



Application Notes for Configuring Avaya IP Office 11.1 with Telenor IPT Multi-User SIP Trunk – Issue 1.0

Abstract

These Application Notes describe the procedures for configuring Session Initiation Protocol (SIP) trunking between Telenor IPT Multi-User SIP Trunk and Avaya IP Office.

The Telenor IPT Multi-User SIP Trunk Platform provides PSTN access via a SIP trunk connected to the Telenor Voice over Internet Protocol (VoIP) network as an alternative to legacy analogue or digital trunks. Telenor is a member of the Avaya DevConnect Service Provider program.

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

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

1. Introduction

These Application Notes describe the procedures for configuring Session Initiation Protocol (SIP) trunking between the Telenor IPT Multi-User SIP Trunk and Avaya IP Office R11.1. Customers using this Avaya SIP-enabled enterprise solution with Telenor IPT Multi-User SIP Trunk are able to place and receive PSTN calls via a dedicated Internet connection and the SIP protocol. This converged network solution is an alternative to traditional PSTN trunks. This approach generally results in lower cost for the enterprise customer.

2. General Test Approach and Test Results

The general test approach was to configure a simulated enterprise site using Avaya IP Office R11.1 to connect to the Telenor IPT Multi-User SIP Platform. This configuration (shown in **Figure 1**) was used to exercise the features and functionality listed in **Section 2.1**.

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

Avaya recommends our customers implement Avaya solutions using appropriate security and encryption capabilities enabled by our products. The testing referenced in these DevConnect Application Notes included the enablement of supported encryption capabilities in the Avaya products. Readers should consult the appropriate Avaya product documentation for further information regarding security and encryption capabilities supported by those Avaya products.

Support for these security and encryption capabilities in any non-Avaya solution component is the responsibility of each individual vendor. Readers should consult the appropriate vendor-supplied product documentation for more information regarding those products.

For the testing associated with this Application Note, the interface between Avaya systems and the Telenor IPT Multi-User SIP platform do not include use of any specific encryption features.

2.1. Interoperability Compliance Testing

Avaya IP Office was connected to the Telenor IPT Multi-User SIP Trunk. To verify SIP trunking interoperability the following features and functionality were exercised during the interoperability compliance test:

- Incoming PSTN calls to various phone types including H.323, SIP, Digital and Analog telephones at the enterprise.
- All inbound PSTN calls were routed to the enterprise across the SIP trunk from the Service Provider.
- Outgoing PSTN calls from various phone types including H.323, SIP, Digital, and Analog telephones at the enterprise.
- All outbound PSTN calls were routed from the enterprise across the SIP trunk to the Service Provider.
- Incoming and Outgoing PSTN calls to/from Avaya Workplace Client for Windows soft phone.
- Calls using the G.722 and G.711A codec's.
- Fax calls to/from a group 3 fax machine to a PSTN-connected fax machine using G.711 pass-through transmissions.
- DTMF transmission using RFC 2833 with successful Voice Mail/Vector navigation for inbound and outbound calls.
- Various call types including: local, long distance, international, toll free (outbound) and directory assistance.
- Caller ID presentation and Caller ID restriction.
- User features such as hold and resume, and conference.
- Blind and Consultative call transfer to PSTN.
- Off-net call forwarding and mobile twinning.

2.2. Test Results

Interoperability testing of the sample configuration was completed with successful results for the Telenor IPT Multi-User SIP Trunk with the following observations:

- T.38 fax is not supported by Telenor and therefore was not tested.
- No inbound toll-free numbers were tested, however routing of inbound DDI numbers and the relevant number translation was successfully tested.
- Access to Emergency Services was not tested as no test call had been booked by the Service Provider with the Emergency Services Operator.

2.3. Support

For technical support on the Avaya products described in these Application Notes visit <http://support.avaya.com>.

For technical support on Telenor products please use the following web link: <https://www.telenor.no/bedrift/kundeservice/>

3. Reference Configuration

Figure 1 illustrates the test configuration. The test configuration shows an enterprise site connected to the Telenor IPT Multi-User SIP Trunk. Located at the enterprise site is an Avaya IP Office Server Edition and Avaya IP Office 500 V2 as an expansion. Endpoints include Avaya 1600 Series IP Telephones (with H.323 firmware), Avaya 9600 Series IP Telephones (with H.323 firmware), Avaya 1140e SIP Telephones, Avaya J179 Series SIP Phones, Avaya 1400 Series Digital Deskphones, Analog Telephone and a fax machine. The site also has a Windows 10 PC running Avaya IP Office Manager to configure the Avaya IP Office as well as Avaya Workplace Client for Windows for softphone testing.

For security purposes, public IP addresses have been changed and any PSTN routable phone numbers used in the compliance test are not shown in these Application Notes.

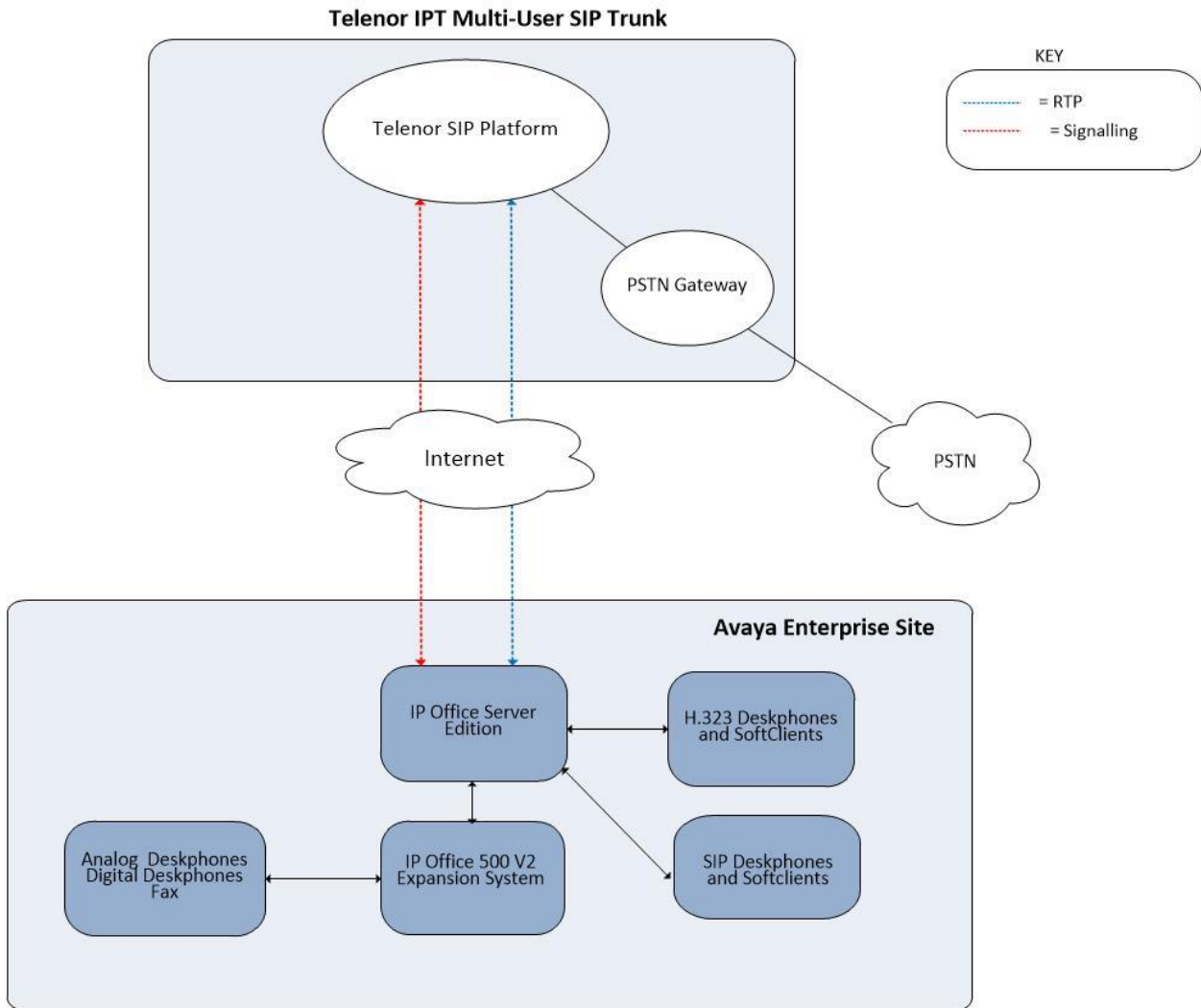


Figure 1: Telenor IPT Multi-User SIP Trunk to Avaya IP Office Topology

4. Equipment and Software Validated

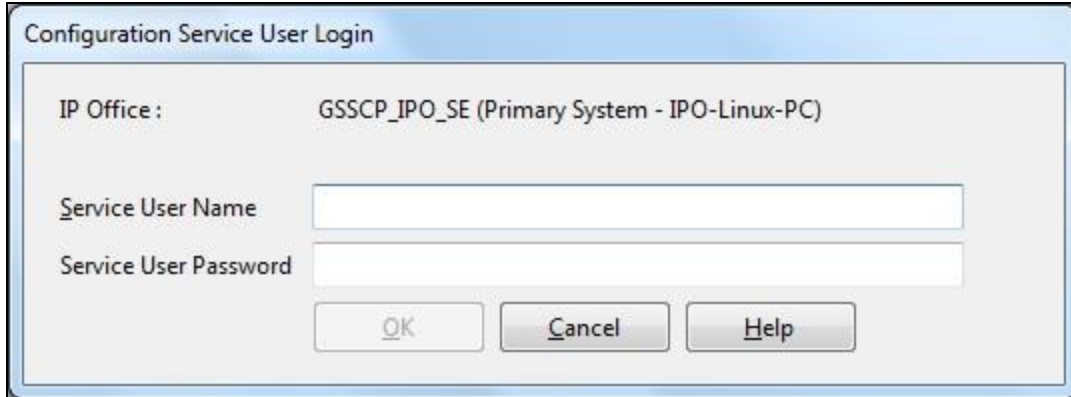
The following equipment and software were used for the sample configuration provided:

Equipment/Software	Release/Version
Avaya	
Avaya IP Office Server Edition	Version 11.1.2.3.0 build 47
Avaya IP Office 500 V2	Version 11.1.2.3.0 build 47
Avaya Voicemail Pro Client	Version 11.1.2.3.0
Avaya IP Office Manager	Version 11.1.2.3.0 build 47
Avaya 1608 Phone (H.323)	1.3.12
Avaya 9611G Series Phone (H.323)	6.8.5
Avaya 9608 Series Phone (H.323)	6.8.5
Avaya J179 IP Phone (SIP)	4.0.13
Avaya Workplace for Windows (SIP)	3.31.2
Avaya 1140e (SIP)	FW: 04.04.30.00.bin
Avaya 98390 Analogue Phone	N/A
Telenor	
Oracle SBC	v9.1

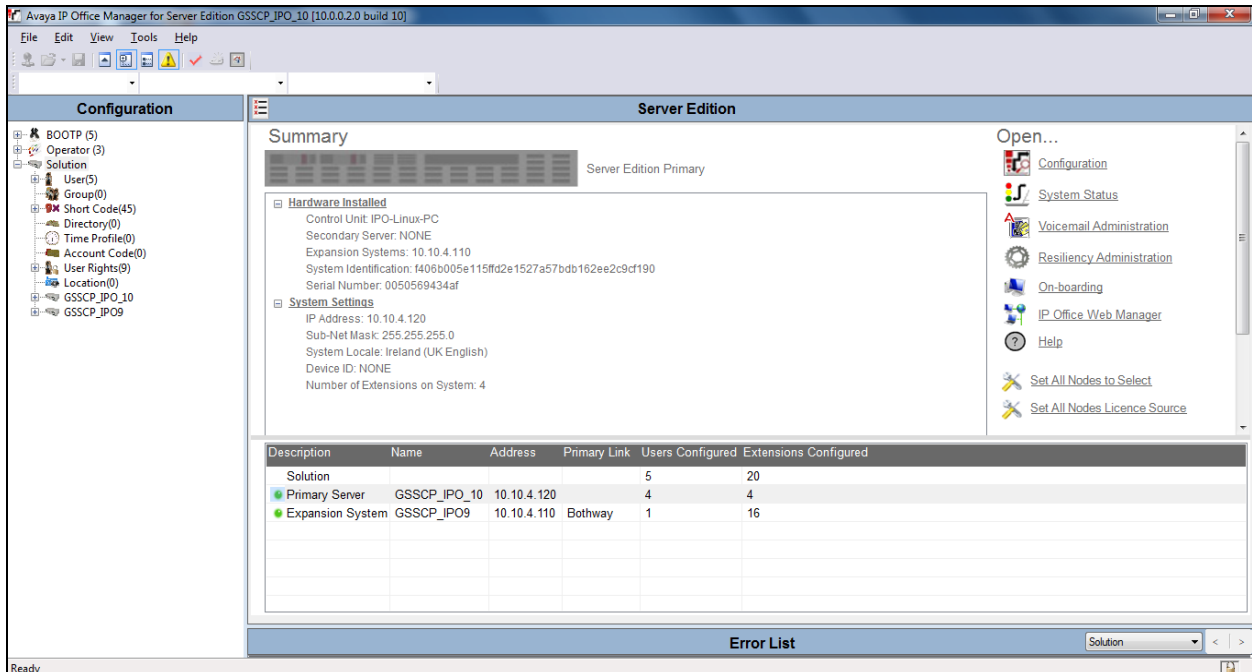
Note – Testing was performed with IP Office Server Edition with 500 V2 Expansion R11.1. Compliance Testing is applicable when the tested solution is deployed with a standalone IP Office 500 V2 and also when deployed with all configurations of IP Office Server Edition. **Note:** that IP Office Server Edition requires an Expansion IP Office 500 V2 to support analog or digital endpoints or trunks, this includes T.38 fax.

5. Configure Avaya IP Office

This section describes the Avaya IP Office configuration to support connectivity to the Telenor IPT Multi-User SIP platform. Avaya IP Office is configured through the Avaya IP Office Manager PC application. From a PC running the Avaya IP Office Manager application, select **Start → Programs → IP Office → Manager** to launch the application. Navigate to **File → Open Configuration**, select the appropriate Avaya IP Office system from the pop-up window and log in with the appropriate credentials.



A management window will appear similar to the one in the next section. All the Avaya IP Office configurable components are shown in the left pane known as the Navigation Pane. The pane on the right is the Details Pane. These panes will be referenced throughout the Avaya IP Office configuration. All licensing and feature configuration that is not directly related to the interface with the Service Provider is assumed to already be in place.



5.1. Verify System Capacity

Navigate to **License** in the Navigation Pane. In the Details Pane verify that the **License Status** for **SIP Trunk Channels** is Valid and that the number of **Instances** is sufficient to support the number of SIP trunk channels provisioned by Telenor.

The screenshot displays the Avaya License Management console interface. At the top, the 'Remote Server' tab is selected. Below the navigation pane, the following license details are shown:

- Licence Mode: Licence Normal
- Licensed Version: 11.0
- PLDS Host ID: 647560473402
- PLDS File Status: Valid

The main area contains a table of license features. The 'SIP Trunk Channels' row is highlighted in blue, indicating it is the selected feature. The table columns are Feature, Instances, Status, Expiry Date, and Source.

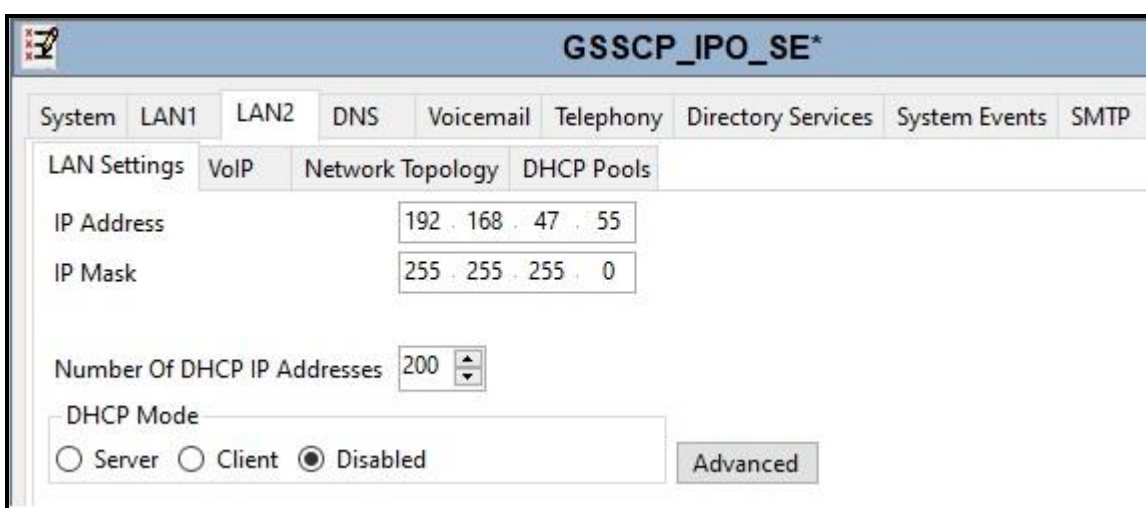
Feature	Instances	Status	Expiry Date	Source
Receptionist	10	Valid	Never	PLDS Nodal
Additional Voicemail Pro Ports	252	Valid	Never	PLDS Nodal
VMPro Recordings Administrators	1	Valid	Never	PLDS Nodal
Office Worker	1000	Valid	Never	PLDS Nodal
VMPro TTS Professional	40	Valid	Never	PLDS Nodal
IPSec Tunnelling	1	Obsolete	Never	PLDS Nodal
Power User	1000	Valid	Never	PLDS Nodal
Customer Service Agent	100	Dormant	Never	PLDS Nodal
Customer Service Supervisor	100	Dormant	Never	PLDS Nodal
Avaya IP endpoints	1000	Valid	Never	PLDS Nodal
SIP Trunk Channels	256	Valid	Never	PLDS Nodal
IP500 Universal PRI (Additional cha...	100	Obsolete	Never	PLDS Nodal
CTI Link Pro	1	Valid	Never	PLDS Nodal
Wave User	16	Obsolete	Never	PLDS Nodal
3rd Party IP Endpoints	1000	Valid	Never	PLDS Nodal
Server Edition	150	Valid	Never	PLDS Nodal
UMS Web Services	1000	Valid	Never	PLDS Nodal
Avaya Mac Softphone	1000	Valid	Never	PLDS Nodal

On the right side of the table, there are two buttons: 'Add...' and 'Remove'.

5.2. LAN2 Settings

In an Avaya IP Office, the LAN2 tab settings correspond to the Avaya IP Office WAN port (public network side) and the LAN1 tab settings correspond to the LAN port (private network side).

In the test configuration, the LAN2 port was used to connect the Avaya IP Office to the external internet. To access the LAN2 settings, first navigate to **System** → **GSSCP_IPO_SE** in the Navigation Pane where GSSCP_IPO_SE is the name of the IP Office. Navigate to the **LAN2** → **LAN Settings** tab in the Details Pane. The **IP Address** and **IP Mask** fields are the public interface of the IP Office. All other parameters should be set according to customer requirements. On completion, click the **OK** button (not shown).



The screenshot displays the configuration page for 'GSSCP_IPO_SE*'. The 'LAN2' tab is selected, and the 'LAN Settings' sub-tab is active. The 'IP Address' field is set to '192 . 168 . 47 . 55' and the 'IP Mask' field is set to '255 . 255 . 255 . 0'. The 'Number Of DHCP IP Addresses' is set to '200'. Under 'DHCP Mode', the 'Disabled' radio button is selected. An 'Advanced' button is visible at the bottom right of the configuration area.

On the **VoIP** tab in the Details Pane, the **H323 Gatekeeper Enable** box is checked to allow the use of Avaya IP Telephones using the H.323 protocol. Check the **SIP Trunks Enable** box to enable the configuration of SIP trunks. If Avaya Communicator along with any other SIP endpoint is to be used, the **SIP Registrar Enable** box must also be checked. The **Domain Name** has been set to the customer premises equipment domain “**avaya.com**”. If the **Domain Name** is left at the default blank setting, SIP registrations may use the IP Office LAN2 IP Address. All other parameters shown are default values.

The **RTP Port Number Range** can be customized to a specific range of receive ports for the RTP media. Set **Scope** to **RTP-RTCP** and **Initial keepalives** to **Enabled** and **Periodic timeout** to **30**.

Avaya IP Office can also be configured to mark the Differentiated Services Code Point (DSCP) in the IP Header with specific values to support Quality of Services policies for both signalling and media. The **DSCP** field is the value used for media and the **SIG DSCP** is the value used for signalling. The specific values used for the compliance test are shown in the example below. All other parameters should be set according to customer requirements. On completion, click the **OK** button (not shown).

The screenshot displays the configuration interface for GSSCP_IPO_SE* in Avaya IP Office. The interface is divided into several sections:

- System Navigation:** Includes tabs for System, LAN1, LAN2, DNS, Voicemail, Telephony, Directory Services, System Events, SMTP, SMDR, VoIP, and Contact Center. The VoIP tab is active.
- LAN Settings:** Includes sub-tabs for LAN Settings, VoIP, and Network Topology. The VoIP sub-tab is selected.
- H323 Gatekeeper Enable:**
 - H323 Gatekeeper Enable
 - Auto-create Extn
 - Auto-create User
 - H323 Remote Extn Enable
 - H.323 Signalling over TLS: Disabled
 - Remote Call Signalling Port: 1720
- SIP Trunks Enable:**
 - SIP Trunks Enable
 - SIP Registrar Enable
 - Auto-create Extn/User
 - SIP Remote Extn Enable
 - Allowed SIP User Agents: Block blacklist only
 - SIP Domain Name: avaya.com
 - SIP Registrar FQDN: avaya.com
- Layer 4 Protocol:**
 - UDP: UDP Port 5060, Remote UDP Port 5060
 - TCP: TCP Port 5060, Remote TCP Port 5060
 - TLS: TLS Port 5061, Remote TLS Port 5061
- Challenge Expiry Time (secs):** 10
- RTP:**
 - Port Number Range: Minimum 49152, Maximum 53246
 - Port Number Range (NAT): Minimum 49152, Maximum 53246
 - Enable RTCP Monitoring on Port 5005
 - RTCP collector IP address for phones: 0 . 0 . 0 . 0
 - Keopalives:
 - Scope: RTP-RTCP
 - Periodic timeout: 30
 - Initial keepalives: Enabled
- DiffServ Settings:**
 - DSCP (Hex): B8, Video DSCP (Hex): B8, DSCP Mask (Hex): FC, SIG DSCP (Hex): 88
 - DSCP: 46, Video DSCP: 46, DSCP Mask: 63, SIG DSCP: 34

On the **Network Topology** tab, set the **Firewall/NAT Type** from the pulldown menu to **Open Internet**. With this configuration, the **STUN Server IP Address** and **STUN Port** are not used as NAT was not required for this configuration, therefore resulting in no requirement for a STUN server. The **Use Network Topology Info** in the **SIP Line** was set to **None** in **Section 5.5.2**. Set **Binding Refresh Time (seconds)** to **300**. This value is used to determine the frequency at which Avaya IP Office will send SIP OPTIONS messages to the service provider. Default values were used for all other parameters. On completion, click the **OK** button (not shown).

The screenshot shows the configuration window for GSSCP_IPO_SE*. The window has a title bar with the text "GSSCP_IPO_SE*" and a menu bar with the following items: System, LAN1, LAN2, DNS, Voicemail, Telephony, Directory Services, System Events, SMTP, SMDR, VoIP, Contact Center, and Avaya Cloud Services. Below the menu bar, there are three tabs: LAN Settings, VoIP, and Network Topology. The Network Topology tab is selected. The main area of the window is titled "Network Topology Discovery" and contains the following fields and controls:

- STUN Server Address: An empty text input field.
- STUN Port: A spin box set to 3478.
- Firewall/NAT Type: A dropdown menu set to "Open Internet".
- Binding Refresh Time (seconds): A spin box set to 300.
- Public IP Address: A text input field containing "0 . 0 . 0 . 0".
- Run STUN and Cancel buttons: Two buttons located to the right of the Public IP Address field.
- Public Port section: A group box containing three spin boxes for UDP, TCP, and TLS, all set to 0.
- Run STUN on startup: A checkbox that is currently unchecked.

5.3. System Telephony Settings

Navigate to the **Telephony** → **Telephony** tab on the Details Pane. Choose the **Companding Law** typical for the enterprise location. For Europe, **ALAW** is used. Uncheck the **Inhibit Off-Switch Forward/Transfer** box to allow call forwarding and call transfer to the PSTN via the Service Provider across the SIP trunk. On completion, click the **OK** button (not shown).

The screenshot displays the configuration interface for GSSCP_IPO_SE*. The main navigation bar includes tabs for System, LAN1, LAN2, DNS, Voicemail, Telephony, Directory Services, System Events, SMTP, SMDR, VoIP, Contact Center, and Avaya Cloud Services. The Telephony tab is active, with sub-tabs for Park & Page, Tones & Music, Ring Tones, SM, Call Log, and TUI. The configuration is divided into two columns. The left column contains various time and priority settings, while the right column is dedicated to Companding Law and other call-related features.

Setting	Value
Dial Delay Time (secs)	1
Dial Delay Count	4
Default No Answer Time (secs)	15
Hold Timeout (secs)	0
Park Timeout (secs)	300
Ring Delay (secs)	5
Call Priority Promotion Time (secs)	Disabled
Default Currency	EUR
Default Name Priority	Favour Trunk
Media Connection Preservation	Enabled
Phone Failback	Automatic

Companding Law

Category	Option	Selected
Switch	U-Law	<input type="radio"/>
	A-Law	<input checked="" type="radio"/>
Line	U-Law Line	<input type="radio"/>
	A-Law Line	<input checked="" type="radio"/>

Other Settings:

- DSS Status
- Auto Hold
- Dial By Name
- Show Account Code
- Inhibit Off-Switch Forward/Transfer
- Restrict Network Interconnect
 - Include location specific information
- Drop External Only Impromptu Conference
- Visually Differentiate External Call

Login Code Complexity

- Enforcement
 - Minimum length: 4
- Complexity

5.4. VoIP Settings

Navigate to the **VoIP** tab on the Details Pane. Check the available Codecs boxes as required. Note that **G.711 ULAW 64K** and **G.711 ALAW 64K** are greyed out and always available. Once available codecs are selected, they can be used or unused by using the horizontal arrows as required. Note that in test, **G.722 64K** is set as the priority codec and **G.711 ALAW 64K** set as the secondary codec as per screenshot below.

GSSCP_IPO_SE*

System LAN1 LAN2 DNS Voicemail Telephony Directory Services System Events SMTP SMDR VoIP

VoIP VoIP Security Access Control Lists

Ignore DTMF Mismatch For Phones

Allow Direct Media Within NAT Location

RFC2833 Default Payload 101

Available Codecs

- G.711 ULAW 64K
- G.711 ALAW 64K
- G.722 64K
- G.729(a) 8K CS-ACELP

Default Codec Selection

Unused

- G.711 ULAW 64K
- G.729(a) 8K CS-ACELP

Selected

- G.722 64K
- G.711 ALAW 64K

5.5. SIP Line

A SIP line is needed to establish the SIP connection between Avaya IP Office and the Telenor IPT Multi-User SIP platform. The recommended method for configuring a SIP Line is to use the template associated with these Application Notes. The template is an .xml file that can be used by IP Office Manager to create a SIP Line. Follow the steps in **Section 5.5.1** to create the SIP Line from the template.

Some items relevant to a specific customer environment are not included in the template or may need to be updated after the SIP Line is created. Examples include the following:

- IP addresses
- SIP Credentials (if applicable)
- SIP URI entries
- Setting of the **Use Network Topology Info** field on the Transport tab

Therefore, it is important that the SIP Line configuration be reviewed and updated if necessary after the SIP Line is created via the template. The resulting SIP Line data can be verified against the manual configuration shown in **Section 5.5.2**.

Also, the following SIP Line settings are not supported on Basic Edition:

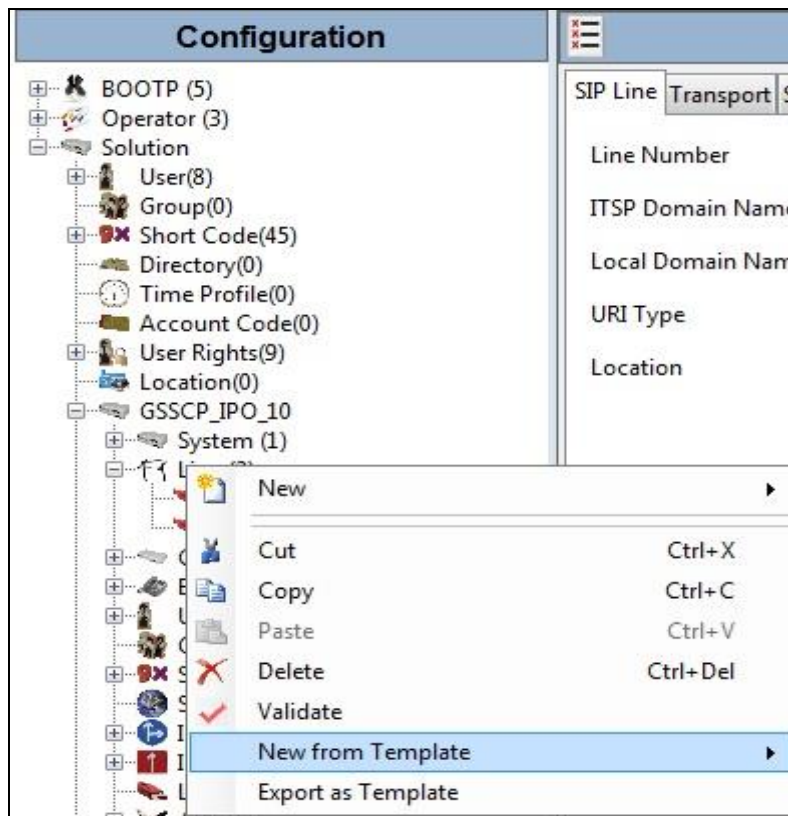
- SIP Line – Originator number for forwarded and twinning calls
- Transport – Second Explicit DNS Server
- SIP Credentials – Registration Required

Alternatively, a SIP Line can be created manually. To do so, right-click **Line** in the Navigation Pane and select **New → SIP Line**. Then, follow the steps outlined in **Section 5.5.2**.

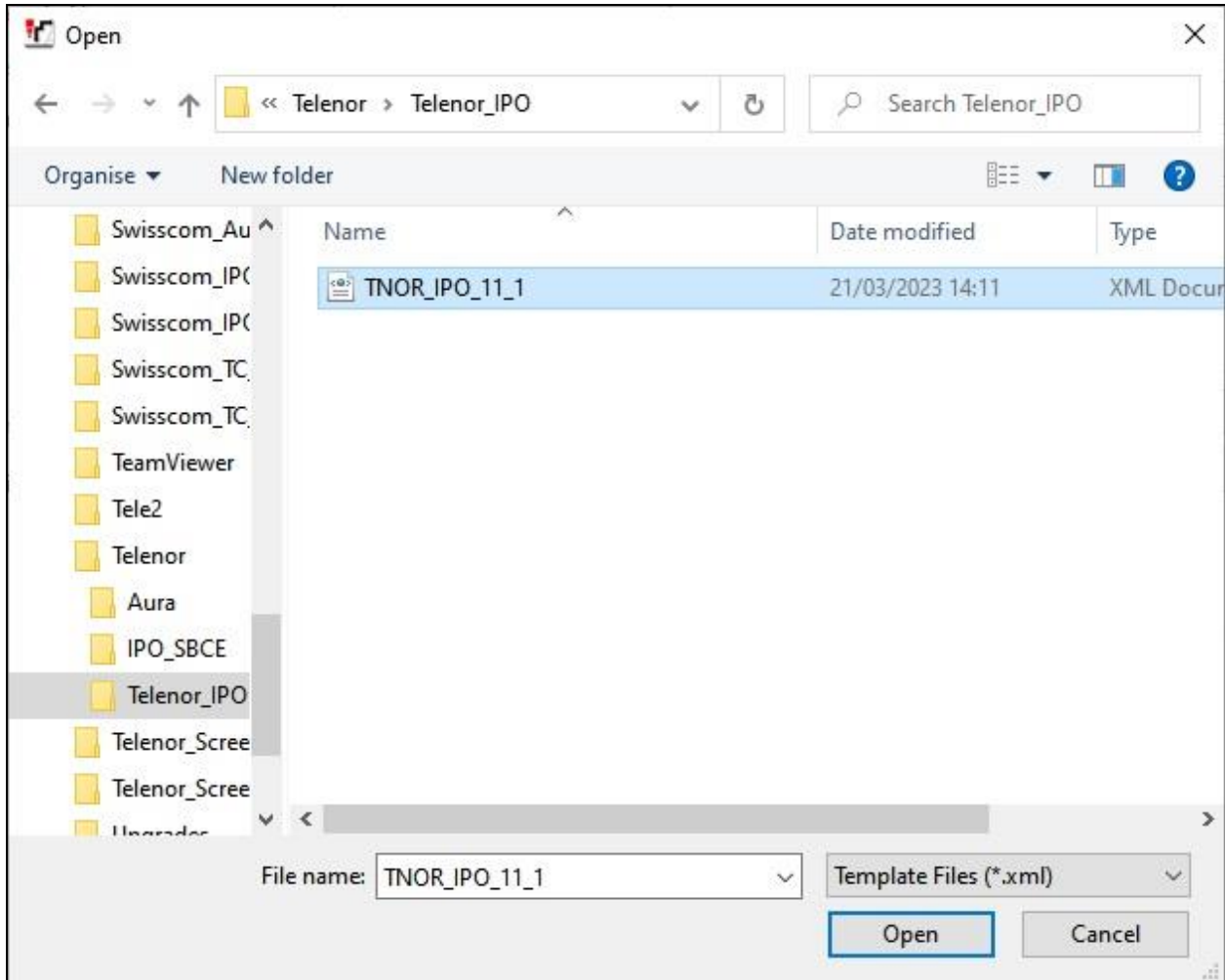
5.5.1. SIP Line From Template

DevConnect generated SIP Line templates are always exported in an XML format. These XML templates do not include sensitive customer specific information and are therefore suitable for distribution. The XML format templates can be used to create SIP trunks on both IP Office Standard Edition (500 V2) and IP Office Server Edition systems. Alternatively, binary templates may be generated. However, binary templates include all the configuration parameters of the Trunk, including sensitive customer specific information. Therefore, binary templates should only be used for cloning trunks within a specific customer's environment.

Copy a previously created template file to a location (e.g., *temp*) on the same computer where IP Office Manager is installed. To create the SIP Trunk from the template, right-click on **Line** in the Navigation Pane, then navigate to **New** → **New from Template**.



Navigate to the directory on the local machine where the template was copied and select the template as required.



The SIP Line is automatically created and can be verified and edited as required using the configuration described in **Section 5.5.2**.

5.5.2. Manual SIP Line Configuration

On the **SIP Line** tab in the Details Pane, configure the parameters below to connect to the SIP Trunking service.

- Set **ITSP Domain Name** to a domain name provider by the Service Provider as per the screenshot below.
- Set **National Prefix** to **0** and **International Prefix** to **00** for number conversion as follows: outbound national and international called party numbers are converted to E.164 format; inbound national and international calling party numbers are converted to diallable format.
- Ensure the **In Service** box is checked.
- Ensure the **Check OSS** box is checked.
- Leave the **Refresh Method** at the default value of **Auto** which results in re-INVITE being used for Session Refresh.
- Leave **Timer (seconds)** at the default value of **On Demand**. This value allows the Session Refresh interval to be set by the network.
- Set **Incoming Supervised REFER** and **Outgoing Supervise REFER** to **Auto**.
- Default values may be used for all other parameters.

On completion, click the **OK** button (not shown).

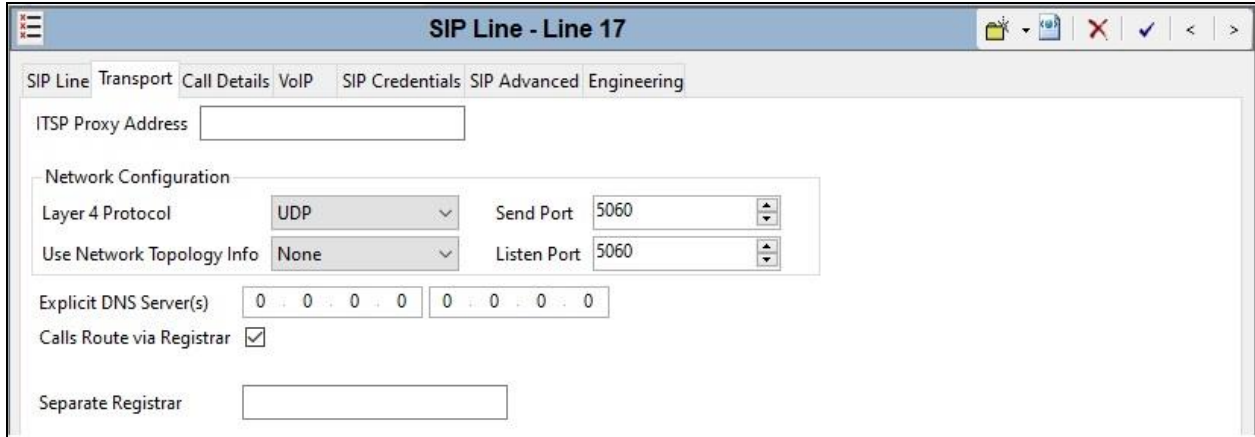
The screenshot displays the configuration interface for a SIP Line, titled "SIP Line - Line 17". The interface is organized into several sections:

- Line Identification:** Line Number is set to 17.
- Domain and Location:** ITSP Domain Name is "ipt-internet-lab.telenor.com", Local Domain Name is empty, URI Type is "SIP URI", and Location is "Cloud".
- Prefixes:** National Prefix is "0" and International Prefix is "00".
- Service Status:** "In Service" and "Check OSS" are both checked.
- Session Timers:** Refresh Method is set to "Auto" and Timer (seconds) is set to "On Demand".
- Redirect and Transfer:** Incoming Supervised REFER and Outgoing Supervised REFER are both set to "Auto". "Send 302 Moved Temporarily" and "Outgoing Blind REFER" are unchecked.

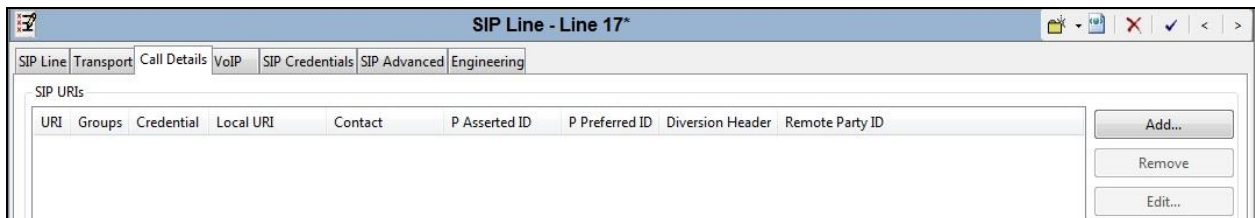
Select the **Transport** tab and set the following:

- Leave **ITSP Proxy Address** blank.
- Set **Use Network Topology Info** to **None** as NAT is not used in this configuration and the Network Topology settings defined in **Section 5.2** are not required.
- Set **Layer 4 Protocol** to **UDP**.
- Set **Send Port** and **Listen Port** to **5060**.

On completion, click the OK button (not shown).

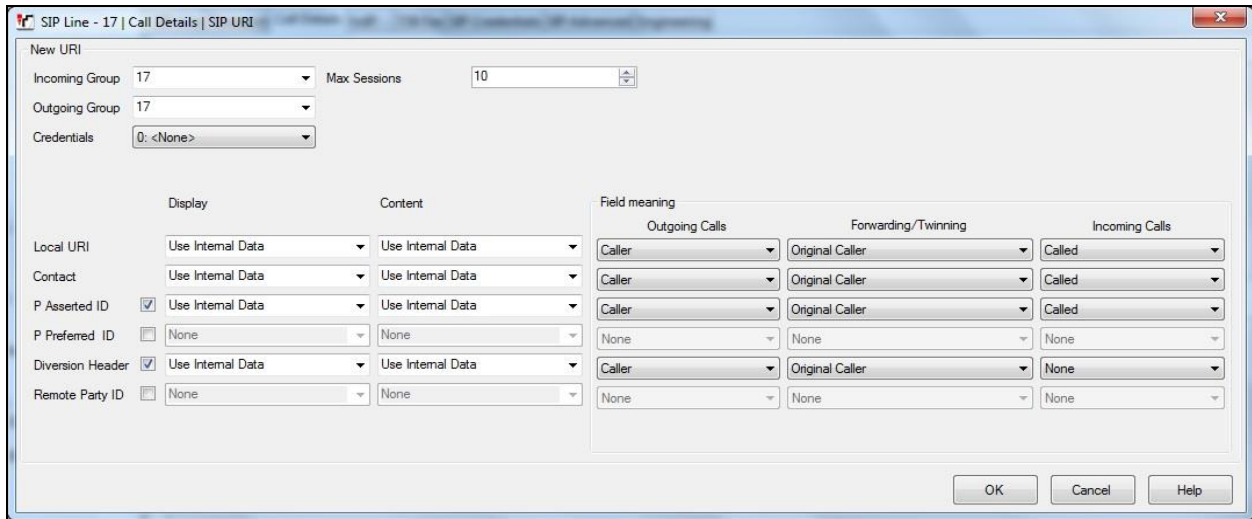


After the SIP line parameters are defined, the SIP URIs that Avaya IP Office will accept on this line must be created. To create a SIP URI entry, select the **Call Details** tab and click on **Add**.

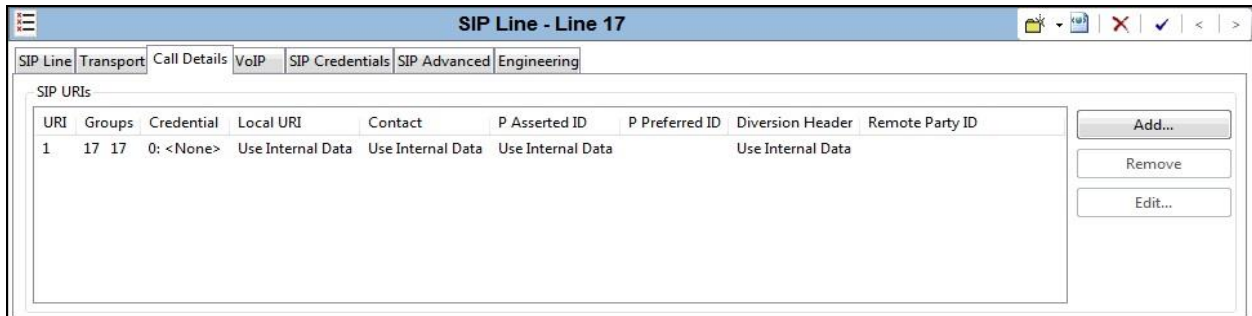


For the compliance test, SIP URI entries were created that matched any number assigned to an Avaya IP Office user. The entry was created with the parameters shown below.

- Set **Incoming Group**. This is the value assigned for incoming calls that's analysed in the Incoming Call Route settings described in **Section 5.8**. In the test environment a value of **17** was used for the Telenor IPT Multi-User SIP platform.
- Set **Outgoing Group**. This is the value assigned for outgoing calls that can be selected directly in the short code settings described in **Section 5.6**. In the test environment a value of **17** was used.
- Set **Max Sessions** to the number of simultaneous SIP calls that are allowed using this SIP URI pattern.
- Set **Local URI, Contact, P Asserted ID** and **Diversion Header** to **Use Internal Data** for both the **Display** name and **Content**. On incoming calls, this will analyse the Request-Line sent by Telenor and match to the SIP settings in the User profile as described in **Section 5.7**. On outgoing calls this will insert the SIP settings in the User profile into the relevant headers in the SIP messages.
- Leave the **Outgoing Calls, Forwarding/Twinning** and **Incoming Calls** at their respective default values of **Caller, Original Caller** and **Called** for the **Local URI, Contact** and **P Asserted ID** call details.



The following screenshot shows the completed configuration:



Select the **VoIP** tab to set the Voice over Internet Protocol parameters of the SIP line. Set the parameters as shown below:

- Select **System Default** from the drop-down menu as system default codecs were already defined in **Section 5.4**.
- Set the **Fax Transport Support** box to **G.711** as this is the preferred method of fax transmission for Telenor.
- Set the **DTMF Support** field to **RFC2833/RFC4733**. This directs Avaya IP Office to send DTMF tones using RTP events messages as defined in RFC2833.
- Check the **Local Hold Music** box.
- Check the **Re-invite Supported** box to allow for codec re-negotiation in cases where the target of the incoming call or transfer does not support the codec originally negotiated.
- Check the **PRACK/100rel Supported** box if early media is required. This was checked during compliance testing.
- On completion, click the **OK** button (not shown).

Default values may be used for all other parameters.

The screenshot shows the configuration interface for a SIP Line (Line 17) in the VoIP tab. The interface includes several sections:

- Codec Selection:** A dropdown menu is set to "System Default". Below it are two lists: "Unused" (G.711 ULAW 64K, G.729(a) 8K CS-ACELP) and "Selected" (G.722 64K, G.711 ALAW 64K). Navigation buttons (>>>, <<<<, <<<, >>>) are between the lists.
- Fax Transport Support:** A dropdown menu set to "G.711".
- DTMF Support:** A dropdown menu set to "RFC2833/RFC4733".
- Media Security:** A dropdown menu set to "Same as System (Preferred)". Below it is a checkbox for "Advanced Media Security Options" which is checked and labeled "Same As System".
- Checkboxes on the right:** Local Hold Music (checked), Re-invite Supported (checked), Codec Lockdown (unchecked), Allow Direct Media Path (unchecked), Force direct media with phones (unchecked), and PRACK/100rel Supported (checked).

Select the **SIP Advanced** tab and set the following:

- Check the **Add user=phone** box to send SIP parameter user with the value phone to the From and To Headers in outgoing calls.
- Check the **Use + for International** as E.164 numbering is used on the SIP Trunk.
- Default values may be used for all other parameters.

The screenshot shows the 'SIP Line - Line 17*' configuration window with the 'SIP Advanced' tab selected. The window is divided into several sections:

- Addressing:** Association Method is set to 'By Source IP address' and Call Routing Method is set to 'Request URI'. Suppress DNS SRV Lookups is unchecked.
- Identity:** A list of checkboxes includes 'Add user=phone' (checked), 'Use + for International' (checked), and 'Cache Auth Credentials' (checked). Other options like 'Use "phone-context"', 'Use PAI for Privacy', and 'Send From In Clear' are unchecked.
- Media:** Includes options like 'Allow Empty INVITE', 'Send Empty re-INVITE', and 'Media Connection Preservation' (set to 'Disabled').
- Call Control:** Includes 'Call Initiation Timeout (s)' set to 4, 'Call Queuing Timeout (m)' set to 5, and 'Service Busy Response' set to '486 - Busy Here'.

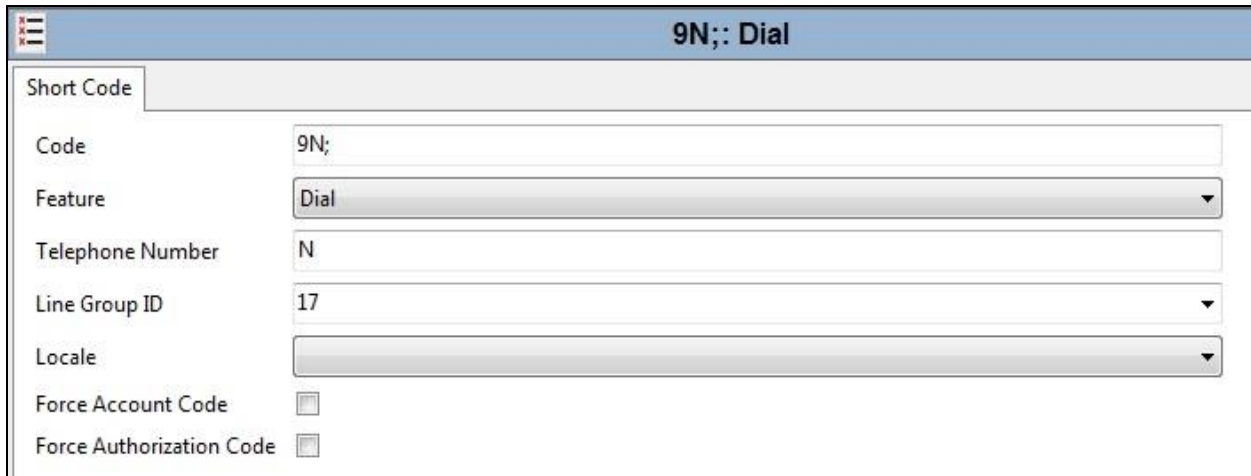
Note: It is advisable at this stage to save the configuration as described in **Section 5.10** to make the Line Group ID defined in **Section 5.5.2** available.

5.6. Short Codes

Define a short code to route outbound traffic to the SIP line. To create a short code, right-click **Short Code** in the Navigation Pane and select **New**. On the **Short Code** tab in the Details Pane, configure the parameters as required. The example below shows the configuration used during testing for national numbers.

- In the **Code** field, enter the dial string which will trigger this short code, followed by a semi-colon. The example shows **9N;** which will be invoked when the user dials 9 followed by the dialled number.
- Set **Feature** to **Dial**. This is the action that the short code will perform.
- Set **Telephone Number** to **N**. The **Telephone Number** field is used to construct the Request URI and To Header in the outgoing SIP INVITE message.
- Set the **Line Group Id** to the outgoing line group number defined on the SIP URI tab on the SIP Line in **Section 5.5.2**.

On completion, click the **OK** button (not shown).



The screenshot shows a configuration window titled "9N;: Dial". The window has a tab labeled "Short Code". The configuration fields are as follows:

Code	9N;
Feature	Dial
Telephone Number	N
Line Group ID	17
Locale	
Force Account Code	<input type="checkbox"/>
Force Authorization Code	<input type="checkbox"/>

5.7. User

Configure the SIP parameters for each user that will be placing and receiving calls via the SIP line defined in **Section 5.5**. To configure these settings, first navigate to **User** in the Navigation Pane. Select the **User** tab if any changes are required.

The following example shows the configuration required for a SIP Endpoint.

- Change the **Name** of the User if required.
- Set the **Password** and **Confirm Password**.
- Select the required profile from the **Profile** drop down menu. **Basic User** is commonly used; **Power User** can be selected for SIP softphone, WebRTC and Remote Worker endpoints.

The screenshot displays the configuration page for a user named 'Ext89110: 89110'. The page has a blue header with the user name. Below the header is a navigation bar with tabs: Group Membership, Announcements, SIP, Personal Directory, and Web Self-Administration. Under the 'SIP' tab, there are sub-tabs: User, Voicemail, DND, ShortCodes, Source Numbers, Telephony, Forwarding, Dial In, Voice Recording, and Button Programming. The 'User' sub-tab is active, showing a form with the following fields and values:

Name	Ext89110
Password	••••••••
Confirm Password	••••••••
Unique Identity	
Audio Conference PIN	
Confirm Audio Conference PIN	
Account Status	Enabled
Full Name	Ext89110
Extension	89110
Email Address	
Locale	
Priority	5
System Phone Rights	None
Profile	Power User

At the bottom of the form, there is a checkbox labeled 'Receptionist' which is currently unchecked.

SIP endpoints require setting of the **SIP Registrar Enable** as described in **Section 5.2**.

Next, select the **SIP** tab in the Details Pane. To reach the **SIP** tab click the right arrow on the right-hand side of the Details Pane until it becomes visible. The values entered for the **SIP Name** and **Contact** fields are used as the user part of the SIP URI in the From header for outgoing SIP trunk calls. These allow matching of the SIP URI for incoming calls without having to enter this number as an explicit SIP URI for the SIP line (**Section 5.5.2**). As such, these fields should be set to one of the DDI numbers assigned to the enterprise from Telenor.

The screenshot shows the configuration page for 'Ext89110: 89110*'. The 'SIP' tab is selected. The configuration includes the following fields:

- SIP Name:** +4722xxxx31
- SIP Display Name (Alias):** +4722xxxx31
- Contact:** +4722xxxx31
- Anonymous:**

Note: The **Anonymous** box can be used to restrict Calling Line Identity (CLIR).

The following screen shows the Mobility tab for user 89110. The **Mobility Features** and **Mobile Twinning** are checked. The **Twinned Mobile Number** field is configured with the number to dial to reach the twinned mobile telephone over the SIP Trunk. Other options can be set accordingly to customer requirements.

The screenshot shows the 'Mobility' configuration page for 'Ext89110: 89110*'. The 'SIP' tab is selected. The configuration includes the following fields and options:

- Twinned Handset:** <None>
- Maximum Number of Calls:** 1
- Twin Bridge Appearances
- Twin Coverage Appearances
- Twin Line Appearances
- Mobility Features**
 - Mobile Twinning**
 - Twinned Mobile Number (including dial access code):** 0035389xxxxxxxx1
 - Twinning Time Profile:** <None>
 - Mobile Dial Delay (secs):** 3
 - Mobile Answer Guard (secs):** 0
 - Hunt group calls eligible for mobile twinning
 - Forwarded calls eligible for mobile twinning
 - Twin When Logged Out
 - one-X Mobile Client
 - Mobile Call Control
 - Mobile Callback

5.8. Incoming Call Routing

An incoming call route maps an inbound DDI number on a specific line to an internal extension. To create an incoming call route, right-click **Incoming Call Routes** in the Navigation Pane and select **New**. On the **Standard** tab of the Details Pane, enter the parameters as shown below:

- Set the **Bearer Capability** to **Any Voice**.
- Set the **Line Group Id** to the incoming line group of the SIP line defined in **Section 5.5.2**.
- Set the **Incoming Number** to the incoming number that this route should match on. Matching is right to left.
- Default values can be used for all other fields.

The screenshot shows the configuration form for an incoming call route. The title bar displays '17 +4722xxxxx31'. The 'Standard' tab is selected. The form contains the following fields:

Bearer Capability	Any Voice
Line Group ID	17
Incoming Number	+4722xxxxx31
Incoming Sub Address	
Incoming CLI	
Locale	
Priority	1 - Low
Tag	
Hold Music Source	System Source
Ring Tone Override	None

On the **Destinations** tab, select the destination extension from the pull-down menu of the **Destination** field. On completion, click the **OK** button (not shown). In this example, incoming calls to the test DDI number **+4722xxxxx31** on line 17 are routed to extension 89110.

The screenshot shows the 'Destinations' tab of the configuration form. The title bar displays '17 +4722xxxxx31'. The 'Destinations' tab is selected. The form contains the following fields:

TimeProfile	Destination
Default Value	89110 Extn89110

5.9. G.711 Fax

At Release 11, both G.711 and T.38 Fax is supported on IP Office Server Edition when using an IP Office Expansion (500 V2). The Telenor SIP Trunk testing was carried out using this configuration with only the analogue extension for the fax machine on the Expansion. In this configuration, the G.711 fax settings are configured on the SIP line between the Expansion and the Server.

5.9.1. Analogue User

To configure the settings for the fax User, first navigate to **User** in the Navigation Pane for the Expansion. In the test environment, the 500V2 Expansion is called **GSSCP_IPO9**. Select the **User** tab. The following example shows the configuration required for an analogue Endpoint.

- Change the **Name** of the User if required.
- The **Password** and **Confirm Password** fields are set but are not required for analogue endpoints.
- Select the required profile from the **Profile** drop down menu. **Basic User** is sufficient for fax.

The screenshot displays the Avaya IP Office configuration interface. On the left is a navigation pane titled 'Configuration' showing a tree structure of system components. The 'User' component is selected, and the configuration page for 'Analog89119: 89119' is shown on the right. The configuration page has several tabs: 'Announcements', 'SIP', 'Personal Directory', and 'Web Self-Administration'. The 'SIP' tab is active, and the 'User' sub-tab is selected. The configuration fields are as follows:

Field	Value
Name	Analog89119
Password	••••••••
Confirm Password	••••••••
Unique Identity	
Audio Conference PIN	
Confirm Audio Conference PIN	
Account Status	Enabled
Full Name	
Extension	89119
Email Address	
Locale	
Priority	5
System Phone Rights	None
Profile	Basic User

There is also a checkbox for 'Receptionist' which is currently unchecked.

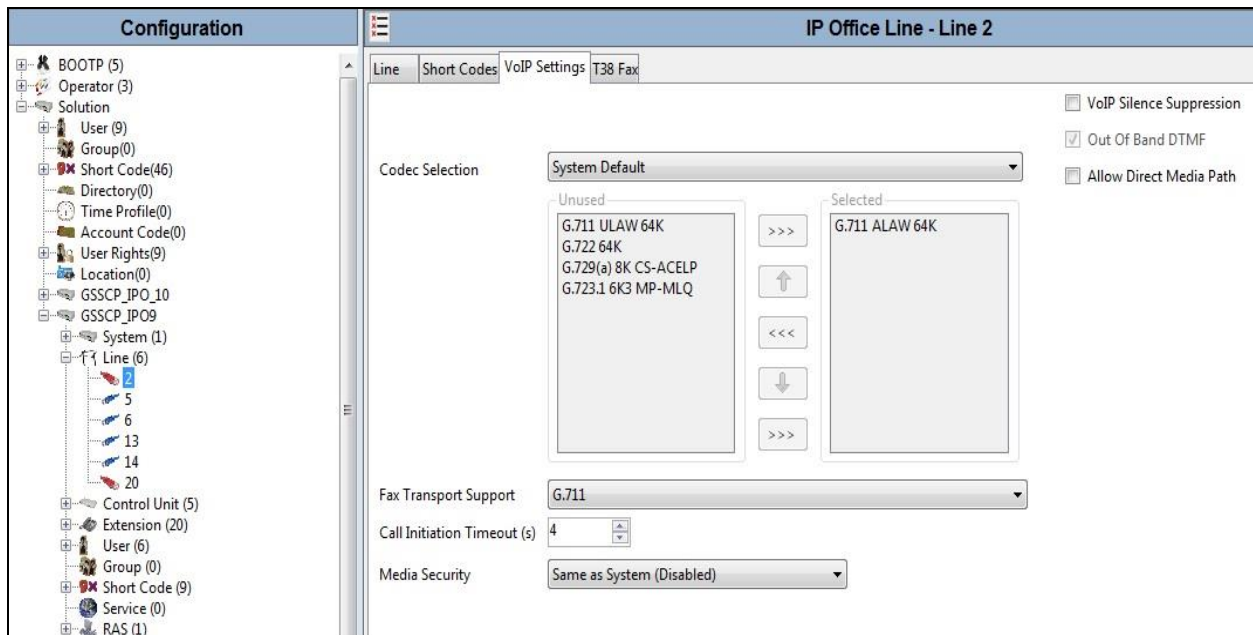
Configure other settings as described in **Section 5.7**.

5.9.2. G.711 Fax Settings

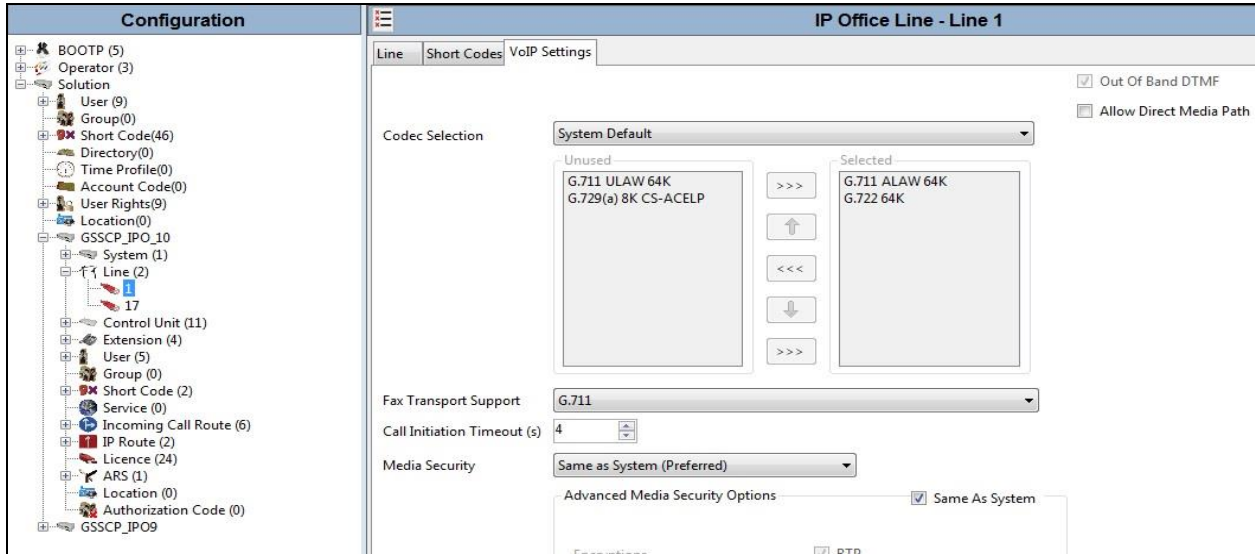
The G.711 Fax settings are defined on the SIP Line between the Expansion and the Server. Note that the VoIP settings for G.711 Fax are required in three places in this configuration:

- The SIP Line for the Telenor SIP Trunk as described in **Section 5.5.2**.
- The IP Office Line between the Server and the Expansion on the Expansion.
- The IP Office Line between the Server and the Expansion on the Server.

In all the above cases, the **Fax Transport Support** was set to **G.711**. The following screenshot shows the VoIP Settings for the IP Office Line between the Server and the Expansion on the Expansion:



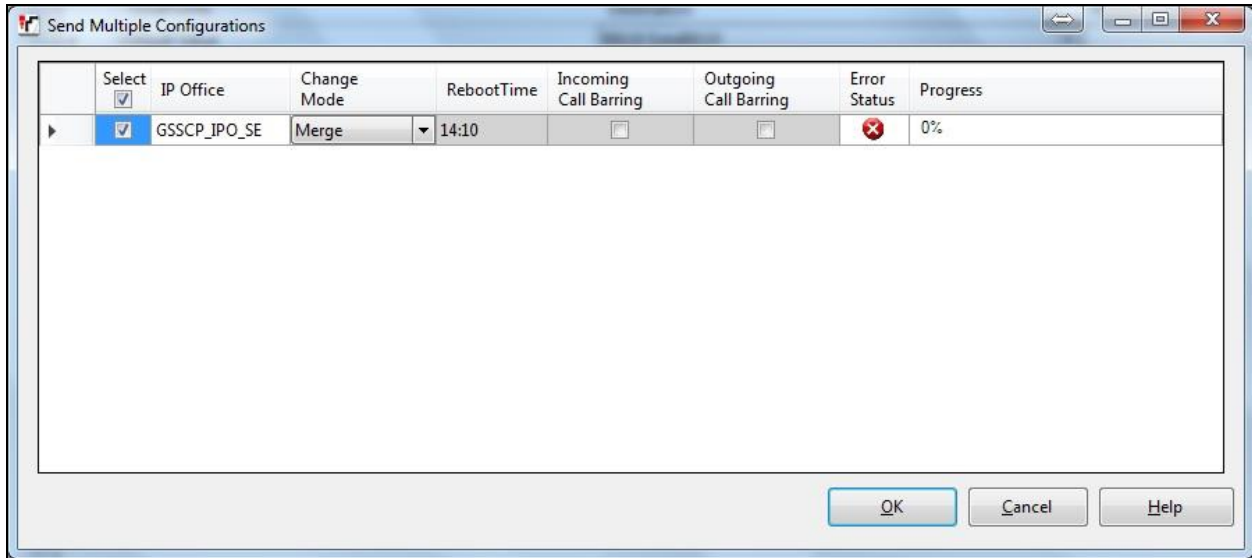
The following shows the **VoIP Settings** tab in the IP Office Line for the Expansion in the Server configuration:



Refer to **Section 5.5.2** for the VoIP Settings on the SIP Line for the Telenor SIP Trunk.

5.10. Save Configuration

Navigate to **File → Save Configuration** in the menu bar at the top of the screen to save the configuration performed in the preceding sections. A screen like the one shown below is displayed where the system configuration has been changed and needs to be saved on the system. **Merge, Reboot, Timed** or **RebootWhen Free** can be selected from the **Change Mode** drop-down menu based on the nature of the configuration changes made since the last save. Note that clicking **OK** may cause a service disruption. Click **OK** to save the configuration.



6. Telenor IPT Multi-User SIP Trunk Configuration

The configuration of the Telenor equipment used to support Telenor's SIP platform is outside of the scope of these Application Notes and will not be covered. To obtain further information on Telenor equipment and system configuration please contact an authorized Telenor representative

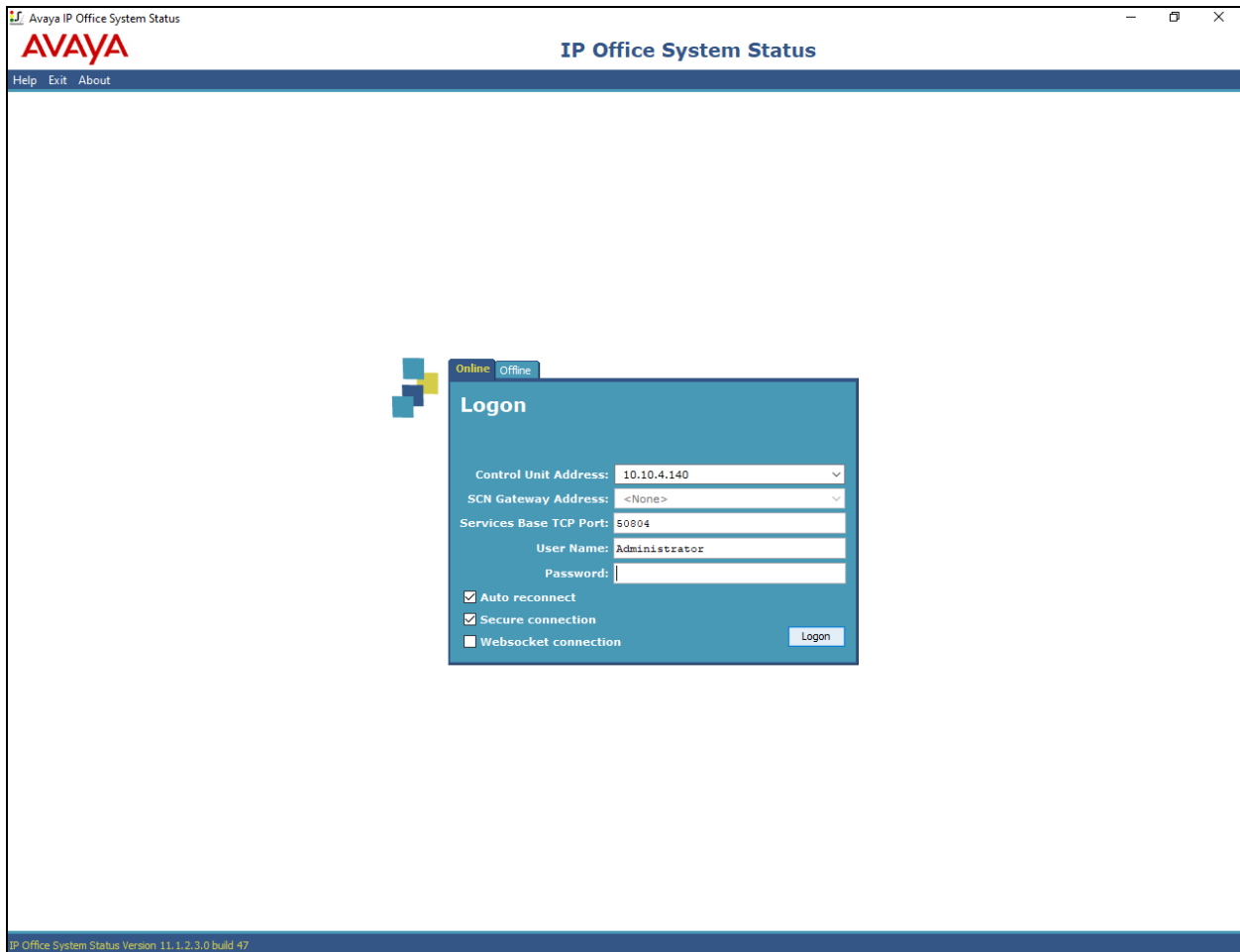
7. Verification Steps

This section includes steps that can be used to verify that the configuration has been done correctly.

7.1. SIP Trunk status

The status of the SIP trunk can be verified by opening the System Status application. This is found on the PC where IP Office Manager is installed in PC programs under **Start → All Programs → IP Office → System Status** (not shown).

Log in to IP Office System Status at the prompt using the **Control Unit IP Address** for the IP Office. The **User Name** and **Password** are the same as those used for IP Office Manager.



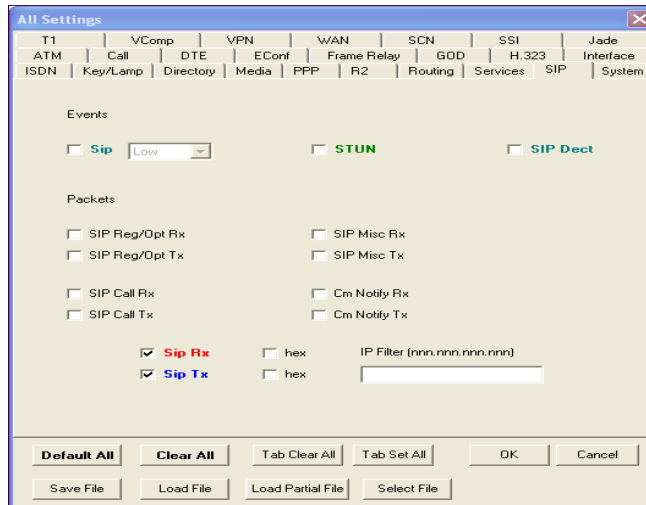
From the left-hand menu expand **Trunks** and choose the SIP trunk (**17** in this instance). The status window will show the status as being idle and time in state if the Trunk is operational.

The screenshot displays the Avaya IP Office System Status interface. The left-hand menu is expanded to show 'Trunks (2)', with 'Line: 1' selected and 'Line: 17' highlighted. The main window title is 'IP Office System Status'. The 'Status' tab is active, showing a 'SIP Trunk Summary' for Line 17. The summary indicates the line is 'In Service' and 'Idle'. A green progress indicator shows 0% utilization. Below the summary is a table with 10 columns: Channel Number, URL Gr..., Call Ref, Current State, Time in State, Remote Media Address, Codec, Connection Type, Caller ID or Dialed Digits, Other Party on Call, Direction of Call, Round Trip Delay, Receive Jitter, Receive Packet Los..., Transmit Jitter, and Transmit Packet Los... The table contains 10 rows, all showing 'Idle' in the 'Current State' column and '00:00:47' in the 'Time in State' column.

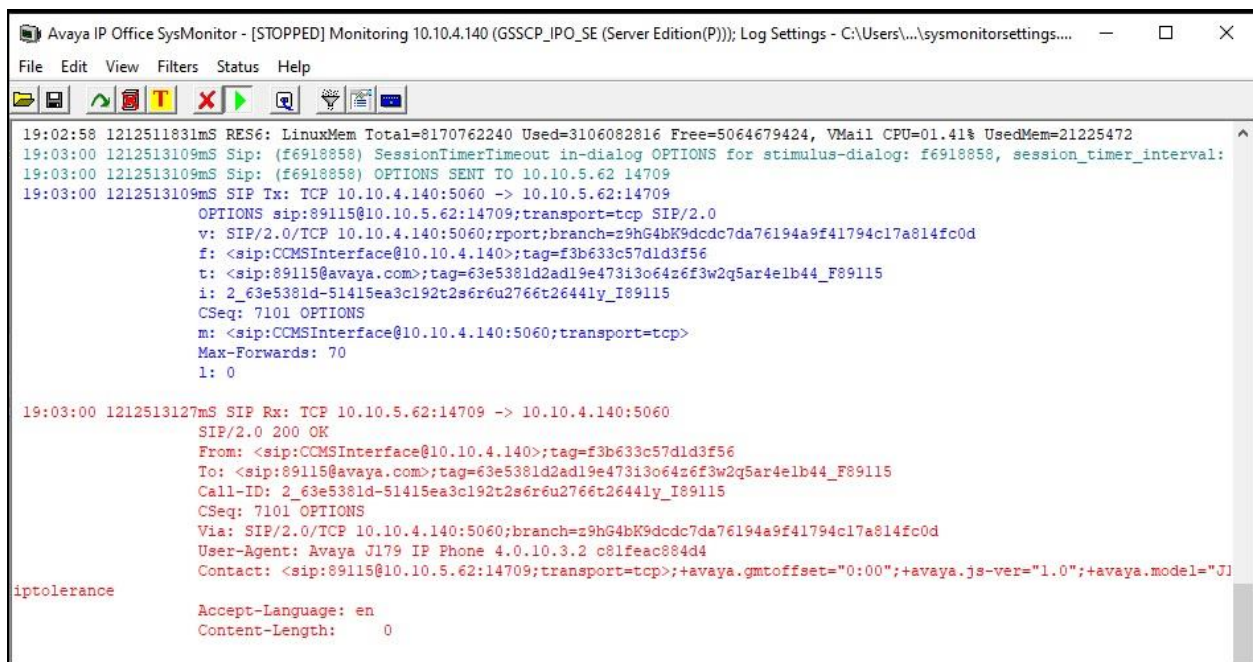
Channel Number	URL Gr...	Call Ref	Current State	Time in State	Remote Media Address	Codec	Connection Type	Caller ID or Dialed Digits	Other Party on Call	Direction of Call	Round Trip Delay	Receive Jitter	Receive Packet Los...	Transmit Jitter	Transmit Packet Los...
1			Idle	00:00:47											
2			Idle	00:00:47											
3			Idle	00:00:47											
4			Idle	00:00:47											
5			Idle	00:00:47											
6			Idle	00:00:47											
7			Idle	00:00:47											
8			Idle	00:00:47											
9			Idle	00:00:47											
10			Idle	00:00:47											

7.2. Monitor

The Monitor application can also be used to monitor and troubleshoot IP Office. Monitor can be accessed from **Start → Programs → IP Office → Monitor**. The application allows the monitored information to be customized. To customize, select the button that is third from the right in the screen below, or select **Filters → Trace Options**. The following screen shows the **SIP** tab, allowing configuration of SIP monitoring. In this example, the **SIP Rx** and **SIP Tx** boxes are checked. All SIP messages will appear in the trace with the color blue. To customize the color, right-click on **SIP Rx** or **SIP Tx** and select the desired color.



As an example, the following shows a portion of the monitoring window of an OPTIONS message being sent between IP Office and the Service Provider.



8. Conclusion

These Application Notes describe the procedures required to configure the connectivity between Avaya IP Office R11.1 and Telenor IPT Multi-User SIP Trunk solution as shown in **Figure 1**.

The reference configuration shown in these Application Notes is representative of a basic enterprise customer configuration and demonstrates Avaya IP Office R11.1 can be configured to interoperate successfully with Telenor IPT Multi-User SIP Trunk service. Telenor IPT Multi-User SIP Trunk service is a SIP-based Voice over IP solution providing businesses a flexible, cost-saving alternative to traditional hardwired telephony trunks. The service was successfully tested with a number of observations listed in **Section 2.2**.

9. Additional References

Product documentation for Avaya products may be found at <http://support.avaya.com>.

- [1] *Deploying IP Office as Virtual Servers*, Release 11.1, Nov 2021.
- [2] *Deploying IP Office Server Edition Servers*, Release 11.1, Nov 2021.
- [3] *Deploying an IP500 V2 IP Office System*, Release 11.1, Jul 2022.
- [4] *Administering Avaya IP Office with IP Office Web Manager*, Release 11.1, Nov 2021.
- [5] *Administering Avaya IP Office with IP Office Manager*, Release 11.1, Nov 2021.
- [6] *Using Avaya IP Office System Status*, Nov 2021.
- [7] *Using IP Office System Monitor*, Nov 2021.
- [8] *Administering Voicemail Pro*, Release 11.1, Nov 2021.
- [9] *Using Avaya Workplace Client for Windows*, Jul 2022.
- [10] *IP Office SIP Phone Installation Notes*, Nov 2021.
- [11] *RFC 3261 SIP: Session Initiation Protocol*, <http://www.ietf.org/>

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