

### EXECUTIVE SUMMARY

TelcoBridges initiated testing of Xener Systems Limited's softswitch in June of 2010 with completion of the effort in October 2010. The goal of the effort was to demonstrate interoperability between TelcoBridges Tmedia family of VOIP gateways and Xener's softswitch using the H.248 media gateway control protocol and TDM signaling protocols such as SIP, SS7/C7 and SIGTRAN.

Since all Tmedia VOIP gateways share the same technical underpinnings, differing only in their channel capacity, it would be possible to affirm interoperability across the family of Tmedia devices simply by performing interoperability tests using the Tmedia model from which all others are derived, specifically the TMG3200 VOIP gateway.

After completing an exhaustive bank of tests, described later in this document, TelcoBridges can confirm that its Tmedia family of VOIP gateways, including the TMG800, TMG3200, TMG5800 and TMG7800 models, can successfully interoperate with Xener Systems Ltd.'s softswitch platform.

### INTRODUCTION

In June of 2010, TelcoBridges and Xener Systems Ltd. publicly announced their intention to undertake joint interoperability testing of their respective media gateway and softswitch products. TelcoBridges' engineering team took the lead in the interoperability testing effort and were assisted by engineers from Xener Systems. Testing of the products became possible following TelcoBridges delivery of support for the H.248 media gateway control protocol with version 2.5.x of its Toolpack software engine and media gateway application. The interoperability testing effort was completed in October 2010.

### EQUIPMENT

The following hardware and software was used for the purpose of interoperability testing:

#### ***TelcoBridges Media Gateway (MGW)***

- Tmedia TMG3200
- Toolpack software version 2.5.19

#### ***Xener Systems Softswitch (SSW)***

- SSW3000 version INTLC5\_SSW\_0906R3

#### ***Providers***

- Tdev TMP6400
- Toolpack release 2-5-19 running on a VMware virtual machine running the CentOS operating system
- Call generator application

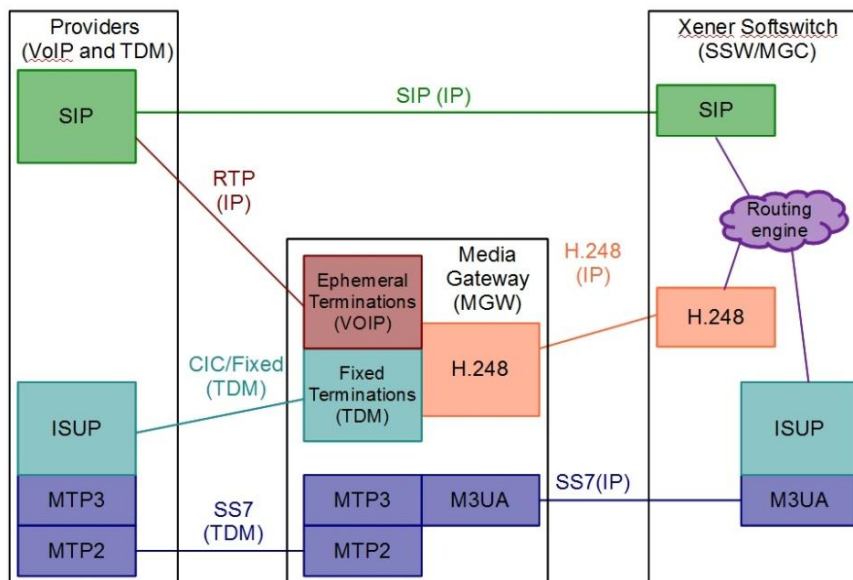
## DEFINITIONS

The following terms are used in figures, and discussions throughout this document:

- **Toolpack:** TelcoBridges' software suite that controls a Tmedia VoIP gateway
- **MGW:** Media Gateway (a TelcoBridges Tmedia device with Toolpack installed)
- **MGC or SSW:** Media Gateway Controller (Xener Systems' softswitch)
- **System under test (SUT):** Represents the MGW and MGC together
- **Providers:** Represents the system or systems that can send to or receive calls from the SUT
- **IOT:** Interoperability Testing

## NETWORK SETUP

For testing purposes, the following network schematic (see Figure 1) was designed and deployed:



**Figure 1:** IOT setup

The provider and MGW components of the system were located at TelcoBridges offices in Boucherville, QC, Canada, while the Xener Systems softswitch was hosted in Xener's R&D facilities in Seoul, South Korea, and accessed over the public Internet.

## **CONFIGURATION**

In order to execute the bank of tests required to perform interoperability testing (IOT), the system under test (SUT) comprised of MGW and MGC elements was configured as follows:

### ***SS7 (MTP2/MTP3/ISUP)***

- 1 MTP2 link, MTP3 link, MTP3 linkset
- 1 OPC and 2 DPC
- 1 MTP3 network
- 3 routes (1 self route, 2 outgoing routes)
- 1 ISUP interface
- 2 line services used as ISUP CIC (Same line service as H.248)

### ***SIGTRAN (M3UA)***

- MGW M3UA type: signalling gateway process (SGP)
- MGC M3UA type: application server process (ASP)
- 1 peer server
- 3 routes (1 self route, 2 routes)

### ***SIP***

- Accept/Make calls from at least 2 destinations (i.e., SIP phones)

### ***H.248***

- 2 line services configured as fixed terminations (same line service as ISUP)
- 200 VoIP resource capacities as ephemeral terminations

### ***Routing***

- Enable all TDM users to contact any TDM or VoIP user
- Enable all VoIP users to contact any TDM or VoIP user

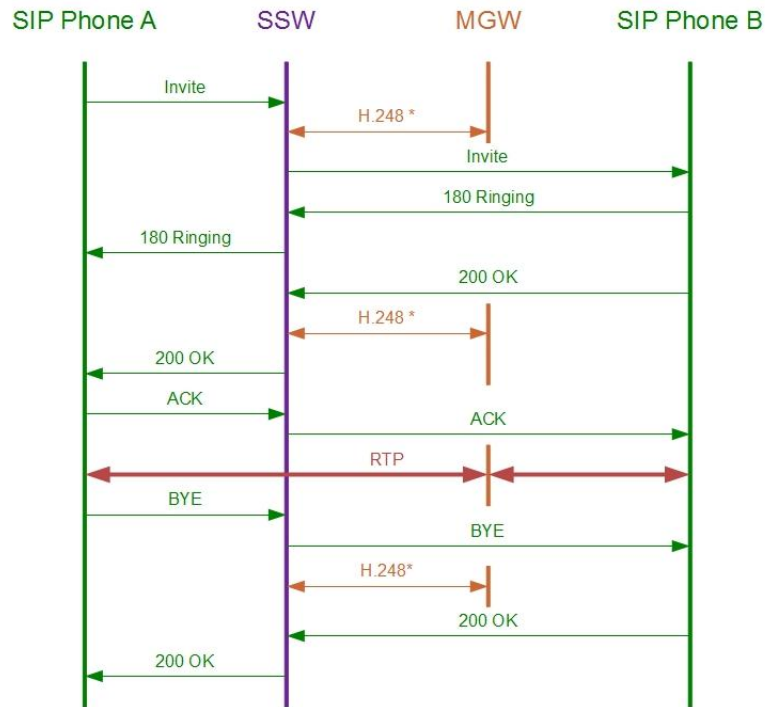
Please note that the provider configuration(s) need(s) to be deducted from the overall SUT configuration.

**CALL FLOWS**

The following four call flows were developed and tested as part of the overall interoperability test effort:

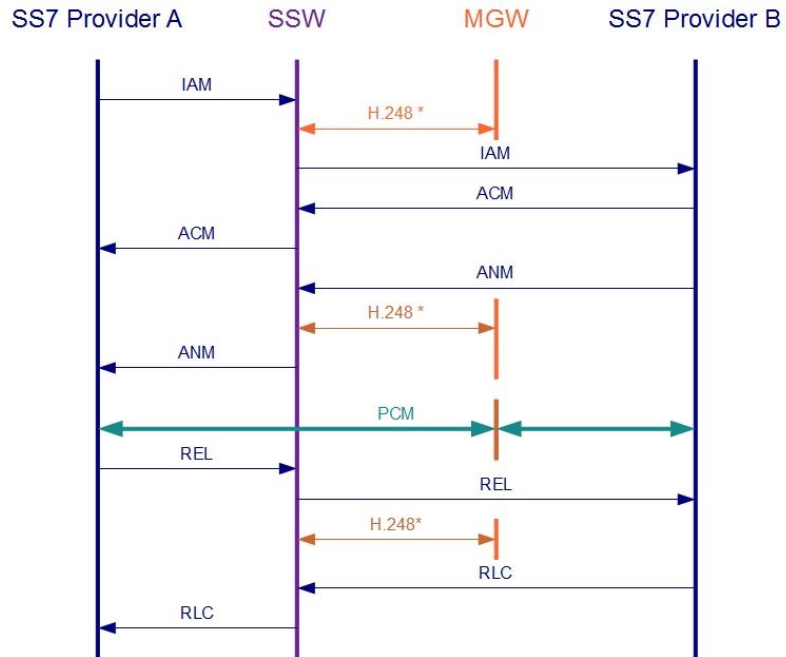
- VOIP to VOIP
- TDM to TDM
- VOIP to TDM
- TDM to VOIP

**Call flow #1: VOIP to VOIP**



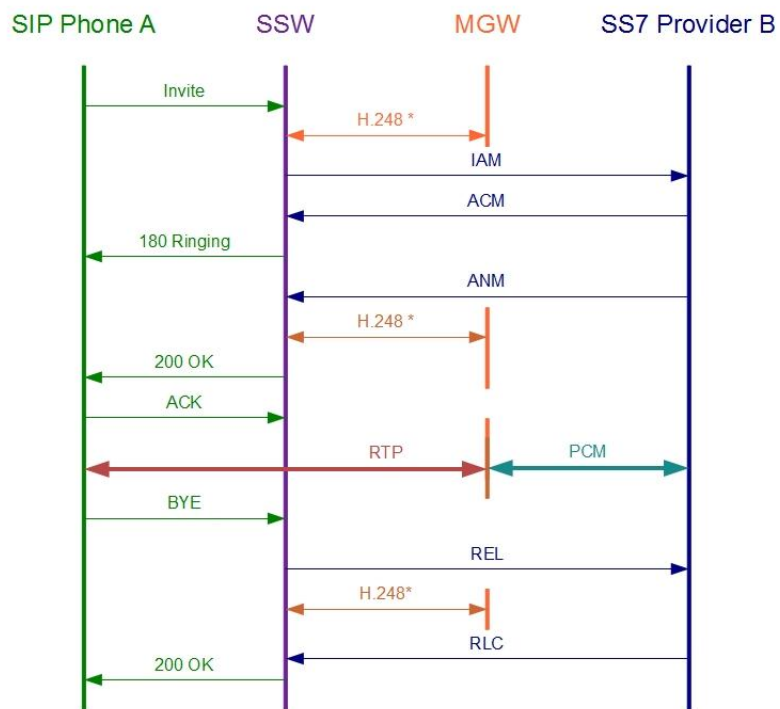
**Figure 2: VOIP to VOIP call flow**

**Call flow #2: TDM to TDM**



**Figure 3: TDM to TDM call flow**

**Call flow #3: VOIP to TDM**



**Figure 4: VOIP to TDM call flow**

Call flow #4: TDM to VOIP

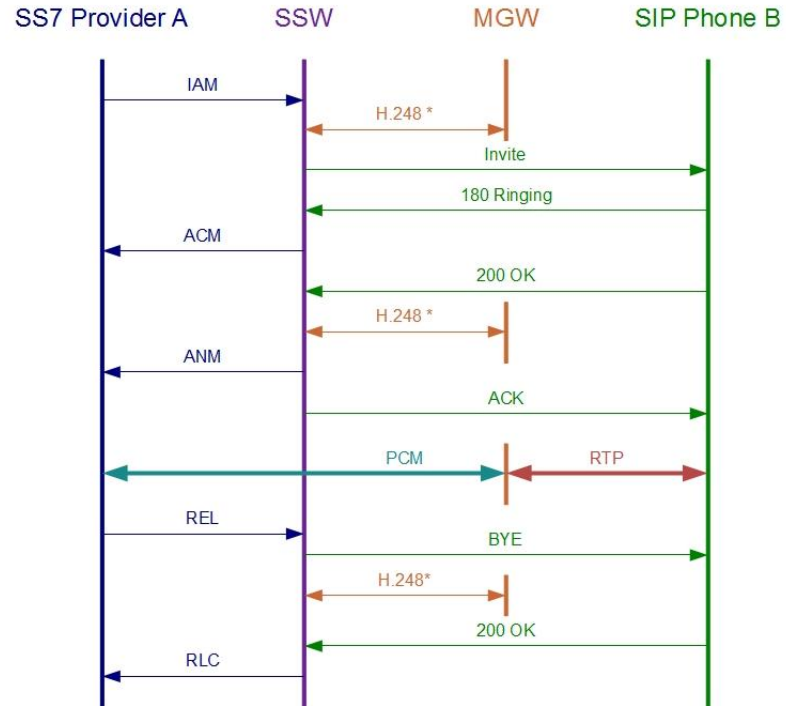


Figure 5: TDM to VOIP call flow

## RESULTS

The overall interoperability test was comprised of dozens of individual tests. The results of those tests are listed in the table below. Where N/A is indicated as a result, a given feature is not supported by the softswitch or the feature is supported but could not be tested. Descriptions of the individual tests follow in the appendix to this document.

Test Id	Test Title	Result
1	H.248-specific features	
1.1	MGW registration and communication with the MGC	
1.1.1	UDP transport	PASSED
1.1.2	SCTP transport	N/A
1.2	Service change	
1.2.1	Setting fix termination In/Out of Service	PASSED
1.2.2	Setting root termination In/Out of service	PASSED
1.2.3	Test lost of connectivity (use Inactivity Timer)	N/A
1.3	Audit	
1.3.1	Audit Capabilities	PASSED
1.3.2	Audit value	
1.3.2.1	Media	PASSED
1.3.2.2	Packages	PASSED
1.3.2.3	Statistics	PASSED
1.4	Live configuration changes	
1.4.1	MGW changed configuration before MGC	
1.4.1.1	Rename fixed termination	PASSED
1.4.1.2	Remove fixed termination	PASSED
1.4.1.3	Add fixed termination	PASSED
1.4.2	MGC changed configuration before MGW	
1.4.2.1	Rename fixed termination	PASSED
1.4.2.2	Remove fixed termination	PASSED
1.4.2.3	Add fixed termination	PASSED
1.5	Other packages	
1.5.1	Test Network failures (nt/netfail,net/qalert,qac/qualertcease )	N/A
2	SS7/SIGTRAN-specific features	
2.1	SCTP configuration and establishment	PASSED
2.2	M2UA link establishment and MTP2 link activation	N/A
2.3	M3UA link establishment and MTP3 link activation	PASSED
2.4	ISUP interface activation	PASSED
2.5	Restart of MGW SIGTRAN stacks	PASSED

2.6	Restart of MGC SIGTRAN stacks	PASSED
2.7	Loss of connectivity between MGC and MGW	PASSED
3	Call Flows (SS7/SIGTRAN + SIP + H.248)	
3.1	Voice Call Flows	
3.1.1	TDM to TDM	PASSED
3.1.2	TDM to VOIP	PASSED
3.1.3	VOIP to VOIP	PASSED
3.1.4	VOIP to TDM	PASSED
3.2	Fax call flows	
3.2.1	TDM to TDM	PASSED
3.2.2	TDM to VOIP	PASSED
3.2.3	VOIP to VOIP	PASSED
3.2.4	VOIP to TDM	PASSED
3.3	Test tones play/detect	
3.3.1	Using signal and events 'd0', 'd1', etc.	PASSED
3.3.2	Using signal 'pt' and events 'std' and 'etd'.	N/A
3.3.3	Generating call progress tone on tdm	PASSED
3.3.4	Test of Signal Completion (g/sc) events	N/A
3.3.5	Test digit maps	PASSED
3.4	Continuity Check call flows	
3.4.1	Incoming call: setting loop on tdm	PASSED
3.4.2	Outgoing call: sending and detecting tone	N/A
3.5	Play prompts	
3.5.1	Play announcements with Generic announcement package	N/A
3.6	Tone relay	
3.6.1	Using RFC2833 tone	PASSED
3.6.2	Using in-band tone	PASSED
3.7	Longrun test	
3.7.1	1,000,000 calls @ 15cps, duration 500ms per call	PASSED

### CONCLUSION

After completing the series of tests described in this document, TelcoBridges can confirm that its Tmedia family of VOIP gateways, including the TMG800, TMG3200, TMG5800 and TMG7800 models, can successfully interoperate with Xener Systems Limited's softswitch platform using the H.248 media gateway control protocol as well as signaling protocols such as SIP, SS7/C7 and SIGTRAN.



**About Xener**

*Xener Systems is Korea's number one NGN & VoIP solution vendor commanding over 70% softswitch market share in Korea as well as having a proven track record in the overseas market. Delivering top-of-the-class IP based service platforms and service solutions for NGN since its inception in February of 2000, Xener has outperformed and outpaced its competitors and has established itself as one of leading groups in NGN, packet-based convergence network technology. Today 8 of 9 major VoIP service providers in Korea including KT, SK Broadband, LG Telecom have adopted and deployed Xener's VoIP solutions since Xener commenced the roll-out of Korea's first softswitch in 2002. Xener's VoIP, NGN and IMS platforms have been up and running in the field for a decade, currently catering to around 3 million end users in the domestic and overseas markets, which proves its carrier-class platform's scalability and reliability to accommodate mass users. In addition, Xener has implemented the IMS/TISPAN-compliant 3G multimedia service solution for all Korean mobile carriers and recently has provided a large scale fixed-mobile-convergence service solutions over the Smartphone for Korea's carriers and major enterprises. Meanwhile, Xener has expanded its global presence by supplying its solutions for the major overseas carries including Starhub (Singapore), Telecom Malaysia (Malaysia), Indosat (Indonesia) and T-Mobile (USA). The Company can be reached at its headquarters in 5F Hyundai Intellex Bld. 261 Nonhyeon-dong, Gangnam-gu, and Seoul, South Korea or on the internet at <http://www.xener.com>.*

**About TelcoBridges**

*TelcoBridges is clearly defining the future of telecommunications technologies. With the industry's premier unified hardware platform for network convergence, value-added services, and performance management, TelcoBridges is enabling service providers to meet and exceed their service goals while ensuring exceptional operating cost-efficiency. TelcoBridges' channel partners, including value-added resellers, system integrators and solution developers, have delivered and deployed carrier-grade solutions in over 50 countries around the world. These include VoIP gateways, mobile value-added services, unified communications, network monitoring, lawful intercept, location-based services, and many others. For more information, please visit <http://www.telcobridges.com/>*

**APPENDIX: TEST DESCRIPTIONS**

Test Id	Test Title	Description	Procedure
1	H.248-specific features		
1.1	MGW registration and communication with the MGC		
1.1.1	UDP transport	Test whether UDP can be used as a transport protocol.	<ul style="list-style-type: none"> <li>- Configure SSW and MGW to use UDP transport</li> <li>- Start MGW and SSW service</li> <li>- Verify that SSW replies to ServiceChange command</li> </ul>
1.1.2	SCTP transport	Test whether SCTP can be used as a transport protocol.	<ul style="list-style-type: none"> <li>- Configure SSW and MGW to use SCTP transport</li> <li>- Start MGW and SSW service</li> <li>- Verify that SSW replies to ServiceChange command</li> </ul>
1.2	Service change		
1.2.1	Setting fixed termination point In/Out of Service	Test whether a fixed termination point can be put InService or OutOfService and that the SSW responds correctly to the change of state.	<ul style="list-style-type: none"> <li>- Start MGW and SSW service</li> <li>- On provider side, set one line service to 'out-of-service'</li> <li>- Wait approximately 30 seconds and verify that MGW sends 'out-of-service' service change for the trunk that was set to 'down'</li> <li>- Verify that replies from SSW do not contain errors</li> <li>- On provider side, set the line service back to 'in service'</li> <li>- Wait approximately 30 seconds and verify that MGW sends 'in service' service change for the trunk that was set to 'up'</li> <li>- Verify that replies from SSW do not contain errors</li> </ul>
1.2.2	Setting root termination In/Out of service	Test whether the root termination point can be put InService or OutOfService and that the SSW responds correctly to the change of state.	<ul style="list-style-type: none"> <li>- Start MGW</li> <li>- Verify that MGW sends 'on root' service change with method 'restart' (setting root termination in service)</li> <li>- Start SSW</li> <li>- When the connection between MGW and SSW is up, reboot the MGW</li> <li>- Wait 3-5 seconds and verify that MGW sends service change 'on root' with the method 'forced' (setting root termination 'out of service')</li> </ul>
1.2.3	Test loss of connectivity (use Inactivity Timer)	Test whether TelcoBridges' Toolpack Media Gateway Application can detect loss of connectivity using the inactivity timer.	<ul style="list-style-type: none"> <li>- Enable inactivity timer detection in SSW configuration</li> <li>- Start MGW and SSW services</li> <li>- Once the SSW asks to detect inactivity timer, remove the link between MGW and SSW</li> <li>- After the time value of the inactivity timer is attained, see that MGW is sending 'notify of inactivity' timer messages (ObservedEvents=1000{it/ito})</li> <li>- After maximum repetition of the previous notify attempt is attained, MGW should send 'on root termination' service change with method 'disconnected'</li> </ul>

1.3	Audit		
1.3.1	Audit Capabilities	Test whether the answer of an AuditCapability contains valid capabilities.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- Verify that MGW answers to AuditCapability=ROOT{Audit{Media}} (Note that while AuditCapability can be sent on an individual trunk or termination point, it is usually done at the time of start-up)</li> </ul>
1.3.2	Audit Value		
1.3.2.1	Media	Test whether the answer to an AuditValue for media contains values of the requested property.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- Verify that MGW answers to AuditValue=ROOT{Audit{Media}}</li> </ul>
1.3.2.2	Packages	Test whether the answer to an AuditValue for package contains every supported package.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- Verify that MGW replies to AuditValue=ROOT{Audit{Packages}} with a list of all supported packages (Note that while the audit package command can be sent on an individual trunk or termination, it is usually performed at the time of start up on the root termination)</li> </ul>
1.3.2.3	Statistics	Test whether the answer to an AuditValue for statistics contains the statistics of the termination audited.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- Generate a VOIP to TDM call (see 3.1.4) and then terminate it</li> <li>- Verify that MGW answers with statistics to the substract command with Audit{Statistics}</li> </ul>
1.4	Live Configuration changes		
1.4.1	MGW changed configuration before MGC		
1.4.1.1	Rename fixed termination	Test whether the name of a fixed termination point can be changed by the MGW and then by the MGC.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- On MGW side, change the name of one trunk</li> <li>- In SSW configuration, change the name of the same trunk to the new name described in MGW</li> <li>- Verify that there is no error in MGW</li> </ul>
1.4.1.2	Remove fixed termination point	Test whether a fixed termination point can be removed from the system by the MGW and then by the MGC.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- On MGW side, remove a trunk</li> <li>- In SSW configuration, remove the same trunk that was removed in MGW</li> <li>- Verify that there is no error in MGW</li> </ul>
1.4.1.3	Add fixed termination point	Test whether a fixed termination point can be added to the system by the MGW and then by the MGC.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- On MGW side, add a trunk</li> <li>- In SSW configuration, add the same trunk with the same timeslot configuration</li> <li>- Verify that there is no error in MGW</li> </ul>

1.4.2	MGC changed configuration before MGW		
1.4.2.1	Rename fixed termination point	Test whether the name of a fixed termination point can be changed by the MGC and then by the MGW.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- In SSW configuration, change the name of one trunk</li> <li>- On MGW side, change the name of the same trunk that was changed in SSW</li> <li>- Verify that there is no error in MGW</li> </ul>
1.4.2.2	Remove fixed termination point	Test whether a fixed termination point can be removed from the system by the MGC and then by the MGW.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- In SSW configuration, remove a trunk</li> <li>- On MGW side, remove the same trunk that was removed in SSW</li> <li>- Verify that there is no error in MGW</li> </ul>
1.4.2.3	Add fixed termination point	Test whether a fixed termination point can be added to the system by the MGC and then by the MGW.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- In SSW configuration, add a trunk</li> <li>- On MGW side, add the same trunk that was added in SSW</li> <li>- Verify that there is no error in MGW</li> </ul>
1.5	Other packages		
1.5.1	Test Network failures (nt/netfail, net/qalert, qac/qualertcease )	Test whether MGW correctly handles network errors and that SSW responds correctly.	<ul style="list-style-type: none"> <li>- Configure SSW to ask for netfail event on termination</li> <li>- Generate a VOIP to VOIP call as per 3.1.3</li> <li>- SSW should ask to detect event 'nt/netfail' on terminations</li> <li>- Wait 30 seconds</li> <li>- MGW should send an event notify with netfail as the event</li> </ul>
2	SS7/SIGTRAN-specific features		
2.1	SCTP configuration and establishment	Test whether SCTP Associations can be connected successfully.	<ul style="list-style-type: none"> <li>- Start MGW and SSW services</li> <li>- Wait 30 seconds</li> <li>- Verify that the SCTP Association is UP</li> </ul>
2.2	M2UA link establishment and MTP2 link activation	Test whether all SS7 links carried over SIGTRAN are UP and stable.	<ul style="list-style-type: none"> <li>- With MGW and SSW active, verify the status of all MTP2/M2UA links and make sure they are all UP and stable</li> </ul>
2.3	M3UA link establishment and MTP3 link activation	Test whether all SS7 links carried over SIGTRAN are UP and stable.	<ul style="list-style-type: none"> <li>- With MGW and SSW active, verify the status of all MTP3/M3UA links and make sure they are all UP and stable</li> </ul>
2.4	ISUP interface activation	Test whether all ISUP interfaces carried over SIGTRAN are AVAILABLE.	<ul style="list-style-type: none"> <li>- With MGW and SSW active, verify the status of all ISUP interfaces and make sure they are all AVAILABLE</li> </ul>
2.5	Restart of MGW SIGTRAN stacks	Test whether service is restored correctly after SIGTRAN stack is restarted on MGW	<ul style="list-style-type: none"> <li>- Starting with active MGW and SSW with all SS7 entities in a valid state, restart the MGW</li> <li>- Wait that the MGW is fully restarted</li> <li>- Verify that all SS7 entities are back in a valid state (all ISUP interfaces should be AVAILABLE)</li> </ul>
2.6	Restart of MGC SIGTRAN stacks	Test whether service is restored correctly after the SIGTRAN stack is restarted on SSW	<ul style="list-style-type: none"> <li>- Starting with active MGW and SSW with all SS7 entities in a valid state, restart the SSW</li> <li>- Wait that the SSW is fully restarted</li> <li>- Verify that all SS7 entities are back in a valid state (all ISUP interfaces should be AVAILABLE)</li> </ul>

2.7	Loss of connectivity between MGC and MGW	Test whether service is restored after a loss of network connectivity between MGW and MGC	<ul style="list-style-type: none"> <li>- Starting with an active MGW and SSW with all SS7 entities in a valid state, unplug the network connection between the MGW and the SSW</li> <li>- Wait 1 minute</li> <li>- Reconnect network connection</li> <li>- Verify that all SS7 entities are back in a valid state</li> </ul>
3	Call Flows (SS7/SIGTRAN + SIP + H.248)		
3.1	Voice Call Flows		
3.1.1	TDM to TDM	Test ability to create a call from and to TDM terminations	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 3: TDM to TDM call flow</li> <li>- Verify that both providers are connected together</li> </ul>
3.1.2	TDM to VOIP	Test ability to create a call from a TDM to a VOIP termination	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow</li> <li>- Verify that provider is connected to SIP phone</li> </ul>
3.1.3	VOIP to VOIP	Test ability to create a call from and to VOIP terminations	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 4: VOIP to TDM call flow</li> <li>- Verify that SIP phone is connected to provider</li> </ul>
3.1.4	VOIP to TDM	Test ability to create a call from a VOIP to a TDM termination	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 2: VOIP to VOIP call flow</li> <li>- Verify that both SIP phones are connected together</li> </ul>
3.2	Fax call flows		
3.2.1	TDM to TDM	Test ability to create a fax call from and to TDM terminations	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 3: TDM to TDM call <b>flow</b></li> <li>- On provider side, send fax and verify that it is received on the other provider side</li> </ul>

3.2.2	TDM to VOIP	Test ability to create a fax call from a TDM to a VOIP termination	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow- On provider side, send fax on TDM and verify, on TDM termination on MGW side, that the 'CNG' is detected and reported to SSW</li> <li>- Verify that SSW is asking MGW to switch VOIP termination to image T38</li> <li>- Verify, on SIP phone side, that the fax is received</li> </ul>
3.2.3	VOIP to VOIP	Test ability to create a fax call from and to VOIP terminations	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 2: VOIP to VOIP call flow- On SIP phone side, send a fax and verify that SSW id asking MGW to switch both VOIP terminations to image T38</li> <li>- Verify, on sip phone side, that the fax is received</li> </ul>
3.2.4	VOIP to TDM	Test ability to create a fax call from a VOIP to a TDM termination	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 4: VOIP to TDM call flow- On provider side, send fax on VOIP and verify, on TDM termination on MGW side, that the 'ANS' is detected and reported to SSW</li> <li>- Verify that SSW is asking MGW to switch VOIP termination to image T38</li> <li>- Verify, on provider side, that the fax is received</li> </ul>

3.3	Test tones play/detect		
3.3.1	Using signal and events 'd0', 'd1', etc.	Test ability to play and detect DTMF, using package 'dg' (DTMF generation) and 'dd' (DTMF detection) with signal and event id	<ul style="list-style-type: none"> <li>- Configure provider and SSW to play tone using SIP INFO</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow, SSW should ask to detect 'dd/*' on the TDM side</li> <li>- On the provider side, generate DTMF 5 on VOIP side using SIP INFO, SSW should ask to generate tone on TDM side with 'dg/d5'</li> <li>- On the provider side, generate DTMF 4 on TDM side, MGW should send to SSW that it detects 'dd/d4' on the TDM termination</li> </ul>
3.3.2	Using signal 'pt' and events 'std' and 'etd'.	Test ability to play and detect DTMF, using package dg and dd with signal 'pt' (play tone) and with event 'std' (start tone detection) and 'etd' (end tone detection)	<ul style="list-style-type: none"> <li>- Configure SSW to send tone signal and event using 'pt' and 'std'</li> <li>- Configure provider and SSW to play tone using SIP INFO</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow, SSW should ask to detect 'dd/std' with item '*' (all) on the TDM side</li> <li>- On the provider side, generate DTMF 5 on VOIP side using SIP INFO, SSW should ask to generate tone on TDM side with 'dg/pt' with 'tl = d5'</li> <li>- On the provider side, generate DTMF 4 on TDM side, MGW should send to SSW that it detects 'tid = d4' on the TDM termination</li> </ul>
3.3.3	Generating call progress tone on TDM	Test ability to play call progress tone, using package 'cg' (call progress generation) with signal id	<ul style="list-style-type: none"> <li>- Configure SSW to send call progress tone on TDM to VOIP call</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow</li> <li>- Verify that when SSW sends 'cg/rt' on TDM termination, a ring tone is heard on provider side</li> </ul>
3.3.4	Test of Signal Completion (g/sc) events	Test ability to detect the end of a signal and notify it to the SSW by sending the observed event 'sc' (signal completion) of package 'g' (generic)	<ul style="list-style-type: none"> <li>- Configure SSW to ask for NotifyCompletion on signals</li> <li>- Configure provider and SSW to play tone using SIP INFO</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow, SSW should ask to detect 'dd/*' on the TDM side</li> <li>- On the provider side, generate DTMF 5 on VOIP side using SIP INFO, SSW should ask to generate tone on TDM side with 'dg/d5' with NotifyCompletion option. Event descriptor 'g/sc' should also be asked to be detected by SSW</li> <li>- When the tone play is done, verify that MGW is sending ObservedEvent 'g/sc' to the SSW</li> </ul>

3.3.5	Test digit maps	Test ability to detect a digit map sequence and send the observed event 'ce' when the digit map is detected	<ul style="list-style-type: none"> <li>- Configure SSW to detect tone using digit map</li> <li>- Configure provider and SSW to play tone using SIP INFO</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow, SSW should ask to detect event 'dd/ce' with digit map equals to '[0-9EF]' (digit map is test specific) on TDM side</li> <li>- On the provider side, generate DTMF 4 on TDM side, MGW should send to SSW that it detects 'dd/ce' with 'ds=4' on the TDM termination</li> </ul>
3.4	Continuity Check call flows		
3.4.1	Incoming call: setting loop on TDM	Test ability to set a loopback on a TDM termination upon reception of signal 'rsp' (respond) from package 'ct' (basic continuity check)	<ul style="list-style-type: none"> <li>- From the provider side, generate a continuity check on a timeslot</li> <li>- SSW should ask MGW to apply signal 'ct/rsp' (setting loopback) on the TDM termination representing the above timeslot</li> <li>- Verify that the continuity check passed on the provider side</li> <li>- SSW should ask MGW to apply an empty signal on the TDM termination to remove the loopback</li> </ul>
3.4.2	Outgoing call: sending and detecting tone	Test ability to generate a test tone upon reception of signal 'ct' (continuity test) and send the observed event 'cmp' (completion) when we detect it	<ul style="list-style-type: none"> <li>- From the SSW side, generate a continuity check on a timeslot/TDM termination</li> <li>- SSW should ask MGW to apply signal 'ct/ct' and to detect event 'ct/cmp' on TDM termination</li> <li>- Wait few seconds to tone to be detected, then verify that MGW sends the observed event 'ct/cmp' with 'res=SUCCESS' meaning that the test succeeded</li> </ul>
3.5	Play prompts		
3.5.1	Play announcements with Generic announcement package	Test ability to play prompts, upon reception of 'apf' signal (fixed: announcement play) of package 'an' (generic announcement)	<ul style="list-style-type: none"> <li>- Configure SSW to play prompt when there is no route for a called number</li> <li>- On the provider side, generate a call to an unknown called number</li> <li>- Verify that, after the call is created in MGW, SSW sends to MGW to play a prompt using 'an/apf'</li> <li>- On provider side, verify that the prompt can be heard</li> </ul>

3.6	Tone relay		
3.6.1	Using RFC2833 tone	Test ability to relay tone using RFC2833 (telephony-event)	<ul style="list-style-type: none"> <li>- Configure SSW and provider to play tone with RFC2833</li> <li>- Generate call flow as in Figure 5: TDM to VOIP call flow</li> <li>- On provider side, generate DTMF 2 on TDM termination</li> <li>- Verify that the DTMF 2 is passed to the VOIP using RFC2833</li> </ul>
3.6.2	Using in-band tone	Test ability to relay in-band tone	<ul style="list-style-type: none"> <li>- Generate call flow as in Figure 3: TDM to TDM call flow</li> <li>- On provider side, generate DTMF 3 on one of the TDM termination</li> <li>- Verify that the tone is received on the other TDM termination</li> </ul>
3.7	Long run test		
3.7.1	1,000,000 calls @ 15cps, duration 500ms per call	Test the robustness of the MGW by performing many short calls at a medium to high call rate	<ul style="list-style-type: none"> <li>- On provider side, prepare test scenario to generate 1,000,000 mixed calls (all of voice call flows) at a rate of 15 cps with call duration of 500 ms</li> <li>- Start the test and when all calls are completed, verify that there is no error on MGW side</li> </ul>