Avaya Solution & Interoperability Test Lab

Application Notes for Empirix Hammer FX-IP with Avaya Communication Manager using the H.323 IP Trunk Interface – Issue 1.0

Abstract

These Application Notes describe the configuration steps required for the Empirix Hammer FX-IP to interoperate with Avaya Communication Manager using the H.323 IP trunk interface. Information in these Application Notes has been obtained through Developer*Connection* compliance testing and additional technical discussions. Testing was conducted via the Developer*Connection* Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

Empirix Hammer FX-IP is a VoIP test platform. The system generates signaling and voice streams to simulate VoIP traffic loads, and the system also performs real time voice quality measurements. The Hammer FX-IP has a fully programmable state machine-based signaling emulation engine that offers users the control over the behavior of all emulated endpoints, as well as scripting flexibility. The Hammer FX-IP is offered as a 2U Rack-Mount Chassis configuration, or as a Software Only configuration.

These Application Notes focus on the specific configuration for Avaya Communication Manager and Hammer FX-IP to interoperate over H.323 IP trunks. For full details on configuring both platforms refer to the respective product manuals listed in **Section 9**.

The configuration tested for H.323 IP trunks is depicted in **Figure 1**. Two H.323 IP trunks were configured. One trunk handled all incoming traffic into Avaya Communication Manager, which in turn was routed back over another H.323 IP trunk.

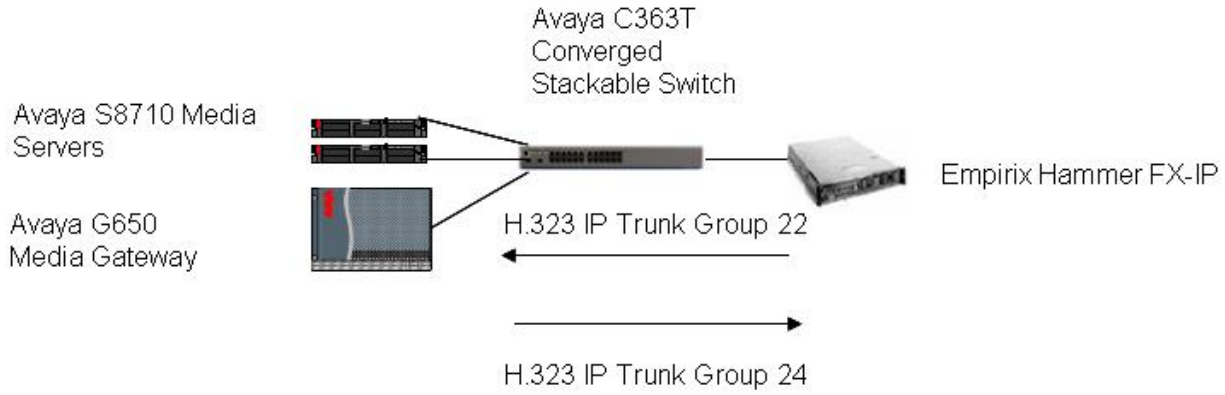


Figure 1 – Network Configuration

2. Equipment and Software Validated

The following equipment and software were used for the configurations provided:

Equipment	Software
Avaya S8710 Media Servers	Avaya Communication Manager 4.0 (R014x.00.0.730.5)
Avaya G650 Media Gateway • TN799DP C-LAN Circuit Pack • TN2302AP IP Media Processor Circuit Pack	 HW01 FW024 HW20 FW116
Avaya C363T Converged Stackable Switch	4.3.12
Empirix Hammer FX-IP	2.4.1

3. Configure Avaya Communication Manager

This section provides the procedures for configuring the H.323 trunks between Avaya Communication Manager and Empirix Hammer FX-IP. The configuration focuses on the IP trunk configuration and routing. For additional detail in configuring Avaya Communication Manager, refer to the administration manual in **Section 9**.

The procedures for configuring the H.323 trunks on Avaya Communication Manager include the following areas:

- Administer IP codec set and network region
- Administer IP node names for C-LAN, MEDPRO, and Hammer FX-IP
- Administer IP interface and data module for C-LAN
- Administer H.323 trunk group
- Administer H.323 signaling group
- Administer H.323 trunk group members
- Administer AAR analysis and route patterns

The Avaya Communication Manager system under test needs to have the appropriate licenses to support the number of trunk ports used for the test.

3.1. Administer IP Codec Set and Network Region

Use the "change ip-codec-set n" command, where "n" is an existing codec set number that will be used for integration with Hammer FX-IP. Select an audio codec type in the **Audio Codec** field, in this case "G.711MU". The actual codec set number and codec type may vary. **Section 5** contains a list of the audio codec types that were covered in the compliance testing. Retain the default values for the remaining fields on the screen, and submit these changes.

```
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:
```

Use the “change ip-network-region n” command, where “n” is an existing network region number that will be used for integration with the Empirix Hammer FX-IP. Enter the audio codec set number from the **IP Codec Set** screen above into the **Codec Set** field. Enable the following fields to allow for audio shuffling: **Intra-region IP-IP Direct Audio**, **Inter-region IP-IP Direct Audio**, and **IP Audio Hairpinning**. Retain the default values for the remaining fields, and submit these changes.

Note that the “IP-IP Direct Audio” feature enables the originating and terminating endpoints to exchange audio streams directly, without using the media resources in the Avaya G650 Media Gateway. This setting should be either enabled or disabled in both Avaya Communication Manager and Hammer FX-IP.

```
change ip-network-region 1                                    Page   1 of  19

                        IP NETWORK REGION
  Region: 1
Location:         Authoritative Domain:
    Name:
MEDIA PARAMETERS               Intra-region IP-IP Direct Audio: yes
      Codec Set: 1             Inter-region IP-IP Direct Audio: yes
   UDP Port Min: 2048                     IP Audio Hairpinning? y
   UDP Port Max: 65535
DIFFSERV/TOS PARAMETERS                RTCP Reporting Enabled? y
 Call Control PHB Value: 46      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: 6
        Audio 802.1p Priority: 6
        Video 802.1p Priority: 5      AUDIO RESOURCE RESERVATION PARAMETERS
H.323 IP ENDPOINTS                                     RSVP Enabled? y
  H.323 Link Bounce Recovery? y                 RSVP Refresh Rate(secs): 15
 Idle Traffic Interval (sec): 20      Retry upon RSVP Failure Enabled? y
   Keep-Alive Interval (sec): 5                  RSVP Profile: guaranteed-service
            Keep-Alive Count: 5       RSVP unreserved (BBE) PHB Value: 46
```

3.2. Administer IP Node Names for C-LAN, MEDPRO, Hammer FX-IP

Use the "change node-names ip" command, and add entries for the C-LAN, MEDPRO, and Hammer FX-IP. In this case, "CLAN-1A02" and "192.45.100.144" are entered as **Name** and **IP Address** for the C-LAN. "MEDPRO-1B03" and "192.45.100.156" are entered as **Name** and **IP Address** for the MEDPRO. "FXIP3" and "192.45.53.102" are entered as **Name** and **IP Address** for the trunks used for inbound traffic. "FXIP4" and "192.45.53.104" are entered as **Name** and **IP Address** for the trunks used for outbound traffic. The actual node names and IP addresses may vary. Submit these changes.

```
change node-names ip                                          Page   1 of   1
                                IP NODE NAMES
    Name                  IP Address
CLAN-1A02               192.45.100.144
FXIP3                   192.45.53.102
FXIP4                   192.45.53.104
MEDPRO-1B03             192.45.100.156
```

3.3. Administer IP Interface and Data Module for C-LAN

Add the C-LAN to the system configuration using the "add ip-interface 1a02" command. Note that the actual slot number may vary. In this case, "1a02" is used as the slot number. Enter the C-LAN node name assigned from **Section 3.2** into the **Node Name** field, and then the **IP Address** will be populated automatically.

Enter proper values for the **Subnet Mask** and **Gateway Address** fields. In this case, "255.255.255.0" and "192.45.100.1" are used to correspond to the network configuration in these Application Notes. Set the **Enable Ethernet Port** field to "y", and the **Network Region** field to the network region number from **Section 3.1**. Default values may be used in the remaining fields. Submit these changes.

```
add ip-interface 1a02
                                IP INTERFACES
                   Type: C-LAN
                   Slot: 01A02
             Code/Suffix: TN799  D
               Node Name: CLAN-1A02
              IP Address: 192.45 .100.144
             Subnet Mask: 255.255.255.0                          Link:
          Gateway Address: 192.45 .100.1
  Enable Ethernet Port? y                       Allow H.323 Endpoints? y
        Network Region: 1                        Allow H.248 Gateways? y
                   VLAN: n                         Gatekeeper Priority: 5

 Target socket load and Warning level: 400
       Receive Buffer TCP Window Size: 8320
                               ETHERNET OPTIONS
                   Auto? y
```

An IP interface for the MEDPRO must also be added in a similar manner.

Next, add a new data module using the "add data-module n" command, where "n" is an available extension. Enter the following values, and submit these changes.

- **Name:** A descriptive name.
- **Type:** "ethernet"
- **Port:** Same slot number from the **IP INTERFACES** screen above and port "17".
- **Link:** An available link number.

```
add data-module 2999                                          Page   1 of   1
                              DATA MODULE

  Data Extension: 2999            Name: clan-1a02
            Type: ethernet
            Port: 01A0217
            Link: 1


Network uses 1's for Broadcast Addresses? Y
```

Note that a data module is not needed for the MEDPRO.

3.4. Administer H.323 Trunk Group

Administer the H.323 trunk group to originate traffic on the Hammer FX-IP. Use the "add trunk-group n" command, where "n" is an available trunk group number. On **Page 1** of the **TRUNK GROUP** screen, enter the following values for the specified fields, and retain the default values for the remaining fields.

- **Group Type:** "isdn"
- **Group Name:** A descriptive name.
- **TAC:** An available trunk access code.
- **Carrier Medium:** "H.323"
- **Service Type:** "tie"

```
add trunk-group 22                                        Page   1 of  21
                                TRUNK GROUP

Group Number: 22                   Group Type: isdn          CDR Reports: y
  Group Name: FXIP3                       COR: 1        TN: 1        TAC: 122
   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: manual
```

Repeat the same steps for the trunk group used to route traffic back to the Hammer FX-IP. In this case, trunk group number 24 was used for outbound traffic.

3.5. Administer H.323 Signaling Group

Administer the H.323 signaling group for the newly added trunk group to use for signaling. Use the "add signaling-group n" command, where "n" is an available signaling group number. Enter the following values for the specified fields, and retain the default values for all remaining fields. Submit these changes.

- **Group Type:** "h.323"
- **Trunk Group for Channel Selection:** Trunk group number from **Section 3.4**.
- **Near-end Node Name:** C-LAN node name from **Section 3.2**.
- **Near-end Listen Port:** "1720"
- **Far-end Node Name:** Hammer FX-IP node name from **Section 3.2**.
- **Far-end Listen Port:** "1720"

```
add signaling-group 22                                    Page   1 of   5
                              SIGNALING GROUP

 Group Number: 22             Group Type: h.323
                           Remote Office? n          Max number of NCA TSC: 0
                                     SBS? n           Max number of CA TSC: 0
         IP Video? n                               Trunk Group for NCA TSC:
      Trunk Group for Channel Selection: 22
     TSC Supplementary Service Protocol: a
                         T303 Timer(sec): 10

   Near-end Node Name: CLAN-1A02             Far-end Node Name: FXIP3
 Near-end Listen Port: 1720                Far-end Listen Port: 1720
                                        Far-end Network Region:
        LRQ Required? n                  Calls Share IP Signaling Connection? n
        RRQ Required? n
    Media Encryption? 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
                                       DCP/Analog Bearer Capability: 3.1kHz
```

Repeat the same steps for the signaling group used to route traffic back to the Hammer FX-IP. In this case, signaling group number 24 with node name "FXIP4" was used for outbound traffic.

3.6. Administer H.323 Trunk Group Members

Use the "change trunk-group n" command, where "n" is the trunk group number added in **Section 3.4**.

Enter the following values for the specified fields, and retain the default values for all remaining fields. Submit these changes.

- **Member Assignment Method:** "auto"
- **Signaling Group:** Signaling group number from **Section 3.5**.
- **Number of Members:** Maximum number of trunks to be used.

```
change trunk-group 22                                        Page   1 of  21
                              TRUNK GROUP

Group Number: 22                   Group Type: isdn          CDR Reports: y
  Group Name: FXIP3                       COR: 1        TN: 1        TAC: 122
   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: 22
                                                       Number of Members: 60
```

Repeat the same steps for the trunk group used to route traffic back to the Hammer FX-IP.

3.7. Administer AAR Analysis and Route Patterns

In this configuration, Automatic Alternate Routing (AAR) was used to route the traffic. The Hammer FX-IP system was configured to send a digit string with the format 8200xx. The digit 8 was assigned in Avaya Communication Manager as the AAR access code. When receiving the leading digit 8, Avaya Communication Manager software strips the digit 8 and processes the remaining digits using the AAR tables. There are different methods for routing calls with Avaya Communication Manager, consult the administration manual in **Section 9** for other options.

Use the "change aar analysis 200" command, and proceed to page 1 or 2 where a row is available to enter new values.

Enter the following values for the specified fields, and retain the default values for all remaining fields. Submit these changes.

- **Dialed String:** "200" (the dialed prefix digits to match on)
- **Total Min:** "5"
- **Total Max:** "5"
- **Route Pattern:** "22" (an available route pattern)
- **Call Type:** "aar"

```
change aar analysis 200                                      Page   2 of   2
                           AAR DIGIT ANALYSIS TABLE
                                                          Percent Full:    2

          Dialed           Total     Route    Call   Node  ANI
          String          Min  Max  Pattern   Type   Num   Reqd
    200                   5    5     22       aar          n
```

Use the “change route-pattern n” command, where “n” is the route pattern assigned earlier. Enter the following values for the specified fields, and retain the default values for all remaining fields. Submit these changes.

- **Grp No:** Outbound trunk group number “24”.
- **FRL:** “0”
- **ITC:** “both”
- **BCIE:** “ept”

```
change route-pattern 22                                          Page   1 of   3
                     Pattern Number: 22  Pattern Name:
                                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: 24   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            both ept                                  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
                                                  Number of Members: 60
```

4. Configure EMPIRIX Hammer FX-IP

The Empirix Hammer FX-IP is configured through a graphical user interface residing on the FX-IP server. The following sections focus on describing the settings applicable to the configuration with Avaya Communication Manager. The user is expected to be familiar with the Empirix Hammer FX-IP interface. For additional detail in configuring the Hammer FX-IP, refer to the Empirix Hammer FX-IP online Help manual.

The Hammer Configurator is the application used to configure and manage Hammer systems. The Hammer Configurator can also be used to view the status of a server, and to view license and version information.

1. Login to the FX-IP via remote desktop connection or console login. The default login credentials are:

   Login: Hammer

   Password: 123Hammer!

2. On the desktop of the Empirix Server, double-click Hammer Configurator 

. The Hammer Configurator window appears, displaying a list of server types in the left pane. For a full view of the main screen, see **Figure 5**.
3. The FX-IP must be in **Master Controller mode**. Verify the FX-IP is in Master Controller mode by clicking the 

button. If no 

button exists, the FX-IP is already in Master Controller mode.
4. In the left pane, click **Hammer FX Servers** as shown in **Figure 2**.

Figure 2 - Adding an FX Server

5. Click the  button to open the **Add/Remove Servers** window shown in **Figure 3**.

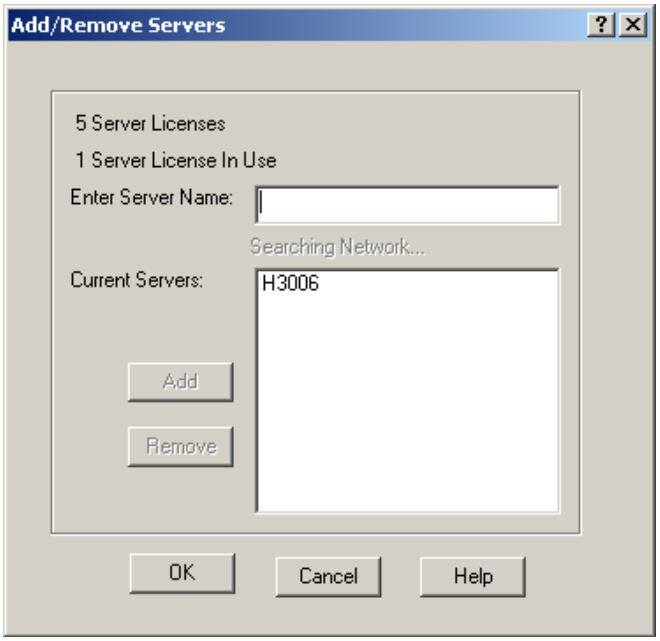


Figure 3 - Add/Remove Servers Window

Any servers that are currently attached to the system appear in the **Current Servers** list box. The top of the Add/Remove Servers window shows how many total server licenses are available and how many are being used.

6. In the **Enter Server Name** field, enter the name of the server to connect to (including the server currently used).
7. Click the **Add** button.
8. Repeat steps 5 through 7 for each server to connect to.

9. Click OK. Each server entered is added to the **Current Servers** list and then appears in the list of servers in the Hammer Configurator window as shown in **Figure 4**.
10. To remove a server from the **Current Servers** list, highlight the server, and click the **Remove** button.

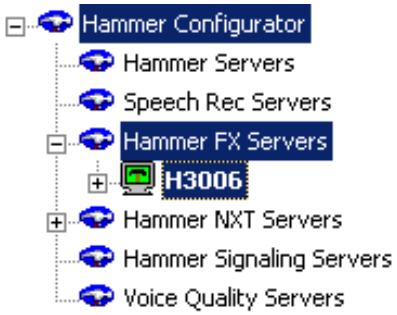


Figure 4 - List of Servers in Hammer Configurator

4.1. Configuring Hammer FX-IP Signaling

For the purposes of Avaya interoperability, the H323 FS Phone state machine was modified to support Avaya media shuffling, "IP-IP Direct Audio", in a new state machine called **Avaya H323 FS Phone.** To obtain a copy of this new state machine contact Empirix support, see **Section 7**.

1. Configure the FX-IP by selecting **IP Channels Configuration** on the left pane.
2. Select the **Signaling → Basic.** Select all available channels by selecting **channel 1** in the **Channels** column, holding the *shift* key, and depressing the *end* key.
3. Right click in the **Protocol** column and select **H.323**.
4. Right click in the **State Machine** column and select the **Avaya H323 FS Phone** state machine as shown in **Figure 5**.

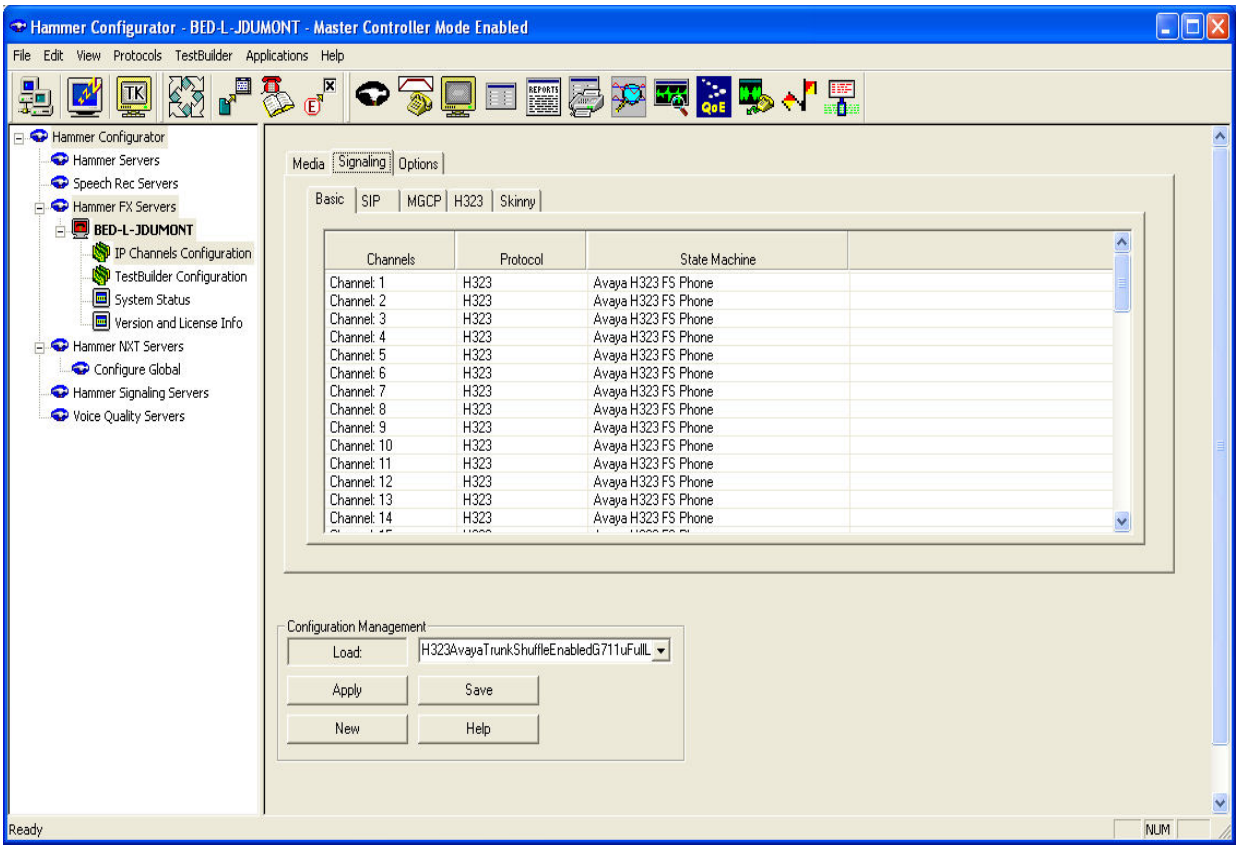


Figure 5 – Signaling Basic Tab Configuration

Use the **H323** tab shown in **Figure 5** to configure the H.323 parameters. Unless otherwise indicated, each parameter is defined on a per channel basis. The values set for these parameters are used by the system to populate fields in H.323 messages. The following three figures, **Figures 6-8**, are one continuous screen showing the fields to be configured in the **H323** tab. The values shown were used in the tested configuration.

Channels	Endpoint ID	Phone IP	Phone Port	Register with Gatekeeper?	Requested Expiration [s]	Auto re-Register?	Registration Stagger [ms]
Channel: 1	20001	192.45.53.102	1720	No	1000	No	0
Channel: 2	20002	192.45.53.102	1720	No	1001	No	0
Channel: 3	20003	192.45.53.102	1720	No	0	No	0
Channel: 4	20004	192.45.53.102	1720	No	0	No	0
Channel: 5	20005	192.45.53.102	1720	No	0	No	0
Channel: 6	20006	192.45.53.102	1720	No	0	No	0
Channel: 7	20007	192.45.53.102	1720	No	0	No	0
Channel: 8	20008	192.45.53.102	1720	No	0	No	0
Channel: 9	20009	192.45.53.102	1720	No	0	No	0
Channel: 10	20010	192.45.53.102	1720	No	0	No	0
Channel: 11	20011	192.45.53.102	1720	No	0	No	0
Channel: 12	20012	192.45.53.102	1720	No	0	No	0
Channel: 13	20013	192.45.53.102	1720	No	0	No	0
Channel: 14	20014	192.45.53.102	1720	No	0	No	0
Channel: 15	20015	192.45.53.102	1720	No	0	No	0
Channel: 16	20016	192.45.53.102	1720	No	0	No	0
Channel: 17	20017	192.45.53.102	1720	No	0	No	0
Channel: 18	20018	192.45.53.102	1720	No	0	No	0
Channel: 19	20019	192.45.53.102	1720	No	0	No	0
Channel: 20	20020	192.45.53.102	1720	No	0	No	0
Channel: 21	20021	192.45.53.102	1720	No	0	No	0
Channel: 22	20022	192.45.53.102	1720	No	0	No	0
Channel: 23	20023	192.45.53.102	1720	No	0	No	0
Channel: 24	20024	192.45.53.102	1720	No	0	No	0
Channel: 25	20025	192.45.53.102	1720	No	0	No	0
Channel: 26	20026	192.45.53.102	1720	No	0	No	0
Channel: 27	20027	192.45.53.102	1720	No	0	No	0
Channel: 28	20028	192.45.53.102	1720	No	0	No	0
Channel: 29	20029	192.45.53.102	1720	No	0	No	0
Channel: 30	20030	192.45.53.102	1720	No	0	No	0
Channel: 31	20031	192.45.53.104	1720	No	0	No	0
Channel: 32	20032	192.45.53.104	1720	No	0	No	0
Channel: 33	20033	192.45.53.104	1720	No	0	No	0
Channel: 34	20034	192.45.53.104	1720	No	0	No	0

Figure 6 – Signaling H.323 Tab Configuration Part 1

H.225 Identifier	H.245 Identifier	Local H.245 IP	Local H.245 Port	Local H.245 Port	Gatekeeper IP	Gatekeeper Port	Destination IP address (e.g. Gateway)	Destination Port
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10000	10000	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10001	10001	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10002	10002	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10003	10003	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10004	10004	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10005	10005	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10006	10006	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10007	10007	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10008	10008	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10009	10009	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10010	10010	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10011	10011	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10012	10012	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10013	10013	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10014	10014	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10015	10015	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10016	10016	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10017	10017	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10018	10018	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10019	10019	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10020	10020	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10021	10021	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10022	10022	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10023	10023	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10024	10024	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10025	10025	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10026	10026	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10027	10027	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10028	10028	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10029	10029	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10030	10030	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10031	10031	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10032	10032	192.45.100.140	1719	192.45.100.144	1720
0.0.8.2250.0.5	0.0.8.245.0.10	192.45.53.102	10033	10033	192.45.100.140	1719	192.45.100.144	1720

Figure 7 – Signaling H.323 Tab Configuration Part 2

The last column, in **Figure 8**, **Media Shuffling** is a customized parameter added to support "IP-IP Direct Audio" with Avaya Communication Manager H.323 trunks. When **Media Shuffling** is set to 'Enabled' the media (RTP) will flow between the endpoints, whereas when it is set to 'Disabled' then media flows through the gateway. This setting should be either enabled or disabled in both Avaya Communication Manager and Hammer FX-IP. A detailed description of the fields is available in the Empirix manual listed in **Section 9**. Note that for signaling the **Destination IP Address** should be set to that of the Avaya CLAN ("CLAN-1A02" as shown in **Section 3.2**).

QSIG Test Type	QSIG User Diversion Type	QSIG Diversion Number	RAS IP	RAS Port	Local Terminal Type	Media Negotiation Type	Media Shuffling
Basic Call	Busy		192.45.53.102	11000	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.104	11001	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11002	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11003	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11004	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11005	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11006	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11007	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11008	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11009	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11010	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11011	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11012	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11013	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11014	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11015	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11016	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11017	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11018	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11019	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11020	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11021	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11022	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11023	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11024	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11025	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11026	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11027	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11028	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11029	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11030	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11031	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11032	50 - Terminal ...	Dynamic	Enabled
Basic Call	Busy		192.45.53.102	11033	50 - Terminal ...	Dynamic	Enabled

Figure 8 – Signaling H.323 Tab Configuration Part 3

4.2. Configuring Hammer FX-IP Media

The following figures, **Figures 9-10**, are part of one screen that shows the parameters and values used for the RTP and RTCP media. Access this screen by selecting **IP Channels Configuration** on the left pane (shown in **Figure 5**), and selecting the **Media** tab. **Figures 9-10** show sample values used during the test. A detailed description of the fields is available in the Empirix manual listed in **Section 9**.

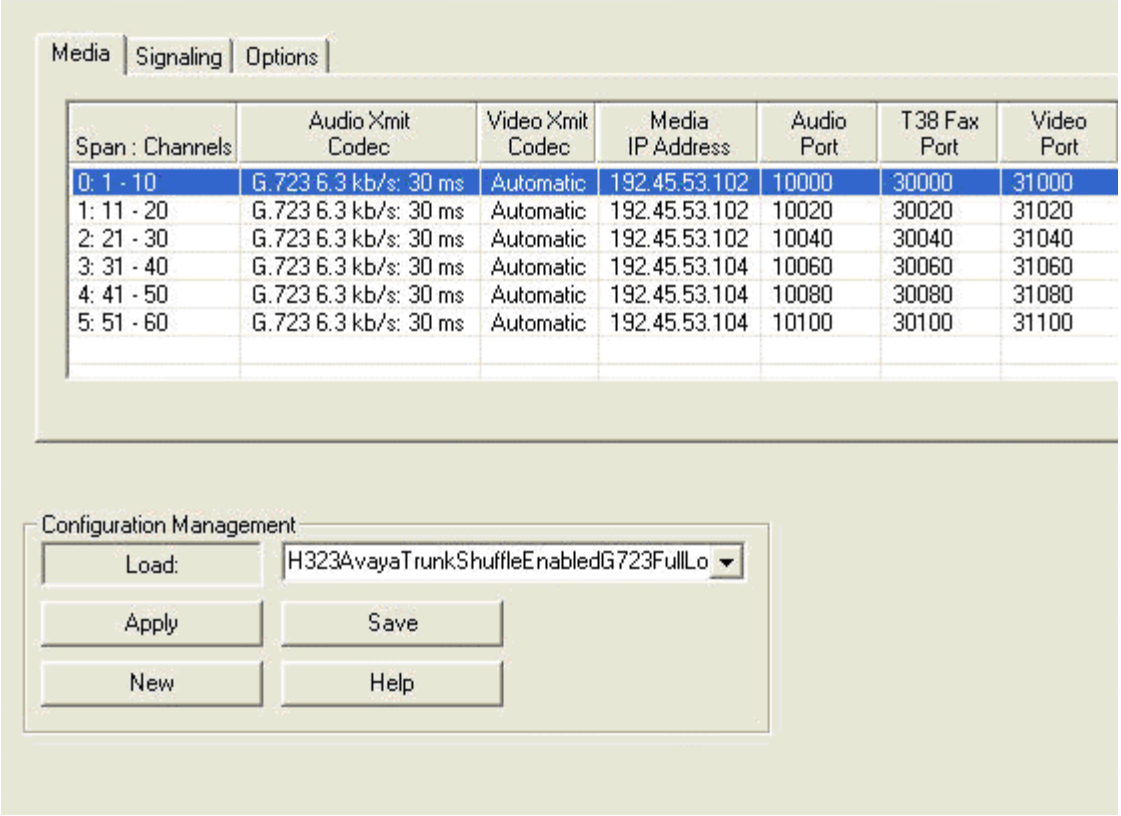


Figure 9 – Media Tab Configuration Part 1

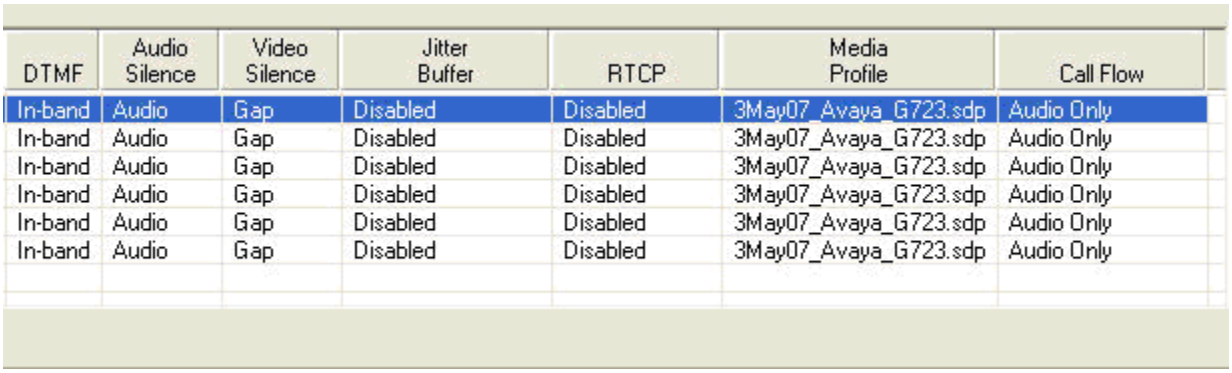


Figure 10 – Media Tab Configuration Part 2

The **Media Profile** provides the ability to configure the codec negotiation and dynamic payload of all supported codecs. A **Media Profile** needs to be selected to determine the properties a span uses when establishing a media session. The “default.sdp” can be selected to use the default settings or the user can create a customized profile. **Figure 11** displays the media configuration.

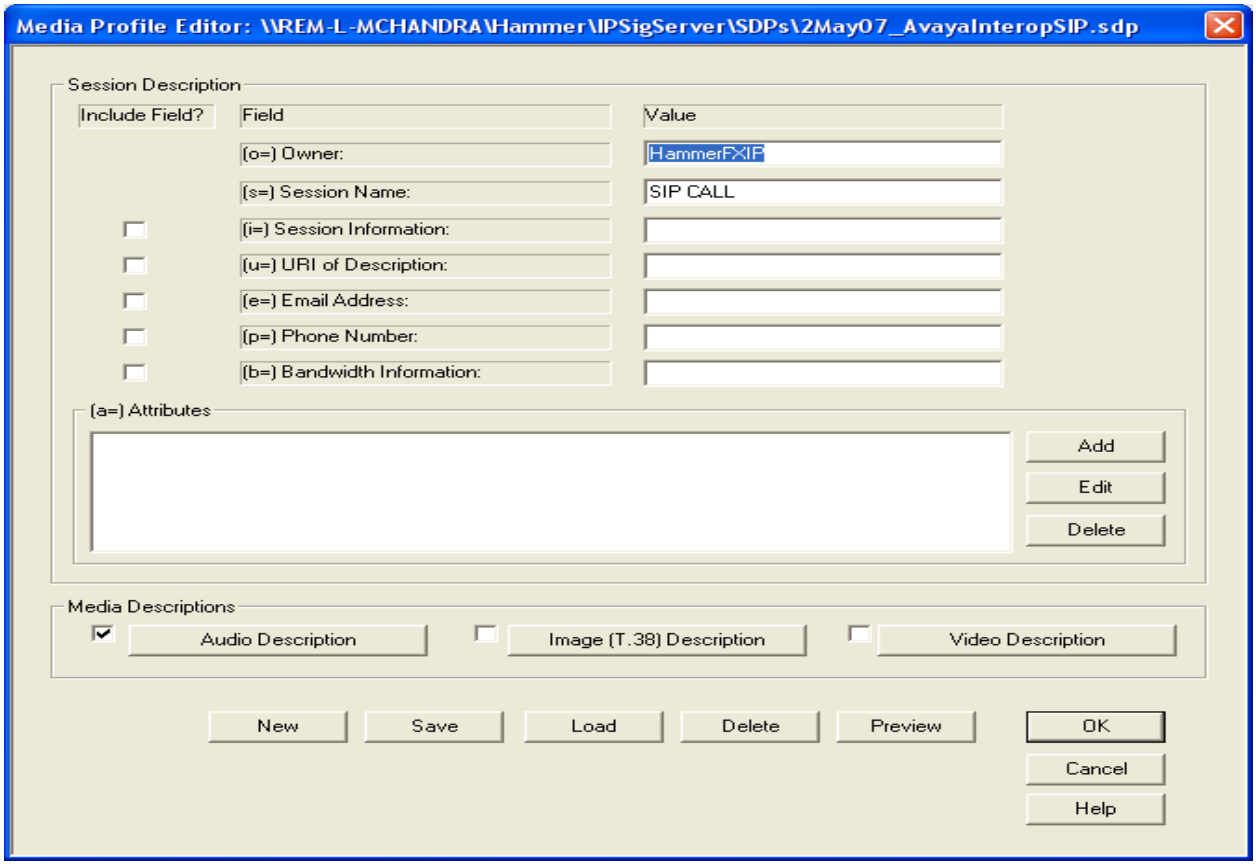


Figure 11 – Media Profile

To change the settings, click on the **Audio Description** button (see **Figure 11**). The screen will display the available codecs, their priority order (listed top-down), the RTPMap and the Payload number for all codecs. For dynamic payloads (such as RFC 2833) the payload number can be changed. **Figure 12** displays the audio codecs description window. Once configured, click the **OK** button. Click **OK** again to return to the main screen.

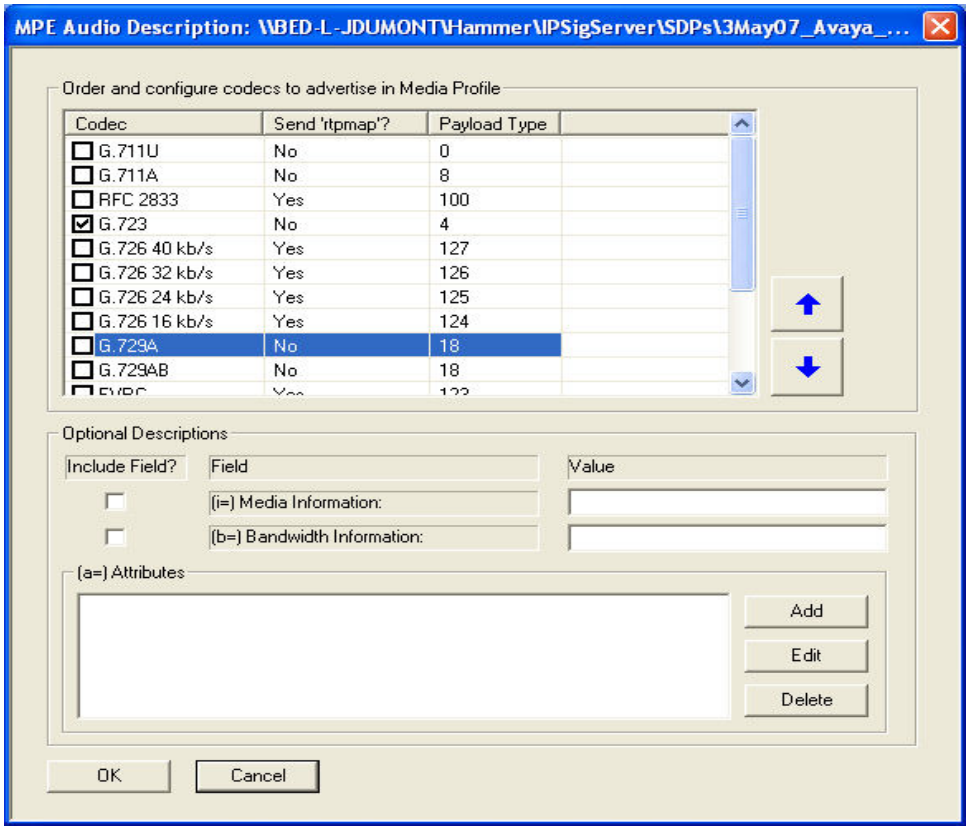


Figure 12 – Audio Codecs

The following table shows different Media Profile (SDP) configured for the codecs covered in the testing.

Codec	SDP
G.711	Avaya_Interop_H323_711.sdp
G.723 6.3k	Avaya_Interop_H323_723.sdp
G.729AB	Avaya_Interop_H323_729.sdp

4.2.1. Applying the Configuration and Starting the HTServer Process

1. In the Hammer Configurator, click the **Apply** button to update the FX-IP with the new configuration. See **Figure 5**.
2. From the left pane, click on **System Status** as shown in **Figure 13.**

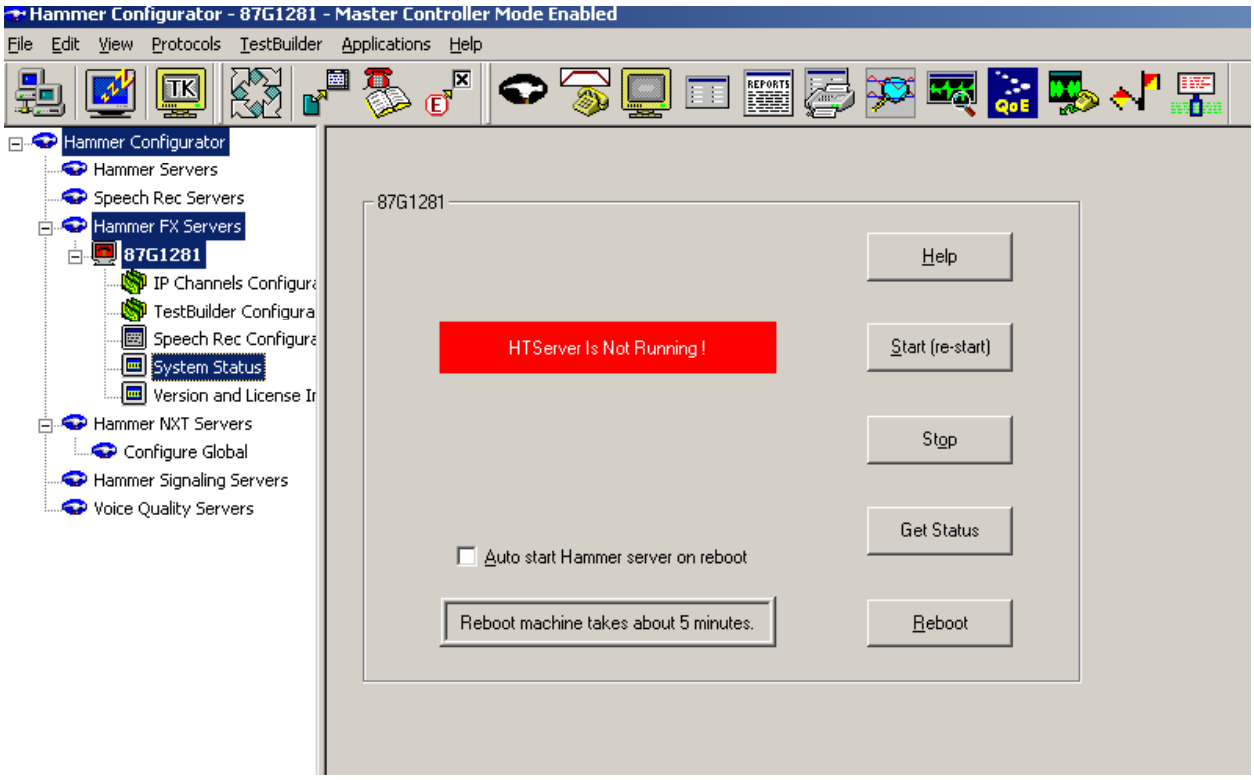


Figure 13 - System Status Screen

3. Click the  button to start HTServer.

The HTServer is now successfully started.

4.2.2. Creating a Dial Plan Using the Phonebook

Before building and executing a test, a Phone Book needs to be created to place calls. To create a Phone Book:

1. Launch the Hammer Configurator.
2. On the Configurator menu, select **PhoneBook**. The last saved Phone Book opens. If the last saved Phone Book cannot be found, a new blank Phone Book opens. To open a different saved Phone Book, select **File → Open**, and then select a PhoneBook (.phn) file. To open a new blank Phone Book, select **File → New**.
3. Select the **Phonebook Settings** tab, as shown in **Figure 14**.
4. Using one or more of the following methods, enter dialing information for each channel that will be used. Enter phone numbers or destination addresses in the **Phone #** column. Optionally, enter dialing digits in the **Field 1**, **Field 2**, and **Field 3** columns.

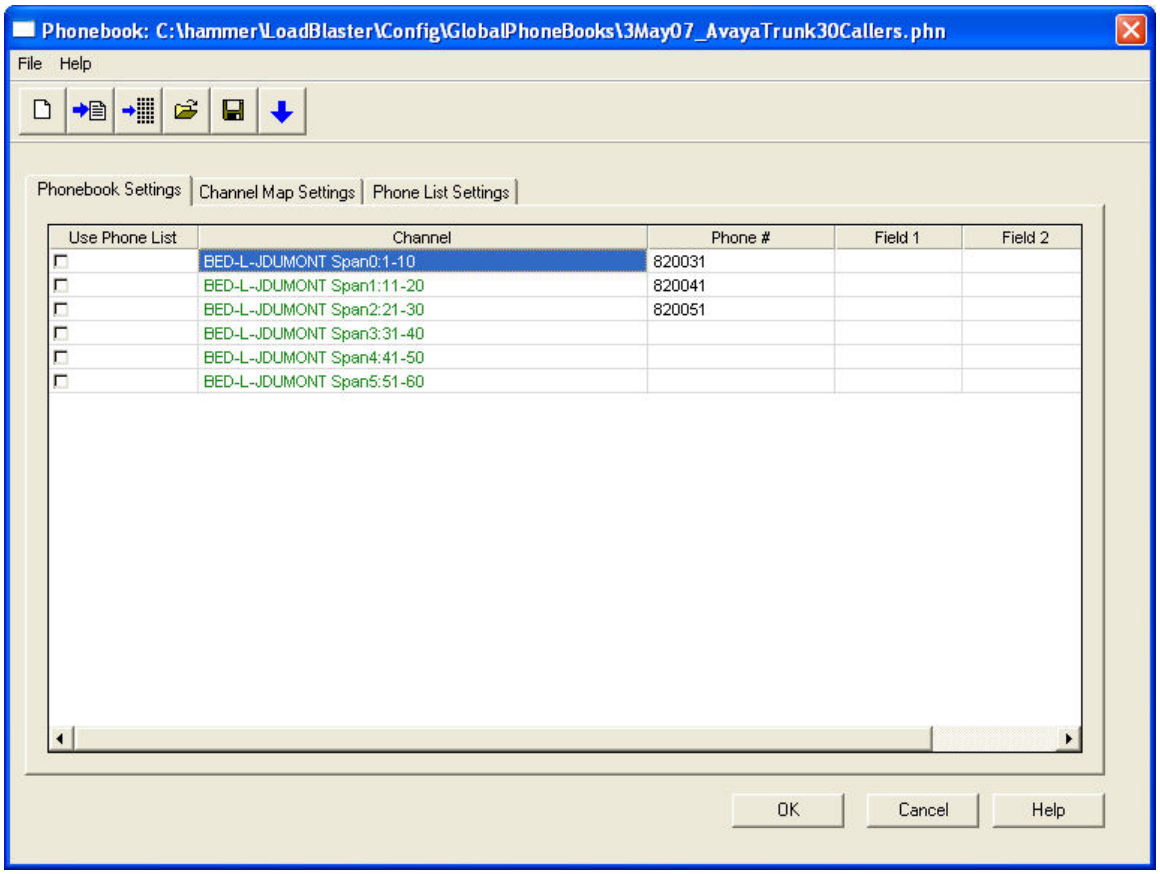


Figure 14 – Phone Book

5. When finished entering values, select **File → Save**. The **Save PhoneBook** dialog box appears.
6. Enter a file name and click **Save**. If prompted to overwrite an existing Phone Book, click **Yes**. Phone Book files (including .phn, .map, and .lst) are saved in the ..\LoadBlaster\Config\GlobalPhoneBooks directory.
7. When asked if the user wants to replace the Test Builder default Phone Book with the latest saved Phone Book, click **Yes**. Otherwise, click **No**.

   If **Yes** is selected, the system copies the PhoneBook files to every Hammer server connected to the system. These files become the default PhoneBook. If tests are running, the new default PhoneBook files will take effect after all tests have stopped.

   If **No** is selected, the user can replace TestBuilder with the latest saved PhoneBook files later by opening the saved PhoneBook and selecting **Update** on the Hammer Configurator TestBuilder menu.

8. Select **File → Exit** to close the PhoneBook Suite window.

4.2.3. Building an FX-IP Test Builder Test

TestBuilder is a telephony testing software package that allows users to easily create and run load tests using a simple graphical interface. TestBuilder provides the following:

- Two interfaces for creating tests. Users can assemble test action icons in a TestBuilder ladder diagram, or write a test script using Hammer Visual Basic (HVB) in the HVB editor.
- Test monitors show test statistics and channel status in real-time as a test runs.
- Reports created after a test finishes provide detail for an entire test and for individual channels.
- Scheduling options including the ability to run multiple tests simultaneously.
- TestBuilder Plus includes predefined calling patterns that enable a user to simulate real world operating conditions. A user can schedule a test on a group of channels and allow the Hammer to control when each channel starts in order to create the selected calling pattern.

1. Launch TestBuilder by clicking the  icon.
2. Open the ConfirmPath.hld test from **Hammer → CallProfileTests** as shown in **Figure 15**.

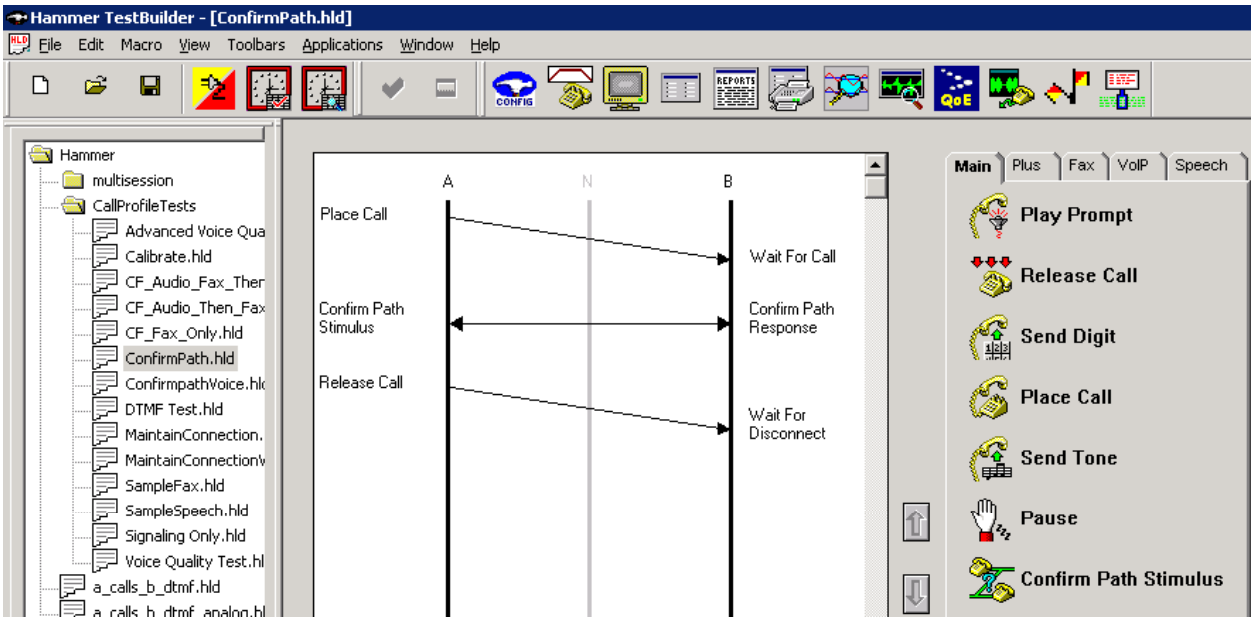


Figure 15 – Sample Test Script

3. Righ-click on the **Place Call** action to display its properties as shown in **Figure 16**.

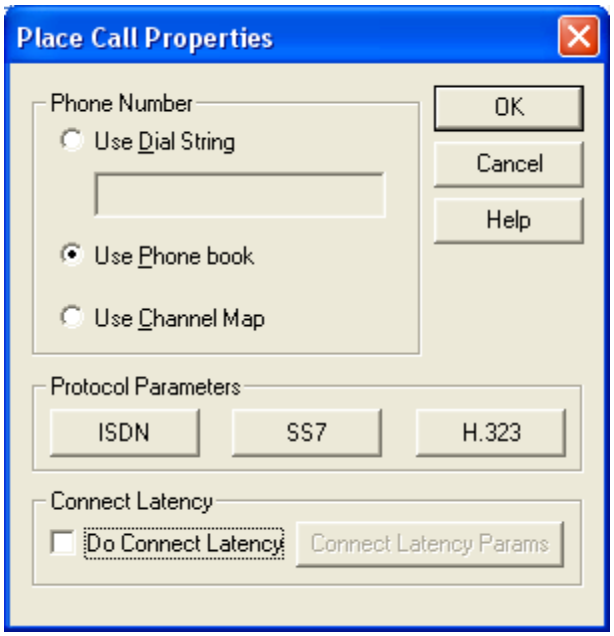


Figure 16– Place Call Properties Settings

4. The Place Call action object allows the user to configure the destination phone number to be used. Alternatively a dial plan can be created in the Phone Book. For more information on building a Phone Book in the Hammer Configurator click **Help → How To → Enter Phone Numbers to Call → Entering Phone Numbers and Destination Addresses**.

5. Right click on the **Confirm Path** action object and click properties. From this window, shown in **Figure 17**, the user can select to use either **Tones** or **Voice** media in the test. To define the type of media.

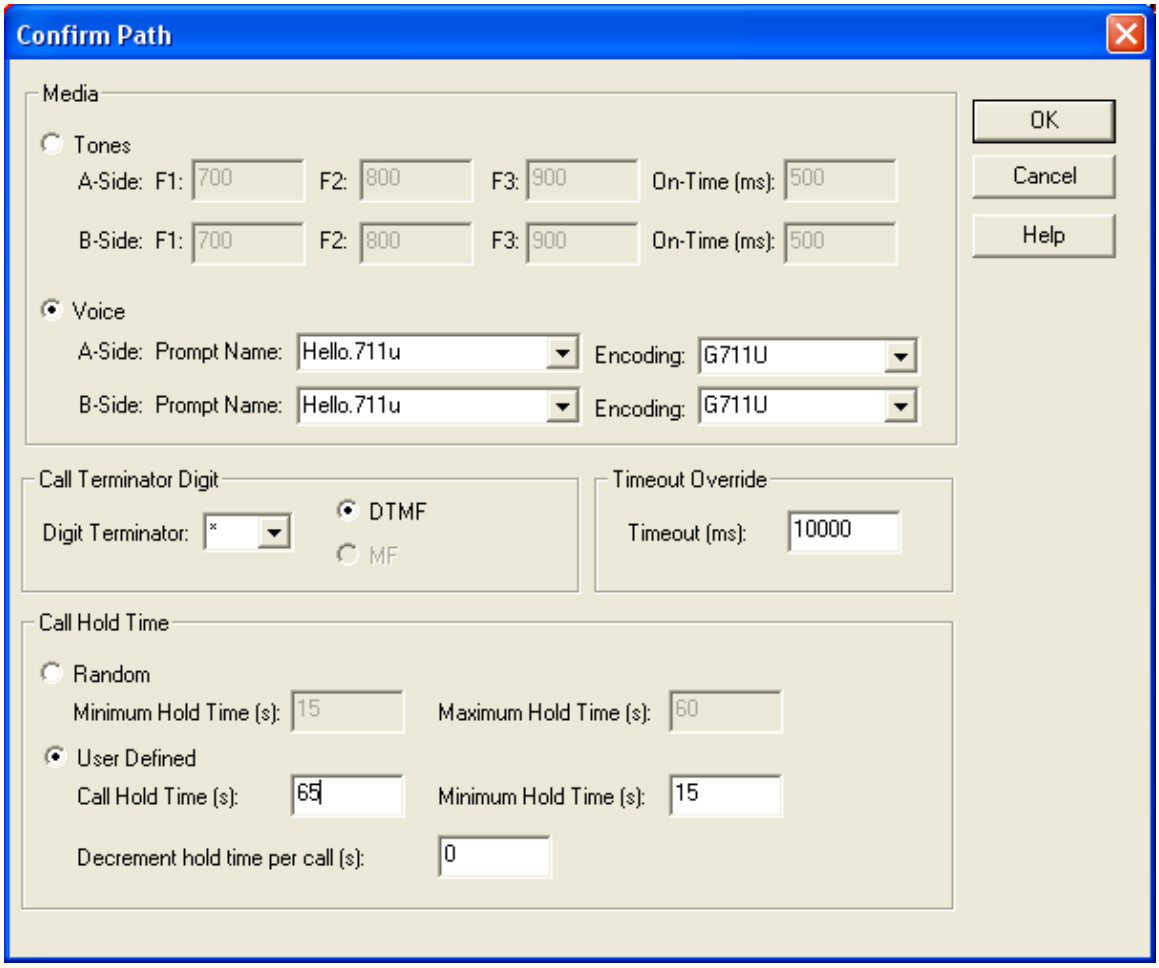


Figure 17 – Confirm Path Using Voice Prompts for G711U

6. Select an appropriate prompt to be played in both directions. With the configuration in **Figure 17**, the Hello prompt will be played by both the calling and answering sides repeatedly for 65 seconds.

4.2.4. Executing a TestBuilder Test

To execute a test follow these steps:

1. Right click on the test case name in the left side display.
2. Click on schedule followed by Edit and Run.
3. Select the parameters as shown in **Figure 18**.

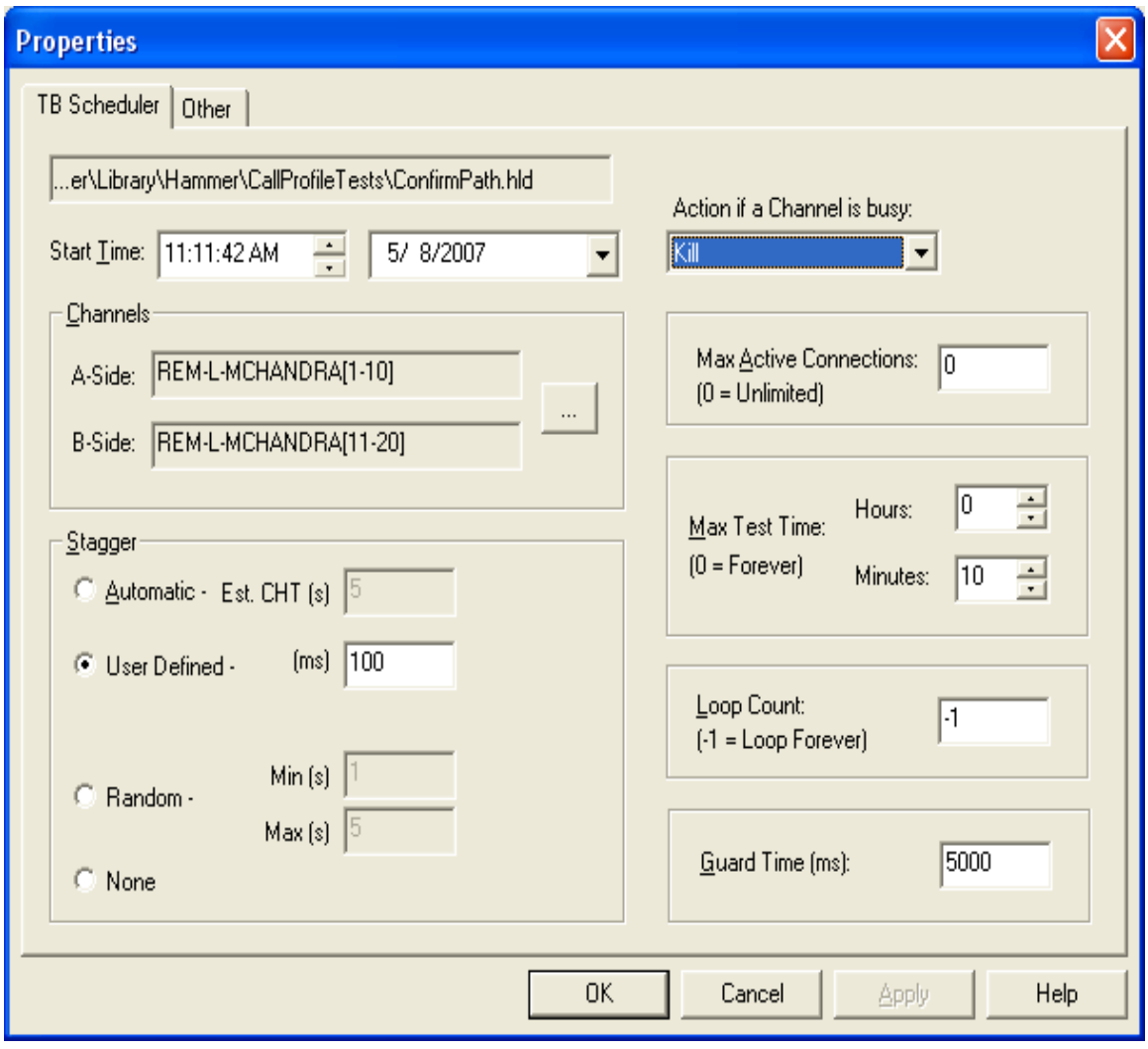


Figure 18 – Test Builder Scheduler

4. Select the channels to use to execute the test for A side and B side as shown in **Figure 19**, and click **OK**. Click **OK** in the main window to start the test. Test execution will now begin at the scheduled time.

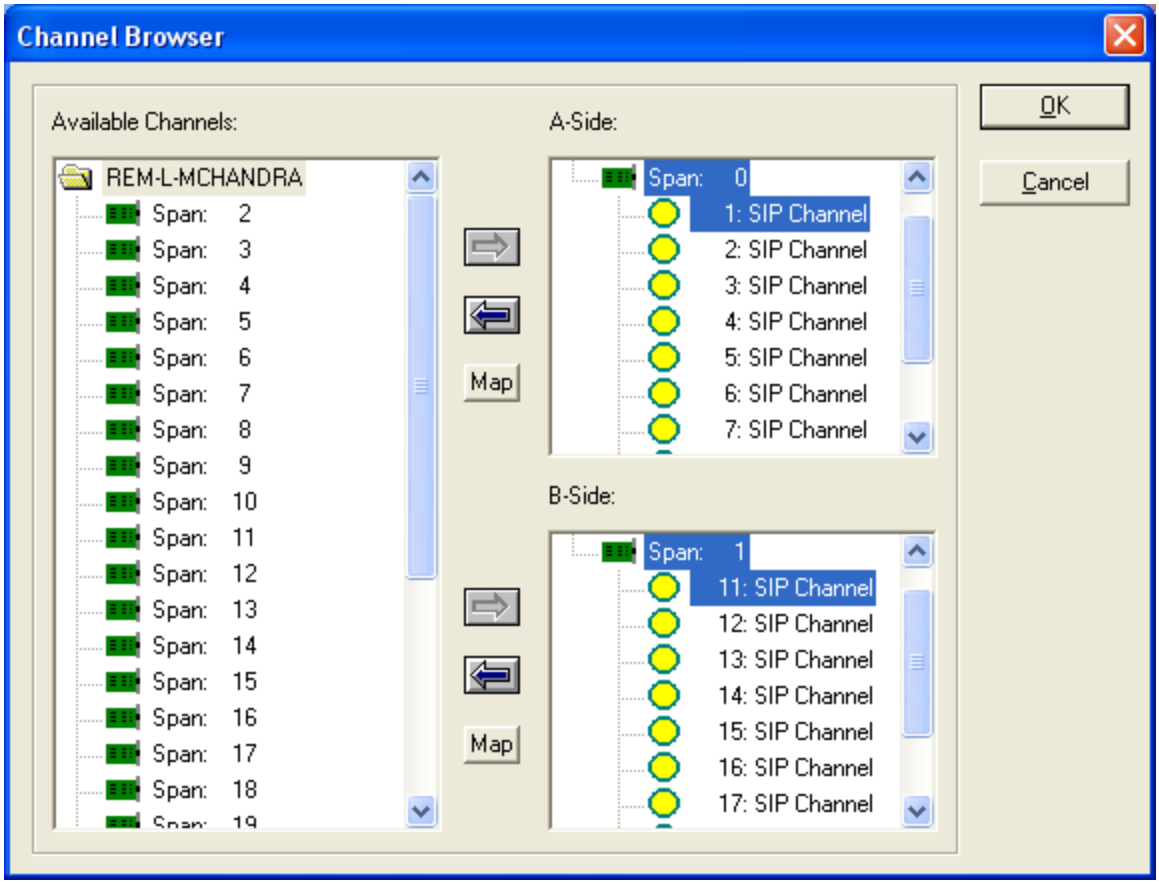


Figure 19 – Test Builder Scheduler

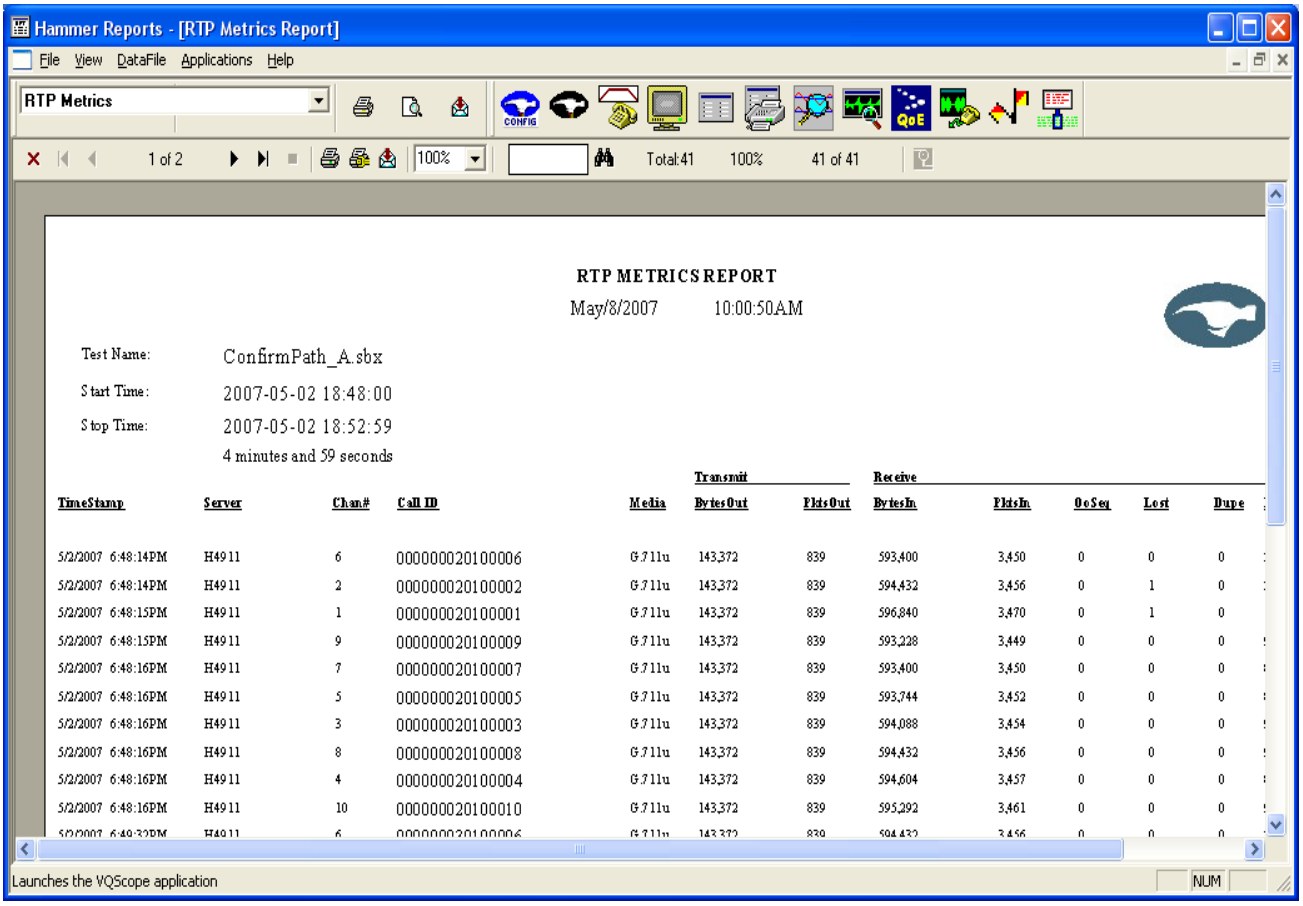
4.2.5. Generating a Report with Hammer Reports

After test execution has concluded, test results including a call detail report, call summary report, and RTP Metrics report can be generated.

1. Launch the reports tool by clicking the 

icon. See **Figure 5**.
2. From the drop-down list in the top left-hand corner of the window, select the type of report to be generated.
3. A new dialog box will appear. From the dialog box select the test named **Confirm Path** with the appropriate time and date stamp for the test.

The report will be displayed on the screen as shown in **Figure 20**.



TimeStamp	Server	Chan#	Call ID	Media	Transmit BytesOut	Transmit PktsOut	Receive BytesIn	Receive PktsIn	OoSeq	Lost	Dupe
5/2/2007 6:48:14PM	H4911	6	000000020100006	G.711u	143,372	839	593,400	3,450	0	0	0
5/2/2007 6:48:14PM	H4911	2	000000020100002	G.711u	143,372	839	594,432	3,456	0	1	0
5/2/2007 6:48:15PM	H4911	1	000000020100001	G.711u	143,372	839	596,840	3,470	0	1	0
5/2/2007 6:48:15PM	H4911	9	000000020100009	G.711u	143,372	839	593,228	3,449	0	0	0
5/2/2007 6:48:16PM	H4911	7	000000020100007	G.711u	143,372	839	593,400	3,450	0	0	0
5/2/2007 6:48:16PM	H4911	5	000000020100005	G.711u	143,372	839	593,744	3,452	0	0	0
5/2/2007 6:48:16PM	H4911	3	000000020100003	G.711u	143,372	839	594,088	3,454	0	0	0
5/2/2007 6:48:16PM	H4911	8	000000020100008	G.711u	143,372	839	594,432	3,456	0	0	0
5/2/2007 6:48:16PM	H4911	4	000000020100004	G.711u	143,372	839	594,604	3,457	0	0	0
5/2/2007 6:48:16PM	H4911	10	000000020100010	G.711u	143,372	839	595,292	3,461	0	0	0

Figure 20 – Sample Report

5. Interoperability Compliance Testing

The interoperability compliance testing focused on the following areas:

- H.323 trunks between Avaya Communication Manager and Empirix Hammer FX-IP.
- Generation of moderate load from the Empirix Hammer FX-IP to Avaya Communication Manager via the H.323 trunk interface, and back out to the Empirix Hammer FX-IP.
- Support of the following audio codecs with Avaya Communication Manager: G.711MU, G.729AB, G.723-6.3K.
- Voice quality as measured by PESQ scores with path confirmation.
- Support of non-direct audio, and direct audio with media shuffling.
- Recovery from adverse conditions during a load test.

5.1. General Test Approach

The feature test cases were conducted by using the Empirix Hammer FX-IP to originate and terminate H.323 trunk calls to Avaya Communication Manager. The audio codec test calls were connected for 60 seconds. The serviceability test cases were performed by disconnecting and reconnecting the LAN cable to the Empirix Hammer FX-IP.

The verification included monitoring of various reports from the Empirix Hammer FX-IP during and after the traffic runs, and checking the status of various H.323 resources on Avaya Communication Manager.

5.2. Test Results

All test cases were executed and passed.

The following was observed during the introduction of failures: when the Ethernet cable was disconnected from the Empirix Hammer FX-IP, the test stopped and trunks were left in an active state in Avaya Communication Manager. The Empirix Hammer FX-IP had no way to release the trunks after the cable was disconnected. The condition was cleared by a manual “busy-out” and “release” of the trunks in Avaya Communication Manager.

6. Verification Steps

This section provides verification steps that can be performed to verify proper configuration of H.323 between Avaya Communication Manager and the Empirix Hammer FX-IP.

6.1. Avaya Communication Manager commands

- Use the "status signaling-group x" command, where "x" is the signaling group used, to verify that the "service state" of the signaling group is "in-service"

- Use the "status trunk x" command, where "x" is the trunk group used, to verify that the trunks' **Service State** is "in-service/idle" when no calls are active or "in-service/active" when a call is active on the trunk.

- Use the "status trunk x/y" command, where "x" is the trunk group used and "y" is the trunk group member used, to verify the IP codec and whether shuffling was used. The codec in use appears to the left of the **Audio** field. The **Audio Connection Type** field shows "ip-direct" if shuffling is used, or "ip-tdm" otherwise. Additional information is also displayed with this command, such as the endpoint and signaling IP addresses.

6.2. Empirix Hammer FX-IP

The Hammer System Monitor is an application that displays the current status of each channel and displays the log messages each channel generates. The System Monitor also provides the user with the ability to stop specific channels, spans, or the entire server. A user can choose to stop channels immediately, or can select the gradual stop option that causes channels to complete their current test iteration before stopping. This section describes how to use the System Monitor along with the type of information that can be gathered during running tests.

If there are speakers connected to the system, a user can listen to the media sent and received on the currently selected channel. One speaker will play transmitted audio, the other will play received audio. No audio is played for RFC 2833 DTMF digits.

To monitor a channel, select System Monitor from the Applications menu, or click the  icon on the desktop. When the System Monitor is opened, the screen will look similar to **Figure 21**.

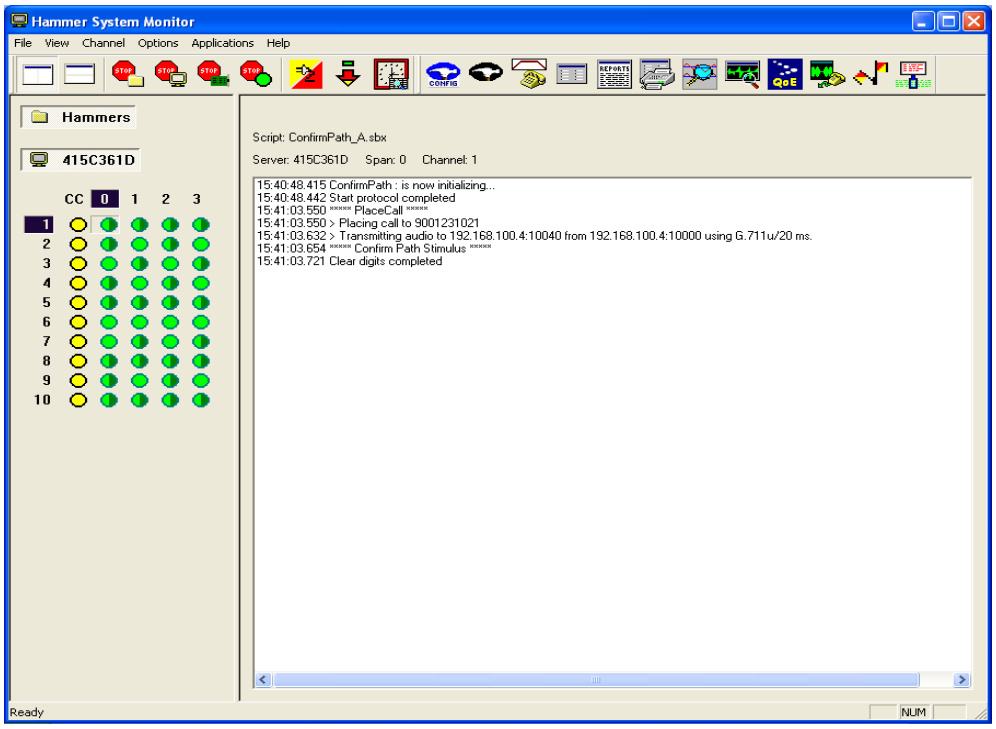


Figure 21 – Monitor Screen

1. After the Hammer System Monitor window appears, select a server to monitor.

   Note: Each server controlled by the system will be listed on top of the channel status area (left pane). If the system controls more than one FX-IP, FX-TDM, NXT-IP, or NXT-TDM system, then the name of each server will appear in separate buttons. This allows for monitoring the status of channels on any system.

2. Click the channel whose log messages are to be viewed. Information above the log message display shows the active test script, server, span, and channel. The channel status and log messages update as a test runs.
3. To select the detail level of the messages for a specific channel, right-click a channel, select Log Level from the pop-up menu, and choose the level of log message detail: None, Failure, Normal, or Debug.
4. Optionally, enable or disable gradual stop. If gradual stop is enabled and there is an attempt to stop a test, each channel finishes its current iteration of the test before stopping. Otherwise, the channel will stop immediately.

7. Support

Technical support on Empirix Hammer FX-IP can be obtained by contacting Empirix directly:

- Email: support@empirix.com
- Phone : +1.781.266.3202

8. Conclusion

These Application Notes describe the configuration steps required for Empirix Hammer FX-IP Release 2.4.1 to interoperate with Avaya Communication Manager 4.0. All feature and serviceability test cases completed successfully.

9. Additional References

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

- *Administrator Guide for Avaya Communication Manager*, Document 03-300509, Issue 3, February 2007, available at http://support.avaya.com.

- *Administrator for Network Connectivity for Avaya Communication Manager*, Document 555-233-504, Issue 12, February 2007, available at http://support.avaya.com.

- *Empirix Hammer Fx-IP Online Help.*

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 Developer*Connection* Program at devconnect@avaya.com.