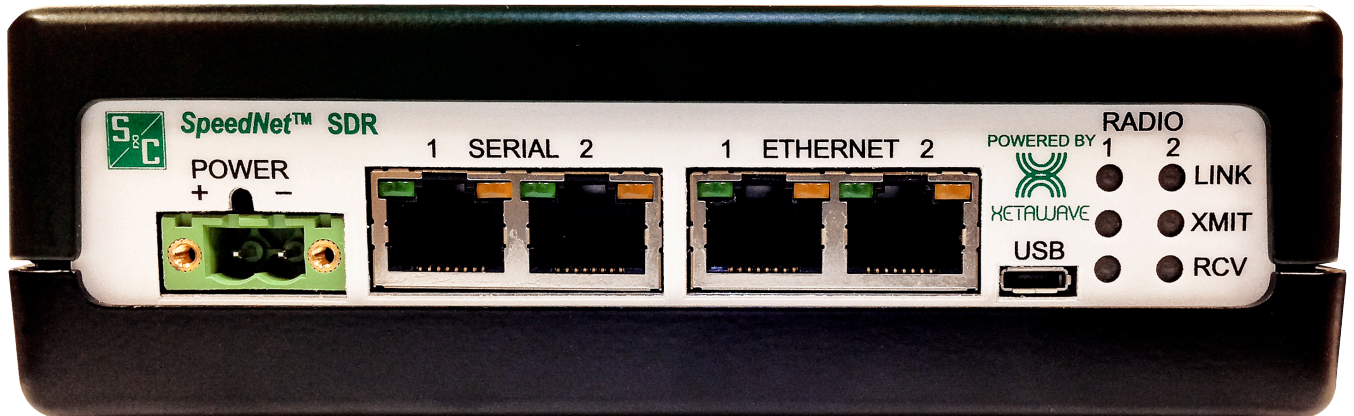


Setup

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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 radios in electric power distribution equipment, along with the associated hazards. A qualified person is a radio technician who is qualified to install transmission-power-limited radio equipment per FCC Part 15, and who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive 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

Thoroughly and carefully read this instruction sheet before installing or operating your S&C SpeedNet SDR Software Defined Radio. The latest version is available online in PDF format at sandc.com/en/Support/Product-Literature.

These instructions apply to SpeedNet SDR Radio Firmware **1.37.X**, and Ethernet Firmware version **sc4(x4)-EBA.5.2.X**. The version number can be found on the main page of the SpeedNet SDR Radio Web Client, as shown in Figure 1.

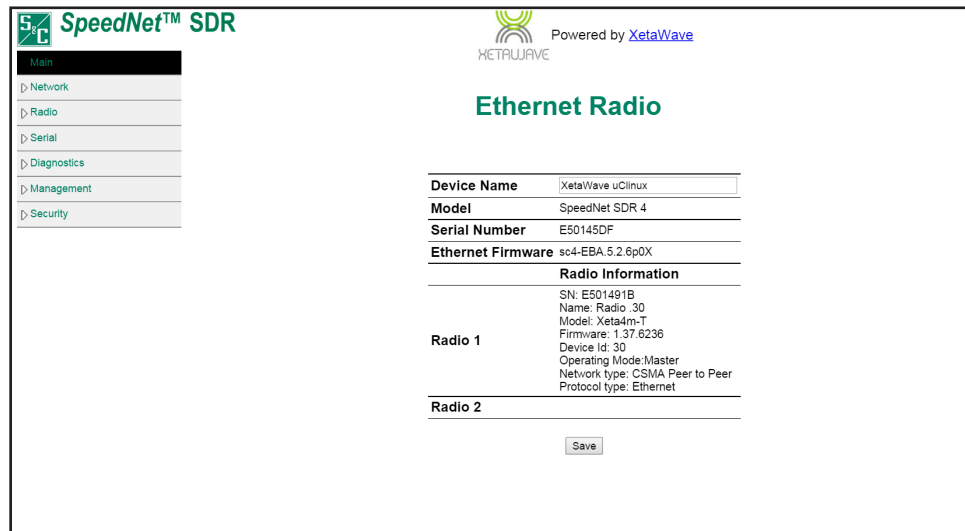


Figure 1. The *Main* screen of the SpeedNet SDR Radio Web Client.

Retain this Instruction Sheet

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

Warranty

The standard warranty contained in the seller's standard conditions of sale, as set forth in Price Sheets 150 and 155, applies to S&C SpeedNet SDR Software Defined Radios, except the first paragraph of said warranty is replaced by the following:

- (1) General:** Seller warrants to purchaser for a period of two years from the date of shipment that the equipment delivered will be of the kind and quality specified in the contract description and will be free of defects of workmanship and material. Should any failure to conform to this warranty appear under proper and normal use within two years after the date of shipment, the seller agrees, upon prompt notification thereof and confirmation that the equipment has been stored, installed, operated, inspected, and maintained in accordance with recommendations of the seller and standard industry practice, to correct the nonconformity either by repairing any damaged or defective parts of the equipment, or (at seller's option) by shipment of necessary replacement parts.

The above special warranty does not apply to gateway communication devices applied with SpeedNet SDR Software Defined Radios.

The end user is granted a nontransferable, non-sublicensable, nonexclusive license to use the software furnished with SpeedNet SDR Software Defined Radios only upon acceptance of all the terms and conditions of the seller's end user license agreement set forth in Price Sheet 155.

Both the single-channel SpeedNet SDR Radio and the dual-channel SpeedNet 4x4 Radio are versatile smart grid-enabled wireless devices that have been designed specifically for power distribution automation (DA), SCADA, and distributed-generation applications. SpeedNet SDR Radios provide wireless connections between two or more Internet Protocol (IP) or serial devices. Application devices, such as the S&C IntelliRupter® PulseCloser® Fault Interrupter, can be connected to a SpeedNet SDR Radio. As routers, SpeedNet SDR Radios route IP data between separate Ethernet subnets. 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 the SpeedNet SDR Radio's proprietary enhanced version of the Ad hoc On-demand Distance Vector (AODV) routing protocol.

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

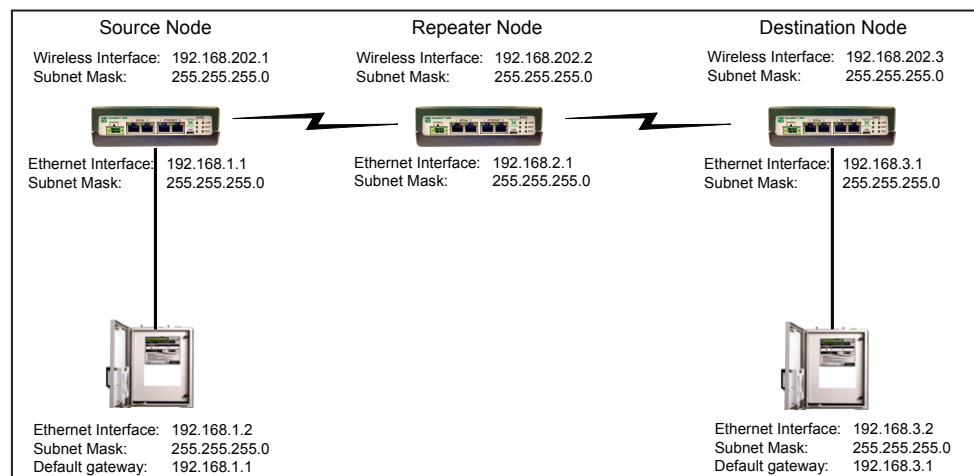


Figure 2. Multi-node SpeedNet SDR network.

The SpeedNet SDR Radio network shown in Figure 2 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 SDR Radio from the Source Node is assigned an address of 192.168.202.1. The wireless interface of the SpeedNet SDR Radio from the Repeater Node is assigned an address of 192.168.202.2. The wireless interface of the SpeedNet SDR Radio from Destination Node is assigned an address of 192.168.202.3.

In this example, each SpeedNet SDR 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 SDR Radios, regardless of their role within the network (i.e. source, destination, repeater), must use unique IP addresses for their Ethernet and wireless interfaces. All the SpeedNet SDR Radios on the same mesh should have wireless IP addresses in the same subnet. All the SpeedNet SDR Radios on the same mesh should have different Ethernet subnets.

Refer to S&C Instruction Sheet 1075-510 for additional information about network planning.

The configuration and management of a SpeedNet SDR Radio network is achieved using a standard Web browser and entering the IP address of the radio. The default IP address of a SpeedNet SDR is set to 192.168.0.3 at the factory. Note that your PC IP address must be on the same LAN segment of the SpeedNet SDR radio.

Open up a Web browser and enter the IP address of the radio. Again, the default IP address of a SpeedNet SDR is set to 192.168.0.3 at the factory.

Authentication requires a username and password. Contact S&C for these credentials. See Figure 3.

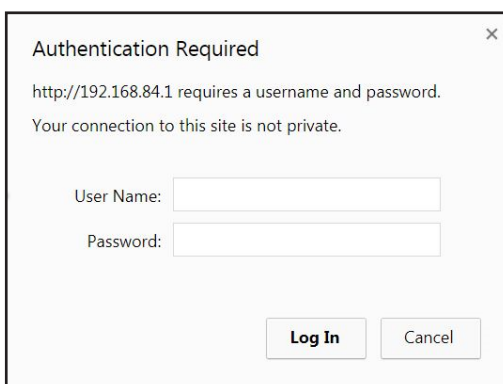


Figure 3. Authentication Required dialog box.

Enter a Device Name for the radio in the text box on the *Main* screen, and click on the **Save** button to save. See Figure 4.

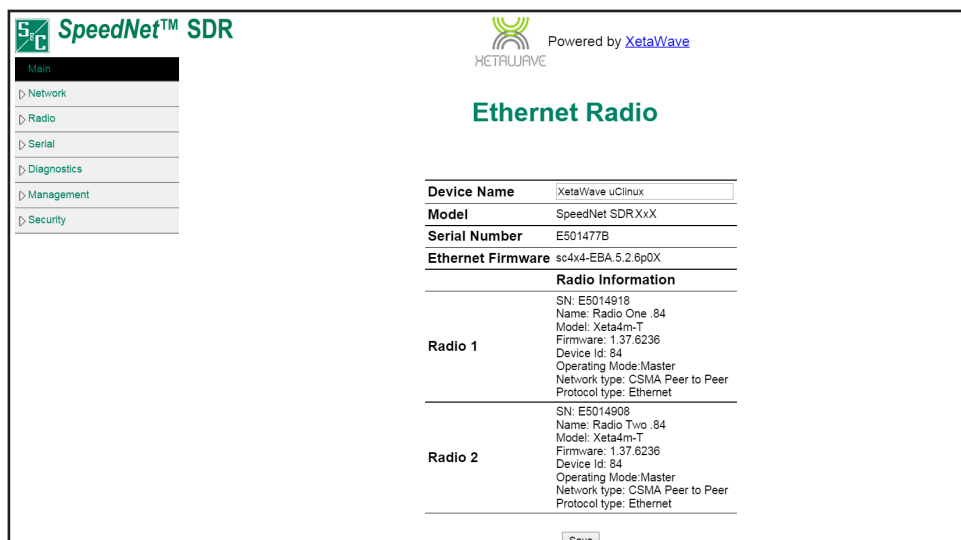


Figure 4. Ethernet Radio information on the Main screen.

VLAN

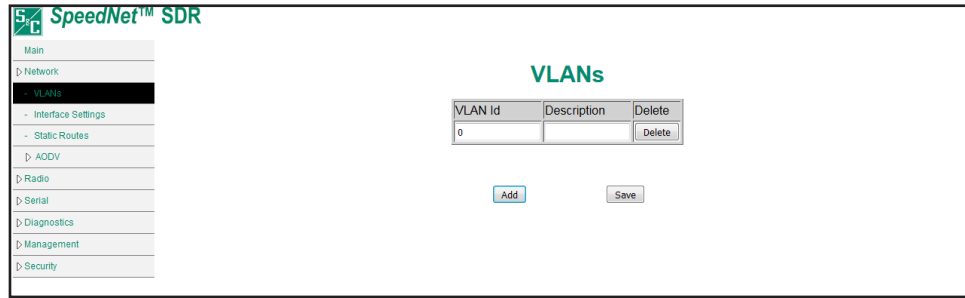


Figure 5. The Network>VLAN screen.

Navigate to the *Network>VLAN* screen, as shown in Figure 5, and configure the VLAN(s) to be created in the radio. A VLAN may be added and defined. Enter the VLAN Id and Description, and click on the **Save** button.

NOTE: VLANs are not supported with AODV mesh networks.

Interface Settings

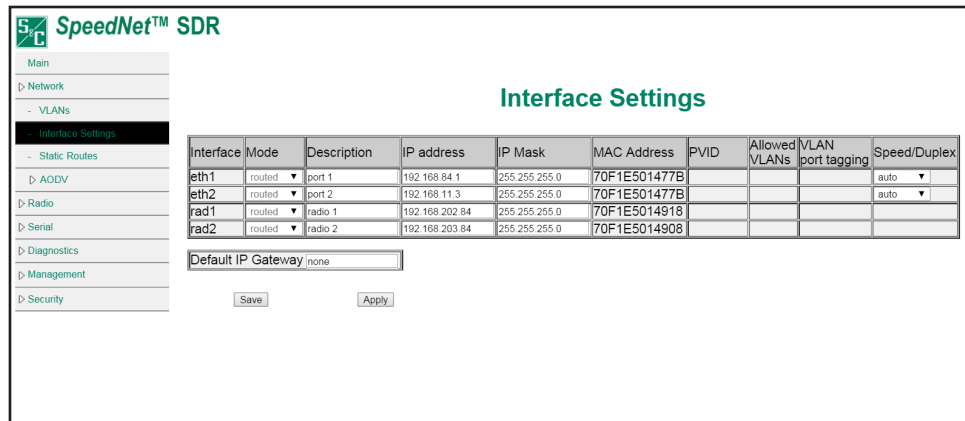


Figure 6. The Network>Interface Settings screen.

Navigate to the *Interface Settings* screen, as shown in Figure 6.

Interface—This is the list of the physical interfaces within the radio.

Mode—There could be a **Routed** or **Bridged** mode. Routed is the normal mode of operation intended for AODV mesh radio systems. Other configurations support Bridged operation with VLAN IDs.

Description—This is an alphanumeric name to be associated with the physical port.

IP address—This is the IP address of the physical port.

IP Mask—This is the subnet mask of the physical port.

Note: On a given SpeedNet SDR Radio mesh, the configurations of all the Ethernet interfaces must differ on each radio so there is no overlap between the Ethernet port subnets, or between the Ethernet port subnets and the wireless subnet.

MAC Address—This read-only field displays the unique Media Access Control (MAC) address for each of the SpeedNet SDR Radio interfaces. No two network devices will use the same MAC address.

PVID—This is the primary VLAN ID associated with a physical Ethernet port. By convention, untagged Ethernet frames entering the radio via a physical Ethernet port are assigned to the native VLAN specified for that port. Any untagged frames leaving an Ethernet port are also associated with the port's native VLAN. The default setting is 1.

Note: VLANs are not supported with AODV routing protocol.

Note: VLANs are not supported with AODV mesh radio configuration.

Allowed VLANs—This list is used in combination when the Allowed VLANs is set to LIST to specifically identify which VLANs can enter or leave the radio over a physical Ethernet port or wireless radio interface.

VLAN Port Tagging—This value controls the VLAN tagging behavior for an Ethernet port. The default is the **None** setting.

When set to the **None** setting, an Ethernet port does not add VLAN tags to any frame leaving the port, and only untagged frames are allowed to enter the radio. One exception to this rule is that tagged frames belonging to the native VLAN are accepted by the radio. All packets entering and leaving the radio are associated with the native VLAN. **Note:** As above, Port Tagging is not supported with AODV mesh radio systems.

When set to the **Exclude Native** setting, the port acts as a VLAN trunk and will tag all frames leaving the port, except those belonging to the native VLAN. Traffic entering the port can be tagged or untagged, with all untagged frames automatically being associated with a port's native VLAN.

When set to the **All** setting, the port acts as a VLAN trunk and will tag all frames leaving the port, including those belonging to the native VLAN. Traffic entering the port must be tagged. Any untagged frames entering a port are dropped.

Default IP Gateway—Enter the IP address of the next-hop gateway that will act as the default gateway for this SpeedNet SDR Radio. The gateway will be the IP address of the wireless interface of a SpeedNet SDR Radio. **NOTE:** This Gateway address is not typically configured for when AODV routing is enabled. The Gateway used for AODV routing is configured on the AODV: Settings page.

Click on the **Save** button to save your changes or the **Apply** button to make the new changes active. **Note:** Depending on your computer's configuration, it will most likely be necessary to change or add an IP address on your computer to be on the radio's new subnet after the new settings are applied.

Static Routes

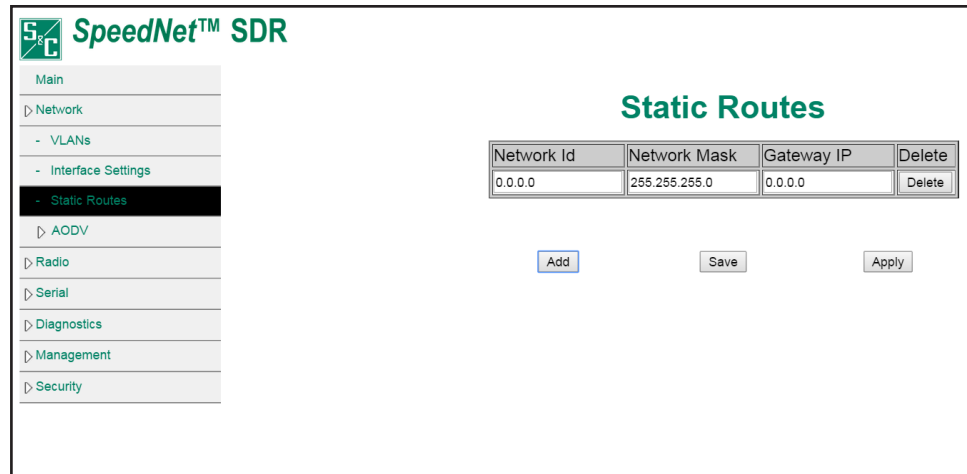


Figure 7. The *Network>Static Routes* screen.

The screen shown in Figure 7 displays the Static Routes of each installed radio.

- **Network ID**—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.
- **Network Mask**— This is the subnet mask for the destination network for which the route is being created.
- **Gateway IP**— 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 SDR Radio.
- **Add**—After entering the details of the static route, click the **Add** button to add the route to the route table.
- **Save**—Click the **Save** button to save all information.

Note: Static routes must not be configured when AODV automatic mesh routing is enabled.

AODV Settings

SpeedNet™ SDR

Main

Network

- VLANs
- Interface Settings
- Static Routes
- ▷ AODV
 - Settings
 - Network
 - Blacklist
 - Apply
- ▷ Radio
- ▷ Serial
- ▷ Diagnostics
- ▷ Management
- ▷ Security

AODV Settings

Enable Routing Mode AODV Off

Active Route Timeout minutes

Hello Interval seconds

Allowed Hello Loss times (0 = no limit)

Net Diameter hops

Node Traversal Time milliseconds

ARQ Minimum Time seconds

ARQ Maximum Time seconds

ARQ Percent %

Link Threshold dBm

Route Refresh Time minutes

LLP Timeout minutes (0 = no LLP)

Gateway Parameters

AODV Gateway IP IP address

Enable AODV Gateway

Save

Figure 8. The AODV>Settings screen.

The *Main* screen provides a list of tabs that can be used to configure the routing performance of a SpeedNet SDR Radio. Selecting a tab will provide a list of configurable options.

The **AODV Settings** tab, shown in Figure 8, 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 Vector (AODV). The following parameters can be configured:

Off—Selecting the **Off** setting disables the automated mesh networking protocol. When disabled, static routes must be entered manually on the Static Routes tab for all endpoints this radio needs to reach. No combination of automatic AODV routing and static routing is supported.

AODV—Selecting AODV enables the embedded mesh networking protocol, allowing network routes to be created and maintained automatically among SpeedNet SDR Radios. All radios in the network must enable AODV to use the feature. Selecting AODV is recommended for ease of configuration, robustness to radio failure, and ease of adding radios to the mesh. The remaining configuration options on the **Ad Hoc Settings** tab pertain specifically to the mesh networking protocol.

Active Route Timeout—The Active Route Timeout parameter determines how long a SpeedNet SDR 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. 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 SDR 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.

Hello Interval—This setting determines how frequently the SpeedNet SDR 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—This 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. The default value is 0. Setting this value too

low can cause unnecessary route generation when a Hello message was lost due to 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 due to the persistent failure of a link in the route.

Net Diameter—This setting determines the maximum number of wireless hops between the source and destination nodes, specifically, the maximum number of hops that a route request message can travel. This value has a default setting of 5 hops. 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 due to 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 highly 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.

Node Traversal Time—This value provides an estimate of the time required for a packet to traverse one wireless hop. The value affects how long a SpeedNet SDR Radio waits before resending a route-request packet. This value is measured in milliseconds and has a default value of 800 msec.

ARQ Minimum Time—When a message has not been successfully delivered to a destination radio as defined by the number of attempts configured on the **Master Repeat Addr** setting on the *Radio Network Settings* screen, the message is dropped and a timer is started. The ARQ Minimum Time is the sample period from the start of the timer.

ARQ Maximum Time—This is the reset timer. The time in which the radio memory is cleared of an unsuccessful message to a destination radio.

ARQ Percent—This is the percentage of messages that are not successfully delivered to a unique destination in the sample period defined by the ARQ Minimum Time.

Note: The above ARQ setpoints allow a configurable means to determine a number of successive, unique packet-delivery retries prior to terminating a route. When this percentage 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 that more expedient routing may be performed around an unavailable node.

Link Threshold—The **Link Threshold** value determines the signal level above which routes are selected strictly on a minimum hop count basis. If routes within the Network Diameter restriction comprising solely links with signal strength above the Link Threshold are found, then the route with the minimum hop count will be selected from among these possible routes. If no route within the Network Diameter restriction comprising solely links with signal strength above the Link Threshold is found, then the route with the strongest minimum link signal strength will be selected. If multiple routes with the same minimum link signal strength are found, then the route with the minimum hop count will be selected from among those routes. The default **Link Threshold** value is -77 dBm. Setting the **Link Threshold** value too high can cause the mesh to use longer-than-necessary routes. Setting the **Link Threshold** value too low can cause the radios to encounter excessive errors and link-level retries along the selected route. Also note that only bidirectional links wherein hello beacons have been successfully exchanged between both endpoint radios can be used in SpeedNet SDR Radio routes.

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 180 minutes. If the Route Refresh Time is too short, there may be excessive overhead on the radio network in carrying the route updates. If the Route Refresh Time is too long, 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).

LLP (Local Link Preference) Timeout—A SpeedNet SDR Radio 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 due to conditions such as RF interference, line of sight impediments, multipath propagation, and network congestion. If Local Link Preference is enabled and a radio experiences inability to deliver messages through a given neighboring node, a SpeedNet SDR Radio will attempt to avoid that neighbor, if alternate neighbors are available to deliver the messages, when building future routes. It should be noted that LLP can coexist with the Blacklisting feature. Blacklisted IPs remain blacklisted regardless of LLP state. LLP does not blacklist an IP address, it simply places the offending next hop neighbor into a “penalty box” so it is not used until a time that is configurable.

The LLP Timeout parameter specifies when a neighbor who had been put in the LLP blacklist is made available as a routing option. Setting LLP Timeout to 0 effectively disables LLP. When LLP is enabled, the recommended value for LLP Timeout is 1440 minutes (1 day). Factory Default is set to 0.

AODV Gateway IP—The gateway address is the IP address of the router that the SpeedNet SDR Radio will use as its gateway to the corporate LAN, Internet, or other routable network external to the wireless networks.

AODV Gateway—This feature allows a SpeedNet SDR 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 check box enables this feature and provides the additional configuration options detailed below. The Enable AODV Gateway option should only be enabled on the SpeedNet SDR Radio that will act as the gateway for the rest of the wireless network.

Save—Saves changes made to the configuration of the **AODV Settings** tab. Changes will not be saved if you change to a different configuration tab without first clicking on the **Save** button.

AODV Network

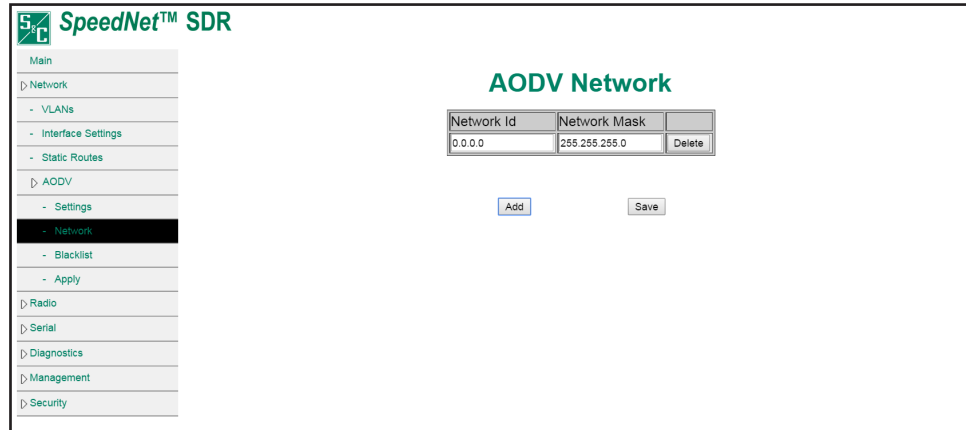


Figure 9. The AODV Network screen.

The AODV Networks table provides the list of wireless networks that are able to use the SpeedNet SDR AODV Gateway Radio as a gateway to other networks. See Figure 9. The table must be populated to include all of the Ethernet subnets of all SpeedNet SDR Radios. All wireless networks used by the radios must also be configured in this table. This list of networks determines which route requests the AODV Gateway radio should not answer (in other words, what IP traffic the AODV gateway should not attract and forward to the gateway address).

Network ID—Defines the network(s) for which the SpeedNet SDR gateway radio will act as the gateway.

Network Mask—The Subnet Mask (Network Mask) works in conjunction with the Network ID to define the SpeedNet SDR Radio networks that have a need to use a default gateway.

Note: The above networks may be summarized or configured as a range that covers all of individual networks on the wireless side of the AODV Gateway radio.

Add—After entering a Network ID and Network Mask, click on 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 click on the **Delete** button.

Save—Saves changes made to the configuration of the AODV Network tab. Changes will not be saved if you change to a different configuration tab without first clicking on the **Save** button.

AODV Blacklist

The **AODV Blacklist** feature is used to prevent routing through SpeedNet SDR Radios that qualify as valid neighbors, but are neighbors that you do not want to use as next hop links for that particular radio address. See Figure 10. One reason to exclude a neighbor is that it may have a permanent or transient line-of-sight impediment, which 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 AODV Blacklist address table is limited to a total 36 radio addresses.

If you plan to make use of the **Blacklist** feature to prevent the use of poorly performing neighbor links, contact Power Systems Solutions for assistance to identify the poorly performing links and properly apply the AODV Blacklist configuration.

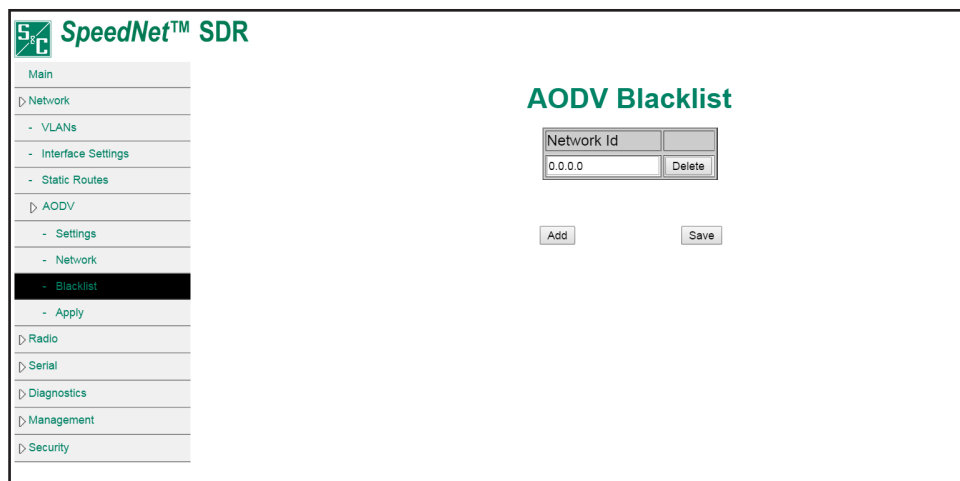


Figure 10. The AODV>Blacklist screen.

Add—After entering a Wireless Network Address and Wireless Subnet Mask, click on 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 click on the **Delete** button.

Save—Saves changes made to the configuration of the **AODV Blacklist** tab. Changes will not be saved if you change to a different configuration tab without first clicking on the **Save** button.

AODV Apply Configuration

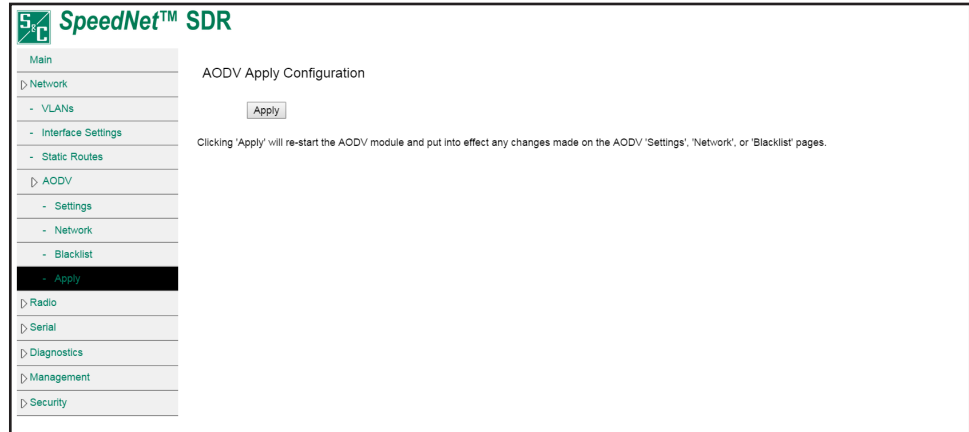


Figure 11. The AODV Apply Configuration screen.

AODV Apply Configuration—Clicking on the **Apply** button will re-start the AODV module and put into effect any changes made in the *AODV Settings*, *Network*, or *Blacklist* screens. See Figure 11.

RF Modules

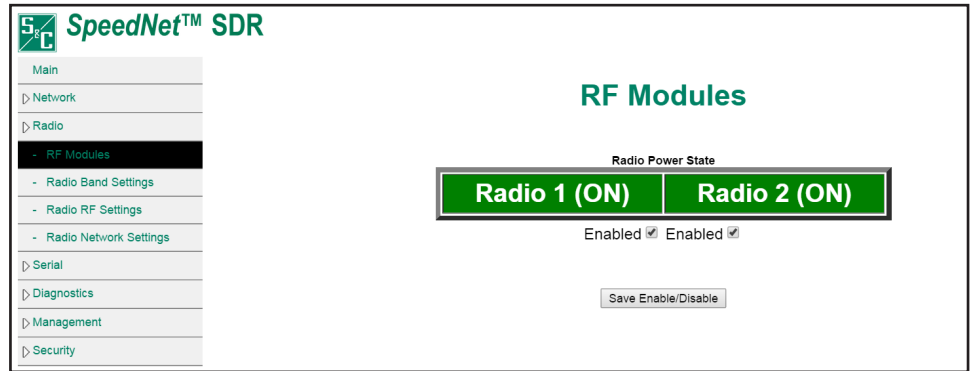


Figure 12. The *Radio>RF Modules* screen.

The screen shown in Figure 12 graphically displays the present state of each installed radio.

Click a radio-selection button to toggle power to that radio. A radio that is powered off will be automatically powered back on after a 2-minute interval to prevent inadvertently being disconnected from the radio.

In addition to being powered off temporarily, a radio can be disabled by unchecking the Enabled check box and clicking on the **Save Enable/Disable** button. If a radio is disabled, it will remain powered off even through reboots and power cycles until it is manually re-enabled from this page.

Radio RF Settings

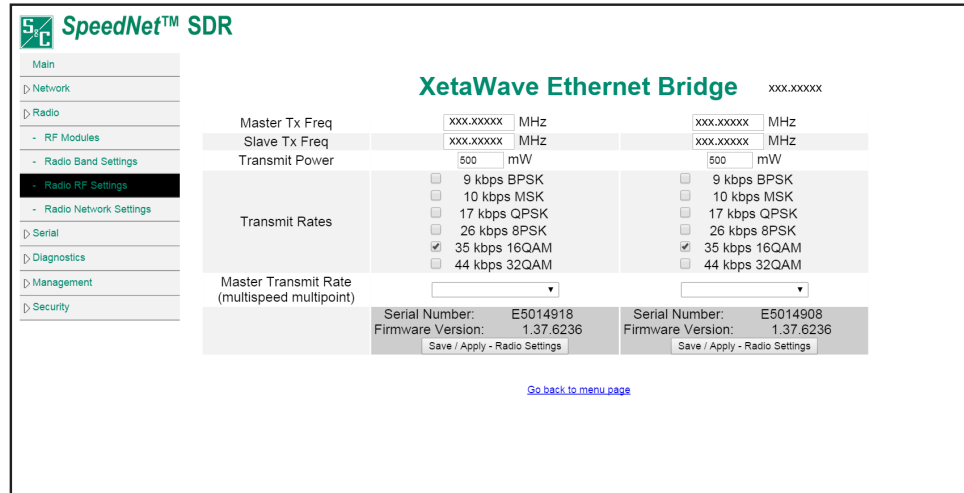


Figure 13. The *Radio RF Settings* screen.

Navigate to the *Radio RF Settings* screen. See Figure 13.

Enter the master and slave frequencies to use. **Note:** On an AODV mesh system, these two frequencies will be the same.

Master Tx Freq—The operating channel of the radio. Enter the frequency in MHz.

Slave Tx Freq—The operating channel of the slave radio. Enter the frequency in MHz.

Note: On an AODV mesh radio system, these two frequencies will be the same.

Transmit Power—Enter the transmit power in milliwatts.

Transmit Rates—Configure the Transmit Rate. The ideal setting is a function of distance, throughput required, transmit power, and radio noise in the area. In AODV routing installations, all radios must be configured to the same transmit rate. Transmit rates that are shown reflect the available rates for FCC, IC, and ETSI. Only the transmit rates that are certified for the market where the radio was initially sold will appear.

Master Transmit Rates—This setting is used for multispeed multipoint radio configurations and not used in AODV mesh radio systems.

Save/Apply-Radio Settings—Click on this button when finished.

Radio Network Settings

	Radio 1		Radio 2	
Description	Radio One		Radio Two	
Network Type	CSMA Peer to Peer		CSMA Peer to Peer	
Mode	Master		Master	
Enable Repeaters	No		No	
Network Address	555		556	
Device ID	456		557	
Upstream Device ID	5		5	
Downstream Device ID	6		6	
Network Radius	11 km		11 km	
Master Repeat	Bcast 0	Addr 4	Bcast 0	Addr 4
Max Payload Bytes	Master 1600	Slave 1600	Master 1600	Slave 1600
Dynamic Payload	Off		Off	
Beacon Rate	1		1	
Transmit Prob	25		25	
Serial Number:	E5014979		E5014A03	
Firmware Version:	1.37.7116		1.37.7116	
Save / Apply - Radio Settings		Save / Apply - Radio Settings		
Diag Threshold -81 dBm		Diag Threshold -81 dBm		

Figure 14. The Radio Network Settings screen.

Navigate to the **Radio Network Settings** screen. See Figure 14.

Description—Enter the alphanumeric name for the radio interface.

Network Type—The options are Point to Point, Point to Multipoint, and CSMA Peer to Peer. CSMA Peer to Peer is the setting to be used for AODV mesh networks.

Mode—The options are Master or Slave. Master is to be selected for AODV mesh networks.

Enable Repeaters—This is a feature of point-to-multipoint systems. Select the **No** option for AODV mesh networks.

Network Address—The Network Address is an identifier used to allow a group of radios to communicate and exclude nonmember radios. In this example 555 is used.

Device ID—A unique number that identifies a radio on the RF network. Each radio on a network, as defined by the network address, is required to have a unique ID in a similar way to IP addresses on an Ethernet network.

Upstream Device ID—For both PTP and PTMP networks, the Upstream Device ID on the slave radio should be the device ID of the Master Radio that the slave is required to communicate with. The Upstream Device ID is non-applicable on a master radio and can be set to the Master's Device ID.

Downstream Device ID—For PTP networks only, and is configured for the Device ID of the slave radio that the master is required to communicate with.

Network Radius—For PTP and PTMP networks only. The link distance or maximum distance of the longest link in the network.

Master Repeat—**Bcast:** This is the number of times the radio will retransmit a packet. It is recommended that this setting is 0 for AODV mesh networks. **Addr:** This specifies the number of Link-level 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 can cause flooding of retries on the radio mesh when none will succeed.

Max Payload Bytes—For PTP and PTMP networks.

Dynamic Payload—For PTP and PTMP networks. This setting is off for AODV mesh networks.

Beacon Rate—For PTP and PTMP networks. This is the number of transmission slots the master radio may skip if it has nothing to transmit/acknowledge.

Transmit Prob—Upon transmit, the RF module uses a probability-based contention-management algorithm when the radio is configured for CSMA **Peer to Peer** mode. Enter the probability in percent. 25 is the default setting.

Click on the **Save/Apply—Radio Settings** button when finished.

Local Serial Settings

The SpeedNet SDR Radio is equipped with two serial ports. Each serial port may be individually configured for RS232, RS422, or RS485. Select the **Local Serial Settings** menu from the menu to support the local serial ports on the radio. See Figure 15.

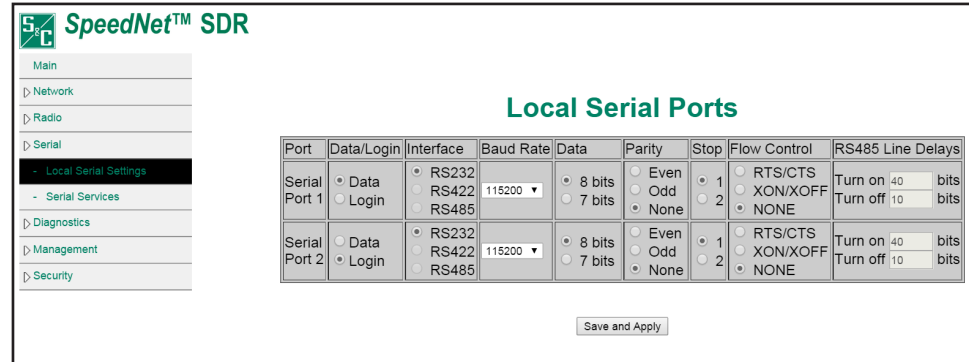


Figure 15. The *Local Serial Ports* screen.

This page displays the Local Serial Ports of each installed radio.

Data/Login—Select the **Login** option to support the serial command line interface to configure the radio or update firmware through the serial port.

Interface—Select either RS232, RS422, or RS485.

Baud Rate—This determines the bit rate used for serial communications. The default value is 115200.

Data Bits—This determines the number of data bits in each character. The default value is 8.

Parity—This determines the setting for the parity bit in each character. The default value is None.

Stop—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 used for serial communication. The default value is None.

RS485 Line Delays—This configures the line delays required for RS485 communications.

Serial Services

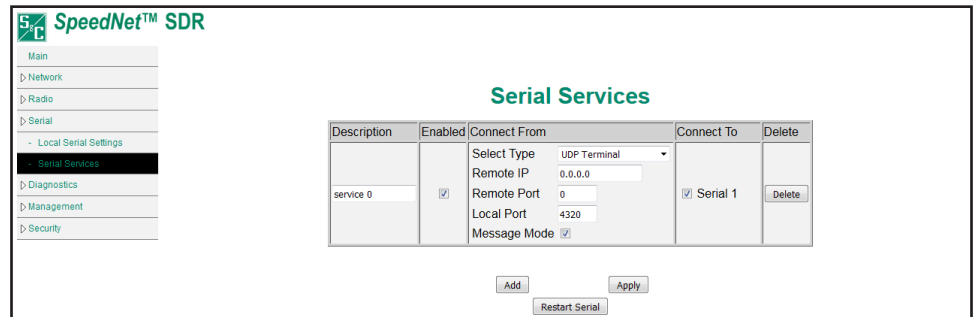


Figure 16. The *Serial Services* screen.

This page displays the Serial Services, as shown in Figure 16.

Serial Services may be added and configured here. Click on the **Add** button, and the dialog box will open. **Note:** The host serial application may target either the radio wireless or Ethernet address for serial services.

Description—This is an alphanumeric description of the service.

Enabled—This enables the feature.

Select Type—Options for TCP Terminal Server, TCP Terminal Client, and UDP Terminal are available. **Note:** It is highly recommended that only UDP Terminal serial services are used on AODV mesh networks.

Local Port—This is the local port the radio is listening on for the serial service.

Remote IP—This is the IP address of the other end of the serial tunnel.

Remote Port—This is the remote port the host serial service application is listening on.

Idle Timeout—This is the time in seconds that the TCP connection will be dropped.

Message Mode—The **Message Mode** option must be checked for any asynchronous serial protocol such as DNP 3.0.

Connect to—The available serial data ports are displayed here. Check either Serial 1 or Serial 2 for the serial service application to apply to.

- After making the selection, click on the **Apply** button to save changes.

Radio Diagnostics

The Diagnostic section has several tabs that provide statistical information regarding Radio Diagnostics, Channel Utilization, Neighbor List, and Radio RF Ping. See Figure 17.

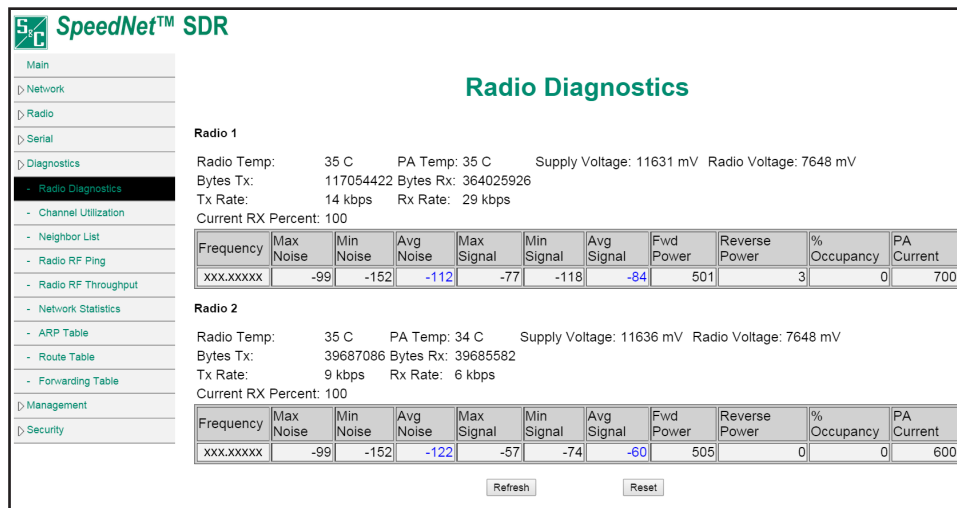


Figure 17. The *Radio Diagnostics* screen.

SpeedNet SDR Radios continuously monitor several important RF and radio-operating parameters for each frequency channel they use. These parameters are reported on this page. Most of the values are self-explanatory, but clarification is provided for the following:

Tx Rate and Rx Rate—These values report a very short running average and can effectively be considered instantaneous values. As a result, these numbers will generally be less than the maximum over-the-air data rate unless the measurements are taken during a sustained transmission.

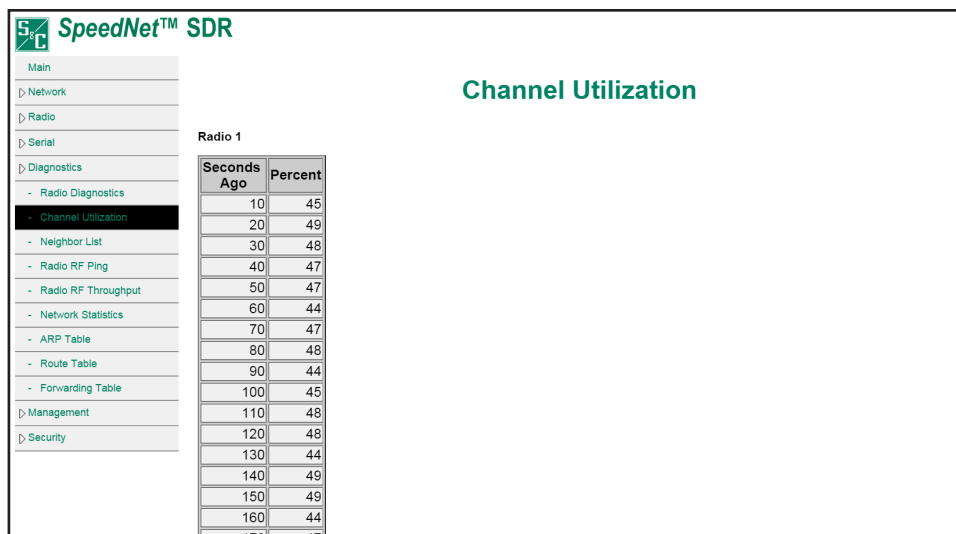
Input Voltage—This reports the voltage in millivolts supplied by the radio to the RF Module, and not the voltage supplied to the radio through its external power connector.

Fwd Power—This is the radio’s output power measured during transmission in milliwatts.

Reverse Power—This is the power reflected back into the radio during transmission in milliwatts. High values for Reverse Power are indicative of problems with RF cabling and/or the antenna.

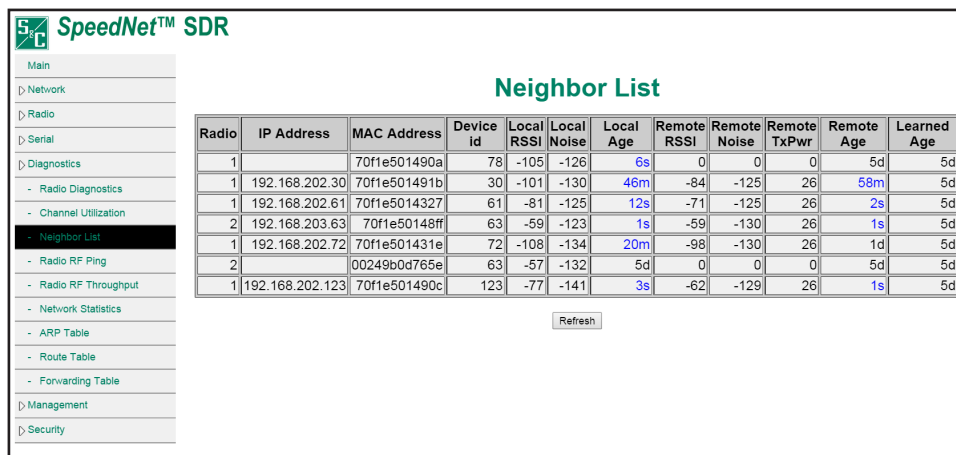
%Occupancy—This indicates the percentage of time the radio transmitted on the specified frequency, and the noise measured was below the noise threshold specified on the *RF Transmission Settings* screen.

Channel Utilization

Figure 18. The *Channel Utilization* screen.

Channel Utilization, shown in Figure 18, provides a list of the total channel utilization in percent for a 10-second time period. The dialog box shows time in Seconds Ago and Percent of total channel utilization.

Neighbor List

Figure 19. The *Neighbor List* screen.

The Neighbor List, shown in Figure 19, provides statistical information regarding the link quality between all SpeedNet SDR Radios within wireless communication range of the local SpeedNet SDR Radio.

The Neighbor List provides a list of SpeedNet SDR Radios that are communicating wirelessly with the local SpeedNet SDR Radio. The Neighbor List is updated each time messages are exchanged from another SpeedNet SDR Radio.

IP Address—This field provides the IP address of the wireless interface of a SpeedNet SDR Radio whose Hello message has been received by the local SpeedNet SDR Radio.

MAC Address—Displays the MAC address of the SpeedNet SDR Radio.

Local RSSI/Local Noise—This provides a measurement of the local SpeedNet SDR Radio signal quality as measured by the SpeedNet SDR Radio that sent the Hello message. This is used to ensure that only bidirectional links are used for routing wireless data packets.

Remote RSSI/Remote Noise—This provides a measurement of the signal quality of the last “Hello” message that was received from the SpeedNet SDR Radio. The Link measurement is provided in dBm.

Local Age—This is the time that has elapsed since the last packet was successfully received from the remote radio.

Remote Age—This is the time that has elapsed since the last packet from the local radio was successfully received on the remote radio.

Learned Age—This is the time that has elapsed since the first successful packet was received from the remote radio.

Radio RF Ping

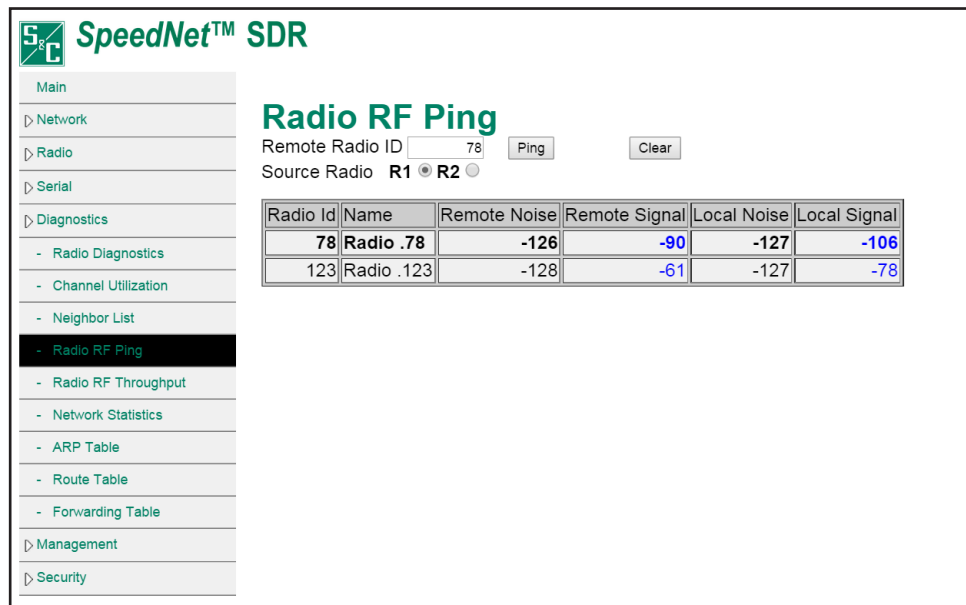


Figure 20. The Radio RF Ping screen.

The **Radio RF Ping** feature enables the direct testing of connectivity and link quality between two SpeedNet SDR Radios and can be initiated from either side of the link. To use this feature, enter the Radio ID for the radio on the far side of the link you wish to test and click on the **Ping** button. See Figure 20.

When the test is initiated, it will ping at the RF protocol level, and each successful ping will report signal and noise information for both the local and far side of the link.

Administration

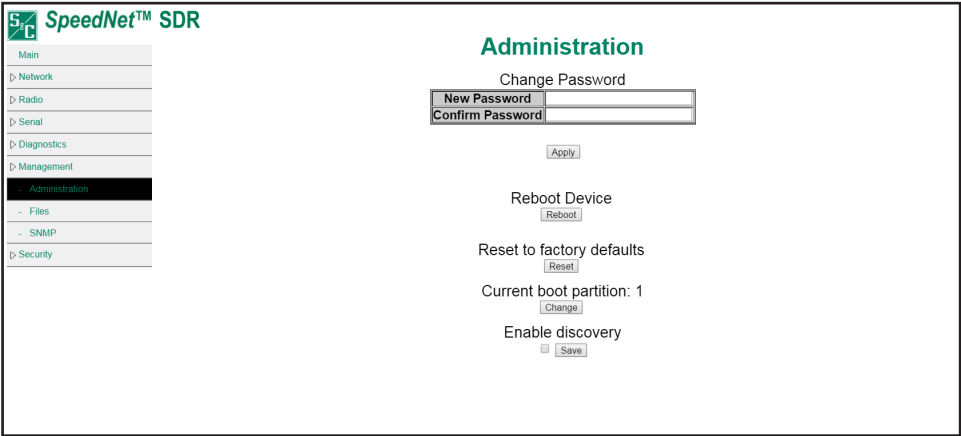


Figure 21. The Administration screen.

The **Administration** tab allows the user to change the password. After entering the new password and confirming, click on the **Apply** button. See Figure 21.

- Reboot Device**—This reboots the radio.
- Reset to Factory Defaults**—This sets the radio to factory defaults.
- Current Boot Partition**—The boot partition may be changed in support of a firm-ware roll back or forward.
- Enable Discovery**—This option enables the radio to respond to a network broadcast discovery request.

Files

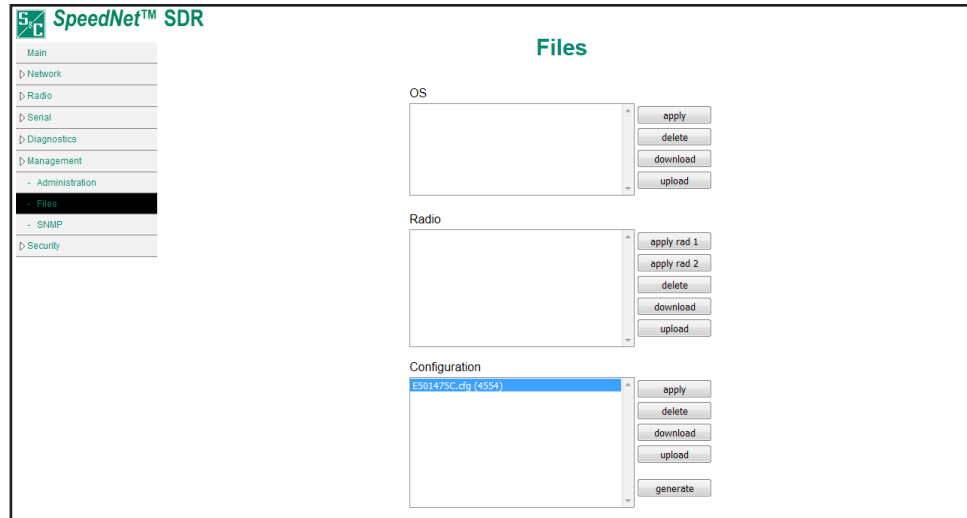


Figure 22. The Files screen.

New firmware and radio configuration files are loaded into the radio on this page. The OS section is for new operating system firmware for the Ethernet board within the radio. The Radio section is for new firmware for the radio RF module. The Configuration section is for support of the text editable radio configuration file. See Figure 22.

Upload new firmware by clicking on the **Upload** button in either the OS or Radio section. Uploading new OS firmware takes several minutes. The upload status may be viewed in the lower left window pane of the Web browser. After new firmware has been loaded into the radio, select the new file to apply. Click on the appropriate **Apply** button to apply the new firmware to the OS or Radio. The radio will automatically restart with the new firmware. This process could take several minutes, and radio power should not be cycled during the process.

Text editable radio configuration files may be generated by clicking on the **Generate** button. Selecting download will download the configuration file to your Windows Download directory. A new radio configuration file may be uploaded into the radio. Once the file appears in the window, select it and click on the **Apply** button to make the new setting active. The radio will automatically restart with the new configuration.