



Avaya Solution & Interoperability Test Lab

Application Notes for Empirix Hammer G5 with Avaya Aura™ Communication Manager using H.323 Endpoint Emulation – Issue 1.0

Abstract

These Application Notes describe the configuration steps required to integrate the Empirix Hammer G5 test system with Avaya Aura™ Communication Manager using H.323 endpoint emulation. The Hammer G5 is a VoIP test platform consisting of a collection of applications used to configure the system, create, schedule, monitor tests, and create reports. In this configuration, the Hammer G5 emulates H.323 endpoints, which originate and terminate calls through Avaya Aura™ Communication Manager. While the call is active, it can send DTMF tones and voice media, and provide voice quality metrics. Call progress can also be monitored, and at the completion of the test, test reports can be generated. The Hammer G5 can be used to verify the functionality, reliability and quality of VoIP services and applications running through Avaya Aura™ Communication Manager.

Information in these Application Notes has been obtained through DevConnect compliance testing and additional technical discussions. Testing was conducted via the DevConnect Program at the Avaya Solution and Interoperability Test Lab.

1 Introduction

These Application Notes describe the configuration steps required to integrate the Empirix Hammer G5 test system with Avaya Aura™ Communication Manager using H.323 endpoint emulation. The Hammer G5 is a VoIP test platform consisting of a collection of applications used to configure the system, create, schedule, monitor tests, and create reports. In this configuration, the Hammer G5 emulates H.323 endpoints, which originate and terminate calls through Avaya Aura™ Communication Manager. While the call is active, it can send DTMF tones and voice media, and provide voice quality metrics. Call progress can also be monitored, and at the completion of the test, test reports can be generated. The Hammer G5 can be used to verify the functionality, reliability and quality of VoIP services and applications running through Avaya Aura™ Communication Manager.

The following set of Hammer G5 applications were used during the compliance testing:

- **Hammer Configurator** used to configure and manage the system.
- **Hammer TestBuilder** used to create and run test scripts.
- **Hammer System Monitor** used to monitor H.323 registration status and call progress.
- **Hammer Call Summary Monitor** used to monitor call completion and to create reports.

A solution using H.323 trunk emulation on the Empirix Hammer G5 is described in [2] *Application Notes for Empirix Hammer G5 with Avaya Aura™ Communication Manager using H.323 Trunk Emulation*.

1.1 Interoperability Compliance Testing

The interoperability compliance testing focused on verifying that the Hammer G5 can register with Avaya Aura™ Communication Manager as H.323 endpoints, establish calls, send voice media, provide voice quality metrics, and generate reports. The following features and functionality were covered:

- H.323 endpoint registration with Avaya Aura™ Communication Manager.
- Originating and terminating calls through Avaya Aura™ Communication Manager.
- Support of G.711 and G.729 codecs.
- Support of direct IP-to-IP media (also known as “Shuffling” which allows IP endpoints to send audio RTP packets directly to each other without using media resources on the Avaya Media Gateway). Calls with Shuffling disabled was also verified.
- Generating voice quality metrics with Shuffling disabled.

1.2 Support

Technical support on the Empirix Hammer G5 can be obtained via phone, website, or email.

- **Phone:** (781) 266-3202
- **Web:** <http://www.empirix.com/support/maintenance.asp>
- **Email:** support@support.com

2 Reference Configuration

The network diagram below illustrates the test configuration. In this configuration, Communication Manager receives calls from the Hammer G5, which emulates H.323 endpoints. The call is then terminated on the Hammer G5. While the call is established, the Hammer G5 sends voice media (i.e., RTP traffic) using an audio recording. This allows voice quality metrics to be provided at the end of each call. The Hammer G5 applications running on the Hammer G5 server were used to configure the system, create and monitor the tests, and view the test reports.

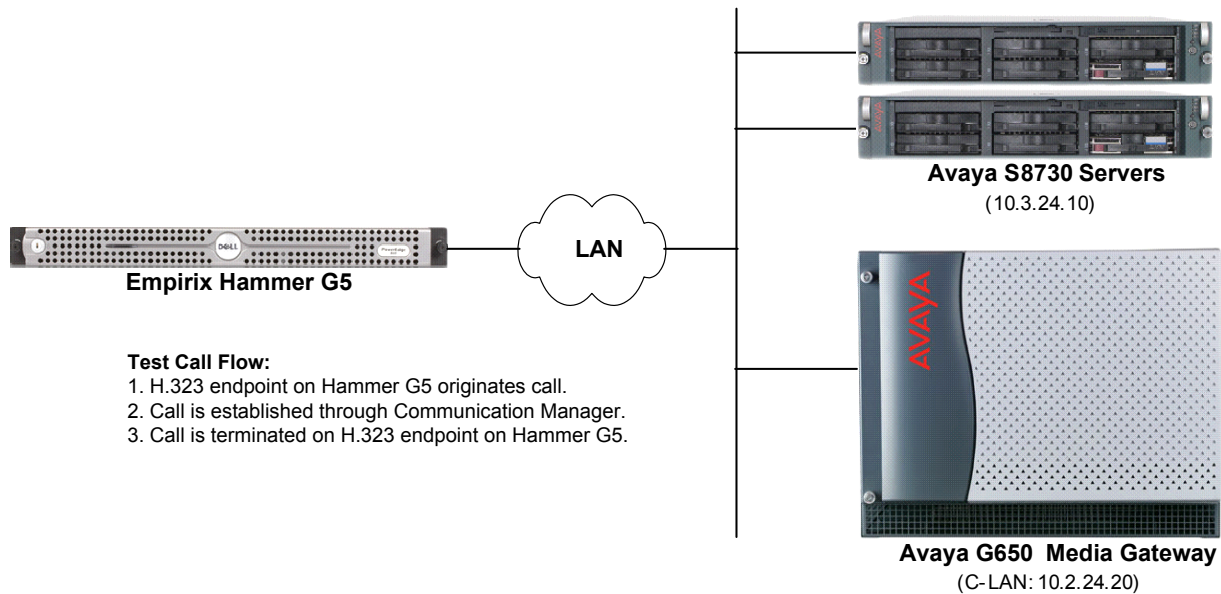


Figure 1: Empirix Hammer G5 with Avaya Aura™ Communication Manager

3 Equipment and Software Validated

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

Equipment	Software
Avaya S8730 Servers	Avaya Aura™ Communication Manager 5.2.1 (R015x.02.1.016.4) with Service Pack 1 (Patch 17959)
Avaya G650 Media Gateway <ul style="list-style-type: none">▪ TN799DP C-LAN Board▪ TN2302AP Media Processor Board	HW01 FW031 HW03 FW094
Empirix Hammer G5 running on Microsoft Windows 2003 Server	1.5.8.295

4 Configure Avaya Aura™ Communication Manager

This section provides the procedures for configuring Communication Manager. The procedures include the following areas:

- Administer IP Codec Set
- Administer IP Network Region
- Administer H.323 Stations

Communication Manager is configured through the System Access Terminal (SAT).

4.1 Administer IP Codec Set

In the **IP Codec Set** form, specify the audio codec(s) required by the test that will be run on the Hammer G5. The form is accessed via the **change ip-codec-set 1** command. Note the codec set number since it will be used in the IP Network Region covered in the next section. The Hammer G5 supports G.711, G.729AB, G.729A, and G.723 codecs. For the compliance test, the IP codec set form was configured as shown below. The G.729AB entry was changed to G.729A when the G.729A was the codec required.

change ip-codec-set 1				Page 1 of 2
IP Codec Set				
Codec Set: 1				
Audio Codec	Silence Suppression	Frames Per Pkt	Packet Size (ms)	
1: G.711MU	n	2	20	
2: G.729AB	n	2	20	
3: G.723-6.3K	n	1	30	

4.2 Administer IP Network Region

In the **IP Network Region** form, configure the codec set to be used for the Hammer calls and specify whether **IP-IP Direct Audio** (Shuffling) is required for the test. Shuffling allows audio traffic to be sent directly between IP endpoints without using media resources in the Avaya G650 Media Gateway. If voice quality metrics are to be generated by the test, disable Shuffling; otherwise, the audio traffic will not leave the Hammer G5 and the voice quality metrics will not yield accurate results. Shuffling can also be disabled at the station level.

change ip-network-region 1		Page 1 of 19
IP NETWORK REGION		
Region: 1		
Location:	Authoritative Domain: avaya.com	
Name:		
MEDIA PARAMETERS		Intra-region IP-IP Direct Audio: no
Codec Set: 1		Inter-region IP-IP Direct Audio: no
UDP Port Min: 2048	IP Audio Hairpinning? y	
UDP Port Max: 3029		
DIFFSERV/TOS PARAMETERS		RTCP Reporting Enabled? y
Call Control PHB Value: 34	RTCP MONITOR SERVER PARAMETERS	
Audio PHB Value: 46	Use Default Server Parameters? y	
Video PHB Value: 26		
802.1P/Q PARAMETERS		
Call Control 802.1p Priority: 7		
Audio 802.1p Priority: 6		
Video 802.1p Priority: 5	AUDIO RESOURCE RESERVATION PARAMETERS	
H.323 IP ENDPOINTS		RSVP Enabled? n
H.323 Link Bounce Recovery? y		
Idle Traffic Interval (sec): 20		
Keep-Alive Interval (sec): 5		
Keep-Alive Count: 5		

4.3 Administer H.323 Stations

Configure a H.323 station for each H.323 channel on the Hammer G5. Set the **Type** field to *H.323*. This is an important setting. Set the **Port** field to *IP* and configure a descriptive **Name**. Lastly, configure the **Security Code** that will be used by the Hammer G5 to register with Communication Manager. For the compliance test, 20 H.323 stations were used with extensions ranging from 25000 to 25019. The first group of 10 channels (extensions 25000 to 25009) was used to originate calls. The calls were then terminated on the remaining 10 channels (extensions 25010 to 25019). Repeat this procedure for each channel required by the Hammer test.

add station 25000		Page 1 of 4
STATION		
Extension: 25000	Lock Messages? n	BCC: 0
Type: H.323	Security Code: *****	TN: 1
Port: IP	Coverage Path 1:	COR: 1
Name: Hammer H323 0	Coverage Path 2:	COS: 1
	Hunt-to Station:	Tests? y
STATION OPTIONS		
	Time of Day Lock Table:	
Loss Group: 19	Message Waiting Indicator: none	
Survivable COR: internal		
Survivable Trunk Dest? y		
DTMF over IP: in-band		
	IP Video? n	

Page 2 of the station form allows Shuffling to be disabled at the station level. Shuffling can also be disabled at the IP Network Region level.

add station 25000		Page 2 of 4
STATION		
FEATURE OPTIONS		
LWC Reception: spe		
LWC Activation? y		Coverage Msg Retrieval? y
LWC Log External Calls? n		
CDR Privacy? n		Data Restriction? n
Redirect Notification? y		Call Waiting Indication: y
Per Button Ring Control? n		Att. Call Waiting Indication: y
Bridged Call Alerting? n		
Switchhook Flash? y		
H.320 Conversion? n	Per Station CPN - Send Calling Number?	
MWI Served User Type:		
AUDIX Name:		
		Coverage After Forwarding? s
		Multimedia Early Answer? n
		Direct IP-IP Audio Connections? y
Emergency Location Ext: 25000		IP Audio Hairpinning? n

5 Configure Empirix Hammer G5

This section provides the procedures for configuring the Empirix Hammer G5. The procedures fall into the following areas:

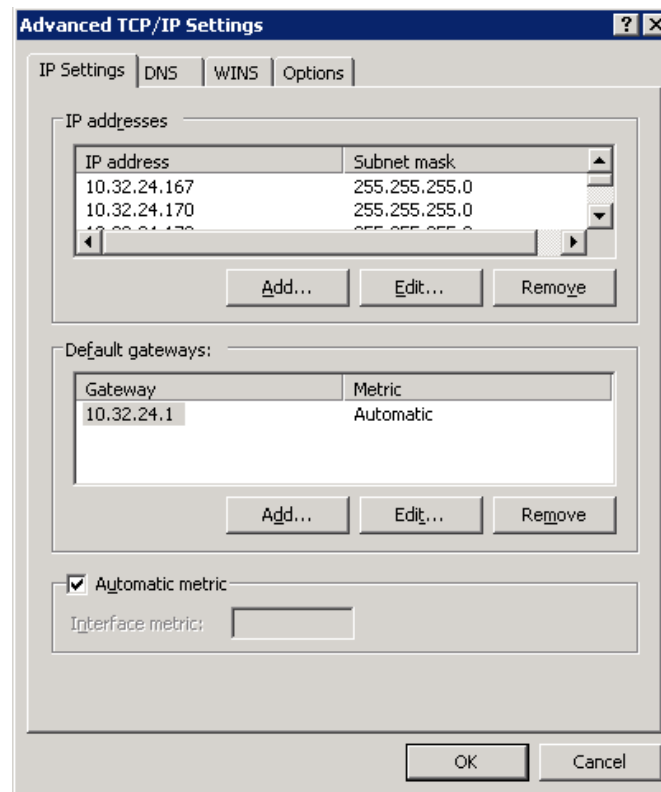
- Configure IP addresses to be used by each Hammer G5 channel.
- Configure the system, including the H.323 endpoint interface and the phone book, using the **Hammer Configurator**.
- Create and run the test script using the **Hammer TestBuilder**.

Checking H.323 registration status and monitoring test call progress is covered in the **Verify Empirix Hammer G5** section (Section 7.2).

Note: Refer to [3] for instructions on installing the Hammer G5 software.

5.1 Configure IP Addresses on Hammer G5 Server

The Hammer G5 server needs to be configured with the IP addresses that it will need for each channel. During the compliance test, 20 H.323 endpoint channels were used. 10 channels were used to originate calls and 10 channels were used to terminate calls. This requires a block of 20 IP addresses, which must be contiguous. The 20 IP addresses used ranged from 10.32.24.160 to 10.32.24.179. These IP addresses are configured in the **Advanced TCP/IP Settings** under Network Connections in Windows 2003 Server.

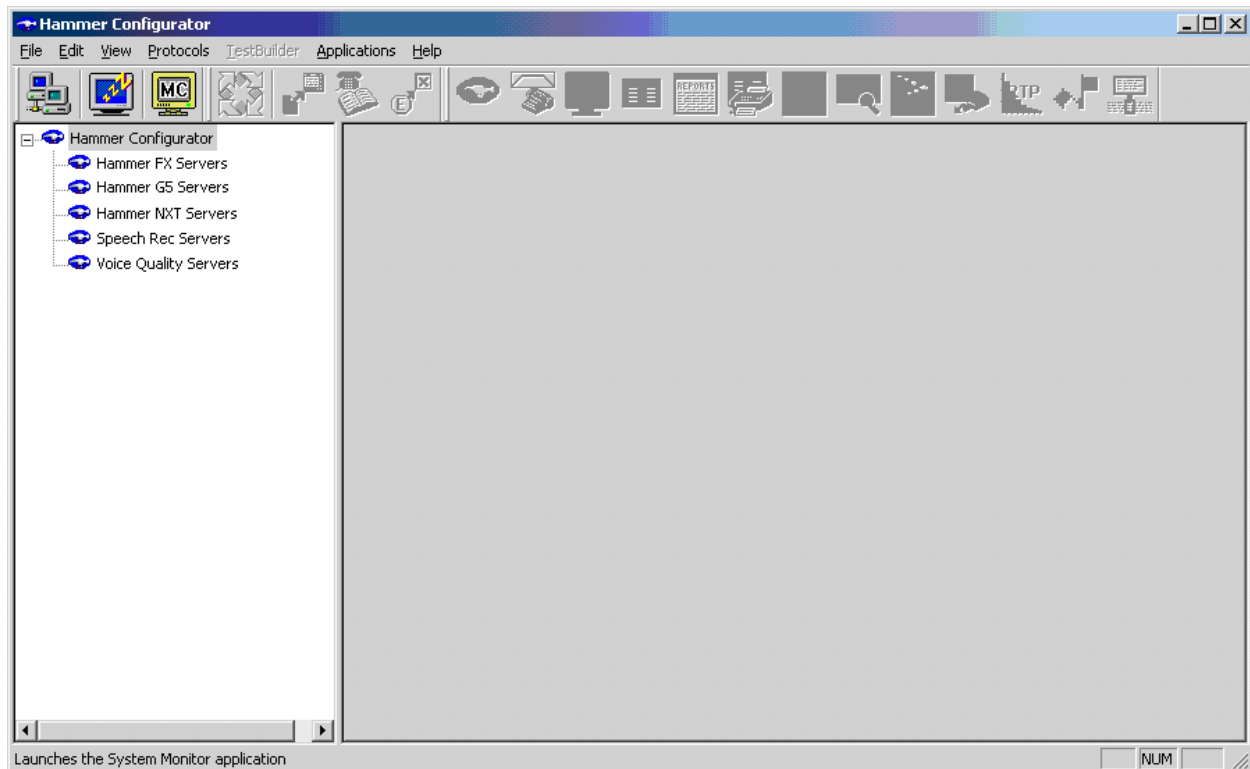


5.2 Configure the System

This section covers the configuration of the H.323 endpoint interface and the phone book.

5.2.1 Configure H.323 Endpoint Interface

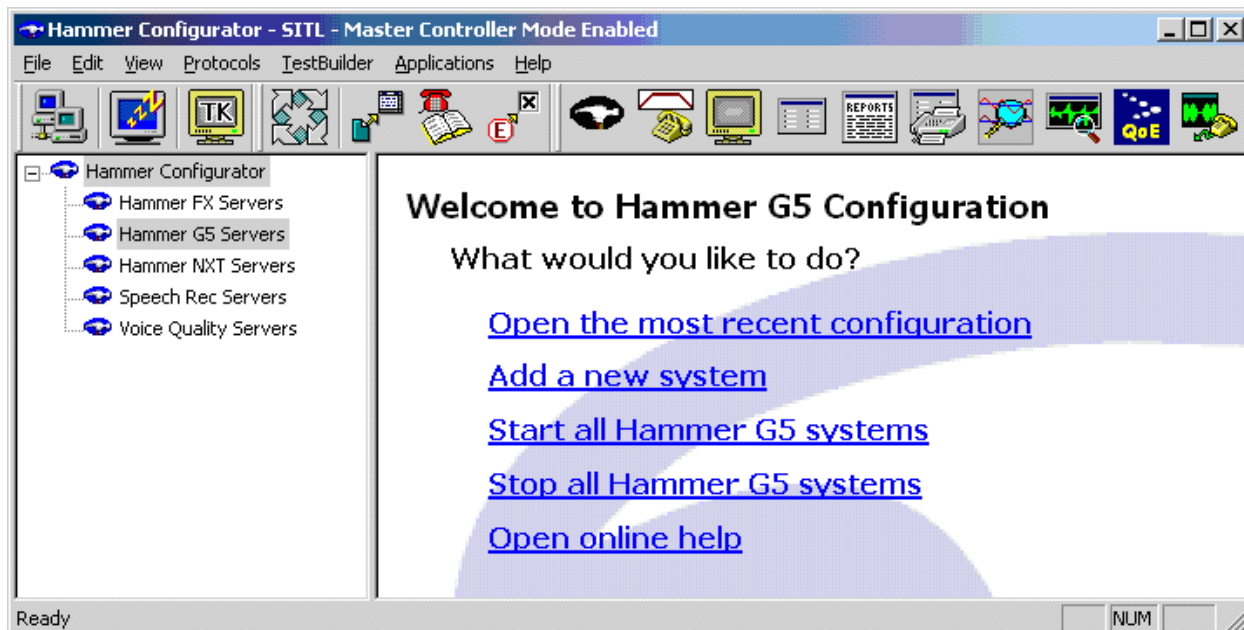
The Empirix Hammer G5 is configured through the **Hammer Configurator**, a graphical user interface, residing on the Hammer G5 server. From the Hammer G5 server, run the **Hammer Configurator**. The initial window is displayed as follows.



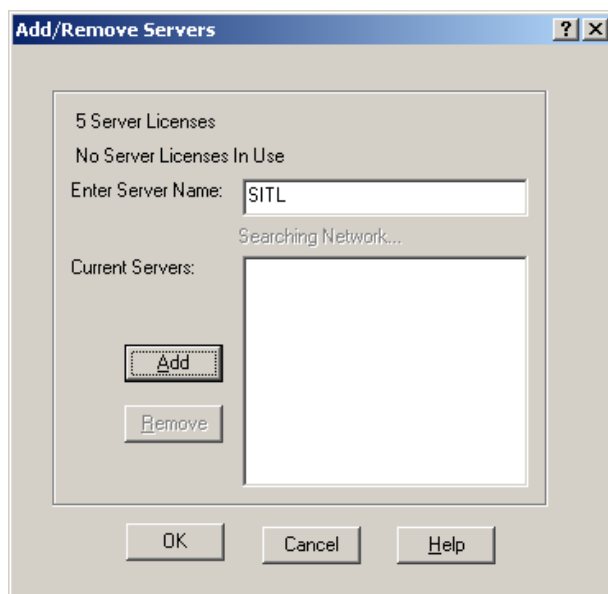
The Hammer G5 must be in **Master Controller Mode**. Verify that it is in Master Controller

Mode by clicking the  icon. If the  icon is not displayed, the Hammer G5 is already in Master Controller Mode.

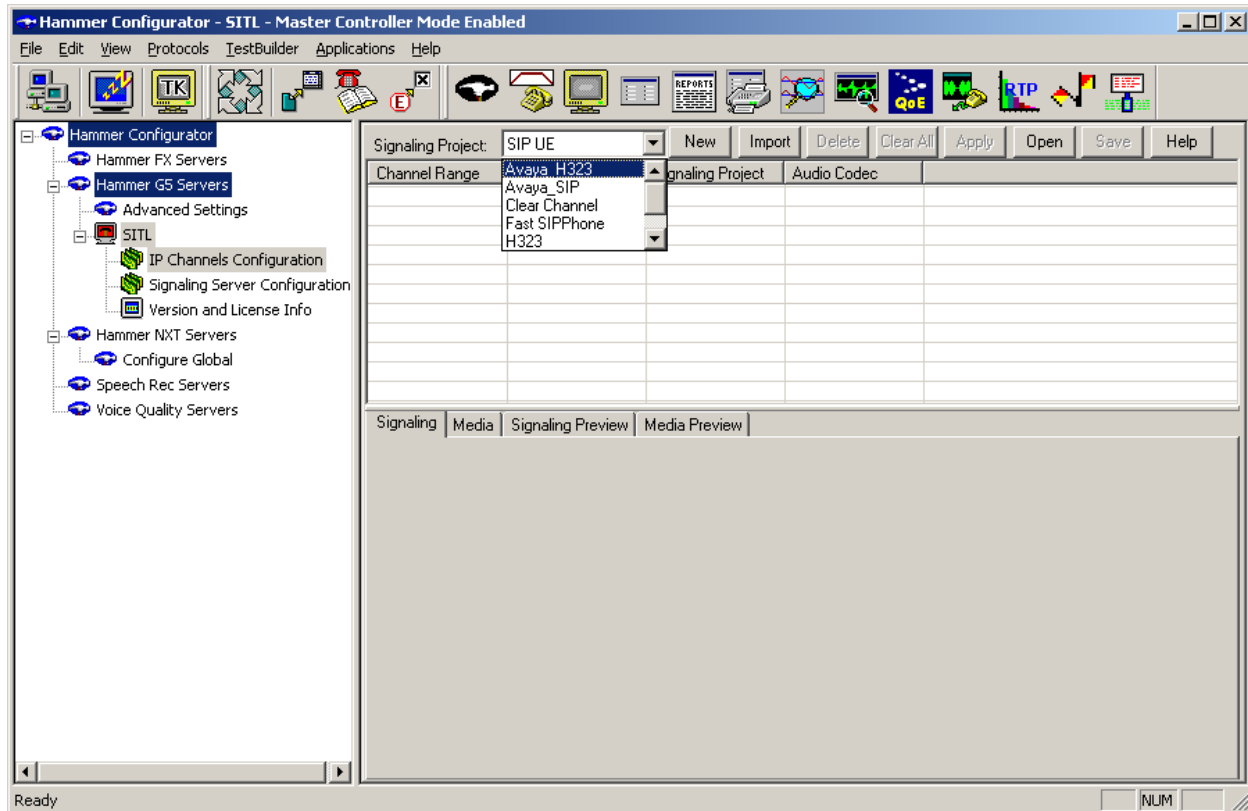
Next, select Hammer G5 Servers item in the left pane and then click on **Add a new system**. The **Add/Remove Servers** window will be displayed.



In the **Add/Remove Servers** window, specify a descriptive **Server Name** and then click the **Add** button. The server name will be moved to the **Current Servers** section. Click **OK**.

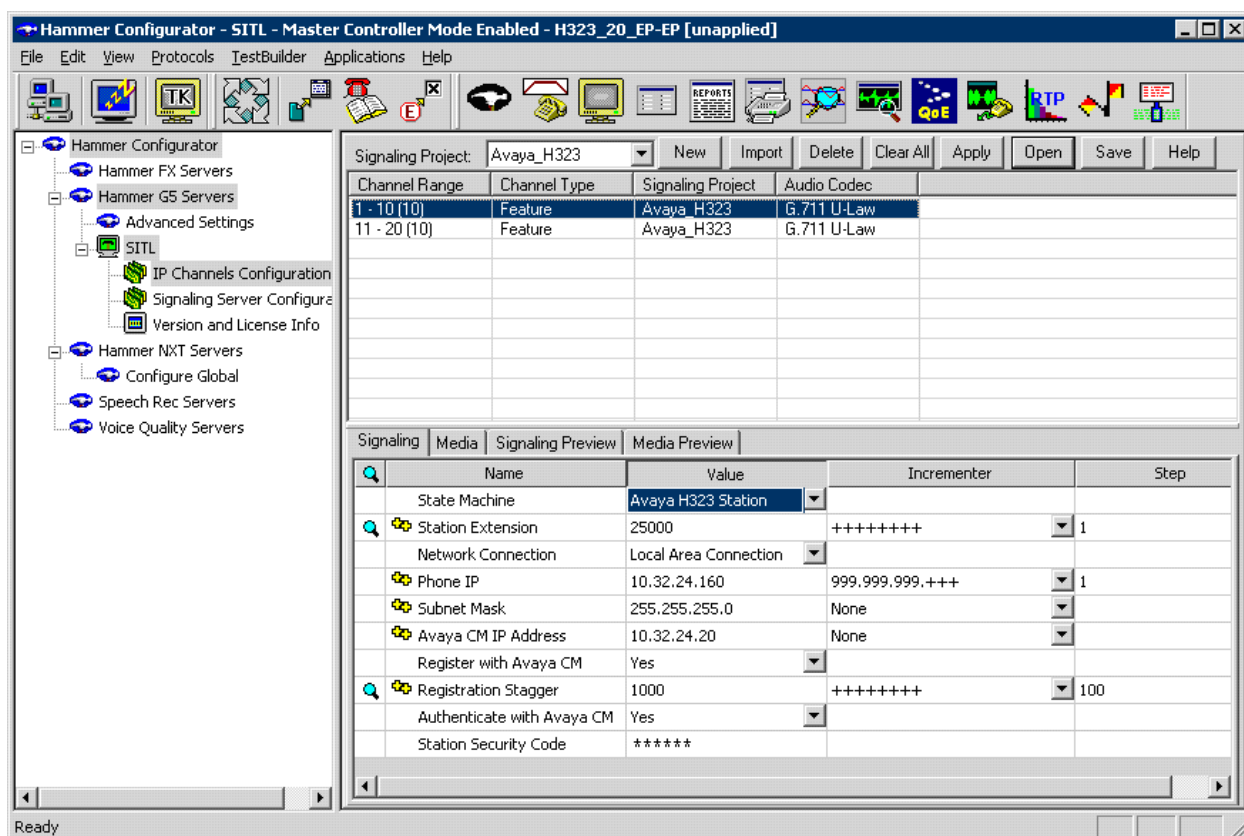


Once the server is added to the system, the server name will appear in the left pane of the **Hammer Configurator**. Expand the server name (e.g., **SITL**) in the left pane and click on **IP Channels Configuration**. The following window will be displayed. Select *Avaya H.323* for the **Signaling Project** and then click **New**.



The first line in the grid that is highlighted in the figure below corresponds to the 10 originating channels. To set the number of channels in the group, click on the **Channel Range** cell in the grid and enter the number *10*. The following fields in the **Signaling** tab should then be set as follows:

- **State Machine** should be set to *Avaya H323 Station*.
- **Station Extension** should be set to the first extension in the group (e.g., *25000*) and the **Incrementer** and **Step** fields should be set as shown so that the extension of the subsequent channels are incremented by one. This covers extensions from *25000* to *25009*.
- **Network Connection** should be set to the appropriate network interface on the server.
- **Phone IP** should be set to the IP address of the first channel in the group and the **Incrementer** and **Step** fields should be set as shown so that the last of octet of the IP address is incremented by one. Note that this requires a block of contiguous IP addresses. This covers IP addresses from *10.32.24.160* to *10.32.24.169*.
- **Subnet Mask** should be set to the network mask (e.g., *255.255.255.0*).
- **Avaya CM IP Address** should be set to the C-LAN IP address if a G650 Media Gateway is used.
- **Register with Avaya CM** should be set to *Yes*.
- **Authenticate with Avaya CM** should be set to *Yes*.
- **Station Security Code** should match the one configured in the corresponding **Station** form on Communication Manager.



In the **Media** tab of the 10 originating channels, configure the fields as follows:

- **Audio Codec** should be set to the appropriate codec for the test. G711, G729, and G.723 codecs are supported.
- **Frequency [ms]** should be set to the appropriate value for the specified codec. It should match the Packet Size [ms] field in the **IP Codec Set** form on Communication Manager for the specified codec.
- **Network Connection** should specify the appropriate network interface.
- **Source IP Address** should be set to the IP address of the first channel in the group. The **Incrementer** and **Step** fields should be set as shown so that the last octet of the IP address is incremented for the subsequent channels. Note that the IP addresses for the channels need to be contiguous.
- **Media Profile** should be set to one that specifies the codec configured in the **Audio Codec** field.
- The remaining fields should be configured as shown.

Hammer Configurator - SITL - Master Controller Mode Enabled - H323_20_EP-EP [unapplied]

File Edit View Protocols TestBuilder Applications Help

Hammer Configurator

- Hammer FX Servers
- Hammer G5 Servers
 - Advanced Settings
 - SITL
 - IP Channels Configuration
 - Signaling Server Configure
 - Version and License Info
- Hammer NXT Servers
 - Configure Global
- Speech Rec Servers
- Voice Quality Servers

Signaling Project: Avaya_H323 New Import Delete Clear All Apply Open Save Help

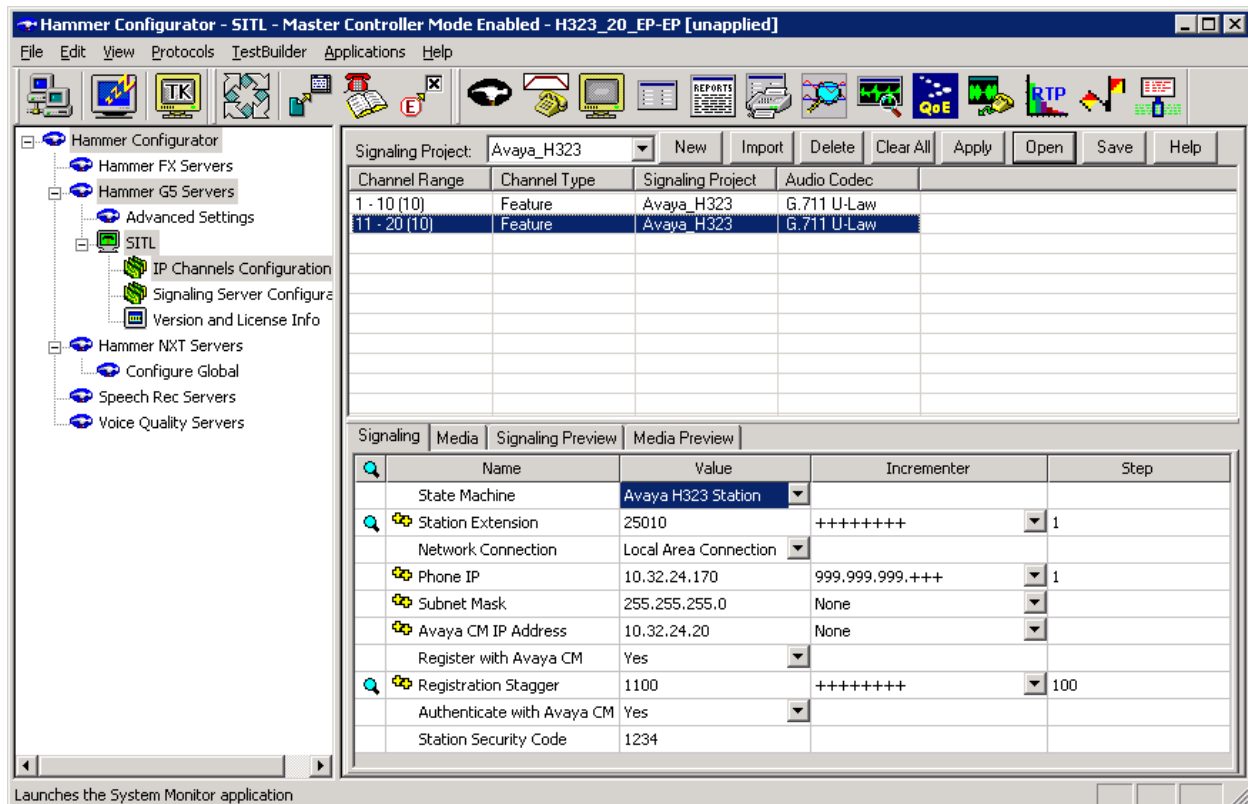
Channel Range	Channel Type	Signaling Project	Audio Codec
1 - 10 (10)	Feature	Avaya_H323	G.711 U-Law
11 - 20 (10)	Feature	Avaya_H323	G.711 U-Law

Signaling Media Signaling Preview Media Preview

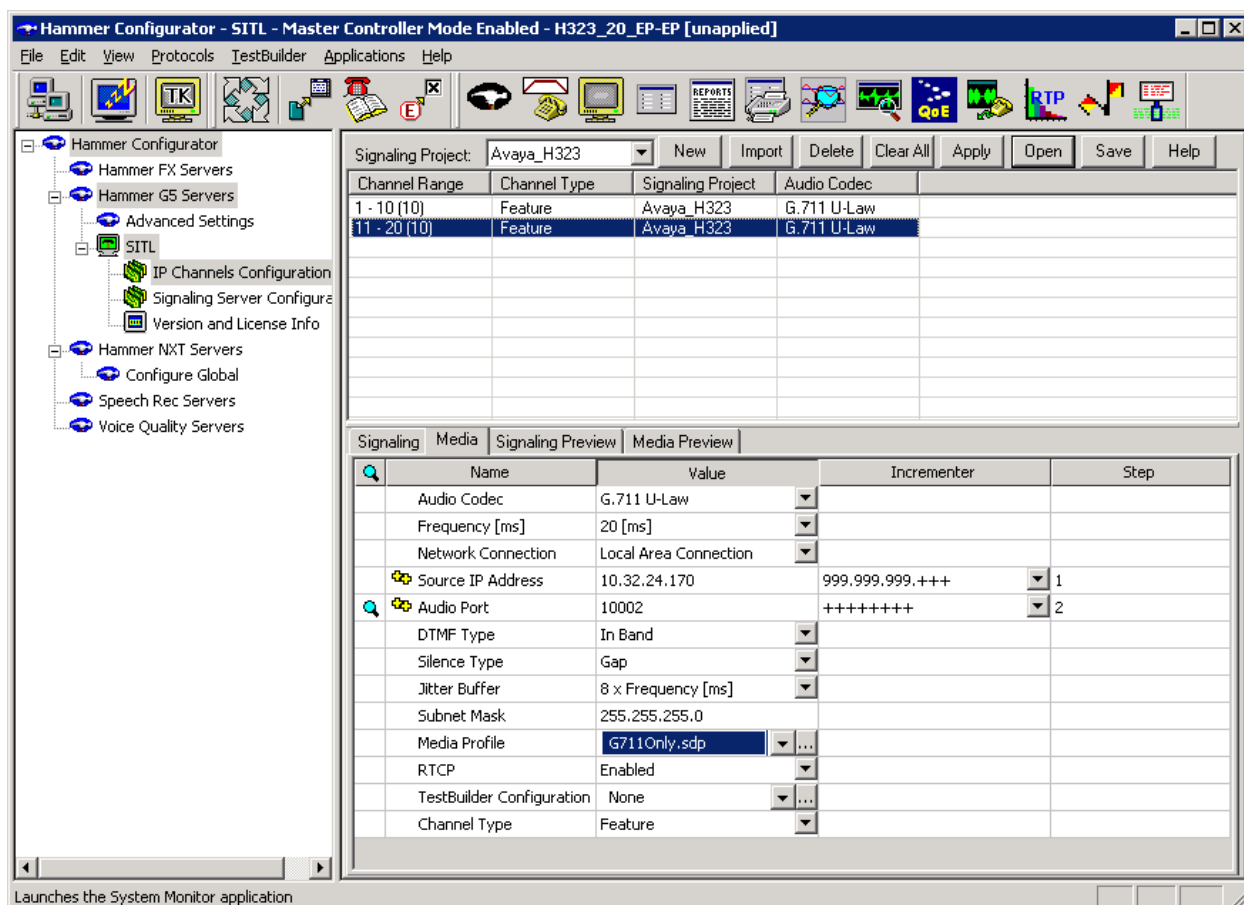
Name	Value	Incrementer	Step
Audio Codec	G.711 U-Law		
Frequency [ms]	20 [ms]		
Network Connection	Local Area Connection		
Source IP Address	10.32.24.160	999.999.999.+++	1
Audio Port	10000	+++++++	2
DTMF Type	In Band		
Silence Type	Gap		
Jitter Buffer	8 x Frequency [ms]		
Subnet Mask	255.255.255.0		
Media Profile	G711Only.sdp		
RTCP	Enabled		
TestBuilder Configuration	None		
Channel Type	Feature		

Launches the System Monitor application

The second line in the grid that is highlighted in the figure below corresponds to the second group of channels that will terminate the calls. Set the **Channel Range** cell to the number of channels in this group. The configuration of the **Signal** tab is similar to the one for the group of originating channels with the exception that the **Station Extension** and **Phone IP** fields will be different. This group of channels will be assigned extensions 25010 to 25019 and IP addresses from 10.32.24.170 to 10.32.24.179. Again, the IP addresses for this group of channels need to be contiguous.



The **Media** tab for the group of terminating channels is shown below. The configuration is similar to the one for the group of originating channels except for the **Source IP Address** field.



The following windows show the configuration of the **Media Profile** used in the **Media** tab above for the two channel groups. To access this window, click on the ellipses button (...) in the Media tab. By default, there are **Media Profiles** for each audio codec type so this configuration is not required since the profiles are available out-of-box. It is presented for informational purposes. Click on the **Audio Description** button to view the codecs that will be advertised by the Hammer G5 when placing a call.

The screenshot shows the 'Media Profile Editor' window with the title bar path: \\SITL\Hammer\IPSigServer\SDPs\G711Only.sdp. The window is divided into three main sections:

- Session Description:** A table with columns 'Include Field?' and 'Value'.

Include Field?	Field	Value
<input type="checkbox"/>	(o=) Owner:	HammerG5
<input type="checkbox"/>	(s=) Session Name:	Hammer Test Session
<input type="checkbox"/>	(i=) Session Information:	
<input type="checkbox"/>	(u=) URI of Description:	
<input type="checkbox"/>	(e=) Email Address:	
<input type="checkbox"/>	(p=) Phone Number:	
<input type="checkbox"/>	(b=) Bandwidth Information:	
- (a=) Attributes:** A large empty text area for adding attributes, with 'Add', 'Edit', and 'Delete' buttons to its right.
- Media Descriptions:** Three buttons: 'Audio Description' (checked), 'Image (T.38) Description', and 'Video Description'.

At the bottom of the window are buttons for 'New', 'Save', 'Load', 'Delete', 'Preview', 'OK', 'Cancel', and 'Help'.

The following window shows the codecs selected for this profile. This **Media Profile** was already created and named *G711Only.sdp*. It specifies G.711U and RFC 2833. When done, click **OK** to return to the previous window. Additional media profiles can be created and saved by selecting the desired codecs in this window and then clicking the **Save** button in the previous window.

MPE Audio Description: \\SITL\Hammer\IP5igServer\SDPs\G711Only.sdp

Order and configure codecs to advertise in Media Profile

Codec	Send 'rtpmap'?	Payload Type
<input checked="" type="checkbox"/> G.711U	No	0
<input type="checkbox"/> G.711A	No	8
<input type="checkbox"/> G.723	No	4
<input type="checkbox"/> G.729A	No	18
<input type="checkbox"/> G.729AB	No	18
<input type="checkbox"/> G.726 40 kb/s	Yes	127
<input type="checkbox"/> G.726 32 kb/s	Yes	97
<input type="checkbox"/> G.726 24 kb/s	Yes	98
<input type="checkbox"/> G.726 16 kb/s	Yes	99
<input checked="" type="checkbox"/> RFC 2833	Yes	100
<input type="checkbox"/> G.726 8 kb/s	Yes	101

Optional Descriptions

Include Field?	Field	Value
<input type="checkbox"/>	(i=) Media Information:	
<input type="checkbox"/>	(b=) Bandwidth Information:	

(a=) Attributes

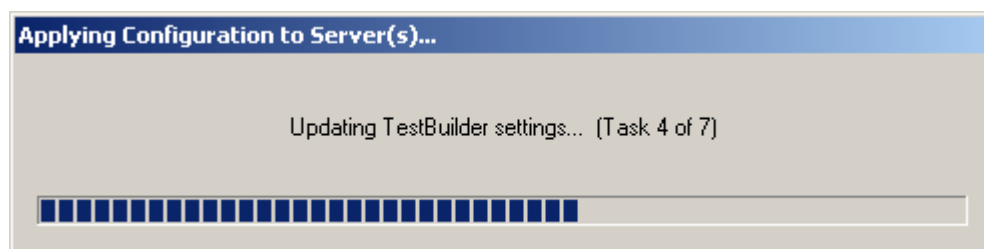
Add

Edit

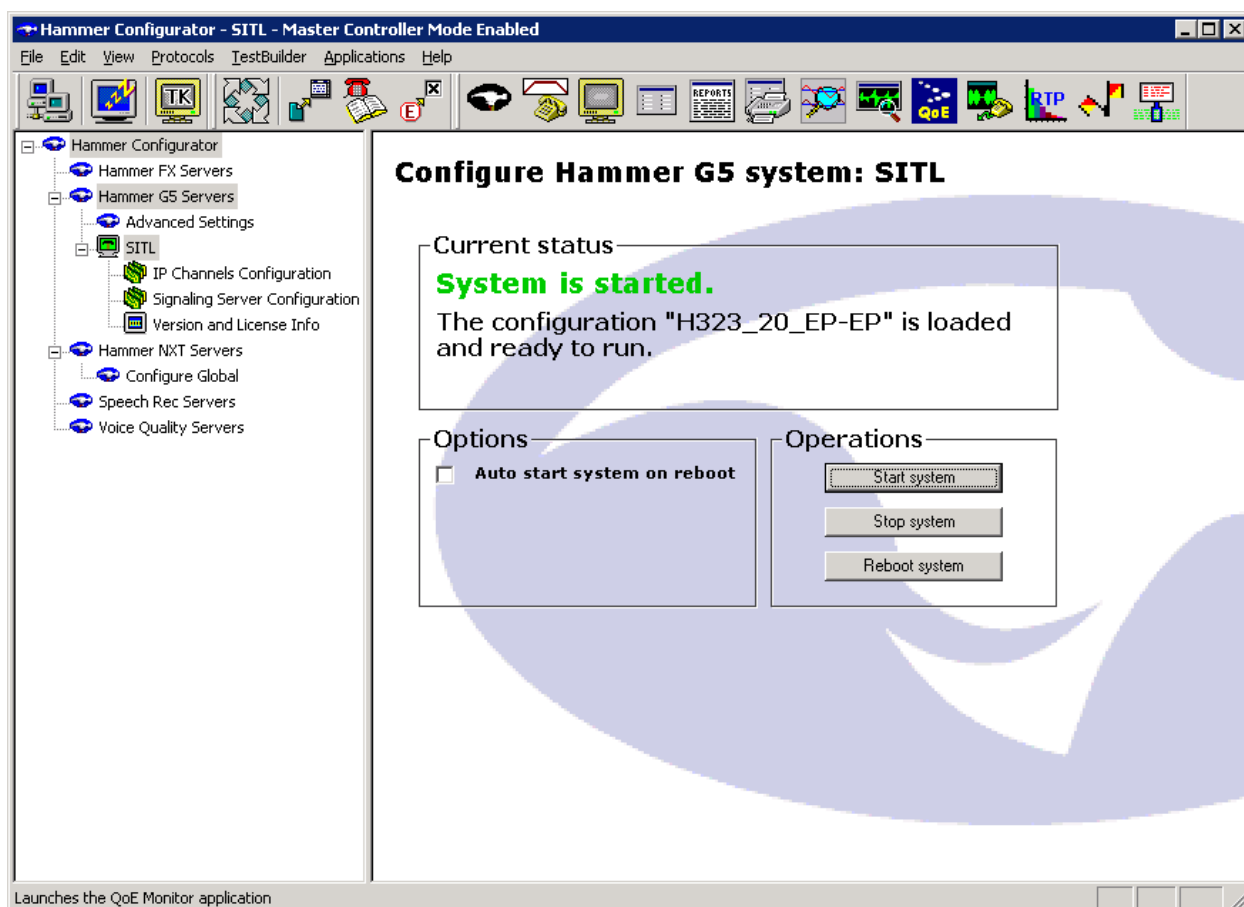
Delete

OK Cancel Help

This completes the configuration of the H.323 endpoint interface. This configuration should be saved by clicking the **Save** button on the **Hammer Configurator** window. The configuration needs to be applied to the server for the changes to take effect. Click on the **Apply** button in the **Hammer Configurator** window. The following window is displayed as the configuration is being applied to the server.

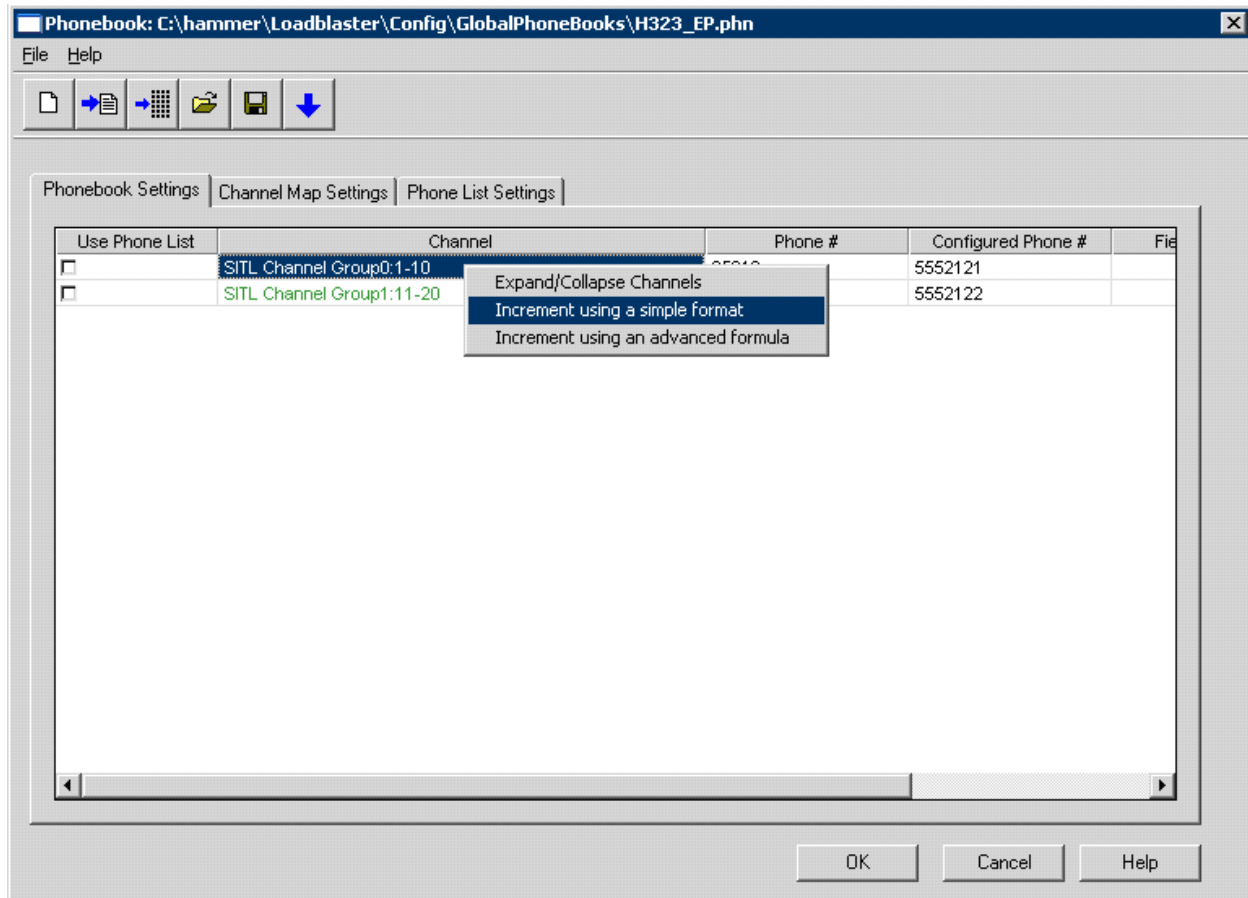


Check that the system has been started by clicking on the server name (e.g., SITL) in the left pane of the **Hammer Configurator**. If the current status is *System Is Stopped*, click the **Start system** button to start the system. When the system is started, it should appear as shown below and should also specify which configuration has been applied. The configuration performed above was saved as *H323_20_EP-EP*. When the system is started, the Hammer G5 will register H.323 endpoints with Communication Manager.



5.2.2 Configure the PhoneBook

The **PhoneBook** is used to specify which number each originating channel should dial when placing a call. Click on the **PhoneBook** icon in the **Hammer Configurator**. The **PhoneBook** window is displayed below. Since a H.323 configuration has already been applied to the system, the **Channel** column is automatically displayed with the appropriate channel groups. Right-mouse click on the first line corresponding to the group of originating channels (channels 1-10) and select the **Increment using a simple format** option as shown below.



In the **Simple Incrementer** window, specify the number that the first originating channel should dial in the **Start Value** field. In this example, the first channel will dial 25010, which corresponds to channel 11. Set the **Increment By** field to 1. This specifies that the subsequent channels should increment the number in the **Start Value** by one. For example, channel 1 will dial 25010, channel 2 will dial 25011, channel 3 will dial 25012, and so on. The **Start Channel** field should be set to the first channel number and the **End Channel** field should be set to the last channel number. The last channel number is 20 since there are 10 originating channels and 10 terminating channels. Click **OK**.

Simple Incrementer

Server: SITL

Column: Phone #

Destination Server:

Fill Type

☒ Channel Fill ☐ Group Fill

Tel.Numbers | IP Addresses | URLs | MAC Addresses

☐ All numbers around non-numerics
(e.g. 9,,1,,888-555-999# becomes 9,,1,,888-556-*000#)

☒ xxx-yyy-zzzz

☐ xxx (e.g. 1 (888) 555-9999 becomes 1 (889) 555-9999)

☐ yyy (e.g. 1 888 555 9999 becomes 1 888 556 9999)

☒ zzzz (e.g. 1-888-555-9999 becomes 1-888-555-0000)

☐ Use H323 formatting, with prefix:

Start Value: 25010

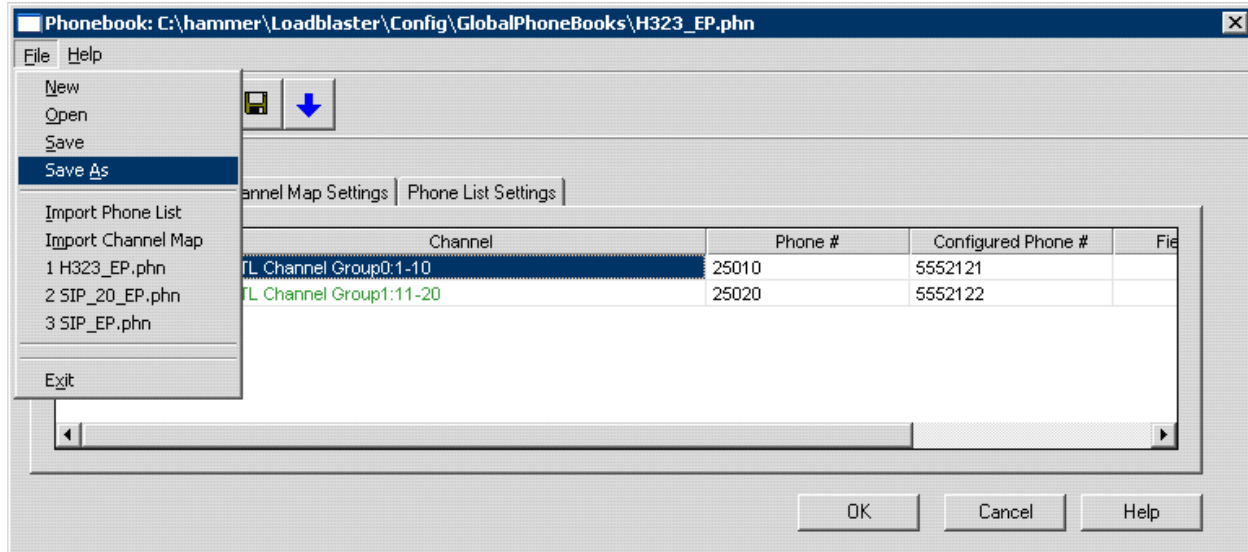
Increment By: 1

Start Channel: 1

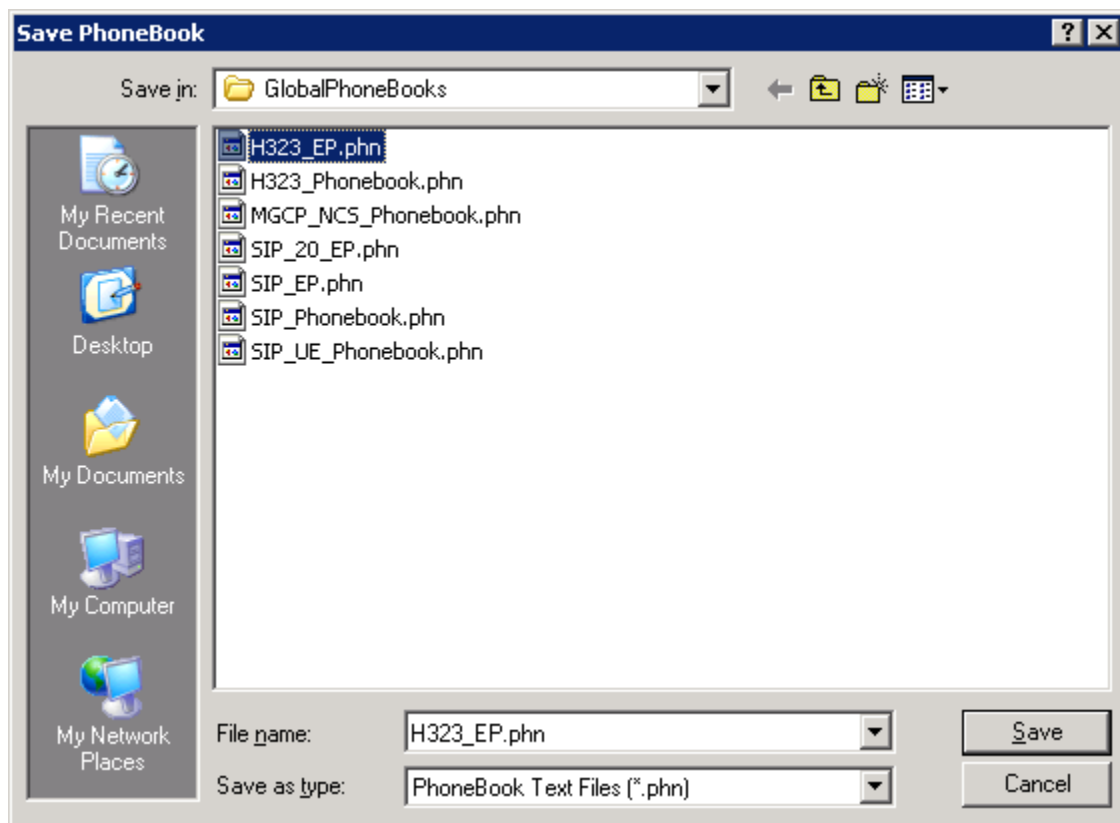
End Channel: 20

OK Cancel Apply Help

Once the **PhoneBook** is configured, select **File→Save As** to save the phone book.

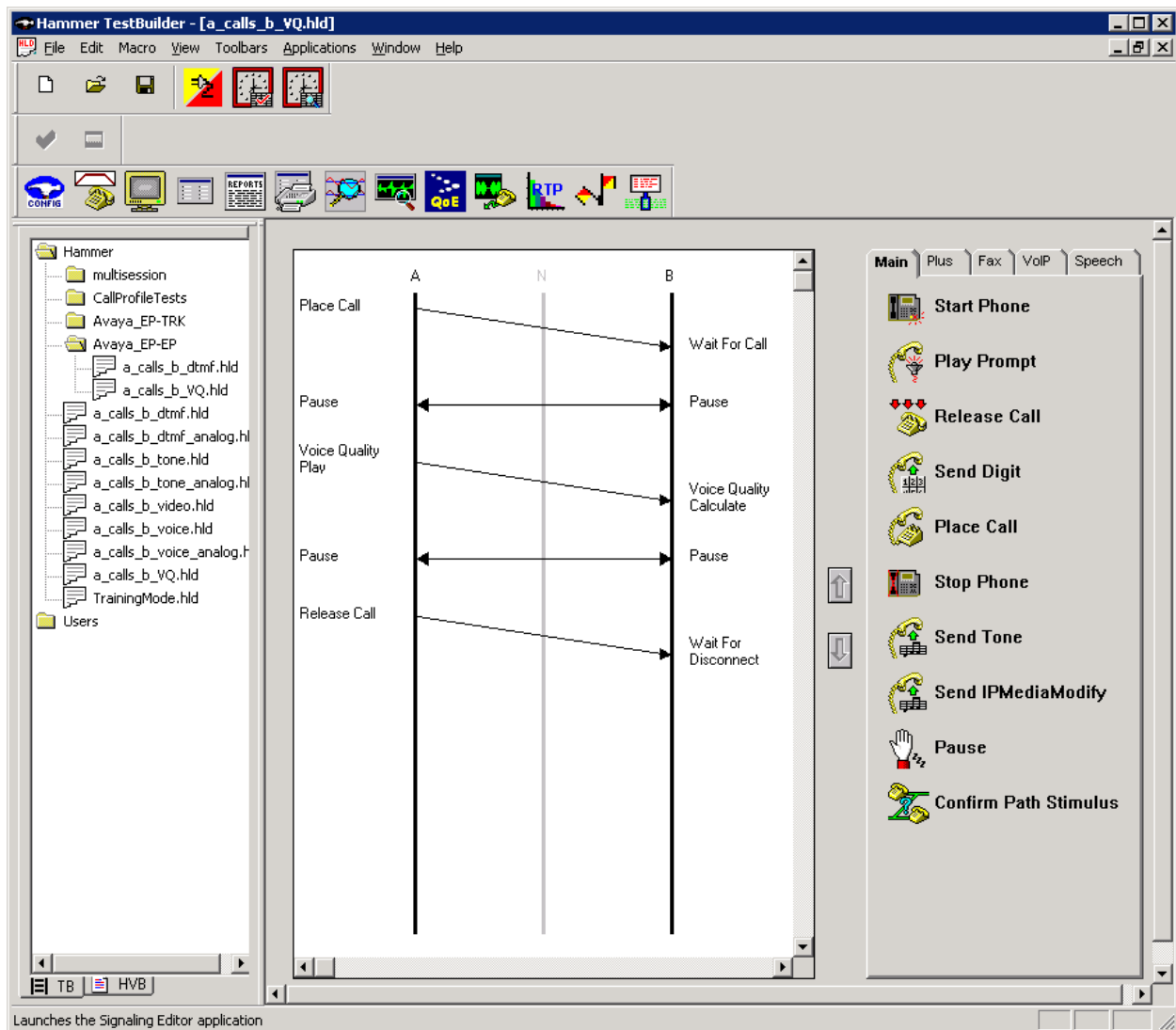


The phone book is saved as *H323_EP.phn* in the following window. This phone book will be used when running the test.

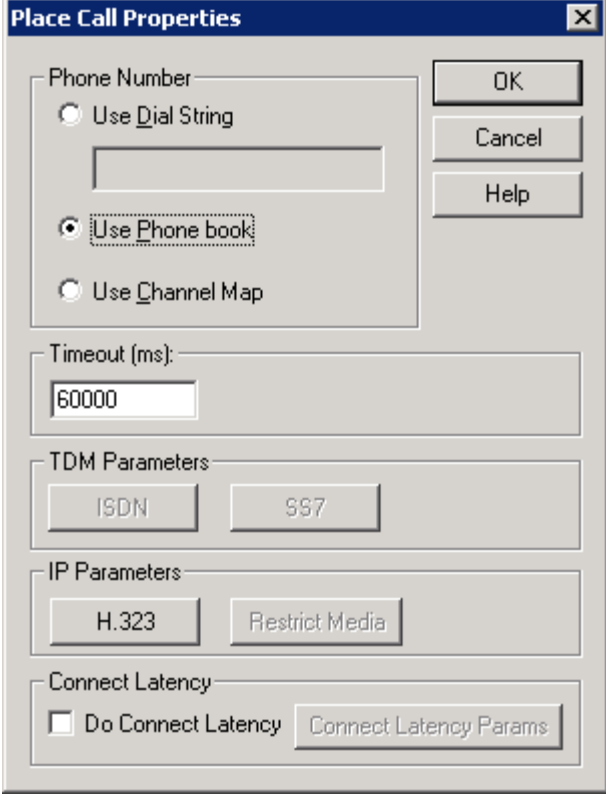


5.3 Configure and Run the Test Script

This section covers the configuration of a test script. The sample test script covered here establishes a VoIP call between two H.323 endpoints on the Hammer G5, followed by the originating side playing an audio prompt to the far-end so that voice quality metrics (e.g., PESQ score) can be obtained. The test script is configured with the **Hammer TestBuilder** application and is displayed in a ladder diagram shown below. Each action in the test script can be configured by double clicking on it. For detailed instructions on how to create the test script, refer to [4]. Each test step is examined below as a brief tutorial, but test scripts will vary depending on the customer's requirements.

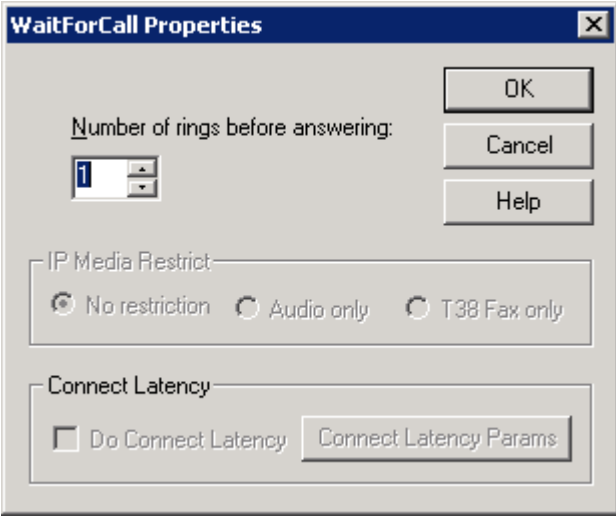


In the sample test script configured above, the A-side (originating H.323 endpoint) places a call to the B-side (terminating H.323 endpoint) using the **Place Call** action. The **Place Call** properties can be configured by double-clicking on the action in the ladder diagram. The **Place Call Properties** is configured to use the phone book as shown below.



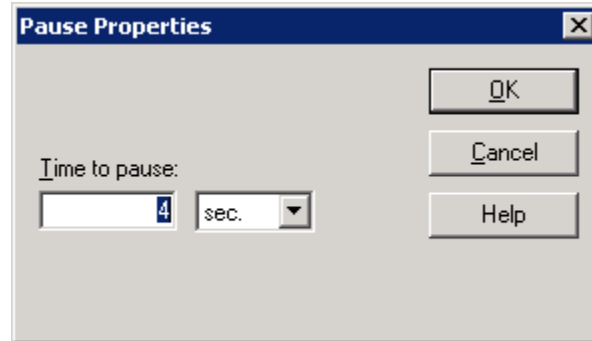
The **Place Call Properties** dialog box is shown. It has a title bar with a close button. The main area contains several sections:
1. **Phone Number**: Three radio buttons are present:
- **Use Dial String**: Unselected.
- **Use Phone book**: Selected.
- **Use Channel Map**: Unselected.
A text input field is located below the radio buttons.
2. **Timeout (ms):**: A text input field containing the value **60000**.
3. **TDM Parameters**: Two buttons, **ISDN** and **SS7**.
4. **IP Parameters**: Two buttons, **H.323** and **Restrict Media**.
5. **Connect Latency**: A checkbox labeled **Do Connect Latency** (unchecked) and a button labeled **Connect Latency Params**.
On the right side of the dialog, there are three buttons: **OK**, **Cancel**, and **Help**.

The B-side then waits for one ring before answering the call as configured in the **Wait for Call** action.

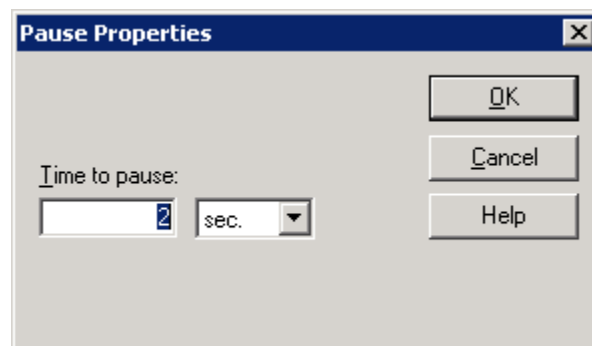


The **WaitForCall Properties** dialog box is shown. It has a title bar with a close button. The main area contains several sections:
1. **Number of rings before answering:**: A spin box showing the value **1**.
2. **IP Media Restrict**: Three radio buttons:
- **No restriction**: Selected.
- **Audio only**: Unselected.
- **T38 Fax only**: Unselected.
3. **Connect Latency**: A checkbox labeled **Do Connect Latency** (unchecked) and a button labeled **Connect Latency Params**.
On the right side of the dialog, there are three buttons: **OK**, **Cancel**, and **Help**.

After the call is established, the A-side pauses for 4 seconds before proceeding.

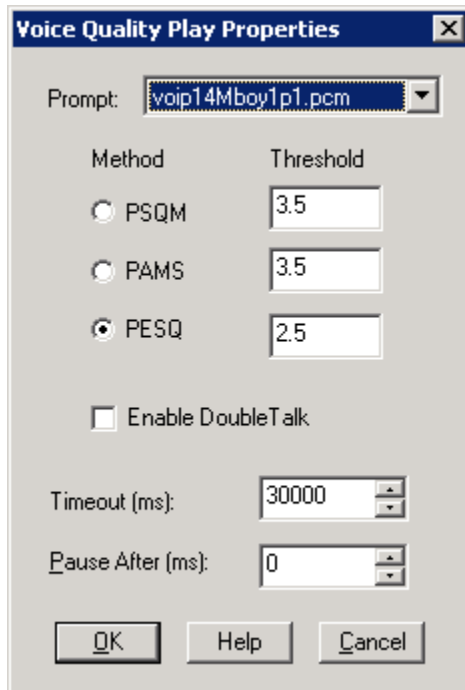


After the call is established, the B-side pauses for 2 seconds before proceeding. The B-side waits for less time because it needs to start listening for the audio prompt before the A-side starts to play it.



Important Note: In order for the call to succeed, the B-side needs to start listening for the audio prompt before the A-side starts to play it. During the compliance test, the B-side started to listen for the prompt about 2 seconds before the A-side started to play it. This can be controlled by the length of the **Pause** step described above. However, the B-side should not start listening too early (e.g., 5 seconds before the A-side starts playing the prompt or the call will most likely fail).

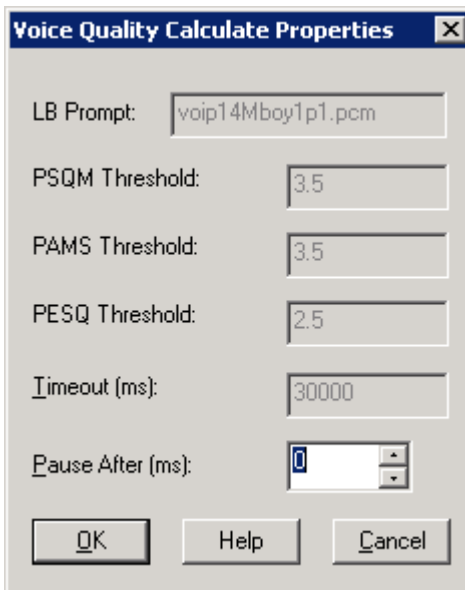
After the pause by the A-side, it starts to play the audio prompt specified in the **Prompt** field of the **Voice Quality Play Properties** window. The action properties also specify that a PESQ score should be provided.



The **Voice Quality Play Properties** dialog box contains the following fields and controls:

- Prompt:** A dropdown menu showing `voip14Mboy1p1.pcm`.
- Method** and **Threshold** section:
 - ☐ PSQM with a threshold of `3.5`
 - ☐ PAMS with a threshold of `3.5`
 - ☒ PESQ with a threshold of `2.5`
- ☐ **Enable DoubleTalk**
- Timeout (ms):** A numeric field set to `30000`.
- Pause After (ms):** A numeric field set to `0`.
- Buttons: **OK**, **Help**, and **Cancel**.

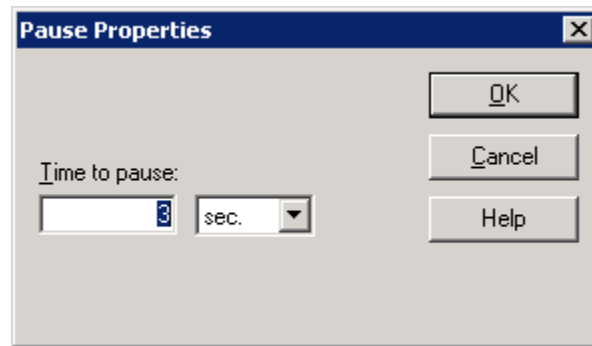
The B-side starts to listen to prompt to calculate the voice quality score.



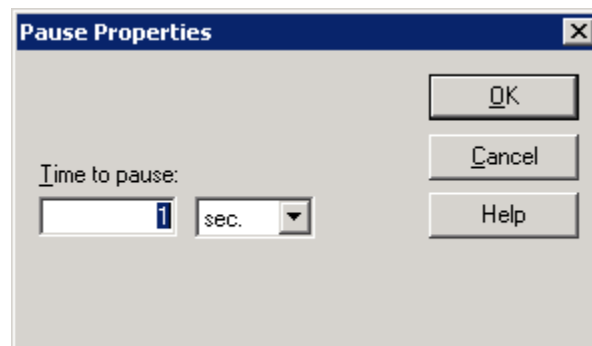
The **Voice Quality Calculate Properties** dialog box contains the following fields and controls:

- LB Prompt:** A text field containing `voip14Mboy1p1.pcm`.
- PSQM Threshold:** A numeric field set to `3.5`.
- PAMS Threshold:** A numeric field set to `3.5`.
- PESQ Threshold:** A numeric field set to `2.5`.
- Timeout (ms):** A numeric field set to `30000`.
- Pause After (ms):** A numeric field set to `0`.
- Buttons: **OK**, **Help**, and **Cancel**.

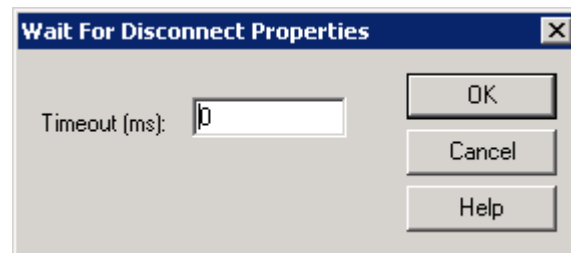
After the audio prompt is played the voice quality score is calculated, the A-side pauses for 3 seconds as shown below before releasing the call.



The B-side pauses for 1 second before releasing the call.

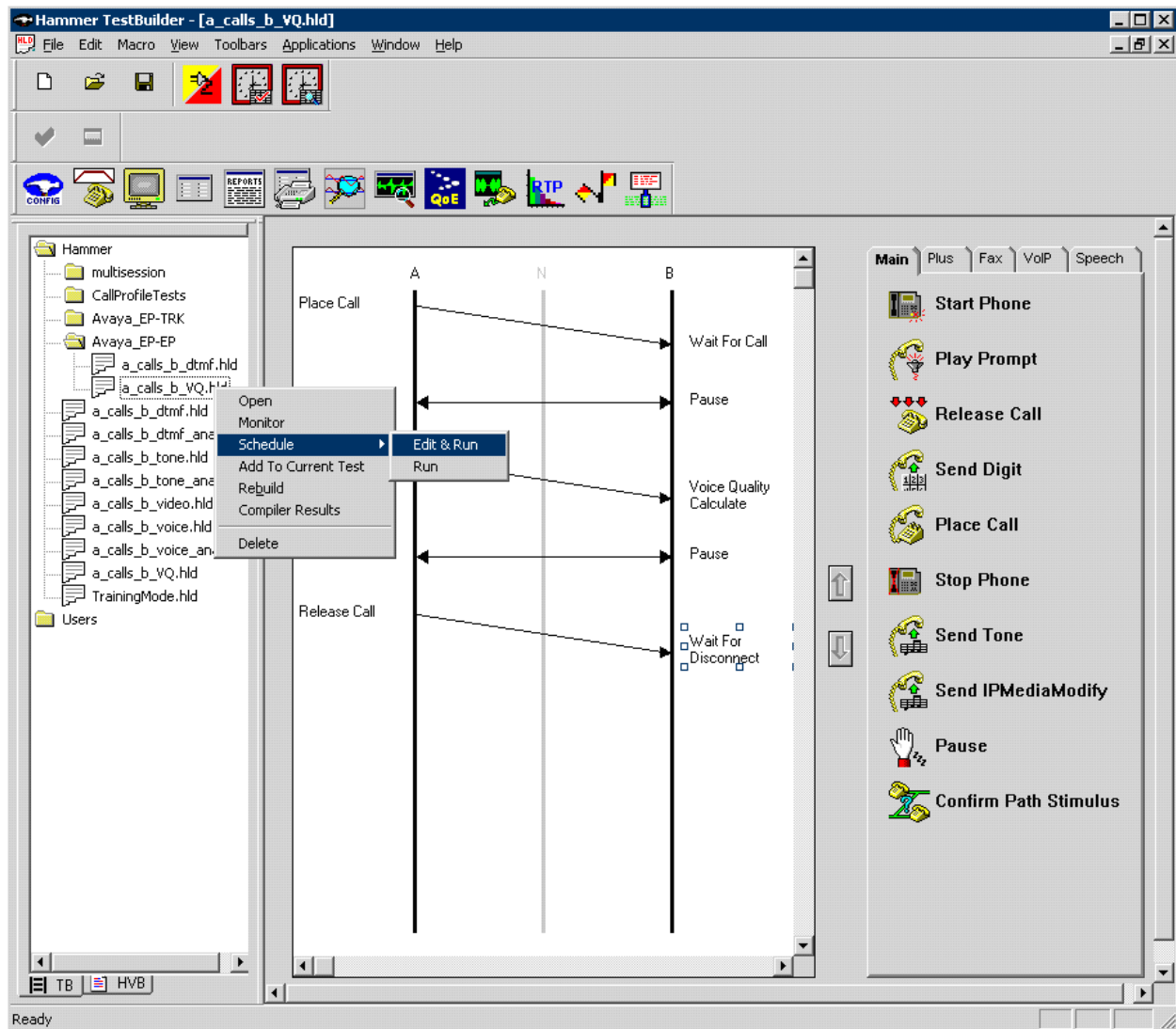


The last step of the test script is to release the call.



Once the test script is configured, save it from the **Hammer TestBuilder** application. Anytime a change is made to the test script, it needs to be saved before it can be run. In this example, the test script was saved as *a_calls_b_VQ.hld*.

To run the test, right-mouse click on the test script in the left pane of the **Hammer TestBuilder** window and navigate to **Schedule→Edit & Run**. To re-run the test, the user can simply select **Schedule→Run**, if no changes are required.

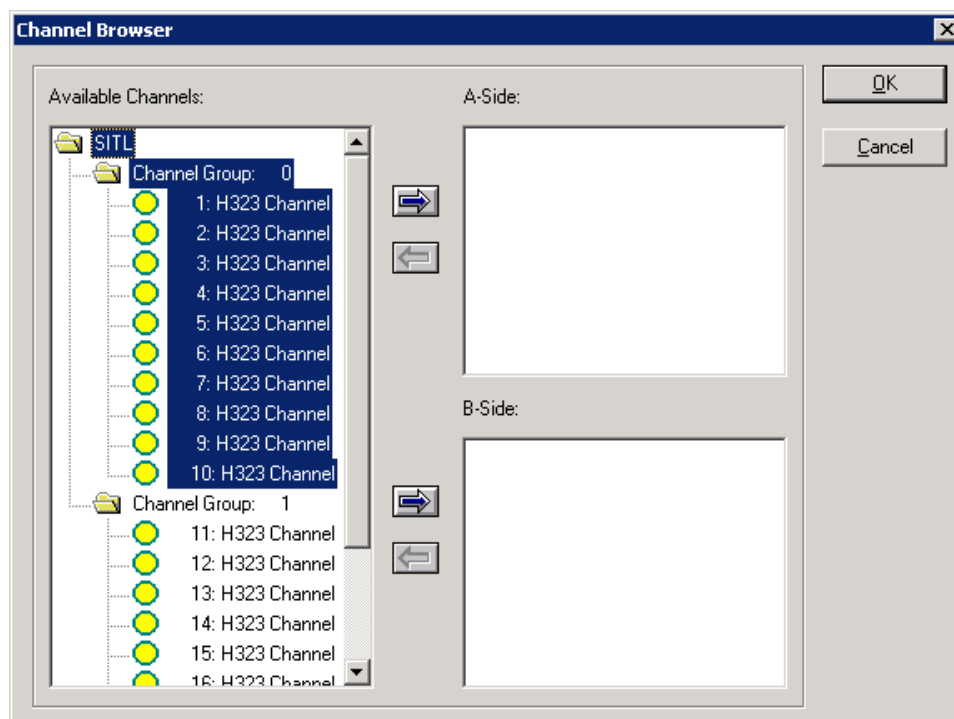


In the **Properties** window, select the appropriate phone book (e.g., H323_EP). The H323_EP phone book was configured above. Set the **Loop Count** to the appropriate value to control the number of times the test should run. Setting this field to -1 will allow the test to run forever. Setting this field to a specific number will run the test for the many iterations and then stop. The **Guard Time (ms)** field specifies how long to wait before the test is run again on the same channel. The **Stagger** section allows the user to specify how long to wait before the test is run on the next channel. Next, click on the ellipses button (...) in the **Channels** section to assign channels to the **A-Side** and **B-Side**.

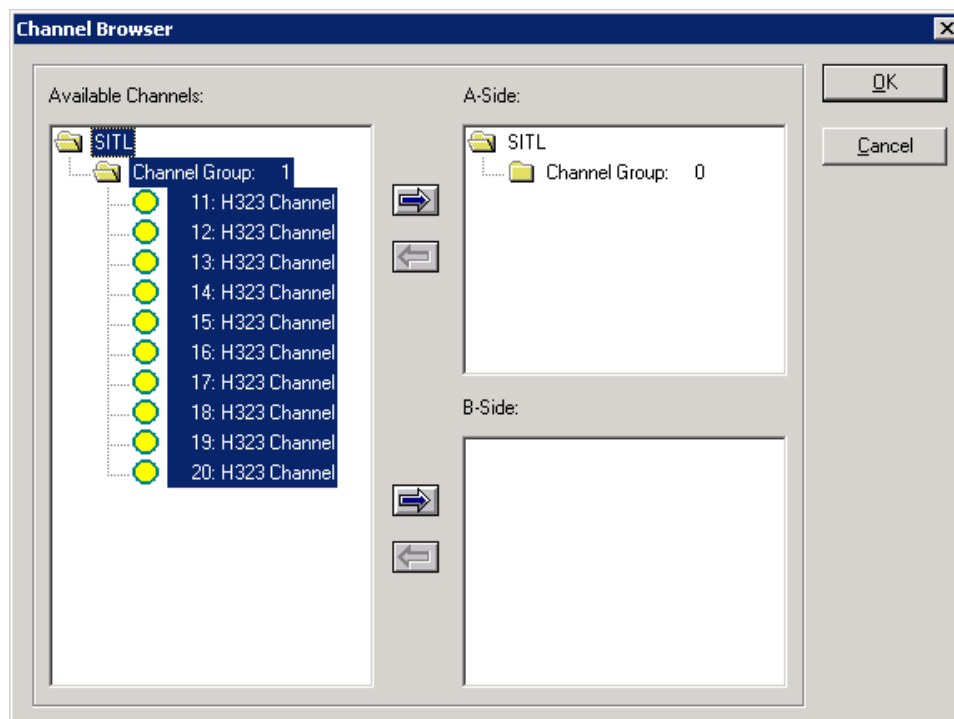
Important Note: The **Guard Time** and **Stagger** parameters should be carefully considered for every test. A test script could fail because the configuration under test cannot handle the load generated by the Hammer G5. These parameters can slow down the test to a rate that can be reasonably handled by the test configuration.

The screenshot shows the 'Properties' dialog box for the 'TB Scheduler' tab. The 'Script' field is set to '...laster\Library\Hammer\Avaya_EP-EP\A_calls_b_VQ.hld'. The 'Start Time' is set to 1:41:35 PM on 4/21/2010. The 'Action if a Channel is busy' is set to 'Wait'. The 'Channels' section shows 'A-Side' as 'SITL[1-10]' and 'B-Side' as 'SITL[11-20]'. The 'PhoneBook' section shows 'Select a PhoneBook' as 'H323_EP'. The 'Stagger' section has four options: 'Automatic - Est. CHT (s)' with a value of 5, 'User Defined - (ms)' with a value of 0, 'Random - Min (s)' with a value of 1 and 'Max (s)' with a value of 5, and 'None' which is selected. The 'Max Active Connections' is set to 0. The 'Max Test Time' is set to 0 hours and 0 minutes. The 'Loop Count' is set to -1. The 'Guard Time (ms)' is set to 1500. The 'OK', 'Cancel', 'Apply', and 'Help' buttons are at the bottom.

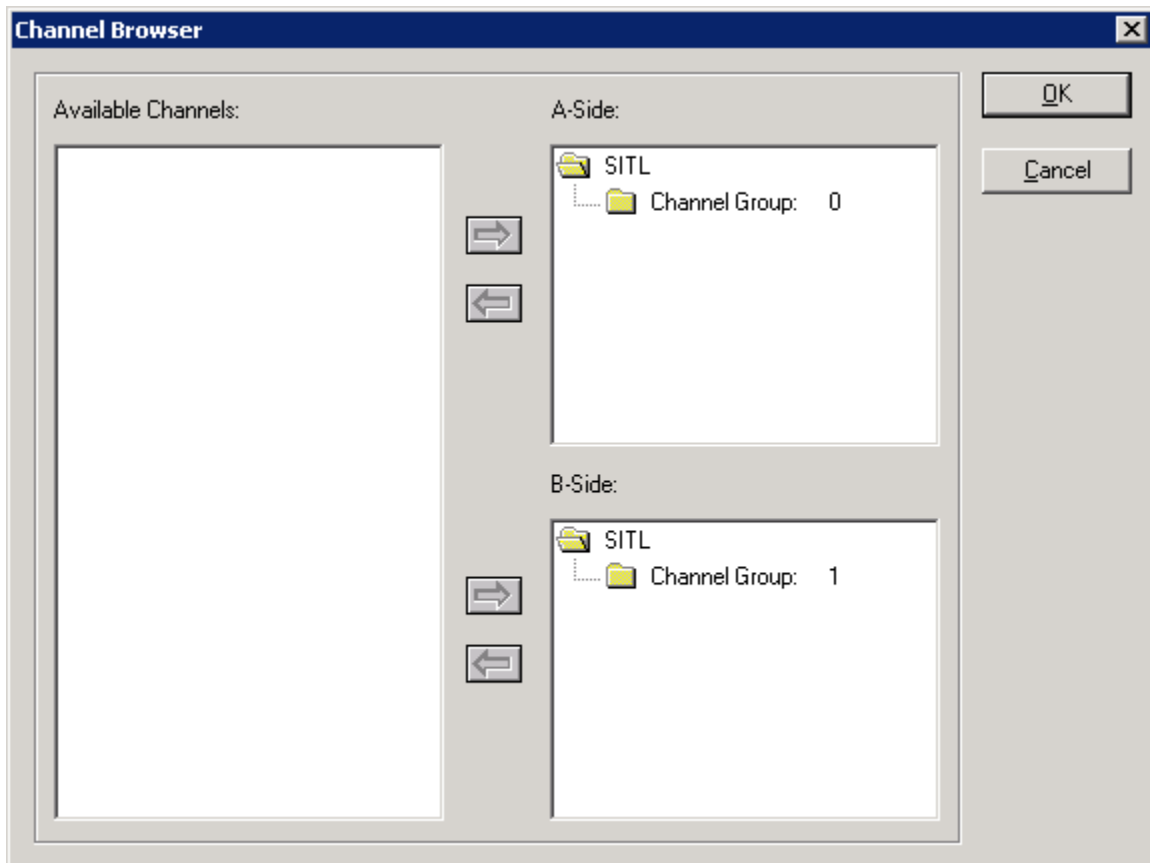
In the **Channel Browser**, select the channels in **Channel Group 0** and assign it to the **A-Side** by clicking on the appropriate right arrow.



Select the channels in **Channel Group 1** and assign it to the **B-Side** by clicking on the appropriate right arrow.




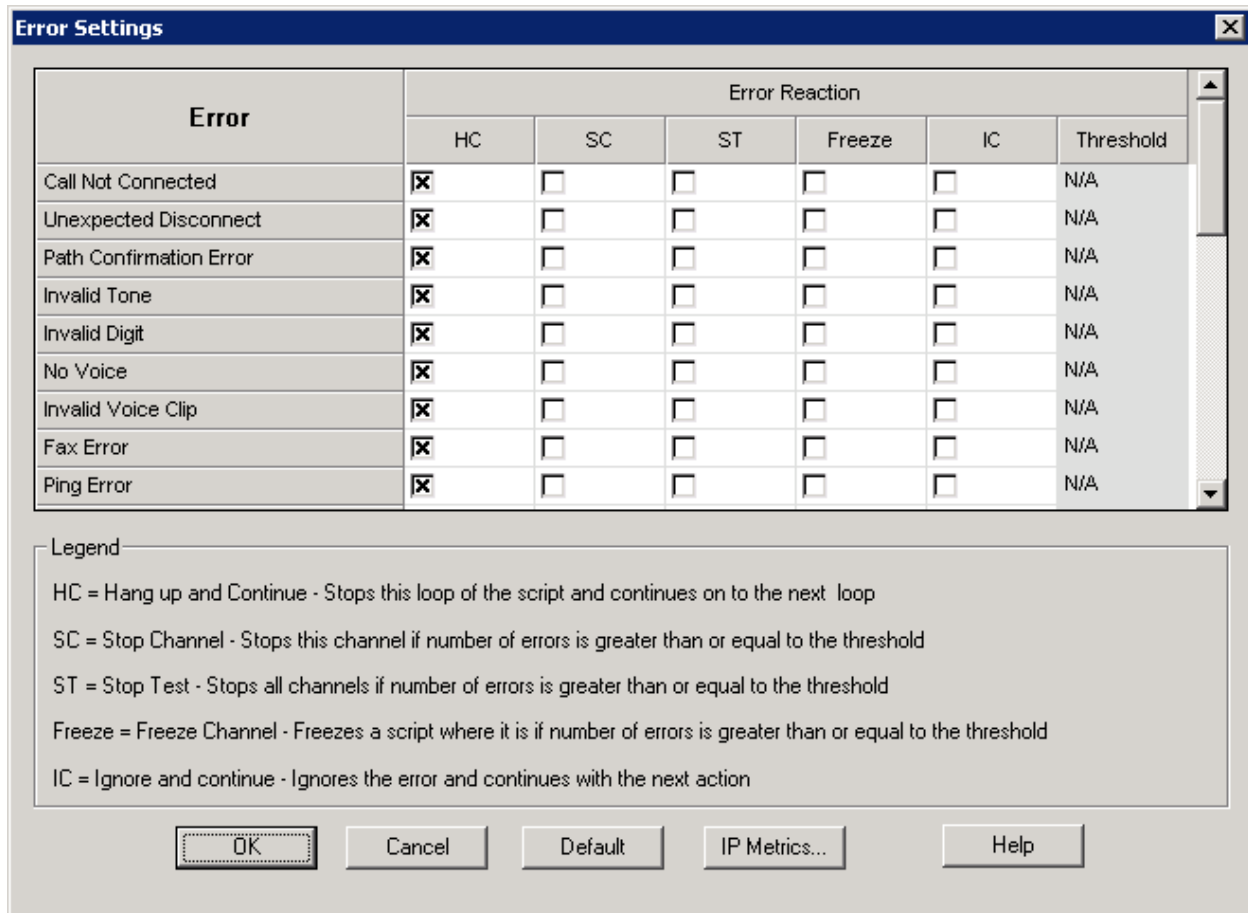
After assigning the channels to the **A-Side** and **B-Side**, the **Channel Browser** window should appear as follows. Click **OK** to return to the **Properties** window.



In the **Properties** window, click **OK** to start the test. Monitoring the test progress is covered in the **Verify Empirix Hammer G5** section (**Section 7.2**).

Helpful Tip: Once a test starts to run, if an error is encountered on a particular channel, the test will stop running on that channel unless the Hammer G5 is configured to continue running. To allow a test to continue running after an error occurs, modify the **Error Settings** by clicking on

the  icon on the **Hammer Configurator**. Click on the **HC** checkbox for each error type. This will allow the test to hang up and continue when an error occurs.



Error	Error Reaction					
	HC	SC	ST	Freeze	IC	Threshold
Call Not Connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Unexpected Disconnect	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Path Confirmation Error	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Invalid Tone	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Invalid Digit	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
No Voice	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Invalid Voice Clip	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Fax Error	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A
Ping Error	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A

Legend

HC = Hang up and Continue - Stops this loop of the script and continues on to the next loop

SC = Stop Channel - Stops this channel if number of errors is greater than or equal to the threshold

ST = Stop Test - Stops all channels if number of errors is greater than or equal to the threshold

Freeze = Freeze Channel - Freezes a script where it is if number of errors is greater than or equal to the threshold

IC = Ignore and continue - Ignores the error and continues with the next action

OK Cancel Default IP Metrics... Help

6 General Test Approach and Test Results

Interoperability compliance testing covered feature and serviceability testing. The feature testing was conducted by originating and terminating calls using the H.323 endpoint channels on the Hammer G5 and establishing the calls through Communication Manager. The interoperability compliance testing focused on the following areas:

- H.323 endpoint registration with Communication Manager.
- Generation of moderate call load from the Hammer G5 to Communication Manager via the H.323 endpoint interface with the call being terminated on the Hammer G5.
- Support of the G.711MU, G.729AB, G.729A, and G.723-6.3K audio codecs.
- Voice quality as measured by PESQ scores and path confirmation.
- Support of non-direct audio, and direct audio with media shuffling.
- Recovery from adverse conditions during a load test.

The compliance test also covered monitoring various reports on the Hammer G5 during and after the test runs, and checking the status of various H.323 resources on Communication Manager.

The serviceability testing focused on verifying the ability of the Hammer G5 to recover from adverse conditions, such as disconnecting the Ethernet cable. Disconnecting the Ethernet cable would obviously cause errors in the test run, but the test would continue to run if configured to do so, otherwise the test would stop running after encountering errors.

All test cases passed. Empirix Hammer G5 was successfully compliance tested with Communication Manager using H.323 endpoint emulation.

7 Verification Steps

This section provides the tests that can be performed to verify proper configuration of Communication Manager and Empirix Hammer G5.

7.1 Verify Avaya Aura™ Communication Manager

To verify that the Hammer G5 can register H.323 endpoints on Communication Manager, the **list trace ras ip-stations <extension>** command may be used to verify the proper exchange of registration messages as shown below.

list trace ras ip-stations 25000		Page	1
LIST TRACE			
time	data		
13:45:56	rcv GRQ	ext 25000	
	endpt	[10.32.24.160]:15000	
	switch	[10.32.24.20]:1719	
13:45:56	snd GCF	ext 25000	
	endpt	[10.32.24.160]:15000	
	switch	[10.32.24.20]:1719	
13:45:56	rcv RRQ	ext 25000	
	endpt	[10.32.24.160]:15000	
	switch	[10.32.24.20]:1719	
13:45:56	snd RCF	ext 25000	
	endpt	[10.32.24.160]:15000	
	switch	[10.32.24.20]:1719	
13:45:56		endpt MAC addr: 00:00:00:00:00:00	
	switch	[10.32.24.20]:1719	
13:46:46	snd KARCF	ext 25000	
	endpt	[10.32.24.160]:15000	
	switch	[10.32.24.20]:1719	

The registered H.323 endpoints can also be viewed using the **list registered-ip-stations** command along with their IP addresses.

list registered-ip-stations					Page	1
REGISTERED IP STATIONS						
Station Ext or Orig Port	Set Type/ Net Rgn	Prod ID/ Release	TCP Skt	Station IP Address/ Gatekeeper	IP Address	
25000	H.323		n	10.32.24.160		
	1	0.0000		10.32.24.20		
25001	H.323		n	10.32.24.161		
	1	0.0000		10.32.24.20		
25002	H.323		n	10.32.24.162		
	1	0.0000		10.32.24.20		
25003	H.323		n	10.32.24.163		
	1	0.0000		10.32.24.20		

When the Hammer G5 is running a test script, the **status station** command may be used to view the active call status.

```
status station 25000                                     Page 1 of 8

                                GENERAL STATUS
Administered Type: H.323                      Service State: in-service/off-hook
Connected Type: N/A                          TCP Signal Status: connected
Extension: 25000
Port: S00019                                Parameter Download: not-applicable
Call Parked? no                             SAC Activated? no
Ring Cut Off Act? no
Active Coverage Option: 1                    one-X Server Status: N/A

EC500 Status: N/A                            Off-PBX Service State: N/A
Message Waiting:
Connected Ports: S00039

Limit Incoming Calls? no

User Cntrl Restr: none                      HOSPITALITY STATUS
Group Cntrl Restr: none                    Awaken at:
                                           User DND: not activated
                                           Group DND: not activated
                                           Room Status: non-guest room
```

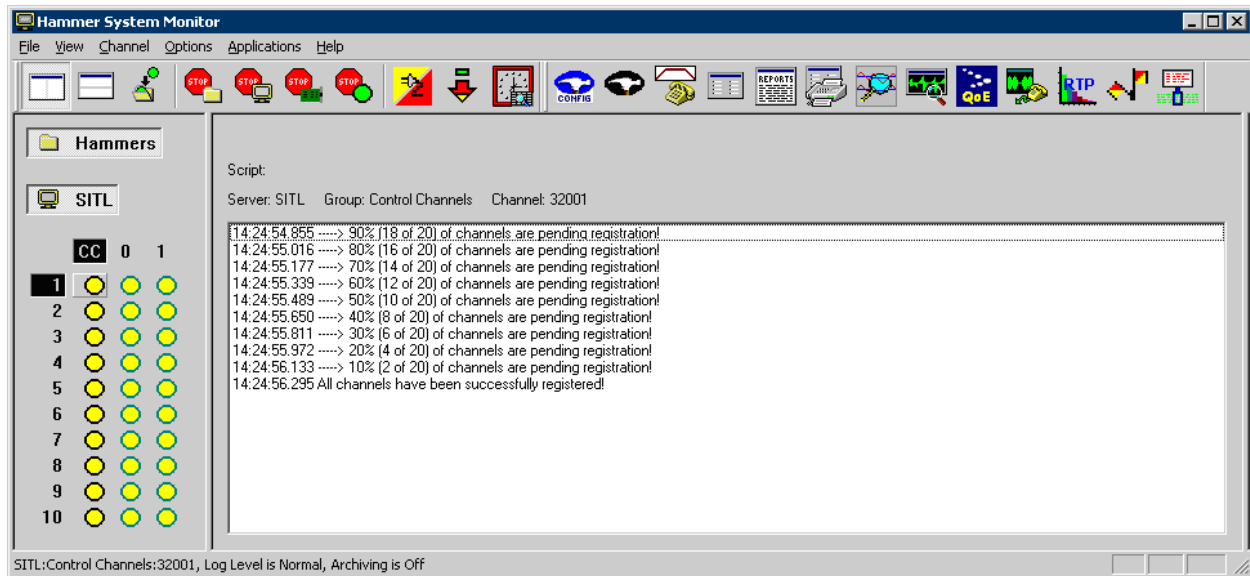
Page 5 of the **status station** command indicates the codec being used for the call and whether the call is shuffled.

```
status station 25000                                     Page 5 of 8

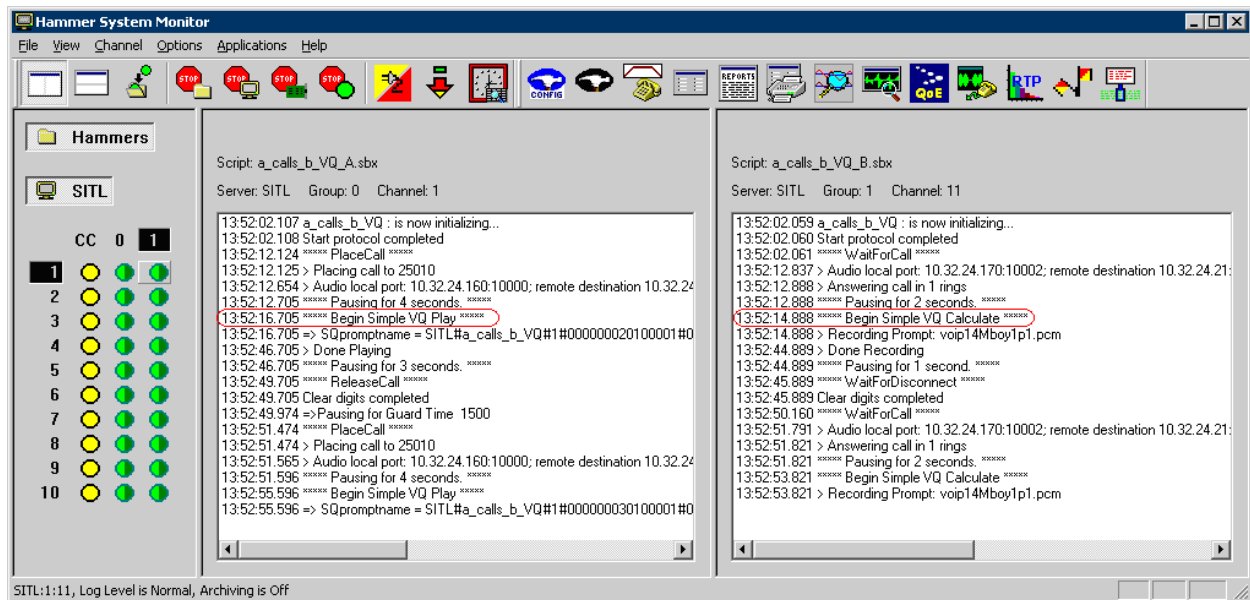
                                AUDIO CHANNEL Port: S00019
G.711MU      Switch-End Audio Location: 01A0503
                IP Address                Port  Node Name      Rgn
Other-End: 10.32.24.21                    2264  medprocrm      1
Set-End: 10.32.24.160                    10000
Audio Connection Type: ip-tdm
```

7.2 Verify Empirix Hammer G5

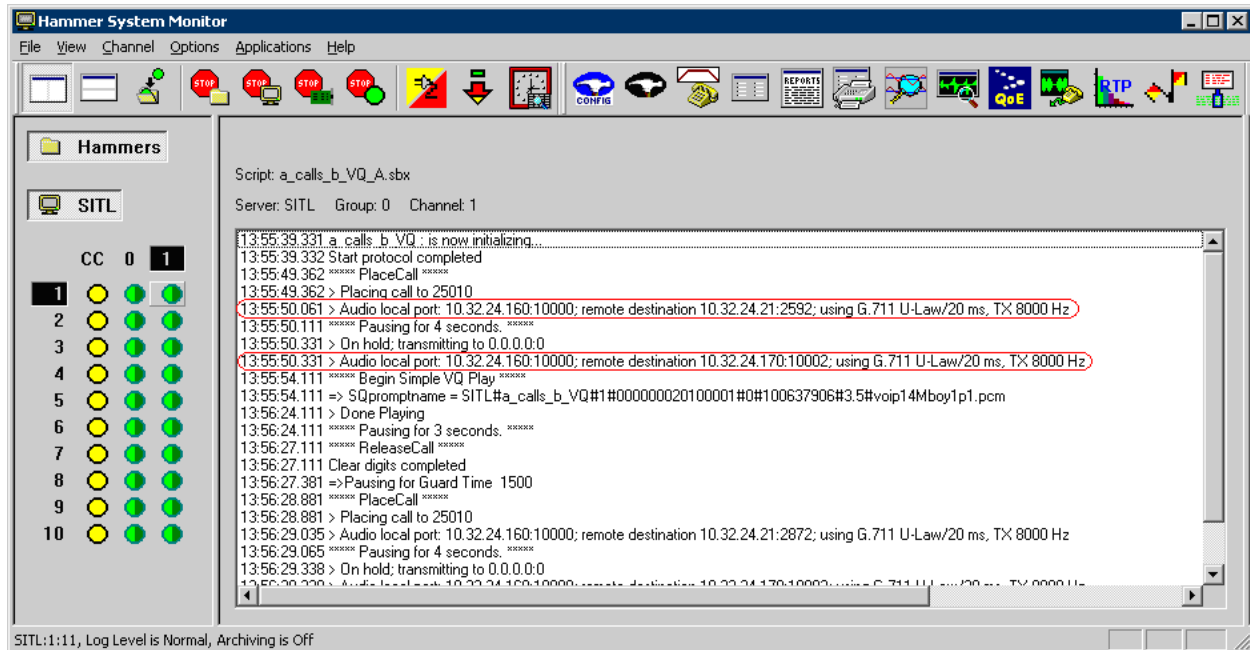
To view the H.323 registration status from the Hammer G5, make sure that the **Hammer System Monitor** is running before starting the system. Click on the yellow circle under the **CC** column and row **1**. The Hammer G5 will indicate when all of the channels have successfully registered.



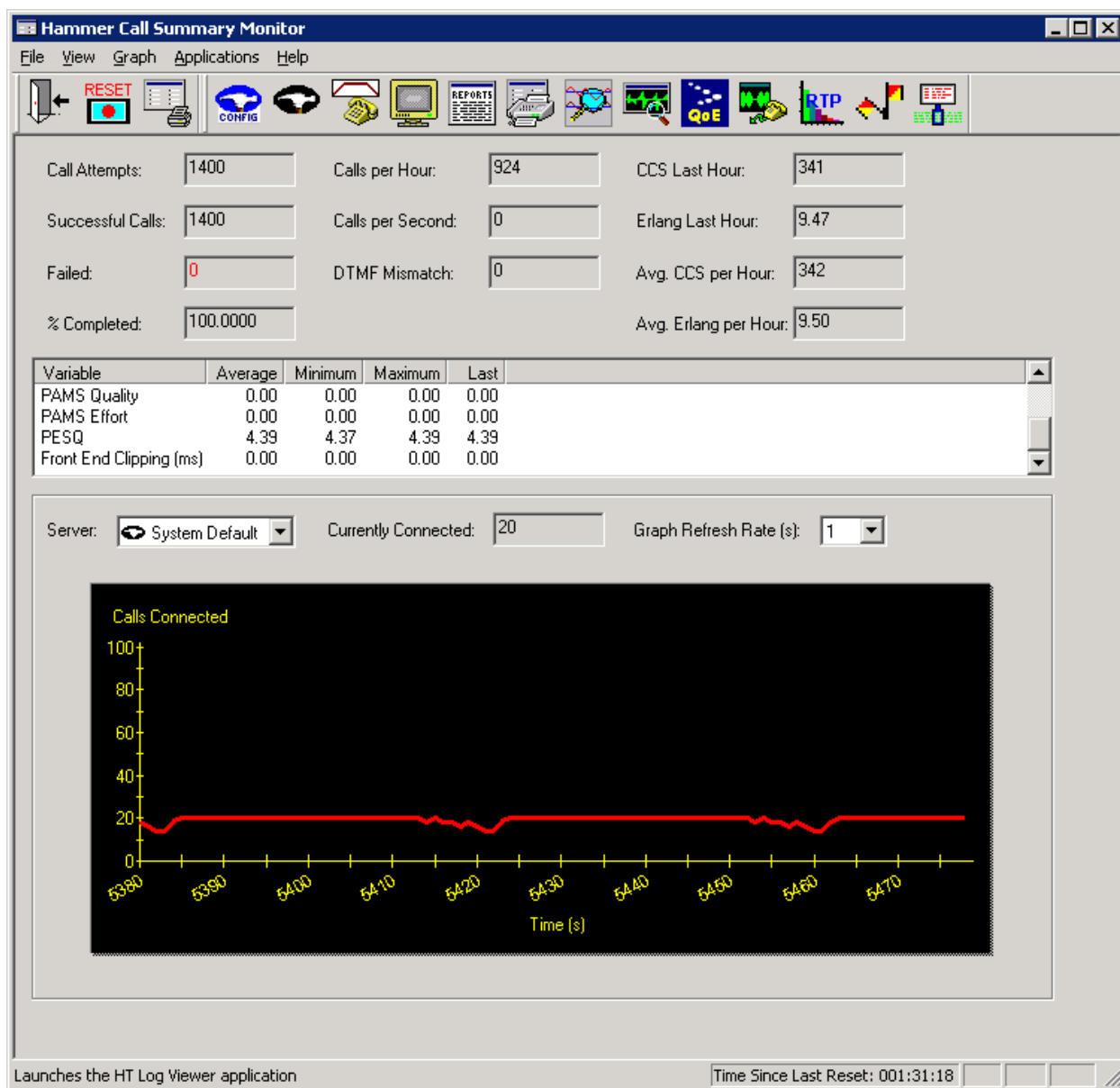
Call progress can be seen in the **Hammer System Monitor**. The call log for an originating channel may be logged to the left window and the call log for a terminating channel may be logged to the right window. This call monitor is useful for checking that the terminating channel is listening prior to the originating channel playing the prompt when a voice quality score is required.



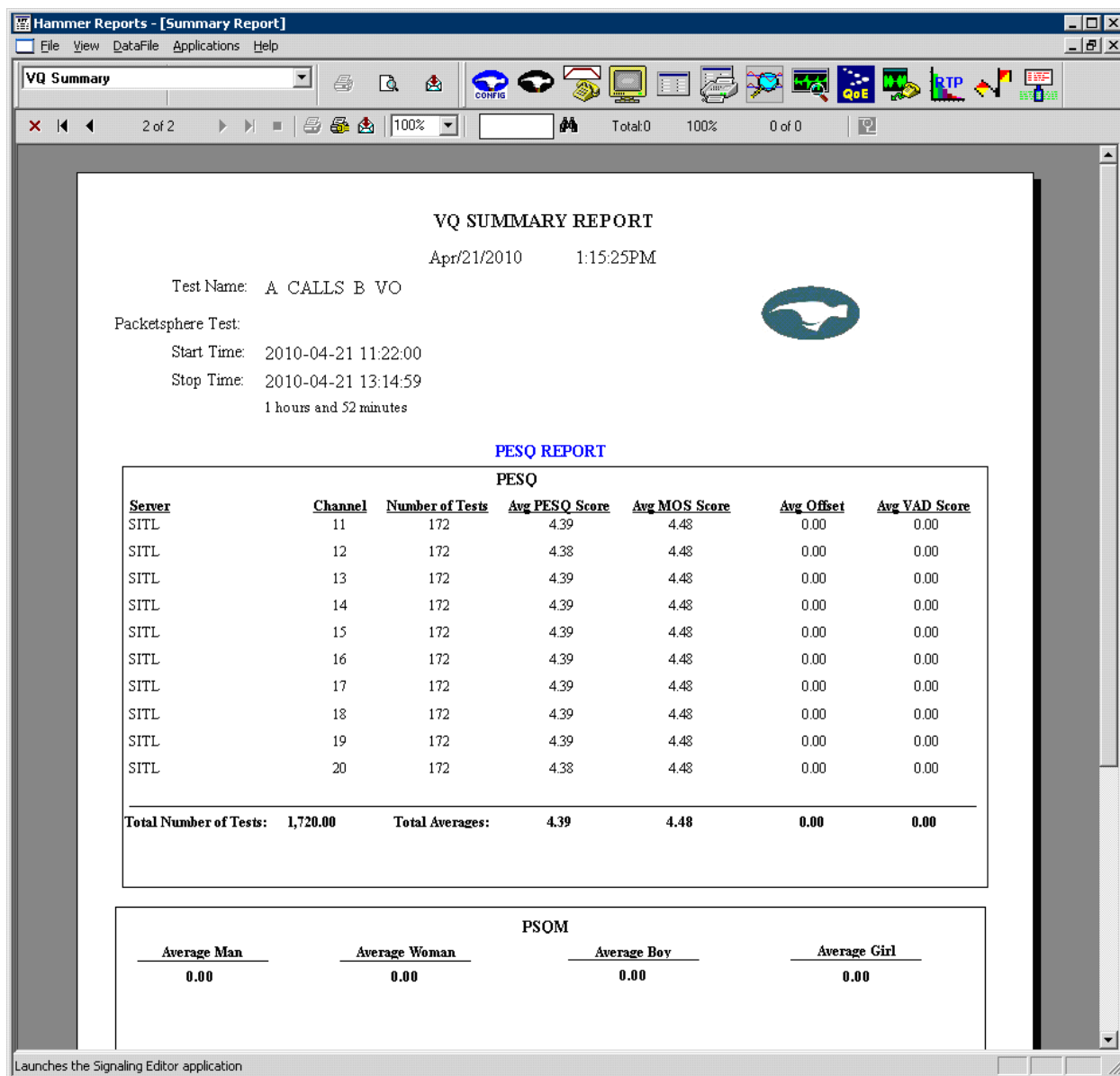
The **Hammer System Monitor** can be used to verify that a call was shuffled. This is noted by the Hammer G5 displaying the local and remote destinations in the call log.



The **Hammer Call Summary Monitor** may be used to get a test status overview, including the number of call attempts, number of failed calls, PESQ scores, amongst other useful metrics.



Hammer Reports can be generated by clicking on the **Reports** icon in the **Hammer Call Summary Monitor**. Various reports are available, such as the **VQ Summary** report shown below, which displays the PESQ score for the calls on each channel.



8 Conclusion

These Application Notes describe the configuration steps required to integrate the Empirix Hammer G5 with Avaya Aura™ Communication Manager using H.323 endpoint emulation. The Hammer G5 was able to register with Avaya Aura™ Communication Manager, successfully establish calls, generate voice quality metrics, monitor the calls, and generate reports. All feature and serviceability test cases were completed successfully.

9 References

This section references the product documentation relevant to these Application Notes.

- [1] *Administering Avaya Aura™ Communication Manager*, Document 03-300509, Issue 5.0, Release 5.2, May 2009, available at <http://support.avaya.com>.
- [2] *Application Notes for Empirix Hammer G5 with Avaya Aura™ Communication Manager using H.323 Trunk Emulation*, Issue 1.0, available at <http://www.avaya.com>.
- [3] *Installation Guide Hammer G5™*, Revision B, June 2009, available from Empirix.
- [4] *Getting Started Guide Hammer G5™*, Document Number 565-005-62, Revision E, June 2009, available from Empirix.

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