Avaya Solution & Interoperability Test Lab

Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager using H.323 Trunk Emulation – Issue 1.0

Abstract

These Application Notes describe the configuration steps required to integrate Empirix Hammer IP test system with Avaya Aura® Communication Manager using H.323 trunk emulation. Hammer IP validates IP-based systems by testing the actual network under anticipated traffic conditions to provide a complete understanding of expected performance. Hammer IP can be used to assess and monitor network performance, reliability and quality of VoIP services in an Avaya IP telephony network. In this configuration, Hammer IP emulates H.323 trunks that originate and terminate calls through Avaya Aura® Communication Manager. While the call is active, Hammer IP 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. Hammer IP provides a collection of applications used to configure the system; create, schedule, and monitor tests; and create reports.

Readers should pay attention to Section 2, in particular the scope of testing as outlined in Section 2.1 as well as the observations noted in Section 2.2, to ensure that their own use cases are adequately covered by this scope and results.

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 Empirix Hammer IP test system with Avaya Aura® Communication Manager using H.323 trunk emulation. Hammer IP validates IP-based systems by testing the actual network under anticipated traffic conditions to provide a complete understanding of expected performance. Hammer IP can be used to assess and monitor network performance, reliability and quality of VoIP services in an Avaya IP telephony network. In this configuration, Hammer IP emulates H.323 trunks that originate and terminate calls through Avaya Aura® Communication Manager. While the call is active, Hammer IP 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. Hammer IP provides a collection of applications used to configure the system; create, schedule, and monitor tests; and create reports.

The following set of Hammer IP 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 call progress.
- **Hammer Call Summary Monitor** used to monitor call completion.

Below is a list of related Application Notes.

- *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager using H.323 Endpoint Emulation* **[2]**
- *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager and Avaya Aura® Session Manager using SIP Trunk Emulation* **[3]**
- *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager and Avaya Aura® Session Manager using SIP Endpoint Emulation* **[4]**

2 General Test Approach

Interoperability compliance testing covered feature and serviceability testing. The feature testing was conducted by originating and terminating calls using H.323 trunk channels on Hammer IP and establishing the calls through Communication Manager. The compliance test also covered monitoring various reports on Hammer IP 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 IP to recover from adverse conditions, such as disconnecting the Ethernet cable.

DevConnect Compliance Testing is conducted jointly by Avaya and DevConnect members. The jointly-defined test plan focuses on exercising APIs and/or standards-based interfaces pertinent to the interoperability of the tested products and their functionalities. DevConnect Compliance Testing is not intended to substitute full product performance or feature testing performed by DevConnect members, nor is it to be construed as an endorsement by Avaya of the suitability or completeness of a DevConnect member's solution.

2.1 Interoperability Compliance Testing

The interoperability compliance testing focused on verifying that Hammer IP can establish H.323 trunks with Avaya Aura® Communication Manager, establish calls, send voice media, and provide voice quality metrics. The following features and functionality were covered:

- Originating and terminating calls through Avaya Aura® Communication Manager.
- Support of G.711mu-law 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 and IP Audio Hairpinning disabled were also verified.
- Generating voice quality metrics with Shuffling disabled.
- DTMF support.
- Originating calls from H.323 trunks and terminating calls on H.323 trunks, H.323 endpoints, SIP trunks, and SIP endpoints.

Note: Performance and load testing was not the focus of the compliance test.

2.2 Test Results

All test cases passed. Empirix Hammer IP was successful in originating calls using H.323 trunk emulation and terminating calls on channels emulating H.323 endpoints, H.323 trunks, SIP endpoints, and SIP trunks. It was observed that after reconnecting the Ethernet cable or re-establishing network connectivity, while a test script was running, required the channels to be unregistered and the configuration to be re-applied.

Important Note: The purpose of this compliance test was to verify interoperability between Empirix Hammer IP and Avaya Aura® Communication Manager using H.323 trunk emulation. That is, the goal was to verify that Hammer IP can establish a H.323 trunk with Communication Manager and establish calls. This was successfully verified. If a Hammer test encounters failed calls, there are various items to consider, including:

- The **Guard Time** and **Stagger** parameters may be set too aggressively (e.g., Hammer IP may be initiating too many calls too quickly) and the configuration under test may not be able to handle the load generated by Hammer IP. These parameters should be considered carefully for each test. It may be necessary to slow down the test to a rate that can be reasonably handled by the test configuration.

- Resources may be getting exhausted in the Avaya media gateway. These resources may include media processing resources, touch-tone receivers (TTRs), network trunks, and TDM bus resources.

Generally speaking, call failures encountered in Hammer IP are usually a result of one of the issues mentioned above.

Note: Communication Manager does not shuffle calls between a SIP trunk and H.323 trunk. This is per design. If the originating endpoint on Hammer is a SIP endpoint, note that the call arrives on Communication Manager via a SIP trunk. Therefore, a call from a SIP endpoint to an H.323 trunk is essentially a call from a SIP trunk to an H.323 trunk and the call is not shuffled.

2.3 Support

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

- **Phone:** (978) 313-7002
- **Web:** http://www.empirix.com/support/maintenance.aspx
- **Email:** supportcontract@empirix.com

3 Reference Configuration

The network diagram below illustrates the test configuration. In this configuration, Communication Manager receives calls from the Hammer IP, which emulates H.323 trunks. Communication Manager routes the call back to Hammer IP over a H.323 trunk. Hammer IP then terminates the calls. The calls can also be terminated to a H.323 endpoint, SIP endpoint, or SIP trunk[1]. While the calls are established, Hammer IP can send DTMF and/or voice media (i.e., RTP traffic) using an audio recording. A voice quality test allows voice quality metrics to be provided at the end of each call. Hammer IP applications running on the Hammer IP server were used to configure the system, create and monitor the tests, and view the test reports.

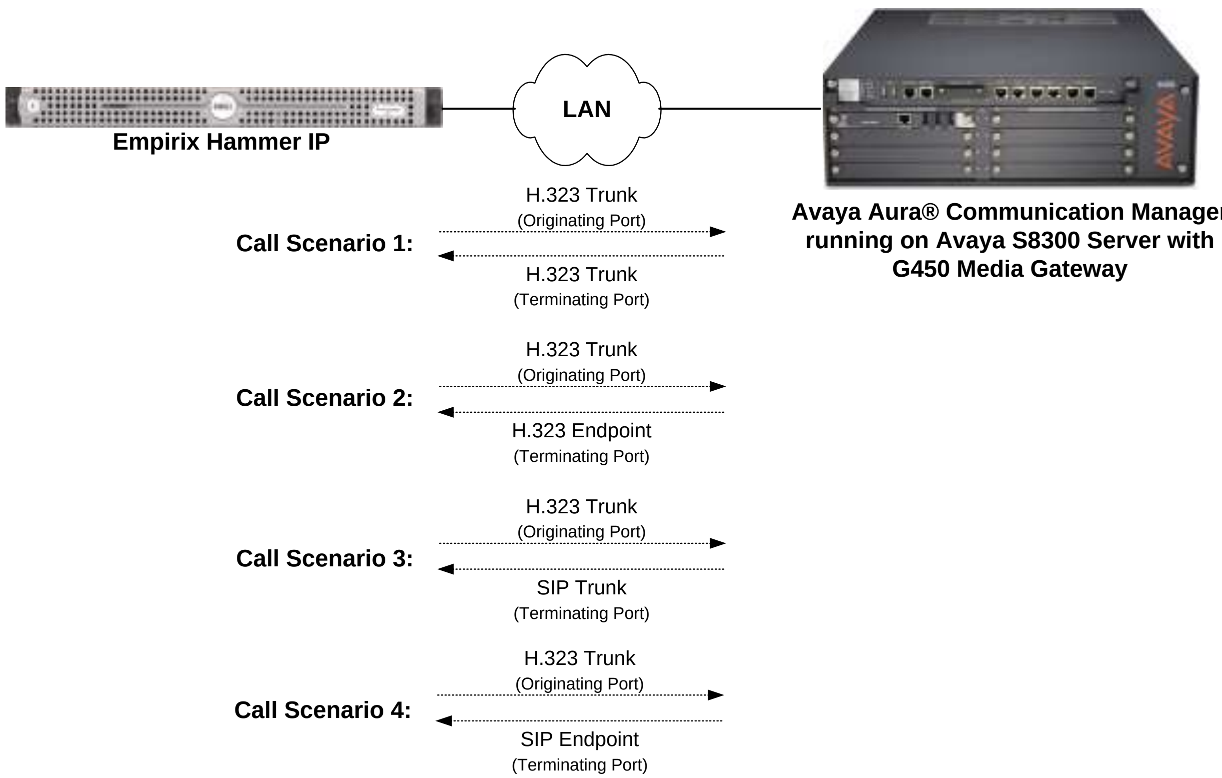


Figure 1: Empirix Hammer IP with Avaya Aura® Communication Manager

[1] To terminate the call to a SIP trunk or endpoint, Avaya Aura® Session Manager is required, but is not shown in the configuration diagram.

4 Equipment and Software Validated

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

Equipment/Software	Release/Version
Avaya Aura® Communication Manager running on S8300 Server	6.3.9 SP 9.1 (R016x.03.0.124.0 with Patch 22098)
Avaya G450 Media Gateway	Gateway FW 36.12.0
Avaya Aura® Session Manager	6.3.11.0.631103
Empirix Hammer IP running on Microsoft Windows Server 2008 R2 with Dual 2.40 GHz Intel Xeon CPU and 12.0 GB of RAM	6.0.0.85

5 Configure Avaya Aura® Communication Manager

This section provides the procedures for configuring Communication Manager. The configuration was performed using the System Access Terminal (SAT). The procedures include the following areas:

- Administer IP Node Names
- Administer IP Codec Set
- Administer IP Network Region
- Administer H.323 Trunks for Incoming and Outgoing Calls
- Administer Call Routing

5.1 Administer IP Node Names

In the **IP Node Names** form, assign an IP address and host name for the S8300 Server and the incoming and outgoing H.323 trunks associated with Hammer IP. The host names will be used throughout the other configuration screens of Communication Manager.

```
change node-names ip                                            Page   1 of   2
                                  IP NODE NAMES
    Name              IP Address
BR110-SM            10.32.32.78
HammerIP-Inc        192.168.100.170
HammerIP-Out        192.168.100.171
default             0.0.0.0
devcon-asm          10.32.24.235
devcon13            10.32.24.20
lz-asm              192.168.100.235
procr               192.168.100.10
procr6              ::

( 9  of 9    administered node-names were displayed )
Use 'list node-names' command to see all the administered node-names
Use 'change node-names ip xxx' to change a node-name 'xxx' or add a node-name
```

5.2 Administer IP Codec Set

In the **IP Codec Set** form, specify the audio codec(s) required by the test that will be run on Hammer IP. 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. For the compliance test, G.711mu-law, G.729AB, and G.729A codecs were used. In the IP codec set form, specify the appropriate codec being used by the Hammer test. Below is the IP codec set configured for **G.711mu**-law.

```
change ip-codec-set 1                                           Page   1 of   2

                          IP Codec Set

    Codec Set: 1

    Audio        Silence      Frames   Packet
    Codec        Suppression  Per Pkt  Size(ms)
 1: G.711MU           n         2        20
 2:
 3:
```

5.3 Administer IP Network Region

In the **IP Network Region** form, specify the codec set to be used for 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 G450 Media Gateway. Note that if Shuffling is enabled, audio traffic does not egress Hammer IP since the call would be shuffled.

```
change ip-network-region 1                                      Page   1 of  20
                               IP NETWORK REGION
  Region: 1
Location: 1       Authoritative Domain: devcon.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? n
   UDP Port Max: 65535
DIFFSERV/TOS PARAMETERS
 Call Control PHB Value: 46
        Audio PHB Value: 46
        Video PHB Value: 26
802.1P/Q PARAMETERS
 Call Control 802.1p Priority: 6
        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
```

5.4 Administer H.323 Trunks

Prior to configuring an H.323 trunk group for communication with Hammer IP, a H.323 signaling group must be configured. This signaling group is used for incoming calls from Hammer IP. Configure the **Signaling Group** form as shown below. The **Far-end Node Name** field is set to *HammerIP-Inc*, which is associated with IP address 192.168.100.170. Shuffling may be enabled or disabled at the signaling group level or at the IP network region level. Configure other fields in **bold** as shown below. After configuring the H.323 trunk group, return to this form and configure the **Trunk Group for Channel Selection** field.

```
add signaling-group 70                                      Page   1 of   6
                                SIGNALING GROUP

 Group Number: 70             Group Type: h.323
          SBS? n           Remote Office? n          Max number of NCA TSC: 0
        Q-SIP? n                                      Max number of CA TSC: 0
     IP Video? n                                   Trunk Group for NCA TSC:
       Trunk Group for Channel Selection: 70      X-Mobility/Wireless Type: NONE
      TSC Supplementary Service Protocol: a          Network Call Transfer? n
                                                  T303 Timer(sec): 10
   H.245 DTMF Signal Tone Duration(msec):
   Near-end Node Name: procr                   Far-end Node Name: HammerIP-Inc
 Near-end Listen Port: 1720                  Far-end Listen Port: 1720
                                          Far-end Network Region: 1
         LRQ Required? n                   Calls Share IP Signaling Connection? n
         RRQ Required? n
                                               Bypass If IP Threshold Exceeded? n
                                                        H.235 Annex H Required? n
         DTMF over IP: out-of-band              Direct IP-IP Audio Connections? y
  Link Loss Delay Timer(sec): 90                          IP Audio Hairpinning? n
         Enable Layer 3 Test? n                      Interworking Message: PROGress
H.323 Station Outgoing Direct Media? n   DCP/Analog Bearer Capability: 3.1kHz
```

Configure the **Trunk Group** form as shown below. This trunk group is used for incoming calls from Hammer IP. Set the **Group Type** field to *isdn* and the **Carrier Medium** field to *H.323*, set the **Service Type** field to *tie*, specify the signaling group associated with this trunk group in the **Signaling Group** field, and specify the **Number of Members** supported by this H.323 trunk group. Signaling Group 70 is associated with this H.323 trunk group used for incoming calls.

```
add trunk-group 70                                          Page   1 of  21
                                TRUNK GROUP

Group Number: 70                   Group Type: isdn          CDR Reports: y
  Group Name: Hammer - Incoming           COR: 1        TN: 1        TAC: 1070
   Direction: two-way        Outgoing Display? n         Carrier Medium: H.323
 Dial Access? n              Busy Threshold: 255  Night Service:
Queue Length: 0
Service Type: tie                   Auth Code? n
                                              Member Assignment Method: auto
                                                       Signaling Group: 70
                                                     Number of Members: 10
```

The H.323 signaling group associated with the H.323 trunk group used to route outgoing calls is configured below. This signaling group is used for routing calls to Hammer IP. Configure the **Signaling Group** form as shown below. The **Far-end Node Name** field is set to *HammerIP-Out*, which is associated with IP address 192.168.100.171. Shuffling may be enabled or disabled at the signaling group level or at the IP network region level. After configuring the H.323 trunk group, return to this form and configure the **Trunk Group for Channel Selection** field.

```
add signaling-group 71                                       Page   1 of   6
                                SIGNALING GROUP

 Group Number: 71             Group Type: h.323
         SBS? n            Remote Office? n         Max number of NCA TSC: 0
       Q-SIP? n                                      Max number of CA TSC: 0
     IP Video? n                                  Trunk Group for NCA TSC:
       Trunk Group for Channel Selection: 71      X-Mobility/Wireless Type: NONE
      TSC Supplementary Service Protocol: a         Network Call Transfer? n
                                                  T303 Timer(sec): 10
   H.245 DTMF Signal Tone Duration(msec):
   Near-end Node Name: procr                   Far-end Node Name: HammerIP-Out
 Near-end Listen Port: 1720                  Far-end Listen Port: 1720
                                          Far-end Network Region: 1
        LRQ Required? n                    Calls Share IP Signaling Connection? n
        RRQ Required? n
                                               Bypass If IP Threshold Exceeded? n
                                                        H.235 Annex H Required? n
        DTMF over IP: out-of-band               Direct IP-IP Audio Connections? y
  Link Loss Delay Timer(sec): 90                          IP Audio Hairpinning? n
        Enable Layer 3 Test? n                     Interworking Message: PROGress
H.323 Station Outgoing Direct Media? n   DCP/Analog Bearer Capability: 3.1kHz
```

Configure the **Trunk Group** form as shown below. This trunk group is used for routing calls to Hammer IP. Set the **Group Type** field to *isdn* and the **Carrier Medium** field to *H.323*, set the **Service Type** field to *tie*, specify the signaling group associated with this trunk group in the **Signaling Group** field, and specify the **Number of Members** supported by this H.323 trunk group. Signaling Group 71 is associated with this H.323 trunk group used for outgoing calls.

```
add trunk-group 71                                           Page   1 of  21
                                TRUNK GROUP

Group Number: 71                   Group Type: isdn          CDR Reports: y
  Group Name: Hammer - Outgoing           COR: 1        TN: 1        TAC: 1071
   Direction: two-way       Outgoing Display? n         Carrier Medium: H.323
 Dial Access? n             Busy Threshold: 255  Night Service:
Queue Length: 0
Service Type: tie                   Auth Code? n
                                              Member Assignment Method: auto
                                                       Signaling Group: 71
                                                     Number of Members: 10
```

5.5 Administer Call Routing

When originating a call, Hammer IP will dial the AAR access code '8' followed by "47002". The **AAR Digit Analysis Table** specifies that for these dialed digits, the call should be routed using Route Pattern 71.

```
change aar analysis 4                                           Page   1 of   2
                             AAR DIGIT ANALYSIS TABLE
                                   Location: all            Percent Full: 2

          Dialed            Total      Route     Call    Node   ANI
          String          Min  Max   Pattern    Type    Num    Reqd
    43000                 5    5      60        aar           n
    46                    5    5      60        aar           n
    47                    5    5      80        aar           n
    47002                 5    5      71        aar           n
    48                    5    5      50        aar           n
    49                    5    5      60        aar           n
    5                     7    7      254       aar           n
    6                     5    5      2         aar           n
    7                     5    5      3         aar           n
    8                     7    7      254       aar           n
    9                     7    7      254       aar           n
```

Route Pattern 71 specifies Trunk Group 71 as the outgoing trunk group. Hammer IP will terminate any call regardless of the digits received.

```
change route-pattern 71                                         Page   1 of   3
                    Pattern Number: 71  Pattern Name: To Hammer
                             SCCAN? n     Secure SIP? n
    Grp FRL NPA Pfx Hop Toll No.  Inserted                                DCS/ IXC
    No          Mrk Lmt List Del  Digits                                  QSIG
                             Dgts                                         Intw
 1: 71   0                                                                 n   user
 2:                                                                        n   user
 3:                                                                        n   user
 4:                                                                        n   user
 5:                                                                        n   user
 6:                                                                        n   user

     BCC VALUE  TSC CA-TSC    ITC BCIE Service/Feature PARM  No. Numbering LAR
    0 1 2 M 4 W     Request                                Dgts Format
                                                        Subaddress
 1: y y y y y n  n            rest                                            none
 2: y y y y y n  n            rest                                            none
 3: y y y y y n  n            rest                                            none
 4: y y y y y n  n            rest                                            none
 5: y y y y y n  n            rest                                            none
 6: y y y y y n  n            rest                                            none
```

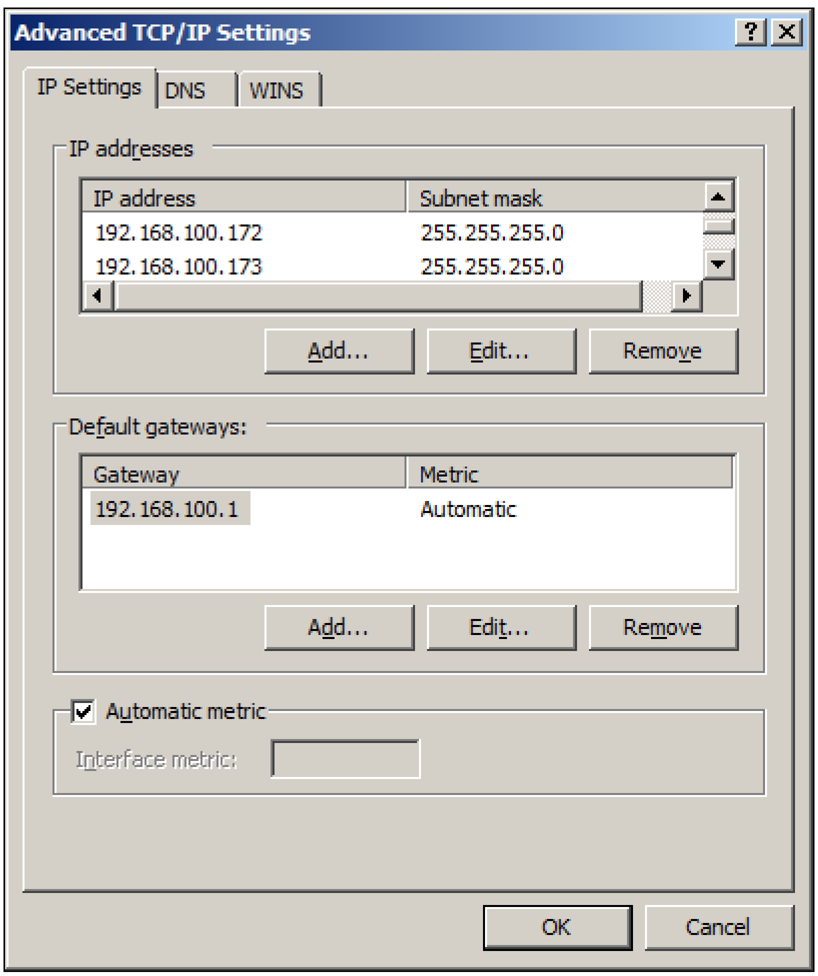
6 Configure Empirix Hammer IP

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

- Assign unique IP addresses to each Hammer IP channel.
- Configure the H.323 trunk interface using the **Hammer Configurator**.
- Save and apply the Hammer configuration and start the Hammer server.
- Create and run the test script using the **Hammer TestBuilder**.

6.1 Configure IP Addresses on Hammer IP Server

The Hammer IP server needs to be configured with the IP addresses for each channel. During the compliance test, 20 H.323 trunk channels were used, but they were arranged into two groups – one for outgoing calls and one for incoming calls. Each group required a unique IP address. Only two IP addresses were required, one per group. The IP address used for the H.323 trunks used for outgoing calls was 192.168.100.170. The IP address used for the H.323 trunk used for incoming calls was 192.168.100.171. These IP addresses are configured in the **Advanced TCP/IP Settings** under Network Connections in Windows Server 2008.



6.2 Configure System

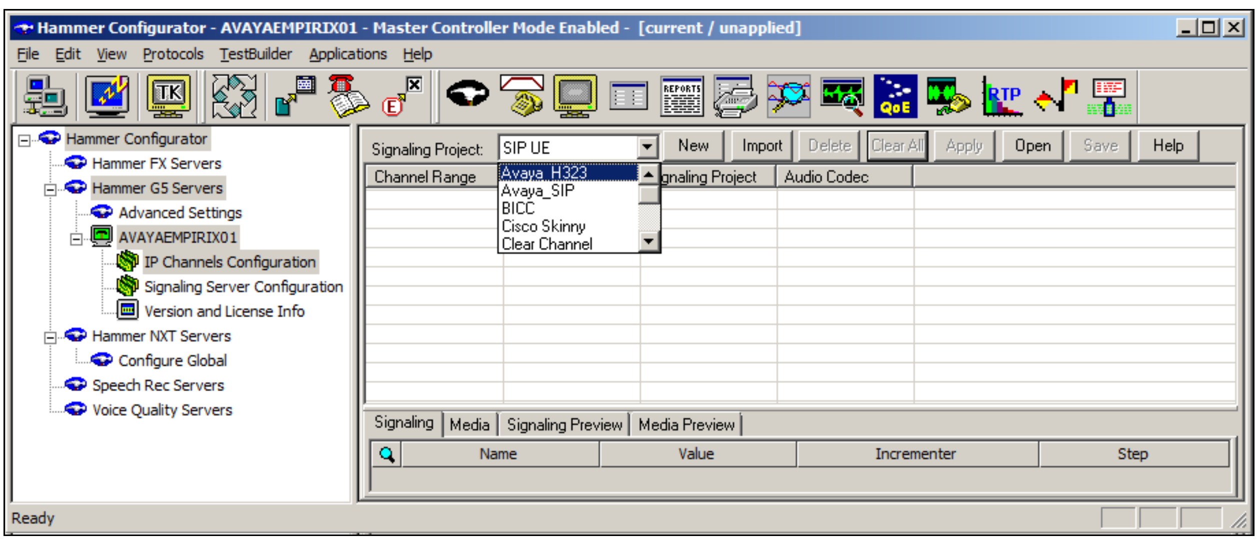
This section covers the configuration of originating and terminating channels on Hammer IP. In this configuration, the originating channels emulate H.323 trunks (described in **Section 6.2.1**). The terminating channels can emulate H.323 endpoints, H.323 trunks, SIP endpoints, or SIP trunks. These Application Notes will explicitly describe the configuration for terminating calls to H.323 trunks in **Section 6.2.2.1**. In addition, it will provide references to other Application Notes for configuring terminating channels as H.323 endpoints, SIP trunks, or SIP endpoints in **Sections 6.2.2.2**, **6.2.2.3**, and **6.2.2.4**, respectively. Only one of those sections needs to be followed depending on the configuration desired.

6.2.1 Configure Originating Channels – H.323 Trunks

Empirix Hammer IP is configured through the **Hammer Configurator**, a graphical user interface, residing on the Hammer IP server. From the Hammer IP server, run the **Hammer Configurator**. The following screen is displayed.

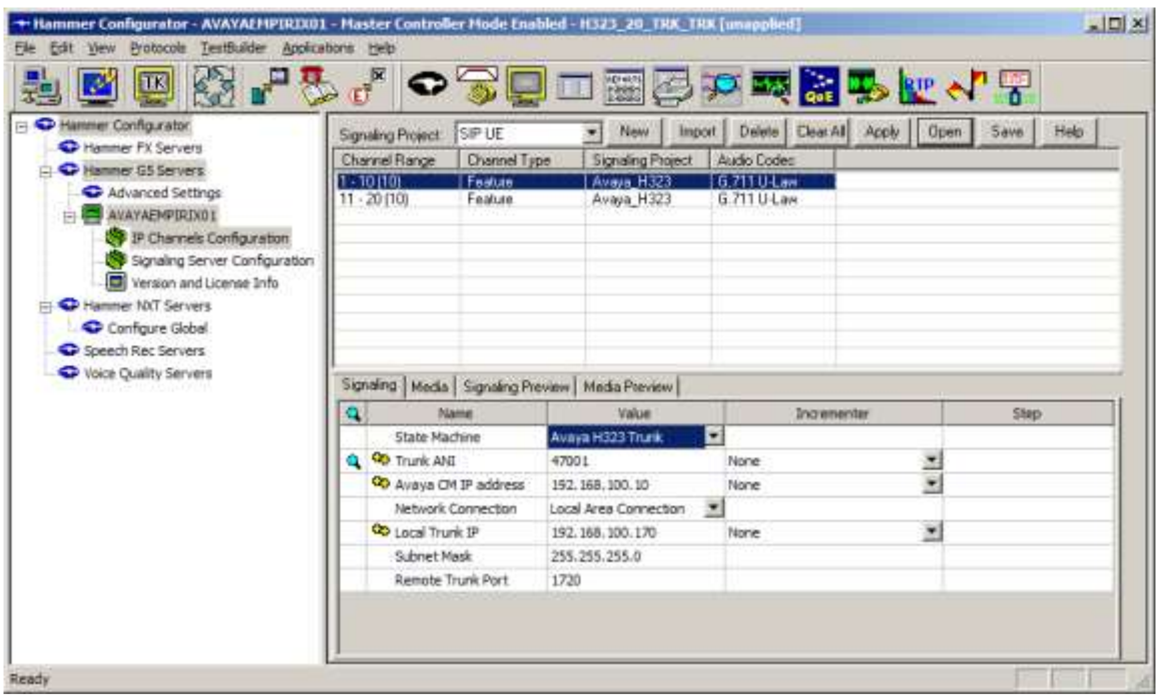
Note: It is assumed that Hammer IP is already in **Master Controller Mode**. To verify, check that the title bar of the **Hammer Configurator** indicates *Master Controller Mode Enabled* as shown below. It is also assumed that a system was already added to the configuration. In this configuration, the system name is *AVAYAEMPIRIX01*, which corresponds to the server name.

In the **Hammer Configurator**, the server name will appear in the left pane of the **Hammer Configurator**. Expand the server name (e.g., *AVAYAEMPIRIX01*) 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**.



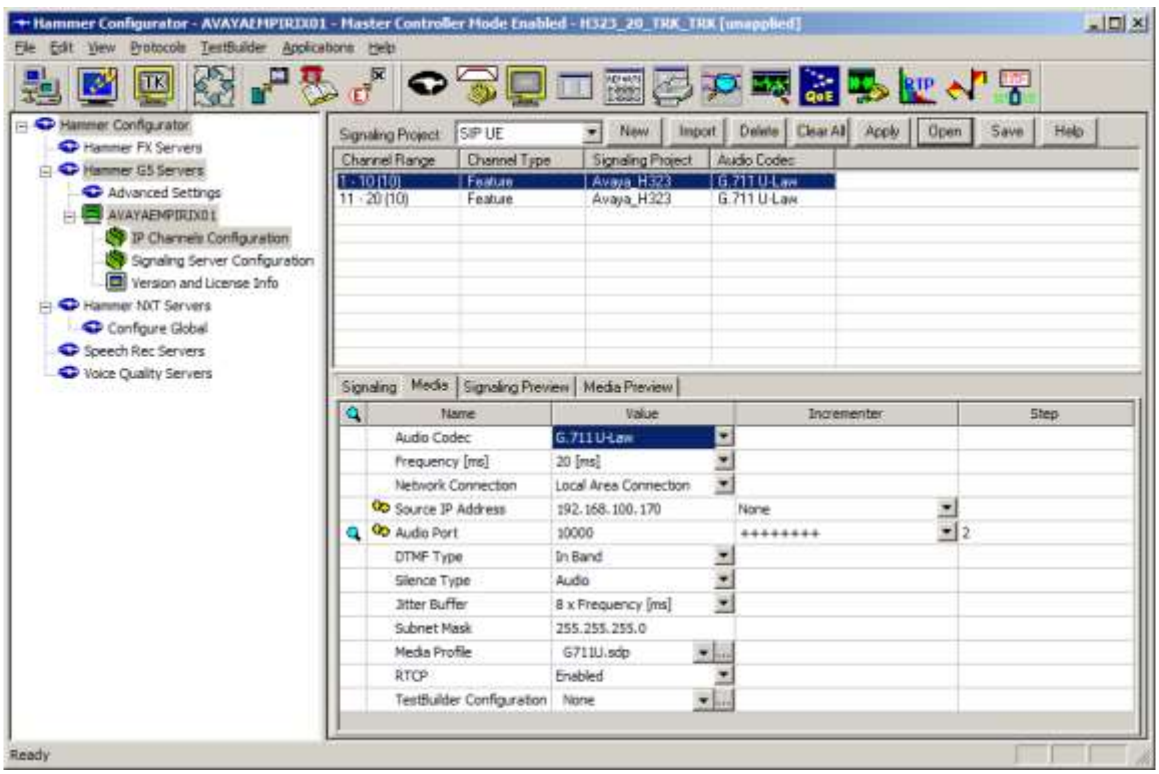
The first line in the grid that is highlighted in the figure below corresponds to the 10 originating channels. To set the number of channels in the group, click on the **Channel Range** cell in the grid and enter the number "10". Set the **Channel Type** cell to *Feature*. The following fields in the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

- **State Machine** should be set to *Avaya H323 Trunk*.
- **Trunk ANI** can be set to any digits.
- **Avaya CM IP Address** should be set to the S8300 Server IP address (e.g., *192.168.100.10*). Use the C-LAN IP address if a C-LAN card is being used in a G650 Media Gateway.
- **Network Connection** should be set to the appropriate network interface on the server.
- **Local Trunk IP** should be set to the IP address of the group (e.g., *192.168.100.170*) and should match the IP address configured on Communication Manager in **Sections 5.1** and **5.4**.
- **Subnet Mask** should be set to the network mask (e.g., *255.255.255.0*).
- **Remote Trunk Port** should be set to the H.323 signaling port (e.g., *1720*).



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 U-Law, G729AB, and G.729A were used during the compliance testing.
- **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 group (e.g., *192.168.100.170*).
- **Media Profile** should be set to one that specifies the codec configured in the **Audio Codec** field. See **Appendix A** for instructions on configuring a **Media Profile**.
- The default values for the remaining fields may be used as shown.



6.2.2 Configure Terminating Channels

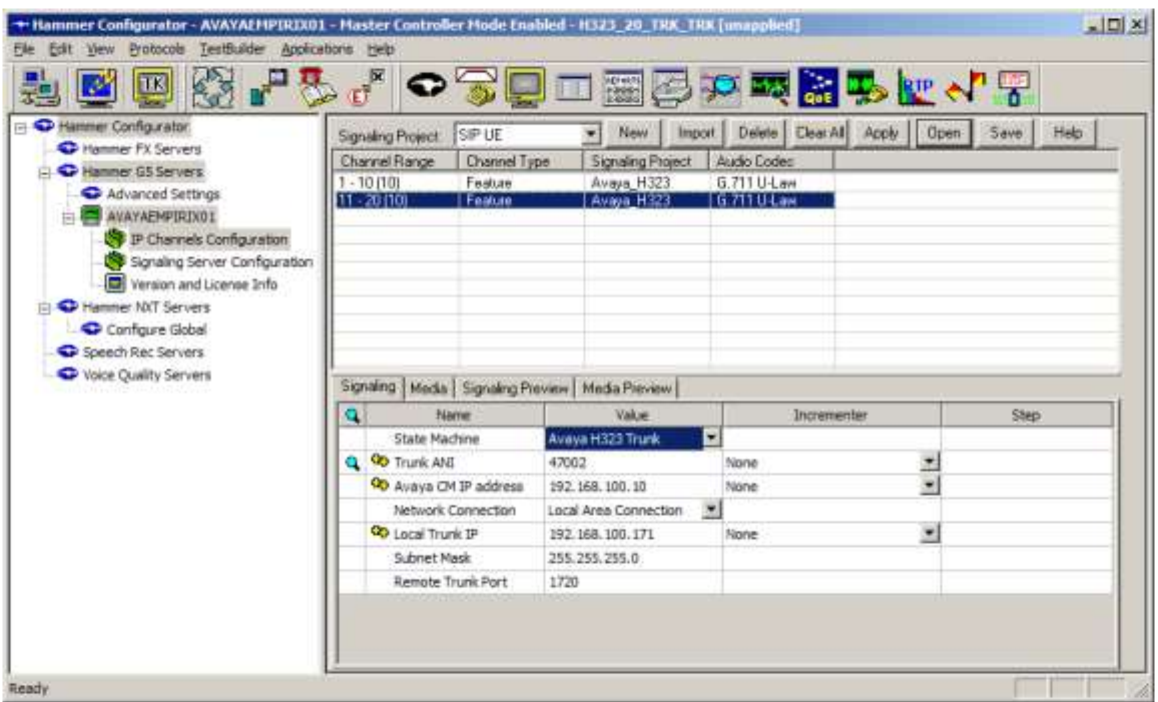
During the compliance test, the originating channels emulated H.323 trunks with the calls terminating on H.323 trunks, H.323 endpoints, SIP trunks, or SIP endpoints. Select one of the following subsections depending on the configuration desired.

- **Section 6.2.2.1** for terminating calls on H.323 trunks.
- **Section 6.2.2.2** for terminating calls on H.323 endpoints.
- **Section 6.2.2.3** for terminating calls on SIP trunks.
- **Section 6.2.2.4** for terminating calls on SIP endpoints.

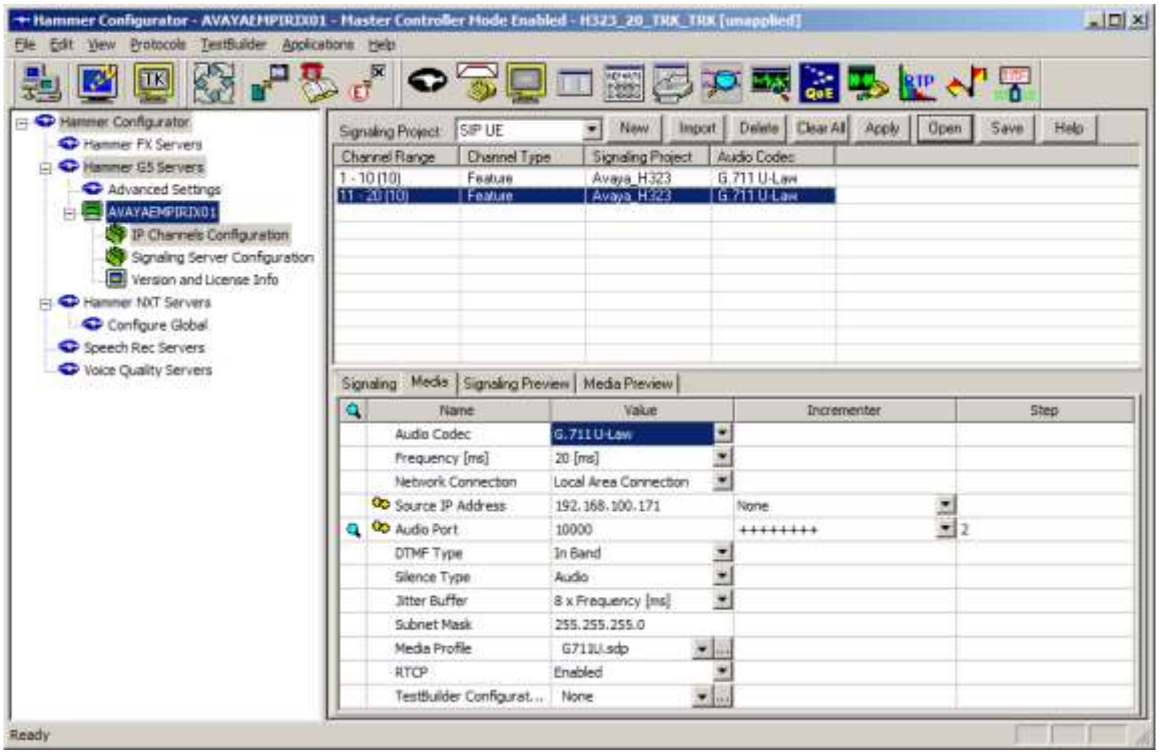
Note: Ensure that the originating and terminating channels are assigned unique IP addresses.

6.2.2.1 Configure Terminating Channels – H.323 Trunks

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 **Trunk ANI** and **Local Trunk IP** fields will be different.



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.



6.2.2.2 Configure Terminating Channels – H.323 Endpoints

To terminate the calls to H.323 endpoints follow the instructions described in **[2]**, specifically:

- **Section 5.3** describes how to configure H.323 stations on Communication Manager.
- **Section 6.2.2.1** describes how to configure terminating H.323 endpoints on Hammer IP.
- **Section 6.2.3** describes the PhoneBook configuration for routing calls to H.323 endpoints.
- **Section 6.4** describes how to use the PhoneBook when running a test script.

The configuration described in all the aforementioned sections of **[2]** must be completed for terminating calls to H.323 endpoints.

6.2.2.3 Configure Terminating Channels – SIP Trunks

To terminate the calls to SIP trunks follow the instructions described in **[3]**, specifically:

- **Section 5** describes how to configure call routing on Communication Manager.
- **Section 6** describes how to configure SIP trunks to Hammer IP on Session Manager.
- **Section 7.2.2.1** describes how to configure terminating SIP trunks on Hammer IP.
- **Section 7.4** describes how to specify the dialed digits when running a test script.

The configuration described in all the aforementioned sections of **[3]** must be completed for terminating calls to SIP trunks.

6.2.2.4 Configure Terminating Channels – SIP Endpoints

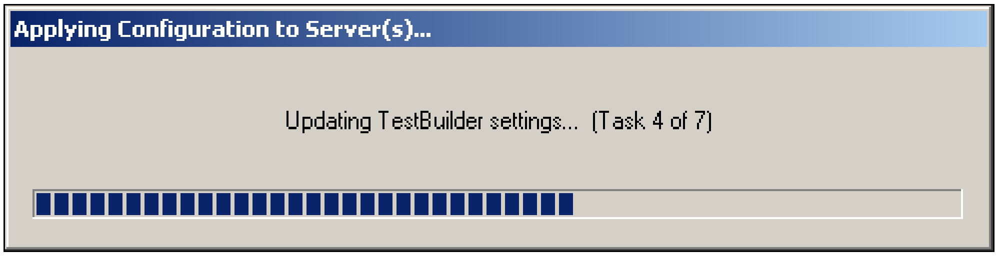
To terminate the calls to SIP endpoints follow the instructions described in **[4]**, specifically:

- **Section 5** describes how to configure SIP trunk to Session Manager, SIP stations, and call routing on Communication Manager.
- **Section 6** describes how to configure Session Manager, including the SIP trunk to Communication Manager and SIP endpoints. This section needs to be configured in its entirety.
- **Section 7.2.2.1** describes how to configure terminating SIP endpoints on Hammer IP.
- **Section 7.2.3** describes how to configure the PhoneBook.
- **Section 7.4** describes how to disable the **Do Connect Latency** option (required) and how to specify the dialed digits when running a test script.

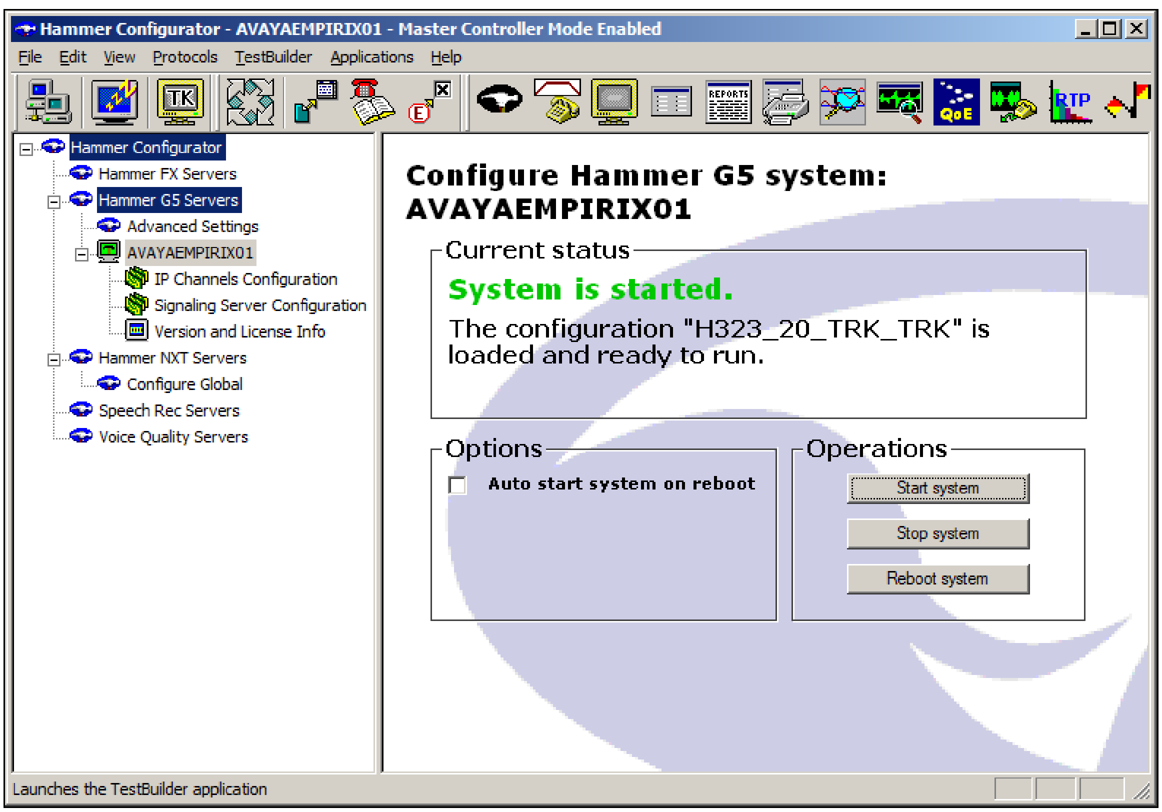
The configuration described in all the aforementioned sections of **[4]** must be completed for terminating calls to H.323 trunks.

6.3 Applying the Hammer IP Configuration

This completes the configuration of Hammer IP. 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., *AVAYAEMPIRIX01*) 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_TRK_TRK*.

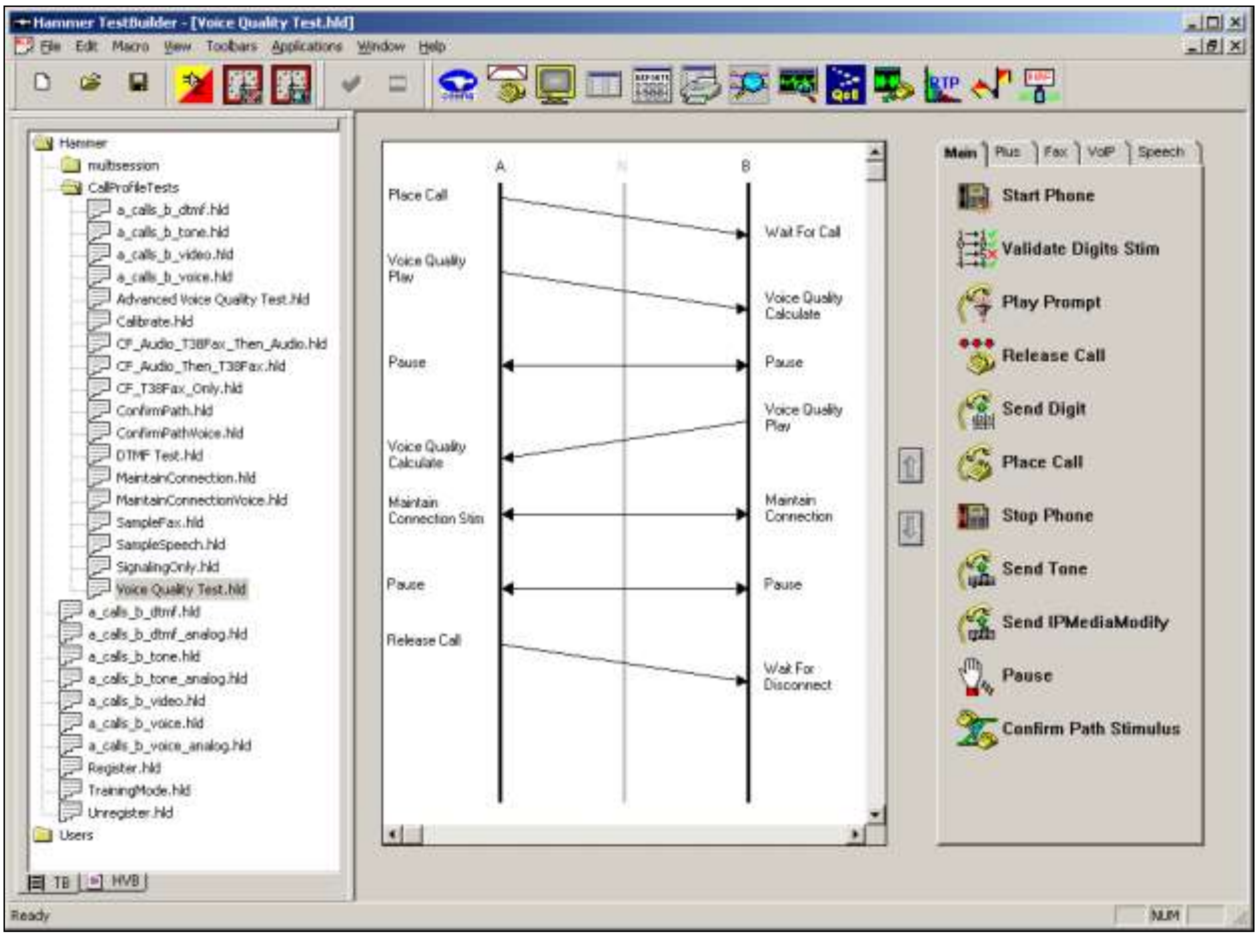


6.4 Configure and Run the Test Script

For the compliance test, two default test scripts were used:

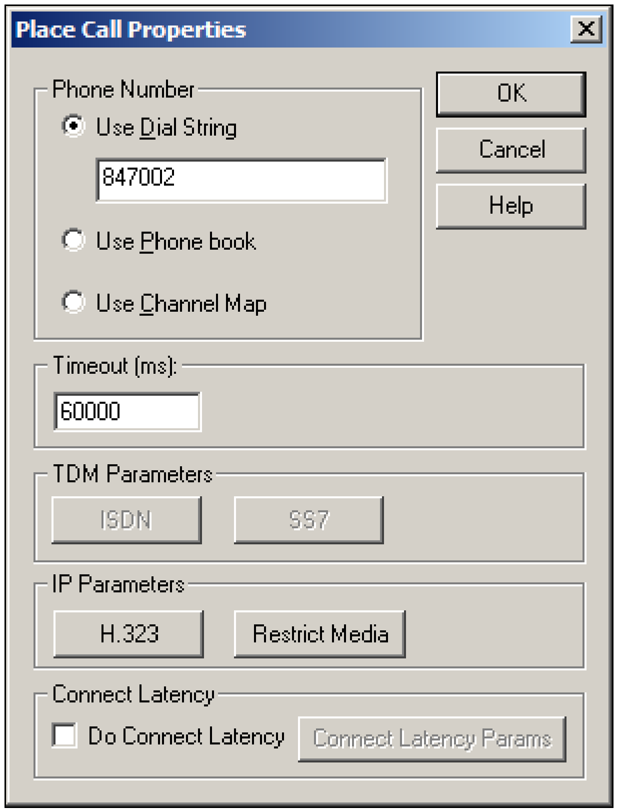
- `a_calls_b_dtmf.hld` to verify DTMF
- `Voice Quality Test.hld` to verify voice quality

The sample test script, `Voice Quality Test.hld`, establishes a VoIP call between two H.323 trunks on Hammer IP, 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 can be displayed in a ladder diagram as shown below by double-clicking on the test script name.

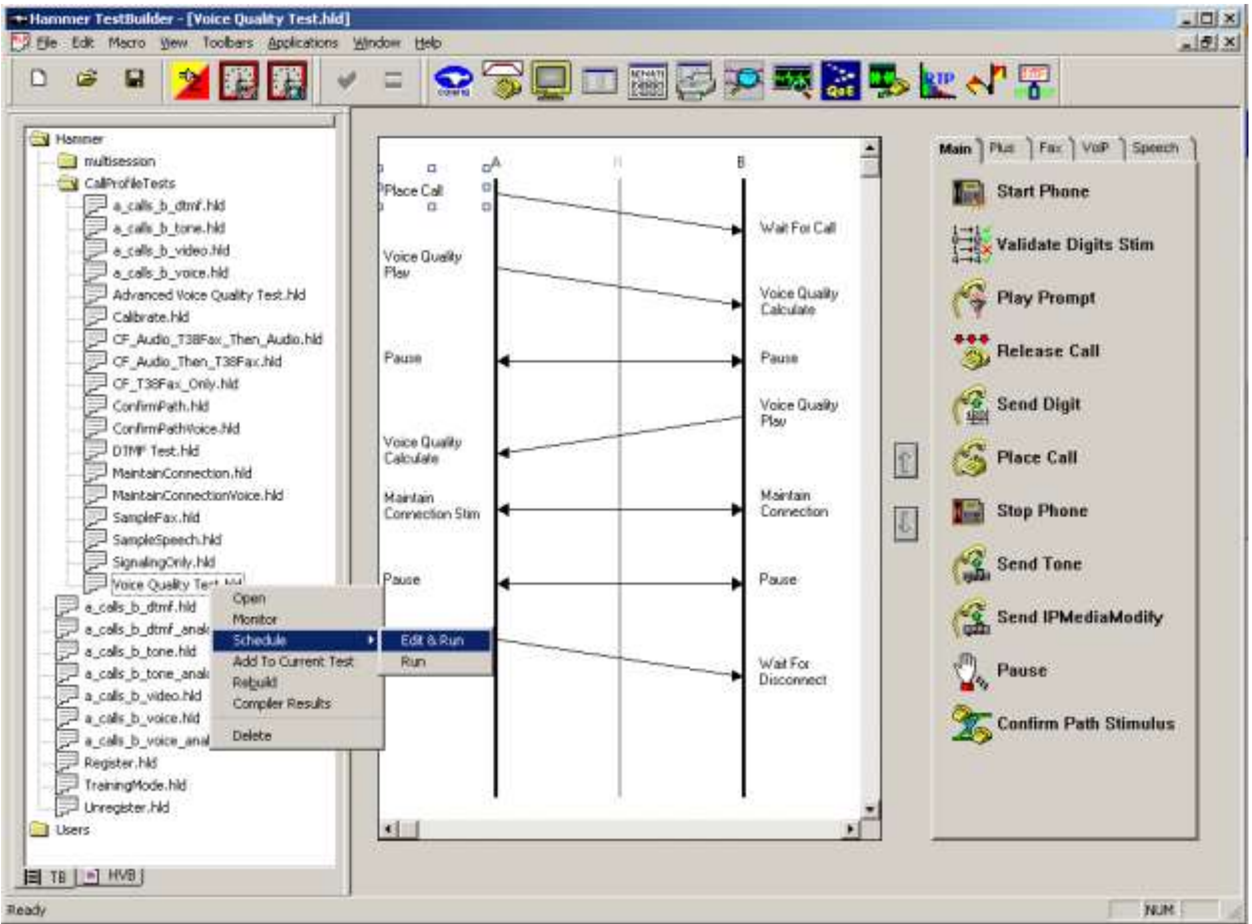


In the sample test script configured above, the A-side (originating H.323 trunk) places a call to the B-side (terminating H.323 trunk) using the **Place Call** action. The **Place Call** properties can be configured by double-clicking on the action in the ladder diagram. The **Place Call Properties** is configured to dial the same digits for every call. In this example, the Hammer IP dials the AAR access code '8' followed by "47002".

Note: Disable **Do Connect Latency** option in the **Place Call Properties** window.

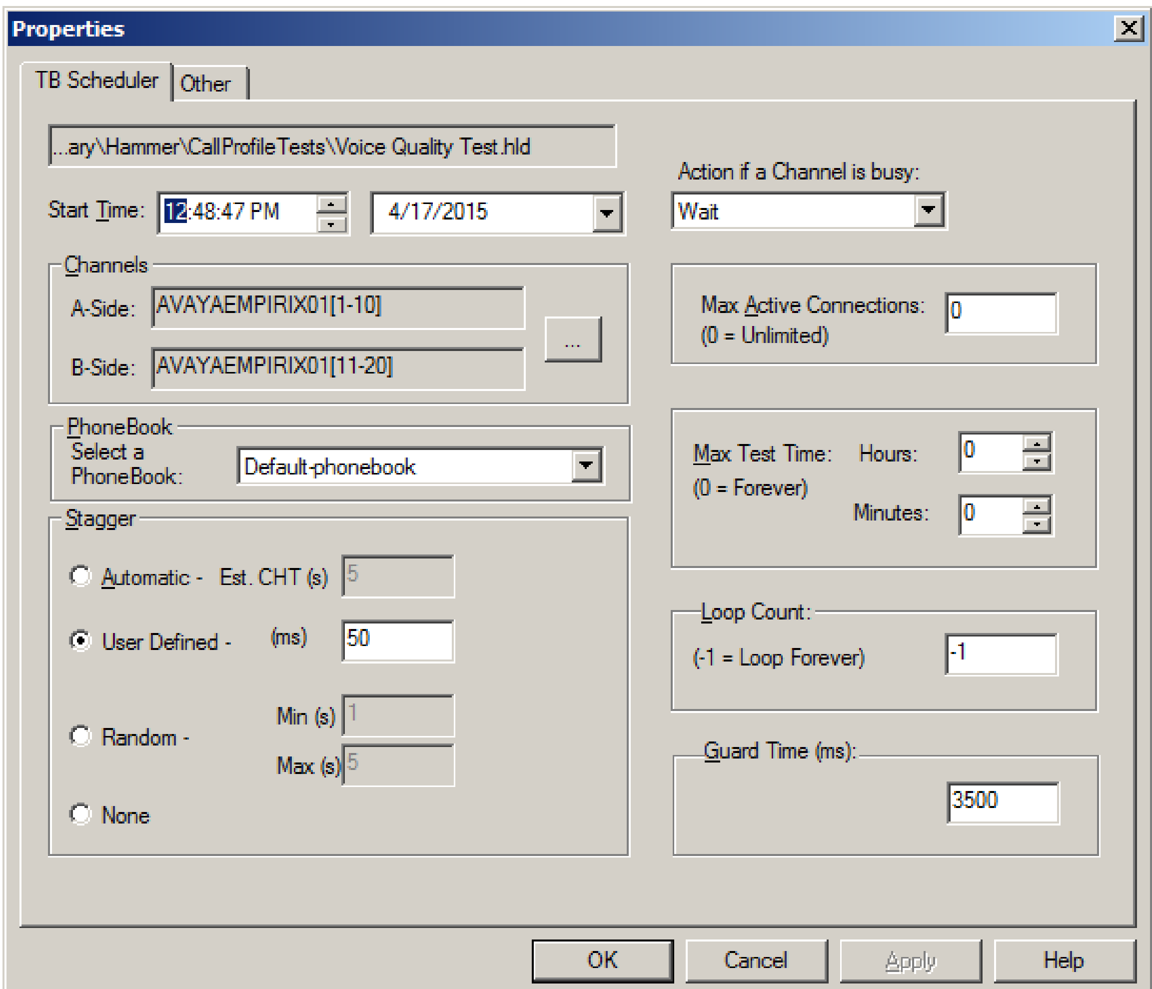


To run the test, right-mouse click on the test script in the left pane of the **Hammer TestBuilder** window and navigate to **Schedule→Edit & Run**. To re-run the test, the user can simply select **Schedule→Run**, if no changes are required.



In the **Properties** window, click on the ellipses button (…) in the **Channels** section and assign channels to the **A-Side** and **B-Side**. Set the **Loop Count** to the appropriate value to control the number of iterations 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 minimum setting should be *3500*. The **Stagger** section allows the user to specify how long to wait before the test is run on the next channel. Click **OK**.

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 IP. These parameters can slow down the test to a rate that can be reasonably handled by the test configuration.



7 Verification Steps

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

7.1 Verify Avaya Aura® Communication Manager

Verify that the H.323 signaling channels are *in-service* using the **status signaling-group** command as shown below. Repeat for both signaling groups.

```
status signaling-group 70
                         STATUS SIGNALING GROUP

        Group ID: 70                                Active NCA-TSC Count: 0
      Group Type: h.323                              Active CA-TSC Count: 0

     Group State: in-service
```

Verify that the H.323 trunks to Hammer IP are in *in-service/idle* using the **status trunk** command as shown below. This command only requires the trunk group number.

```
status trunk 70

                             TRUNK GROUP STATUS

Member   Port     Service State      Mtce Connected Ports
                                     Busy

0070/001 T00054   in-service/idle    no
0070/002 T00055   in-service/idle    no
0070/003 T00056   in-service/idle    no
0070/004 T00057   in-service/idle    no
0070/005 T00058   in-service/idle    no
0070/006 T00059   in-service/idle    no
0070/007 T00060   in-service/idle    no
0070/008 T00061   in-service/idle    no
0070/009 T00062   in-service/idle    no
0070/010 T00063   in-service/idle    no
```

While Hammer IP is running a test script, the **status trunk** command may be used to view the active call status. This command requires that the trunk member on the call be specified.

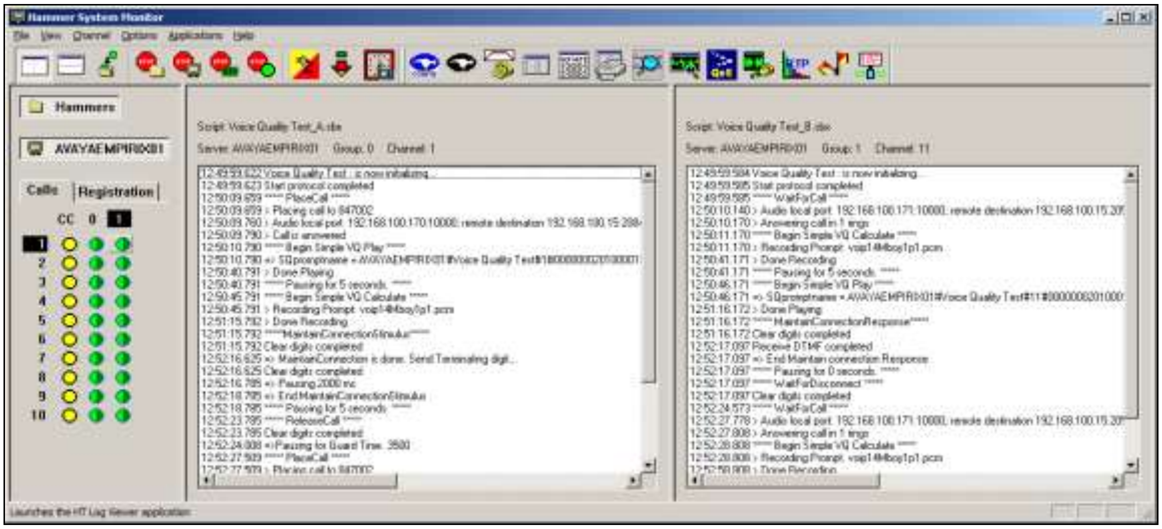
```
status trunk 70/1                                              Page   1 of   3
                              TRUNK STATUS

 Trunk Group/Member: 0070/001             Service State: in-service/active
              Port: T00054            Maintenance Busy? no
 Signaling Group ID: 70                   CA-TSC state: none

   IGAR Connection? no

    Connected Ports: T00065
```

Page 2 of the **status trunk** command indicates the codec being used for the call and whether the call is shuffled. When the call is shuffled, **Audio Connection Type** would be set to *ip-direct*, if not, the field would be set to *ip-tdm* as shown below.

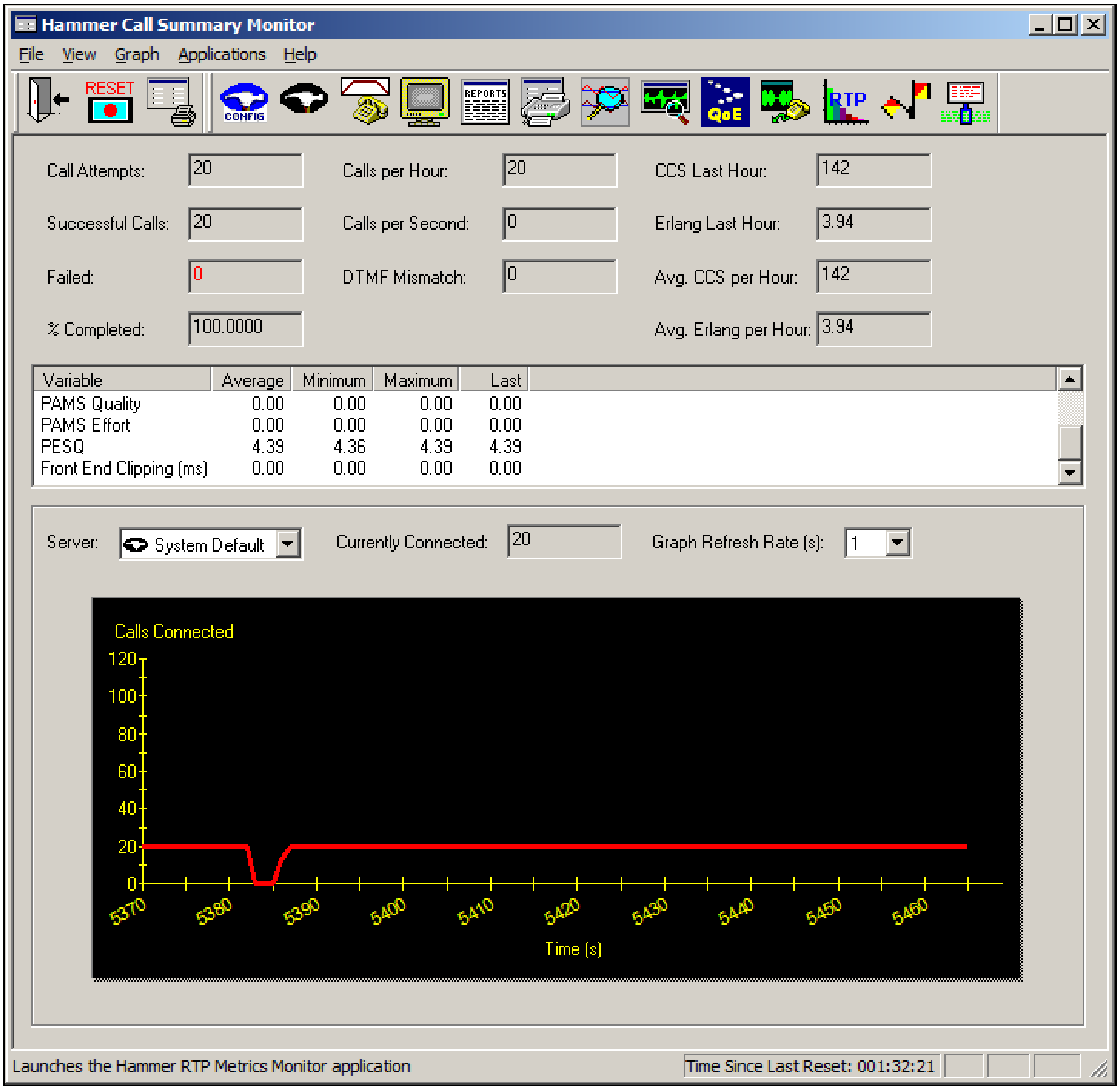
```
status trunk 70/1                                              Page   2 of   3
                                CALL CONTROL SIGNALING

Near-end Signaling Loc: PROCR
  Signaling   IP Address                              Port
   Near-end:  192.168.100.10                        : 1720
    Far-end:  192.168.100.170                       : 1233
 H.245 Near:
  H.245 Far:
   H.245 Signaling Loc:           H.245 Tunneled in Q.931? no

 Audio Connection Type: ip-tdm     Authentication Type: None
    Near-end Audio Loc:                        Codec Type: G.711MU
   Audio      IP Address                              Port
   Near-end:  192.168.100.15                        : 0004
    Far-end:  192.168.100.170                       : 10000

 Video Near:
  Video Far:
 Video Port:
  Video Near-end Codec:               Video Far-end Codec:
```

7.2 Verify Empirix Hammer IP

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.



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.



8 Conclusion

These Application Notes describe the configuration steps required to integrate Empirix Hammer IP with Avaya Aura® Communication Manager using H.323 trunk emulation. Hammer IP was able to successfully establish calls through Communication Manager to H.323 and SIP endpoints/trunks, generate voice quality metrics, monitor the calls, and generate reports. All feature and serviceability test cases were completed successfully. Test observations are noted in **Section 2.2**.

9 References

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

[1] *Administering Avaya Aura® Communication Manager*, Release 6.3, Issue 10.0, June 2014, Document Number 03-300509, available at http://support.avaya.com.

[2] *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager using H.323 Endpoint Emulation*, Issue 1.0, available at http://www.avaya.com.

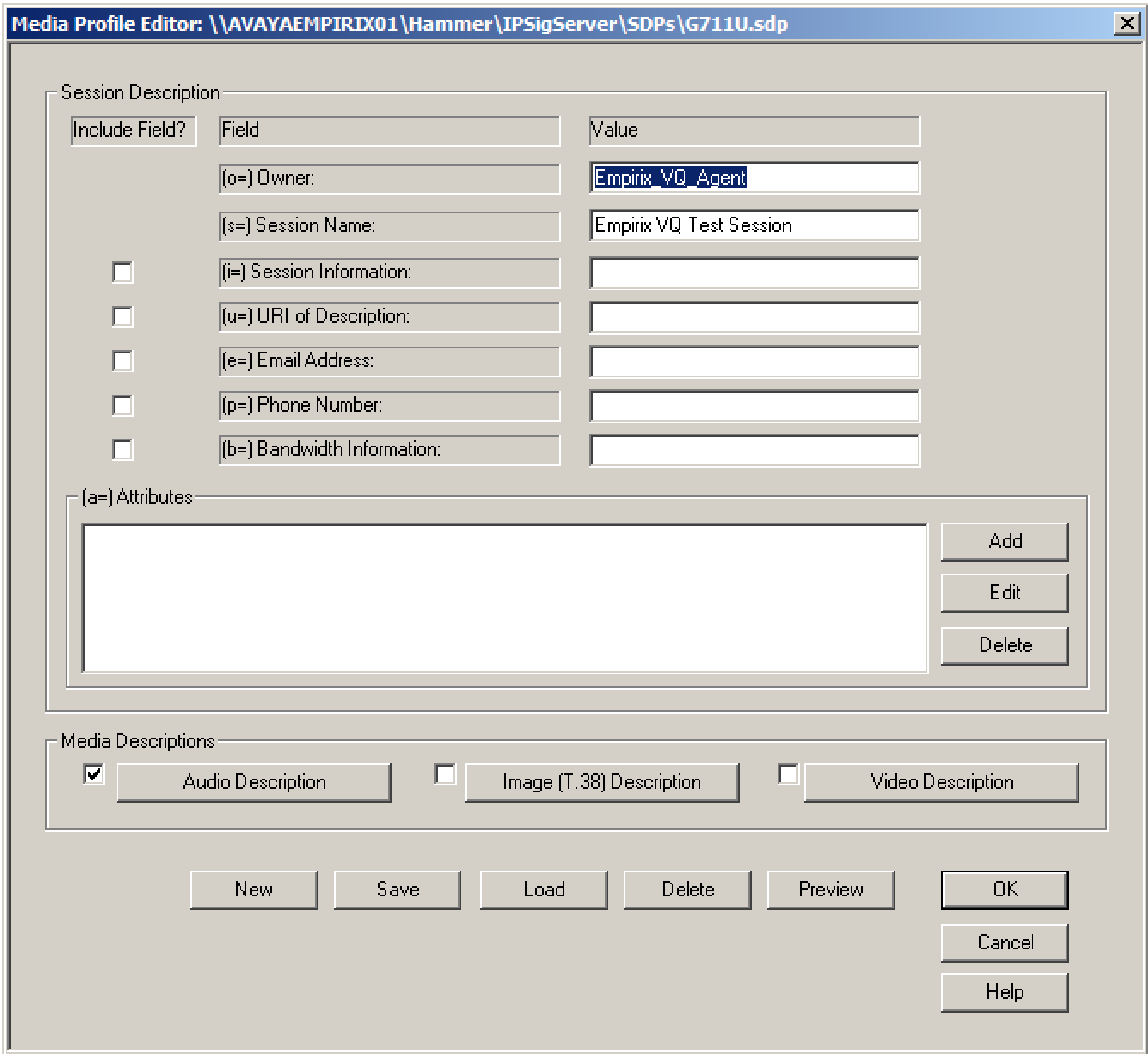
[3] *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager and Avaya Aura® Session Manager using SIP Endpoint Emulation*, Issue 1.0, available at http://www.avaya.com.

[4] *Application Notes for Empirix Hammer IP with Avaya Aura® Communication Manager and Avaya Aura® Session Manager using SIP Trunk Emulation*, Issue 1.0, available at http://www.avaya.com.

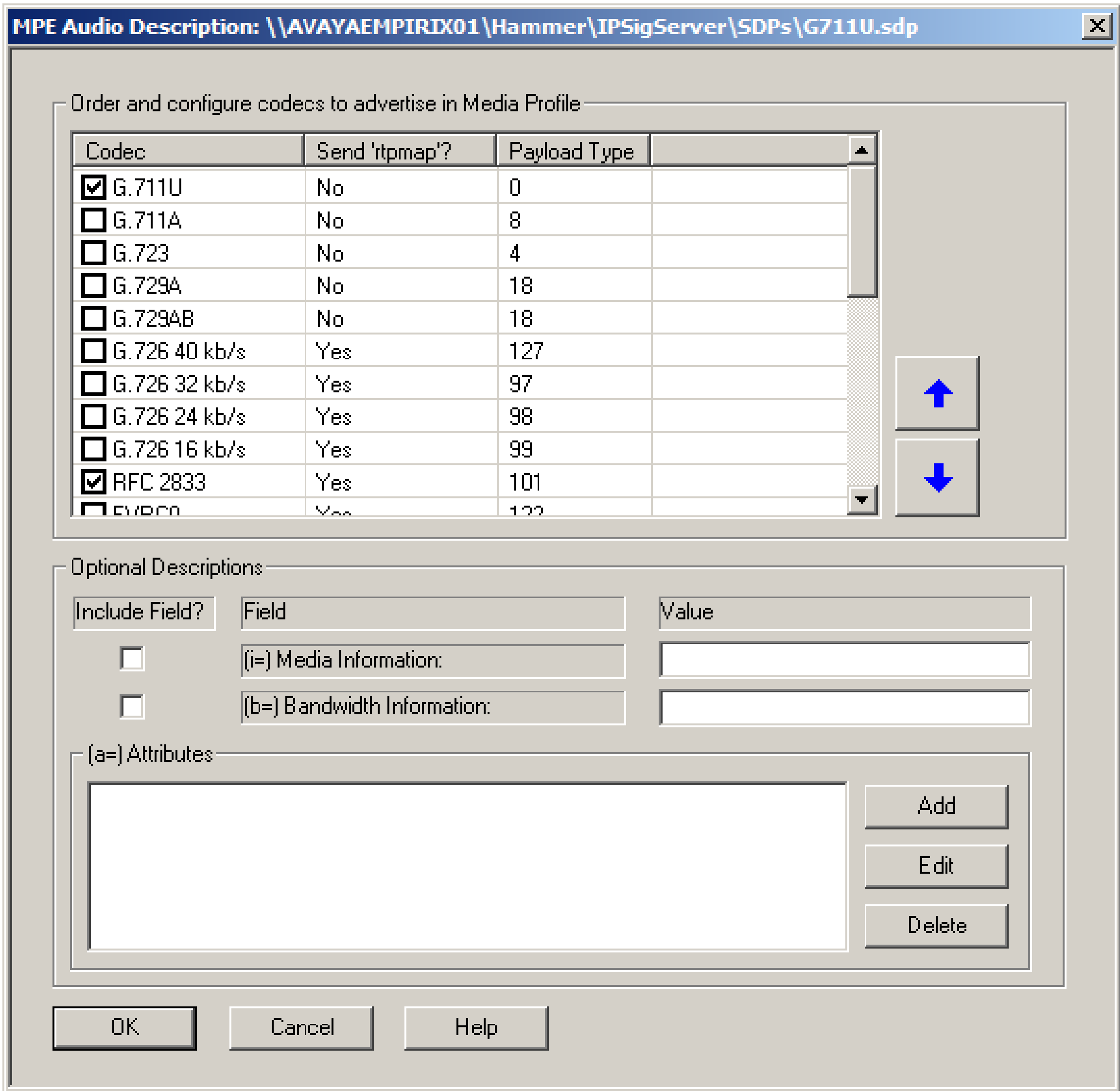
[5] *Empirix Hammer IP Installation Guide,* May 2015, available from Empirix.

APPENDIX A: Configure Media Profile on Empirix Hammer IP

The following windows show the configuration of the **Media Profile** used in the **Media** tab for the originating and terminating channel groups. To access this window, click on the ellipses button (…) by the **Media Profile** field in the **Media** tab. Click on the **Audio Description** button to view the codecs that will be advertised by the Hammer IP when placing a call.



The following window shows the codecs selected for this profile. This **Media Profile** was already created and named *G711U.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.



Please e-mail any questions or comments pertaining to these Application Notes along with the full title name and filename, located in the lower right corner, directly to the Avaya DevConnect Program at devconnect@avaya.com.