Excellence in Compliance Testing

Certification Exhibit

FCC ID: U3DSPEEDNET2
IC: 5349C-SPEEDNET2

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Project Number: 11-0066

Manufacturer: L3 Nova Engerineering
Model: 110-000555-02

Manual

SpeedNet Radio User Manual

Regulatory Information

FCC Warning

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

Any changes or modifications to this device without the express written consent of S&C Electric Co may void the user's authority to operate the device.

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

The *SpeedNet Radio* is specifically designed to close the longest possible links. This goal is accomplished in part by delivering the highest permissible RF output power to the antenna per the FCC Part 15 Rules. In August 1996, the FCC adopted RF exposure guidelines that established safety levels for various categories of wireless transceivers. Those limits are consistent with safety standards previously published by the National Council on Radiation Protection (NCRP) Report 86, §17.4.1, §17.4.1.1, §17.4.2, and §17.4.3 as well as the American National Standards Institute (ANSI) in §4.1 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz," ANSI/IEEE C95.1-1992.

The *SpeedNet Radio* complies with these FCC exposure guidelines when the following precautions are obeyed:

- Only install the exact antennas recommended in this User Manual.
- The cable run for the selected antenna must exceed the minimum length quoted in this User Manual.
- All persons must maintain a minimum separation of 12" (30.48cm) from any *SpeedNet Radio* antenna.

You should disconnect the AC/DC input power source from the *SpeedNet Radio* whenever repositioning the antenna. You are responsible for taking the necessary steps to ensure that these guidelines are communicated to all persons that may come near the *SpeedNet Radio* antennas.

Class B Digital Devices

Note: 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**.**

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

Industry Canada Warning

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed below, having a maximum gain as specified in the table below for each antenna type. Antennas not included in this list or having a gain greater than specified below for each antenna type are strictly prohibited. The required antenna impedance is 50 Ohms.

Description	Part Number
+8.2 dBi omni, 60’ LMR-400 cable	Antenex FG9063 or equivalent
+11.2 dBi Yagi, 130’ LMR-400 cable	Antenex YB8966 or equivalent

Table 1: Approved Antennas

SpeedNet Radios must be installed by a professional, in order to comply with FCC Part 15 radiated power limits. Only antennas supplied by S & C Electric company may be used with the SpeedNet Radios.

The FCC mandates that Effective Isotropic Radiated Power (EIRP) may not exceed +36 dBm. This is equivalent to a radio running at full output power (1 watt +30 dBm) with a +6 dBi antenna. The antenna cable must have sufficient loss to bring the EIRP below +36 dBm if a higher gain antenna is used. For example, using a +8 dBi antenna with a radio transmitting at full power would result in an EIRP of +38 dBm. In this situation, the antenna cable must provide at least 2 dB loss in order to bring the EIRP into compliance.

SpeedNet Radios have the ability to decrease transmit power. Any confirmed decrease in output power should be considered when calculating EIRP.

Operation

The configuration and management of a SpeedNet network is achieved using the SpeedNet Client Tool application. The Client Tool, based on the Simple Network Management Protocol (SNMP), provides a secure method for viewing or modifying SpeedNet configuration parameters. The Client Tool also provides the ability to initiate firmware updates for SpeedNet Radios.

Logging In

Upon launching the SpeedNet Client Tool, the login page will be displayed. In the IP Address field, enter the IP address of the SpeedNet Radio's Ethernet interface; the default is 192.168.200.1. When logging in to a SpeedNet Radio for the first time, 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's case label. The MAC Address must be entered using all lower case characters and without any separators (for example, 0050c2021a1b).

After entering the appropriate login information, press the **Login** button to connect to the SpeedNet Radio. The *Main* page will be displayed.

Main Page

The display in the upper-right corner 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 with 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 Radio by opening the SpeedNet 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. The Statistics page provides detailed information regarding radio performance.

Interfaces Page

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

Ethernet Tab

The Ethernet Tab is used to configure all aspects of the SpeedNet Radio's Ethernet interface. The following parameters can be viewed or configured:

- **MAC ID.** This read-only field displays the unique Media Access Control (MAC) address of the SpeedNet Radio. No two network devices will use the same MAC Address.
- **IP Address.** Specifies the IP Address of the Ethernet interface of the SpeedNet 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) which 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 pressing the apply button.

Wireless Tab

The Wireless Tab is used to configure all aspects of the SpeedNet Radio's wireless interface. The following parameters can be configured or viewed:

- **MAC ID.** This read-only field displays the unique Media Access Control (MAC) address of the SpeedNet Radio's wireless interface. The wireless MAC ID is based on the Ethernet interface MAC address but with the second and third sets of digits replaced with "FF"
- **IP Address.** Specifies the IP Address of the Wireless interface of the SpeedNet Radio. The default IP address is 192.168.202.1. This address must be unique for each radio on the wireless network.
- **Subnet Mask.** Specifies the subnet mask of the wireless interface. The default subnet mask is 255.255.255.0.
- **MTU.** This read-only field displays the Maximum Transmit Unit (MTU), which is the maximum wireless packet size (in bytes) which can be transmitted without being fragmented. The MTU value is 600 bytes.
- **Network ID.** Specifies the frequency hopping pattern that will be used by the SpeedNet Radio. In order to communicate with each other, SpeedNet Radios in the same wireless network must use the same network ID setting. Note that SpeedNet Radio Networks can be co-located without causing network interference by using a separate network ID for each network. The Network ID parameter allows a range of values of 1-16, with a default value of 1.
- **Enable Analog Interference Detection.** This feature detects analog radio interference within the 902-928 MHz frequency band, allowing the SpeedNet Radio to avoid transmitting on frequency channels that have interference.
- **Threshold.** This parameter determines the number of dB above the average signal that will cause Analog Interference Detection to begin working. The default value is 15 dB.
- **Transmit Power.** This setting determines the maximum output power level to be used for wireless transmissions by the SpeedNet Radio. Options are: 10 dBm, 20 dBm, 25 dBm, and 30 dBm. The default value is 30 dBm.
- **Latency/Reliability Setting.** This parameter controls the number of wireless link layer retries. Lower values reduce the number of retries, resulting in lower latency. Higher values increase in the number of retries, increasing reliability at the expense of increased latency
- **Apply.** Saves changes made to the configuration of the *Wireless Tab*. Changes will not be saved if you change to a different configuration tab without first pressing the apply button.

Serial Mode Tab

The Serial Mode Tab determines which serial mode is used by the SpeedNet Radio. Each mode has a unique set of configuration parameters.

The following serial port modes are available:

- **PPP.** The Point-to-Point Protocol (PPP) mode is used for emulating an Ethernet connection over a serial interface.
- **DNP.** The Distributed Network Protocol (DNP) mode is used for transferring DNP data between the SpeedNet Radio's serial port and other Ethernet devices.
- **Repeater.** The Repeater mode is used for SpeedNet Radios that operate as fixed repeaters within the network.
- **Apply:** Saves changes made to the configuration of the *Serial Mode Tab*. Changes will not be saved if you change to a different configuration tab without first pressing the apply button.

PPP Serial Mode

The following options are available when PPP is the selected serial port mode.

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

DNP Serial Mode

The following options are available when DNP is the selected serial port mode.

- **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 Radio to monitor SCADA traffic in order to determine the source port for each data stream. Port information is stored internally, allowing the SpeedNet Radio to know which port to send received packets to on the SCADA master. While many SCADA masters utilize port 20,000 for SCADA communications, some of them use a different port with each device they communicate.
- **IP Address.** When creating an entry for the DNP table, this value denotes the IP Address portion of the DNP table entry.
- **SCADA Address.** When creating an entry for the DNP table, this value denotes the SCADA Address portion of the DNP table entry. The valid range of SCADA addresses is 0-65535. Although some SCADA addresses may be reserved for specific applications or SCADA operations, the SpeedNet Radio allows any addresses within the valid range to be assigned.
- **Add.** After entering an IP Address and the corresponding SCADA address, press 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 press the Delete button.
- **Output Delay.** This value defines the amount of time (in milliseconds) between transmitting DNP packets to the SpeedNet Radio's serial interface after they are received over the wireless interface. This feature has been added to accommodate legacy equipment that cannot receive data packets as quickly as the SpeedNet 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.

SpeedNet Radios include a feature that allows multiple SCADA masters using the same SCADA address to be connected to a single SpeedNet Radio. When using this feature, the connected SpeedNet Radio continually monitors DNP traffic. In the case of multiple SCADA masters using the same SCADA address, the SpeedNet 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 Radio will automatically forward packets from the backup SCADA master.

Configuration of this feature is very simple. When building the SCADA table, each SCADA master will use the same SCADA Address. The IP address will be unique for each SCADA master.

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.

Repeater Serial Mode

The SpeedNet Radio Repeater serial port mode provides the same configuration parameters as the DNP serial port mode – see above for details. As shown in the figure below, one additional parameter is available when the Repeater serial mode is selected.

- **Enable Battery Testing.** Provides the ability for SpeedNet Radios to occasionally test the status of a connected backup battery system. When this feature is enabled the results of battery tests can be seen on the **Batt Status Tab** of the **Statistics** page.

Serial Port Tab

The Serial Port Tab is only available when DNP is selected as the serial port mode. The Serial Port Tab is used to configure the communication parameters for the SpeedNet Radio's serial port. The following parameters can be configured:

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

IP Routing Page

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

Ad Hoc Routing Tab

The Ad Hoc Routing Tab 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 Off will disable the automated mesh networking protocol. When disabled, static routes must be entered manually on the **Routes** tab
- **AODV.** Selecting AODV will enable the embedded mesh networking protocol allowing network routes to be created and maintained automatically. All radios in the network must enable AODV to utilize the feature. Selecting AODV is recommended. 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 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. The value of this parameter is measured in minutes and has a default value of 30 minutes.
- **Hello Interval.** The Hello interval setting determines how frequently the SpeedNet 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 has a default value of 30 seconds.

- **Allowed Hello Loss.** The Allowed Hello Loss value determines the number of consecutive hello messages that, when missed, constitutes a link failure. The default value is 2.
- **Net Diameter.** The Net Diameter parameter determines the maximum of number of wireless hops between the source and destination nodes. This value has a default setting of 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 Radio waits before resending a route request packet. This value is measured in milliseconds and has a default value of 150 msec.
- **Quality Constant.** The Quality Constant parameter controls how quickly neighbor signal quality values can change in order to help determine whether a decreased signal quality is a temporary or permanent condition. A value of 0 will cause the radio to make routing decisions based on the signal quality of the most recent packet received. A value of 10 will cause the radio to make routing decisions based on the average of the last 10 received packets. Therefore, higher values make routes more resilient to temporary changes in the wireless environment. The default value is 3.
- **Link Threshold.** The Link Threshold value determines the signal level above which all routes will be treated as equal. If multiple equal routes are available, the route with the fewest number of hops will be used. All routes with signal qualities that fall below the link threshold will use the signal quality of the total route as the deciding factor in the route determination process. The default value is -77 dBm.
- **Route Refresh Time.** Once a route has been established, periodic route updates are broadcast to the wireless network. The Route Refresh Time determines how frequently route update messages are broadcast. The default value is 30 seconds.
- **Enable AODV Gateway.** This feature allows a SpeedNet Radio in a network to act as a gateway between the wireless network and the Internet or other routable network. Placing a check mark in the Enable AODV Gateway checkbox enables this feature and provides the additional configuration options detailed below. The Enable AODV Gateway option should only be enabled on the SpeedNet Radio that will act as the gateway for the rest of the wireless network.
- **Apply.** 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 pressing the apply button.

Enabling the AODV Gateway feature provides several new configuration options to the Ad Hoc Routing Tab of the SpeedNet Radio Client tool.

- **Gateway Address.** The Gateway Address is the IP address of the router that the SpeedNet Radio will use as its gateway to the corporate LAN, Internet or other routable network.
- **Wireless Networks.** The Wireless Networks table provides a list of wireless networks that are able to utilize the SpeedNet Radio as a gateway to other networks. The table must be populated to include the Ethernet subnets of all SpeedNet Radios that have a need to use a default gateway to reach devices that are not in the wireless network.
- **Wireless Network Address.** Defines the network(s) for which the SpeedNet Radio gateway radio will act as the gateway. For example, a SpeedNet Radio with an Ethernet IP address of 192.168.200.1 and a subnet mask of 255.255.255.0 would use 192.168.200.0 as the Wireless Network Address portion of the entry.
- **Wireless Subnet Mask.** The Wireless Subnet Mask works in conjunction with the Wireless Network Address to define the SpeedNet Radios that have a need to use a default gateway.
- **Add.** After entering a Wireless Network Address and Wireless Subnet Mask, press the Add button to add the wireless network to the table.
- **Delete.** To delete a wireless network from the table, select the wireless network from the table and then press the Delete button.

Routes Tab

The Routes Tab is used to view or delete existing data communication route table entries, as well as to add new route table entries. The following parameters can be configured:

- **Route Table.** The Route Table displays a list of current routes within the SpeedNet 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 detailed below.
- **Add Default.** The Add Default button is used to add a static default gateway to the route table and is detailed below.
- **Delete.** To delete a route from the route table, first select the route. Then press the Delete button to remove the route from the route table.

Adding Static Routes

Pressing the Add Route button will add an **Add Route** section to the Routing Tab.

- **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 Radio.
- **Add.** After entering the details of the static route, press the Add button to add the route to the route table.
- **Cancel.** Press the Cancel button to cancel the route creation process.

Adding a Static Default Gateway

Pressing the Add Default button will add an **Add Default Gateway** section to the Routing Tab.

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

ARP Tab

The Address Resolution Protocol (ARP) is used to associate an IP address to a device's corresponding MAC address. The ARP Tab, as shown in the following figure, 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, press the Add button to add the ARP entry to the Address Resolution Protocol table.
- **Delete.** To delete an ARP entry from the table, first select the entry. Then press the delete button to remove the entry from the Address Resolution Protocol table.

Security Page

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

Encryption Tab

The Encryption Tab is 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 Radio Security Utility, this option allows administrators to upload the network configuration file to the SpeedNet Radio. Press the **Browse** button to locate the network configuration file, which will have a .dat file extension. Then press the **Upload** button to insert the network configuration into the SpeedNet Radio. You will be prompted to login after the network configuration has been applied.
- **Set Security Configuration.** After creating a security configuration file using the SpeedNet Radio Security Utility, this option allows administrators to upload the security configuration file to the SpeedNet Radio. Press the **Browse** button to locate the security configuration file, which will have a .rss file extension. Then press the **Upload** button to insert the security configuration into the SpeedNet Radio. You will be prompted to login after the security configuration has been applied.
- **Keyset.** Specifies the encrypted keyset that is currently in use. All SpeedNet Radios within the network must use the same keyset in order to communicate with each other when encryption is enabled.
- **Use Latest.** Press the Use Latest button to use the keyset with the highest keyset number. All radios must use the same keyset installed in order to communicate.
- **Switchover.** Enter the desired keyset number into the **Keyset** field, and then press the Switchover button to use the new key. SpeedNet Radios include an “auto switchover” feature that allows the network to automatically update to a more recent key. If a SpeedNet 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 in order to avoid losing the ability to connect to a radio that is using a different keyset.
- **Enable Encryption.** Placing a checkmark in the Enable Encryption checkbox enables wireless network encryption on the SpeedNet Radio.

MAC Filter Tab

The MAC Filter Tab can be used to view the list of MAC addresses that have been added to the MAC Address Revocation list using the SpeedNet Radio Security Utility. There are no configurable parameters on the MAC Filter Tab. All changes to the MAC Revocation list must be made using the SpeedNet Radio Security Utility and uploaded to the SpeedNet Radio as part of a new security configuration file.

Admin Page

The Admin Page provides a list of tabs that can be used to perform administrative tasks to the SpeedNet Radio including upgrading firmware and determining system information. Selecting a tab will provide a list of configurable options.

System Tab

The System Tab 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 viewed or configured:

- **Build Date.** This read-only field provides information regarding the date that the current SpeedNet Radio firmware was created.
- **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 Radio
- **Running Time.** This read-only field displays the elapsed time since the last time the SpeedNet Radio was rebooted.
- **SpeedNet Radio ID.** This field can be used by Administrators to assign a descriptive name to the SpeedNet Radio. The SpeedNet 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 must consist of ASCII values.
- **System Contact.** This field can be used by Administrators to list the point of contact for the SpeedNet 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 pressing the apply button.
- **Reboot.** Pressing the Reboot button will cause the SpeedNet Radio to reboot.

Firmware Tab

The Firmware Tab is used to upgrade the firmware that is installed on the SpeedNet 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, press the **Upgrade** button to initiate the firmware upgrade. The SpeedNet Radio will reboot at the conclusion of the upgrade. Note: the radio should not be disturbed during the firmware upgrade process.

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

Shell Tab

The Shell Tab is provided to support advanced integrator troubleshooting and does not play a role in the configuration of a SpeedNet Radio network.

Statistics Page

The Statistics Page contains 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 Radio Client Tool.

Ethernet Tab

The Ethernet Tab provides the following statistical information regarding performance of the SpeedNet Radio's Ethernet interface.

- **Bytes received.** Total number of bytes received by the SpeedNet 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**. Total number of single destination (unicast) frames sent to the SpeedNet Radio's Ethernet interface.
- **Non-Unicast frames received.** Total number of non-unicast frames sent to the SpeedNet Radio's Ethernet interface.
- **Receive errors.** Total number of receive errors.
- **Received frames dropped.** Total number of frames received by the SpeedNet Radio's Ethernet interface that were discarded.
- **Unknown protocol received.** Total number of frames received by the SpeedNet Radio's Ethernet interface with unidentified protocol errors.
- **Bytes sent.** Total number of bytes sent by the SpeedNet Radio's Ethernet interface.
- **Unicast frames sent.** Total number of single destination (unicast) frames sent from the SpeedNet Radio's Ethernet interface.
- **Non-Unicast frames sent.** Total number of non-unicast frames sent from the SpeedNet Radio's Ethernet interface.
- **Transmit errors.** Total number of transmit errors. This error is received from the application device and may indicate a problem with the connected hardware.
- **Transmit frames dropped.** Total number of frames transmitted and then discarded. This error is received from the application device and may indicate a problem with the connected hardware.
- **Output queue length.** Error received from the application device that may indicate a problem with the connected hardware.

ICMP Tab

The ICMP Tab provides the following statistical information regarding the Internet Control Message Protocol.

ICMP Receive Statistics

- **ICMP messages received.** Total number of ICMP messages received by the radio.
- **Received messages discarded due to format errors.** Total number of ICMP messages received by the radio which were not delivered due to format errors.
- **Destination unreachable messages received.** Total number of destination unreachable messages received by the radio. Destination unreachable messages are generated when the destination address is unreachable
- **Time exceeded messages received.** Total number of messages received by the radio that exceeded their time to live.

- **Parameter problem messages received.** Total number of parameter problem messages received. A parameter problem message is sent when an error in an IP header of a datagram is detected.
- **Source quench messages received.** Total number of source quench messages received. A source quench message is sent to request a reduction in the packet transmission rate.
- **Redirect messages received.** Total number of redirect messages received. A redirect is sent when an alternate route for the datagram is selected.
- **Echo request messages received.** Total number of echo requests received. An echo request causes the receiving radio to send an echo reply message back to the originating radio. Echo requests are typically generated using a “Ping” application.
- **Echo reply messages received.** Total number of echo replies received. An echo reply is sent to respond to an echo request. Echo replies are typically generated by a “Ping” application.
- **Timestamp request messages received.** Total number of timestamp requests received. A timestamp causes the radio to send a timestamp reply to the originating radio.
- **Timestamp reply message received.** Total number of timestamp replies received. A timestamp reply is sent in response to a timestamp request. Timestamps replies and requests measure the transmission speed of datagrams on a network.
- **Address mask request messages received.** Total number of address mask requests received. 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 received.** Total number of address mask responses received. An address mask response is sent in response to an address mask request.

ICMP Transmit Statistics

- **ICMP messages sent.** Total number of ICMP messages sent by the radio.
- **Outgoing messages discarded due to format error.** Total number of ICMP messages sent by radio which were not delivered due to format errors.
- **Destination unreachable messages sent.** 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.** Total number of messages sent by the radio which exceeded their time to live.
- **Parameter problem messages sent.** 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.** 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.** Total number of redirect messages sent. A redirect is sent when an alternate route for the datagram is selected.
- **Echo request messages sent.** 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.** 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.** 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.** 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.** 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.** Total number of address mask responses sent. An address mask response is sent in response to an address mask request.

UDP Tab

The UDP Tab 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.** Total number of UDP datagrams successfully received.
- **Datagrams destined for unknown ports.** Total number of received UDP datagrams with unknown destination ports.
- **Datagrams discarded due to format error.** Total number of UDP datagrams which were not delivered due to format errors.
- **Datagrams sent.** Total number of UDP datagrams sent.

IP Tab

The IP Tab provides the following statistical information regarding the Internet Protocol.

- **Default TTL.** 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.** Total number of IP data packets received.
- **Datagrams with header errors.** Total number of received IP data packets that contain errors in the header (i.e., incorrect IP header length).
- **Datagrams with address errors.** Total number of received IP data packets that contain address errors.
- **Datagrams forwarded.** Total number of IP data packets that are forwarded because the receiving radio was not the intended destination.
- **Datagrams with unknown protocols.** Total number of data packets received with protocols not recognized by the radio.
- **Input datagrams discarded.** Total number of IP data packets received which were discarded because the node was too busy.
- **Datagrams delivered.** Total number of IP data packets successfully delivered to the destination application.
- **Datagrams sent.** Total number of IP data packets sent.
- **Output datagrams discarded.** Total number of data packets sent which were discarded because the node was too busy.
- **Datagrams discarded due to no route.** Total number of data packets discarded due to the lack of correct routing information.
- **Timeout value for reassembly queue.** Duration before the reassembly queue is cleared and the connection is dropped.
- **Fragments received needing reassembly.** 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.** Total number of fragmented IP data packets received and reassembled.
- **Fragment reassembly failures.** Total number of fragmented IP data packets received that could not be reassembled.
- **Datagrams successfully fragmented.** Total number of IP data packet fragments generated.

- **Datagrams failing to fragment.** Total number of data packets discarded because the fragmentation process failed to fragment the packets.
- **Fragments created.** Total number of IP data packet fragments created.

Wireless Tab

The Wireless Tab provides the following statistical information regarding the wireless performance of the SpeedNet Radio.

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

Batt Status Tab

The Batt Status Tab provides the following statistical information regarding the battery performance when a battery is connected to the SpeedNet Radio.

- **Battery Monitoring.** Indicates whether Battery Monitoring has been activated. Battery Monitoring is enabled by placing a checkmark next to the **Enable Battery Testing** option, which is located on the **Serial Mode** tab of the **Interfaces** configuration page.
- **AC Power.** 1 = ON, 0 = OFF

- **Charge status.** 0 = ON, 1 = OFF
- **Battery failure.** 0 = ON, 1 = OFF
- **Temperature of BCS.** Internal temperature of the SpeedNet Radio, in ℉.
- **Battery voltage.** This value should be 12 to 13 volts unless the battery is discharging.
- **Seconds since charge went off.** Duration since AC power has been removed.
- **Get Battery Status Log.** Press the **Download** button to save the battery status statistics as a text file.

AODV Tab

The AODV Tab provides statistical information regarding the link quality between all SpeedNet Radios within wireless communication range of the local SpeedNet 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 Radios that are communicating wirelessly with the local SpeedNet Radio. The Neighbor list is updated each time a “Hello” message is received from another SpeedNet Radio.

- **IP Address.** The IP Address field provides the IP Address of the wireless interface of a SpeedNet Radios whose “Hello” message has been received by the local SpeedNet Radio.
- **Link.** Provides a measurement of the local SpeedNet Radio’s signal quality as measured by the SpeedNet Radio that sent the “Hello” message. This is used to ensure that only bidirectional links are used for routing wireless data packets.
- **Reverse Link.** Provides a measurement of the signal quality of the last “Hello” message that was received from the SpeedNet Radio. The Link measurement is provided in dBm.

RSSI Tab

The RSSI Tab provides statistical information regarding the link quality between all SpeedNet Radios within wireless communication range of the local SpeedNet Radio. The RSSI tab lists SpeedNet Radios based on their unique MAC Address.

- **MAC Address.** Displays the MAC Address of the SpeedNet Radio whose signal RSSI value is displayed.
- **RSSI.** The RSSI field, which stands for Received Signal Strength Indicator, 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 quality.

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