



Avaya Solution & Interoperability Test Lab

Application Notes for Firetide Wireless Mesh Network with an Avaya IP Telephony Infrastructure - Issue 1.0

Abstract

These Application Notes describe a solution for supporting wireless voice traffic over an Avaya IP Telephony infrastructure using Firetide Wireless Mesh Network consisting of wireless gateways and access points. Avaya Wireless IP Telephones, and Avaya IP Softphones gained network access through the Firetide Wireless Mesh Network to register with Avaya Communication Manager. The Avaya Voice Priority Processor was used to support SpectraLink Voice Priority (SVP) on the Avaya 3616/3626 Wireless IP Telephones. Emphasis was placed on verifying voice quality on calls associated with the Avaya wireless IP telephones. Information in these Application Notes has been obtained through DeveloperConnection compliance testing and additional technical discussions. Testing was conducted via the DeveloperConnection Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

These Application Notes describe a solution for supporting wireless voice traffic over an Avaya IP Telephony infrastructure using Firetide Wireless Mesh Network consisting of Firetide Hotport 3103 and 3500 series switches in conjunction with Avaya Access Point Model AP-8. Avaya Wireless IP Telephones and Avaya IP Softphones used the Firetide Wireless Mesh Network to register with Avaya Communication Manager. The Avaya Voice Priority Processor was used to support SpectraLink Voice Priority (SVP) on the Avaya 3616/3626 Wireless IP Telephones. An Extreme Networks Alpine 3808 switch and Avaya C364T-PWR switch inter-connected all of the network devices. Emphasis was placed on verifying good voice quality on calls associated with the Avaya wireless IP telephones.

The compliance test verified the following features supported by the Firetide Wireless Mesh Network solution:

- Wireless connectivity and routing
- Network throughput
- 802.1x Security
- WEP and WPA-PSK Encryption
- Quality of Service (QoS) based on Priority Queuing for VoIP
- VLAN separation and tagging
- Layer-2 and Layer-3 Seamless Roaming
- SpectraLink Voice Protocol (SVP)
- IEEE 802.11b and g
- Dynamic IP Addressing using DHCP

Figure 1 illustrates the wireless LAN (WLAN) configuration used to verify the Firetide Wireless Mesh Network solution. All of the wireless IP devices depicted in the configuration roamed between the Access Points for full mobility. The wireless clients obtained their IP address from the DHCP Server using Firetide Wireless Mesh Network. All wireless clients are registered with Avaya Communication Manager over the Firetide Wireless Mesh Network.

For the purpose of these Application Notes, it is assumed that Avaya Communication Manager is already configured with all the wireless and wired telephones.

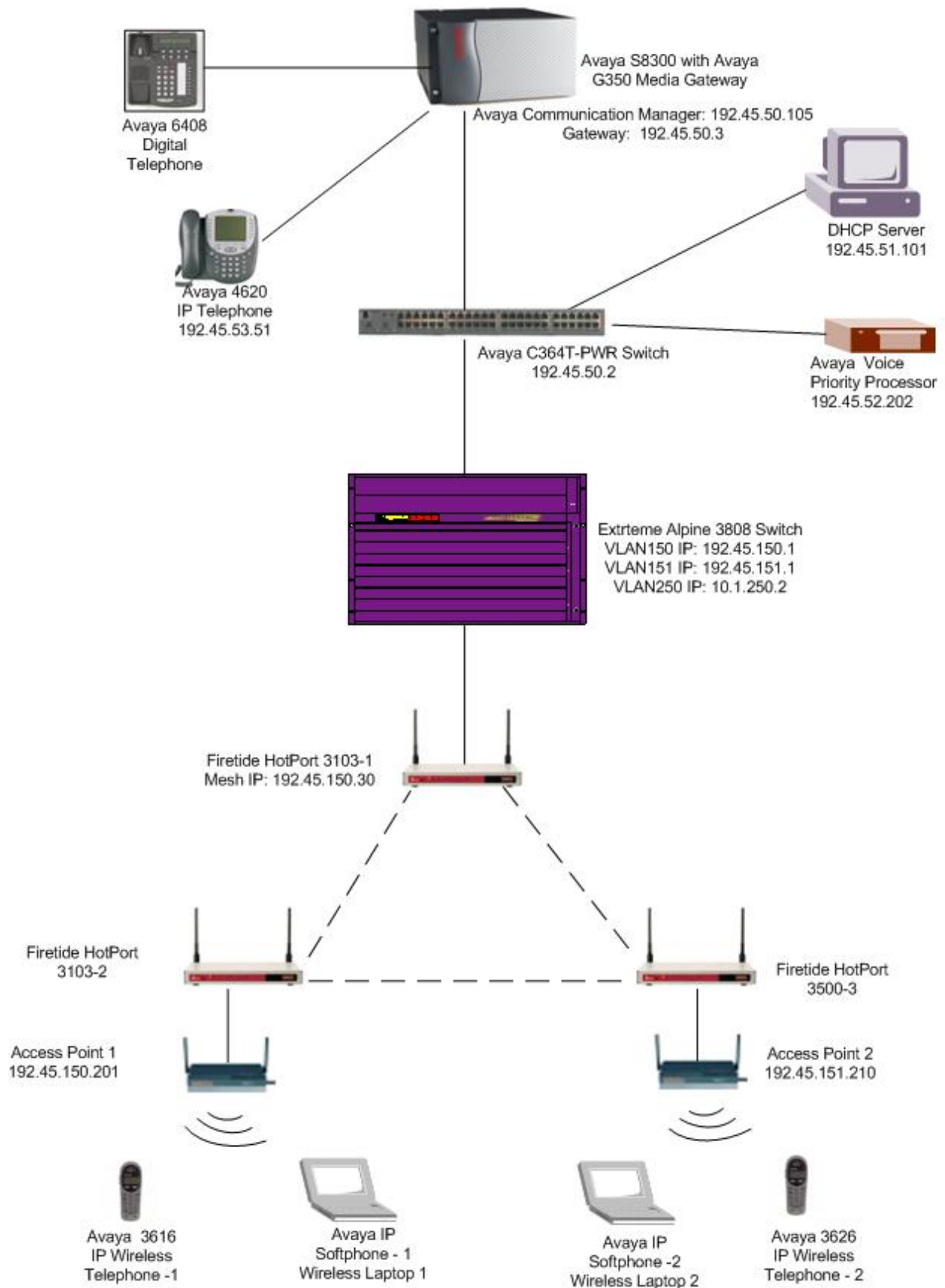


Figure 1: Avaya and Firetide Wireless Mesh Network Configuration

2. Equipment and Software Validated

The following equipment and software were used for the sample configuration provided:

Equipment	Software
Avaya S8300 Server with Avaya G350 Media Gateway	Avaya Communication Manager 3.1.2 (R013x.01.2.628.7)
Avaya Voice Priority Processor	R175.022
Avaya 4610SW IP Telephones	2.6 (H323)
Avaya 3616/3626 IP Wireless Telephones	096.040
Avaya IP Softphone	5.2.4.20
Extreme Alpine 3808 Switch	V7.6.2.3
Avaya C364T-PWR Switch	V4.5.14
DHCP/TFTP Server	Windows 2000 Server
Avaya Access Point Model AP-8	R3.1
Firetide Hotport Models 3103 and 3500	M3.5.0.0

3. Configure the Avaya Voice Priority Processor

The Avaya Voice Priority Processor utilizes SpectraLink Voice Priority (SVP) as the Quality of Service (QoS) mechanism supported by the Avaya 3616/3626 Wireless IP Telephones to reduce jitter and delay for voice traffic over the wireless network.

The Avaya Voice Priority Processor is required to serve as a “gateway” between the Avaya 3616/3626 Wireless IP Telephones and the Avaya IP Telephony infrastructure. Voice traffic from Avaya wireless telephones are directed to the Avaya Voice Priority Processor so that the SVP header information can be removed before the packets are forwarded to Avaya Communication Manager.

To configure the Avaya Voice Priority Processor, connect a PC or laptop to the serial port of the Avaya Voice Priority Processor. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

Once connected, the Avaya Voice Priority Processor login screen is presented. Log in as *admin*. The **NetLink SVP-II System** menu is displayed as shown in **Figure 2**.

```
NetLink SVP-II System
Hostname: [slnk-000006], Address: 192.45.52.202

System Status
SVP-II Configuration
Network Configuration
Change Password
Exit
```

Figure 2: NetLink SVP-II System Menu

From the **NetLink SVP-II System** menu, select **Network Configuration** to configure the IP address, subnet mask, and default gateway of the Avaya Voice Priority Processor as shown in **Figure 3**.

```

                                Network Configuration
                                Hostname: [slnk-000006], Address: 192.45.52.202

Ethernet Address (fixed):      00:90:7A:00:00:06
IP Address:                    192.45.52.202
Hostname:                      slnk-000006
Subnet Mask:                   255.255.255.0
Default Gateway:              192.45.52.1
SVP-II TFTP Download Master:  NONE
Primary DNS Server:           NONE
Secondary DNS Server:         NONE
DNS Domain:                   NONE
WINS Server:                  NONE
Workgroup:                    WORKGROUP
Syslog Server:                NONE
Maintenance Lock:             N

Enter=Change      Esc=Exit      Use Arrow Keys to Move Cursor

```

Figure 3: Network Configuration

From the **NetLink SVP-II System** menu shown in **Figure 2**, select **SVPP-II Configuration** to configure the **Phones per Access Point** and the **802.11 Rate** fields. In this configuration, the **802.11 Rate** was configured to *Automatic*, as shown in **Figure 4**, to allow the wireless telephones to determine their rate (up to 11Mbps), as opposed to the Avaya Voice Priority Processor limiting the transmission rate of the wireless telephones to 1 or 2 Mbps. The sample network has **Phones per Access Point** setting of *10*, which is the maximum number of calls supported by the entire system of Access Points.

```

                                SVP-II Configuration
                                Hostname: [slnk-000006], Address: 192.45.52.202

Phones per Access Point:      10
802.11 Rate:                 Automatic
SVP-II Master:               192.45.52.202
SVP-II Mode:                 Netlink IP
Ethernet link:               100mbps/full duplex
System Locked:               N
Maintenance Lock:           N
Reset System

Enter=Change      Esc=Exit      Use Arrow Keys to Move Cursor

```

Figure 4: SVP-II Configuration

4. Configure the Avaya C364T-PWR Switch

This section covers the configuration of the Avaya C364 switch relevant to Firetide Wireless Mesh Network compliance testing. Specifically, the configuration is related to VLANs created to support the testing.

Step	Description
1.	Log in to the Avaya C364T-PWR Switch with proper credentials. It is assumed that a basic configuration and IP address has already been assigned to the Avaya C364.
2.	Set router interface and assign VLAN and IP address to this interface. <pre>Router-1<super> # configure Router-1<configure> # set vlan 250 name v250 Router-1<configure> # interface v250 Router-1<config-if:v250> # ip vlan 250 Router-1<config-if:v250> # ip address 10.1.250.1 255.255.255.0 Router-1<config-if:v250> # exit Router-1<configure> # exit</pre>
3.	Configure IP Routing on the switch. Both static route configuration and OSPF configuration are presented here. If OSPF is used, it takes precedence. Static Routes <pre>Router-1<super> # configure Router-1<configure> # ip route 192.45.150.0 255.255.255.0 10.1.250.2 Router-1<configure> # ip route 192.45.151.0 255.255.255.0 10.1.250.2 Router-1<configure> # exit</pre> OSPF Routing <pre>Router-1<super> # configure Router-1<configure> # router ospf Router-1<configure router:ospf># network 10.1.250.0 0.0.0.3 area 0.0.0.0 Router-1<configure router:ospf> # exit</pre>
4.	Save the configuration changes using the following command: <pre>Router-1<super> # copy running-config startup-config</pre>

5. Configure the Extreme Networks Alpine 3808 Switch

This section covers the configuration of the Extreme Networks Alpine 3808 Switch relevant to Firetide Wireless Mesh Network testing. Specifically, the configuration related to VLANs 150, 151 and 250 and the Ethernet ports used by the Firetide Hotport node are covered below.

Step	Description
1.	Log in to the Extreme Networks Alpine 3808 Switch as <i>admin</i> . It is assumed that basic configuration and IP address has already been assigned to the Extreme Networks Alpine 3808 Switch.
2.	Clear all ports on the Extreme Networks Alpine 3808 Switch from the default VLAN. By default, all ports on the Extreme Networks Alpine 3808 Switch belong to the default VLAN. Alpine3808 # <code>configure vlan Default delete ports all</code>
3.	Create VLANs 150, 151 and 250 on the Extreme Networks Alpine 3808 Switch. Note: The default VLAN is used as VLAN4093. Therefore, the creation of VLAN 4093 is not shown. Alpine3808 # <code>create vlan vlan150</code> Alpine3808 # <code>create vlan vlan151</code> Alpine3808 # <code>create vlan vlan250</code>
4.	Assign a tag to VLAN150, VLAN151 and VLAN250. Alpine3808 # <code>configure vlan vlan150 tag 150</code> Alpine3808 # <code>configure vlan vlan151 tag 151</code> Alpine3808 # <code>configure vlan vlan250 tag 250</code>
5.	Enable IP Forwarding on the VLAN interfaces to allow the Extreme Networks Alpine 3808 Switch to route between VLANs 150, 151, and 250. Alpine3808 # <code>enable ipforwarding vlan vlan150</code> Alpine3808 # <code>enable ipforwarding vlan vlan151</code> Alpine3808 # <code>enable ipforwarding vlan vlan250</code>
6.	Configure an IP address and subnet mask for each VLAN interface. Alpine3808 # <code>configure vlan vlan2 ipaddr 192.45.150.1 / 24</code> Alpine3808 # <code>configure vlan vlan2 ipaddr 192.45.151.1 / 24</code> Alpine3808 # <code>configure vlan vlan3 ipaddr 10.1.250.2 / 30</code>
7.	Configure the Ethernet port (port 4:32) for the link from the Avaya C364T-PWR switch access. Alpine3808 # <code>configure vlan vlan250 add port 4:32 untagged</code>

8.	<p>Configure the Ethernet port (port 4:13) to connect to the Firetide Hotport.</p> <pre>Alpine3808 # configure vlan vlan150 add port 4:13 untagged</pre>
9.	<p>Configure the Ethernet port (port 4:10) to connect to the Firetide Hotport with tagging on.</p> <pre>Alpine3808 # configure vlan vlan150 add port 4:10 tagged Alpine3808 # configure vlan vlan151 add port 4:10 tagged</pre>
10.	<p>Configure static routes that redirect wireless LAN traffic to the Avaya C364T-PWR switch. 10.1.250.1 is the IP address of the Avaya C364T-PWR Switch.</p> <pre>Alpine3808 # configure default add default 10.1.250.1 Alpine3808 # configure iproute add 192.45.150.0/24 10.1.250.1 Alpine3808 # configure iproute add 192.45.151.0/24 10.1.250.1</pre>
11.	<p>Enable DHCP Relay and specify the IP address of the DHCP server. The Avaya wireless IP telephones and Avaya wireless Softphones request their IP configuration from the DHCP server.</p> <pre>Alpine3808 # enable bootprelay Alpine3808 # configure bootprelay add 192.45.52.101</pre>
12.	<p>Configure OSPF range to enable OSPF routing as follows:</p> <pre>Alpine3808 # configure ospf add vlan "vlan150" area 0.0.0.0 Alpine3808 # configure ospf add vlan "vlan151" area 0.0.0.0 Alpine3808 # configure ospf add vlan "vlan250" area 0.0.0.0 Alpine3808 # enable ospf</pre>
13.	<p>Save the configuration changes using the following command:</p> <pre>Alpine3808 # save configuration</pre>

6. Configure the DHCP Server

The Avaya Wireless IP Telephones and the laptops running Avaya IP Softphone obtained their IP configuration, Avaya Voice Priority Processor IP address (Option 151), and Avaya Communication Manager IP Address (Option 176) settings from a DHCP server. The DHCP server was configured with two scopes that served wireless IP telephones that registered with Avaya Communication Manager. The following scopes were defined on the DHCP server:

```
Scope [192.45.150.0] VLAN150
Address Pool
  Start IP Address = 192.45.150.10
  End IP Address = 192.45.150.20
Option 003 Router = 192.45.150.1
Option 151 AVPP = 192.45.52.202
Option 176 CM Server = MCPADD=192.45.50.105,MCPOR=1719

Scope [192.45.150.0] VLAN151
Address Pool
  Start IP Address = 192.45.151.21
  End IP Address = 192.45.151.30
Option 003 Router = 192.45.151.1
Option 151 AVPP = 192.45.52.202
Option 176 CM Server = MCPADD=192.45.50.105,MCPOR=1719
```


Note: In the DHCP server, Option 151 should be added as a data type *IP Address* and Option 176 should be added as a data type *String*.

6.1. Configure Firetide Wireless Mesh Network

In the sample configuration, there are three Firetide Hotport nodes. One of the Firetide Hotport nodes serves as a head node and is connected to the wired network. The configuration is as follows:

Hotport Model	Role	Serial Number
3103	Head Node	A01310500000164
3103	Mesh Node	A06280500000835
3500	Mesh Node	A10210500002353

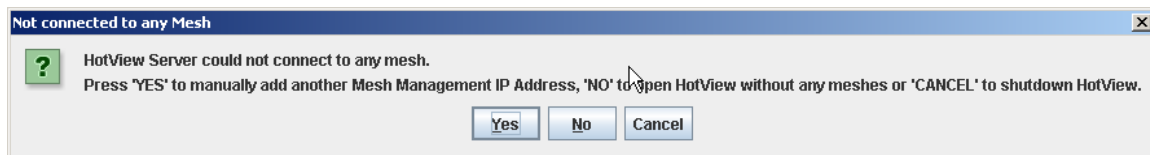
Configuration in the following sections is only for the fields where a value needs to be entered or modified. Default values are used for all other fields.

Step	Description
1.	It is assumed that the Firetide Hotview application to configure the Firetide Hotport nodes is already installed and the server configuration has been performed. Click on the Hotview Pro Launcher  icon.
2.	Click on HotView Pro™ Quick Launch icon.

3. Enter **Password** and click **Login**.

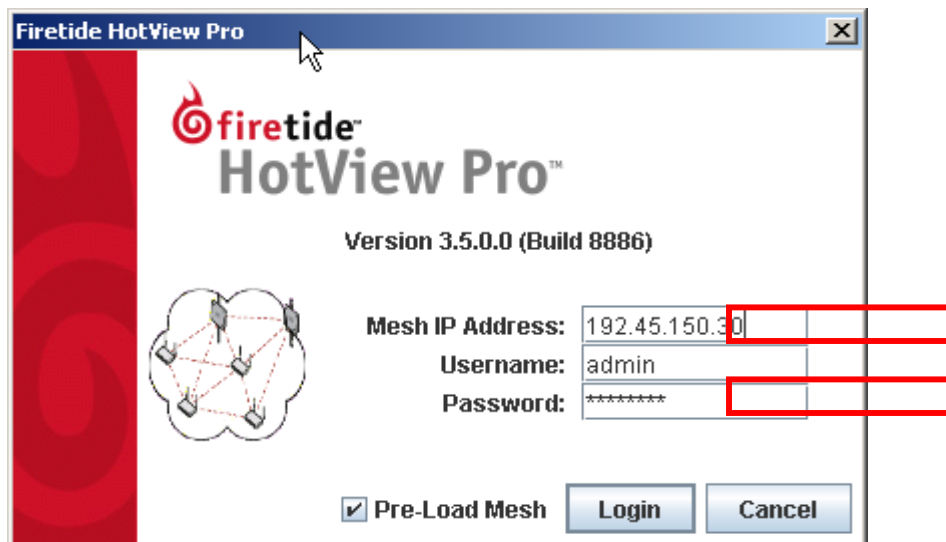


4. Click the **Yes** button to continue configuration.



5. Configure the following:

- **Mesh IP Address** – Set to a valid IP address in the wireless subnet configured in **Section 5**.
- **Password** – Enter a valid password.
- Click **Login**.



6.

Click **File** menu and select **Configure Mesh...** option.

The screenshot shows the Firetide HotView Mesh Management Software interface. The 'File' menu is open, and 'Configure Mesh...' is highlighted. The main window displays a mesh network diagram with nodes and connections. A table at the bottom shows the Mesh Node Inventory.

Mesh Node Inventory	AP Inventory	Mesh Node Performance	AP Performance	Station Inventory	Current Faults: (3 Warnings)		
HotPort Name	Serial Number	Status	Location String	Firmware Version	Model	Ethernet MAC A...	Radio MAC Addr...
HOTPORT 3103-A01310500000164	A01310500000...	✓		M3.5.0.0	HOTPORT 3103	00:E0:98:FC:95:...	00:0B:6B:34:7E:...
HOTPORT 3103-A102105000002353	A10210500000...	✓		M3.5.0.0	HotPort 3500-	00:12:0E:25:84:...	00:15:6D:10:22:...
HOTPORT 3103-A06280500000835	A06280500000...	✓		M3.5.0.0	HOTPORT 3103	00:12:0E:11:93:...	00:0B:6B:36:0D:...

HOTPORT 3103-A06280500000835 - 3 node(s) in mesh: 3 active, 0 down

7.

At the **Mesh Configuration** screen, select the **Network** option and configure the following:

- **Mesh ID** – Enter value between 1 and 100.
- **Mesh Name** – Enter descriptive name.
- **IP Address** – IP Address of the Hotport Wireless Mesh.
- **IP Mask** – Set to 255.255.255.0 in this example.
- **Default Gateway** – Enter the IP address of the gateway for the Hotport Wireless Mesh.

The screenshot shows the 'Mesh Configuration' dialog box with the 'Network' tab selected. The fields are as follows:

Mesh ID:	1	(1-100)		
Mesh Name:	HOTPORT MESH TRAINING1			
IP Address:	192	.45	.150	.30
IP Mask:	255	.255	.255	.0
Default Gateway:	192	.45	.150	.1

Buttons: Save, Cancel

8.

At the **Mesh Configuration** screen, select the **Security** option and configure the following:

- **Wireless Security Settings and Key** – Select **104/128-bit WEP** option and enter a 26 character hexadecimal string in **Key** field.
- **End-to-end Security Settings and Key** – Select **256-bit AES** option and enter a 64 character hexadecimal string in the **Key** field.

The screenshot shows the 'Mesh Configuration' dialog box with the 'Security' tab selected. The settings are as follows:

Wireless Security Settings

40/64-bit WEP 104/128-bit WEP 256-bit AES PSK Disable

Key: [26 character hexadecimal string]

End-to-end Security Settings

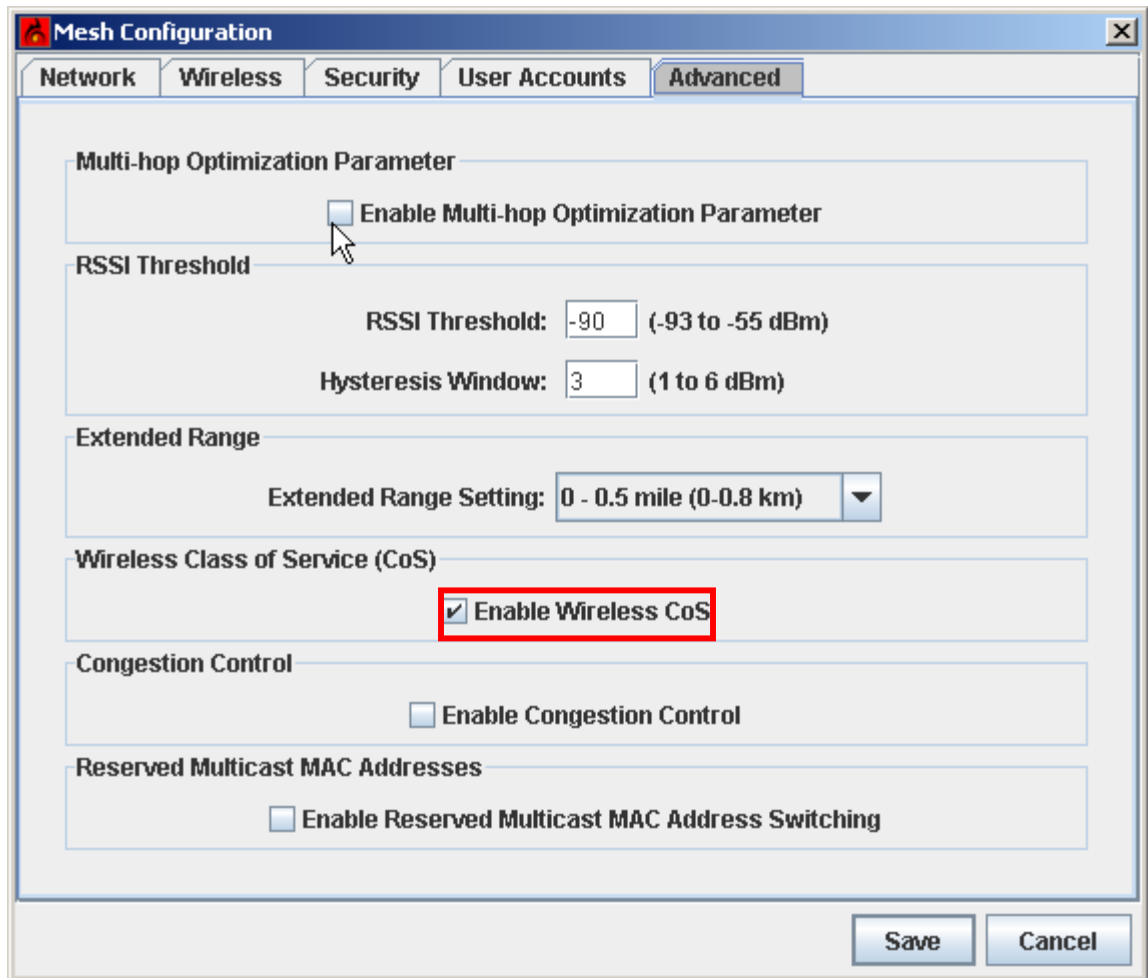
256-bit AES 128-bit AES Disable

Key: [64 character hexadecimal string]

Buttons: Save, Cancel

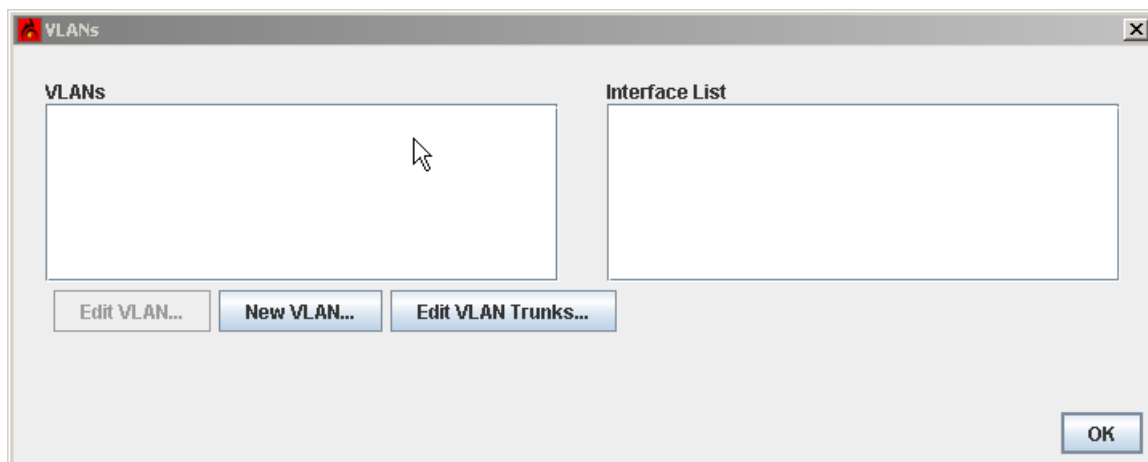
9.

At the **Mesh Configuration** screen, select the **Advanced** option. Select **Enable Wireless CoS** and click **Save** to affect the configuration.

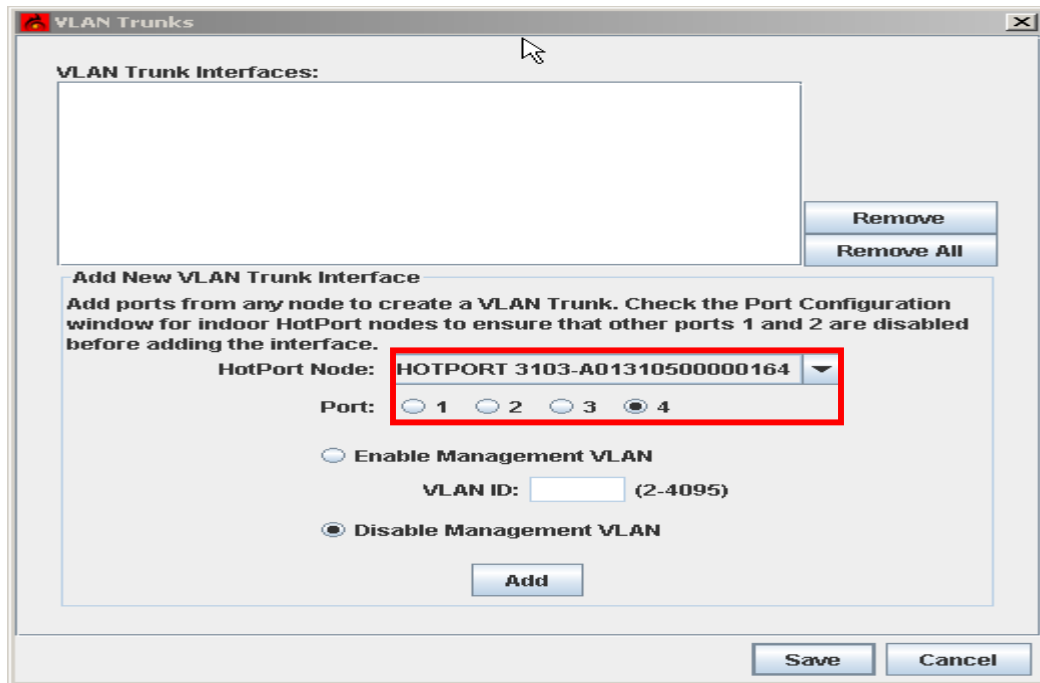


10.

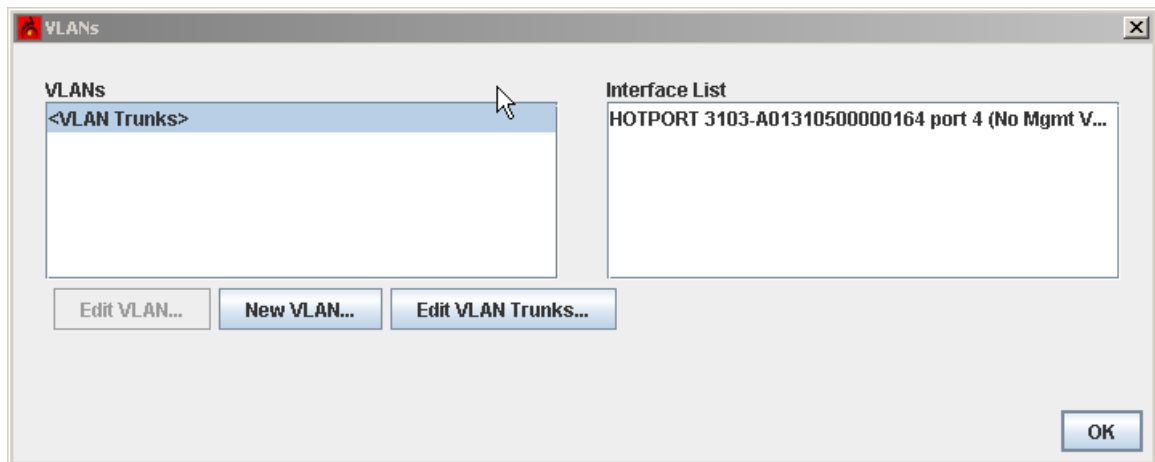
Select **VLAN...** at the screen on **Step 6**. At the **VLANs** screen, click on **Edit VLAN Trunks...** to add a trunk interface.



11. At the **VLAN Trunks** screen, select the **Port** and **Hotport Node** and click **Add** to configure a trunk on a Firetide Hotport Node. Click **Save** to affect the configuration.



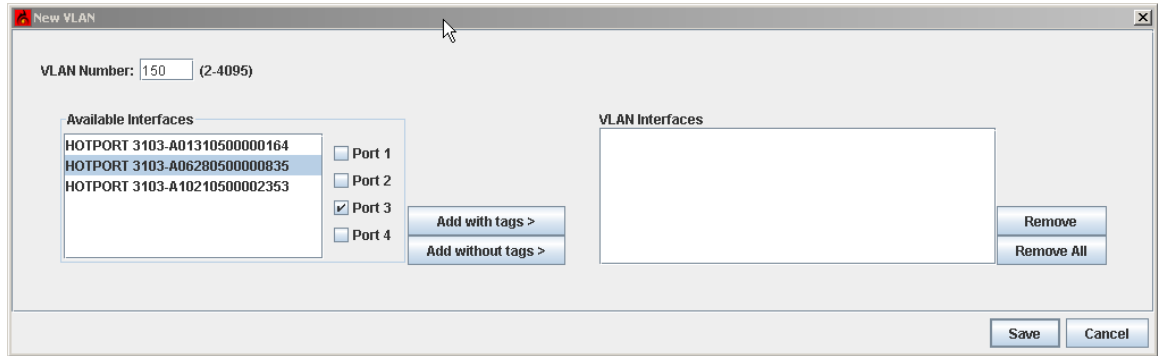
12. At the **VLANs** screen, click **New VLAN...** to add a VLAN.



13.

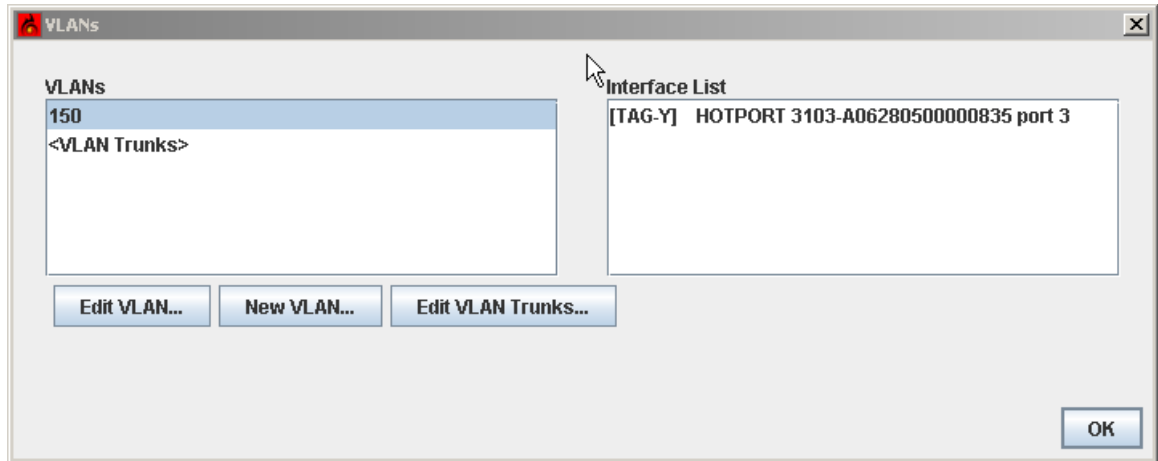
At the **New VLAN** screen, configure the following:

- **VLAN Number** – Enter any value between 2 and 4095.
- **Available Interfaces** – Select the interface to where the VLAN is to be configured.
- Select the port where the VLAN is configured and click **Add with tags** or **Add without tags**.
- Click **Save** to affect the configuration.



14.

At the **VLANs** screen, click on **Edit VLAN...** to configure additional interfaces with ports.

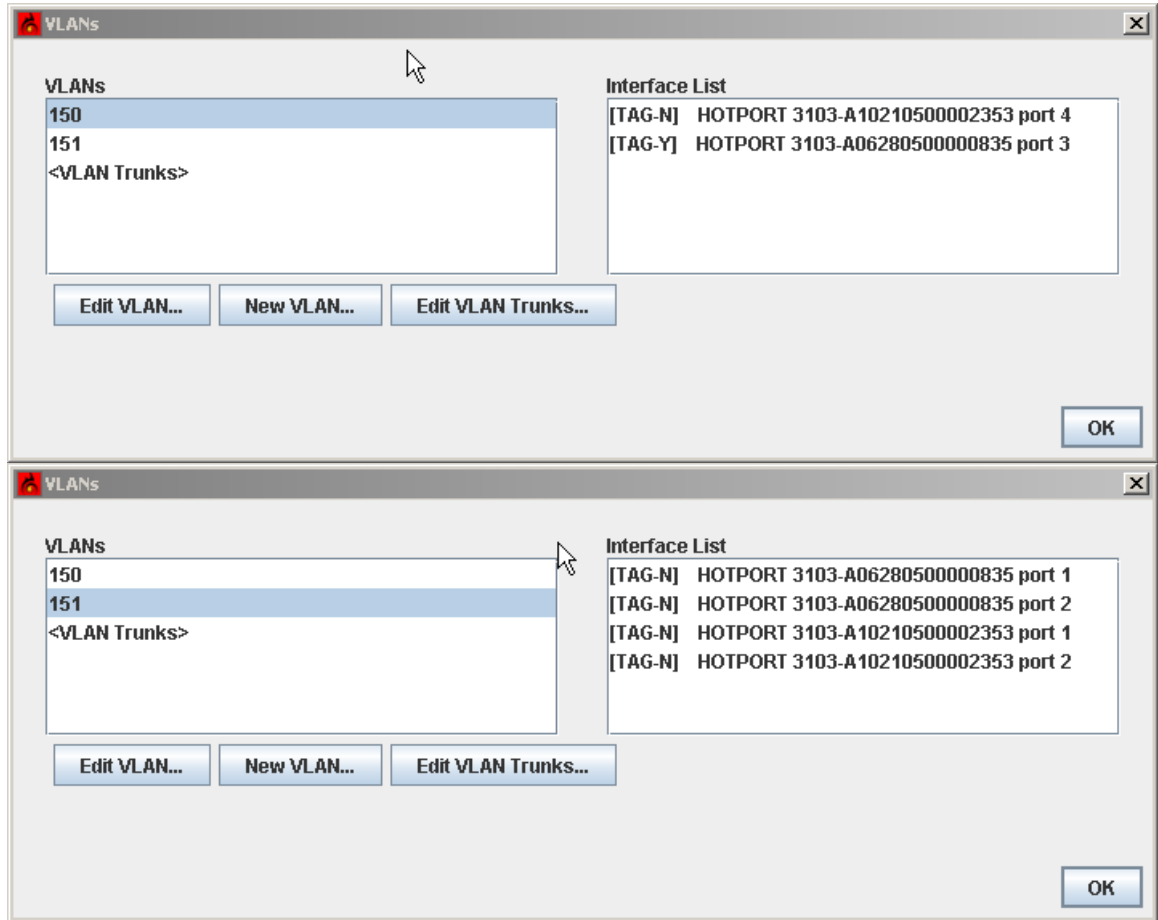


15.

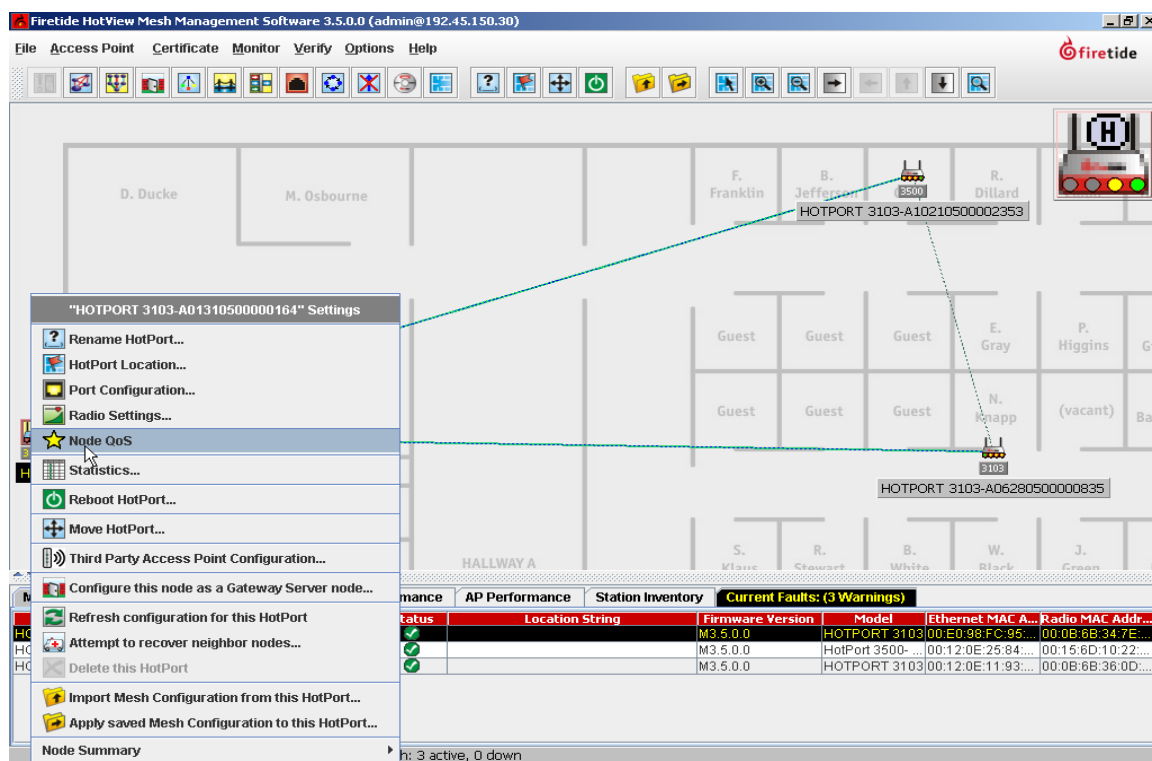
Repeat **Steps 12 – 14** to configure additional VLANs and click **OK** when configuration is complete.

16.

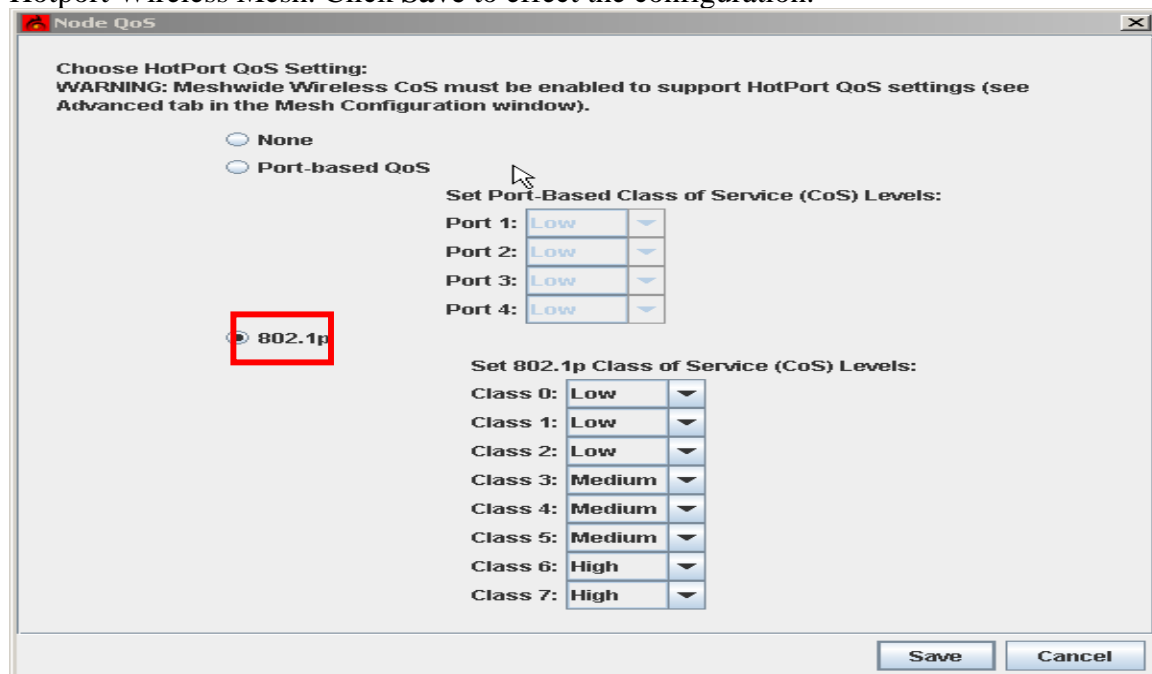
The following screens display the VLANs configured for compliance testing.



17. Right click on any of the nodes in the Hotport Wireless Mesh Network and select **Node QoS** from the menu to configure the QoS setting for the node.



18. At the **Node QoS** screen, select the **QoS** setting. The **QoS** setting can be port based or applied to the whole node. This setting needs to be performed on each node in the Hotport Wireless Mesh. Click **Save** to effect the configuration.



7. Interoperability Compliance Testing

Interoperability compliance testing covered feature functionality, serviceability, and performance testing. Feature functionality testing verified the ability of the Firetide Wireless Mesh Network to provide network access to the Avaya 3616/3626 Wireless IP Telephones and Avaya IP Softphones. The emphasis of testing was on the QoS implementation to achieve good voice quality, WEP and WPA encryption, and seamless roaming at layer-2 and layer-3.

7.1. General Test Approach

All feature functionality test cases were performed manually. The following features and functionality were verified:

- Layer-2 and Layer-3 Connectivity
- 802.1x Security
- WEP and WPA-PSK Encryption
- Quality of Service (QoS) based on Priority Queuing
- VLANs and 802.1Q Trunking
- Layer-2 and Layer-3 Seamless Roaming
- SpectraLink Voice Protocol (SVP)
- IEEE 802.11b and g
- Dynamic IP Addressing using DHCP

Performance testing was accomplished by running a *VoIP Test* on a traffic generator. The *VoIP Test* generated audio (RTP) packets between two wireless clients and calculated a MOS score to quantify the voice quality. In addition, low-priority traffic was generated while empirically verifying the voice quality on an active wireless call.

7.2. Test Results

All feature, serviceability, and performance test cases passed. The Firetide Hotport 3103 and 3500 layer-2 switches provide network access using 802.1x Security, WEP and WPA Encryption. Good voice quality was achieved on wireless voice calls through the use of Firetide QoS implementation. The Avaya Access Points communicated with the Firetide Wireless Mesh using 802.11b/g.

8. Verification Steps

This section provides the verification steps that may be performed in the field to verify that the wireless IP telephones have connectivity to the network and that good voice quality is being provided on wireless calls.

1. Verify the Avaya wireless IP telephones successfully register with Avaya Communication Manager using the **list registered-ip-stations** command on the SAT. Note that the wireless telephones have the same IP address assigned to the Avaya Voice Priority Processor.
2. Verify good voice quality between two wireless IP telephones by placing a call.

9. Support

For technical support on the Firetide Wireless Mesh Network solution, contact Firetide Networks Technical Assistance Center at <http://www.firetide.com> or the Firetide Networks Worldwide TAC at:

- Toll free: 877-FIRETIDE
- Phone: 408-399-7771
- E-mail: support@firetide.com

10. Conclusion

These Application Notes describe a solution for supporting wireless voice traffic over an Avaya IP Telephony infrastructure using Firetide Wireless Mesh Network consisting of Firetide Hotport 3103 and 3500 series switches in conjunction with Avaya Access Point Model AP-8. Avaya Wireless IP Telephones and Avaya IP Softphones used the Firetide Wireless Mesh Network to register with Avaya Communication Manager. The Avaya Voice Priority Processor was used to support SpectraLink Voice Priority (SVP) on the Avaya 3616/3626 Wireless IP Telephones. An Extreme Networks Alpine 3808 switch and Avaya C364T-PWR switch inter-connected all of the network devices. Emphasis was placed on verifying voice quality on calls associated with the Avaya wireless IP telephones.

11. References

This section references the Avaya and Firetide Networks product documentation that are relevant to these Application Notes.

Avaya product documentation can be found at <http://support.avaya.com>.

Firetide Networks product documentation can be found at <http://www.firetide.com>.

- [1] *Administration for Network Connectivity for Avaya Communication Manager*, Issue 11, February 2006, Document Number 555-233-504.
- [2] *Administrator Guide for Avaya Communication Manager*, Issue 2.1, May 2006, Document Number 03-300509.
- [3] *Avaya Voice Priority Processor for IP Interfaces*, Issue 5, July 2005, Document Number 555-301-102.
- [4] *Avaya AP-8 User Guide*, Document Number 21-300482.
- [5] *Avaya 3600 Wireless IP Phone* Document Number 21-300632.
- [6] *Extremeware User Guide (Version 7.6)*
- [7] *Hotport 3100 User Guide (Version 3.1.x)*
- [8] *Hotport 3500 User Guide (Version 3.1.x)*

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