarded due to format error**—This is the total number of ICMP messages sent by radio which were not delivered because of format errors.
- **Destination unreachable messages sent**—This is the total number of destination unreachable messages sent by the radio. Destination unreachable messages are generated when the destination address is unreachable.
- **Time exceeded messages sent**—This is the total number of messages sent by the radio which exceeded their time to live.
- **Parameter problem messages sent**—This is the total number of parameter problem messages sent. A parameter problem message is sent when an error in the IP header of a datagram is detected.
- **Source quench messages sent**—This is the total number of source quench messages sent by the radio. A source quench request is sent to request a reduction in the packet transmission rate.
- **Redirect messages sent**—This is the total number of redirect messages sent. A redirect is sent when an alternate route for the datagram is selected.
- **Echo request messages sent**—This is the total number of echo requests sent. An echo request causes the receiving radio to send an echo reply message back to the originating radio. Echo requests are typically generated by a “Ping” application.
- **Echo reply messages sent**—This is the total number of echo replies sent. An echo reply is sent to respond to an echo request. Echo replies are typically generated by a “Ping” application.
- **Timestamp request messages sent**—This is the total number of timestamp requests sent. A timestamp request causes the radio to send a timestamp reply to the originating radio.
- **Timestamp reply messages sent**—This is the total number of timestamp replies sent. A timestamp reply is sent in response to a timestamp request. Timestamp replies and requests measure the transmission speed of datagrams on a network.
- **Address mask request messages sent**—This is the total number of address mask requests sent. An address mask request is sent to determine the number of bits in the subnet mask for the destination’s Ethernet subnet.
- **Address mask reply messages sent**—This is the total number of address mask responses sent. An address mask response is sent in response to an address mask request.

Statistics Window, UDP Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

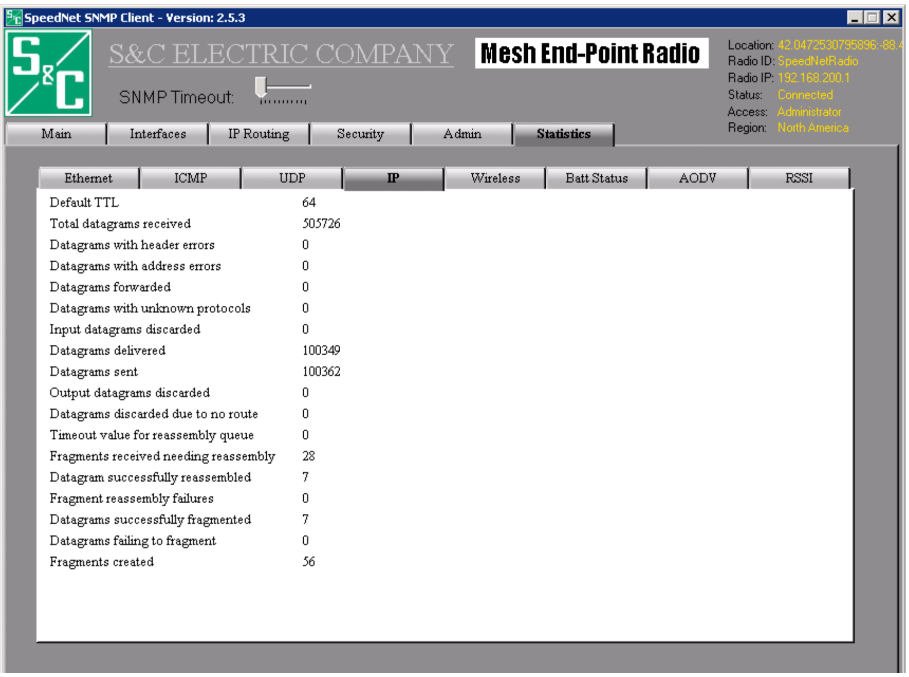
Datagrams received	34757
Datagrams destined for unkown ports	17
Datagrams discarded due to format error	0
Datagrams sent	89126

Figure 70. User Data Protocol statistics window.

The **UDP** tab, as shown in Figure 70, provides the following statistical information regarding the User Datagram Protocol. UDP is generated by the application layer and uses ports to facilitate application-to-application communication:

- **Datagrams received**—This is the total number of UDP datagrams successfully received.
- **Datagrams destined for unknown ports**—This is the total number of received UDP datagrams with unknown destination ports.
- **Datagrams discarded due to format error**—This is the total number of UDP datagrams which were not delivered due to format errors.
- **Datagrams sent**—This is the total number of UDP datagrams sent.

Statistics Window, IP Tab



SpeedNet SNMP Client - Version: 2.5.3

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Default TTL	64
Total datagrams received	505726
Datagrams with header errors	0
Datagrams with address errors	0
Datagrams forwarded	0
Datagrams with unknown protocols	0
Input datagrams discarded	0
Datagrams delivered	100349
Datagrams sent	100362
Output datagrams discarded	0
Datagrams discarded due to no route	0
Timeout value for reassembly queue	0
Fragments received needing reassembly	28
Datagram successfully reassembled	7
Fragment reassembly failures	0
Datagrams successfully fragmented	7
Datagrams failing to fragment	0
Fragments created	56

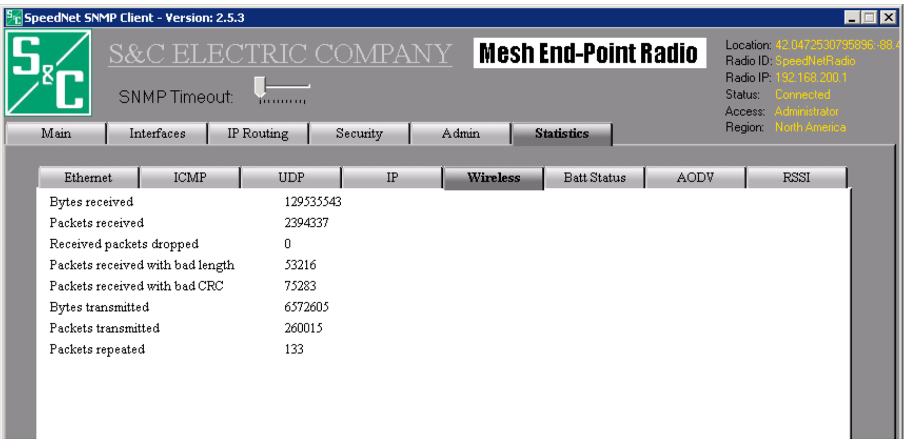
Figure 71. Internet Protocol statistics window.

The **IP** tab, as shown in Figure 71, provides the following statistical information regarding the Internet Protocol:

- **Default TTL**— This is the time-to-live value used to determine how long a packet that has not reached its destination will remain on the network prior to be discarded.
- **Total datagrams received**—This is the total number of IP data packets received.
- **Datagrams with header errors**—This is the total number of received IP data packets that contain errors in the header, such as incorrect IP header length.
- **Datagrams with address errors**—This is the total number of received IP data packets that contain address errors.
- **Datagrams forwarded**—This is the total number of IP data packets that are forwarded because the receiving radio was not the intended destination.
- **Datagrams with unknown protocols**—This is the total number of data packets received with protocols not recognized by the radio.
- **Input datagrams discarded**—This is the total number of IP data packets received that were discarded because the node was too busy.
- **Datagrams delivered**—This is the total number of IP data packets successfully delivered to the destination application.
- **Datagrams sent**—This is the total number of IP data packets sent.
- **Output datagrams discarded**—This is the total number of data packets sent that were discarded because the node was too busy.
- **Datagrams discarded due to no route**—This is the total number of data packets discarded because of the lack of correct routing information.
- **Timeout value for reassembly queue**— This is the duration before the reassembly queue is cleared and the connection is dropped.
- **Fragments received needing reassembly**—This is the total number of received IP data packet fragments that require reassembly. If a data packet cannot be sent in a single transmission, it will be broken into fragments and then reassembled upon receipt.

- **Datagrams successfully reassembled**—This is the total number of fragmented IP data packets received and reassembled.
- **Fragment reassembly failures**—This is the total number of fragmented IP data packets received that could not be reassembled.
- **Datagrams successfully fragmented**—This is the total number of IP data packet fragments generated.
- **Datagrams failing to fragment**—This is the total number of data packets discarded because the fragmentation process failed to fragment the packets.
- **Fragments created**—This is the total number of IP data packet fragments created.

Statistics Window, Wireless Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

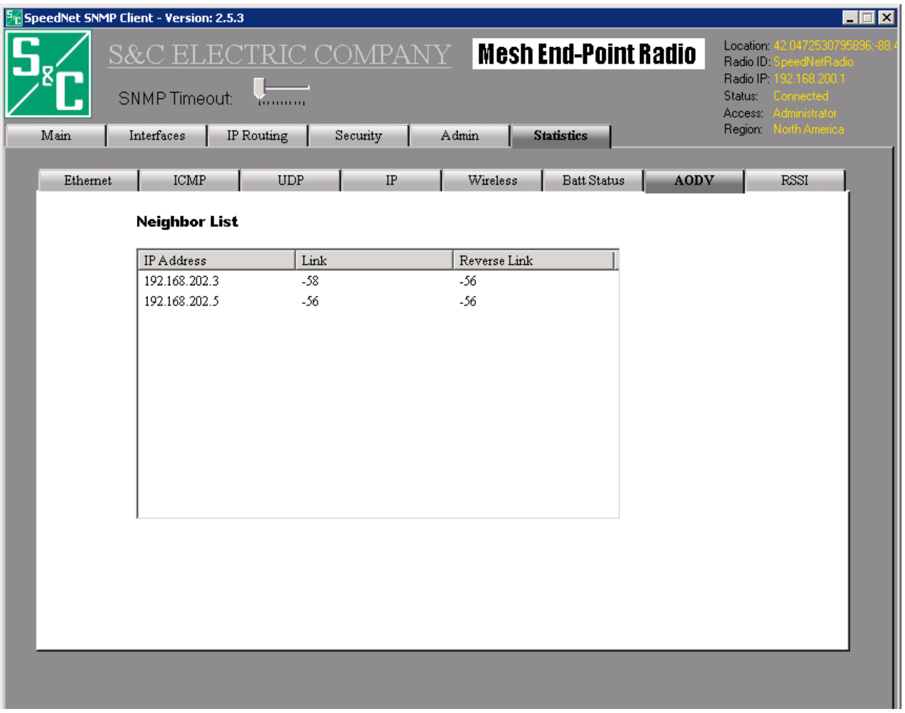
Bytes received	129535543
Packets received	2394337
Received packets dropped	0
Packets received with bad length	53216
Packets received with bad CRC	75283
Bytes transmitted	6572605
Packets transmitted	260015
Packets repeated	133

Figure 72. Wireless statistics window.

The Wireless Tab, shown in Figure 72, provides the provides the following statistical information regarding the wireless performance of the SpeedNet ME Radio.

- **Bytes received**—This is the total number of bytes successfully received by the SpeedNet ME Radio wireless interface.
- **Packets received**—This is the total number of packets successfully received by the SpeedNet ME Radio wireless interface.
- **Received packets dropped**—This is the total number of packets received by the SpeedNet ME Radio wireless interface that failed the validation check for problems, such as a corrupted CRC.
- **Packets received with bad length**—This is the total number of packets received by the SpeedNet ME Radio wireless interface that contained checksum errors involving length.
- **Packets received with bad CRC**—This is the total number of packets received by the SpeedNet ME Radio wireless interface that contained checksum errors.
- **Bytes transmitted**—This is the total number of bytes transmitted over the SpeedNet ME Radio wireless interface.
- **Packets transmitted**—This is the total number of packets transmitted over the SpeedNet ME Radio wireless interface.
- **Packets repeated**— This is the number of repeated packet transmissions. If a transmission fails to receive a confirmation of successful reception the packet is retransmitted.

Statistics Window, AODV Tab



SpeedNet SNMP Client - Version: 2.5.3

S&C ELECTRIC COMPANY

Mesh End-Point Radio

SNMP Timeout:

Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Neighbor List

IP Address	Link	Reverse Link
192.168.202.3	-58	-56
192.168.202.5	-56	-56

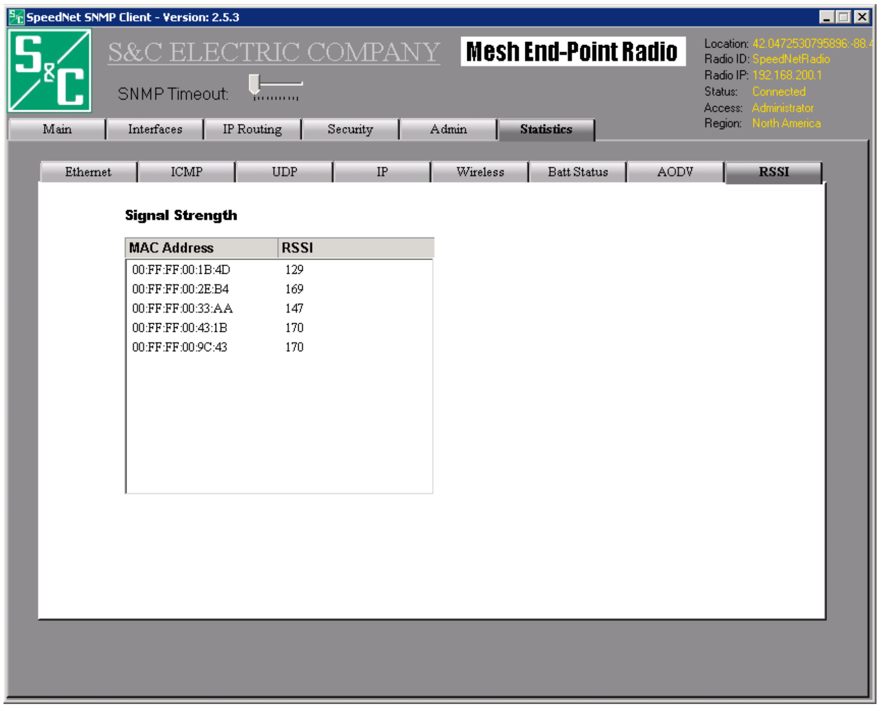
Figure 73. AODV statistics window.

The **AODV** tab, shown in Figure 73, provides statistical information regarding the link quality between all SpeedNet ME Radios within wireless communication range of the local SpeedNet ME Radio. The **AODV Statistics** tab is only active when the AODV ad-hoc routing protocol has been enabled on the **Ad Hoc Routing** tab of the IP Routing configuration page.

The Neighbor List provides a list of SpeedNet ME Radios that are communicating wirelessly with the local SpeedNet ME Radio. The Neighbor List is updated each time a Hello message is received from another SpeedNet ME Radio.

- **IP Address**—The **IP Address** field provides the IP address of the wireless interface of a SpeedNet ME Radios whose Hello message has been received by the local SpeedNet ME Radio.
- **Link**—This provides a measurement of the local SpeedNet ME Radio signal strength as measured by the remote SpeedNet ME Radio, specified by the IP address above, that sent the Hello message. This is used to ensure that only bidirectional links are used for routing wireless data packets. A bidirectional link will show both Link and Reverse Link signal strengths in this Neighbor List. A unidirectional link is indicated when Hello beacons are received from a remote SpeedNet ME Radio that do not contain the local radio's IP address and corresponding measurement of the local radio's received signal strength as received at the remote radio. A unidirectional link will not have a Link entry in this Neighbor List.
- **Reverse Link**—This provides a measurement of the signal strength of the last Hello message that was received from the SpeedNet ME Radio. The Reverse Link measurement is provided in dBm.

Statistics Window, RSSI Tab



Location: 42.0472530795896:-88.4
Radio ID: SpeedNetRadio
Radio IP: 192.168.200.1
Status: Connected
Access: Administrator
Region: North America

Signal Strength

MAC Address	RSSI
00:FF:FF:00:1B:4D	129
00:FF:FF:00:2E:B4	169
00:FF:FF:00:33:AA	147
00:FF:FF:00:43:1B	170
00:FF:FF:00:9C:43	170

Figure 74. RSSI statistics window.

The **RSSI** tab, shown in Figure 74, provides the statistical information regarding the link signal strength between all SpeedNet ME Radios within wireless communication range of the local SpeedNet ME Radio. The **Received Signal Strength Indicator** tab lists SpeedNet ME Radios based on their unique MAC address. Unlike the AODV Neighbor List, the **RSSI** tab does not require an exchange of Hello beacons.

- **MAC Address**—This field displays the MAC address of the SpeedNet ME Radio whose signal RSSI value is displayed.
- **RSSI**—The **RSSI** (Received Signal Strength Indication) field provides a measurement of the current RSSI based on the last packet that was received from the destination radio. RSSI values have a range of 0-255, with larger values equating to better signal strength.