



## Avaya Solution & Interoperability Test Lab

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# Application Notes for Twisted Pair Solutions WAVE with Avaya Communication Manager using H.323 IP Trunks – Issue 1.1

### Abstract

These Application Notes describe the configuration procedures required to allow Twisted Pair Solutions Wide Area Voice Environment (WAVE) communicate across a H.323 IP trunk to endpoints controlled by Avaya Communication Manager. Twisted Pair Solutions WAVE is a software application suite that enables group communication and interoperation between diverse endpoints and networks. Internally, WAVE creates communication “channels” where endpoints communicate via a shared multicast IP address. These channels are “always on” and endpoints can tune into the channels at any time. Because of this, WAVE is particularly suited for addressing the needs of communication environments that require this type of “always on” communication. Examples include:

1. Hoot and Holler networks for financial markets.
2. Land Mobile Radio (LMR) networks for first responders and defense markets requiring radio interoperability.

The compliance testing focused on verifying that endpoints and trunk calls controlled by Avaya Communication Manager could connect to the communication channels hosted by WAVE, interoperate with WAVE endpoints and participate with acceptable voice quality. Basic serviceability and performance testing was also conducted to assess the reliability of the solution. Information in these Application Notes has been obtained through compliance testing and additional technical discussions. Testing was conducted via the Developer*Connection* Program at the Avaya Solution and Interoperability Test Lab.

# 1. Introduction

These Application Notes describe a compliance-tested group communication solution comprised of Avaya Communication Manager and Twisted Pair Solutions Wide Area Voice Environment (WAVE). Twisted Pair Solutions WAVE is a software application suite that enables group communication and interoperation between diverse endpoints and networks. Internally, WAVE creates communication “channels” where endpoints communicate via a shared multicast IP address. These channels are “always on” and endpoints can tune into the channels at any time. Because of this, WAVE is particularly suited for addressing the needs of communication environments that require this type of “always on” communication. Examples include:

1. Hoot and Holler networks for financial markets
2. Land Mobile Radio (LMR) networks for first responders and defense markets requiring radio interoperability.

Any endpoint that can directly connect to the multicast IP address that carries the WAVE channel is generically referred to as a WAVE endpoint. Examples include the WAVE Desktop Communicator PC application and land mobile radios even though the radios use an access router to gain access to the IP network.

Non-WAVE endpoints require a “session” to connect to a WAVE channel. Endpoints that are controlled by Avaya Communication Manager fall in this category. A session is a logical component internal to WAVE that serves as an entry point to a specific channel or bridges between channels. In the case of the compliance test, a session was created that was accessible via a dial-in number. Endpoints that were controlled by Avaya Communication Manager would dial this number to access the associated channel.

WAVE communicates to Avaya Communication Manager via a H.323 IP trunk. For the compliance test, a set of extensions on Avaya Communication Manager were reserved for use by WAVE. Each of these extensions represented a different WAVE session that was connected to a different WAVE channel. Avaya Communication Manager routed calls to these extensions across the H.323 IP trunk associated with WAVE. The appropriate WAVE session would answer the call at the other end and prompt the caller for a PIN number if required. After the PIN was entered by the caller, the caller was then connected to the associated WAVE channel and could now communicate with all other users of the channel.

The general test approach focused on verifying that endpoints and trunk calls controlled by Avaya Communication Manager could connect to communication channels hosted by WAVE, interoperate with WAVE endpoints and participate with acceptable voice quality. In addition, serviceability and performance testing were also conducted to assess the reliability of the solution.

WAVE was tested with Avaya Communication Manager in both a Hoot and Holler network application and a LMR network application. The configuration of Avaya Communication

Manager and the WAVE Media Server is the same for both of these applications. However, the configuration of WAVE channels and sessions will be different. These Application Notes show the WAVE channel and session configuration of the Hoot and Holler application which is the simpler of the two. For details on configuring WAVE channels and sessions for a LMR application, please refer to reference [3].

The components of WAVE used in the compliance test are listed below. These Application Notes will describe the configuration of each component. In addition, the WAVE Media Server configuration will include a description of creating channels and sessions. The components include:

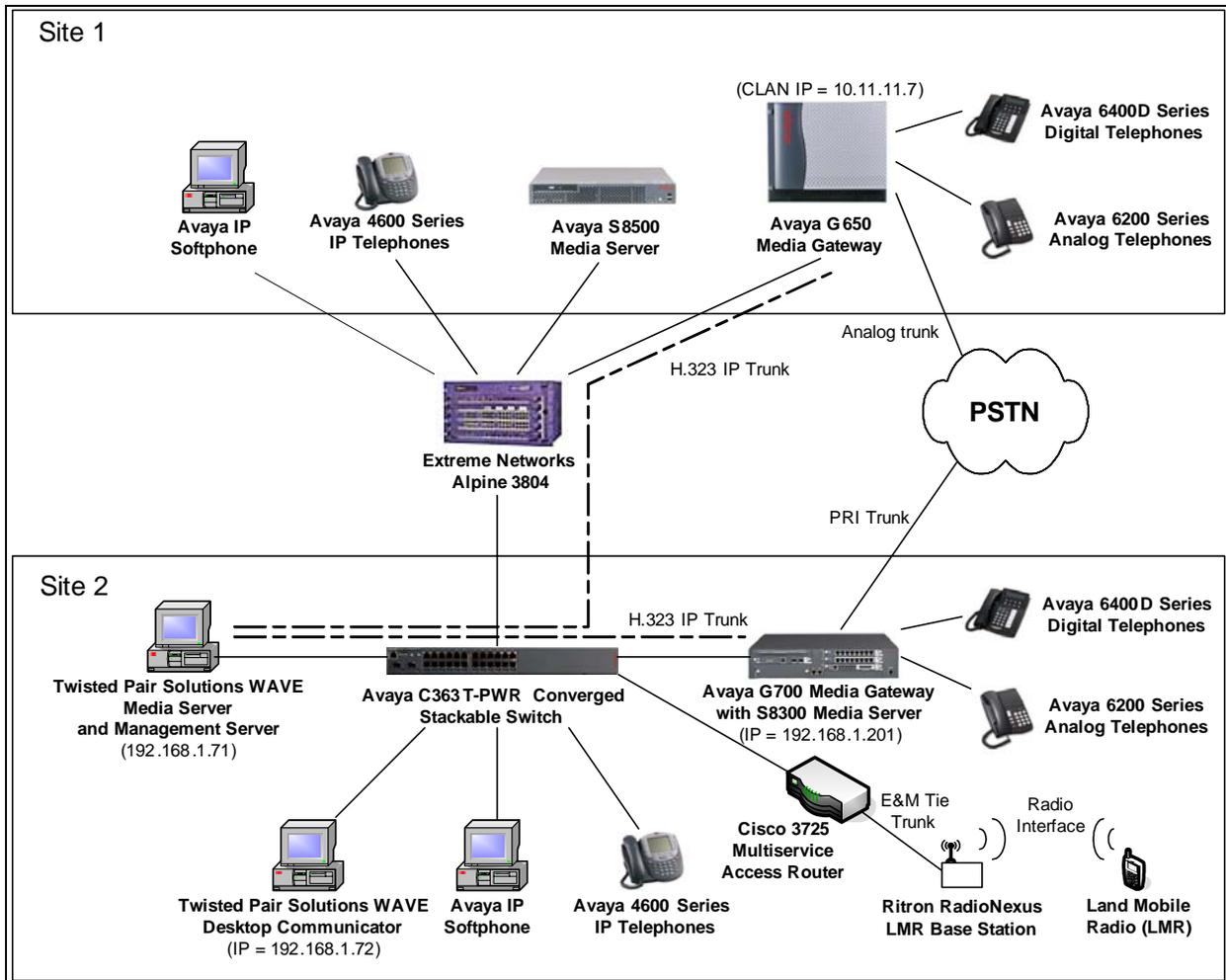
1. *WAVE Management Server* - The WAVE Management Server is the software application for configuring a WAVE system.
2. *WAVE Media Server* - The WAVE Media Server is the software application that provides all the media processing for WAVE.
3. *WAVE Desktop Communicator* - The WAVE Desktop Communicator is the software application that provides a user interface that allows a PC to become a communication device that can access a WAVE communication channel.

**Figure 1** illustrates the sample configuration that was used for the compliance test. It is comprised of two sites each with an Avaya Media Server running Avaya Communication Manager. There is a Twisted Pair Solutions WAVE Media Server located at site 2. The WAVE Media Server communicates to Avaya Communication Manager at each site via a H.323 IP trunk established between itself and each of the Avaya Media Servers. There are no trunks directly between the two Avaya Media Servers. Thus, the only way that endpoints controlled by one Avaya Communication Manager can communicate to endpoints controlled by the other Avaya Communication Manager is through the WAVE Media Server.

Located at site 1 is an Avaya S8500 Media Server running Avaya Communication Manager with an Avaya G650 Media Gateway. Avaya 6400D Series Digital Telephones, Avaya 6200 Series Analog Telephones and an analog trunk are connected to the Media Gateway. Avaya 4600 Series IP Telephones and an Avaya IP Softphone are registered to the Avaya S8500 Media Server.

Located at site 2 is an Avaya S8300 Media Server running Avaya Communication Manager with an Avaya G700 Media Gateway. Avaya 6400D Series Digital Telephones, Avaya 6200 Series Analog Telephones, and a PRI trunk are connected to the Media Gateway. Avaya 4600 Series IP Telephones and an Avaya IP Softphone are registered to the Media Server. Additional endpoints at site 2 include a Twisted Pair Solutions WAVE Desktop Communicator and land mobile radios (LMRs) connected through a Ritron RadioNexus LMR Base Station to a Cisco 3725 Multiservice Access Router which acts as gateway to the IP network for the radios.

The IP network connecting the two sites is an Avaya C363T-PWR Converged Stackable Switch and Extreme Networks Alpine 3804 switch.



**Figure 1: Test Configuration for Twisted Pair Solutions WAVE Compliance Test**

## 2. Equipment and Software Validated

The following equipment and software/firmware were used for the test configuration provided.

Equipment	Software/Firmware
Avaya S8300 Media Server	Communication Manager 3.0.1 (R013x.00.1.346.0)
Avaya G700 Media Gateway (Media Gateway Processor)	24.21.1
Avaya S8500 Media Server	Communication Manager 3.0.1 (R013x.00.1.346.0)
Avaya G650 Media Gateway	-
TN2312BP IP Server Interface (IPSI)	HW03 FW22
TN799DP C-LAN Interface (C-LAN)	HW01 FW15
TN2302AP IP Media Processor (MEDPRO)	HW20 FW105

Equipment	Software/Firmware
Avaya 4600 Series IP Telephones	2.3 (4610SW H.323) 2.3 (4620SW H.323) 2.5 (4625SW H.323)
Avaya IP Softphones	5.2
Avaya C363T-PWR Converged Stackable Switch	4.5.14
Extreme Networks Alpine 3804	7.2.0 Build 25
Twisted Pair Solutions WAVE Media Server Software	2.03 (SP1) running on Windows 2003 Server SP1
Twisted Pair Solutions WAVE Management Server Software	2.03 (SP1) running on Windows 2003 Server SP1
Twisted Pair Solutions WAVE Desktop Communicator	2.03 (SP1) running on Windows XP Professional
Cisco 3725 Multiservice Access Router with Advanced Enterprise Options	IOS 12.4.1A
Ritron RadioNexus LMR Base Station	-
Land Mobile Radio	-

### 3. Configure Avaya Communication Manager

This section describes the procedure for configuring a H.323 IP trunk on Avaya Communication Manager. These steps are performed through the System Access Terminal (SAT). These steps describe the procedure used for the Avaya S8300 Media Server. All steps are the same for the other Media Servers unless otherwise noted.

Step	Description
1.	<p>Use the <b>change node-names ip</b> command to associate a <b>Name</b> with the <b>IP Address</b> of the host that will terminate the far-end of the H.323 trunk. For the compliance test, WAVE was chosen as the node name and the host running the WAVE Media Server had an IP address of 192.168.1.71.</p> <p>The near-end of the H.323 trunk is terminated by the Avaya S8300 Media Server. The Avaya S8300 Media Server has a pre-defined node name of procr. This node name is shown in the example below as having <b>IP Address</b> of 192.168.1.201. This information will be used in subsequent steps.</p> <pre> change node-names ip                                     Page 1 of 1 Name              IP Address      IP NODE NAMES Name              IP Address Wireless-S8500   10 .11 .11 .7   . . . default          0 .0 .0 .0      . . . <b>procr</b>           <b>192.168.1 .201</b> . . . <b>WAVE</b>           <b>192.168.1 .71</b>  . . . </pre>

Step	Description
2.	<p>Create a signaling group for the H.323 trunk by using the <b>add signaling-group x</b> command where x is the number of an available signaling group. Set the <b>Group Type</b> field to h.323. The <b>Near-end Node Name</b> field is set to procr which is the node name of the Avaya S8300 Media Server. In the case of the Avaya S8500 or other Media Server, the <b>Near-end Node Name</b> field would be set to the node name of the resident C-LAN. The <b>Far-end Node Name</b> field is set to WAVE which is the node name created in the previous step for the WAVE Media Server. The <b>Near-end Listen Port</b> and <b>Far-end Listen Port</b> fields must be set to 1720. This is the port number that WAVE uses for H.323 signalling. The <b>Far-end Network Region</b> field is set to 1. Set the <b>DTMF over IP</b> field to out-of-band. This field should not be set to in-band even if G.711 encoding is used exclusively. The <b>Trunk Group for Channel Selection</b> field will be added later after the trunk group is created.</p> <div data-bbox="342 705 1390 1276" style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <pre> add signaling-group 4                                     Page 1 of 5                                      SIGNALING GROUP  Group Number: 4           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: Supplementary Service Protocol: a T303 Timer(sec): 10  Near-end Node Name: procr           Far-end Node Name: WAVE 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 Direct IP-IP Audio Connections? y IP Audio Hairpinning? y Interworking Message: PROGRESS DCP/Analog Bearer Capability: 3.1kHz DTMF over IP: out-of-band </pre> </div>

Step	Description
3.	<p>Create the trunk group for the H.323 trunk using the <b>add trunk-group x</b> command where <i>x</i> is the number of an available trunk group. Set the <b>Group Type</b> field to isdn. Enter any descriptive name in the <b>Group Name</b> field. In the <b>TAC</b> field, enter a trunk access code that is consistent with the dial plan. Set the <b>Dial Access</b> field to y. Set the <b>Service Type</b> field to tie.</p> <div data-bbox="342 449 1390 1016" style="border: 1px solid black; padding: 10px;"> <pre> add trunk-group 4                                     Page 1 of 20                                      TRUNK GROUP Group Number: 4                                     Group Type: isdn          CDR Reports: y   Group Name: WAVE                                  COR: 1                   TN: 1          TAC: 104   Direction: two-way                               Outgoing Display? n      Carrier Medium: IP   Dial Access? y                                   Busy Threshold: 255      Night Service: Queue Length: 0 Service Type: tie                                   Auth Code? n             TestCall ITC: rest                                      Far End Test Line No: TestCall BCC: 4 TRUNK PARAMETERS   Codeset to Send Display: 6                       Codeset to Send National IEs: 6   Max Message Size to Send: 260                    Charge Advice: none   Supplementary Service Protocol: a                Digit Handling (in/out): enbloc/enbloc                                      Trunk Hunt: cyclical                                      Digital Loss Group: 18 Incoming Calling Number - Delete:                  Insert:                   Format:   Bit Rate: 1200                                   Synchronization: async  Duplex: full Disconnect Supervision - In? y Out? n Answer Supervision Timeout: 0 </pre> </div>
4.	<p>On <b>Page 4</b> of this same command, enter ip in the <b>Port</b> field for each member to be added to this trunk group. For each member added, set the <b>Sig Grp</b> field to the number of the signaling group created in the previous step, in this case 4.</p> <div data-bbox="329 1199 1401 1581" style="border: 1px solid black; padding: 10px;"> <pre> add trunk-group 4                                     Page 4 of 20                                      TRUNK GROUP Administered Members (min/max): 0/0 GROUP MEMBER ASSIGNMENTS                          Total Administered Members: 0 Port      Code Sfx Name      Night      Sig Grp 1: ip 2: ip 3: ip 4: ip 5: ip 6: ip 7: ip 8: ip 9: </pre> </div>

Step	Description
5.	<p>Return to the signaling group form of the signaling group created earlier by using the <b>change signaling-group 4</b> command. Set the <b>Trunk Group for Channel Selection</b> field to 4 to associate trunk group 4 to this signaling group.</p> <pre data-bbox="342 373 1390 947"> add signaling-group 4                                     Page 1 of 5                 SIGNALING GROUP  Group Number: 4          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: <b>Trunk Group for Channel Selection: 4</b> Supplementary Service Protocol: a                         T303 Timer(sec): 10  Near-end Node Name: procr          Far-end Node Name: WAVE 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                                     IP Audio Hairpinning? y                                     Interworking Message: PROGRESS DCP/Analog Bearer Capability: 3.1kHz </pre>
6.	<p>Create a route pattern to use the H.323 trunk. To accomplish this, use the <b>change route-pattern x</b> command where <i>x</i> represents an unused route pattern. In the <b>Pattern Name</b> field, enter any descriptive name. In the <b>Grp No</b> field enter the number of the trunk group created in the Step 3. Set the <b>FRL</b> field to 0.</p> <pre data-bbox="337 1163 1398 1734"> change route-pattern 65                               Page 1 of 3                 Pattern Number: 65  <b>Pattern Name: WAVE</b>                 Secure SIP? n    <b>Grp FRL</b> NPA Pfx Hop Toll No.  Inserted          DCS/ IXC   <b>No</b>          Mrk Lmt List Del  Digits          QSIG                 Dgts 1: 4    0 2: 3: 4: 5: 6:        BCC VALUE  TSC CA-TSC      ITC BCIE Service/Feature PARM  No. Numbering LAR       0 1 2 3 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 </pre>

Step	Description
7.	<p>Use the <b>change dialplan analysis</b> command to create a range of dialed digits that will be routed by Automatic Alternate Routing (AAR) to the WAVE Media Server. For the compliance test, all 5-digit extensions beginning with 65 were reserved for use by WAVE. Thus in the example below, an entry was added with the <b>Dialed String</b> field set to 65, the <b>Total Length</b> field set to 5 and the <b>Call Type</b> field set to aar. This entry results in all dialed strings beginning with 65 and 5 digits in length being routed by AAR.</p> <pre data-bbox="342 520 1390 936"> change dialplan analysis                                     Page 1 of 12  DIAL PLAN ANALYSIS TABLE  Percent Full: 1    Dialed Total Call      Dialed Total Call      Dialed Total Call   String Length Type     String Length Type     String Length Type     0         1   attd     1         3   dac     2         3   fac     3         4   ext    33         4   aar     6         5   aar    64         5   ext    65         5   aar     8         1   fac     9         1   fac </pre>
8.	<p>Use the <b>change aar analysis x</b> command, where <i>x</i> is the digit string of interest, to define which route pattern will be chosen when the digit string is dialed. For the compliance test, all 5-digit extensions beginning with 65 were routed to the WAVE Media Server. Route pattern 65 is the route pattern created in Step 6 that uses the trunk group associated with the H.323 trunk terminated at the WAVE Media Server. Thus, an entry was added to the <b>AAR DIGIT ANALYSIS TABLE</b> with the <b>Dialed String</b> field set to 65, <b>Total Min</b> field set to 5, the <b>Total Max</b> field set to 5, <b>Route Pattern</b> set to 65 and <b>Call Type</b> set to aar.</p> <pre data-bbox="342 1304 1390 1608"> change aar analysis 65                                     Page 1 of 2  AAR DIGIT ANALYSIS TABLE  Percent Full: 1        Dialed      Total      Route      Call      Node      ANI       String      Min Max     Pattern     Type     Num     Reqd    65              5  5       65       aar         n     7              7  7       254      aar         n     8              5  5         2      aar         n     9              7  7       254      aar         n </pre>

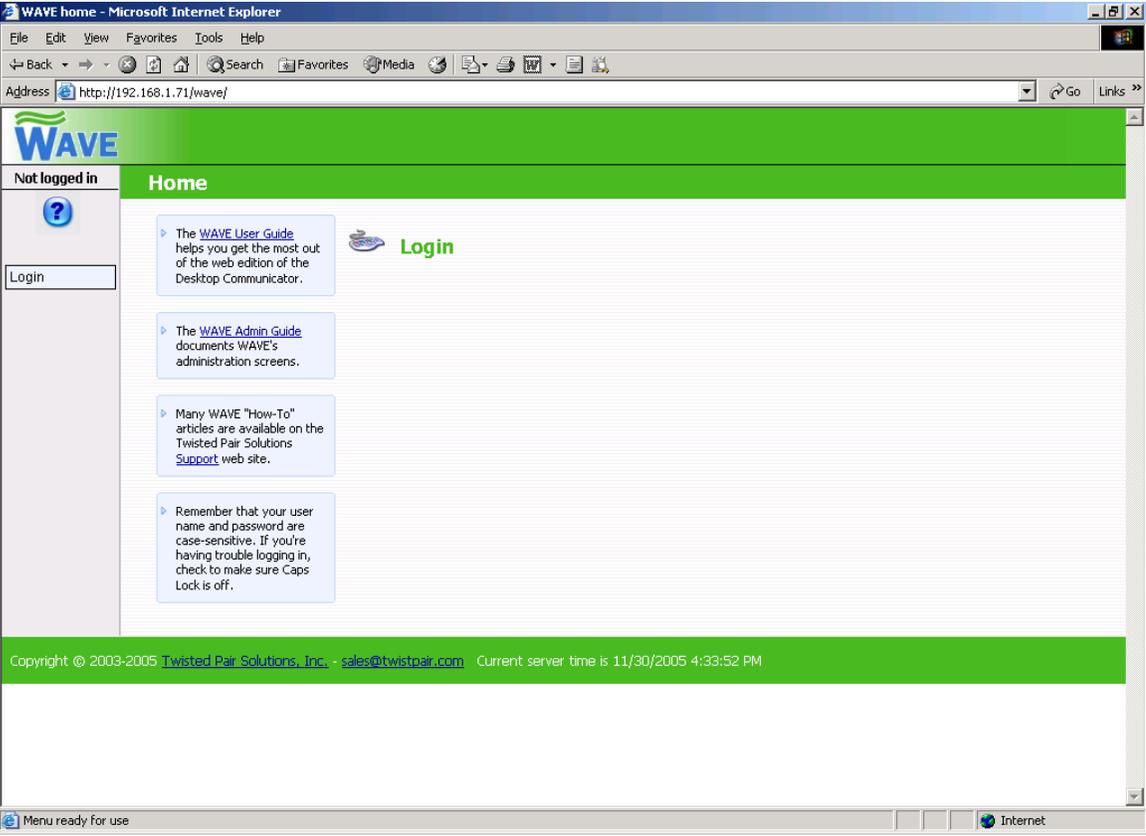
Step	Description																																
9.	<p>Define the codecs supported on the H.323 trunk by configuring the ip-codec-set. Use the <b>change ip-codec-set x</b> command to define the list of codecs, where <i>x</i> is the number of the ip-codec-set associated with the H.323 trunk.</p> <p>The ip-codec-set associated with the trunk is based on which ip-network-region the near-end node of the trunk resides. Use the <b>list ip-interface all</b> command to view the ip-network-region associated with the near-end node. Use the <b>display ip-network-region</b> command for that region to view the ip-codec-set used by the trunk.</p> <p>In the compliance test, ip-codec-set 1 was associated with the H.323 trunk. The compliance test verified the use of G.729 and G.711MU codecs when these codecs were each the only entry in the codec list.</p> <p><i>Note: It was observed that if both codecs were present in the codec list, G.729 had to be listed first as shown below. Otherwise, the connection resulted in no audio.</i></p> <div data-bbox="332 814 1398 1199" style="border: 1px solid black; padding: 10px;"> <pre>change ip-codec-set 1                                     Page 1 of 2</pre> <p style="text-align: center;">IP Codec Set</p> <p>Codec Set: 1</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Audio Codec</th> <th>Silence Suppression</th> <th>Frames Per Pkt</th> <th>Packet Size(ms)</th> </tr> </thead> <tbody> <tr> <td>1: G.729</td> <td>n</td> <td>2</td> <td>20</td> </tr> <tr> <td>2: G.711MU</td> <td>n</td> <td>2</td> <td>20</td> </tr> <tr> <td>3:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>5:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>6:</td> <td></td> <td></td> <td></td> </tr> <tr> <td>7:</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> </div>	Audio Codec	Silence Suppression	Frames Per Pkt	Packet Size(ms)	1: G.729	n	2	20	2: G.711MU	n	2	20	3:				4:				5:				6:				7:			
Audio Codec	Silence Suppression	Frames Per Pkt	Packet Size(ms)																														
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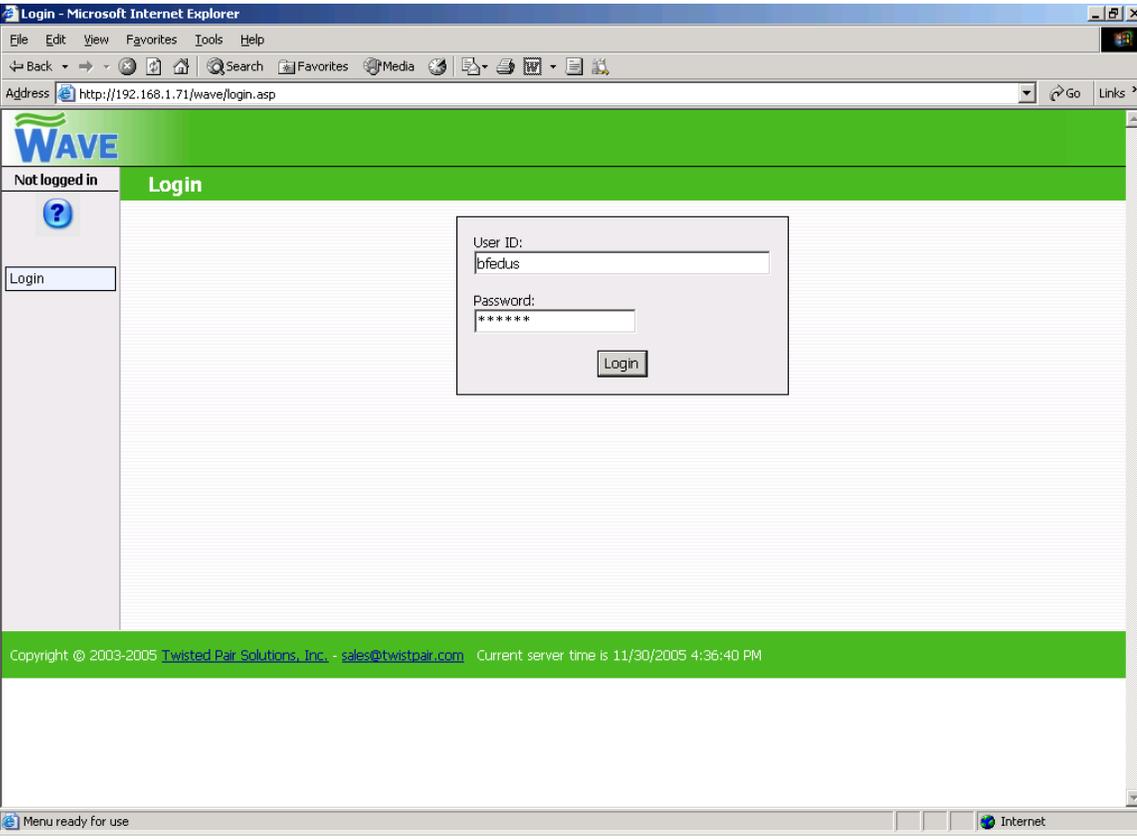
## 4. Configure Twisted Pair Solutions WAVE

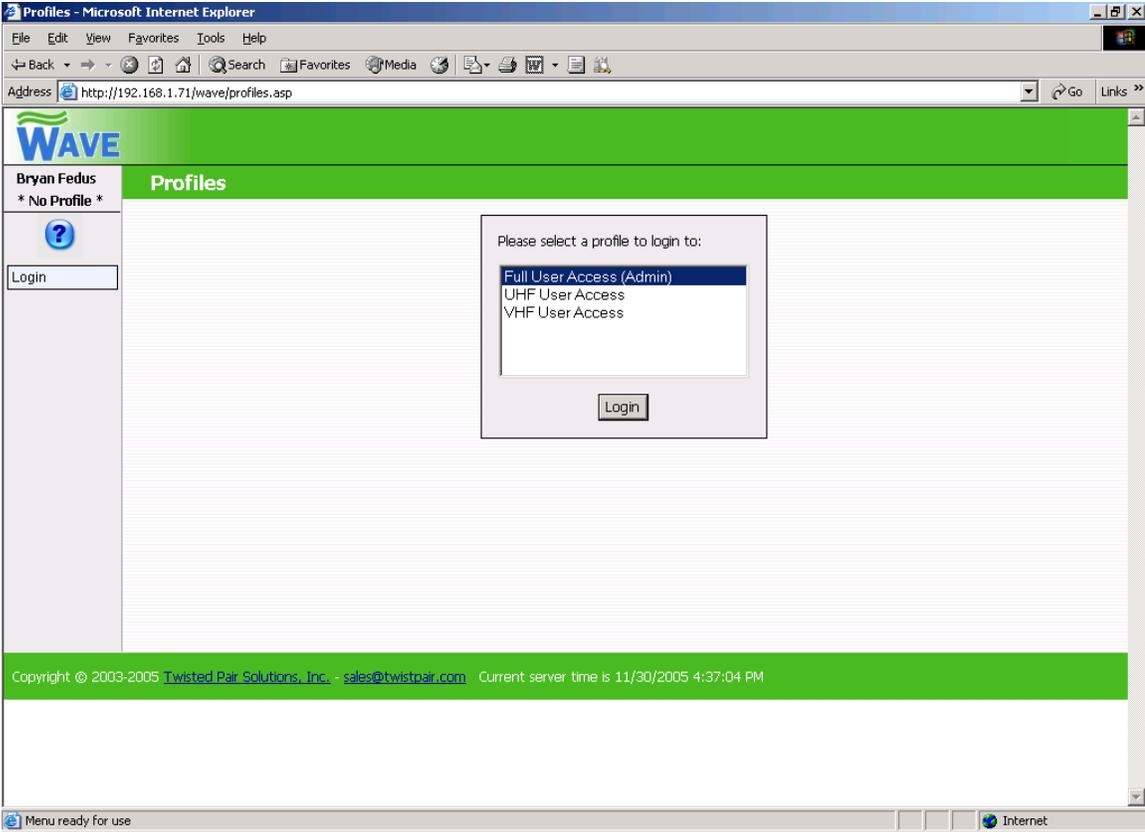
This section describes the configuration of Twisted Pair Solutions WAVE. It is comprised of three components. Each component is installed and configured separately.

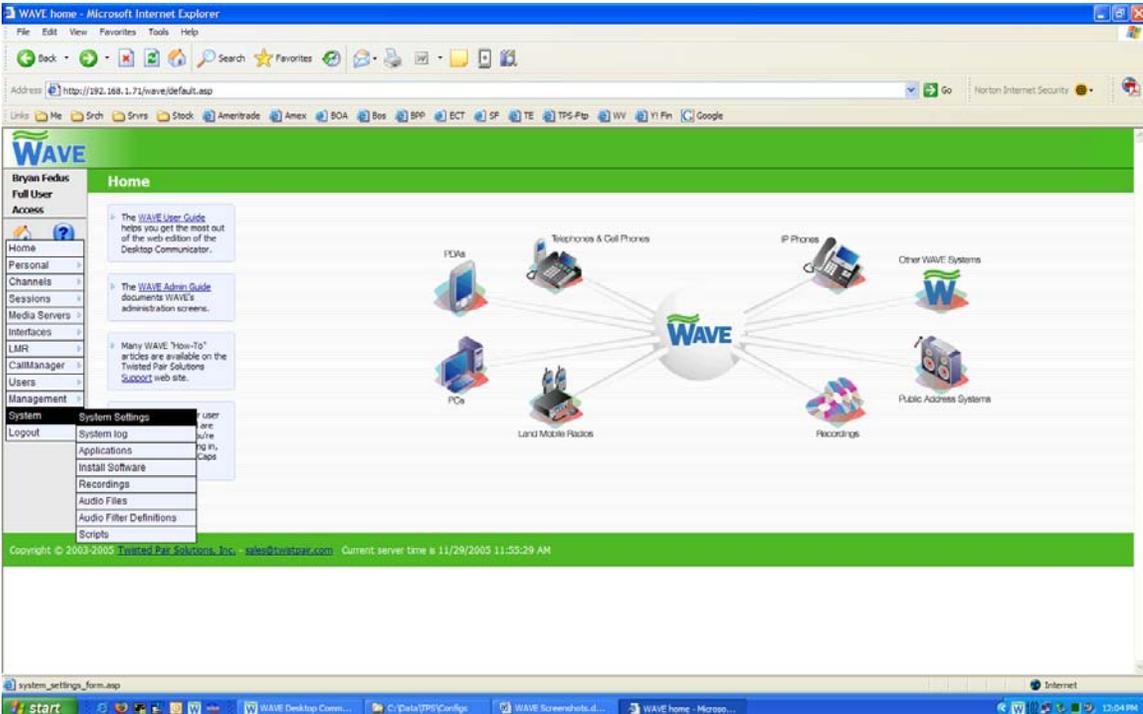
### 4.1. Configure WAVE Management Server

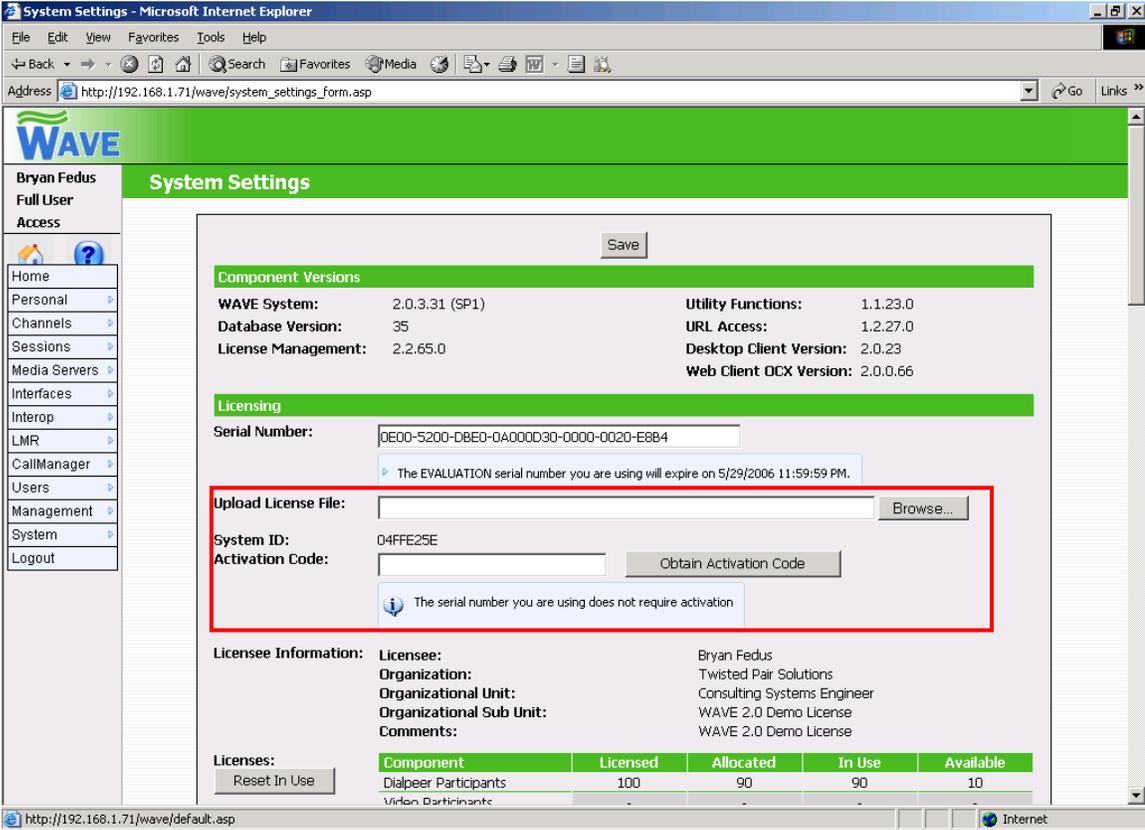
This section describes the configuration of the Twisted Pair Solutions WAVE Management Server. The WAVE Management Server must be installed first before the other components. The other components can then be downloaded and installed from the WAVE Management Server.

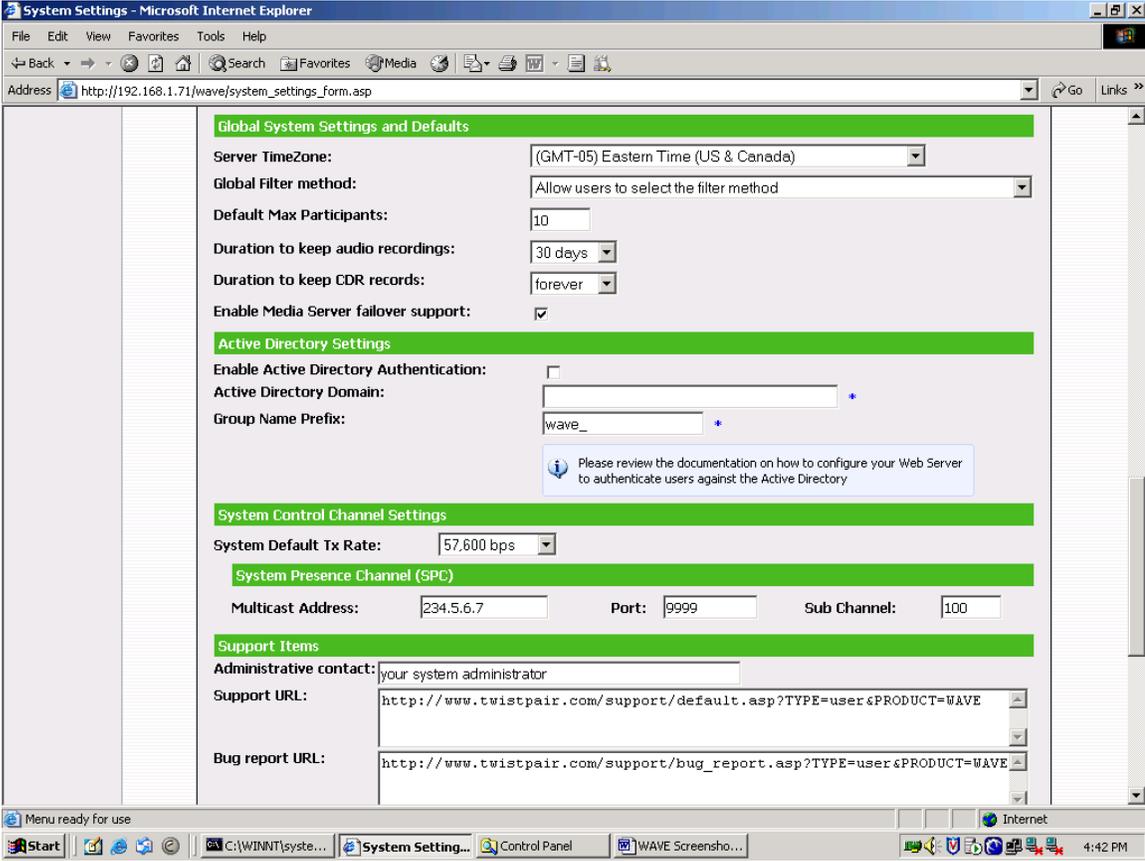
Step	Description
1.	Follow the installation procedures for the WAVE Management Server outlined in the WAVE Version 2.0 Service Pack 1 Administration Guide [3]. It must be installed on a host with Internet access in order to authenticate and activate the license.
2.	<p>After installation, the WAVE Management Server can be accessed by any host on the network via a web browser. To launch the WAVE Management Server, open a web browser window and enter the URL <a href="http://ip_address/wave">http://ip_address/wave</a> in the <b>Address</b> field of the browser, where <i>ip_address</i> is the actual IP address of the host where the WAVE Management Server resides. In the case of the compliance test, the IP address was 192.168.1.71. The WAVE Management Server Login page will appear as shown below.</p> <p>Select <b>Login</b> to continue.</p> 

Step	Description
3.	<p>Enter a valid <b>User ID</b> and <b>Password</b>. The example below shows a system that has a <b>User ID</b> of bfedus administered.</p> <p>Select <b>Login</b> to continue.</p> 

Step	Description
4.	<p>A list of profiles are displayed that can be used for login. An individual user may have access to multiple profiles. To perform the configuration procedures outlined in subsequent steps, select a profile that has full administrative permissions.</p> <p>On an initial installation, using the default <b>User ID</b> of Administrator, the <b>Profiles</b> window does not appear. Instead, the <b>System Settings</b> window appears as shown in Step 6. For more details on creating user IDs and profiles see reference [3].</p> <p>The example below shows the profiles created for the <b>User ID</b> bfedus. Select the <b>Full User Access (Admin)</b> profile. This profile has administrative permissions.</p> <p>Select <b>Login</b> to continue.</p>  <p>The screenshot shows a Microsoft Internet Explorer window titled 'Profiles - Microsoft Internet Explorer'. The address bar shows 'http://192.168.1.71/wave/profiles.asp'. The page has a green header with the 'WAVE' logo. Below the header, the user name 'Bryan Fedus' and '* No Profile *' are displayed. A 'Login' button is present. A modal dialog box is open, prompting the user to 'Please select a profile to login to:'. The dialog lists three options: 'Full User Access (Admin)' (which is highlighted), 'UHF User Access', and 'VHF User Access'. A 'Login' button is at the bottom of the dialog. The footer of the page contains copyright information: 'Copyright © 2003-2005 Twisted Pair Solutions, Inc. - sales@twistpair.com' and the current server time: 'Current server time is 11/30/2005 4:37:04 PM'.</p>

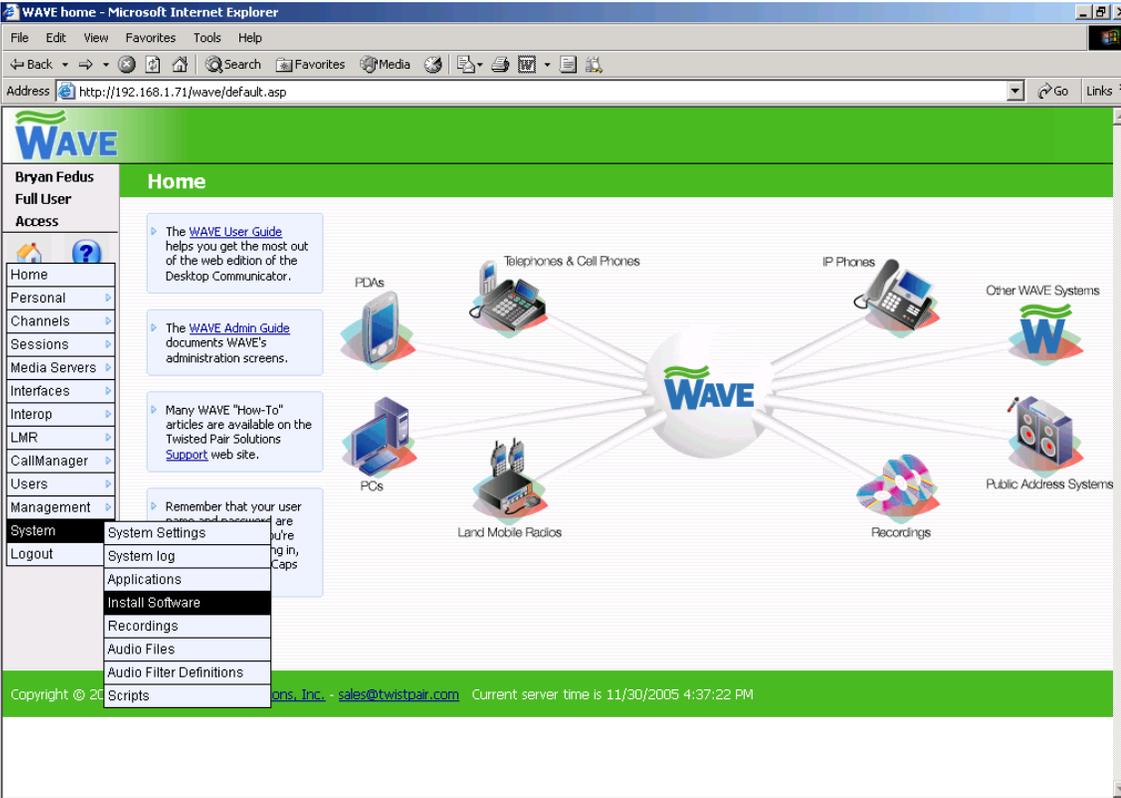
Step	Description
5.	<p>After the user has successfully logged in, the WAVE Home page appears as shown below. To activate the WAVE license, navigate to <b>System</b> → <b>System Settings</b> from the menu on the left.</p> 

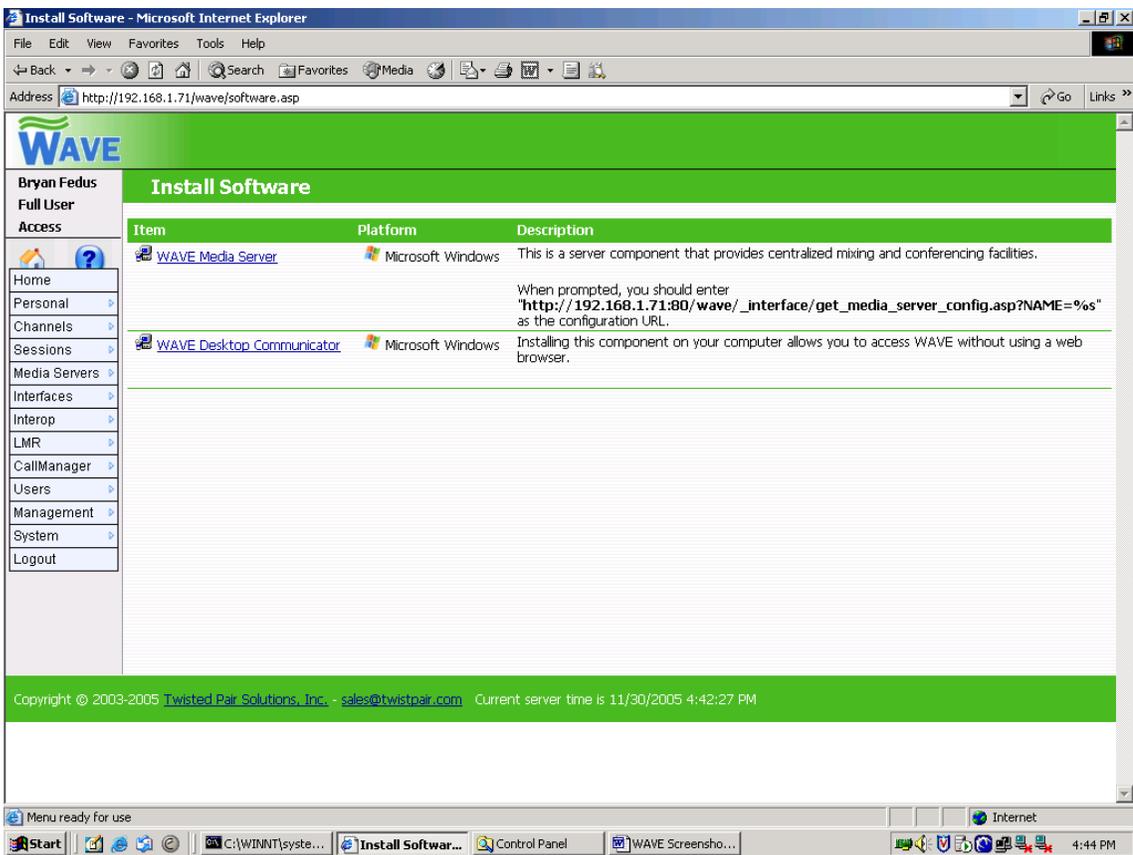
Step	Description
6.	<p>Select the <b>Browse</b> button next to the <b>Upload License File</b> field to locate the license file. The license file will have the name of <i>serial_number.wle</i> where <i>serial_number</i> is the value shown in the <b>Serial Number</b> field. It should be located in the directory where the WAVE Management Server was installed. Once the file has been located and selected, the <b>Upload License File</b> will be populated.</p> <p>Next, select the <b>Obtain Activation Code</b> button. The WAVE Management Server will use its Internet connection to contact a central server to authenticate its license and obtain an activation code. Once this is complete, the <b>Activation Code</b> field will be populated with the newly obtained code.</p> <p>The example shown below is from the compliance test which used a demo license. The demo license did not require an activation code. The screenshot was captured after the license was already authenticated. In this case, the license file and activation code (if required) are not shown.</p> 

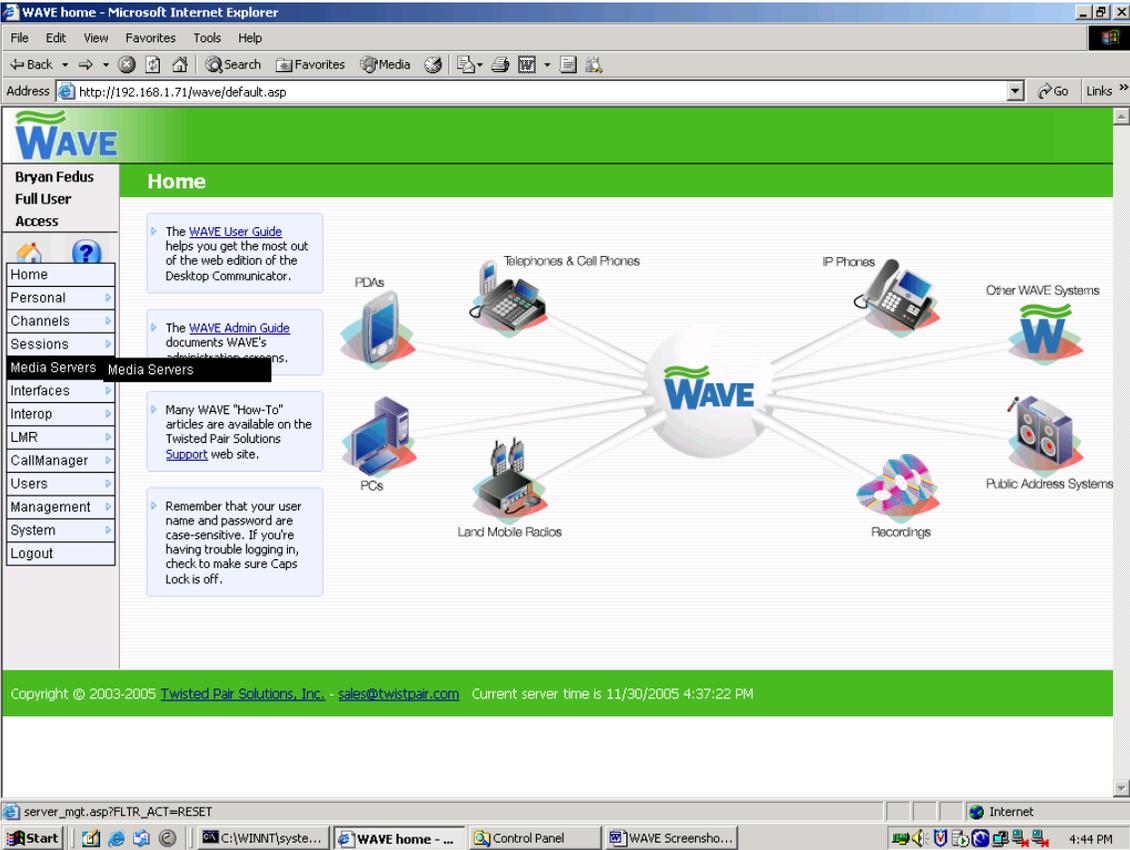
Step	Description
7.	<p>On this same page, scroll down to the <b>Global System Settings and Defaults</b> section. Select the proper time zone from the pull down menu next to the <b>Server TimeZone</b> field. The default settings can be used for all other fields.</p> <p>Scroll back to the top of the page and select the <b>Save</b> button to continue.</p> 

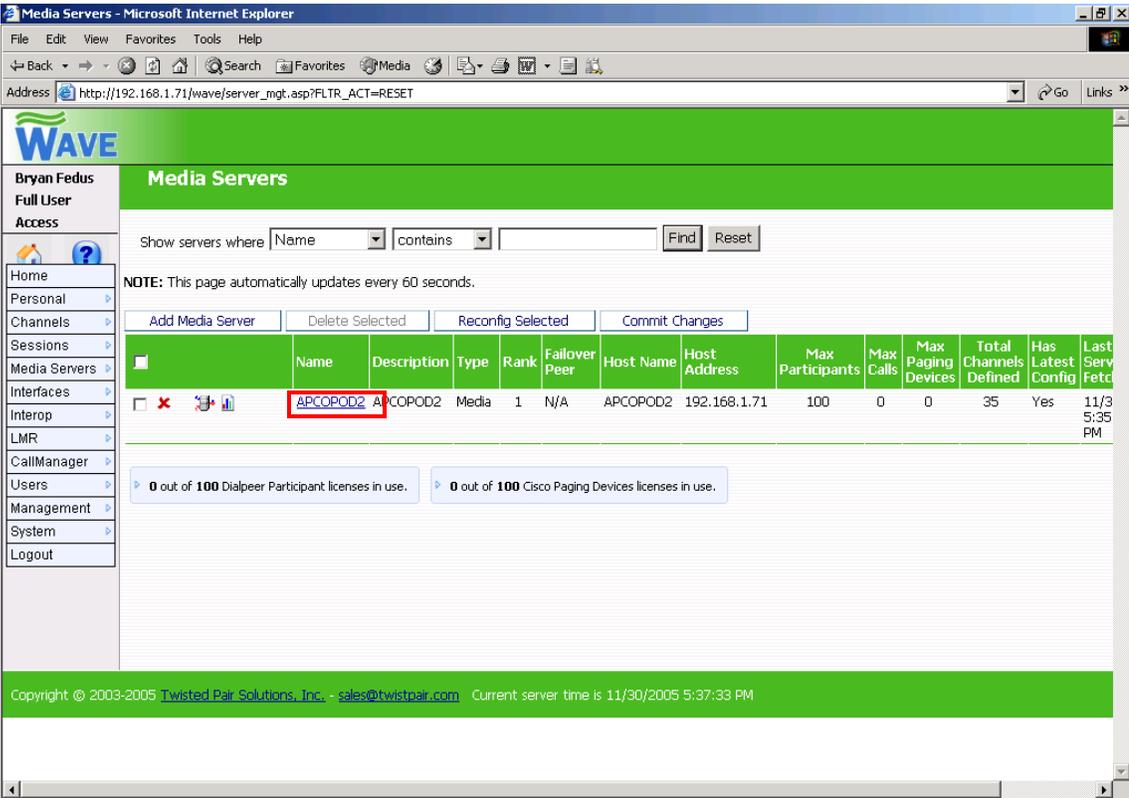
## 4.2. Configure WAVE Media Server

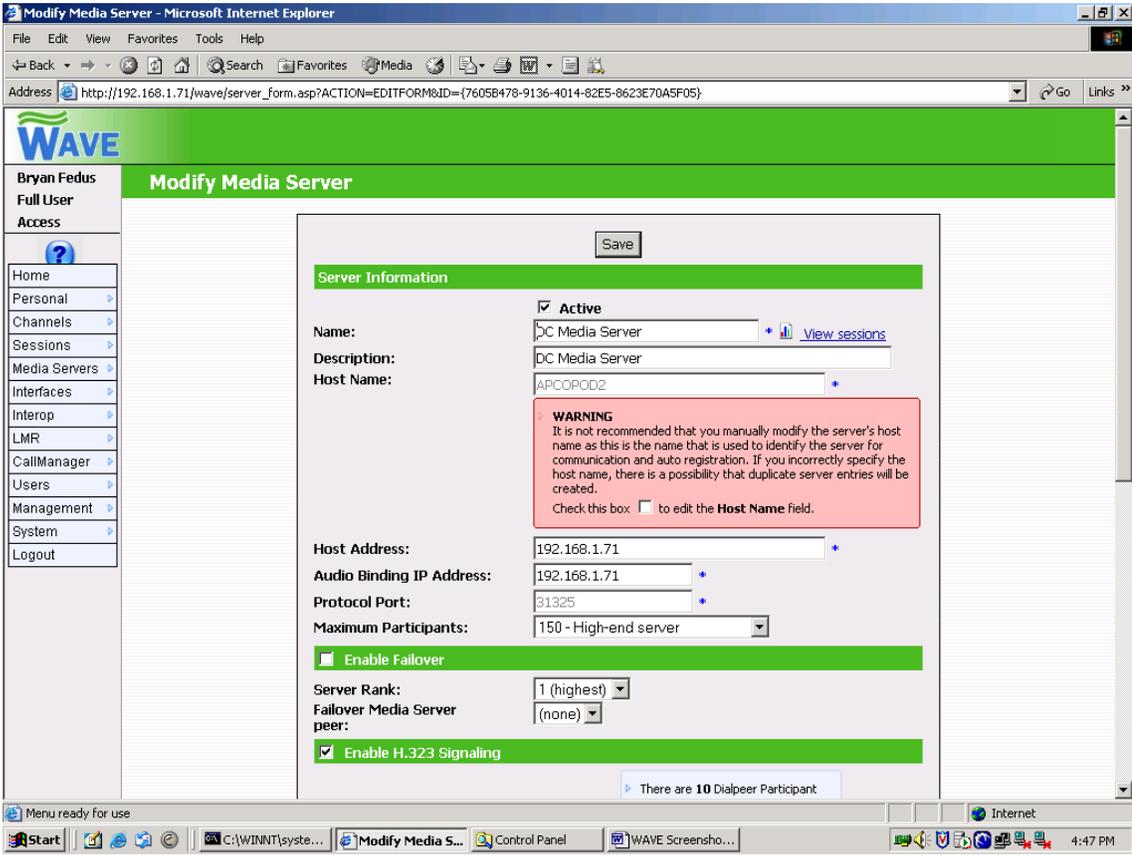
This section describes the configuration of the Twisted Pair Solutions WAVE Media Server. The WAVE Media Server does not have its own user interface. All configuration of the WAVE Media Server is done from the WAVE Management Server.

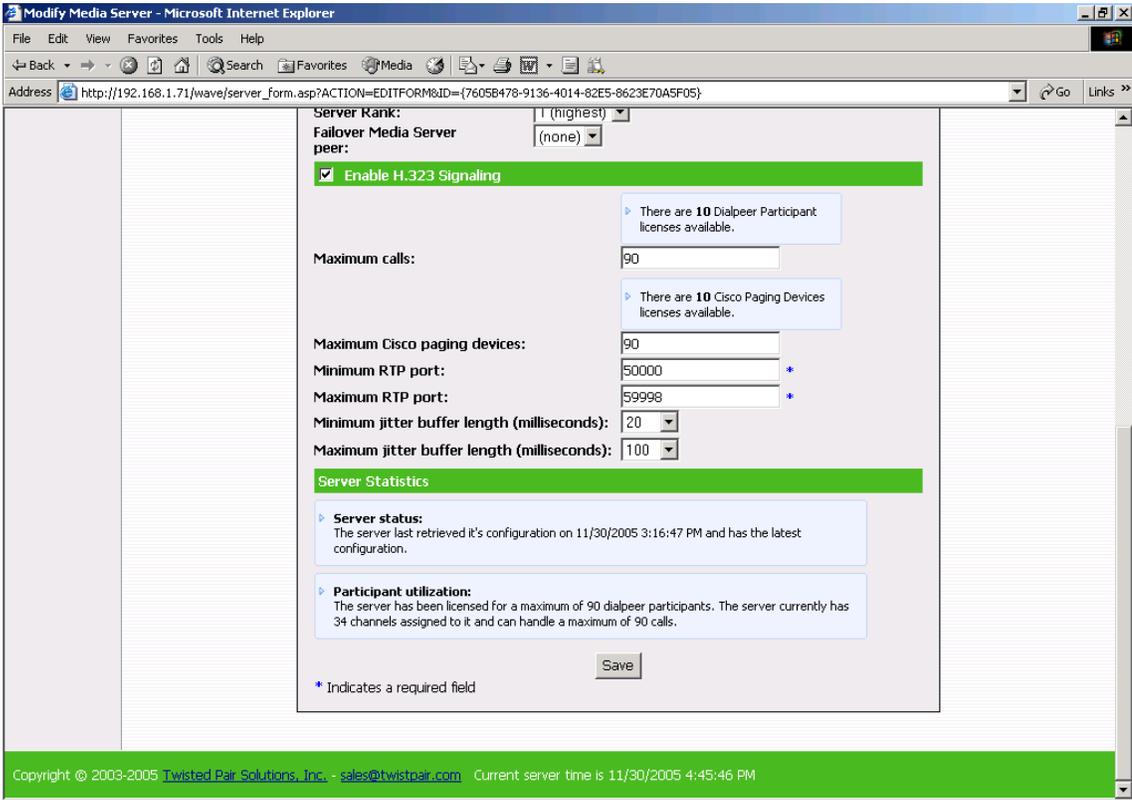
Step	Description
1.	<p>Follow the installation procedures for the WAVE Media Server outlined in the WAVE Version 2.0 Service Pack 1 Administration Guide [3] by selecting <b>System → Install Software</b> from the main menu on the left of the window. In the case of the compliance test, the WAVE Media Server was installed on the same host as the WAVE Management Server with IP address of 192.168.1.71.</p> 

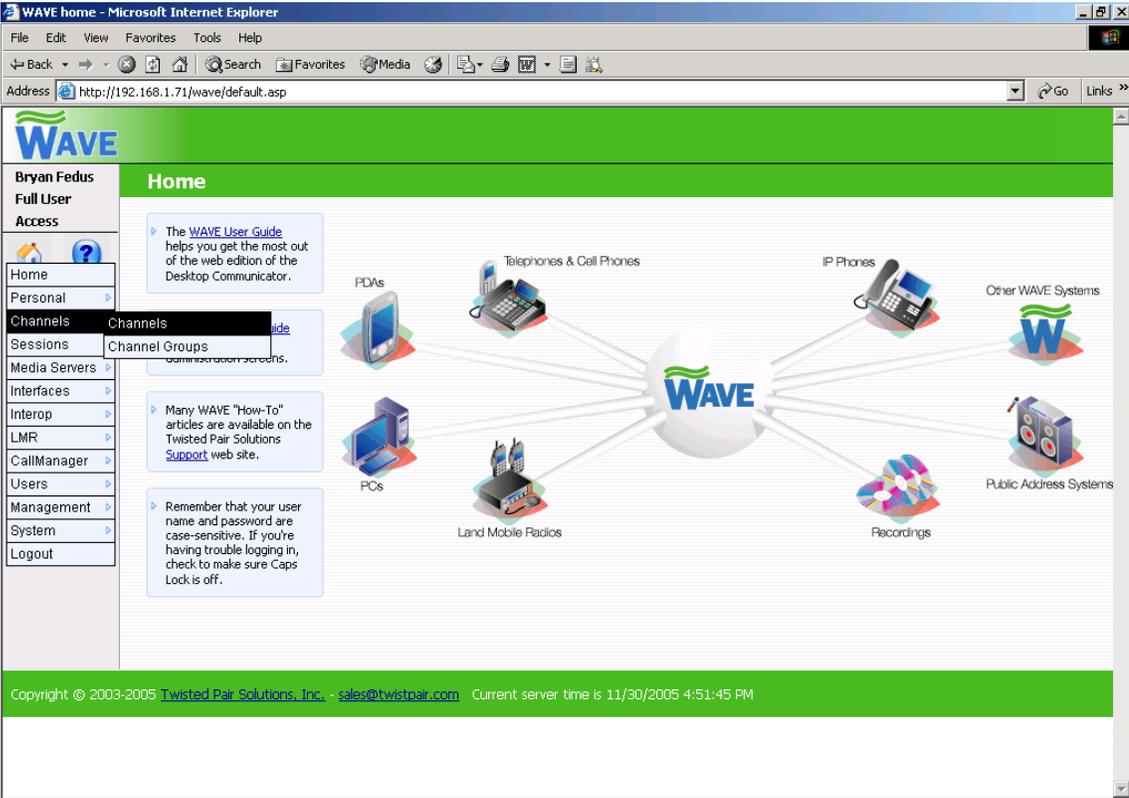
Step	Description
2.	<p data-bbox="297 233 1300 300">Double-click on WAVE Media Server and follow the prompts to complete the installation.</p> 

Step	Description
3.	<p>After the WAVE Media Server has been successfully installed, configure the media server by navigating to <b>Media Servers</b> → <b>Media Servers</b> from the main menu on the left-hand side of the window. The example below shows this being done from the WAVE Management Server Home Page but this can be done from any window where the main menu appears.</p> 

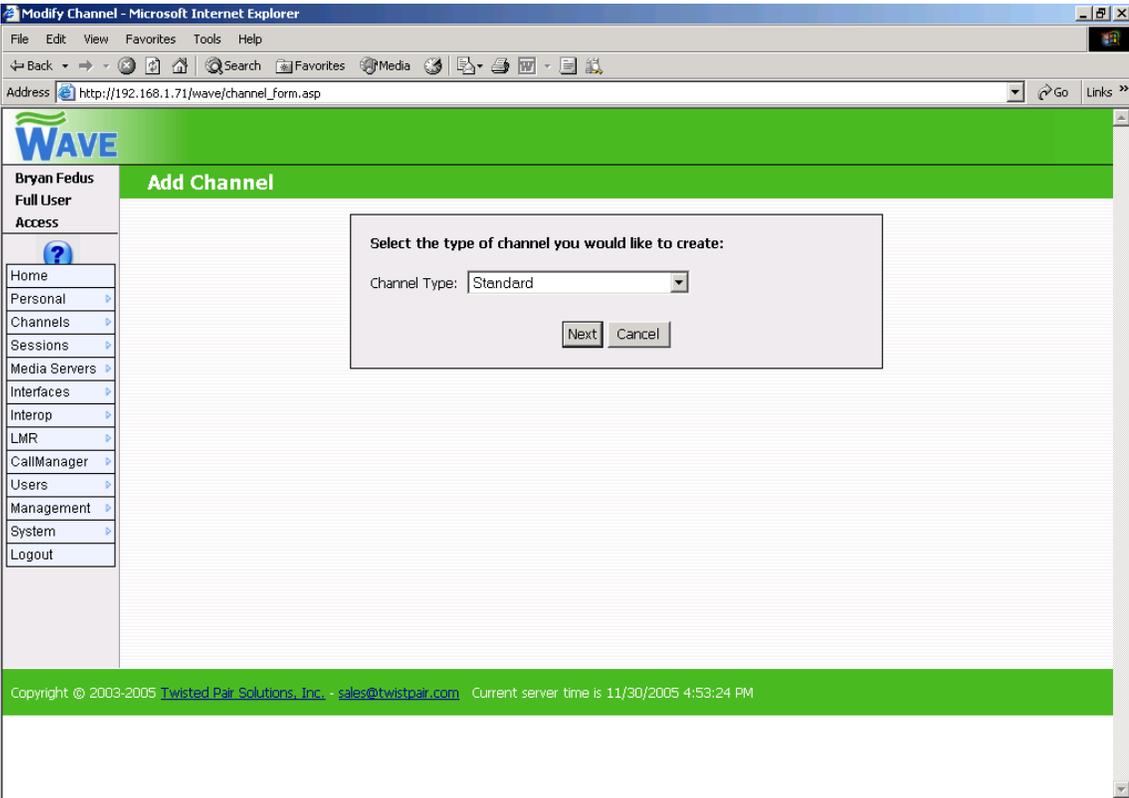
Step	Description
4.	<p>A list of available WAVE Media Servers appears in the window below. In the case of the compliance test, only one media server was installed so there is only one entry in the list. The newly installed media server appears with a default name and description. Double-click on the <b>Name</b> of the media server to configure it.</p> 

Step	Description
5.	<p>Click the <b>Active</b> box at the top of the page. Enter any descriptive name and description in the <b>Name</b> and <b>Description</b> fields. Enter the IP address of the host PC in the <b>Host Address</b> and <b>Audio Binding IP Address</b> fields. The <b>Maximum Participants</b> was set to 150.</p> <p>Click the check box next to <b>Enable H.323 Signaling</b>. This enables WAVE to answer any H.323 call, such as the calls that will be routed to WAVE from Avaya Communication Manager. The signaling port and codec used for the H.323 call is not configured by the WAVE administrator. The signaling port is always 1720. Avaya Communication Manager must be configured to use this port in Section 3 Step 2. WAVE chooses the codec automatically to match the codec used by the far-end, if the codec is supported by WAVE. If the codec is not supported by WAVE, the call will result in no audio. Supported codecs include G.711u and G.729. For a complete list of supported codecs, refer to WAVE product documentation.</p> <p>The configuration of this window continues in the next step.</p> 

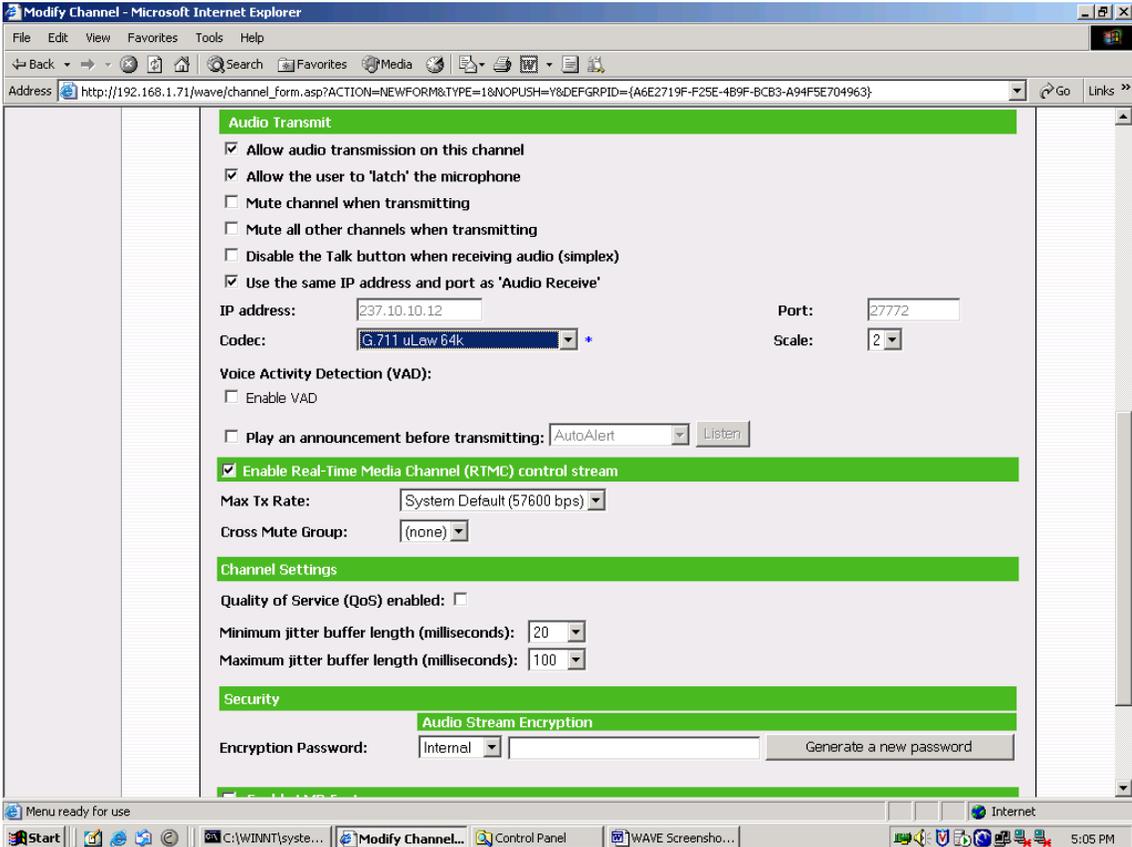
Step	Description
6.	<p>Scroll down to the bottom of the page. In order to support any calls, the <b>Maximum calls</b> field must be increased from the default of 0 to some value up to the maximum number allowed by the available license. The demo license used for the compliance test supported 100 calls. If the user has multiple servers, this number must be statically allocated between the servers. It is not a dynamic pool that is shared between the servers. In the case of the compliance test, which used only one server, the value was set to 90. The <b>Maximum Cisco paging devices</b> was also set to 90. Default values were used for all other fields.</p> <p>Scroll back to the top of the page and select the <b>Save</b> button to complete the configuration.</p> <p><i>Note:</i>  The following screenshot was captured after channels had been assigned to this server as per the next step. Thus, the status at the bottom of the screen shows 34 channels assigned to this server.</p> 

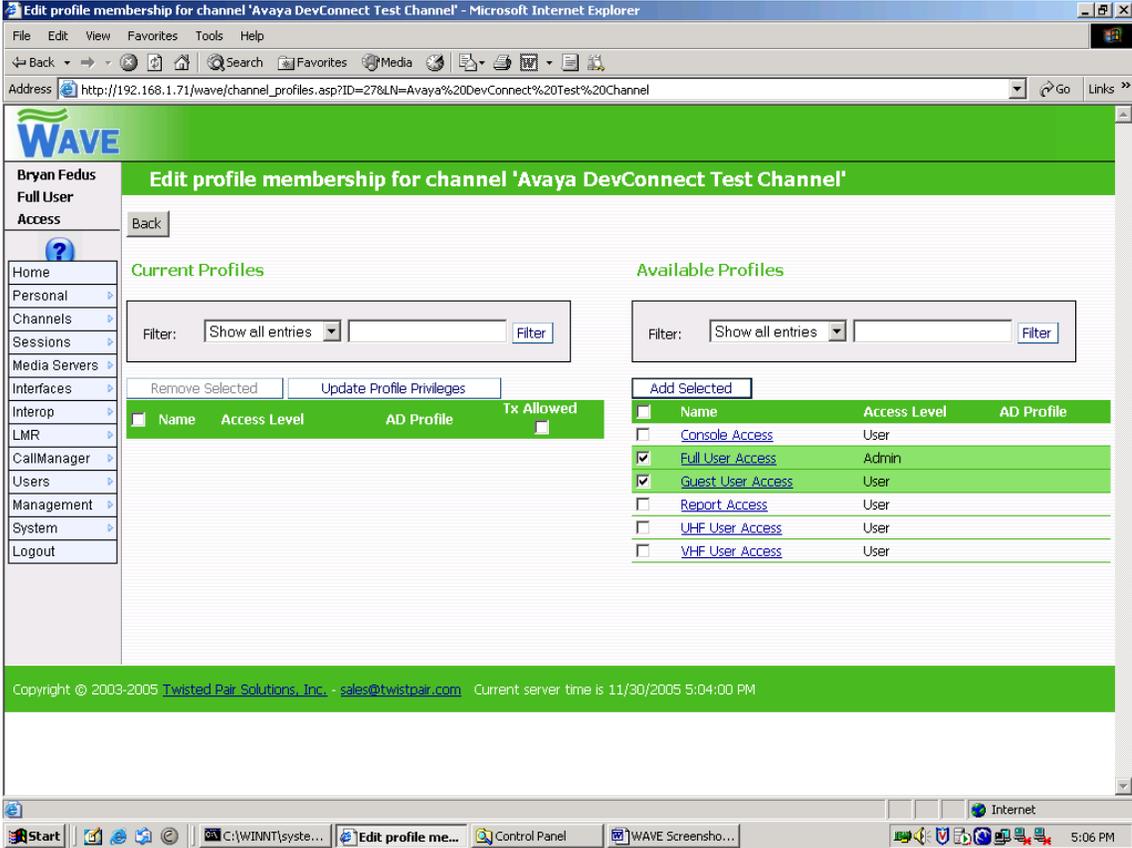
Step	Description
7.	<p>Next, channels are created to allow logical groups of endpoints to communicate through WAVE using an IP multicast address. No channels exist by default and must be created by the administrator. To create a channel, navigate to <b>Channels</b> → <b>Channels</b> from the main menu on the left-hand side of the page. The example below shows this being done from the WAVE Management Server Home Page but this can be done from any window where the main menu appears.</p> 

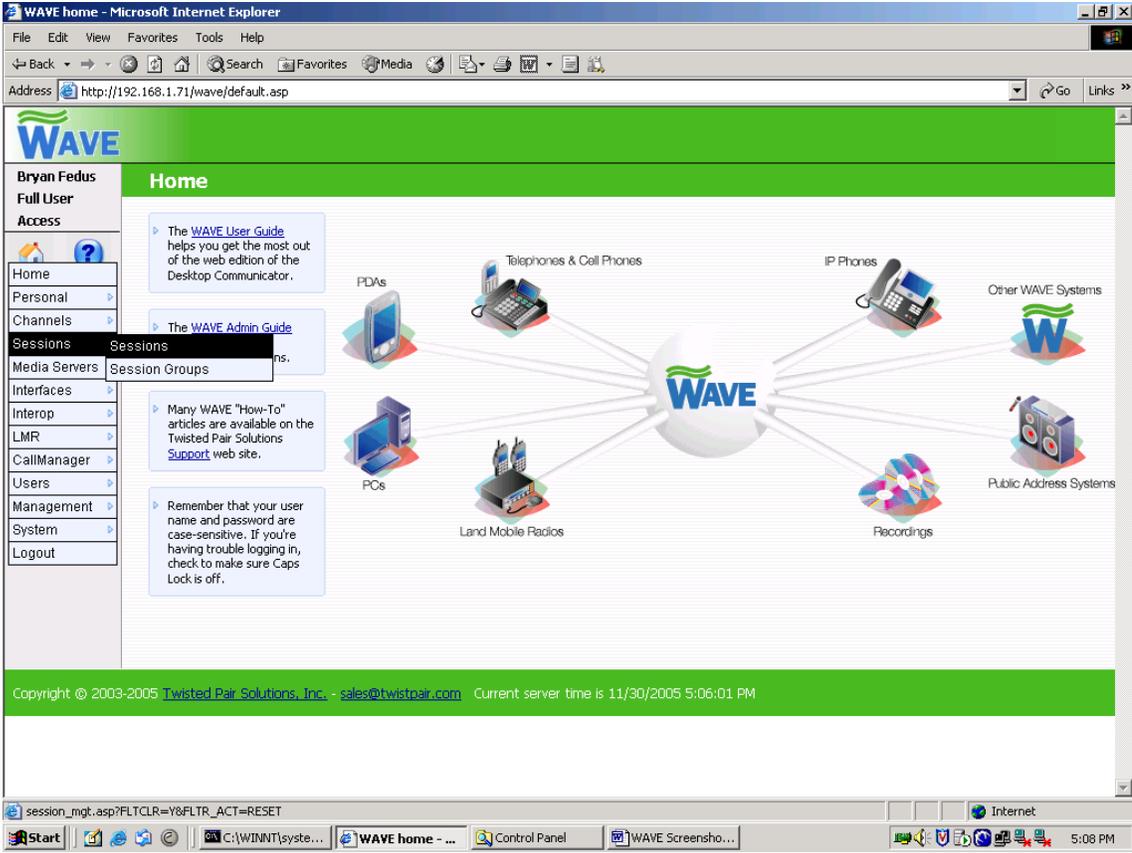
Step	Description																																																																								
<p>8.</p>	<p>Select the <b>Add Channel</b> button.</p> <p>The channel configuration example shown in Steps <b>9</b> - <b>11</b> is typical of a Hoot and Holler network. Configuration of channels for other environments such as Land Mobile Radio networks could be quite different. Refer to the WAVE Version 2.0 Service Pack 2 Administration Guide for complete details.</p> <p><b>Channels</b></p> <p>Show channels where <input type="text" value="Name"/> contains <input type="text"/> <input type="button" value="Find"/> <input type="button" value="Reset"/></p> <p><input type="button" value="Add Channel"/> <input type="button" value="Delete Selected"/> <input type="button" value="Commit Changes"/></p> <table border="1"> <thead> <tr> <th></th> <th>Name</th> <th>Group</th> <th>App Code</th> <th>Description</th> <th>Type</th> <th>Receive</th> <th>Transmit</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>Avaya Hammer (65011)</td> <td>PC Clients</td> <td>(none)Hammer (65011)</td> <td>Avaya Hammer (65011)</td> <td>Standard</td> <td>234.13.13.13:28100</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Avaya Hammer2 (65012)</td> <td>PC Clients</td> <td>(none)Hammer2 (65012)</td> <td>Avaya Hammer2 (65012)</td> <td>Standard</td> <td>234.14.14.14:28200</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Avaya Hoot &amp; Holler (65013)</td> <td>PC Clients</td> <td>(none)Holler (65013)</td> <td>Avaya Hoot &amp; Holler (65013)</td> <td>Standard</td> <td>234.12.12.12:29000</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Avaya LMR (65010)</td> <td>PC Clients</td> <td>(none)Avaya LMR (65010)</td> <td>Avaya LMR (65010)</td> <td>Standard</td> <td>237.10.10.10:27770</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Chat (8001)</td> <td>PC Clients</td> <td>(none)PC Clients - Chat</td> <td>PC Clients - Chat</td> <td>Standard</td> <td>234.1.13.1:34050</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Music (8007)</td> <td>PC Clients</td> <td>(none)Network Music</td> <td>PC Clients - Network Music</td> <td>Standard</td> <td>234.1.3.6:34052</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>UHF Radio (8002)</td> <td>PC Clients</td> <td>(none)Desktop Communicator Clients for UHF System</td> <td>Desktop Communicator Clients for UHF System</td> <td>Standard</td> <td>234.1.3.7:34054</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="checkbox"/></td> <td>VHF Radio (8003)</td> <td>PC Clients</td> <td>(none)Desktop Communicator Clients for VHF System</td> <td>Desktop Communicator Clients for VHF System</td> <td>Standard</td> <td>234.1.3.8:34056</td> <td>G.711 uLaw 64k/2</td> </tr> </tbody> </table> <p> <input type="button" value="12 out of 100 Standard Channel licenses in use."/> <input type="button" value="3 out of 100 Trunk Channel licenses in use."/> <input type="button" value="0 out of 100 Cisco Paging Channel licenses in use."/> <input type="button" value="1 out of 100 LMR Interface licenses in use."/> </p>		Name	Group	App Code	Description	Type	Receive	Transmit	<input type="checkbox"/>	Avaya Hammer (65011)	PC Clients	(none)Hammer (65011)	Avaya Hammer (65011)	Standard	234.13.13.13:28100	G.711 uLaw 64k/2	<input type="checkbox"/>	Avaya Hammer2 (65012)	PC Clients	(none)Hammer2 (65012)	Avaya Hammer2 (65012)	Standard	234.14.14.14:28200	G.711 uLaw 64k/2	<input type="checkbox"/>	Avaya Hoot & Holler (65013)	PC Clients	(none)Holler (65013)	Avaya Hoot & Holler (65013)	Standard	234.12.12.12:29000	G.711 uLaw 64k/2	<input type="checkbox"/>	Avaya LMR (65010)	PC Clients	(none)Avaya LMR (65010)	Avaya LMR (65010)	Standard	237.10.10.10:27770	G.711 uLaw 64k/2	<input type="checkbox"/>	Chat (8001)	PC Clients	(none)PC Clients - Chat	PC Clients - Chat	Standard	234.1.13.1:34050	G.711 uLaw 64k/2	<input type="checkbox"/>	Music (8007)	PC Clients	(none)Network Music	PC Clients - Network Music	Standard	234.1.3.6:34052	G.711 uLaw 64k/2	<input type="checkbox"/>	UHF Radio (8002)	PC Clients	(none)Desktop Communicator Clients for UHF System	Desktop Communicator Clients for UHF System	Standard	234.1.3.7:34054	G.711 uLaw 64k/2	<input type="checkbox"/>	VHF Radio (8003)	PC Clients	(none)Desktop Communicator Clients for VHF System	Desktop Communicator Clients for VHF System	Standard	234.1.3.8:34056	G.711 uLaw 64k/2
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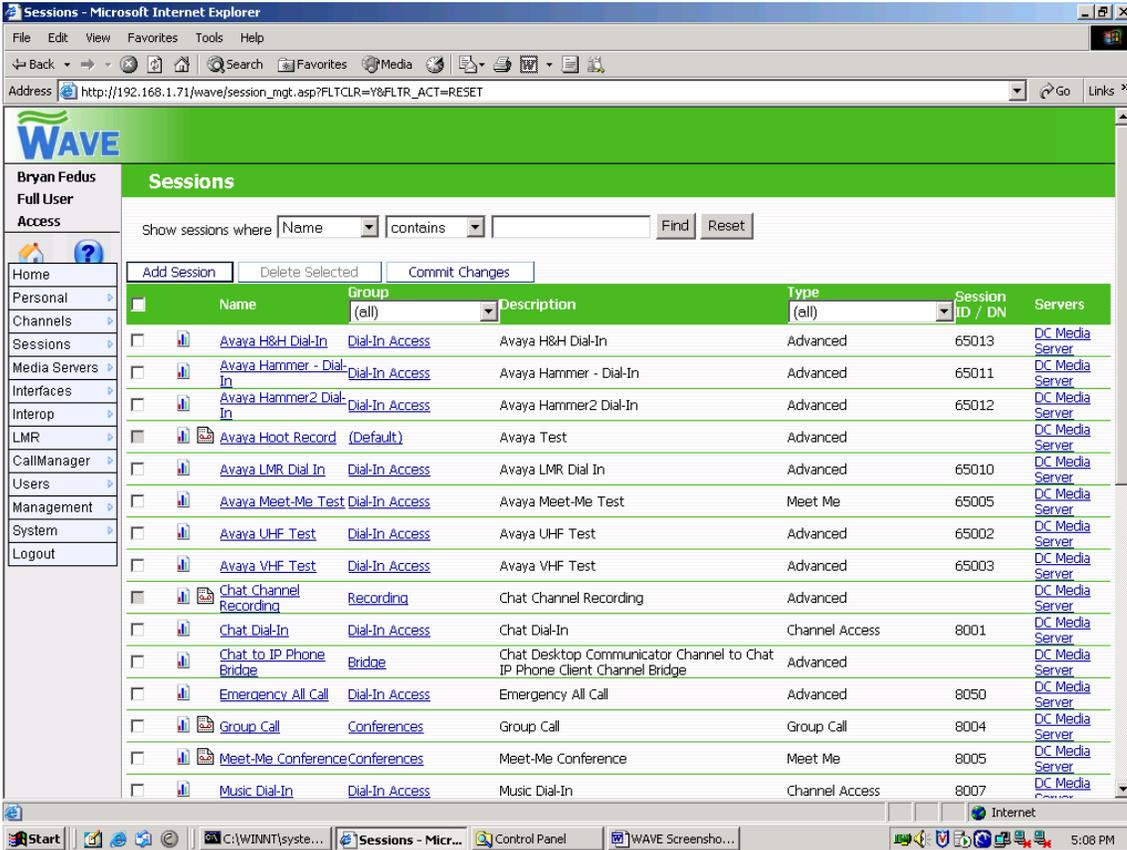
Step	Description
9.	<p>Select the <b>Channel Type</b> to be created from the drop-down menu. The example below shows a <b>Standard</b> channel type being created.</p> <p>Select <b>Next</b> to continue.</p> 

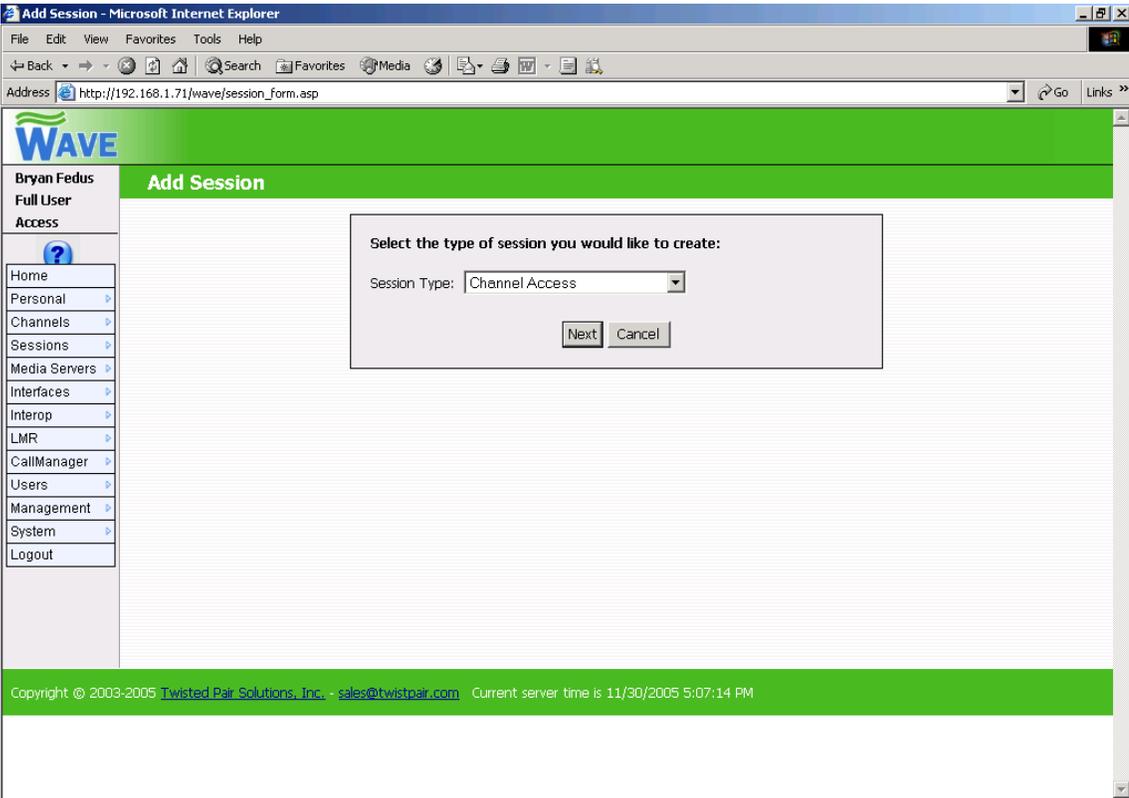
Step	Description
10.	<p>Enter any descriptive name and description in the <b>Name</b> and <b>Description</b> fields. Enter an available valid IP multicast address in the <b>IP address</b> field. The Internet Assigned Numbers Authority (IANA) define globally scoped IP multicast addresses as being in the range of 224.0.1.0 to 238.255.255.255. However, many of these are reserved for specific purposes. See <a href="http://www.iana.org/assignments/multicast-addresses">http://www.iana.org/assignments/multicast-addresses</a> for a complete list. However, generally IP addresses in the range of 234.0.0.0 to 238.255.255.255 can be used in the <b>IP Address</b> field in the form below. The <b>Port</b> field must be set to an even number value greater than 1024 and less than 65,536.</p> <p>The configuration of this screen continues in the next step.</p>

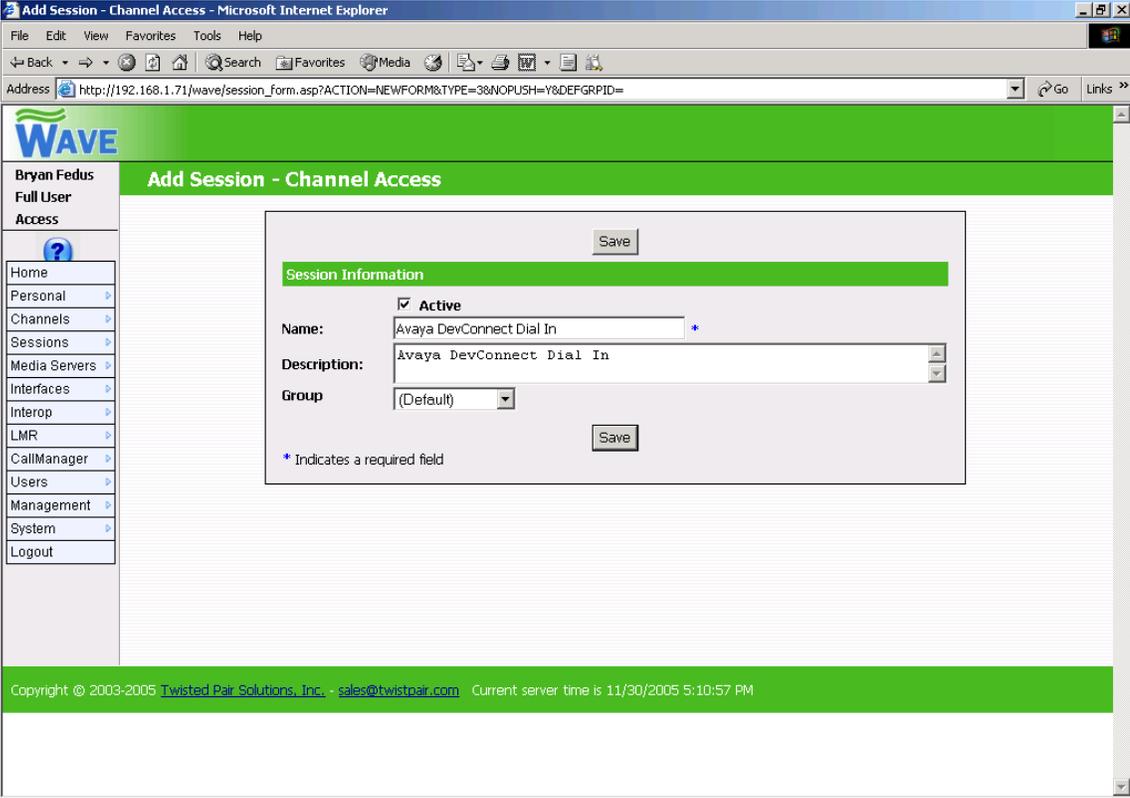
Step	Description
11.	<p>Scroll down to the page to the <b>Audio Transmit</b> section. In this example, for a channel used in a Hoot and Holler network, verify that the following options are checked:</p> <ul style="list-style-type: none"> <li>• <b>Allow audio transmission on this channel</b></li> <li>• <b>Allow the user to 'latch' the microphone</b></li> </ul> <p>Verify the following option is unchecked:</p> <ul style="list-style-type: none"> <li>• <b>Mute channel when transmitting</b></li> </ul> <p>The <b>Codec</b> field represents the codec for the WAVE multicast IP channel. Select a value from the pull-down menu that is appropriate for the bandwidth available on the IP network for this type of traffic. It is not necessary for this value to match the codec value configured on the Avaya Communication Manager in Section 3 Step 9. If the values do not match, WAVE will translate the audio stream using the codec on the H.323 call from Avaya Communication Manager to the codec used by the WAVE IP multicast channel. For the compliance test, the value of <b>G.711 uLaw 64K</b> was selected for the WAVE IP multicast channel.</p> <p>The default value was used for all other options.</p> <p>Scroll back to the top of the page and select <b>Save</b> to continue.</p> 

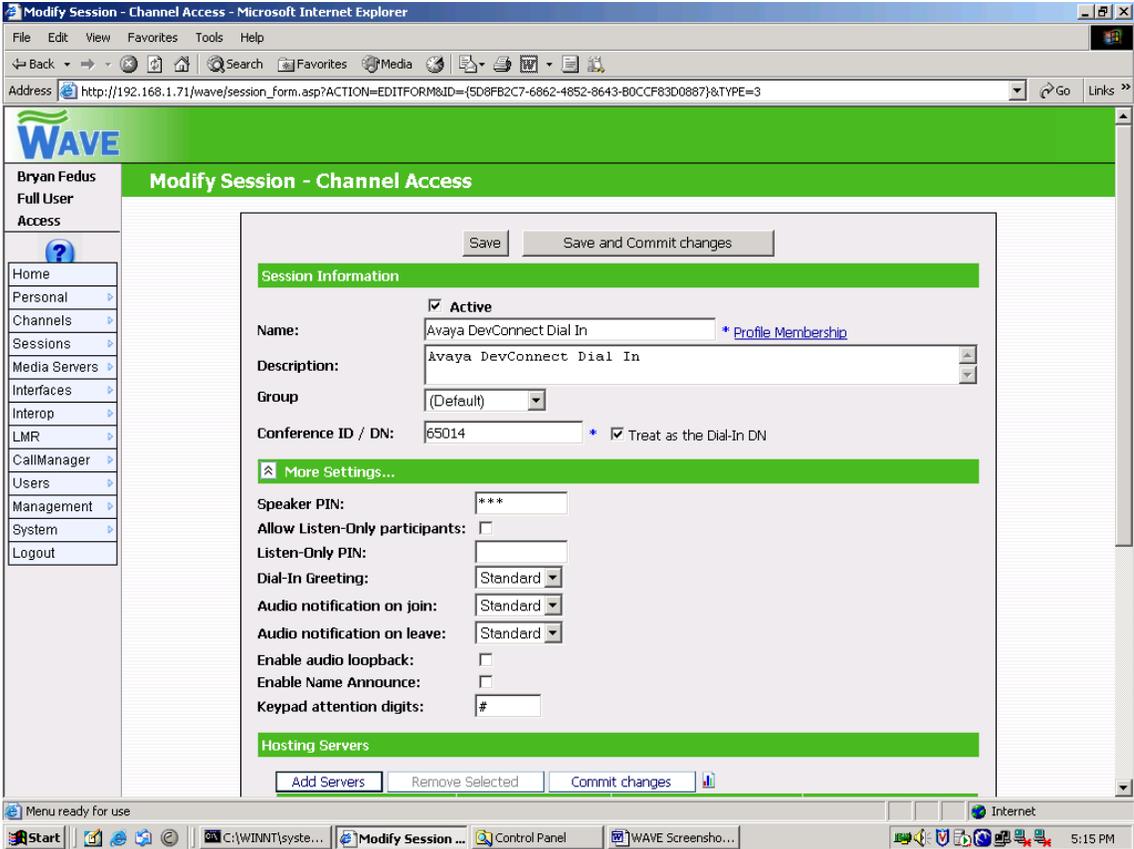
Step	Description
12.	<p>After the channel is configured, the following screen appears so the administrator can define which profiles can use this channel. To allow access to this channel by a given profile, select the check box next to the profile <b>Name</b> in the list of <b>Available Profiles</b>. The <b>Available Profiles</b> are displayed on the right side of the window. More than one can be selected. The example below shows two profiles being given access: the <b>Full User Access</b> profile and the <b>Guest User Access</b> profile.</p> <p>Select the <b>Update Profile Privileges</b> button to submit the data. The window below will be updated to show the selected profiles have been added to the <b>Current Profiles</b> list on the left side of the window.</p> 

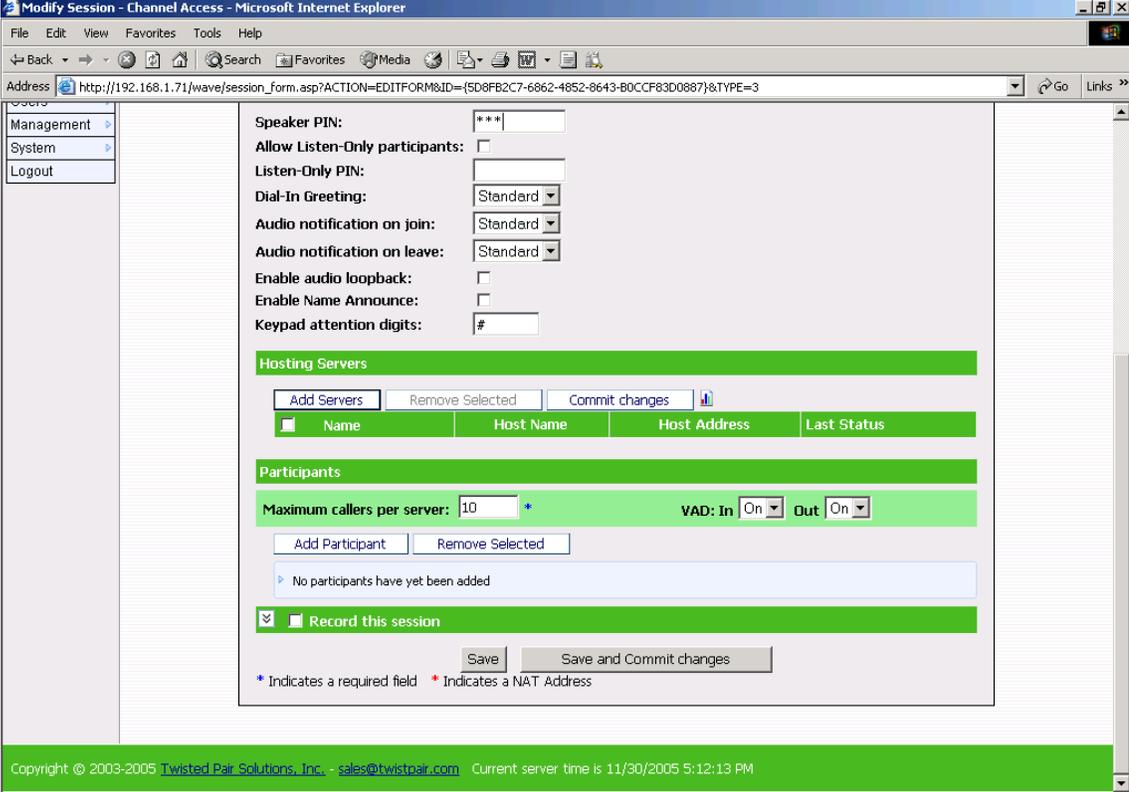
Step	Description
13.	<p>Next, sessions are created to allow other endpoints to access the channel which cannot access the channel directly. For the compliance test, a session was created to provide dial-in access to the channel. A separate session is created for each channel that needs to be accessed by Avaya Communication Manager endpoints. To create a session, navigate to <b>Sessions</b> → <b>Sessions</b> from the main menu on the left-hand side of the page. The example below shows this being done from the WAVE Management Server Home Page but this can be done from any window where the main menu appears.</p> 

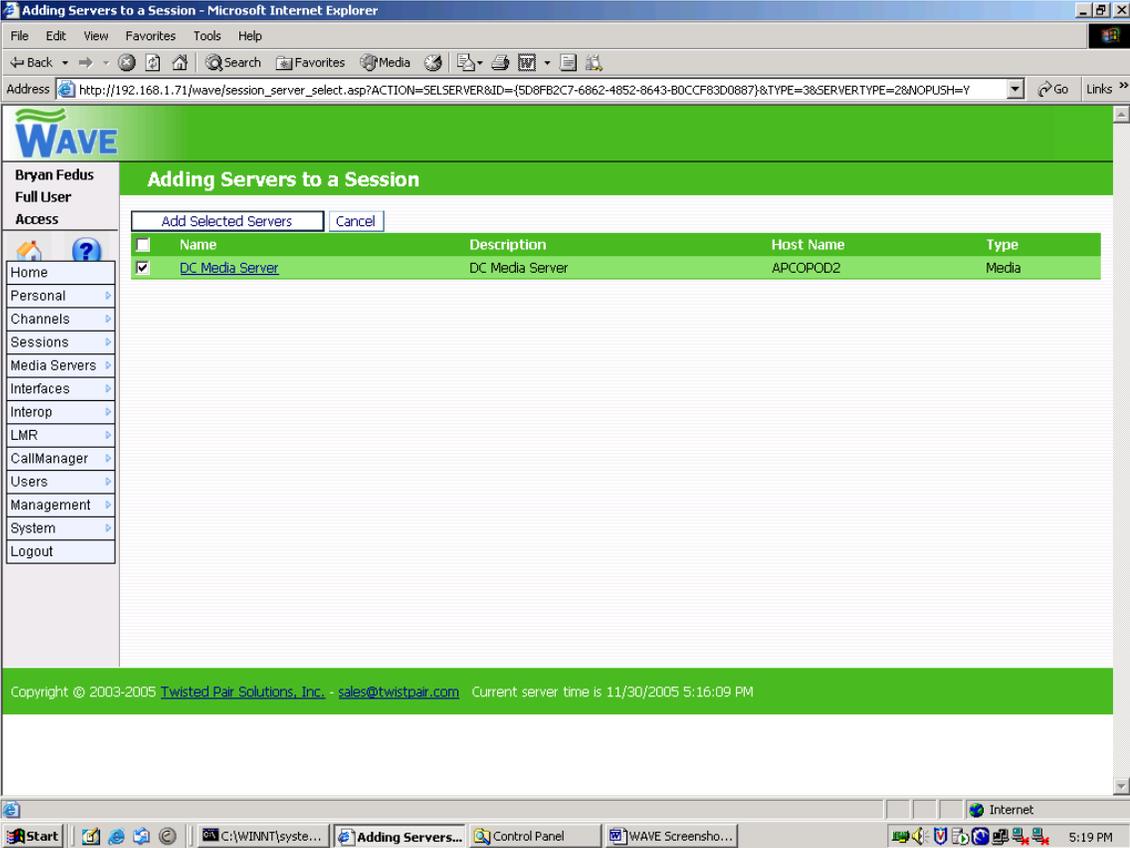
Step	Description																																																																																																
14.	<p data-bbox="298 235 558 268"><b>Select Add Session.</b></p> <p data-bbox="298 306 1435 449">The session configuration example shown in Steps <b>15</b> - <b>24</b> is typical of a dial-in session for a Hoot and Holler channel. Configuration of sessions for other environments such as Land Mobile Radio networks could be quite different. Refer to the WAVE Version 2.0 Service Pack 2 Administration Guide for complete details.</p>  <table border="1" data-bbox="422 766 1404 1291"> <thead> <tr> <th>Name</th> <th>Group</th> <th>Description</th> <th>Type</th> <th>Session ID / DN</th> <th>Servers</th> </tr> </thead> <tbody> <tr> <td>Avaya H&amp;H Dial-In</td> <td>Dial-In Access</td> <td>Avaya H&amp;H Dial-In</td> <td>Advanced</td> <td>65013</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hammer - Dial-In</td> <td>Dial-In Access</td> <td>Avaya Hammer - Dial-In</td> <td>Advanced</td> <td>65011</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hammer2 Dial-In</td> <td>Dial-In Access</td> <td>Avaya Hammer2 Dial-In</td> <td>Advanced</td> <td>65012</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hoot Record</td> <td>(Default)</td> <td>Avaya Test</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Avaya LMR Dial In</td> <td>Dial-In Access</td> <td>Avaya LMR Dial In</td> <td>Advanced</td> <td>65010</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Meet-Me Test</td> <td>Dial-In Access</td> <td>Avaya Meet-Me Test</td> <td>Meet Me</td> <td>65005</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya UHF Test</td> <td>Dial-In Access</td> <td>Avaya UHF Test</td> <td>Advanced</td> <td>65002</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya VHF Test</td> <td>Dial-In Access</td> <td>Avaya VHF Test</td> <td>Advanced</td> <td>65003</td> <td>DC Media Server</td> </tr> <tr> <td>Chat Channel Recording</td> <td>Recording</td> <td>Chat Channel Recording</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Chat Dial-In</td> <td>Dial-In Access</td> <td>Chat Dial-In</td> <td>Channel Access</td> <td>8001</td> <td>DC Media Server</td> </tr> <tr> <td>Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge</td> <td>Bridge</td> <td>Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Emergency All Call</td> <td>Dial-In Access</td> <td>Emergency All Call</td> <td>Advanced</td> <td>8050</td> <td>DC Media Server</td> </tr> <tr> <td>Group Call</td> <td>Conferences</td> <td>Group Call</td> <td>Group Call</td> <td>8004</td> <td>DC Media Server</td> </tr> <tr> <td>Meet-Me Conference</td> <td>Conferences</td> <td>Meet-Me Conference</td> <td>Meet Me</td> <td>8005</td> <td>DC Media Server</td> </tr> <tr> <td>Music Dial-In</td> <td>Dial-In Access</td> <td>Music Dial-In</td> <td>Channel Access</td> <td>8007</td> <td>DC Media Server</td> </tr> </tbody> </table>	Name	Group	Description	Type	Session ID / DN	Servers	Avaya H&H Dial-In	Dial-In Access	Avaya H&H Dial-In	Advanced	65013	DC Media Server	Avaya Hammer - Dial-In	Dial-In Access	Avaya Hammer - Dial-In	Advanced	65011	DC Media Server	Avaya Hammer2 Dial-In	Dial-In Access	Avaya Hammer2 Dial-In	Advanced	65012	DC Media Server	Avaya Hoot Record	(Default)	Avaya Test	Advanced		DC Media Server	Avaya LMR Dial In	Dial-In Access	Avaya LMR Dial In	Advanced	65010	DC Media Server	Avaya Meet-Me Test	Dial-In Access	Avaya Meet-Me Test	Meet Me	65005	DC Media Server	Avaya UHF Test	Dial-In Access	Avaya UHF Test	Advanced	65002	DC Media Server	Avaya VHF Test	Dial-In Access	Avaya VHF Test	Advanced	65003	DC Media Server	Chat Channel Recording	Recording	Chat Channel Recording	Advanced		DC Media Server	Chat Dial-In	Dial-In Access	Chat Dial-In	Channel Access	8001	DC Media Server	Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge	Bridge	Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge	Advanced		DC Media Server	Emergency All Call	Dial-In Access	Emergency All Call	Advanced	8050	DC Media Server	Group Call	Conferences	Group Call	Group Call	8004	DC Media Server	Meet-Me Conference	Conferences	Meet-Me Conference	Meet Me	8005	DC Media Server	Music Dial-In	Dial-In Access	Music Dial-In	Channel Access	8007	DC Media Server
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Meet-Me Conference	Conferences	Meet-Me Conference	Meet Me	8005	DC Media Server																																																																																												
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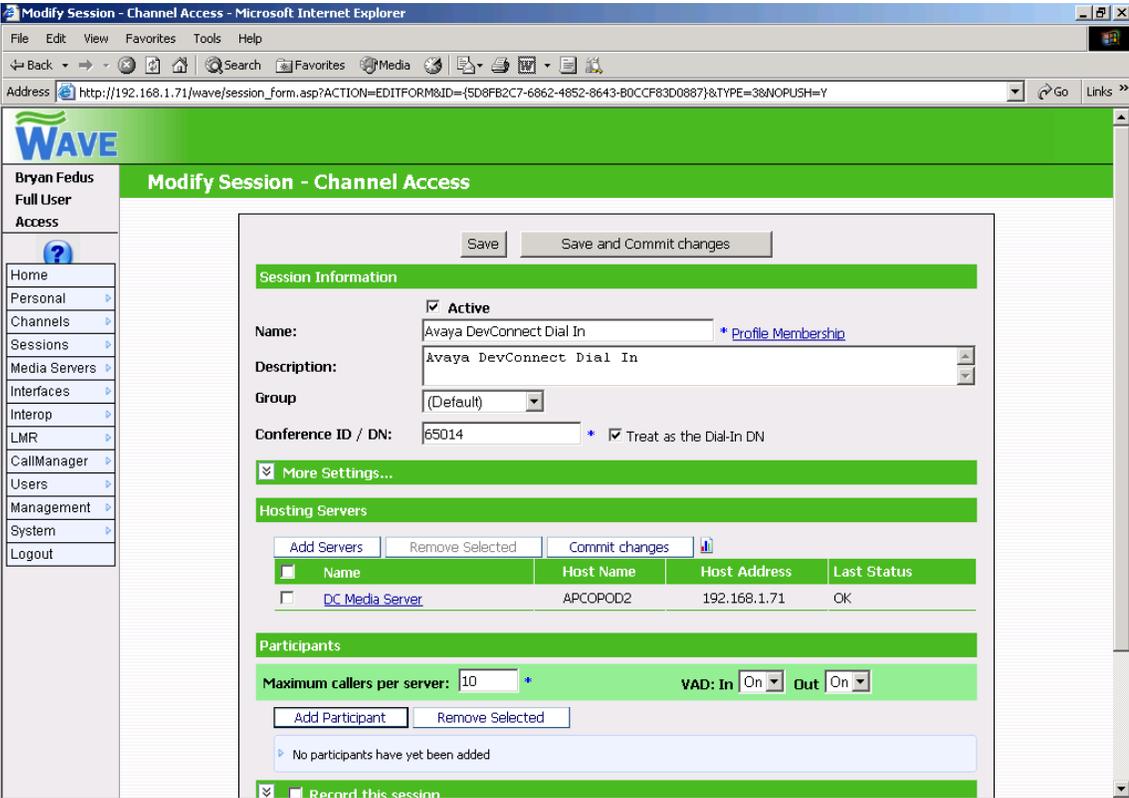
Step	Description
15.	<p>From the pull-down menu for the <b>Session Type</b> field, select <b>Channel Access</b>. This is the appropriate choice to create a dial-in session for the channel created earlier.</p> <p>Select <b>Next</b> to continue.</p> 

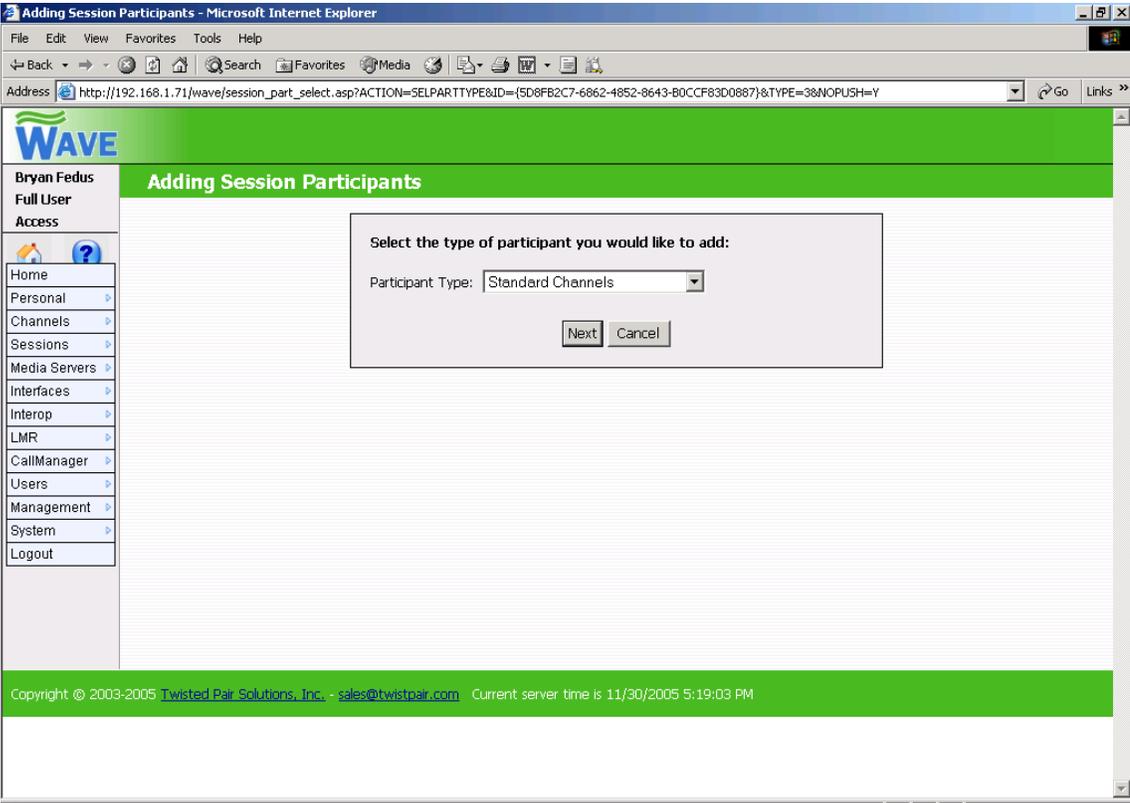
Step	Description
16.	<p>Enter any descriptive name in the <b>Name</b> field. Optionally, a description can be added in the <b>Description</b> field. If not, the <b>Description</b> field will be auto-populated with the same information entered in the <b>Name</b> field. Check the check box next to <b>Active</b>. Use the default value for the remaining field.</p> <p>Select <b>Save</b> to continue.</p> 

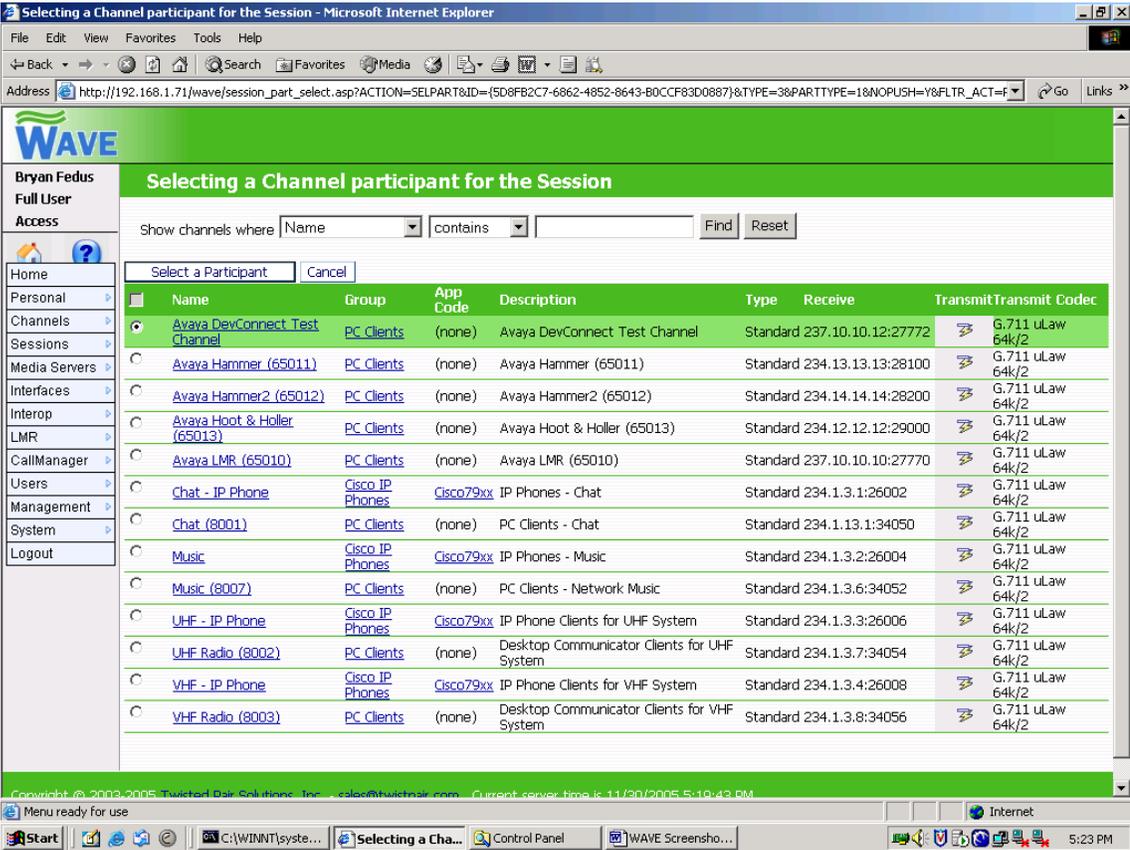
Step	Description
17.	<p>The <b>Modify Session</b> window appears as shown below. The <b>Name</b> and <b>Description</b> fields are auto-populated from the information provided in the previous step. In the <b>Conference ID / DN</b> field, enter a valid extension on Avaya Communication Manager that will serve as the dial-in number. Verify that the check box is checked next to <b>Treat as the Dial-In DN</b>. Users can be required to enter a personal identification number when dialing in by entering a value in the <b>Speaker PIN</b> field. Use default values for all other fields.</p>  <p>The screenshot shows the 'Modify Session - Channel Access' web page. The browser title is 'Modify Session - Channel Access - Microsoft Internet Explorer'. The address bar shows 'http://192.168.1.71/wave/session_form.asp?ACTION=EDITFORM&amp;ID={5D8FB2C7-6862-4852-8643-80CCF83D0887}&amp;TYPE=3'. The page has a green header with the 'WAVE' logo and the text 'Modify Session - Channel Access'. On the left, there is a navigation menu for 'Bryan Fedus Full User Access' with options like Home, Personal, Channels, Sessions, Media Servers, Interfaces, Interop, LMR, CallManager, Users, Management, System, and Logout. The main content area has a 'Session Information' section with fields for Name (Avaya DevConnect Dial In), Description (Avaya DevConnect Dial In), Group (Default), and Conference ID / DN (65014). The 'Treat as the Dial-In DN' checkbox is checked. Below this is a 'More Settings...' section with fields for Speaker PIN (***), Allow Listen-Only participants (unchecked), Listen-Only PIN, Dial-In Greeting (Standard), Audio notification on join (Standard), Audio notification on leave (Standard), Enable audio loopback (unchecked), Enable Name Announce (unchecked), and Keypad attention digits (#). At the bottom, there is a 'Hosting Servers' section with buttons for 'Add Servers', 'Remove Selected', and 'Commit changes'.</p>

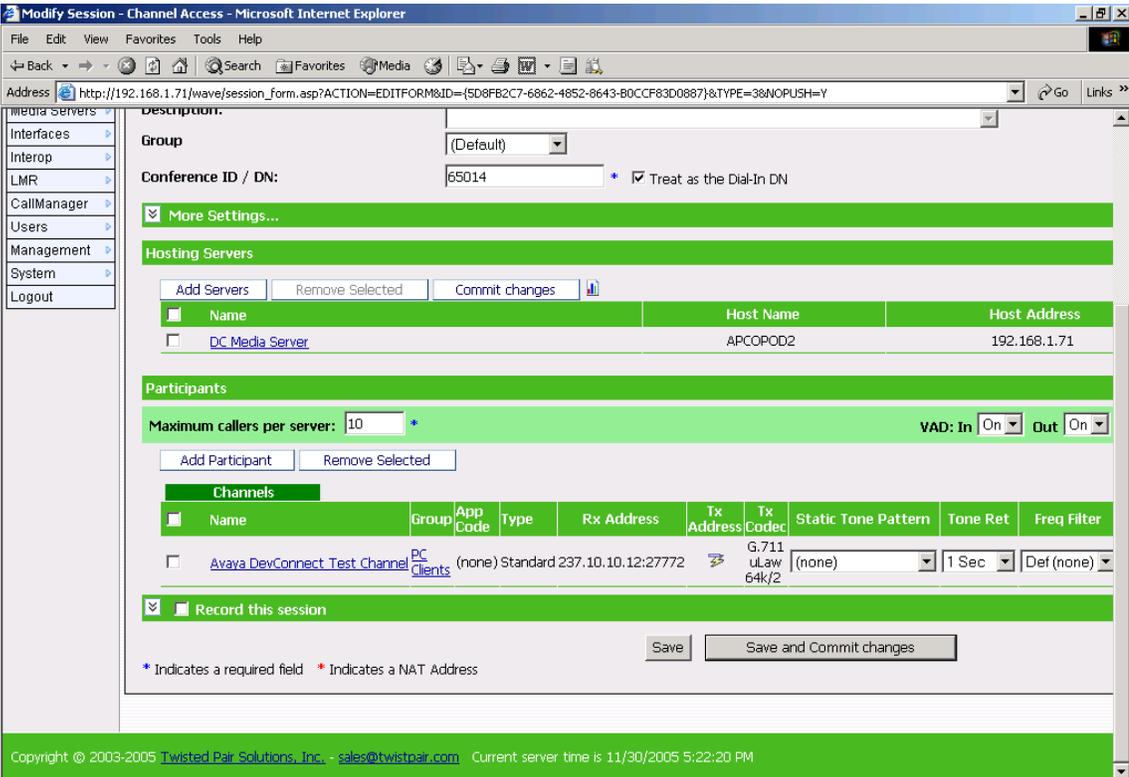
Step	Description
18.	<p>Scroll to the bottom of this same page to define which WAVE Media Server will host this session.</p> <p>Select the <b>Add Servers</b> button.</p> 

Step	Description
19.	<p>A list of available WAVE Media Servers will appear. Check the box next to the <b>Name</b> of the server to host this session. In the case of the compliance test, there was only one WAVE Media Server.</p> <p>Select the <b>Add Selected Servers</b> button to continue.</p> 

Step	Description
20.	<p>After adding a server, the administrator is returned to the <b>Modify Session</b> window. Select the <b>Add Participant</b> button to define which channels will use this dial-in session.</p> 

Step	Description
21.	<p>From the pull-down menu for the <b>Participant Type</b> field, select <b>Standard Channels</b>.</p> <p>Select <b>Next</b> to continue.</p> 

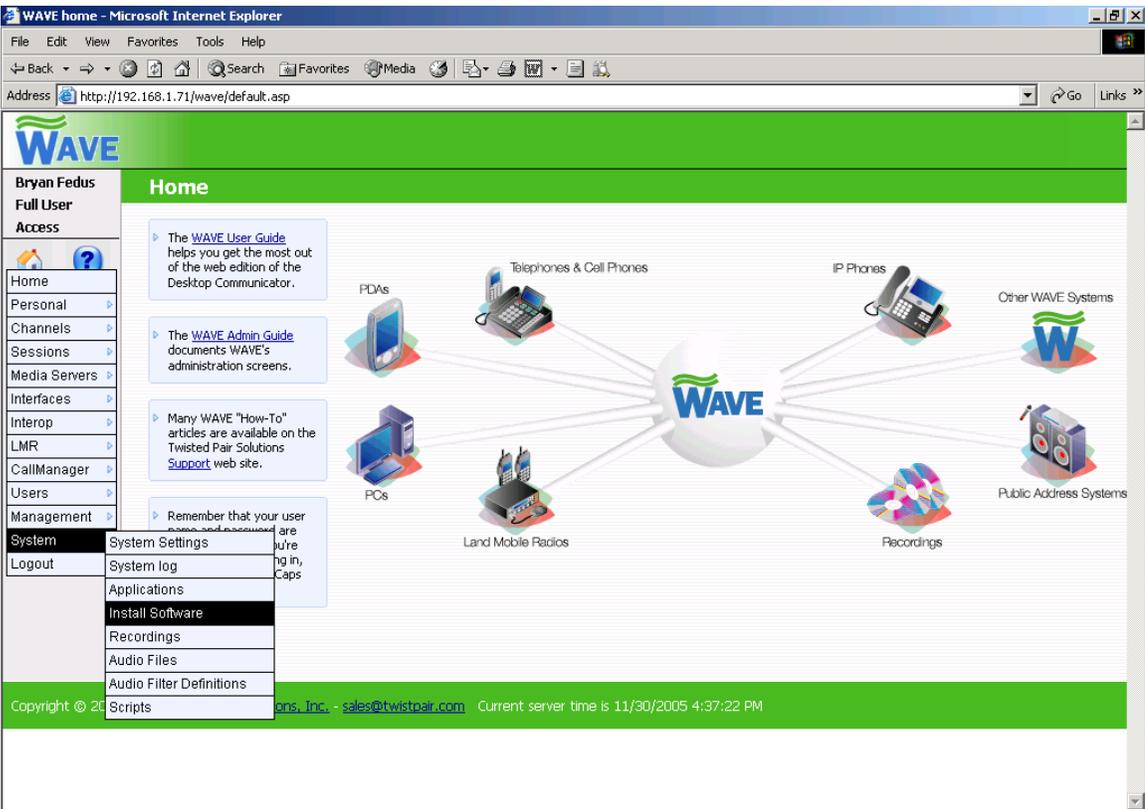
Step	Description																																																																																																		
22.	<p>A list of available channels will appear including the channel created earlier. Select the radio button next to the channel to be added. In the case of the example below, the <b>Avaya DevConnect Test Channel</b> was selected.</p> <p>Choose the <b>Select a Participant</b> button to continue.</p>  <table border="1" data-bbox="422 730 1409 1182"> <thead> <tr> <th>Name</th> <th>Group</th> <th>App Code</th> <th>Description</th> <th>Type</th> <th>Receive</th> <th>Transmit/Transmit Codec</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="radio"/> Avaya DevConnect Test Channel</td> <td>PC Clients</td> <td>(none)</td> <td>Avaya DevConnect Test Channel</td> <td>Standard</td> <td>237.10.10.12:27772</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Avaya Hammer (65011)</td> <td>PC Clients</td> <td>(none)</td> <td>Avaya Hammer (65011)</td> <td>Standard</td> <td>234.13.13.13:28100</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Avaya Hammer2 (65012)</td> <td>PC Clients</td> <td>(none)</td> <td>Avaya Hammer2 (65012)</td> <td>Standard</td> <td>234.14.14.14:28200</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Avaya Hoot &amp; Holler (65013)</td> <td>PC Clients</td> <td>(none)</td> <td>Avaya Hoot &amp; Holler (65013)</td> <td>Standard</td> <td>234.12.12.12:29000</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Avaya LMR (65010)</td> <td>PC Clients</td> <td>(none)</td> <td>Avaya LMR (65010)</td> <td>Standard</td> <td>237.10.10.10:27770</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Chat - IP Phone</td> <td>Cisco IP Phones</td> <td>Cisco79xx</td> <td>IP Phones - Chat</td> <td>Standard</td> <td>234.1.3.1:26002</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Chat (8001)</td> <td>PC Clients</td> <td>(none)</td> <td>PC Clients - Chat</td> <td>Standard</td> <td>234.1.13.1:34050</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Music</td> <td>Cisco IP Phones</td> <td>Cisco79xx</td> <td>IP Phones - Music</td> <td>Standard</td> <td>234.1.3.2:26004</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> Music (8007)</td> <td>PC Clients</td> <td>(none)</td> <td>PC Clients - Network Music</td> <td>Standard</td> <td>234.1.3.6:34052</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> UHF - IP Phone</td> <td>Cisco IP Phones</td> <td>Cisco79xx</td> <td>IP Phone Clients for UHF System</td> <td>Standard</td> <td>234.1.3.3:26006</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> UHF Radio (8002)</td> <td>PC Clients</td> <td>(none)</td> <td>Desktop Communicator Clients for UHF System</td> <td>Standard</td> <td>234.1.3.7:34054</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> VHF - IP Phone</td> <td>Cisco IP Phones</td> <td>Cisco79xx</td> <td>IP Phone Clients for VHF System</td> <td>Standard</td> <td>234.1.3.4:26008</td> <td>G.711 uLaw 64k/2</td> </tr> <tr> <td><input type="radio"/> VHF Radio (8003)</td> <td>PC Clients</td> <td>(none)</td> <td>Desktop Communicator Clients for VHF System</td> <td>Standard</td> <td>234.1.3.8:34056</td> <td>G.711 uLaw 64k/2</td> </tr> </tbody> </table>	Name	Group	App Code	Description	Type	Receive	Transmit/Transmit Codec	<input checked="" type="radio"/> Avaya DevConnect Test Channel	PC Clients	(none)	Avaya DevConnect Test Channel	Standard	237.10.10.12:27772	G.711 uLaw 64k/2	<input type="radio"/> Avaya Hammer (65011)	PC Clients	(none)	Avaya Hammer (65011)	Standard	234.13.13.13:28100	G.711 uLaw 64k/2	<input type="radio"/> Avaya Hammer2 (65012)	PC Clients	(none)	Avaya Hammer2 (65012)	Standard	234.14.14.14:28200	G.711 uLaw 64k/2	<input type="radio"/> Avaya Hoot & Holler (65013)	PC Clients	(none)	Avaya Hoot & Holler (65013)	Standard	234.12.12.12:29000	G.711 uLaw 64k/2	<input type="radio"/> Avaya LMR (65010)	PC Clients	(none)	Avaya LMR (65010)	Standard	237.10.10.10:27770	G.711 uLaw 64k/2	<input type="radio"/> Chat - IP Phone	Cisco IP Phones	Cisco79xx	IP Phones - Chat	Standard	234.1.3.1:26002	G.711 uLaw 64k/2	<input type="radio"/> Chat (8001)	PC Clients	(none)	PC Clients - Chat	Standard	234.1.13.1:34050	G.711 uLaw 64k/2	<input type="radio"/> Music	Cisco IP Phones	Cisco79xx	IP Phones - Music	Standard	234.1.3.2:26004	G.711 uLaw 64k/2	<input type="radio"/> Music (8007)	PC Clients	(none)	PC Clients - Network Music	Standard	234.1.3.6:34052	G.711 uLaw 64k/2	<input type="radio"/> UHF - IP Phone	Cisco IP Phones	Cisco79xx	IP Phone Clients for UHF System	Standard	234.1.3.3:26006	G.711 uLaw 64k/2	<input type="radio"/> UHF Radio (8002)	PC Clients	(none)	Desktop Communicator Clients for UHF System	Standard	234.1.3.7:34054	G.711 uLaw 64k/2	<input type="radio"/> VHF - IP Phone	Cisco IP Phones	Cisco79xx	IP Phone Clients for VHF System	Standard	234.1.3.4:26008	G.711 uLaw 64k/2	<input type="radio"/> VHF Radio (8003)	PC Clients	(none)	Desktop Communicator Clients for VHF System	Standard	234.1.3.8:34056	G.711 uLaw 64k/2
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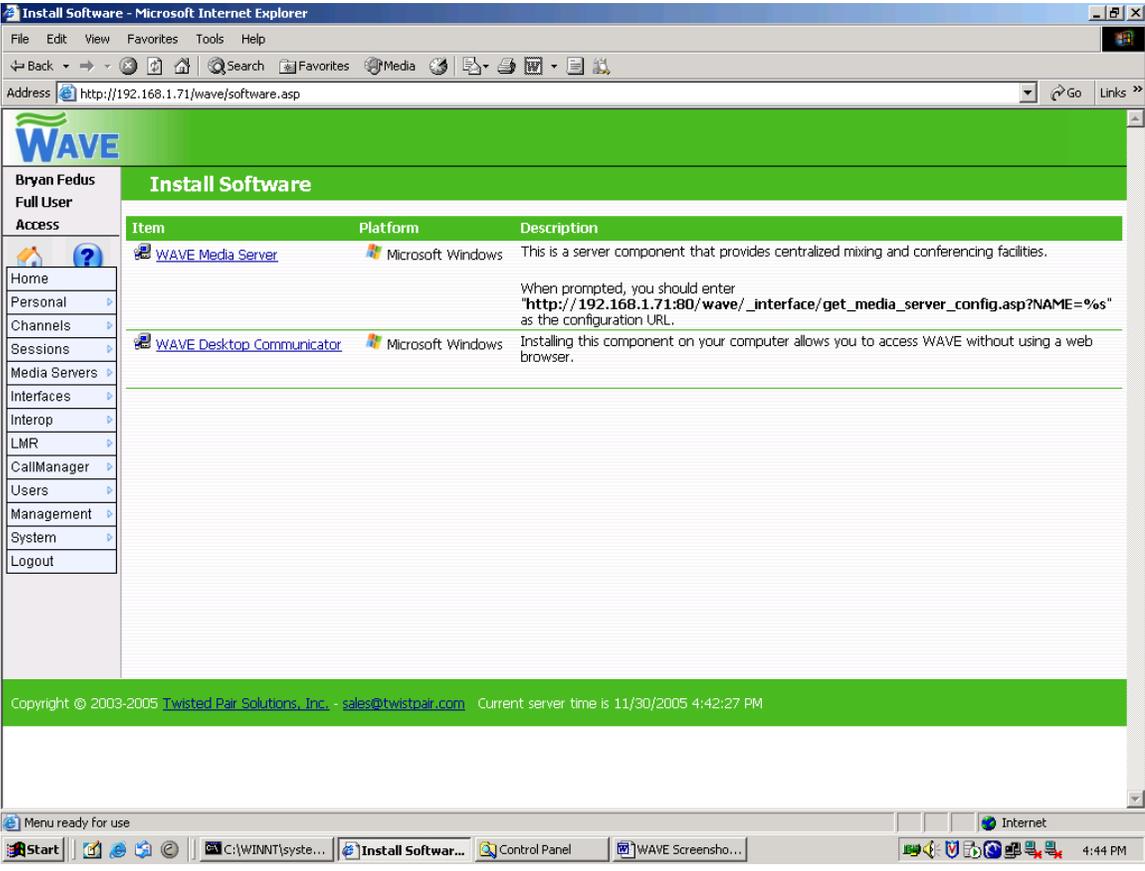
Step	Description
23.	<p>After selecting a participant, the administrator is returned to the <b>Modify Session</b> window. Scroll to the bottom of the page to view the participant just added.</p> <p>Select the <b>Save and Commit changes</b> button.</p> 

Step	Description																																																																																																
24.	<p>After committing the changes, the administrator is returned to the <b>Sessions</b> window. The sessions are listed alphabetically. The newly created session appears at the top of the list.</p>																																																																																																
<p>The screenshot shows the 'Sessions' management page. The table below represents the data visible in the screenshot:</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Group</th> <th>Description</th> <th>Type</th> <th>Session ID / DN</th> <th>Servers</th> </tr> </thead> <tbody> <tr> <td>Avaya DevConnect Dial In</td> <td>(Default)</td> <td>Avaya DevConnect Dial In</td> <td>Channel Access</td> <td>65014</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya H&amp;H Dial-In</td> <td>Dial-In Access</td> <td>Avaya H&amp;H Dial-In</td> <td>Advanced</td> <td>65013</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hammer - Dial-In</td> <td>Dial-In Access</td> <td>Avaya Hammer - Dial-In</td> <td>Advanced</td> <td>65011</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hammer2 Dial-In</td> <td>Dial-In Access</td> <td>Avaya Hammer2 Dial-In</td> <td>Advanced</td> <td>65012</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Hoot Record</td> <td>(Default)</td> <td>Avaya Test</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Avaya LMR Dial In</td> <td>Dial-In Access</td> <td>Avaya LMR Dial In</td> <td>Advanced</td> <td>65010</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya Meet-Me Test</td> <td>Dial-In Access</td> <td>Avaya Meet-Me Test</td> <td>Meet Me</td> <td>65005</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya UHF Test</td> <td>Dial-In Access</td> <td>Avaya UHF Test</td> <td>Advanced</td> <td>65002</td> <td>DC Media Server</td> </tr> <tr> <td>Avaya VHF Test</td> <td>Dial-In Access</td> <td>Avaya VHF Test</td> <td>Advanced</td> <td>65003</td> <td>DC Media Server</td> </tr> <tr> <td>Chat Channel Recording</td> <td>Recording</td> <td>Chat Channel Recording</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Chat Dial-In</td> <td>Dial-In Access</td> <td>Chat Dial-In</td> <td>Channel Access</td> <td>8001</td> <td>DC Media Server</td> </tr> <tr> <td>Chat to IP Phone Bridge</td> <td>Bridge</td> <td>Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge</td> <td>Advanced</td> <td></td> <td>DC Media Server</td> </tr> <tr> <td>Emergency All Call</td> <td>Dial-In Access</td> <td>Emergency All Call</td> <td>Advanced</td> <td>8050</td> <td>DC Media Server</td> </tr> <tr> <td>Group Call</td> <td>Conferences</td> <td>Group Call</td> <td>Group Call</td> <td>8004</td> <td>DC Media Server</td> </tr> <tr> <td>Meet-Me Conference</td> <td>Conferences</td> <td>Meet-Me Conference</td> <td>Meet Me</td> <td>8005</td> <td>DC Media Server</td> </tr> </tbody> </table>		Name	Group	Description	Type	Session ID / DN	Servers	Avaya DevConnect Dial In	(Default)	Avaya DevConnect Dial In	Channel Access	65014	DC Media Server	Avaya H&H Dial-In	Dial-In Access	Avaya H&H Dial-In	Advanced	65013	DC Media Server	Avaya Hammer - Dial-In	Dial-In Access	Avaya Hammer - Dial-In	Advanced	65011	DC Media Server	Avaya Hammer2 Dial-In	Dial-In Access	Avaya Hammer2 Dial-In	Advanced	65012	DC Media Server	Avaya Hoot Record	(Default)	Avaya Test	Advanced		DC Media Server	Avaya LMR Dial In	Dial-In Access	Avaya LMR Dial In	Advanced	65010	DC Media Server	Avaya Meet-Me Test	Dial-In Access	Avaya Meet-Me Test	Meet Me	65005	DC Media Server	Avaya UHF Test	Dial-In Access	Avaya UHF Test	Advanced	65002	DC Media Server	Avaya VHF Test	Dial-In Access	Avaya VHF Test	Advanced	65003	DC Media Server	Chat Channel Recording	Recording	Chat Channel Recording	Advanced		DC Media Server	Chat Dial-In	Dial-In Access	Chat Dial-In	Channel Access	8001	DC Media Server	Chat to IP Phone Bridge	Bridge	Chat Desktop Communicator Channel to Chat IP Phone Client Channel Bridge	Advanced		DC Media Server	Emergency All Call	Dial-In Access	Emergency All Call	Advanced	8050	DC Media Server	Group Call	Conferences	Group Call	Group Call	8004	DC Media Server	Meet-Me Conference	Conferences	Meet-Me Conference	Meet Me	8005	DC Media Server
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### 4.3. Configure WAVE Desktop Communicator

This section describes the configuration of the Twisted Pair Solutions WAVE Desktop Communicator. No manual configuration is required beyond the initial software installation. Each time a user logs into the WAVE Desktop Communicator with a specific profile, the configuration for that profile is automatically downloaded from the WAVE Management Server to the WAVE Desktop Communicator.

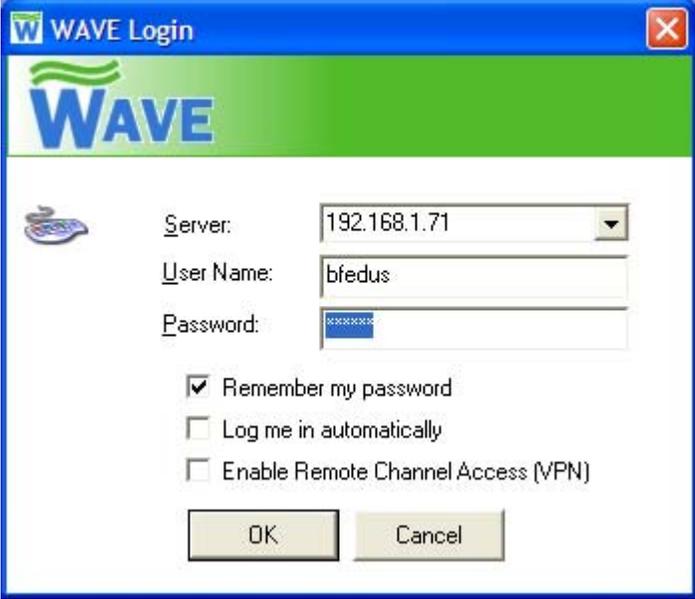
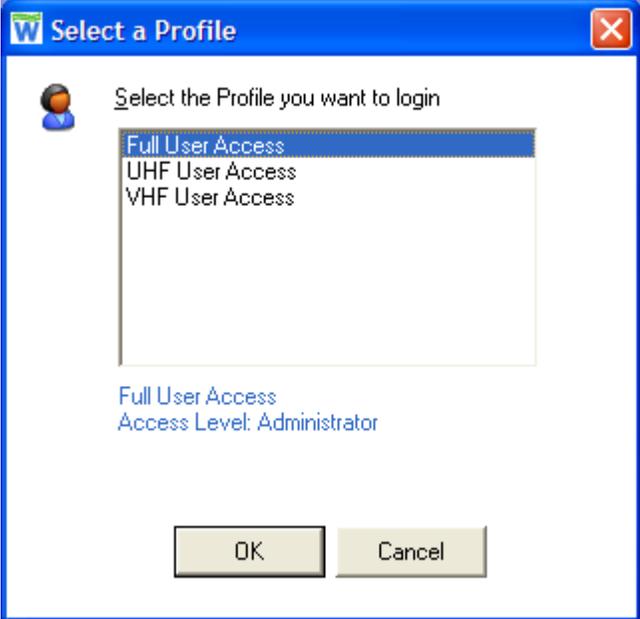
Step	Description
1.	<p>Follow the installation procedures for the WAVE Desktop Communicator outlined in the WAVE Version 2.0 Service Pack 1 Administration Guide [3] by selecting <b>System</b> → <b>Install Software</b> from the main menu on the left of the window. In the case of the compliance test, the WAVE Desktop Communicator was installed on a different host (IP address of 192.168.1.72) than the WAVE Management Server.</p> 

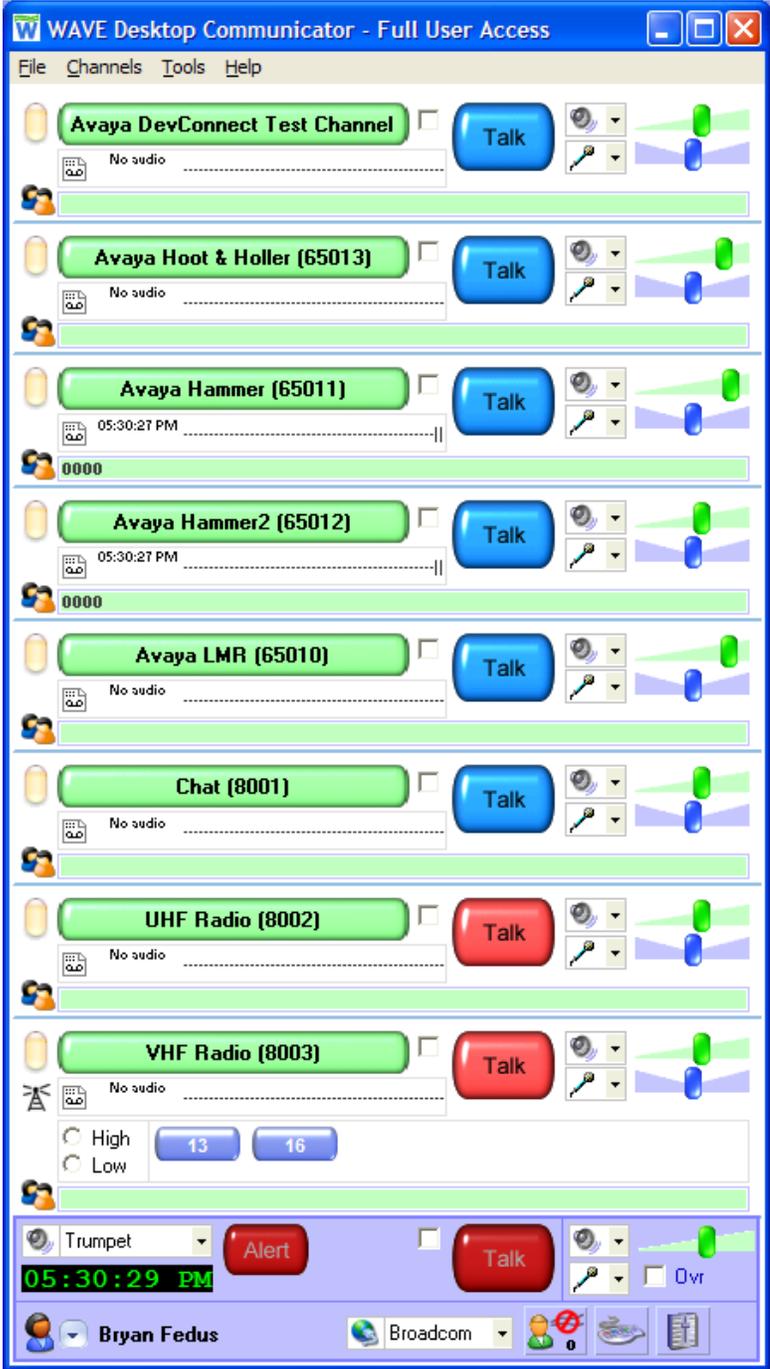
Step	Description
2.	<p>Double-click on WAVE Desktop Communicator and follow the prompts to complete the installation.</p> 

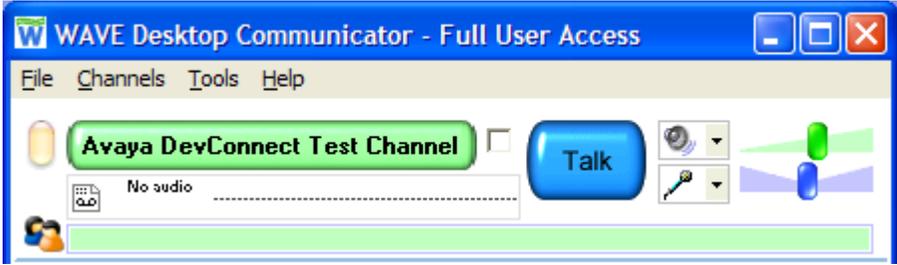
## 5. Using WAVE Desktop Communicator

This section describes the most basic operation of the Twisted Pair Solutions WAVE Desktop Communicator. For a complete description of all icons and features please refer to the WAVE Version 2.0 Service Pack 1 Desktop Communicator User Guide. The WAVE Desktop Communicator is used by the end-user to access a WAVE channel from a PC.

Step	Description
1.	<p>Launch the WAVE Desktop Communicator from the Windows Start menu by navigating to <b>Start → Programs → Twisted Pair Solutions → WAVE → Desktop Communicator.</b></p>

Step	Description
2.	<p>Select the IP address of the WAVE Media Server from the pull-down menu next to the <b>Server</b> field. Enter a valid <b>User Name</b> and <b>Password</b>.</p> <p>Select <b>OK</b> to continue.</p> 
3.	<p>From the list of profiles provided, highlight the one to be used for login.</p> <p>Select <b>OK</b> to continue.</p> 

Step	Description
4.	<p>The main WAVE Desktop Communicator window will appear. In the example shown below, the user has access to eight separate channels including some Hoot and Holler type channels and LMR type channels. Each channel is represented as a separate panel in the window with a white background called the Client Channel Panel. The last panel in the window with the purple background is the Client Control Panel which contains controls which are not channel specific.</p>  <p>The screenshot displays the 'WAVE Desktop Communicator - Full User Access' window. It features a menu bar with 'File', 'Channels', 'Tools', and 'Help'. Below the menu are eight channel panels, each with a green header and a 'Talk' button. The channels are: 'Avaya DevConnect Test Channel', 'Avaya Hoot &amp; Holler (65013)', 'Avaya Hammer (65011)', 'Avaya Hammer2 (65012)', 'Avaya LMR (65010)', 'Chat (8001)', 'UHF Radio (8002)', and 'VHF Radio (8003)'. The 'UHF Radio' and 'VHF Radio' panels have red 'Talk' buttons. The bottom panel is the 'Client Control Panel' with a purple background, containing a 'Trumpet' dropdown, an 'Alert' button, a 'Talk' button, a 'Dvr' checkbox, a digital clock showing '05:30:29 PM', and the user name 'Bryan Fedus'. The 'Broadcom' logo is also visible in the bottom right corner.</p>

Step	Description
5.	<p>The example below shows the <b>Client Channel Panel</b> for the <b>Avaya DevConnect Test Channel</b>. The channel is active, as indicated by the <b>Channel Activity</b> icon being yellow. The <b>Channel Activity</b> icon is oval-shaped and is located to the far left of the <b>Client Channel Panel</b>.</p> <p>The channel name appears on the <b>Channel State</b> button. If the <b>Channel State</b> button is green, as shown below, the channel is not muted. If it is yellow, the channel is muted. Multiple channels can be active at one time and the conversation on all active channels will be heard on the user's PC speakers. Below the <b>Channel State</b> button is the text <b>No audio</b>. This indicates that no one is currently speaking on this channel even though it is active. If someone was speaking, a timestamp would appear in this area of the window.</p> <p>The mute state of a channel can be toggled on or off by clicking the <b>Channel State</b> button. If the user wishes to be removed from a channel, the user would click on the <b>Channel Activity</b> icon and the icon would turn grey.</p> <p>To talk on a channel, the user clicks the <b>Talk</b> button. If the <b>Talk</b> button is blue, then the microphone for that channel is latched. This means the user does not have to hold the <b>Talk</b> button down to be heard. The user clicks the <b>Talk</b> button again when the user is done speaking. If the <b>Talk</b> button is red, then the microphone for that channel is not latched. This means the user must hold down the <b>Talk</b> button to be heard and releases the <b>Talk</b> button when the user is done talking.</p> <p>To exit the application, navigate to <b>File</b> → <b>Exit</b> from the menu bar.</p> 

## 6. Interoperability Compliance Testing

This section describes the compliance testing used to verify the interoperability of Twisted Pair Solutions WAVE and Avaya Communication Manager using a H.323 IP trunk.

### 6.1. General Test Approach

The general test approach focused on verifying that endpoints controlled by Avaya Communication Manager could connect to communication channels hosted by WAVE, interoperate with WAVE endpoints and participate with acceptable voice quality. The following functionality was exercised as part of the compliance test.

- Calls to WAVE sessions involving only Avaya Communication Manager endpoints (H.323, digital, and analog).
- Calls to WAVE sessions involving Avaya Communication Manager endpoints (H.323, digital, and analog) and WAVE Desktop Communicator tuned to the corresponding WAVE channel. This simulated a Hoot and Holler network scenario.
- Calls to WAVE sessions involving Avaya Communication Manager endpoints (H.323, digital, and analog) and land mobile radios tied to the corresponding WAVE channel. This simulated a first responder radio network scenario.
- Calls using G.711 and G.729 codecs.
- Calls requiring transcoding internal to WAVE. If calls attempt to connect to a WAVE channel using a different codec than the channel itself, then WAVE will perform the transcoding and convert the audio from one codec to the other.
- DTMF transmission using out-of-band signaling.
- Interactions with hold, transfer and conference.
- Direct IP-to-IP media (also known as “shuffling” which allows H.323 endpoints to send audio (RTP) packets directly to each other without using media resources on the Avaya Media Gateway).

In addition, the solution’s recovery behavior was tested with network failures and system restarts. Lastly, a bulk call generator was used to generate significant call volumes to three separate WAVE sessions simultaneously.

## 6.2. Test Results

All test cases passed. Endpoints controlled by Avaya Communication Manager were able to dial-in to WAVE sessions and be connected to existing WAVE channels. These endpoints were able to participate with acceptable voice quality with native WAVE endpoints connected to the channel.

The following observations were made during the compliance test and documented in the configuration steps where appropriate:

1. This solution does not support in-band transmission of DTMF tones.
2. If G.729 appears in the codec set on Avaya Communication Manager, this solution requires that it appears first in the preferred list.
3. Intermittently, endpoints registered to the Avaya S8500 Media Server or connected to the Avaya G650 Media Gateway at site 1 in **Figure 1** could not rejoin a WAVE session after placing the call on hold that connects to the WAVE session. In these instances, multiple attempts to take the call off hold were necessary to rejoin the session.

## 7. Verification Steps

The following steps may be used to verify the configuration:

1. Verify that the state of the H.323 IP trunk between the WAVE Media Server and the Avaya Media Server is in-service. To accomplish this, use the **status trunk-group x** command, where *x* is the trunk group number associated with this trunk.

2. Place a call to a dial-in WAVE session with an associated WAVE channel from an Avaya Communication Manager endpoint. Verify that the Avaya Communication Manager endpoint has a two-way talk path to a WAVE endpoint currently on the channel.
3. Place two calls to a dial-in WAVE session that requires a PIN. Originate the calls from two Avaya Communication Manager endpoints. Verify that a two-way talk path is established between the endpoints via the WAVE session thus verifying the PIN digits were correctly detected.

## 8. Support

Technical support for Twisted Pair Solutions WAVE can be obtained by contacting Twisted Pair Solutions via the support link at <http://www.twistpair.com>.

## 9. Conclusion

These Application Notes describe the procedures for configuring the group communication solution comprised of Avaya Communication Manager and Twisted Pair Solutions Wide Area Voice Environment (WAVE) using a H.323 IP trunk. This solution allows endpoints and trunk calls controlled by Avaya Communication Manager to connect to “always on” communication channels hosted by WAVE and interoperate with WAVE endpoints. Typical environments that currently use WAVE are Hoot and Holler networks for financial markets and Land Mobile Radio environments requiring radio interoperability with other frequencies or endpoints.

## 10. Additional References

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

- [1] Feature Description and Implementation For Avaya Communication Manager, Release 3.0, Issue 3.0, June 2005, Document Number 555-245-205
- [2] Administrator Guide for Avaya Communication Manager, Release 3.0, Issue 1.0, June 2005, Document Number 03-300509

The following WAVE product documentation is available from Twisted Pair Solutions. Visit the website at <http://www.twistpair.com> for company and product information.

- [3] WAVE Version 2.0 Service Pack 1 Administration Guide
- [4] WAVE Version 2.0 Service Pack 1 Desktop Communicator User Guide

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