



Verizon Technology Organization

Technical Memorandum

SIT.GNIE.TM.VOIP.2006.002

Technology Test Suite for Wholesale VoIP Interoperability

Version 1.4

September 28th, 2006

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Revision History

Version	Contact	Action	
Version 1.0 05/30/2006	Stephen Ballard	New	Draft document
Version 1.1 06/01/2006	Stephen Ballard	Change	Corrections based on Team Feedback
Version 1.2 06/20/2006	Stephen Ballard	Change	Added requirements for codec negotiation and DTMF
Version 1.3 09/26/2006	Wayne Garrett	Change	Edited for public web access; Modified TC23; added Appendix A & B
Version 1.4 09/28/2006	Wayne Garrett	Change	Edited Footer; Added Alternate Gateway Test-cases; Renumbered Testcases
<i>Actions Taken are: New = new document, Add/Delete/Change = a section or topic has been added, or deleted, or changed.</i>			

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1. Executive Overview

Verizon would like to rapidly accelerate the deployment of SIP Wholesale VoIP products & services in its network. This endeavor would enable the company to provide new, innovative and cost efficient services to its Wholesale customers. Given the relative immaturity of SIP Wholesale, there arises a need to have customers test their products against a standard test suite that meets Verizon's requirements.

This Technical Memorandum provides a set of test cases that will be used by the customer community to ensure that their products will conform to Verizon's requirements for SIP Wholesale VoIP interoperability. These test cases are based on Verizon's SIP deployment strategy and IETF's Request for Comments (RFC); mainly Session Initiation Protocol (RFC 3261), Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity with Trusted Networks (RFC 3325), A Privacy Mechanism for the Session Initiation Protocol (SIP) (RFC 3323) and RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals (RFC 2833).

2. Technical Scope

Based on Verizon's VoIP deployment strategy, the Wholesale VoIP Interop team has developed a Technology Test Suite consisting of SIP interoperability test cases to ensure customer's SIP equipment compatibility. The requirements are for customers to test their SIP softswitch against a standard test suite so that their SIP softswitch can be correctly integrated into the Verizon network with limited interoperability issues. This Technology Test Suite focuses on test cases that require interaction with the PSTN. Test cases do not show complete exchange of messages. Only messages relevant to the test case are shown.

3. Technical Description

This section presents the typical SIP VoIP Wholesale test configurations along with the associated basic call flows.

[Click here](#) to view a comprehensive list of customer Proxy/IPSec hardware combinations that have successfully completed Verizon Interoperability testing.

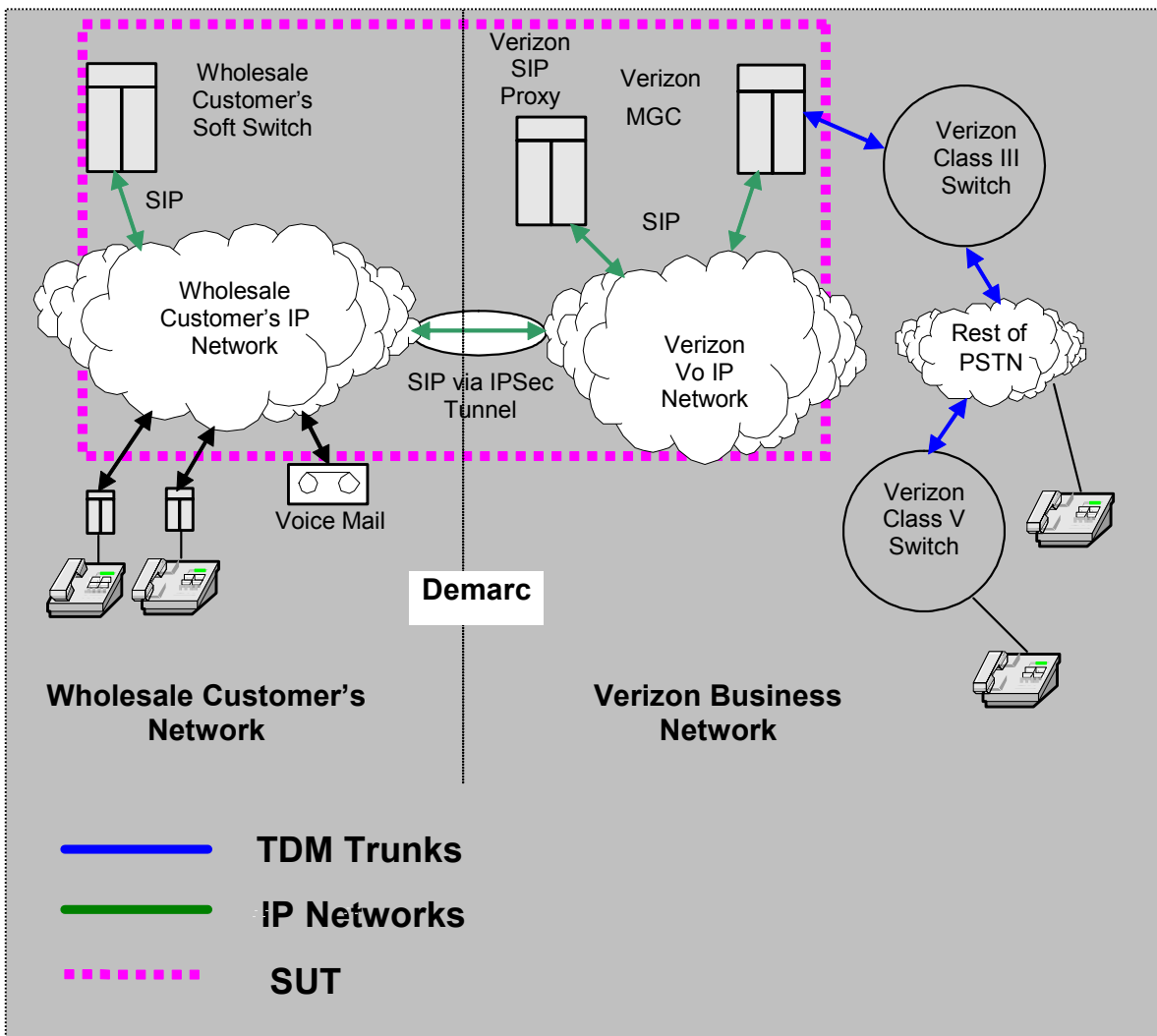


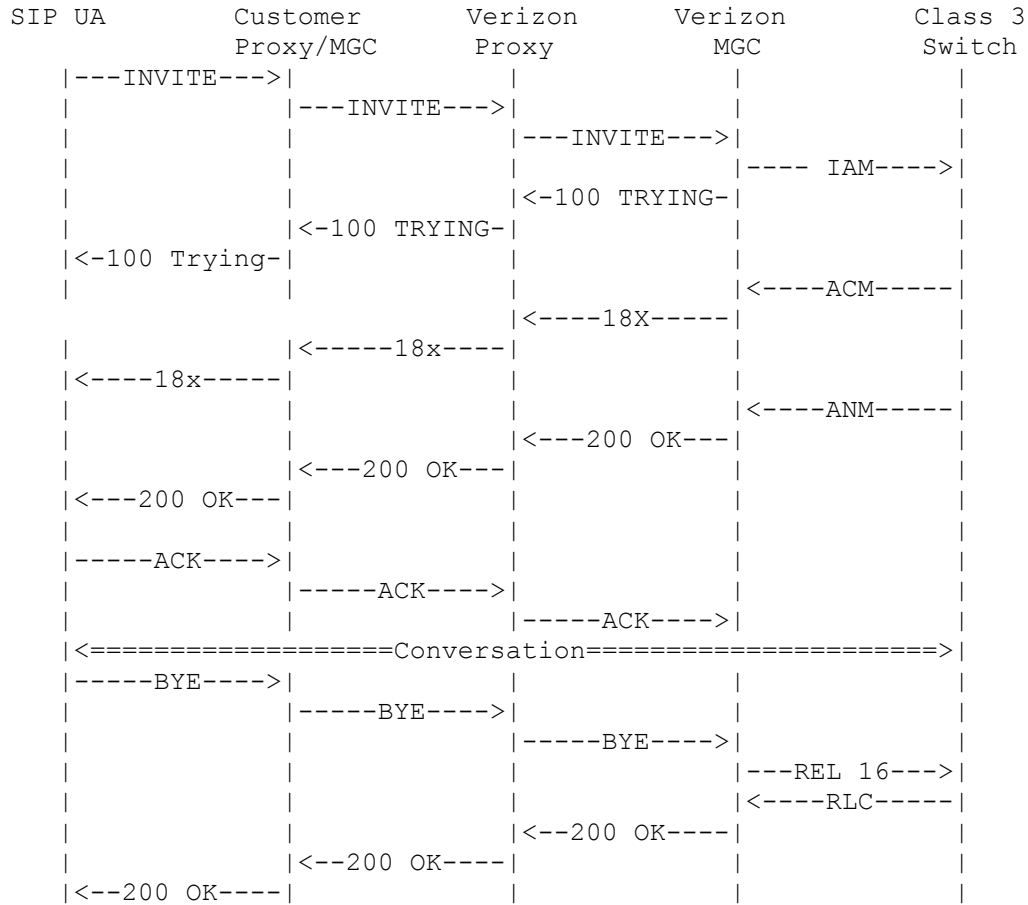
Figure 1: PSTN access for Wholesale customer

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3.1 IP Origination - PSTN Termination

A basic outbound to PSTN call flow for SIP Wholesale is shown below.



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4. Test Instructions

Test Objectives

Verizon Wholesale IP Communications Services interoperability testing verifies that a potential wholesale customer's Voice over IP (VoIP) platform properly interoperates with the Verizon Network from the perspective of Session Initiation Protocol (SIP) and Real-Time Transport Protocol (RTP) and is approved for use with the production Verizon Network.

Interop Lab Entrance Criteria

- The Verizon Customer Rep will have worked with the Customer to obtain completed legal documentation covering a non-disclosure agreement and bailment/beta test agreement.
- The Verizon Customer Rep will have worked with the Customer to technically pre-qualify their capabilities and confirm that the Customer is ready for testing.
- The Verizon Customer Rep will initiate and attend a Kickoff meeting between the Customer and Verizon Interop Engineering.
 - The Verizon Customer Rep will provide Verizon Interop Engineering with the Customer's service requirements.
 - The Verizon Customer Rep will provide Verizon Interop Engineering with a completed Customer Connectivity Questionnaire, which is contained in Appendix A.
 - Verizon Interop Engineering will provide the Customer with connectivity information to Verizon's Interop Lab as indicated in Appendix B.
 - Verizon Interop Engineering will provide the Customer with this Interop Test Plan.
 - Verizon Interop Engineering will indicate which category(s) of test cases, as defined in sections 5 through 10 of this document, are applicable for this specific Customer's service.
- Following the kickoff meeting, Verizon Interop Engineering will work with the Customer to establish IP connectivity between the Customer's equipment and Interop lab equipment.
- Verizon Interop Engineering will provide the Verizon Customer Rep and Customer with notification of entrance criteria completion, connectivity, and readiness to begin Interop testing.

Testing Requirements

- The Customer will need the ability to provision their equipment and environment.

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- Communication with the Interop Lab will primarily be through the exchange of e-mail.
- Verizon Customer Rep should be copied on all e-mail exchanged.
- A "hot line" phone to the Verizon Interop Engineering will be used when more interactive dialog is needed.
- The Customer will need the ability to capture SIP traces for each test case executed and send them to Verizon Interop Engineering.
- The Customer should also be able to log RTP traffic and provide traces if needed for troubleshooting

Test Suite Execution

- The customer will run each applicable test case as defined the test sections of this document.
 - Most test cases can be run by the customer independently.
- As test cases are executed, test results along with test numbers and associated SIP trace should be e-mailed to the Verizon Interop lab where the results can be reviewed by Verizon Interop Engineering for final pass/fail determination.
 - It is recommended that these not be sent in bulk, but in small groups as they are completed.
- The Verizon Interop Engineering will respond to this e-mail within one business day.
 - If many test cases are included then a complete review and response by Verizon Interop Engineering may require additional time.
- A reply will be sent to the customer by Verizon Interop Engineering to indicate whether the test case meets the requirements (pass/fail).
 - If failed, the reasons for the failure will be indicated.

Support during Test Case Execution

- For any issue that occurs during test case execution, pertinent information should be sent in an e-mail to the Verizon Interop lab along with SIP logs and the following additional information:
 - * Test case number and issue with the test case
 - * Call-ID for the call
 - * "From" phone number
 - * "To" phone number
 - * Date and Time of test case call
- Verizon Interop Engineering will respond to this e-mail within one business day and provide assistance in resolving the issue.

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- It is preferred that test case issues and SIP logs be sent to Verizon Interop Engineering for review as they occur to forestall the possibility that one problem will cause a large number of subsequent test case failures.

Test Suite Completion

- If there are no issues, then test cases should take less than one week to complete, depending on number of applicable test cases, including review.
- When all test cases have been executed and passed from the Customer perspective, an e-mail should be sent indicating completion.
- Any issues still believed to be open by Verizon Interop Engineering will be addressed with the Customer and Customer Rep in an attempt to resolve or clarify those issues.
- Testing and/or troubleshooting will not extend beyond a two week period if issues persist.
- When all, if any, open issues have been resolved then the Customer will have completed the interoperability testing and the Customer Rep will schedule a Test Completion Review.
- Handoff documents and test results will be provided by Verizon Interop Engineering to the Customer and the Verizon Customer Rep at the Test Completion Review.
- The Customer Rep will work with the Customer and Operations to complete Operations IP connectivity and handoff.

Restrictions and Limitations

- The Interop test plan does not mandate bulk call traffic testing during Interop testing. Bulk traffic testing helps to insure reliability of interoperation between networks. It is recommended, but not required, that the Customer perform traffic testing during the Interop test phase.
- Supported SIP methods: INVITE, ACK, BYE, CANCEL, OPTIONS
- Unsupported SIP methods: REFER, SUBSCRIBE, NOTIFY, UPDATE, INFO
- ANI Delivery Option 1: For this option, wholesalers must send a valid ANI in the P-Asserted-Identity (RFC 3325) and optionally a Privacy Header (RFC 3323) to Verizon otherwise the call will be blocked.
- Delayed SDP, where the SDP is sent in the ACK, is not supported.
- SIP-MIME, SIPs/TLS, and other application level authentication and encryption techniques are not supported.
- Verizon obeys RFC3261 and ignores any headers it does not understand. Verizon may send proprietary headers to the wholesaler, which must be ignored.
- Verizon may send RTCP as part of the audio session, however, RTCP is not fully deployed and Verizon does not provide any control based on the RTCP data.
- Group 3 FAX sent over G.711 is "best effort". T.38 FAX is not supported.

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- RFC3389 RTP comfort noise is not supported.
- Mid-session codec changes, without a re-INVITE, are not supported.
- The SIP INFO, KPML, SUBSCRIBE and NOTIFY methods for DTMF transport are not supported.
- SRTP and other methods of media encryption are not supported.
- Verizon proxies send all numbers formatted as E.164 to the wholesaler.
- Verizon authenticates and only supports SIP signaling to the wholesaler via IPSEC tunnels.
- Centrex functions are not supported.
- Compact SIP Headers must be supported.
- Wholesale customer Soft switch must be able to parse "From" header in the format below
 - "f: <sip:Anonymous@Anonymous.invalid:5060>;tag=6-13c4-433ae085-b7e3b6
 - "f: <sip:Unavailable@Unavailable.invalid:5060>;tag=6-13c4-433ae085-b7e3b6
- P-Asserted-Identity and From header from Wholesale customer should be in E.164 format.
- Only valid e.164 numbers should be prefixed with a "+". All other number formats should be sent in raw digit form.
- G729
 - Endpoints shall send with 20ms
 - Packetization interval should be provisioned
 - Endpoints shall be able to receive 20ms or 40ms
 - No requirements defined for ptimes larger than 40ms [endpoints may receive or reject calls]
- G711
 - Endpoints shall send with 20ms
 - Packetization interval should be provisioned
 - Endpoints shall be able to receive 10ms, 20ms, or 40ms
 - No requirements defined for ptimes larger than 40ms [endpoints may receive or reject calls]
- RFC2833 [DTMF Relay] is supported and required when using the G729 codec. In-band DTMF is not supported for G729.

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SECURITY and AUTHENTICATION

TCA: Customer IPSec Peerpoint to Verizon IPSec Peerpoint

Test Steps

1. Configure Phase 1 with pre-g2-3des-md5 and pre-shared key.
2. Configure Phase 2 with g2-esp-3des-md5.
3. Configure access list policies accordingly.

Expected Results

1. Verify IPSec handshake for phase 1 proposal
2. Verify IPSec handshake for phase 2 proposal.
3. Verify interesting traffic can be exchanged through the VPN tunnel.
4. Verify the following handshake exchange.

Phase 1 Proposal - Main Mode

Verizon Peer Point	Customer Peer Point	
-----HDR, SA----->		SA: Security Association
		KE: Diffie-Hellman exchanged public value
<-----HDR, SA-----		Ni, Nr: The Nonce
		ID_I, ID_R: the Initiator, Responder
<-----HDR, KE Ni-----		CERT: Certificate
		SIG_I, SIG_R: the signature of the
-----HDR, KE Ni----->		Initiator, Responder
		[x]: x is optional
<-HDR*, ID_I, [CERT], SIG_I--		*: encryption must begin after the header
		HDR: ISAKMP header
--HDR*, ID_R, [CERT], SIG_R->		

Phase 2 Proposals - Quick Mode

Verizon Peer Point	Customer Peer Point
HDR*, HASH1, SA, Ni SA	
-----[KE], [ID_I], [ID_R]----->	
HDR*, HASH2, SA Nr, [KE]	
<-----[ID_I], [ID_R]-----	
<-----HDR*, HASH3----->	

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TCB: Calling Party Number Authentication

Test Steps

1. Assign and configure a DID number to the originating party and Verizon Proxy.
2. Originate a voice call via customer MGC to Verizon MGC using the assigned DID.
3. Answer the call. Calling party disconnects the call.

Expected Results

1. Verify that the calling party hears audible ring back.
2. Verify that the called party hears power ringing (alerted).
3. Verify that a two way speech path is established.
4. Verify Caller ID on the terminating line.
5. Verify that the SIP INVITE contains P-Asserted-Identity with correct calling party information as shown in the example INVITE below.

```

INVITE sip:+19725553265@verizon.com;user=phone SIP/2.0
Via:SIP/2.0/UDP 10.10.10.10;branch=71V5060-0-912782047
From:"Customer"<sip:+19727282400@10.10.10.10;user=phone>;tag=321064913
To:<sip:9725553265@verizon.com;user=phone>
Call-ID:133032125250506744915018
CSeq:912782047 INVITE
Contact:<sip:10.10.10.10:5060>
P-Asserted-Identity:"Wholesale Custname"<sip:+19727282400@10.10.10.10;user=phone>
Privacy:none
Allow:ACK,BYE,CANCEL,INFO,INVITE
Supported:
Accept:application/sdp,application/dtmf
Max-Forwards:10
Content-Type:application/sdp
Content-Length:292
    
```

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4.1. VoIP to PSTN Call Direction Test Cases

TC1: 7-Digit Local

Test Steps

1. Customer dials a 7-Digit local number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:NXXXXXX@<Verizon proxy>; user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify ringing at the destination phone and ring back at the originating device.
4. Answer terminating phone.
5. Verify media path.
6. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Class 5
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----	<-----ACM-----	
	<-----18x-----	<-----ANM-----	
<---18x-----		<-----200 OK-----	
<---200 OK-----	<-----200 OK-----		
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
	<-----200 OK-----	-----REL 16----->	
<---200 OK-----		<-----RLC-----	

TC2: 10-Digit Local

Test Steps

1. Customer dials a 10-Digit local number.
2. Verify the number in the Request URI is in the following format:

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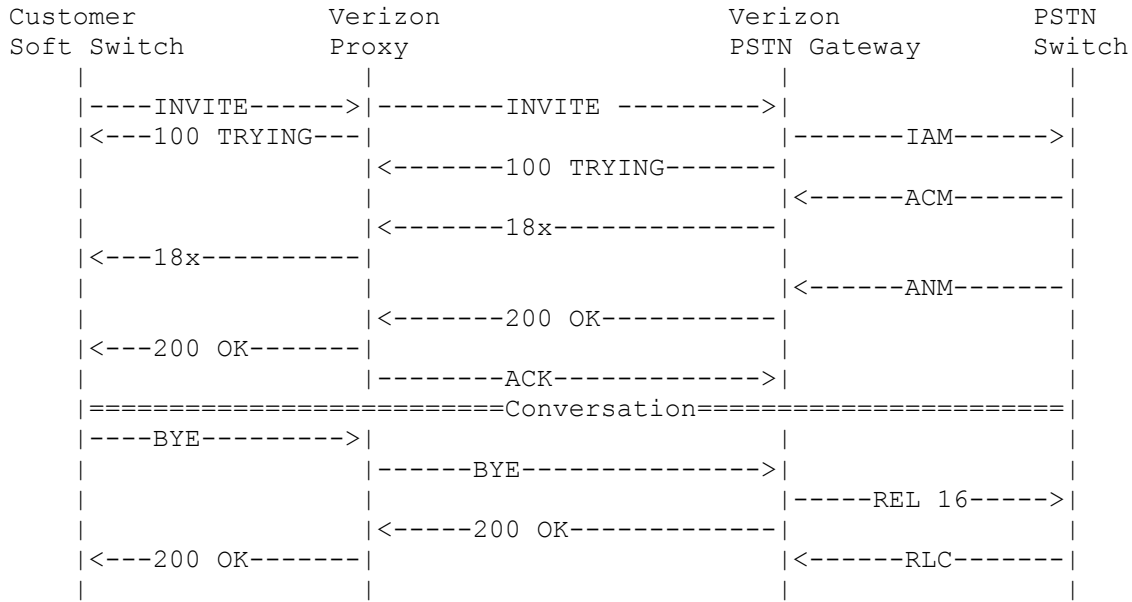
INVITE sip:NPANXXXXXX@<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify ringing at the destination phone and ring back at the originating device.
4. Answer terminating phone.
5. Verify media path.
6. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call Terminated properly.



TC3: 1 Plus 10-Digit Long Distance

Test Steps

1. Customer dials a 1+10-Digit Long Distance number.
2. Verify the number in the Request URI is in the following format:

INVITE sip:1NPANXXXXXX@<Verizon proxy>; user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify ringing at the destination phone and ring back at the originating device.
4. Answer terminating phone.
5. Verify media path
6. Calling party terminates the call

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Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 3 Switch
-----INVITE----->	-----INVITE----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----	<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC4: 011-Plus International

Test Steps

1. Customer dials a 011+CC-XXXXXX International number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:011CCXXXXXXXX@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
 NOTE: International Number cannot exceed 15 digits.
3. Verify ringing at the destination phone and ring back at the originating device
4. Answer terminating phone.
5. Verify media path.
6. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly

Customer	Verizon	Verizon	Class 3
----------	---------	---------	---------

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Soft Switch	Proxy	PSTN Gateway	Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----			
		<-----ANM-----	
<---200 OK-----	<-----200 OK-----		
	-----ACK----->		
=====Conversation=====			
----BYE----->	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC5: 311 Non-Emergency

NOTE: 311 not supported in all areas

Test Steps

1. Customer dials 311
2. Verify the number in the Request URI is in the following format:
 INVITE sip:311@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the 311 Operator.
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 5 Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		

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```

|<---18x-----|
|
|<-----ANM-----|
|<-----200 OK-----|
|<---200 OK-----|
|-----ACK----->|
|=====Conversation=====|
|---BYE----->|
|-----BYE----->|
|-----REL 16----->|
|<---200 OK-----|
|<-----RLC-----|
|

```

TC6: 911 Emergency

Note: Please inform the operator immediately this is a test call only! Also inform the operator of the next 911 call (TC7), during this call.

Test Steps

1. Customer dials a 911 number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:911@<Verizon proxy>; user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the 911 Emergency Operator
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----			

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```

|                                     |<-----ANM----->|
|                                     |<-----200 OK----->|
|<----200 OK----->|                                     |
|                                     |-----ACK----->|
|=====Conversation=====|
|-----BYE----->|                                     | |
|                                     |-----BYE----->|
|                                     |-----REL 16----->|
|                                     |<-----200 OK----->|
|<----200 OK----->|                                     |<-----RLC----->|
|                                     |                                     |

```

TC7: Hang Up During 911 Emergency Call

Note: Please inform the 911 operator prior to making this hang up call. Please inform the operator immediately this is a test call only!

Test Steps

1. Customer dials a 911 number.
2. Verify the call terminates to the 911 Emergency Operator.
3. Verify media path.
4. Disconnect the call from the originator simulating a forced disconnect.
5. Verify the Emergency Operator can return the call.
6. Verify media path.
7. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->			
<----100 TRYING---	-----INVITE ----->		
	<-----100 TRYING----->	-----IAM----->	
		<-----ACM----->	
<----18x----->	<-----18x----->		
-----CANCEL----->			
<----200 OK----->			
	-----CANCEL----->		
	<-----200 OK----->		
	<-----487----->		

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```

|                                     |-----ACK----->| |
|<---487-----|                                     |-----REL 16----->|
|-----ACK----->|                                     |-----RLC----->|
|                                     |                                     |

```

TC8: 711 Telephone Relay Services (Hearing Impaired Services)

NOTE: Optional Testcase

Test Steps

1. Customer dials 711
2. Verify the number in the Request URI is in the following format:
 INVITE sip:711@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the target destination
4. Verify media path
5. Terminate the call

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 5 Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----	<-----ACM-----	
		<-----18x-----	
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
<---200 OK-----	<-----200 OK-----	<-----RLC-----	

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TC9: 511 Information Line

NOTE: Optional Testcase

Test Steps

1. Customer dials 511.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:511@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the target destination.
4. Verify media path.
5. Terminate the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Verify that a two way speech path is established.
4. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 5 Switch
----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

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TC10: 1-8XX Toll Free

Note: 8XX can be 800, 866 or 877.

Test Steps

1. Customer dials an 8XX Toll Free number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:18XXXXXXXXX@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the target destination.
4. Verify media path.
5. Calling party terminates the call

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 5 Switch
-----INVITE----->	-----INVITE ----->		
<----100 TRYING----		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<----18x-----		<-----ANM-----	
	<-----200 OK-----		
<----200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
<----200 OK-----	<-----200 OK-----		
		<-----RLC-----	

TC11: 411 Directory Assistance

Test Steps

1. Customer dials a 411 Directory Assistance number .
2. Verify the number in the Request URI is in the following format.
 INVITE sip:411@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported

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3. Verify the call terminates to the DA Operator.
4. Verify media path
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

```

Customer          Verizon          Verizon          Class 5
Soft Switch       Proxy           PSTN Gateway     Switch
|                |               |                 |
|----INVITE----->|-----INVITE ----->|                 |
|<---100 TRYING---|                   |-----IAM----->|
|                |<-----100 TRYING-----|                 |
|                |<-----18x-----|<-----ACM-----|
|<---18x-----|                   |<-----ANM-----|
|                |<-----200 OK-----|                 |
|<---200 OK-----|                   |-----ACK----->|
|=====Conversation=====|
|----BYE----->|                   |                   |
|                |-----BYE----->|<-----REL 16----->|
|                |<-----200 OK-----|                   |
|<---200 OK-----|                   |<-----RLC-----|
|                |                   |                   |

```

TC12: 1411 Directory Assistance

Test Steps

1. Customer dials a 1411 Directory Assistance number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:1411@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the DA Operator.
4. Verify media path
5. Calling party terminates the call.

Expected Results

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1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	Class 3 Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---	<-----100 TRYING-----	-----IAM----->	
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC13: 555-1212 Directory Assistance

Test Steps

1. Customer dials a 555-1212 Directory Assistance number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:5551212@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the DA Operator.
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

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Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<----100 TRYING----		-----IAM----->	
	<-----100 TRYING-----	<-----ACM-----	
		<-----18x-----	
<----18x-----		<-----ANM-----	
	<-----200 OK-----		
<----200 OK-----		-----ACK----->	
=====Conversation=====			
----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<----200 OK-----		<-----RLC-----	

TC14: 0-Plus Operator Assisted (Local)

Test Steps

1. Customer dials a 0+NPA-NXX-XXXX (Local Number) Operator Assistance number.
2. Verify the number in the Request URI is in the following format.

INVITE sip:0NPANXXXXXX@<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify the call terminates to the Operator or ARU.
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		

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```

|<---100 TRYING---| |-----IAM----->| |
| |<-----100 TRYING-----| | |
| | |<-----ACM-----| |
| | |<-----18x-----| |
|<---18x-----| |<-----ANM-----|
| | |<-----200 OK-----| |
|<---200 OK-----| | |
| | |-----ACK----->| |
|=====Conversation=====|
|----BYE----->| | | | |
| | |-----BYE----->| |
| | | |-----REL 16----->| |
|<---200 OK-----| |<-----RLC-----|
| | | |

```

TC15: 0-Plus Operator Assisted (Toll)

Test Steps

1. Customer dials a 0+NPA-NXX-XXXX (Long Distance) Operator Assistance number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:0NPANXXXXXX@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the Operator or ARU.
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----			

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```

|----BYE----->|
|
|-----BYE----->|
|
|-----REL 16----->|
|<----200 OK-----|
|<-----RLC-----|

```

TC17: 00-Minus Operator Assistance

Test Steps

1. Customer dials a 00- Operator Assistance number.
2. Verify the number in the Request URI is in the following format:
 INVITE sip:00@<Verizon proxy>;user=phone; SIP/2.0
 NOTE: user and phone-context are optional but supported
3. Verify the call terminates to the Operator or ARU
4. Verify media path
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
----INVITE----->	-----INVITE ----->		
<---100 TRYING---	<-----100 TRYING-----	-----IAM----->	
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
<---200 OK-----	<-----200 OK-----		
	-----ACK----->		
=====Conversation=====			
----BYE----->	-----BYE----->		
		-----REL 16----->	
<---200 OK-----	<-----200 OK-----	<-----RLC-----	

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TC18: 01-Plus International Operator Assistance

Test Steps

1. Customer dials a 01+CC-XXXXXXX Operator Assistance number.
2. Verify the number in the Request URI is in the following format:

INVITE sip:01CCXXXXXXXX@<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify the call terminates to the Operator or ARU.
4. Verify media path
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
----INVITE----->	-----INVITE ----->		
<----100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
	<-----18x-----	<-----ACM-----	
<----18x-----		<-----ANM-----	
	<-----200 OK-----		
<----200 OK-----			
	-----ACK----->		
=====Conversation=====			
----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<----200 OK-----		<-----RLC-----	

TC19: 900 Premium Call

Test Steps

1. Customer dials a 1+900-NXX-XXXX premium number.
2. Verify the number in the Request URI is in the following format.

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INVITE sip:1900NXXXXXX@<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify the call does not complete and is blocked.
4. Calling party terminates the call.

Expected Results

1. Call is blocked.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---			
	<-----100 TRYING-----		
	<-----4XX-----		
<---4XX-----			
-----ACK----->			
	-----ACK----->		

TC20: 976 Premium Call

Test Steps

1. Customer dials a 1+976-NXX-XXXX premium number.
2. Verify the number in the Request URI is in the following format:

INVITE sip:1976NXXXXXX@<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify the call is blocked.
4. Calling party terminates the call.

Expected Results

1. Call is blocked.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---			
	<-----100 TRYING-----		
	<-----4XX-----		
<---4XX-----			
-----ACK----->			
	-----ACK----->		

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TC21: 1010xxx Casual Toll call

Test Steps

1. Customer dials a 1010xxx-NPA-NXX-XXXX toll number (for example 1010222 for Verizon).
2. Verify the number in the Request URI is in the following format:

INVITE sip: 1010XXNPNANXXXXXXXX @<Verizon proxy>;user=phone; SIP/2.0

NOTE: user and phone-context are optional but supported

3. Verify the call terminates to the target destination.
4. Verify media path.
5. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
	<-----18x-----	<-----ACM-----	
<---18x-----			
	<-----200 OK-----	<-----ANM-----	
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC22: Fast Answer

NOTE: This call scenario may require a special termination.

Test Steps

1. Customer dials a LD or Local number destined to the PSTN.
2. Verify the call terminates to the target destination with immediate answer.
3. Verify the originator does not receive a 180 Ringing or 183 Session Progress prior to receiving the 200OK.
4. Verify media path

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5. Calling party terminates the call

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

```

Customer          Verizon          Verizon          PSTN
Soft Switch       Proxy           PSTN Gateway     Switch
|                |               |                 |
|----INVITE----->|-----INVITE ----->|                 |
|<---100 TRYING---|                 |-----IAM----->|
|                |<-----100 TRYING-----|                 |
|                |<-----200 OK-----|                 |
|<---200 OK-----|                 |                 |
|                |-----ACK----->|                 |
|=====Conversation=====|
|----BYE----->|                 |                 |
|                |-----BYE----->|                 |
|                |                 |-----REL 16----->|
|                |<-----200 OK-----|                 |
|<---200 OK-----|                 |<-----RLC-----|
    
```

TC23: Call Origination with 180 ringing (No SDP)- Alternate Gateway Test

NOTE: Please contact the Verizon Interop lab for assistance with this test.

Test Steps

1. Contact the Interop lab for a terminating test number.
2. Verify originator receives near-end ring back.
3. Verify media path
- [3.4](#). Verify Call is answered. When prompted, leave message and then retrieve message to verify voice path.
5. Calling party disconnects the call.

Expected Results

1. Verify that the calling party hears audible ring back.
- [3.2](#). Verify the 180 Ringing is received without SDP.
3. Verify that a two way speech path is established.
4. Call terminates properly.

```

Customer          Verizon          Verizon          PSTN
Soft Switch       Proxy           PSTN Gateway     Switch
|                |               |                 |
|----INVITE----->|-----INVITE ----->|                 |
    
```

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```

|<---100 TRYING---| |-----IAM----->| |
| |<-----100 TRYING-----| | |
| | |<-----ACM-----| |
| | |<-----180-----| |
|<---180-----| | |
| | |<-----ANM-----| |
| | |<-----200 OK-----| |
|<---200 OK-----| | |
| | |-----ACK----->| |
|=====Conversation=====|
|----BYE----->| | | | |
| | |-----BYE----->| |
| | | |-----REL 16----->| |
| | |<-----200 OK-----| |
|<---200 OK-----| |<-----RLC-----|
    
```

TC24: Call Origination with 183 Session Progress Call waiting

NOTE: This call scenario may require a special termination.

Test Steps

1. Customer dials a LD or Local number destined to the PSTN.
2. Verify the call terminates to the target destination.
3. Verify the originator receives a 183 Session Progress.
4. Verify the originator receives far-end ringback.
5. Verify media path.
6. Terminate the call.

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
----BYE----->			
	-----BYE----->		

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```

|                                     |-----REL 16----->| |
|                                     |<-----200 OK-----|
|<---200 OK-----|                                     |<-----RLC-----|

```

TC25: 1-Plus10-Digit Long Distance, CPN=restricted

Test Steps

1. Customer dials a LD number destined to the PSTN.
2. Verify the call terminates to the target destination.
3. Verify the SIP header PRIVACY set to "id"
4. Verify the Calling Party Number Address Presentation=Presentation Restricted without calling party number at the Media Gateway
5. Verify media path.
6. Calling party terminates the call.

Expected Results

1. Call routes through the determined path.
2. Calling Party Number presentation is accurate.
3. Voice path is available in both directions
4. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---	<-----100 TRYING-----	-----IAM----->	
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC26: CPN Not Provisioned in the Verizon Proxy

Test Steps

1. Customer sets up a calling party device with Calling Party Number not assigned to their account.
2. Customer dials a Local or LD number destined to the PSTN .
3. Verify the call is rejected and receives a "403 Forbidden" from the Verizon Proxy in response to the INVITE.

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Expected Results

1. Call is rejected by the Verizon Proxy.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->			
<---100 TRYING---			
<---403-----			
-----ACK----->			

TC27: Call with no Calling Party Number

NOTE: Optional Testcase

Test Steps

1. Customer sets up a calling party device without sending Calling Party Number.
2. Customer dials a Local or LD number destined to the PSTN.
3. Verify the call is rejected and receives a “403 Forbidden” from the Verizon Proxy in response to the INVITE.

Expected Results

1. Verify the call is properly rejected by the Verizon Proxy.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->			
<---100 TRYING---			
<---403-----			
-----ACK----->			

TC28: Call Forward from Wholesale

Test Steps

1. Customer sets up user account to Call Forward to a PSTN number.
2. Customer dials the call forwarded phone.
3. Verify the Call is re-directed to a PSTN number.
4. Verify the INVITE received at Verizon contains the Diversion Header with correct originating ANI information.
5. Verify the call terminates to the target destination
6. Verify media path
7. Terminate the call

Expected Results

1. Call is routed to the PSTN without issues.
2. The Diversion Header information is processed correctly

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-------------------------	------------------	-------------------------	----------------

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```

|-----INVITE----->|-----INVITE ----->|
|<---100 TRYING---|-----IAM----->|
|-----100 TRYING-----|-----ACM-----|
|-----18x-----|-----ANM-----|
|<---18x-----|-----200 OK-----|
|<---200 OK-----|-----ACK----->|
|-----Conversation-----|
|-----BYE----->|-----BYE----->|
|-----REL 16----->|
|<---200 OK-----|-----RLC-----|

```

TC29: Media Inactivity

Test Steps

1. Customer dials a LD or Local number destined to the PSTN
2. Verify the call terminates to the target destination
3. Terminating devices answers the call
4. The originating user places the call on HOLD
5. Verify that no Music on Hold is activated and the media stream has stopped between the two SIP endpoints
6. Verify no media path is present
7. Keep the call in this state for an extended period of time. This test can be run with multiple media inactivity duration times
8. Retrieve the call to re-activate the media path
9. Verify voice path in both directions
10. Calling party terminates the call.

Expected Results

1. Call routes through the determined path
2. Voice path is available in both directions
3. Call terminates properly

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		

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```

|                                     |<-----ACM-----|
|                                     |<-----18x-----|
|<---18x-----|                                     |
|                                     |<-----ANM-----|
|                                     |<-----200 OK-----|
|<---200 OK-----|                                     |
|                                     |-----ACK----->|
|=====Conversation=====|
|                                     |
|=====hold no rtp=====|
|                                     |
|=====Conversation=====|
|-----BYE----->|                                     | |
|                                     |-----BYE----->|
|                                     |-----REL 16----->|
|                                     |<-----200 OK-----|
|<---200 OK-----|                                     |<-----RLC-----|

```

TC30: DTMF (RFC2833)

Note: This call can also be set up to terminate to a test device which measures each DTMF signal.

Test Steps

1. Customer dials a Local or LD number destined to the PSTN which terminates to a response unit requiring DTMF interaction.
2. Verify the call is answered and the DTMF menu is received
3. Enter the DTMF digits to execute menu instruction
4. Verify the menus can be accessed
5. Disconnect the call

Expected Results

1. The DTMF signals are sent using the RFC2833 standards

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
	<-----18x-----	<-----ACM-----	
<---18x-----			
	<-----200 OK-----	<-----ANM-----	
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		

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|<---200 OK-----|

|<-----RLC-----|

TC31: Hang Up During Ring Phase (Cancel Call)

Test Steps

1. Customer dials a LD or Local number destined to the PSTN
2. Verify terminating device receives the call. DO NOT Answer
3. Verify ring back is present
4. Customer hangs up phone during ring stage
5. Verify the terminating phone is disconnected
6. Verify the originating phone is disconnected

Expected Results

1. Call routes through the determined path.
2. Call terminates properly

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
----INVITE----->			
<---100 TRYING---	-----INVITE ----->		
	<-----100 TRYING-----	-----IAM----->	
		<-----ACM-----	
	<-----18x-----		
<---18x-----			
----CANCEL----->			
<---200 OK-----	-----CANCEL----->		
	<-----200 OK-----		
	<-----487-----		
	-----ACK----->		
<---487-----		-----REL 16----->	
----ACK----->		-----RLC----->	

TC32: Local Call, CPN=restricted

Test Steps

1. Customer dials a local number destined to the PSTN.
2. Verify the call terminates to the target destination.
3. Verify the SIP header PRIVACY set to "id"

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4. Verify the Calling Party Number Address Presentation=Presentation Restricted without calling party number at the Media Gateway
5. Verify voice path in both directions
6. Calling party terminates the call

Expected Results

1. Call routes through the determined path.
2. Calling information is set to restricted.
3. Voice path is available in both directions.
4. Call terminates properly.

```

Customer          Verizon          Verizon          PSTN
Soft Switch       Proxy           PSTN Gateway     Switch
|                |                |                |
|----INVITE----->|-----INVITE ----->|                |
|<---100 TRYING---|                |-----IAM----->|
|                |<-----100 TRYING-----|                |
|                |<-----18x-----|                |
|<---18x-----|                |<-----ANM-----|
|                |<-----200 OK-----|                |
|<---200 OK-----|                |-----ACK----->|
|                |                |=====Conversation=====|
|----BYE----->|                |                |
|                |-----BYE----->|                |
|                |<-----200 OK-----|                |
|<---200 OK-----|                |<-----REL 16----->|
|                |<-----RLC-----|                |

```

TC33: Basic Call with Originator Release

Test Steps

1. Customer dials a Local or Long Distance number.
2. Verify ringing at the destination phone and ring back at the originating device.
3. Answer terminating phone.
4. Verify media path.
5. Disconnect the call from the originating device.
6. Verify the call terminates properly

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Expected Results

1. Call routes through the determined path
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		
<---100 TRYING---		-----IAM----->	
	<-----100 TRYING-----		
		<-----ACM-----	
	<-----18x-----		
<---18x-----		<-----ANM-----	
	<-----200 OK-----		
<---200 OK-----			
	-----ACK----->		
=====Conversation=====			
-----BYE----->			
	-----BYE----->		
		-----REL 16----->	
	<-----200 OK-----		
<---200 OK-----		<-----RLC-----	

TC34: Basic Call with Terminator Release

Test Steps

1. Customer dials a Local or Long Distance number.
2. Verify ringing at the destination phone and ring back at the originating device.
3. Answer terminating phone
4. Verify media path
5. Disconnect the call from the terminating device
6. Verify the call terminates properly

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions.
3. Call terminates properly.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
-----INVITE----->	-----INVITE ----->		

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```

|<---100 TRYING---| |-----IAM----->| |
| |<-----100 TRYING-----| | |
| | |<-----ACM-----| |
| |<-----18x-----| |
|<---18x-----| | |
| | |<-----ANM-----| |
| |<-----200 OK-----| |
|<---200 OK-----| | |
| |-----ACK----->| |
|=====Conversation=====|
| | |<-----REL 16-----| |
| | |-----RLC----->| |
|<---BYE-----| | |
|-----200 OK----->| |
| |-----200 OK----->| |
    
```

TC35: T-30 FAX Transmittal

Test Steps

1. Customer dials a Local or LD number destined to the PSTN which terminates to a FAX machine
2. Verify the CODEC negotiated is G.711.
3. Verify the FAX transmittal is successful
4. Disconnect the call.

Expected Results

1. FAX transmittal is successful.

TC36: G711 CODEC Negotiation

Test Steps

1. Customer dials a Local or LD number destined to the PSTN.
2. Once the call is answered, verify the customer’s preferred G711 CODEC is negotiated in the SDP.
3. Verify voice path in both directions
4. Calling party terminates the call.

Expected Results

1. Verify the call terminates to the target destination
2. Verify the correct G711 CODEC is negotiated

Customer	Verizon	Verizon	PSTN
Soft Switch	Proxy	PSTN Gateway	Switch

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```

|----INVITE----->|-----INVITE ----->|
|<---100 TRYING---|-----IAM----->|
|                  |<-----100 TRYING-----|
|                  |<-----ACM----->|
|                  |<-----18x----->|
|<---18x----->|
|                  |<-----ANM----->|
|                  |<-----200 OK----->|
|<---200 OK-----|
|                  |-----ACK----->|
|=====Conversation=====|
|----BYE----->|-----BYE----->|
|                  |-----REL 16----->|
|                  |<-----200 OK----->|
|<---200 OK-----|<-----RLC----->|

```

TC37: G729 CODEC Negotiation

Test Steps

1. Customer dials a Local or LD number destined to the PSTN.
2. Once the call is answered, verify the customer’s preferred G711 CODEC is negotiated in the SDP
3. Verify voice path in both directions
4. Calling party terminates the call

Expected Results

1. Verify the call terminates to the target destination
2. G729 CODEC negotiation is successful.

Customer Soft Switch	Verizon Proxy	Verizon PSTN Gateway	PSTN Switch
----INVITE----->	-----INVITE ----->		
<---100 TRYING---	-----IAM----->		
	<-----100 TRYING-----	<-----ACM----->	
	<-----18x----->		
<---18x----->		<-----ANM----->	
	<-----200 OK----->		
<---200 OK-----	-----ACK----->		
=====Conversation=====			
----BYE----->	-----BYE----->		
		-----REL 16----->	
	<-----200 OK----->		

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|<---200 OK-----|

|<-----RLC-----|

4.2. Calls from Verizon VOIP to Wholesale Customer Test Cases

TC38: 10-Digit Local

NOTE: This dial plan may not be supported in all local calling areas

Test Steps

1. Originate a 10-Digit local number from the PSTN Local line
2. Verify the call terminates to the customer's target user
3. Answer terminating phone
4. Verify media path
5. Terminate the call

Expected Results

1. Call routes through the determined path
2. Voice path is available in both directions
3. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
	-----IAM----->		
	-----INVITE----->		
	<-----100 TRYING-----	-----INVITE----->	
		<-----100 TRYING-----	
		<-----18x-----	
	<-----ACM-----		
	<-----200 OK-----		
	<-----200 OK-----	<-----200 OK-----	
	<-----ANM-----		
	-----ACK----->		
		-----ACK----->	
	=====Conversation=====		
	-----REL----->		
	-----BYE----->		
	<-----RLC-----		
		-----BYE----->	

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```

|                                     |<-----200 OK-----|
|                                     |<-----200 OK-----|
|                                     |

```

TC39: 10-Digit Long Distance

Test Steps

1. Originate a 10-Digit Long Distance number from the PSTN.
2. Verify the call terminates to the customer's target user
3. Answer terminating phone
4. Verify media path
5. Terminate the call

Expected Results

1. Call routes through the determined path.
2. Voice path is available in both directions
3. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
	-----IAM----->		
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING-----		
		<-----100 TRYING-----	
		<-----18x-----	
	<-----18x-----		
	<-----ACM-----		
	<-----200 OK-----		
		<-----200 OK-----	
	<-----200 OK-----		
	<-----ANM-----		
	-----ACK----->		
		-----ACK----->	
=====Conversation=====			
	-----REL----->		
	-----BYE----->		
	<-----RLC-----		
		-----BYE----->	
		<-----200 OK-----	
	<-----200 OK-----		

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TC40: 10-Digit Long Distance – Alternate Gateway Test

NOTE: Please contact the Verizon Interop lab for assistance with this test.

Test Steps

1. Contact the Interop lab to originate the call.
2. Verify the call terminates to the customer’s target user
3. Answer terminating phone
4. Verify media path
5. Terminate the call

Expected Results

1. Call routes through the alternate gateway path.
2. Voice path is available in both directions
3. Call terminates properly

```

Switch          Verizon          Verizon          Customer
                PSTN Gateway   Softswitch       Softswitch
|-----IAM----->|          |          |          |
|                   |-----INVITE----->|          |
|                   |<-----100 TRYING-----|          |
|                   |                   |<----100 TRYING-----|
|                   |                   |<-----18x-----|
|                   |<-----18x-----|          |
|<----ACM-----|          |          |
|                   |<-----200 OK-----|          |
|                   |                   |<-----200 OK-----|
|                   |<-----200 OK-----|          |
|<----ANM-----|          |          |
|                   |-----ACK----->|          |
|                   |                   |-----ACK----->|
|=====Conversation=====|
|-----REL----->|          |          |
|                   |-----BYE----->|          |
    
```

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```

|<-----RLC-----|           |-----BYE----->|
|                   |           |                   |
|                   |           |<-----200 OK-----|
|                   |<-----200 OK-----|           |
|                   |           |                   |

```

TC41: 10-Digit Long Distance with CPN presentation=restricted originating Class 5

Test Steps

1. Activate Complete Blocking on the originating PSTN phone line (*67).
2. Originate the call from the PSTN line
3. Verify the call terminates to the customer's target user
4. Verify Privacy : ID" and P-Asserted header is received by Wholesale Customer
5. Verify that no calling information is received by end user
6. Verify media path
7. Terminate the call

Expected Results

1. Call routes through the determined path
2. Calling information is not presented to the terminating phone
3. Voice path is available in both directions
4. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
	<-----100 TRYING-----	-----INVITE----->	
		<-----100 TRYING-----	
		<-----18x-----	
<-----ACM-----	<-----18x-----		
	<-----200 OK-----		
	<-----200 OK-----	<-----200 OK-----	
<-----ANM-----	-----ACK----->		
		-----ACK----->	
=====Conversation=====			
-----REL----->			
	-----BYE----->		
<-----RLC-----		-----BYE----->	

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```

|                                     |<-----200 OK-----|
|                                     |<-----200 OK-----|
|                                     |

```

TC42: 10-Digit LD call with CPN presentation=allowed into Class 5

Test Steps

1. Originate call from a PSTN account that allows calling party number delivery to the distant end.
2. Verify the call terminates to the customer's target user.
3. Verify the originator's calling information is displayed on the terminating phone.
4. Verify media path
5. Terminate the call

Expected Results

1. Call routes through the determined path
2. Calling information is presented to the terminating phone
3. Voice path is available in both directions
4. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING----		
		<----100 TRYING-----	
		<-----18x-----	
	<-----18x-----		
<----ACM-----			
	<-----200 OK-----		
		<-----200 OK-----	
	<-----200 OK-----		
<----ANM-----			
	-----ACK----->		
		-----ACK----->	
=====Conversation=====			
-----REL----->			
	-----BYE----->		
<----RLC-----		-----BYE----->	
		<-----200 OK-----	
	<-----200 OK-----		

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TC44: Basic Call with Terminator Release

Test Steps

1. Place a call from the PSTN terminating to the Customer's phone
2. Verify ringing at the destination phone and ring back at the originating device
3. Answer terminating phone
4. Verify media path
5. Disconnect the call from the terminating device
6. Verify the call terminates properly

Expected Results

1. Call routes through the determined path
2. Voice path is available in both directions
3. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
----IAM----->			
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING-----	<-----100 TRYING-----	
		<-----18x-----	
<-----ACM-----	<-----18x-----		
	<-----200 OK-----		
		<-----200 OK-----	
<-----ANM-----	<-----200 OK-----		
	-----ACK----->		
		-----ACK----->	
=====Conversation=====			
		<-----BYE-----	
<-----REL-----	<-----BYE-----		
	-----200 OK----->		
<-----RLC-----		-----200OK----->	

TC45: Hang Up During Ring Phase (Cancel Call)

Test Steps

1. Place a call from the PSTN terminating to the Customer's phone.

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2. Verify terminating device receives the call. DO NOT Answer
3. Verify ring back is present
4. Customer hangs up phone during ring stage
5. Verify the terminating phone is disconnected
6. Verify the originating phone is disconnected

Expected Results

1. Call routes through the determined path
2. Call terminates properly

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
	<-----100 TRYING-----	-----INVITE----->	
		<-----100 TRYING-----	
		<-----18x-----	
	<-----18x-----		
<-----ACM-----			
-----REL----->			
<-----RLC-----	-----CANCEL----->		
	<-----200 OK-----		
		-----CANCEL----->	
		<-----200 OK-----	
	<-----487-----		
	-----ACK----->		
<-----487-----			
-----ACK----->			

TC46: T-30 FAX Transmittal

Test Steps

1. Initiate a Local or LD number destined to the customer which terminates to a FAX machine.
2. Verify the CODEC negotiated is G.711
3. Verify the FAX transmittal is successful
4. Disconnect the call.

Expected Results

1. FAX transmittal is successful

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING-----		

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```

|                                     |<-----100 TRYING-----| | | |
|                                     |<-----18x-----|
|<-----ACM-----|                                     |<-----18x-----|
|                                     |<-----200 OK-----|                                     |<-----200 OK-----|
|                                     |<-----200 OK-----|                                     |<-----200 OK-----|
|<-----ANM-----|                                     |-----ACK----->|                                     |-----ACK----->|
|=====Conversation=====|
|-----REL----->|                                     |-----BYE----->|                                     |-----BYE----->|
|<-----RLC-----|                                     |-----BYE----->|                                     |-----BYE----->|
|                                     |<-----200 OK-----|                                     |<-----200 OK-----|
|                                     |<-----200 OK-----|

```

TC47: G.711 CODEC Negotiation

Test Steps

1. Originate an LD or local call from the PSTN which terminates to the customer's phone.
2. Once the call is answered, verify the customer's preferred G.711 CODEC is negotiated in the SDP regardless of what is preferred by Verizon's PSTN gateway.
3. Verify voice path in both directions.
4. Disconnect the call.

Expected Results

1. G.711 CODEC negotiation is successful.

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING-----	<-----100 TRYING-----	
		<-----18x-----	
	<-----18x-----		
<-----ACM-----			
	<-----200 OK-----		
		<-----200 OK-----	
	<-----200 OK-----		
<-----ANM-----			
	-----ACK----->		
		-----ACK----->	

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```

|=====Conversation=====|
|-----REL----->|          |          | |
|          |-----BYE----->|          |
|<-----RLC-----|          |-----BYE----->|
|          |          |          |<-----200 OK-----|
|          |<-----200 OK-----|          |
|          |          |          |

```

TC48: User Busy

Test Steps

1. Place the target destination phone in a Busy State.
2. Originate an LD or local call from the PSTN which terminates to the target phone.
3. Verify that the 486 Busy Here is received indicating a busy destination.
4. Verify Busy Tone is received

Expected Results

1. 486 Busy Here SIP message is generated

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
-----IAM----->			
	-----INVITE----->		
		-----INVITE----->	
	<-----100 TRYING-----		
		<-----100 TRYING-----	
		<-----486 Busy-----	
	<-----486 Busy-----	-----ACK----->	
	-----ACK----->		
<-----REL-----			
-----RLC----->			

TC49: Anonymous, Unknown, Unavailable in From header

Test Steps

1. Request the Verizon Interop Lab send a call from the PSTN with Anonymous, Unknown, and Unavailable in the From header of the INVITE
2. Verify call from the PSTN terminates to the target phone .

Expected Results

1. Verify call completes and calling party information is not delivered
2. Customer can receive and complete call with either Anonymous, unknown, or unavailable in the From header.

Switch	Verizon	Verizon	Customer
--------	---------	---------	----------

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```

|                               PSTN Gateway           Softswitch           Softswitch
|-----IAM----->|                               |                               |
|                               |-----INVITE----->|                               |
|                               |<-----100 TRYING-----|                               |
|                               |                               |<-----100 TRYING-----|
|                               |                               |<-----18x-----|
|                               |<-----18x-----|                               |
|<-----ACM-----|                               |                               |
|                               |<-----200 OK-----|                               |
|                               |<-----200 OK-----|                               |
|<-----ANM-----|                               |                               |
|                               |-----ACK----->|                               |
|                               |-----ACK----->|                               |
|=====Conversation=====|
|-----REL----->|                               |                               |
|                               |-----BYE----->|                               |
|<-----RLC-----|                               |-----BYE----->|
|                               |                               |<-----200 OK-----|
|                               |<-----200 OK-----|                               |

```

4.3. PSTN to SIP Release Cause Testing

TC50: RNA Timer expiry

Test Steps

1. Originate the call from the PSTN destined to the target customer phone
2. Do not answer the call. Let it ring until the ring no answer timer expires
3. Verify customer softswitch responds to 408 Request Timeout from Verizon proxy

Expected Results

1. 408 Request Timeout is generated

```

Switch           Verizon           Verizon           Customer
|               PSTN Gateway       Softswitch         Softswitch
|-----IAM----->|               |               |               |
|               |-----INVITE----->|               |               |
|               |<-----100 TRYING-----|               |               |
|               |               |<-----100 TRYING-----|
|               |               |<-----18x-----|
|               |<-----18x-----|               |               |
|<-----ACM-----|               |               |               |
|               |<-----CANCEL-----|               |               |

```

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```

| | | | | |
| |-----200 OK----->| | |
|<-----REL-----| | |
|-----RLC----->| | |
| | | | |
| |-----487----->| | |
| |<-----ACK-----| | |
| | | | |
| | |-----408----->| | |
| | |<-----ACK-----| | |

```

TC51: Wholesale customer is off-hook

Test Steps

1. Place the target destination phone in a Busy State
2. Originate a call from the PSTN which terminates to the target phone
3. Verify that the 486 Busy Here is received indicating a busy destination

Expected Results

1. 486 Busy Here SIP message is generated

Switch	Verizon PSTN Gateway	Verizon Softswitch	Customer Softswitch
	-----IAM----->		
		-----INVITE----->	
	<-----100 TRYING-----	-----INVITE----->	
		<-----100 TRYING-----	
		<-----486 Busy-----	
		-----ACK----->	
	<-----486 Busy-----		
	-----ACK----->		
<-----REL-----			
-----RLC----->			

TC52: Customer Phone not connected/not online

Test Steps

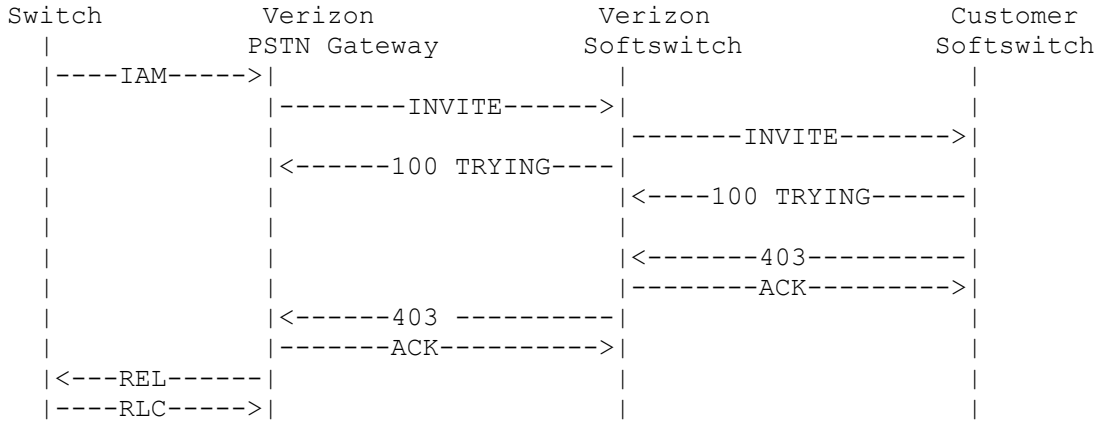
1. Put the destination customer phone in an unavailable or un-registered state
2. Originate an LD or local call from the PSTN which terminates to the target phone
3. Verify that a 40X response is sent by the customer device

Expected Results

1. 40X Error message is generated

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4.4. Post Dial Delay Test Cases

TC53: PDD: Customer to Media Gateway PSTN Termination

Test Steps

1. Customer originates a Long Distance call
2. Measure the time from the last digit dialed to the time ring back is received

Expected Results

1. Acceptable PDD value is less than 3 seconds. Note that calls to Cell Phones may be significantly higher and are subject to more variation

TC54: PDD: Customer to Class 5 PSTN Termination

Test Steps

1. Customer originates a local call
2. Measure the time from the last digit dialed to the time ring back is received

Expected Results

1. Acceptable PDD value

TC55: PDD: PSTN to Customer

Test Steps

1. Originate a call from the PSTN terminating to the customer
2. Measure the time from the last digit dialed to the time ring back is received

Expected Results

1. Acceptable PDD value.

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4.5. SRV lookup Test Cases

TC56: SRV lookup from Verizon

Note: Optional Test case

Test Steps

1. Configure Verizon Proxy so that Wholesale softswitch address is resolved via DNS lookup.
2. Originate a PSTN to VOIP call.
3. Answer the call. Calling party releases the call.

Expected Results

1. Verify that the call completes to the customer softswitch.
2. Verify that all calls from Verizon Proxy are using digit-string@dns domain name in INVITE request URI to Wholesale customer.

TC57: SRV lookup from Wholesale customer

Note: Optional Test case

Test Steps

1. Configure customer's wholesale softswitch to use DNS SRV records for outbound calls to the Verizon Proxy.
2. Place VOIP to PSTN test call.
3. Configure the Calling Party Number and Charge Number to be unique.
4. Answer the call. Calling party releases the call.

Expected Results

1. Verify that the call completes to the PSTN.
2. Verify that all calls from customer softswitch are using digit-string@dns domain name in INVITE request URI to the Verizon Proxy.

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5. Acronyms

ACK	Acknowledgment
ACM	Address Complete Message
ANM	Answer Message
ANSI	American National Standards Institute
CAS	Channel Associated Signaling
CIC	Carrier Identification Code
CPG	Call Progress Message
DTMF	Dial Tone Multi Frequency
Switch	End Office
FQDN	Fully Qualified Domain Name.
G.711	ITU standard for encoding telephone audio signals on a 64 Kbps channel - PCM scheme using an 8 bit sample at an 8 KHZ sample rate
GW	Gateway
IAM	Initial Address Message
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
ITU-T	International Telecommunication Union
LAN	Local Area Network
LNP	Local Number Portability
MG	Media Gateway
MGC	Media Gateway Controller
MTP	Message Transfer Part
PBX	Private Branch Exchange
POTS	Plain Old telephone service
PRI	Primary Rate Interface
PSTN	Public Service Telephone Network
REL	Release Message
RES	Resume Message
RFC	Request for Comments
RLC	Release Complete Message
RTP	Real Time Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol

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SS7	Signaling System No. 7
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
UAC	User Agent Client
UAS	User Agent Server
UDP	User Datagram Protocol
VoIP	Voice over Internet Protocol
WAN	Wide Area Network

6. References

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- [5] Peterson, J. "RFC 3323 - A Privacy Mechanism for the Session Initiation Protocol (SIP)". November 2002.
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Appendix A: Customer Connectivity Questionnaire

Customer Name: _____

Contact: _____

Phone Number(s): _____

Email: _____

DNS(es) (if required) for Soft-Switch/SBC:

- _____
- _____
- _____

IPSEC Requirements

- **SIP Endpoints**
 - * **Softswitch (s) IP address(es):**
 - _____
 - _____
 - _____
 - * **Session Border Controller (if any) IP addresses:**
 - _____
 - _____
 - _____
- **Media Endpoints:**
 - * **RTP endpoint IP address(es) or range:**
 - _____
 - _____
 - _____

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- **Router(s) / Firewall(s):**
 - * **Type of Firewall/Router (Cisco/Netscreen):**
 - _____
 - _____
 - _____
 - * **Access Control List(s):**
 - _____
 - _____
 - _____
 - * **IPSEC Peer IP addresses:**
 - _____
 - _____
 - _____

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Appendix B: Verizon Interoperability Lab Connectivity Information Sheet:

Interop Lab Contact: _____

Hot Line: _____

Email: _____

DNS (if required by customer) for Verizon Interop SIP proxy or Session Border Controller:

- Verizon NS DNS : _____
- Verizon SBC DNS: _____

IPSEC Requirements

- Router(s) / Firewall(s):
 - * IPSEC Peer Addresses:
 - Verizon Netscreen Peer: _____
 - Customer Firewall/Router Peer: _____
 - Customer Firewall/Router Peer: _____
 - * IP ISAKMP Crypto Key:
 - PHASE 1 information: _____
 - PHASE 2 information: _____
 - Verizon PRESHARED key: _____
- SIP Endpoints
 - * Proxy IP address(es):
 - Verizon NS: _____
 - Verizon NS: _____
 - Customer SIP Proxy or Softswitch: _____
 - Customer SIP Proxy or Softswitch: _____
 - Customer SIP Proxy or Softswitch: _____
 - * Session Border Controller (if any) IP addresses:

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- Verizon SBC: _____
- Customer SBC: _____
- Customer SBC: _____
- **Media Endpoints:**
 - * RTP endpoint address(es) or range:
 - _____
 - _____
 - _____

DID numbers assigned for customer use during Interop testing only:

- _____
- _____
- _____
- _____
- _____

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