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SIP Access Device

Interoperability Test Plan

Release 22.0

Document Version 1.8

BroadWorks® Guide

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Document Revision History

Version	Reason for Change	Date
1.1	Introduced document for Release 22.0.	August 2016
1.2	Edited changes and published document.	August 2016
1.3	Additional modifications for Release 22.0.	October 2016
1.4	Edited changes and published document.	October 2016
1.5	Removed mention of Call Manager as it is end-of-life. Replaced with BroadSoft UC-One Desktop client. Added clarification to the Connected Line Identification test cases.	December 2016
1.6	Edited changes and published document.	January 2017
1.7	Updated IOP1 and IOP2 server IPv6 addresses.	June 2017
1.8	Edited changes and published document.	June 2017

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1   Introduction

The purpose of this document is to validate the SIP interoperability between BroadWorks and SIP access devices without a user interface, such as access gateways, IADs, SIP MTAs, ATAs, and so on, which typically employ an FXS connection to an analog phone. This test plan is not applicable to SIP phones or soft clients. SIP phones and soft clients must use the *BroadSoft SIP Phone Interoperability Test Plan* [4].

Test sections in this document provide broad coverage of the SIP interface with BroadWorks to identify interoperability issues. However, it is not possible to cover every possible interface scenario. It is expected that the device under test is fully conformant to applicable RFCs and that the device has undergone thorough testing outside the scope of interoperability testing with BroadWorks to ensure quality and reliability with respect to the SIP interface.

BroadSoft provides the ability for partners to use this test plan to self-test and validate their devices in the BroadWorks environment. This process is called *Vendor Validation*. For process requirements, see the *BroadSoft Partner Device Validation Process* [6].

2 Changes from Previous Test Plan Versions

This section documents significant changes from previous test plan versions. Only revisions with major updates are documented here. Minor updates for corrections and editing are not documented.

2.1 Changes from Release 21.0, Version 1.6

This section identifies the significant changes in the test plan from the Release 21.0, Version 1.6.

2.1.1 General Document Updates

The test plan has been updated for BroadWorks Release 22.0.

The CommPilot Call Manager client is end-of-life. It has been replaced throughout the test plan with the BroadSoft UC-One Desktop client in call control mode.

2.1.2 Test Case Updates

The following subsections identify updates made to test cases.

2.1.2.1   New Tests

The following tests are new:

- BroadWorks Services – Meet-Me Conferencing: Meet-Me Conference – Opus
- BroadWorks Services – Collaborate – Audio: Collaborate – Audio – Opus
- DUT Services – *P-Access-Network-Info* Header

2.1.2.2   Modified Tests

There are no modified tests.

2.1.2.3   Removed Tests

There are no removed tests.

2.2 Changes from Release 20.0, Version 1.6

This section identifies the significant changes in the test plan from the Release 20.0, Version 1.6.

2.2.1 General Document Updates

This section identifies general document updates.

2.2.2 Test Case Updates

The following subsections identify updates made to test cases.

2.2.2.1   New Tests

The following tests are new:

- BroadWorks Services – Collaborate – Audio
- SBC/ALG – Failover/Failback

2.2.2.2   Modified Tests

The following tests are modified:

- BroadWorks Services – Advice of Charge: Updates to setup instructions.

- BroadWorks Services – *Diversion* and *History-Info*: New *Support Cause Parameter* for *History-Info* identified and signaling verification updated.

- BroadWorks Services – Meet-Me Conference: Added steps to mute and unmute.

- DUT Services – Network-based Conference: Added description for alternate REFER methods.

2.2.2.3   Removed Tests

There are no removed tests.

2.3   Changes from Release 20.0, Version 1.4

This section identifies the significant changes in the test plan from the Release 20.0, Version 1.4.

2.3.1   General Document Updates

This section identifies general document updates.

2.3.2   Test Case Updates

The following subsections identify updates made to test cases.

2.3.2.1   New Tests

The following test is new:

- DUT Services – T38 Fax

2.3.2.2   Modified Tests

There are no modified tests.

2.3.2.3   Removed Tests

There are no removed tests.

2.4   Changes from Release 19.sp1, Version 1.4

This section identifies the significant changes in the test plan from the Release 19.sp1, Version 1.4.

2.4.1   General Document Updates

This section identifies general document updates.

- This test plan was updated to apply only to devices without a user interface. SIP phones and soft clients are now covered by an alternate test plan: *BroadWorks SIP Phone Interoperability Test Plan* [4].

- Custom ringback configuration instructions were updated as required for the announcement repository feature introduced in Release 20.0.

2.4.2 Test Case Updates

The following subsections identify updates made to test cases.

2.4.2.1 New Tests

There are no new tests.

2.4.2.2 Modified Tests

There are no modified tests.

2.4.2.3 Removed Tests

The following tests have been removed:

■ BroadWorks Services/Third Party Call Control – Advanced Call Control

■ BroadWorks Services/Voice Messaging – Message Waiting Count

■ BroadWorks Services/Voice Messaging – Message Waiting Saved and Urgent Information

■ BroadWorks Services/Advanced Alerting – Silent Alert

■ Advanced Phone Services Package

■ Video Package

■ IPV6 – Advanced Phone Services

■ IPV6 – Video

2.5 Changes from Release 19.0, Version 1.4

This section identifies the significant changes in the test plan from the Release 19.0, Version 1.4.

2.5.1 General Document Updates

This section identifies general document updates.

2.5.2 Test Case Updates

The following subsections identify updates made to test cases.

2.5.2.1 New Tests

The following tests are new:

■ BroadWorks Services – Advanced Alerting: Silent Alerting

■ BroadWorks Services – Meet Me Conferencing: Meet Me Conference – AMR-WB

■ Feature Key Synchronization, Private Line – Executive

■ Feature Key Synchronization, Private Line – Executive-Assistant

■ Shared Call Appearance – Bridging: Silent Monitor Bridge Active Line

2.5.2.2 Modified Tests

There are no modified test cases.

2.5.2.3   Removed Tests

There are no removed test cases.

2.6   Changes from Release 18.sp1, Version 1.2

This section identifies the significant changes in the test plan from the Release 18.sp1, Version 1.2.

2.6.1   General Document Updates

This section identifies general document updates.

- Identified system IPV6 addresses.

2.6.2   Test Case Updates

The following subsections identify updates made to test cases.

2.6.2.1   New Tests

The following tests are new:

- DUT Services – Emergency Call
- Shared Call Appearance – Hybrid Key System
- IPV6 – Voice Message Deposit, Voice Message Retrieval
- IPV6 – Dual Stack with Alternate Connectivity (ALTC)

2.6.2.2   Modified Tests

The following test has been modified:

- IPV6 – updated test section setup instructions.

2.6.2.3   Removed Tests

There are no removed test cases.

2.7   Changes from Release 18.0, Version 1.2

This section identifies the significant changes in the test plan from the Release 18.0, Version 1.2.

2.7.1   General Document Updates

This section identifies general document updates.

2.7.2   Test Case Updates

The following subsections identify updates made to test cases.

2.7.2.1   New Tests

The following tests are new:

- BroadWorks Services: Calling and Connected Line ID – calling/connected name with Unicode characters.
- Advanced Phone Services: Busy Lamp Field – add monitored user with Unicode characters in display name.

- Advanced Phone Services: Busy Lamp Field – BFL Notify of User Busy, Multi-Dialog.

2.7.2.2   Modified Tests

The following tests have been modified:

- DUT Services: Call Control – Call Transfer – NOTIFY added to verification steps.
- Feature Key Sync Shared Line – DND and CFA ring splash scenarios corrected. Ring splash INVITE is sent to the primary line only.

2.7.2.3   Removed Tests

The following tests have been removed:

- Shared Call Appearance – Dialog Info Method
- Short Message Service (SMS) Send/Receive

2.8   Changes from Release 17.sp4, Version 1.2

This section identifies the significant changes in the test plan from the Release 17.sp4, Version 1.2.

2.8.1   General Document Updates

This section identifies general document updates.

2.8.2   Test Case Updates

The following subsections identify updates made to test cases.

2.8.2.1   New Tests

- Short Message Service (SMS) Send/Receive
- Feature Key Sync: Shared lines
- IPV6

2.8.2.2   Modified Tests

The following test has been modified:

- Call Transfer: BroadWorks now sends a NOTIFY to suppress the implicit REFER subscription.

2.8.2.3   Removed Tests

There are no removed tests.

2.9   Changes from Release 17.sp3, Version 1.4

This section identifies the significant changes in the test plan from the Release 17.sp3, Version 1.4.

2.9.1   General Document Updates

This section identifies general document updates.

2.9.2 Test Case Updates

The following subsections identify updates made to test cases.

2.9.2.1 New Tests

The following tests are new:

- Calling and Connected Line ID – Connected Line Presentation on UPDATE
- Calling and Connected Line ID – Connected Line Presentation on Re-INVITE

2.9.2.2 Modified Tests

There are no modified tests.

2.9.2.3 Removed Tests

There are no removed tests.

2.10 Changes from Release 17.0, Version 1.4

This section identifies the significant changes in the test plan from the Release 17.0, Version 1.4.

2.10.1 General Document Updates

This section identifies general document updates.

2.10.2 Test Case Updates

The following subsections identify updates made to test cases.

2.10.2.1 New Tests

The following tests are new:

- Interrogation Feature Access Code Dialing (*XX*)
- Meet-Me Conferencing
- Call Park Notification
- Call Park Notification – BLF
- Call Park Notification – SCA
- Video Services – HD

2.10.2.2 Modified Tests

There are no modified tests.

2.10.2.3 Removed Tests

There are no removed tests.

2.11 Changes from Release 16.sp1, Version 1.4

This section identifies the significant changes in the test plan from the Release 16.sp1, Version 1.4.

2.11.1 General Document Updates

This section identifies general document updates.

- Redundancy: A brief description of the Release 17.0 call session replication feature was added.

2.11.2 Test Case Updates

The following subsections identify updates made to test cases.

2.11.2.1 New Tests

The following tests are new:

- Basic – Ringback and Early Media: 181 Call Being Forwarded
- Advanced Phone Services – Feature Key Synchronization: Call Center Unavailable Codes
- Advanced Phone Services – Call Center: Hold Reminder
- Advanced Phone Services – Call Center: Call Information
- Advanced Phone Services – Call Center: Hoteling Event
- Advanced Phone Services – Call Center: Status Event
- Advanced Phone Services – Call Center: Disposition Code
- Advanced Phone Services – Call Center: Emergency Escalation
- Advanced Phone Services – Call Center: Customer Originated Trace

2.11.2.2 Modified Tests

There are no modified tests.

2.11.2.3 Removed Tests

There are no removed tests.

2.12 Changes from Release 16.0, Version 1.2

This section identifies the significant changes in the test plan from the Release 16.0, Version 1.2.

2.12.1 General Document Updates

This section identifies general document updates.

2.12.2 Test Case Updates

The following subsections identify updates made to test cases.

2.12.2.1 New Tests

New tests were done on Video Custom Ringback.

2.12.2.2 Modified Tests

There are no modified tests.

2.12.2.3 Removed Tests

There are no removed tests.

3 Document and Test Conventions

3.1 Document Conventions

Definitions of common terms and abbreviations used in the test cases are as follows:

- **AS** – BroadWorks Application Server. The AS is used for call control and services.

- **NS** – BroadWorks Network Server. The NS performs routing and translations and acts as a SIP redirect server.

- **MS** – BroadWorks Media Server. The MS performs media services for applications such as interactive voice response (IVR) or BroadWorks three-way conferencing.

- **Intelligent Device** – A SIP access device that performs its own call control, including such features as Hold, Transfer, and Three-Way Calling. If the device only communicates flash hook events to BroadWorks, it is non-intelligent.

- **Non-Intelligent Device** – A SIP access device does not perform its own call control, but communicates flash hook events to BroadWorks via SIP INFO messages.

There are two types of users mentioned in the test cases:

- **DUT** – A BroadWorks user that has been configured to use the *Device Under Test* (DUT) as its endpoint.

- **BroadWorks** – A BroadWorks user (for example, BroadWorks User A, BroadWorks User B, BroadWorks User C, and so on) that has been configured with a device already validated with BroadWorks. These users are typically in the same BroadWorks group as the DUT except where noted in test cases that the user must be in a different group.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** See the *BroadSoft Interoperability Account Information* [7] for suggested devices.

3.2 Test Case Format

This document contains test cases used to verify protocol interoperability. Each test case contains an overview followed by detailed verification instructions.

For each test case, the overview section describes how to configure the access device and BroadWorks in preparation for the test and how the test should be executed. The verification section shows the specific actions required to execute the test and the expected results after each step. The format of the verification section is as follows:

- Action initiated by the tester.

  - A system response to that action.

  - Another system response to that action.

- The next action initiated by the tester.

  - A system response to that next action.

  - Another system response to that next action.

3.3 Test Case Priority

Each test case is tagged with a priority, which is used in the validation process. The priority values are assigned meanings as follows:

- P0 – required to pass

- P1 – required to pass if supported

- P2 – not required to pass

All supported test cases must be executed. Generally, for a device to achieve validation with a particular BroadWorks release, all P0 test cases must pass and all supported P1 test cases must pass. Most P2 test cases are associated with advanced feature functionality. It is not required to support P2 test cases, but if supported, they must be executed.

3.4 Message Verification

Many of the test cases require inspection of the SIP protocol messages. The tester must use a network tracing tool, such as Wireshark, to inspect the protocol messages.

4   Public Interoperability System Information

This test plan is written from the perspective of a tester who has complete access to and control over the BroadWorks system. However, it is also intended for use by testers using the BroadSoft Public Interoperability Systems. Instructions vary for some test cases because of this. This section explains the use of the test plan for testers using the Public Interoperability System.

There are two public servers available for testing. The IOP1 System runs the most recent GA BroadWorks release. The IOP2 System runs the previous BroadWorks release. Upgrade announcements are communicated via the *Announcements* forum at interop.broadsoft.com.

Many of the test cases have special instructions when executing the test against the Public Interoperability System, as opposed to a BroadWorks system for which the tester has complete configuration control. Specifically, command line interface (CLI) access is not available on the Public Interoperability System, so workaround instructions are provided. The special instructions are indicated in the following format.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** To perform this test case using the Public Interoperability System, these special instructions must be followed.

4.1   IOP1 System Address Information

IOP1 System FQDNs:

BroadWorks Application Server cluster	as.iop1.broadworks.net
BroadWorks Reverse Application Server cluster	revas.iop1.broadworks.net
BroadWorks Network Server cluster	ns.iop1.broadworks.net
BroadWorks XSP Server (GUI)	ews1.iop1.broadworks.net
BroadWorks XSP Server (Device Mgmt, XSI)	xsp1.iop1.broadworks.net
Session Border Controller 1 (Oracle 3820)	sbc1.iop1.broadworks.net
Session Border Controller 2 (Sonus 5100)	sbc2.iop1.broadworks.net
BroadWorks Redundant test Application Server cluster	redas.iop1.broadworks.net
BroadWorks Redundant test Network Server cluster	redns.iop1.broadworks.net
SBC Failover test	sbcfailover.iop1.broadworks.net

IOP1 System IPV4 Addresses:

BroadWorks Application Server Primary	199.19.193.10
BroadWorks Application Server Secondary	199.19.193.11
BroadWorks Media Server 1	199.19.193.12
BroadWorks Media Server 2	199.19.193.13
BroadWorks Network Server	199.19.193.14
BroadWorks XSP Server (GUI)	199.19.193.15
BroadWorks XSP Server (DM, XSI)	199.19.193.16
Session Border Controller 1 (Oracle 3820)	199.19.193.9

| Session Border Controller 2 (Sonus 5100) | 199.19.193.29 |
| DNS Server | 8.8.8.8 (or other public DNS) |

IOP1 System IPV6 Addresses:

BroadWorks Application Server Primary	2620:108:0:b600:20c:29ff:fe60:76f
BroadWorks Application Server Secondary	2620:108:0:b600:20c:29ff:fea8:8636
BroadWorks Media Server 1	2620:108:0:b600:20c:29ff:fe18:d9b0
BroadWorks Media Server 2	2620:108:0:b600:20c:29ff:fe93:5e56
BroadWorks Network Server	2620:108:0:b600:20c:29ff:fee0:f03a
BroadWorks XSP Server (GUI)	2620:108:0:b600:20c:29ff:fe2f:62db
BroadWorks XSP Server (DM, XSI)	2620:108:0:b600:20c:29ff:feda:abd7
Session Border Controller 1 (Oracle 3820)	2620:108::b600:208:25ff:fe05:27a3/64
Session Border Controller 2 (Sonus 5100)	TBD
DNS Server	2001:4860:4860::8888 (or other public)

4.2   IOP2 System Address Information

IOP2 System FQDNs:

BroadWorks Application Server cluster	as.iop2.broadworks.net
BroadWorks Reverse Application Server cluster	revas.iop2.broadworks.net
BroadWorks Network Server cluster	ns.iop2.broadworks.net
BroadWorks XSP Server (GUI)	ews1.iop2.broadworks.net
BroadWorks XSP Server (Device Mgmt, XSI)	xsp1.iop2.broadworks.net
Session Border Controller 1 (Oracle 3820)	sbc1.iop2.broadworks.net
Session Border Controller 2 (Sonus 5100)	sbc2.iop2.broadworks.net
BroadWorks Redundant test Application Server cluster	redas.iop2.broadworks.net
BroadWorks Redundant test Network Server cluster	redns.iop2.broadworks.net
SBC Failover test	sbcfailover.iop2.broadworks.net

IOP2 System IPV4 Addresses:

BroadWorks Application Server Primary	199.19.193.20
BroadWorks Application Server Secondary	199.19.193.21
BroadWorks Media Server 1	199.19.193.22
BroadWorks Media Server 2	199.19.193.23
BroadWorks Network Server	199.19.193.24
BroadWorks XSP Server (GUI)	199.19.193.25
BroadWorks XSP Server (DM XSI)	199.19.193.26
Session Border Controller 1 (Oracle 3820)	199.19.193.9
Session Border Controller 2 (Sonus 5100)	199.19.193.29
DNS Server	8.8.8.8 (or other public DNS)

IOP2 System IPV6 Addresses:

BroadWorks Application Server Primary	2620:108:0:b600:20c:29ff:fe5f:1314
BroadWorks Application Server Secondary	2620:108:0:b600:20c:29ff:fe10:4b39
BroadWorks Media Server 1	2620:108:0:b600:20c:29ff:fe9b:c532
BroadWorks Media Server 2	2620:108:0:b600:20c:29ff:fe70:a152
BroadWorks Network Server	2620:108:0:b600:20c:29ff:fe09:e5c2
BroadWorks XSP Server (GUI)	2620:108:0:b600:20c:29ff:feeb:b8f5
BroadWorks XSP Server (DM, XSI)	2620:108:0:b600:20c:29ff:fe3b:b48d
Session Border Controller 1 (Oracle 3820)	2620:108::b600:208:25ff:fe05:27a3/64
Session Border Controller 2 (Sonus 5100)	TBD
DNS Server	2001:4860:4860::8888 (or other public)

5   BroadSoft UC-One Desktop Client

The BroadSoft UC-One Desktop client can be used as an endpoint to test against for many of the test cases in the test plan. It can also be used as a call control client for third-party call control test cases.

This section provides instructions for download and configuration of the client for endpoint mode and for call control mode.

5.1   Download and Install the UC-One Desktop Client

The UC-One Desktop client can be downloaded from the BroadSoft interop site under the UC-One tab here. Scroll to the bottom of the page and select either the Windows or Mac client installer for download.

After download, open the installer file and click through the queries to install. In most cases, stick with the defaults.

As BroadWorks group administrator, browse to *<user> → Profile → Assign Services* for the user you will be testing with. Make sure that the *UC-One* service pack is assigned to the user. The *UC-One* service pack contains all of the Business Communicator licenses.

5.2   Use UC-One Desktop Client as an Endpoint

The UC-One Desktop client can be used as the BroadWorks User A/User B endpoint for many of the test cases in the test plan.

Accounts provided on the BroadSoft IOP systems typically are pre-configured with two users enabled for the UC-One Desktop client as an endpoint. These users contain "BTBC" in the username. See the account setup email that you received or log in to the web portal as group administrator to view the users in the group.

For most testers, it is sufficient to use the BroadWorks users that are pre-configured with the UC-One Desktop client. If additional information is needed, see the UC-One section of the *BroadSoft Interoperability Account Information* [7]. Note that a separate Mac or PC must be used for each client instance.

After the client is installed, start the client and enter the *Login URL* corresponding to the IOP system you are testing on. This *Login URL* specifically applies to endpoint mode.

- IOP1: http://xsp1.iop1.broadworks.net
- IOP2: http://xsp1.iop2.broadworks.net

Then supply the web portal login username and password for the BroadWorks user.

The following figure is an example of the login.

Figure 1 Login

The following figure is an example of after the login. Note that several icons are shown at the bottom of the client screen. This indicates that the client is correctly configured for endpoint mode.

Figure 2 After Login

For more information, see the *BroadSoft Interoperability Account Information* [7].

5.3 Use UC-One Desktop Client for Call Control

The client can also be configured as a third-party call-control only client. This enables the client to remotely control the phone or other endpoints. This configuration is necessary for test cases that require use of a third-party call-control client.

As BroadWorks group administrator, check the following configuration for the BroadWorks user selected to perform third-party call control:

■ Browse to *<user> → Addresses*. Select the *Configure Identity/Device Profile* link. On the subsequent web page, make sure that *Identity/Device Profile Type* is not any of the following: *Business Communicator – PC, Business Communicator – Mobile, Business Communicator – Tablet*. The client does not work as a call control client if the primary endpoint is also a UC-One client.

■ Browse to *<user> → Call Control → Shared Call Appearance*. Make sure that *Alert all appearances* for Click-to-Dial calls is not selected.

After the client is installed, start the client and enter the *Login URL* corresponding to the IOP system you are testing on. This *Login URL* specifically applies to call control mode.

■ IOP1: http://xsp1.iop1.broadworks.net:80/dms/bc/Xsi-Only/config.xml

■ IOP2: http://xsp1.iop2.broadworks.net:80/dms/bc/Xsi-Only/config.xml

Then supply the web portal login username and password for the BroadWorks user performing the call control.

The following figure is an example of the login.

Figure 3 Login – 2

The following figure is an example of after the login. Note that only the phone icon is shown at the bottom of the client screen. This indicates that the client is correctly configured for endpoint mode.

Figure 4 After Login – 2

6 Basic Package

This test section covers basic SIP interoperability scenarios including tests for:

- Origination

- Termination

- Session Audit

- Session Timers

- Ringback and Early Media

- Dial Plan

- DTMF

- Codec Negotiation/Renegotiation

6.1 Basic – Call Origination

The purpose of this section is to verify that basic calls can be originated by the DUT to BroadWorks.

The BroadWorks solution includes two Application Servers: a primary and a secondary Application Server. The DUT must always contact the primary Application Server except in failover conditions. To make sure that the primary Application Server is contacted, the DUT should conform to *RFC 3263* and use NAPTR or DNS SRV lookups on the BroadWorks Application Server Cluster FQDN and on any contact.

> **NOTE**: Failover conditions are verified in the Redundancy section of this test plan.

1. BASIC – DUT to BroadWorks; DUT Hangs Up After Answer (P0)

This test case verifies a DUT-originated call that is answered and then terminated by the DUT.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from the DUT.

Verify the following:

- DUT dials the number of BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- DUT hangs up.

  - The call is released.

- Verify the SIP signaling to and from the DUT.

  - Make sure the DUT sends all messages to the primary Application Server address.

2.   BASIC – DUT to BroadWorks; DUT Hangs Up Before Answer (P0)

This test case verifies a DUT-originated call that is hung up by the DUT before it is answered.

Originate a local call from the DUT to BroadWorks User A. Do not answer the call. Disconnect the call from the DUT before BroadWorks User A answers.

Verify the following:

- DUT dials the number of the BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- DUT hangs up.
  - The call is released.
- Verify the SIP signaling to and from the DUT.
  - Make sure the DUT sends all messages to the primary Application Server address.

3.   BASIC – DUT to BroadWorks; BroadWorks Hangs Up After Answer (P0)

This test case verifies a DUT-originated call that is answered and then terminated by the called party.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from BroadWorks User A.

Verify the following:

- DUT dials the number of the BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- BroadWorks User A hangs up.
  - The call is released.
- Verify the SIP signaling to and from the DUT.
  - Make sure the DUT sends all messages to the primary Application Server address.

6.2 Basic – Call Termination

The purpose of this section is to verify that basic calls can be terminated by the DUT from BroadWorks.

4.   BASIC – BroadWorks to DUT; BroadWorks Hangs Up After Answer (P0)

This test case verifies a call originated from a BroadWorks user to the DUT that is answered and then terminated by the BroadWorks user.

Originate a call from BroadWorks User A to the DUT. Answer the call. Disconnect the call from BroadWorks User A.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- BroadWorks User A hangs up.
    - The call is released upon disconnect.
- Verify the SIP signaling to and from the DUT.
    - Make sure the DUT sends all messages to the primary Application Server address.

5.   BASIC – BroadWorks to DUT; BroadWorks Hangs Up Before Answer (P0)

This test case verifies a call originated from a BroadWorks user to the DUT that is hung up by the BroadWorks user before it is answered.

Originate a call from BroadWorks User A to the DUT. Do not answer the call. Disconnect the call from BroadWorks User A before the DUT answers.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- BroadWorks User A hangs up.
    - The call is released upon disconnect.
- Verify the SIP signaling to and from the DUT.
    - Make sure the DUT sends all messages to the primary Application Server address.

6.   BASIC – BroadWorks to DUT; DUT Hangs Up After Answer (P0)

This test case verifies a call originated from a BroadWorks user to the DUT that is answered and then terminated by the DUT.

Originate a call from BroadWorks User A to the DUT. Answer the call. Disconnect the call from the DUT.

Verify the following:

- BroadWorks User dials the DUT.
  - DUT is alerted.
  - BroadWorks User A receives audible ringback.
- DUT answers the call.
  - Two-way voice path is established.
- DUT hangs up.
  - The call is released upon disconnect.
- Verify the SIP signaling to and from the DUT.
  - Make sure the DUT sends all messages to the primary Application Server address.

6.3 Basic – Session Audit

BroadWorks provides an auditing capability to periodically poll a device in an active call to make sure that it is still responsive. This is a BroadWorks feature not to be confused with SIP Session Timers (*RFC 4028*), which are covered in the next section. This auditing capability is intended for scenarios where SIP Session Timers are not enabled or not supported. These tests make sure that this audit mechanism does not interfere with normal, active, established calls.

Additionally, this section tests that the DUT sends a negative response if it receives an audit message for a call that has not been established or does not exist from the perspective of the DUT, as would happen if the DUT power cycled or restarted during the call.

Test setup for session audit tests:

1) Via the BroadWorks CLI, enable session audit.

```
AS_CLI/System/CallP/SessionAudit> set auditActive true
```

2) Configure session audit polling rate. It is recommended to set the interval to a small value (for example, 60 seconds) for the audit success scenarios. For the audit failure scenarios, the interval should be set to a value that gives the DUT time to reboot and to be ready for call processing, before the polling interval elapses.

```
AS_CLI/System/CallP/SessionAudit> set auditIntervalSeconds 60
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. Session audit is enabled on the system and the audit interval time is set at five minutes so that all test cases in this section can be executed.

The audit occurs in one of two ways:

- If the DUT advertises UPDATE in the *Allow* header, the audit is sent as an UPDATE message without SDP. The DUT is expected to respond with *200 OK*.

- If the DUT does not advertise support for UPDATE, the audit occurs as a re-INVITE with SDP. BroadWorks does not modify the version in the SDP. This re-INVITE is to be interpreted by the DUT as a no-op as described in *RFC 3264* section 8. The DUT is expected to respond to the re-INVITE with *200 OK* and unmodified SDP (that is, same version).

> **NOTE 1**: There is a BroadWorks system parameter to enable/disable use of UPDATE for session audit when the DUT advertises UPDATE in the *Allow* header.
>
> AS_CLI/System/Callp/SessiontAudit> get allowUPDATEForSIPRefresh
>
> This flag defaults to "true" and is configured as such on the Public Interoperability System.
>
> **NOTE 2**: SIP session timers, if negotiated, take precedence over session audit. In this case, session timer re-INVITES occur rather than the session audit. To verify SESSION Audit, disable SESSION Timers on the DUT and/or on BroadWorks.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. Session Audit and Session Timers are enabled on the Public Interoperability System. To test Session Audit, disable Session Timers on the DUT.

7. **BASIC – BroadWorks to DUT; Wait for Session Audit (P0)**

This test case verifies session audit for a call originated from a BroadWorks user to the DUT.

Originate a call from a BroadWorks User A to the DUT. Wait for the session audit to occur.

Verify the following:

- BroadWorks User A dials DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
    - The call remains to the BroadWorks session audit interval.
    - An audit request is sent to the DUT.
    - The DUT sends a successful response to the audit request.
    - The call remains up and there is still a two-way voice path.
- Verify the audit signaling.
    - BroadWorks sends a re-INVITE or UPDATE.
        - If audit occurs by re-INVITE, the re-INVITE from BroadWorks contains unmodified SDP (that is, the version is not incremented).

– DUT responds with a *200 OK*.

  – If audit occurs by re-INVITE, the *200 OK* from the DUT must contain unmodified SDP (that is, the version is not incremented).

8.   **BASIC – BroadWorks to DUT; BroadWorks Holds, Wait for Session Audit (P0)**

This test case verifies session audit for a call originated from a BroadWorks user to the DUT and put on hold by the BroadWorks user.

Originate a call from a BroadWorks User A to the DUT. Hold the call at the BroadWorks User A's device. Wait for the session audit to occur. Resume the held call from BroadWorks User A's device.

Verify the following:

■   BroadWorks User A dials DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

■   DUT answers the call.

  – Two-way voice path is established.

■   BroadWorks User A holds the call using device hold mechanism.

  – There is no voice path between the BroadWorks User A and the DUT.

  – The call remains up to the BroadWorks session audit interval.

  – An audit request is sent to the DUT.

  – DUT sends a successful response to the audit request.

■   BroadWorks User A retrieves the held call by resuming the call at the device.

  – The call remains up and a two-way voice path is re-established.

■   Verify the audit signaling.

  – BroadWorks sends a re-INVITE or UPDATE.

    – If audit occurs by re-INVITE, the re-INVITE from BroadWorks contains unmodified SDP (that is, the version is not incremented).

  – DUT responds with a *200 OK*.

    – If audit occurs by re-INVITE, the *200 OK* from the DUT must contain unmodified SDP (that is, the version is not incremented).

9.   **BASIC – DUT to BroadWorks; Wait for Session Audit (P0)**

This test case verifies session audit for a call originated by the DUT.

Originate a call from the DUT to BroadWorks User A. Wait for the session audit to occur.

Verify the following:

■   DUT dials the number of BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

  – The call remains up to the BroadWorks session audit interval.

  – An audit request is sent to the DUT.

  – DUT sends a successful response to the audit request.

  – The call remains up and a two-way voice path is still established.

- Verify the audit signaling.

  – BroadWorks sends a re-INVITE or UPDATE.

    – If audit occurs by re-INVITE, the re-INVITE from BroadWorks contains unmodified SDP (that is, the version is not incremented).

  – DUT responds with a *200 OK*.

    – If audit occurs by re-INVITE, the *200 OK* from the DUT must contain unmodified SDP (that is, the version is not incremented).

10. BASIC – DUT to BroadWorks; DUT Holds, Wait for Session Audit (P0)

This test case verifies session audit for a call originated by the DUT and put on hold by the DUT.

Originate a call from the DUT to BroadWorks User A. Hold the call from the DUT. Wait for the session audit to occur. Resume the held call from the DUT.

> **NOTE**: If the DUT does not support call hold, this test case should be identified as Not Supported.

Verify the following:

- DUT dials the number of the BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

- DUT holds the call using device hold mechanism.

  – There is no voice path between BroadWorks User A and the DUT.

  – The call remains up to the BroadWorks session audit interval.

  – An audit request is sent to the DUT.

  – The DUT sends a successful response to the audit request.

- DUT retrieves held call by resuming the call at the DUT device.

  – The call remains up and a two-way voice path is re-established.

- Verify the audit signaling.

  – BroadWorks sends a re-INVITE or UPDATE.

- If audit occurs by re-INVITE, the re-INVITE from BroadWorks contains unmodified SDP (that is, the version is not incremented).

- DUT responds with a *200 OK*.

  - If audit occurs by re-INVITE, the *200 OK* from the DUT must contain unmodified SDP (that is, the version is not incremented).

11. **BASIC – DUT to BroadWorks; DUT Restarts, Wait for Session Audit (P0)**

This test case verifies the DUT properly handles a session audit request for a call that no longer exists on the DUT.

Test setup:

■ Set the audit polling interval to a value that gives the DUT time to reboot so it is ready for call processing before the polling interval elapses.

```
AS_CLI/System/CallP/SessionAudit> set auditIntervalSeconds
300
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The system has the audit interval time set at five minutes, which is usually long enough to execute this test case.

Originate a call from the DUT to BroadWorks User A. Restart the DUT. Wait for the session audit to occur.

Verify the following:

■ DUT dials the number of BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

■ BroadWorks User A answers the call.

  - Two-way voice path is established.

■ DUT device is restarted by a power cycle. (The DUT must be restarted in such a way that the call is not gracefully terminated.)

  - BroadWorks User A call remains up to the BroadWorks audit interval.

  - An audit request is sent to the DUT.

  - DUT sends the proper error response (such a 481 Call Leg/Transaction Does Not Exist) to the audit request.

■ Verify the audit signaling.

  - BroadWorks sends a re-INVITE or UPDATE.

  - DUT responds with a SIP 481 Call Leg/Transaction does not exist.

  - If the DUT treats the re-INVITE as a new call, this is a failure. The existence of a TO tag identifies the INVITE as pertaining to an existing dialog, which no longer exists on the DUT.

6.4 Basic – Session Timer

> **NOTE**: Session timer support is NOT required for interoperability with BroadWorks. However, if it is supported, the test cases in this section must pass.

This section tests the interoperability of the DUT's SIP Session Timer implementation (*RFC 4028*) with BroadWorks.

Test setup for session timer tests:

1) Via the BroadWorks CLI, enable session timers.

```
AS_CLI/System/CallP/SessionAudit> set sipSessionTimerActive
true
```

2) Set the preferred session refresher (local=BroadWorks).

```
AS_CLI/System/CallP/SessionAudit> set
preferredSessionTimerRefresher local
```

This enables session timers on the BroadWorks Application Server and configures BroadWorks to designate itself as the preferred session refresh controller in session timer negotiation.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. Session timer is enabled on the Interoperability Server: *sipSessionTimerActive* is set to "true" and *preferredSessionTimerRefresher* is set to "local". Session audit is also enabled as described in the previous section.

Session timers work similarly to BroadWorks session audit with respect to message flow. However, session timers take precedence over session audit, so if session audit is enabled and timers are active for a dialog, session audit does not trigger, preventing duplicate refreshes.

After each of the test cases in this section, inspect the SIP messaging to verify that:

■ Session expiration is negotiated in the initial call setup via the *Session-Expires* header. This is the refresh interval.

■ A session timer refresh request is sent from the negotiated session refresher (BroadWorks or the DUT) in the form of a re-INVITE containing the same SDP as originally sent by the refresher or as an UPDATE. This refresh request is sent at or before the negotiated session expiration.

■ There is a *200 OK* response from the other party (BroadWorks or DUT) containing the same SDP as was originally sent.

12. BASIC – BroadWorks to DUT; Wait for Session Timer (P1)

This test case verifies session timer for a call originated from a BroadWorks user to the DUT.

Originate a call from BroadWorks User A to the DUT. Answer the call. Wait for the session timer refresh to occur.

Verify the following:

- BroadWorks User A dials the DUT.

    – DUT is alerted.

    – BroadWorks User A receives audible ringback.

- DUT answers the call.

    – Two-way voice path is established.

    – The call remains up to the session timer interval.

    – A timer refresh request is sent.

    – A successful response is sent to the timer refresh request.

    – The call remains up and there is still a two-way voice path.

- Verify the session timer signaling per the instructions at the beginning of this test section.

13. BASIC – BroadWorks to DUT; BroadWorks Holds, Wait for Session Timer (P1)

This test case verifies session timer for a call originated from a BroadWorks user to the DUT and put on hold by the BroadWorks user.

Originate a call from BroadWorks User A to the DUT. Hold the call at the BroadWorks User A's device. Wait for the session timer refresh to occur. Resume the held call from the BroadWorks User A's device.

Verify the following:

- BroadWorks User A dials the DUT.

    – DUT is alerted.

    – BroadWorks User A receives audible ringback.

- DUT answers the call.

    – Two-way voice path is established.

- BroadWorks User A holds call using device hold mechanism.

    – There is no voice path between the BroadWorks User A and the DUT.

    – The call remains up to the session timer interval.

    – A timer refresh request is sent.

    – The call remains up passed the session timer interval.

- BroadWorks User A retrieves held call by resuming the call at the device.

    – The call remains up and a two-way voice path is re-established.

- Verify the session timer signaling per the instructions at the beginning of this test section.

14. BASIC – DUT to BroadWorks; Wait for Session Timer (P1)

This test case verifies session timer for a call originated by the DUT.

Originate a call from the DUT to BroadWorks User A. Answer the call. Wait for the session timer refresh to occur.

Verify the following:

- DUT dials BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
  - The call remains up to the session timer interval.
  - A timer refresh request is sent.
  - A successful response is sent to the timer refresh request.
  - The call remains up and there is still a two-way voice path.
- Verify the session timer signaling per the instructions at the beginning of this test section.

15. BASIC – DUT to BroadWorks; DUT Holds, Wait for Session Timer (P1)

This test case verifies session timer for a call originated by the DUT and put on hold by the DUT.

Originate a call from the DUT to BroadWorks User A. Hold the call from the DUT. Wait for the session timer refresh to occur. Resume the held call from the DUT.

> **NOTE**: If the DUT does not support call hold, this test case should be identified as Not Supported.

Verify the following:

- DUT dials BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- DUT holds call using device hold mechanism.
  - There is no voice path between BroadWorks User A and the DUT.
  - The call remains up to the session timer interval.
  - A timer refresh request is sent.
  - The call remains up passed the session timer interval.
- DUT retrieves held call by resuming the call at the device.
  - The call remains up and a two-way voice path is re-established.

- Verify the session timer signaling per the instructions at the beginning of this test section.

6.5 Basic – Ringback and Early Media

This section verifies the DUT's interoperability with BroadWorks for ringback and early media scenarios including the following:

- Generating local ringback

- Receiving remote ringback

- Forked dialog

- Early UPDATE

- Early-session

- 181 call being forwarded

The early UPDATE and early-session test cases each are required only for devices that support these capabilities. For devices that do not support these capabilities, the test cases are Not Supported. Read the test scenarios carefully to determine if they apply to your device.

6.5.1 Ringback

In remote ringback scenarios, the terminator provides ringback via early media. If early media is not provided, the DUT must provide its own ringback tone to the user (local ringback).

For the remote ringback scenarios, use one of the following options to generate remote ringback:

1) Configure the called user with a device providing remote ringback. Some SIP Integrated Access Devices (IADs) or gateways provide or can be configured to provide remote ringback (for example, AudioCodes MP-11x).

2) Configure the called user with the BroadWorks Custom Ringback feature.

Browse to *<user> → Profile → Announcement Repository* for the called user. Select *Add* and upload an audio file. The audio file must be CCITT u-Law, 8 kHz, 8 bit Mono, or WAV file type. Alternatively, dial into the voice portal from the user phone and follow the menu to "record a new announcement".

Browse to *<user> → Incoming Calls → Custom Ringback User* for the called user. Select Add to add a custom ringback instance. Under the *General Setting* tab, provide a description and select *Play Custom Ringback*. Set *Selected Time Schedule* to *All Day Every Day*. Select calls from *Any phone number*. Under the *Initial Ringback* tab, for *Audio Ringback*, select *Personal Ringback File* and select the uploaded or recorded announcement from the drop-down menu. The recorded announcement will have a name similar to Voice Portal.wav.

Browse to *<user> → Incoming Calls → Custom Ringback User* for the called user. Make sure the *Active* box for the custom ringback is checked.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: Sample custom ringback files are available via the *Account Info* tab at interop.broadsoft.com.

16. BASIC – DUT Generates Local Ringback (P0)

This test case verifies the DUT's ability to generate local ringback.

Make sure BroadWorks User A is configured with a SIP device that does not provide remote ringback via early media. This means the remote endpoint sends 180 without SDP. Typically, SIP phones do not provide remote ringback.

Originate a call from the DUT to BroadWorks User A. Allow the phone to ring.

Verify the following:

- DUT dials BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT hears audible locally supplied ringback.
- Verify the signaling to the DUT.
  - BroadWorks sends 180 Ringing without SDP to the DUT.

17. BASIC – DUT Receives Remote Ringback (P0)

This test case verifies the DUT's ability to receive ringback generated by the remote end, that is, the BroadWorks party device.

Make sure BroadWorks User A is configured with a SIP device that provides remote ringback via early media. This means the remote endpoint sends 18x with SDP. Alternatively, configure custom ringback as described in the opening to this test section.

Originate a call from the DUT to BroadWorks User A. Allow the phone to ring.

Verify the following:

- DUT dials BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
  - Make sure the DUT is rendering the remote ringback by removing the LAN connection from the remote endpoint. The ringback should stop. If it does not stop, then the DUT is ignoring the remote ringback and improperly generating local ringback.
- Verify the signaling to the DUT.
  - BroadWorks sends SIP 18x with SDP.

18. BASIC – DUT Generates Local Ringback, Followed by Receiving Remote Ringback (P0)

This test case verifies the DUT's ability to generate local ringback and then receive ringback generated by the remote end after the call forwards.

Test setup:

1) Assign BroadWorks User A the Call Forward No Answer (CFNA) service.

2) Assign BroadWorks User A to a device that does not provide remote ringback.

3) Configure BroadWorks User A's CFNA service to forward to BroadWorks User B.

4) Assign BroadWorks User B to a device that does provide remote ringback. Alternatively, configure custom ringback for BroadWorks User B as described in the opening to this test section.

Originate a call from the DUT to the BroadWorks User A. Allow the call to forward to BroadWorks User B. Allow the phone to ring.

Verify the following:

- BroadWorks User A is alerted.

    - DUT hears audible locally supplied ringback.

    - After some number of rings, the call forwards and BroadWorks User B is alerted.

    - DUT hears a remote ringback tone.

    - Make sure the DUT is rendering the remote ringback by removing the LAN connection from the remote endpoint. The ringback should stop. If it does not stop, then the DUT is ignoring the remote ringback and improperly generating local ringback.

- Verify the signaling to the DUT.

    - BroadWorks sends 180 Ringing without SDP to the DUT.

    - BroadWorks sends SIP 18x with SDP. To-tag can change.

6.5.2   Forked Dialog

To comply with *RFC 3261,* BroadWorks simulates a forking proxy if early media changes are detected or if media changes upon transition to a confirmed dialog (that is, upon answer). BroadWorks continues to send successive 18x responses for these scenarios, but sends a different To-tag if the SDP changes between 18x responses. If the SDP changes upon call answer (for example, redirection to Voice Portal) then the BroadWorks sends the changed SDP in the 2xx response with a different To-tag.

> **NOTE**: The To-tag is the tag field at the end of the SIP *To* header.

Access devices are required to handle support of forking proxies for received responses where the To-tag is used to identify a distinct dialog. Access Devices must be able to handle receiving multiple 18x responses with different To-tags and *200 OK* responses with different To-tags then the 18x responses for the same call.

The following test cases verify the DUT's support for early and confirmed dialog forking.

Test setup for forking tests:

Via the BroadWorks CLI, enable forking.

```
AS_CLI/Interfaces/Sip> set accessForkingSupport
multipleDialogsWithErrorCorrection
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The *accessForkingSupport* is set to "multipleDialogsWithErrorCorrection".

19. BASIC – Early to Confirmed Dialog Forking (P0)

This test case verifies the DUT's interoperability with BroadWorks for a call that forks from the 18x to the *200 OK*.

Test setup:

1) Configure BroadWorks User A with Voice Messaging.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: For Public Interoperability System testing, the first user of the first group of the assigned accounts is preconfigured for *Voice Messaging*, so use that user as BroadWorks User A.

2) Make sure that BroadWorks User A is configured with a SIP device that provides remote ringback via early media. This means the remote endpoint sends 18x with SDP. Alternatively, configure custom ringback as described in the opening to ringback section.

Originate a call from the DUT to BroadWorks User A. Do not answer the call. Allow the call to roll to voice mail.

Verify the following:

- DUT dials BroadWorks User A.
    - BroadWorks User A is alerted.
    - DUT receives audible ringback.
    - DUT is forwarded to voice mail and hears BroadWorks User A's *Voice Message No Answer* greeting.
- Verify the signaling to the DUT.
    - The TO tag in the *200 OK* is different than the TO tag in 18x.
    - The DUT ACKs the *200 OK*.

20. BASIC – Early to Early to Confirmed Dialog Forking (P0)

This test case verifies the DUT's interoperability with BroadWorks for a call that forks from the 18x to the next 18x and again to the *200 OK*.

Test setup:

1) Assign BroadWorks User A the Call Forward No Answer (CFNA) service.

2) Make sure that BroadWorks User A is configured with a SIP device that provides remote ringback via early media. This means the remote endpoint sends 18x with SDP. Alternatively, configure custom ringback as described in the opening to ringback section.

3) Configure BroadWorks User A's CFNA service to forward to BroadWorks User B.

4) Assign BroadWorks User B to a device that does not provide remote ringback.

Originate a call from the DUT to BroadWorks User A. Allow the call to CFNA to the BroadWorks User B. After a few rings, answer the call.

Verify the following:

- DUT dials BroadWorks User A.

    – BroadWorks User A is alerted.

    – DUT receives audible remote ringback.

    – After some number of rings, BroadWorks User B is alerted.

    – DUT receives audible remote ringback.

- BroadWorks User B answers the call.

    – Two-way voice path is established.

- Verify the signaling to the DUT.

    – The TO tag in the second 18x is different than the TO tag in the first 18x.

    – The TO tag in the *200 OK* is different than the TO tag in the second 18x.

    – The DUT ACKs the *200 OK*.

6.5.3   Early UPDATE

The test cases in this section verify the DUT's interoperability with BroadWorks for offer/answer exchange via early UPDATE. These test cases apply only to devices that support the following:

- Provide early media

- UPDATE method (*RFC 3311*)

- Reliable Provisional Response (*RFC 3262*)

If the DUT does not support one or more of the above, the test cases should be identified as Not Supported.

For this section, ringback/early media should be provided by the endpoints, unless otherwise noted.

Before running these tests, make sure reliable provisional response (100rel) is enabled on the BroadWorks Application Server as follows:

```
AS_CLI/Interface/SIP> set 100rel true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is configured with "100rel = true".

21.   BASIC – DUT Receives Early UPDATE (P1)

This test case verifies the DUT's ability to receive an UPDATE for early media change according to *RFC 3311*.

Test setup:

- This test case requires use of the UC-One Desktop client in call control mode. See section *5.3 Use UC-One Desktop Client for Call Control* for instructions on using the UC-One client for call control.

- Log in to the UC-One client using the BroadWorks User B web login credentials.

Originate a call from BroadWorks User A to BroadWorks User B. Answer the call. From User B's UC-One client, dial the DUT's extension and select Transfer while the DUT phone is ringing (that is, transfer before answer). Answer the call.

Verify the following:

■ BroadWorks User A calls BroadWorks User B. User B answers.

  – Two-way voice path is established.

■ From User B's UC-One client, enter the DUT's extension in the *Search and Dial* box. Select the phone icon at client bottom left to initiate click to dial.

  – BroadWorks User A is put on hold.

  – DUT is alerted.

  – BroadWorks User B hears ringback.

■ From User B's UC-One client, for the call from User B to the DUT, select the *Transfer To → User A* option from the other options menu (three vertical dots).

  – BroadWorks User A hears ringback.

■ DUT answers the call.

  – Two-way voice path is established.

■ Verify the signaling.

  – DUT receives initial INVITE.

  – DUT responds with 18x with SDP.

  – DUT receives UPDATE with OFFER SDP.

  – DUT responds to UPDATE with *200 OK* with ANSWER SDP.

22. BASIC – DUT Sends Early UPDATE (P2)

This test case verifies the DUT's ability to send an UPDATE for early media change according to *RFC 3311*.

Test setup:

1) Make sure that BroadWorks User A's device supports 100rel.

2) Make sure that BroadWorks User A's device supports UPDATE.

3) Configure the DUT to either CFNA to another party or to otherwise trigger early UPDATE to be sent by the DUT.

Originate a call from BroadWorks User A to the DUT. Allow the call to ring and to trigger the early update. After several rings, answer the call.

Verify the following:

■ BroadWorks User A calls DUT.

  – DUT is alerted.

  – BroadWorks User A receives remote ringback.

■ The call CFNAs to another party or otherwise triggers UPDATE.

  – BroadWorks User A still hears ringback.

■ DUT answers the call.

– Two-way voice path is established.

- ■ Verify the signaling.

    - – DUT responds with 18x with SDP.

    - – DUT sends UPDATE with OFFER SDP when the call forwards.

    - – The UDPATE is sent through to BroadWorks User A's device.

    - – BroadWorks User A's device responds to UPDATE with *200 OK* with ANSWER SDP.

6.5.4   Early-Session

The test cases in this section verify the DUT's interoperability with BroadWorks for offer/answer exchange via early-session. These test cases apply only to devices that support the following:

- ■ Provide early media

- ■ Early Sessions (*RFC 3959/3960*)

- ■ Reliable Provisional Response (*RFC 3262*)

If the DUT does not support one or more of the above, the test cases should be identified as Not Supported.

For this section, ringback/early media should be provided by the endpoints, unless otherwise noted.

Before running these tests, make sure reliable provisional response (100rel) is enabled on the BroadWorks Application Server as follows.

```
AS_CLI/Interface/SIP> set 100rel true
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is configured with "100rel = true".

23.   BASIC – DUT Receives Early-Session Offer (P2)

This test case verifies the DUT's ability to respond to an early-session offer according to *RFC 3959/3960*. The terminating endpoint provides an early-session offer in the 18x response, and the originating endpoint provides the early-session answer in the PRACK.

The DUT must supply early-session and 100rel option tags in the *Supported* or *Requires* header.

Originate a call from the DUT to BroadWorks User A, which is configured with a device that supports early-session. Answer the call.

Verify the following:

- ■ DUT dials BroadWorks User A.

    - – BroadWorks User A is alerted.

    - – DUT hears audible remote ringback.

- ■ BroadWorks User A answers the call.

    - – Two-way voice path is established.

■ Verify the signaling to the DUT.

– BroadWorks sends an 18x with early-offer to the DUT.

– The DUT sends a PRACK with early-answer.

24. BASIC – DUT Sends Early-Session Offer (P2)

This test case verifies the DUT's ability to initiate an early-session offer according to *RFC 3959/3960*. The terminating endpoint provides an early-session offer in the 18x response, and the originating endpoint provides the early-session answer in the PRACK.

The DUT must supply early-session and 100rel option tags in the *Supported* or *Requires* header.

Originate a call to the DUT from BroadWorks User A that is configured with a device that supports early-session. Answer the call.

Verify the following:

■ BroadWorks User A dials the DUT.

– DUT is alerted.

– BroadWorks User A hears audible remote ringback.

■ DUT answers the call.

– Two-way voice path is established.

■ Verify the signaling to the DUT.

– DUT sends an 18x with early-offer.

– BroadWorks sends a PRACK with early-answer.

6.5.5 181 Call Being Forwarded

BroadWorks provides a configuration option to supply a 181 response to the originator when a call is redirected. The 181 response precedes the eventual alerting (180 or 183) response.

The *Reason* header with a protocol value of "Diversion" is included in the SIP 181 response messages.

Within the SIP 181 response message, the *To* header is associated with the dialog of the redirecting user. After the call is redirected, the destination change can result in a new dialog. Therefore, the subsequent 18x/200 response can have a different *To* tag value.

The DUT must handle receiving the 181 response. The DUT is not required to act on the response. However, it can display a status message to the user.

25. BASIC – 181 Call Being Forwarded (P1)

This test case verifies the DUT's interoperability with BroadWorks for receiving a *181 Call is Being Forwarded* response.

Test setup:

1) Enable BroadWorks to send/proxy 181 responses.

```
AS_CLI/Interface/SIP> set send181Response true
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is configured with send181Response = true.

2) Browse to *User A → Profile → Call Policies.* Set *Send Call Being Forwarded Response on Redirect Calls* to *All Calls*.

3) Configure the Call Forward Always service for BroadWorks User A to forward to BroadWorks User B.

Originate a call from the DUT to BroadWorks User A. The call forwards to BroadWorks User B. BroadWorks User B answers.

Verify the following:

■ DUT dials BroadWorks User A.

    – BroadWorks User B is alerted.

    – DUT receives audible ringback.

■ BroadWorks User B answers the call.

    – Two-way voice path is established.

■ DUT hangs up.

    – The call clears.

■ Verify the signaling to the DUT.

    – BroadWorks sends a *181 Call is Being Forwarded* response to the DUT.

    – BroadWorks sends a 180 or 183 to the DUT.

    – The TO tag in the 180/183 or *200 OK* can be different than the TO tag in 181.

6.6   Basic – Dial Plan

This section verifies basic functionality of the DUT dial plan. The DUT is expected to send digits as dialed to BroadWorks, except for the dial termination character, which should be stripped. The test cases in this section cover selected North American Dial Plan (NADP) scenarios. Other dial plans and digit patterns should be tested as well but are not required to be submitted.

It is not important that the call completes the called number for the offnet calls. It is sufficient to inspect the messages and verify that the called number is sent as dialed in the INVITE to BroadWorks.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: There is no PSTN access on the Public Interoperability System, so make sure the number is populated correctly in the INVITE to BroadWorks.

26. **BASIC – Local Operator Dialing (0) (P0)**

This test case verifies NADP local operator dialing.

Originate a call to the local operator (0) from the DUT.

Verify the following:

- DUT dials "0".
- Verify the signaling from the DUT.
  - DUT sends SIP INVITE with Request-URI containing 0@<sip-domain>.

27. **BASIC – International Dialing (011XXXXXXXXX) (P0)**

This test case verifies NADP international number dialing.

Dial an international number from the DUT.

Verify the following:

- DUT dials an international number (prefixed by "011" in North America).
- Verify the signaling from the DUT.
  - DUT sends SIP INVITE with Request-URI containing the international number dialed, 011xxxxxxxxx@<sip-domain>.

28. **BASIC – Casual Access Dialing (1010321-12405550000) (P0)**

This test case verifies NADP casual access dialing.

Dial a North American number prefixed by a casual access code from the DUT.

Verify the following:

- DUT dials a casual access number, for example, 1010321-12405550000.
- Verify the signaling from the DUT.
  - DUT sends SIP INVITE with Request-URI containing the complete number dialed, 101032112405550000@<sip-domain>.

29. **BASIC – Extension Dialing (XXXX#) (P0)**

This test case verifies extension dialing.

Dial the four-digit extension for BroadWorks User A, followed by # to terminate digit collection.

> **NOTE**: If the DUT uses "send" or another method to terminate digit collection, "#" does not apply.

Verify the following:

- DUT dials the extension for BroadWorks User A (xxxx#).
- Verify the signaling from the DUT.
  - DUT sends SIP INVITE with Request-URI containing the extension dialed, 1234@<sip-domain> or 1234#@<sip-domain>.

30. **BASIC – Feature Access Code Dialing (*XX) (P0)**

This test case verifies feature access code dialing.

Dial a feature access code, for example, *73 from the DUT.

Verify the following:

■ DUT dials the feature access code (*xx).

■ Verify the signaling from the DUT.

– DUT sends SIP INVITE with Request-URI containing the feature access code, *73@<sip-domain>.

31. **BASIC – Interrogation Feature Access Code Dialing (*XX*) (P0)**

This test case verifies interrogation feature access code dialing.

Dial an interrogation feature access code, for example, *21* from the DUT.

Verify the following:

■ DUT dials the feature access code (*xx*).

■ Verify the signaling from the DUT.

– DUT sends SIP INVITE with Request-URI containing the feature access code, *21*@<sip-domain>.

6.7 Basic – DTMF

This section verifies the DUT's interoperability with the BroadWorks Media Server for generating Dual-Tone Multi-Frequency (DTMF) via the following methods:

■ In-band

■ *RFC 2833*

■ DTMF Relay

The DUT must support at least one of these methods for signaling DTMF. Each method that is supported by the DUT must be verified.

Test setup for DTMF tests:

■ Assign and configure a BroadWorks Auto Attendant for the BroadWorks group.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If you are using the Public Interoperability Server for testing, an Auto Attendant was preconfigured for you when your accounts were created. See your account setup information.

32. **BASIC – In-band DTMF (P0)**

This test verifies the DUT's ability to send in-band DTMF.

Test setup:

■ Configure the DUT to use in-band DTMF only. If the DUT always offers *RFC 2833*, this test case should be identified as Not Supported.

Originate a call from the DUT to the Auto Attendant. Follow the interactive voice response (IVR) instructions to transfer the call to BroadWorks User A.

Verify the following:

- DUT dials the Auto Attendant.

  - DUT hears a greeting and a prompt provided by the Auto Attendant.

- DUT responds to the Auto Attendant prompts and supplies the necessary digits to transfer the call to BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT hears audible ringback.

- Verify the signaling from the DUT.

  - DUT sends INVITE to BroadWorks without the *RFC 2833* payload type in the SDP.

33. BASIC – RFC 2833 DTMF Offered, In-band DTMF Negotiated (P0)

This test validates the DUT's ability to fall back to in-band DTMF, when the terminating device does not support *RFC 2833* DTMF.

Test setup:

1) Configure the DUT to offer *RFC 2833* DTMF. If the DUT does not support *RFC 2833,* this test case should be identified as Not Supported.

2) Configure the BroadWorks Media Server to disable the use of *RFC 2833* under the Media Server CLI at *Applications/MediaStreaming*/Interfaces/RTP.

3) Make sure the BroadWorks Media Server does not have the G729 or AMR CODECs enabled.

```
MS_CLI/Applications/MediaStreaming/Service/IVR/AudioCodec>
delete g729

MS_CLI/Applications/MediaStreaming/Service/IVR/AudioCodec>
delete amr
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System uses two Media Servers. One is configured to support *RFC 2833*, while the other is not. The Application Server load balances the connections to each of these servers. To make sure that the proper Media Server is selected for this connection, verify via signaling that the SDP in the *200 OK* from BroadWorks does not include the *RFC 2833* payload type. Several call attempts can be required to connect to the correct Media Server.

Originate a call from the DUT to the Auto Attendant. Follow the interactive voice response (IVR) instructions to transfer the call to BroadWorks User A.

Verify the following:

- DUT dials the Auto Attendant.

  - DUT hears a greeting and a prompt provided by the Auto Attendant.

- DUT responds to the Auto Attendant prompts and supplies the necessary digits to transfer the call to BroadWorks User A.

  - BroadWorks User A is alerted.

- DUT hears audible ringback.

■ Verify the signaling to and from the DUT.

- DUT sends INVITE to BroadWorks with the *RFC 2833* payload type in the SDP.

  Example: rtpmap:101 telephone-event/8000

- Verify the BroadWorks returns an SDP without the *RFC 2833* payload type.

- Inspect the RTP to make sure that there is no *RFC 2833* DTMF sent by the DUT.

34. **BASIC – RFC 2833 DTMF (P0)**

This test validates the DUT's ability to send *RFC 2833* DTMF to the terminating device.

Test setup:

1) Configure the DUT to offer *RFC 2833* DTMF. If the DUT does not support *RFC 2833*, this test case should be identified as Not Supported.

2) Configure the BroadWorks Media Server to enable the use of *RFC 2833* under the Media Server CLI at *Applications/MediaStreaming/Interfaces/RTP*.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The Public Interoperability System uses two Media Servers. One is configured to support *RFC 2833*, while the other is not. The Application Server load balances the connections to each of these servers. To make sure that the proper Media Server is selected for this connection, verify via signaling that the SDP in the *200 OK* from BroadWorks includes the *RFC 2833* payload type. Several call attempts can be required to connect to the correct Media Server.

Originate a call from the DUT to the Auto Attendant. Follow the interactive voice response (IVR) instructions to transfer the call to BroadWorks User A.

Verify the following:

■ DUT dials the Auto Attendant.

- DUT hears a greeting and a prompt provided by the Auto Attendant.

■ DUT responds to the Auto Attendant prompts and supplies the necessary digits to transfer the call to BroadWorks User A.

- BroadWorks User A is alerted.

- DUT hears audible ringback.

■ Verify the signaling to and from the DUT.

- DUT sends INVITE to BroadWorks with the *RFC 2833* payload type in the SDP.

  Example: rtpmap:101 telephone-event/8000

- Verify the BroadWorks returns an SDP with the *RFC 2833* payload type.

- Inspect the RTP to make sure that *RFC 2833* DTMF is sent by the DUT.

35. BASIC – DTMF Relay (P2)

This test validates the DUT's ability to send DTMF via SIP INFO.

Test setup:

1) Configure the DUT to use DTMF Relay. If the DUT does not support DTMF Relay, this test case should be identified as Not Supported.

2) Enable the dtmf-relay content type on the BroadWorks Application Server.

```
AS_CLI/Interface/SIP/ContentType/Content> add
application/dtmf-relay
```

3) Enable the BroadWorks Media Server to accept DTMF relay.

```
MS_CLI/Applications/MediaStreaming/Interface/SIP> set
acceptDTMFRelay true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured with the dtmf-relay content type enabled.

Originate a call from the DUT to the Auto Attendant. Follow the interactive voice response (IVR) instructions to transfer the call to BroadWorks User A.

NOTE: The BroadWorks Media Server listens on the RTP stream for DTMF in addition to processing DTMF relay messages, so sending over RTP in addition to DTMF relay causes the Media Server to recognize extra digits.

Verify the following:

- DUT dials the Auto Attendant.
    - DUT hears a greeting and a prompt provided by the Auto Attendant.
- DUT responds to the Auto Attendant prompts and supplies the necessary digits to transfer the call to BroadWorks User A.
    - BroadWorks User A is alerted.
    - DUT hears audible ringback.
- Verify the signaling to and from the DUT.
    - DUT sends SIP INFO messages for DTMF-relay.
    - DUT does not send in-band or *RFC 2833* DTMF in addition to DTMF-relay.

6.8 Basic – Codec Negotiation/Renegotiation

This section tests the ability of the DUT to perform codec negotiation as specified in *RFC 3264*. Complete compliance to this RFC is required to make sure the DUT has no codec interoperability issues.

The test cases in this section require inspection of the SDP content.

Media Server setup:

Make sure the Media Server's IVR codec lists use the codec preference order – G729, G726-32, and G.711 μ-law. This codec list is configured via the CLI under the CLI/Service/Ivr/AudioCodec menu.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The two Media Servers are configured with codec priority lists of 1) G729-8, G726-32, G711μlaw, G711alaw, and 2) G726-32, G711μlaw, and G711alaw.

6.8.1 Codec Negotiation

The test in this section verifies the DUT capability for codec negotiation in response to re-invite without SDP as well as initial answer with HOLD SDP.

36. BASIC – Codec Negotiation: re-INVITE without SDP (P0)

This test verifies the DUT responds to a re-INVITE without SDP by sending OFFER SDP in the *200 OK*. The DUT must send OFFER SDP (all of its codecs) in response to re-INVITE without SDP.

Test setup:

1) Assign the Call Pickup service to the BroadWorks group.

2) Create a *Call Pickup* group and assign the DUT and BroadWorks Users A and B to the *Call Pickup* Group.

Originate a call from the BroadWorks User A to BroadWorks User B. Do not answer the call. From the DUT, dial the Call Pickup feature access code (*98) to pick up the call.

Verify the following:

- BroadWorks User A dials BroadWorks User B.

    – BroadWorks User B is alerted.

    – BroadWorks User A receives audible ringback.

- DUT dials *98 to pick up the call.

    – Two-way voice path is established between the DUT and BroadWorks User A.

- Verify the signaling.

    – Inspect the SDP in the *200 OK* from DUT in response to re-INVITE without SDP from BroadWorks.

        – The SDP must contain all of the DUT's supported and enabled codecs.

        – The version in the o-line must be incremented.

37. BASIC – Codec Negotiation: Initial Answer with HOLD SDP (P0)

This test verifies the DUT handles codec negotiation after initial answer containing HOLD SDP.

Test setup:

■ Assign the Call Park service to the group. There is no configuration necessary for this service.

Originate a call from BroadWorks User A to BroadWorks User B. Answer the call. From BroadWorks User A, place a second call and dial the Call Park feature code *68 to park the call. Supply the DUT's extension as the parking number. From the DUT, retrieve the call by dialing *88+<DUT extension>.

> **NOTE**: This test case only applies to SIP devices that can dial *88+DUT number from the device. Some devices automatically terminate digit collection after *XX is dialed, so this test case is not applicable to those devices.

Verify the following:

■ BroadWorks User A dials BroadWorks User B.

   – BroadWorks User B is alerted.

   – BroadWorks User A receives audible ringback.

■ BroadWorks User B answers the call.

   – Two-way voice path is established.

■ BroadWorks User A dials a second call to Call Park feature code *68 to park the call.

   – BroadWorks User A hears IVR announcement requesting a number to park the call against.

■ BroadWorks User A supplies the DUT extension to park the call against.

   – BroadWorks User A hears IVR announcement indicating the call has been parked.

   – BroadWorks User B is now held.

■ BroadWorks User A hangs up.

■ DUT dials *88+<DUT DN> to retrieve the parked call.

   – Two-way voice path is established between the DUT and BroadWorks User B.

■ Verify the signaling to and from the DUT.

   – BroadWorks sends HOLD SDP in the *200 OK* answer to the initial INVITE from the DUT.

   – BroadWorks sends a re-INVITE with B's SDP to the DUT.

   – DUT sends *200 OK* to BroadWorks with ANSWER SDP.

6.8.2 Codec Renegotiation

The tests in this section validate the device's ability to renegotiate codecs between devices that support a different list of codecs. For example, BroadWorks User A and the DUT are both in a call that negotiates the G729A codec. BroadWorks User A transfers the DUT to BroadWorks User B. BroadWorks User B's device does not support the

G.729A codec. To negotiate a codec with BroadWorks User B, the DUT must offer its supported codecs in an OFFER SDP.

Test setup for the following test cases:

1) Enable two or more codecs on the DUT device (for example: G711µ and G729A).

2) Enable the first codec on the BroadWorks User A device. Make sure the second codec is not enabled on the BroadWorks User A device.

3) Enable the second codec on the BroadWorks User B device. Make sure the first codec is not enabled on the BroadWorks User B device.

4) Enable a third codec shared by BroadWorks User A and BroadWorks User B, but not enabled on the DUT.

5) Make sure the BroadWorks Call Transfer service is assigned to BroadWorks User A.

6) This test section requires use of the UC-One Desktop client in call control mode. See section *5.3 Use UC-One Desktop Client for Call Control* for instructions on using the UC-One client for call control.

7) Log in to the UC-One client using the BroadWorks User A web login credentials.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Call Transfer service is pre-assigned to each BroadWorks user supplied in the initial account setup.

The tests in this section do not require the DUT endpoint to perform call control, except for Call Hold in one of the test cases. Otherwise, the call control is performed by BroadWorks User A using the UC-One Desktop client in call control mode.

38. BASIC – Codec Renegotiation: Blind Transfer (P0)

This test case verifies the DUT's ability to renegotiate codecs when the remote end blind transfers the DUT to another party.

Originate a call from BroadWorks User A to the DUT. Answer the call. From User A's UC-One client, blind transfer the DUT to BroadWorks User B.

Verify the following:

■ BroadWorks User A dials the DUT.

– DUT is alerted.

– BroadWorks User A receives audible ringback.

■ DUT answers the call.

– Two-way voice path is established between BroadWorks User A and the DUT.

■ From User A's UC-One client, select *Transfer To → New* from the other options menu (three vertical dots). In the window that pops up, enter User B's extension in the *Search and Dial* box and select *Transfer Now*.

– BroadWorks User A is released.

– BroadWorks User B is alerted.

– DUT receives audible ringback.

■ BroadWorks User B answers the call.

– Two-way voice path is established between BroadWorks User B and the DUT.

- Verify the SIP signaling and RTP.

  - Check initial *200 OK* and RTP stream to determine negotiated codec between BroadWorks User A and the DUT.

  - During the transfer, BroadWorks sends the DUT a re-INVITE without SDP.

  - DUT responds with *200 OK* containing OFFER SDP.

  - BroadWorks sends ACK containing ANSWER SDP.

  - Check *200 OK* and RTP stream to determine negotiated codec between BroadWorks User B and the DUT, which must be different than the codec negotiated with BroadWorks User A.

39. **BASIC – Codec Renegotiation: Attended Transfer (P0)**

This test case verifies the DUT's ability to renegotiate codecs when the remote end attended transfers the DUT to another party.

Originate a call from BroadWorks User A to BroadWorks User B. Answer the call. From User A's UC-One client, place a second call to the DUT. Answer the call. From User A's UC-One client transfer the DUT to User B.

Verify the following:

- BroadWorks User A dials the BroadWorks User B.

  - BroadWorks User B is alerted.

  - BroadWorks User A receives audible ringback.

- BroadWorks User B answers the call.

  - Two-way voice path is established between BroadWorks User A and BroadWorks User B.

- From User A's UC-One client, enter the DUT's extension in the *Search and Dial* box. Select the phone icon at client bottom left to initiate click to dial.

  - BroadWorks User B is held.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

- DUT answers the call.

  - Two-way voice path is established between BroadWorks User A and the DUT.

- From User A's UC-One client, for the call from User A to the DUT, select the *Transfer To → User B* option from the other options menu (three vertical dots).

  - BroadWorks User A is released.

  - Two-way voice path is established between BroadWorks User B and the DUT.

- Verify the SIP signaling and RTP.

  - Check initial *200 OK* and RTP stream to determine negotiated codec between BroadWorks User A and the DUT.

  - During the transfer, BroadWorks sends the DUT a re-INVITE without SDP.

  - DUT responds with *200 OK* containing OFFER SDP.

  - BroadWorks sends ACK containing ANSWER SDP.

– Check *200 OK* and RTP stream to determine negotiated codec between BroadWorks User B and the DUT, which must be different than the codec negotiated with BroadWorks User A.

40. **BASIC – Codec Renegotiation: Blind Transfer of Call on Hold (P0)**

This test case verifies the DUT's ability to renegotiate codecs when the remote end blind transfers the DUT to another party after the DUT has put the call on hold.

Additional test setup:

1) Browse to the *Call Control → Music/Video On Hold* page for the BroadWorks user associated with the DUT. Enable Music On Hold by selecting "On".

> **NOTE**: After completing this test case, disable Music On Hold for the DUT.

Originate a call from BroadWorks User A to the DUT. Answer the call. From the DUT, place the call on hold. From User A's UC-One client, blind transfer the DUT to BroadWorks User B. From the DUT, retrieve the call from hold.

> **NOTE**: If the DUT does not support call hold, this test case should be identified as Not Supported.

Verify the following:

- BroadWorks User A dials the DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT answers the call.

  – Two-way voice path is established between BroadWorks User A and the DUT.

- DUT holds the call by using the DUT's hold mechanism.

  – The call is held. User A hears Music On Hold.

- From User A's UC-One client, select *Transfer To → New* from the other options menu (three vertical dots). In the window that pops up, enter User B's extension in the *Search and Dial* box and select *Transfer Now*.

  – BroadWorks User A is released.

  – BroadWorks User B is alerted.

  – DUT does not receive audible ringback, as the call is still on hold.

- BroadWorks User B answers the call.

  – Call is still held. User B hears Music On Hold.

- DUT retrieves the held call.

  – Two-way voice path is established between BroadWorks User B and the DUT.

- Verify the SIP signaling and RTP.

  – Check initial *200 OK* and RTP stream to determine negotiated codec between BroadWorks User A and the DUT.

- DUT sends re-INVITE with hold SDP.

- DUT sends re-INVITE to resume.

- Check *200 OK* and RTP stream to determine negotiated codec between BroadWorks User B and the DUT, which must be different from the codec negotiated with BroadWorks User A.

7 BroadWorks Services Package

The BroadWorks Services package verifies the DUT's interoperability with BroadWorks to support basic services including the following. Note that not all BroadWorks features and services are included here. Only the services that impact the SIP interface are included for verification.

- Third-Party Call Control
- Voice Messaging
- Advanced Alerting
- Calling and Connected Line ID
- *Diversion* and *History-Info*
- Advice of Charge
- Meet-Me Conferencing
- Collaborate – Audio

7.1 BroadWorks Services – Third-Party Call Control

The purpose of this section is to verify the DUT's interoperability with BroadWorks for call flows resulting from third-party call control. Third-party call control scenarios result in INVITE w/o SDP and re-INVITE w/o SDP being sent to the DUT.

This test section makes use of the BroadSoft UC-One Desktop client in third-party call control mode. See section *5.3 Use UC-One Desktop Client for Call Control* for instructions on using the UC-One client for call control. Note that the UC-One client can also act as a soft client endpoint but cannot be used in the endpoint mode for these test cases. If you are currently using it as an endpoint for other test cases, see section *5.3 Use UC-One Desktop Client for Call Control* to reconfigure the client for third-party call control mode.

Log in to the UC-One client using the DUT BroadWorks user web login credentials.

For the test cases in this test section, make sure the following BroadWorks service is assigned to the DUT:

- Call Waiting

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The Call Waiting service is pre-assigned to each BroadWorks user supplied in the initial account setup.

41. SERVICE – Click To Dial (P0)

This test case verifies the DUT's interoperability with BroadWorks for Click To Dial call origination. For Click to Dial, BroadWorks sends initial INVITE without SDP to the DUT.

Click To Dial is a client call control feature in which the called party's number is dialed via the client rather than the endpoint. The originating endpoint (DUT) is alerted first. After answer, the called party is alerted.

From the DUT's UC-One Desktop client, Click To Dial a call from the DUT to BroadWorks User A. From the UC-One client, hang up the call.

Verify the following:

- From the DUT's UC-One client, enter BroadWorks User A's extension in the *Search and Dial* box. Select the phone icon at client bottom left to initiate click to dial.
  - DUT is alerted.
- DUT endpoint answers the Click To Dial call.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- From the UC-One client select the red phone icon to hang up.
  - Call gracefully terminates.
- Verify the SIP signaling.
  - BroadWorks sends the DUT initial INVITE without SDP.
  - After the Click To Dial, call is answered at the DUT, the DUT responds with a *200 OK* and OFFER SDP.

42. **SERVICE – Click To Hold; DUT Originator (P0)**

This test case verifies the DUT's interoperability with BroadWorks for holding a call the DUT originated using Click To Hold. For Click to Hold, BroadWorks sends re-INVITE without SDP to the DUT.

Click To Hold is a client call control feature in which the call is held or resumed via the client rather than the endpoint. BroadWorks sends re-INVITE to put the call on hold and to resume the call.

From the DUT's UC-One Desktop client, Click To Dial a call from the DUT to BroadWorks User A. From the UC-One client, place the call on hold. From the UC-One client, resume the call. From the UC-One client, hang up the call.

Verify the following:

- From the DUT's UC-One client, enter BroadWorks User A's extension in the *Search and Dial* box. Select the phone icon at client bottom left to initiate click to dial.
  - DUT is alerted.
- DUT endpoint answers the Click To Dial call.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- From the UC-One client, select the hold button.
  - There is no voice path between BroadWorks User A and the DUT.
- From the UC-One client, select the on hold button to resume.
  - Two-way voice path is re-established.

- From the UC-One client, select the red phone icon to hang up.

  – Call gracefully terminates.

- Verify the SIP signaling.

  – When the UC-One client holds the call, BroadWorks sends a re-INVITE with HOLD SDP to the DUT.

  – DUT responds with a *200 OK* with held SDP.

  – When the UC-One client resumes the call, BroadWorks sends a re-INVITE without SDP to the DUT.

  – DUT responds with a *200 OK* ANSWER SDP.

43.   SERVICE – Click To Hold; DUT Terminator (P0)

This test case verifies the DUT's interoperability with BroadWorks for holding a call to the DUT using Click To Hold. For Click to Hold, BroadWorks sends re-INVITE without SDP to the DUT.

Click To Hold is a client call control feature in which the call is held or resumed via the client rather than the endpoint. BroadWorks sends re-INVITE to put the call on hold and to resume the call.

Originate a call from a BroadWorks User A to the DUT. From the DUT's UC-One client, place the call on hold. From the UC-One client, resume the call. From the UC-One client, hang up the call.

Verify the following:

- BroadWorks User A dials the DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT endpoint answers the call.

  – Two-way voice path is established.

- From the UC-One client, select the hold button.

  – There is no voice path between BroadWorks User A and the DUT.

- From the UC-One client, select the on hold button to resume.

  – Two-way voice path is re-established.

- From the UC-One client select the red phone icon to hang up.

  – Call gracefully terminates.

- Verify the SIP signaling.

  – When the UC-One client holds the call, BroadWorks sends a re-INVITE with HOLD SDP to the DUT.

  – DUT responds with a *200 OK* with held SDP.

  – When the UC-One client resumes the call, BroadWorks sends a re-INVITE without SDP to the DUT.

  – DUT responds with a *200 OK* ANSWER SDP.

44. SERVICE – Click To Answer; Call Waiting (P0)

This test case verifies the DUT's interoperability with BroadWorks for answering a call waiting call using Click To Answer.

Click To Answer is a client call control feature in which the call is answered via the client rather than the endpoint.

> **NOTE**: This test case only applies to non-intelligent devices which are devices that rely on BroadWorks to perform call control by using INFO messages for flash hook events. For intelligent devices that send their own re-INVITEs, this test case should be marked Not Applicable.

Originate a call from BroadWorks User A to the DUT. Answer the call from the DUT endpoint. Originate a second call from BroadWorks User B to the DUT. Answer the second call via the DUT's UC-One client. Toggle between the calls using the UC-One client. From the UC-One client, hang up the call.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT endpoint answers the call.
    - Two-way voice path is established.
- BroadWorks User B dials the DUT.
    - There is a popup toast for the UC-One client with options *Accept* and *Decline*.
    - DUT is alerted with call waiting tone.
    - BroadWorks User B receives audible ringback.
- Choose *Accept* on the UC-One client popup toast.
    - A popup window for the UC-One client asks something like "*Answering a call will put ongoing call on hold, Continue?*" with *Yes/No* options.
- Choose *Yes* on the UC-One client popup window.
    - Two-way voice path is established between the DUT and BroadWorks User B.
    - The call with BroadWorks User A is on hold (no voice path in either direction).
- From the UC-One client, select the on hold button to resume the call with BroadWorks User A.
    - Two-way voice path is re-established with BroadWorks User A.
    - The call with BroadWorks User B is on hold (no voice path in either direction).
- From the UC-One client select the red phone icon to hang up each call.
    - Call gracefully terminates.
- Verify the SIP signaling.
    - When the *Accept* and *Yes* buttons are selected to answer the second call, BroadWorks sends a re-INVITE with OFFER SDP for the second call.

    – DUT responds with a *200 OK* with ANSWER SDP.

    – When the on hold button is selected to resume the first call, BroadWorks sends a re-INVITE with OFFER SDP for the first call.

    – DUT responds with a *200 OK* with ANSWER SDP.

7.2 BroadWorks Services – Voice Messaging

This section tests the DUT's interoperability with BroadWorks Voice Messaging features including the following:

- Voice Message Deposit/Retrieval
- Message Waiting Indicator
- Voice Portal Outcall

Test section setup:

1) Configure the BroadWorks group with a *Voice Portal*. Assign a number to the *Voice Portal*.

2) Configure BroadWorks User A and the DUT with the BroadWorks Voice Messaging service. Browse to the *<user>* → *Messaging* →*Voice Management* page and make sure the following options are selected:

    – Voice Messaging: On

    – Send Busy Calls to Voice Mail: Checked

    – Send Unanswered Calls to Voice Mail: Checked

    – Use Unified Messaging: Selected.

> **NOTE**: Advanced Settings must also be configured.

    – Use Phone Message Waiting Indicator: Checked

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Public Interoperability System accounts include a preconfigured *Voice Portal*. Additionally, the first user in the first group is preconfigured with *Voice Messaging* and the voice management settings identified above. This user must be BroadWorks User A for the first two test cases and the DUT user for the remaining test cases.

Do not attempt to configure the voice management settings or to modify the preconfigured settings. The *Advanced Settings* can only be configured correctly by BroadSoft interoperability personnel.

For the voice portal number and for the user's voice portal password, both of which are needed in the following test cases, see the account setup email.

7.2.1 Voice Message Deposit/Retrieval

This section verifies the DUT's interoperability with BroadWorks for depositing and retrieving voice messages.

45. SERVICE – Voice Message Deposit (P0)

This test case verifies the DUT's interoperability with BroadWorks for voice message deposit.

Originate a call from the DUT to the BroadWorks User A. Do not answer the call. Wait for the call to forward to voice mail. Leave a message.

Verify the following:

- DUT dials BroadWorks User A.

    - BroadWorks User A is alerted.

    - DUT receives audible ringback.

    - DUT is forwarded to voice mail and hears BroadWorks User A's *No Answer* greeting.

- DUT follows the IVR instructions to leave a short message and presses # to terminate the message.

    - DUT hears announcement indicating that the message was sent.

- DUT hangs up.

    - Call is released.

46. SERVICE – Voice Message Retrieval (P0)

This test case verifies the DUT's interoperability with BroadWorks for voice message retrieval.

After executing the previous test case, originate a call from the DUT to the BroadWorks voice portal. Retrieve the message previously left for BroadWorks User A.

Verify the following:

- DUT dials the BroadWorks group voice portal.

    - The DUT receives audible ringback.

    - The DUT is connected to the BroadWorks Voice Mail Retrieval service and receives the login greeting.

- DUT follows the IVR instructions to enter the voice mailbox ID and voice portal password for BroadWorks User A.

    - DUT is logged into the BroadWorks User A mailbox.

- DUT follows the IVR instructions to listen to the new voice message and delete the message.

    - DUT hears the voice message.

    - DUT hears announcement indicating that the message has been deleted.

- DUT hangs up.

    - Call is released.

7.2.2 Message Waiting Indicator

This test section verifies the DUT's interoperability with BroadWorks for handling Message Waiting Indicator (MWI) scenarios. Scenarios the DUT does not support should be identified as Not Supported.

BroadWorks supports both subscribed (or solicited) MWI and unsolicited MWI. Both implementations are verified in this test section. It is not required for the DUT to support both implementations.

■ Subscribed/solicited MWI: MWI notification is subscription-based, per *RFC 3265*. The DUT sends a SUBSCRIBE to BroadWorks for message-summary updates. BroadWorks sends a message-summary NOTIFY within the subscription dialog each time the MWI status changes.

■ Unsolicited MWI: MWI notification is not subscription-based. The DUT does not SUBSCRIBE for message-summary updates. BroadWorks sends a message-summary NOTIFY in a new dialog each time the MWI status changes.

Most devices support either audio or visual MWI, but some support both. The visual WMI can be an LED on the phone or an icon or message on the phone's display.

47. SERVICE – Message Waiting Indicator: Unsolicited (P1)

This test case verifies the DUT's support for unsolicited MWI notification.

Test setup:

■ If the DUT supports subscribed MWI, make sure this feature is disabled on the DUT if it is configurable. Restart the DUT to clear the subscription on the DUT.

Clear the DUT's message waiting indicator (MWI). Originate a call from BroadWorks User A to the DUT. Do not answer the call. Allow the call to forward to voice mail. Leave a message.

Verify the following:

■ DUT dials *99 to clear the MWI.

  – DUT hears IVR announcement indicating the MWI has been cleared.

  – MWI (audio and/or visual) on the DUT is deactivated.

■ DUT hangs up.

■ BroadWorks User A dials DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

  – BroadWorks User A is eventually transferred to voice mail and hears the DUT's *No Answer* greeting.

■ BroadWorks User A follows the IVR instructions to leave a short message and presses # to terminate the message.

  – BroadWorks User A hears an announcement indicating that the message was sent.

■ BroadWorks User A hangs up.

  – Call is released.

  – DUT MWI (audio and/or visual) is activated.

- Verify the SIP signaling to the DUT.

  – BroadWorks sends the DUT a NOTIFY with body containing *Messages-Waiting: No*.

  – BroadWorks sends the DUT a NOTIFY with body containing *Messages-Waiting: Yes*.

  – The *Call-ID* header in each SIP NOTIFY from BroadWorks contains a BroadWorks-generated Call-Id. (If it contains a DUT-generated Call-ID, it indicates the NOTIFY matches a subscription dialog, so the test case was not run correctly.)

48. **SERVICE – Message Waiting Indicator: Solicited, MWI Subscription (P1)**

This test case verifies that the DUT is able to successfully SUBSCRIBE for message-summary events.

Test setup:

- Configure the DUT to enable subscribed MWI.

Restart the DUT or otherwise trigger it to re-reregister or re-subscribe.

Verify the following:

- DUT is restarted.

  – DUT boots up and registers successfully.

  – DUT audio/visual MWI status is *off* or *on* based on the current BroadWorks user's MWI status.

- Verify the SIP signaling to and from the DUT.

  – DUT sends SUBSCRIBE request to BroadWorks with *Event: Message-Summary*.

  – BroadWorks responds with *200 OK*.

  – BroadWorks sends a NOTIFY request with *Event: Message-Summary*, S*ubscription-State: Active*, and *Content-Type: Application/Simple-Message-Summary*.

  – The NOTIFY content indicates *Messages-Waiting: Yes/No*.

  – DUT responds with *200 OK*.

49. **SERVICE – Message Waiting Indicator: Solicited, Refresh MWI Subscription (P1)**

This test case verifies that the DUT is able to successfully refresh the SUBSCRIBE for message-summary events before expiration of the SUBSCRIBE dialog. The DUT must re-subscribe before expiration as it does with REGISTER requests.

A refresh SUBSCRIBE request has the same *Event* header value and the same *Call-ID* header value as the initial SUBSCRIBE. It also has a tag value in the *To* header with the same value as returned by BroadWorks in the To tag of the *200 OK* response to the initial SUBSCRIBE request.

Test setup:

- Configure the DUT to enable subscribed MWI.

Restart the DUT or otherwise trigger it to re-register or re-subscribe. Wait for initial MWI SUBSCRIBE expiration.

Verify the following:

- DUT is restarted.

    – DUT boots up and registers successfully.

- Wait for initial SUBSCRIBE to expire.

- Verify the SIP signaling to and from the DUT.

    – DUT sends SUBSCRIBE request to BroadWorks with *Event: Message-Summary*.

    – BroadWorks responds with *200 OK*.

    – BroadWorks sends a NOTIFY request with *Event: Message-Summary*, S*ubscription-State: Active*, and *Content-Type: Application/Simple-Message-Summary*.

    – The NOTIFY content indicates *Messages-Waiting: Yes/No*.

    – DUT responds with *200 OK*.

    – DUT sends refresh SUBSCRIBE request to BroadWorks before initial SUBSCRIBE expiration, as identified in the *Expires* header from BroadWorks.

    – The refresh SUBSCRIBE request *To* header tag value matches the *200 OK* from BroadWorks for the initial SUBSCRIBE.

    – BroadWorks responds with *200 OK* with *Expires* header.

    – BroadWorks sends a NOTIFY request with *Event: Message-Summary*, S*ubscription-State: Active*, and *Content-Type: Application/Simple-Message-Summary*.

    – The NOTIFY content indicates *Messages-Waiting: Yes/No*.

    – DUT responds with *200 OK*.

50.   SERVICE – Message Waiting Indicator: Solicited, NOTIFY for MWI Status Change (P1)

This test case verifies the DUT's handling of MWI NOTIFY sent within the subscription dialog when the MWI status changes.

Clear the DUT's MWI. Originate a call from BroadWorks User A to the DUT. Do not answer the call. Allow the call to forward to voice mail. Leave a message.

Verify the following:

- DUT dials *99 to clear the MWI.

    – DUT hears IVR announcement indicating the MWI has been cleared.

    – MWI (audio and/or visual) on the DUT is deactivated.

- DUT hangs up.

- BroadWorks User A dials DUT.

    – DUT is alerted.

    – BroadWorks User A receives audible ringback.

    – BroadWorks User A is eventually transferred to voice mail and hears the DUT's *No Answer* greeting.

- BroadWorks User A follows the IVR instructions to leave a short message and presses # to terminate the message.
  - BroadWorks User A hears announcement indicating that the message was sent.
  - DUT's visual MWI is activated.
- BroadWorks User A hangs up.
  - Call is released.
- Verify the SIP signaling to the DUT.
  - BroadWorks sends the DUT a NOTIFY with body containing *Messages-Waiting: No.*
  - BroadWorks sends the DUT a NOTIFY with body containing *Messages-Waiting: Yes.*
  - The *Call-ID* header in each SIP NOTIFY from BroadWorks contains a Call-ID matching the Call-Id of the SUBSCRIBE.

51. SERVICE – Message Waiting Indicator: Update During Active Call (P1)

This test case verifies the DUT properly handles updating MWI when the MWI NOTIFY is received during an active call. It is acceptable for the MWI to update immediately (preferred for visual MWI) or after the active call has terminated.

Test setup:

- This test case can be run with either solicited or unsolicited MWI.
- In addition to the configuration identified as required at the beginning of this test section, make sure the DUT has the BroadWorks Call Waiting service assigned and enabled.

Originate a call from BroadWorks User A to the DUT. Answer the call. Originate a call from BroadWorks User B to the DUT. Do not answer the second call. Allow the call to forward to voice mail. Leave a message.

Verify the following:

- DUT dials *99 to clear the MWI.
  - DUT hears IVR announcement indicating the MWI has been cleared.
  - Visual MWI on the DUT is deactivated.
- DUT hangs up.
- BroadWorks User A dials DUT.
  - DUT is alerted.
  - BroadWorks User A receives audible ringback.
- DUT answers the call.
  - Two-way voice path is established between the DUT and BroadWorks User A.
- BroadWorks User B dials the DUT.
  - DUT hears call-waiting tone.
  - BroadWorks User B receives audible ringback.

- BroadWorks User B is eventually transferred to voice mail and hears the DUT's *Busy* greeting.

- ■ BroadWorks User B follows the IVR instructions to leave a short message and presses # to terminate the message.

  - BroadWorks User B hears announcement indicating that the message was sent.

  - DUT's visual MWI can be activated at this point.

- ■ BroadWorks User B hangs up call to Voice Portal.

  - Call is released.

- ■ DUT hangs up call with BroadWorks User A.

  - Call is released.

  - DUT now displays a visual MWI. If the DUT was already displaying visual MWI, then the MWI continues to be displayed when the DUT goes on-hook.

- ■ Verify the SIP signaling to the DUT.

  - BroadWorks sends the DUT a NOTIFY with body containing *Messages-Waiting: Yes*.

7.2.3 Voice Portal Outcall

This test section verifies the DUT's interoperability with BroadWorks for voice portal outcall in which a call is made to the BroadWorks voice portal and menu options are followed to call out to another user via the voice portal.

52. SERVICE – Voice Portal Outcall (P0)

This test case verifies the DUT's ability to outcall via the BroadWorks voice portal.

Test setup:

- ■ In addition to the configuration identified as required at the beginning of this test section, browse to *<user> → Voice Messaging* and make sure the DUT has the BroadWorks Voice Portal Calling service assigned and set to "On".

Originate a call from the DUT to the group voice portal number. Follow the IVR menu instructions to "make a call" to BroadWorks User A from the voice portal. After the call is answered, enter "##" to drop the call and return to the voice portal menu.

Verify the following:

- ■ DUT dials the Voice Portal number.

  - DUT is prompted for *passcode*.

- ■ DUT enters voice portal password as *passcode*.

  - DUT hears voice portal menu.

- ■ DUT follows IVR menu instructions to "make a call" to BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT hears ringback.

- ■ BroadWorks User A answers.

  - Two-way voice path is established.

- DUT enters "##" via the phone to return to the voice portal menu.
  - BroadWorks User A is released.
  - DUT hears voice portal options again.
- DUT hangs up to terminate the call.

7.3   BroadWorks Services – Advanced Alerting

This section tests the DUT's interoperability with BroadWorks Advanced Alerting services including the following:

- Ring Splash
- Priority Alert Ringing
- Priority Alert Call Waiting Tone
- Alternate Number Ringing
- Alternate Number Call Waiting Tone

BroadWorks uses the *Alert-Info* header to identify the Bellcore standard ring or call waiting tone for the DUT to use.

Example: *Alert-Info:<http://127.0.0.1/Bellcore-dr2>*

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: The BroadWorks services required in the following test cases have been pre-assigned to the users created for the initial account setup. Browse to the *Incoming Calls* tab and follow the instructions to configure each service.

53.   SERVICE – Ring Splash (P2)

This test case verifies the DUT's interoperability with BroadWorks for initial INVITE indicating ring splash.

Test setup:

1) Assign the BroadWorks Do Not Disturb service to the DUT.

2) Enable the Do Not Disturb service and select the *Play Ring Reminder* when a call is blocked check box.

Originate a local call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials the DUT.
  - DUT plays ring splash (short single ring).
  - BroadWorks User A hears busy treatment.
- Verify the signaling to the DUT.
  - BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr5>*.
  - BroadWorks sends CANCEL to the DUT.

54. SERVICE – Priority Alert Ringing (P2)

This test case verifies the DUT's interoperability with BroadWorks for distinctive ring via the BroadWorks Priority Alert feature.

Test setup:

1) Assign the BroadWorks Priority Alert service to the DUT.

2) Configure the Priority Alert service to trigger on calls from BroadWorks User A's extension.

Originate a call from BroadWorks User A to the DUT. Answer the call.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted with distinctive ring tone, usually a *Long-Long* double ring tone.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- Verify the signaling to the DUT.
    - BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr2>*.

55. SERVICE – Priority Alert Call Waiting Tone (P2)

This test case verifies the DUT's interoperability with BroadWorks for distinctive waiting tone via the BroadWorks Priority Alert feature.

Test setup:

1) Assign the BroadWorks Priority Alert service to the DUT.

2) Configure the Priority Alert service to trigger on calls from BroadWorks User A's extension.

3) Make sure the BroadWorks Call Waiting service is assigned to the DUT and is enabled.

Originate a call from BroadWorks User B to the DUT. Answer the call. Originate a call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User B dials the DUT.
    - DUT is alerted.
    - BroadWorks User B receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- BroadWorks User A dials the DUT.
    - DUT plays distinctive call waiting tone, usually a *Long-Long* double beep tone.
    - BroadWorks User A receives audible ringback.

■ Verify the signaling to the DUT.

- Intelligent SIP devices: BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr2>*.

- Non-intelligent SIP devices: BroadWorks sends SIP INFO to the DUT with application/BroadSoft message body containing *play tone CallWaitingTone2*.

56. SERVICE – Alternate Number Ringing (P2)

This test case verifies the DUT's interoperability with BroadWorks for distinctive ring via the BroadWorks Alternate Numbers feature.

Test setup:

1) Assign the BroadWorks Alternate Numbers service to the DUT.

2) Enable the Alternate Numbers service by selecting the *Distinctive Ring* check box.

3) Configure the Alternate Numbers service *Alternate Number ID 1* with a phone number and select the *Short-Short-Long* ring pattern.

4) Make sure the Priority Alert service is not enabled for the DUT.

Originate a call from BroadWorks User A to the A*lternate Number* for the DUT. Answer the call. Repeat for the *Short-Long-Short* ring pattern available in the Alternate Number service.

Verify the following:

■ BroadWorks User A dials the *Alternate Number* for the DUT.

- DUT is alerted with the configured ring pattern.

- BroadWorks User A receives audible ringback.

■ DUT answers the call.

- Two-way voice path is established.

■ Verify the signaling to the DUT.

- For *Short-Short-Long*, BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr3>*.

- For *Short-Long-Short*, BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr4>*.

57. SERVICE – Alternate Number Call Waiting Tone (P2)

This test case verifies the DUT's interoperability with BroadWorks for distinctive call waiting tone via the BroadWorks Alternate Numbers feature.

Test setup:

1) Assign the BroadWorks Alternate Numbers service to the DUT.

2) Enable the Alternate Numbers service by selecting the *Distinctive Ring* check box.

3) Configure the Alternate Numbers service *Alternate Number ID 1* with a phone number and select the *Short-Short-Long* ring pattern.

4) Make sure the *Priority Alert* service is not enabled for the DUT.

5) Make sure the BroadWorks Call Waiting service is assigned to the DUT and enabled.

Originate a call from BroadWorks User B to the DUT. Answer the call. Originate a call from BroadWorks User A to the DUT. Repeat for the *Short-Long-Short* ring pattern available in the Alternate Number service.

Verify the following:

- BroadWorks User B dials the DUT.

    - DUT is alerted.

    - BroadWorks User B receives audible ringback.

- DUT answers the call.

    - Two-way voice path is established.

- BroadWorks User A dials the A*lternate Number* for the DUT.

    - DUT hears call waiting tone with the configured ring pattern.

    - BroadWorks User A receives audible ringback.

- Verify the signaling for the second call to the DUT.

    - Intelligent SIP devices:

        - For *Short-Short-Long*, BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr3>*.

        - For *Short-Long-Short*, BroadWorks sends INVITE to the DUT with *Alert-Info:<http://127.0.0.1/Bellcore-dr4>*.

    - Non-intelligent SIP devices:

        - For *Short-Short-Long*, BroadWorks sends SIP INFO to the DUT with application/BroadSoft message body containing *play tone CallWaitingTone3.*

        - For *Short-Long-Short*, BroadWorks sends SIP INFO to the DUT with application/BroadSoft message body containing *play tone CallWaitingTone4.*

7.4 BroadWorks Services – Calling and Connected Line ID

This section tests the DUT's interoperability with Broad*Works for caller and connec*ted line ID presentation services including the following:

- Calling Name and Number

- Anonymous Call

- Calling Name with Unicode Characters

- Connected Line Presentation

- Connected Line Presentation with Unicode Characters

- Connected Line Restriction

7.4.1 Calling Line ID

This test section verifies the DUT's interoperability with BroadWorks for presentation of the calling line ID.

Test section setup:

1) Enable BroadWorks for Unicode characters in the SIP identity.

```
AS_CLI/SubscriberMgmt/SystemConfig/CallProcessing> set
useUnicodeIdentityName true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured with *useUnicodeIdentityName* set to "true".

2) Make sure that the following services are assigned and enabled for the BroadWorks user associated with the DUT. These services are configured from the *Incoming Calls* tab for the BroadWorks user. Browse to each service configuration page and make sure it is set to "On".

   – Internal Calling Line ID Delivery

   – External Calling Line ID Delivery

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Internal Calling Line ID Delivery and External Calling Line ID Delivery services are pre-assigned to the users created for the initial account setup. Browse to each service configuration page and make sure it is set to "On".

58. SERVICE – Calling Name and Number (P1)

This test case verifies the DUT's interoperability with BroadWorks for caller name and number presentation.

Test setup:

■ Browse to the *Profile* page for BroadWorks User A and verify the *First Name* and *Last Name*.

Originate a call from the BroadWorks User A to the DUT.

Verify the following:

■ BroadWorks User A dials the DUT.

   – DUT is alerted.

   – BroadWorks User A receives audible ringback.

   – DUT sees the Calling Name and Number (extension) for BroadWorks User A on the display of the DUT.

■ DUT answers the call.

   – Two-way voice path is established.

- Verify the SIP signaling to the DUT.
  - BroadWorks sends an INVITE to the DUT with *From* header: Example: *From:"Paulo Cerruto"<sip:1003@as.iop1.broadworks.net;user=phone>*.

59. SERVICE – Anonymous Call (P1)

This test case verifies the DUT's interoperability with BroadWorks for anonymous caller ID presentation.

Test setup:

1) Make sure BroadWorks User C is in a different BroadWorks group than the DUT. Caller ID is not blocked if the call is within the same group.

2) Assign the BroadWorks Calling Line ID Blocking service to BroadWorks User C.

3) Browse to the *Outgoing Calls → Line ID Blocking* page for BroadWorks User C. Enable the Calling Line ID Blocking service by selecting *Block Calling Line ID on Outgoing Calls*.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: Two BroadWorks groups are provided for testing on the Public Interoperability System. Make sure that BroadWorks User C is in the second group and the DUT is in the first group.

Originate a call from the BroadWorks User C to the DUT.

Verify the following:

- BroadWorks User C dials the DUT.
  - DUT is alerted.
  - BroadWorks User C receives audible ringback.
  - DUT sees "Private" or "Anonymous" as the identity for BroadWorks User C on the display of the DUT.
- DUT answers the call.
  - Two-way voice path is established.
- Verify the SIP signaling to the DUT.
  - BroadWorks sends an INVITE to the DUT with *From* header: *From:"Anonymous"<sip:anonymous@anonymous.invalid>*.

60. SERVICE – Calling Name with Unicode Characters (P1)

This test case verifies the DUT's interoperability with BroadWorks for presentation of a caller name containing Unicode characters. This allows for presentation of non-ASCII characters used in languages other than English.

Test setup:

1) Browse to the *Profile* page for BroadWorks User A.

2) Set BroadWorks User A's *First Name* to a name containing one or more Unicode characters. Example: Björk, François.

3) Set BroadWorks User A's *Last Name* to a name containing one or more Unicode characters. Example: Guðmundsdóttir, Saint-Saëns.

Originate a call from the BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials the DUT.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

  - DUT sees the Calling Name for BroadWorks User A on the display of the DUT. The Unicode characters in the Calling Name are properly displayed.

- DUT answers the call.

  - Two-way voice path is established.

- Verify the SIP signaling to the DUT.

  - BroadWorks sends an INVITE to the DUT with *From* header containing Unicode characters: Example: *From:" Björk Guðmundsdóttir "<sip:1003@as.iop1.broadworks.net;user=phone>*.

7.4.2 Connected Line ID

This test section verifies the DUT's interoperability with BroadWorks for presentation of the connected line ID.

The Connected Line Identification Presentation (COLP) service provides the calling party with the ability to be presented with the identity of the connected party, which may or may not be the dialed party.

The Connected Line Identification Restriction (COLR) service provides the terminating party with the ability to prevent the presentation of their identity to the calling party via COLP.

Test section setup:

1) Make sure the BroadWorks privacyVersion setting is *RFC 3323*.

```
AS_CLI/Interface/SIP> set privacyVersion RFC3323
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured with the *privacyVersion* set to "RFC3323".

2) Enable BroadWorks for Unicode characters in the SIP identity.

```
AS_CLI/SubscriberMgmt/SystemConfig/CallProcessing> set
useUnicodeIdentityName true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured with *useUnicodeIdentityName* set to "true".

3) Make sure that the following services are assigned and enabled for the BroadWorks user associated with the DUT. The Internal and External Calling Line ID services are configured from the *Incoming Calls* tab for the BroadWorks user. Browse to each service configuration page and make sure it is set to "On".

- Internal Calling Line ID Delivery

- External Calling Line ID Delivery

- Connected Line Identification Presentation

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: These services are pre-assigned to the users created for the initial account setup. Browse to *Internal and External Calling Line ID Delivery* service configuration pages to verify each setting is "On".

Note that the *Connected Line Identification Presentation* is included in the Advanced Features/service pack. The service has no configuration, so does not show anywhere in the user's services.

61. SERVICE – Connected Line Presentation (P2)

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in an 18x message.

Test setup:

1) Browse to the *Profile* page for BroadWorks User A and verify the *First Name* and *Last Name*.

Originate a call from the DUT to BroadWorks User A. Answer the call after a few rings. Disconnect the call from the DUT.

Verify the following:

- DUT dials the extension of BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

  - DUT phone display updates with BroadWorks User A's name and number.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- DUT hangs up.

  - The call is released.

- Verify the SIP signaling to the DUT.

  - The 18x message from BroadWorks to the DUT contains a *P-Asserted-Identity* header with the called party's name and number. This name and number is then displayed on the DUT phone.

  - The 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none".

62. SERVICE – Connected Line Presentation with Unicode Characters (P2)

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in an 18x message and containing Unicode characters.

Test setup:

1) Browse to the *Profile* page for BroadWorks User A.

2) Set BroadWorks User A's *First Name* to a name containing one or more Unicode characters. Examples: Björk, François.

3) Set BroadWorks User A's *Last Name* to a name containing one or more Unicode characters. Examples: Guðmundsdóttir, Saint-Saëns.

Originate a call from the DUT to BroadWorks User A. Answer the call after a few rings. Disconnect the call from the DUT.

Verify the following:

■ DUT dials the extension of BroadWorks User A.

– BroadWorks User A is alerted.

– DUT receives audible ringback.

– DUT phone display updates with BroadWorks User A's name and number and properly displays the Unicode characters in User A's calling name.

■ BroadWorks User A answers the call.

– Two-way voice path is established.

■ DUT hangs up.

– The call is released.

■ Verify the SIP signaling to the DUT.

– The 18x message from BroadWorks to the DUT contains a *P-Asserted-Identity* header with the called party's name and number. This name and number is then displayed on the DUT phone. The name contains Unicode characters.

Example: *P-Asserted-Identity:" Björk Guðmundsdóttir "<sip:1003@as.iop1.broadworks.net>*

– The 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none".

63. SERVICE – Connected Line Restriction (P2)

This test case demonstrates the ability for the DUT to update the caller ID display to indicate a restricted number, based on called party information received in an 18x message.

Test setup:

1) Make sure BroadWorks User C is in a different BroadWorks group than the DUT.

2) Assign the Connected Line Identification Restriction service to BroadWorks User C.

3) Configure the Connected Line Identification Restriction service under the user's *Incoming Calls* tab to set *Enable Connected Line Identification Restriction* to "On".

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: Two BroadWorks groups are provided for testing on the Public Interoperability System. Make sure that BroadWorks User C is in the second group and the DUT is in the first group.

The *Connected Line Identification Restriction* service is pre-assigned to the users created for the initial account setup as part of the *Advanced Features/*service pack.

Originate a call from the DUT to BroadWorks User C. Answer the call after a few rings. Disconnect the call from the DUT.

Verify the following:

- DUT dials the number of BroadWorks User C.

    - BroadWorks User C is alerted.

    - DUT receives audible ringback.

    - DUT phone display updates, indicating a restricted number.

- BroadWorks User C answers the call.

    - Two-way voice path is established.

- DUT hangs up.

    - The call is released.

- Verify the SIP signaling to the DUT.

    - The 18x message from BroadWorks to the DUT contains a *Privacy* header set to "id".

64.   **SERVICE – Connected Line Presentation After Call Forward (P2)**

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in an 18x message in a forwarding scenario. The display updates for the original call party and for the forward-to party.

Test setup:

1) Browse to the *Profile* page for BroadWorks User A and verify the *First Name* and *Last Name*.

2) From BroadWorks User A's *Profile* tab, select Call Policies. Set *Connected Line Identification Privacy* on Redirected Calls to *No Privacy*.

3) Enable *Call Forwarding No Answer* for BroadWorks User A and configure to forward to BroadWorks User B after four or more rings.

4) Browse to the *Profile* page for BroadWorks User B and verify the *First Name* and *Last Name*.

Originate a call from the DUT to BroadWorks User A. Allow the call to forward to BroadWorks User B. Answer the call after a few rings. Disconnect the call from the DUT.

Verify the following:

- DUT dials BroadWorks User A.

    - BroadWorks User A is alerted.

    - DUT receives audible ringback.

- DUT phone display updates with BroadWorks User A's name and number.

■ The call forwards BroadWorks User B.

- BroadWorks User B is alerted.

- DUT receives audible ringback.

- DUT phone display updates with BroadWorks User B's name and number.

■ BroadWorks User B answers the call.

- Two-way voice path is established.

■ DUT hangs up.

- The call is released.

■ Verify the SIP signaling to and from the DUT.

- The first 18x message from BroadWorks to the DUT contains a *P-Asserted-Identity* header with BroadWorks User A's name and number. This name and number is then displayed on the DUT phone.

- The second 18x message from BroadWorks to the DUT contains a *P-Asserted-Identity* header with BroadWorks User B's name and number. This name and number is then displayed on the DUT phone.

- Each 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none".

65. **SERVICE – Connected Line Restriction After Call Forward (P2)**

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in an 18x message in a forwarding scenario. The display updates for the original call party but shows restricted for the forward-to party.

Test setup:

1) Browse to the *Profile* page for BroadWorks User A and verify the *First Name* and *Last Name*.

2) From BroadWorks User A's *Profile* tab, select Call Policies. Set *Connected Line Identification Privacy* on Redirected Calls to *No Privacy*.

3) Enable *Call Forwarding No Answer* for BroadWorks User A and configure to forward to BroadWorks User C after four or more rings.

4) Make sure BroadWorks User C is in a different BroadWorks group than the DUT.

5) Assign the Connected Line Identification Restriction service to BroadWorks User C.

6) Configure the Connected Line Identification Restriction service under the user's *Incoming Calls* tab to set *Enable Connected Line Identification Restriction* to "On".

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: Two BroadWorks groups are provided for testing on the Public Interoperability System. Make sure that BroadWorks User C is in the second group and the DUT is in the first group.

The *Connected Line Identification Restriction* service is pre-assigned to the users created for the initial account setup as part of the *Advanced Features/*service pack.

Originate a call from the DUT to BroadWorks User A. Allow the call to forward to BroadWorks User C. Answer the call after a few rings. Disconnect the call from the DUT.

Verify the following:

- DUT dials BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

  - DUT phone display updates with BroadWorks User A's name and number.

- Call forwards to BroadWorks User C.

  - BroadWorks User C is alerted.

  - DUT receives audible ringback.

  - DUT phone display updates, indicating a restricted number.

- BroadWorks User C answers the call.

  - Two-way voice path is established.

- DUT hangs up.

  - The call is released.

- Verify the SIP signaling to and from the DUT.

  - The first 18x message from BroadWorks to the DUT contains a *P-Asserted-Identity* header with BroadWorks User A's name and number. This name and number is then displayed on the DUT phone.

  - The first 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none"*.*

  - The second 18x message from BroadWorks to the DUT contains a *Privacy* header set to "id".

66. SERVICE – Connected Line Presentation on UPDATE (P2)

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in an UDPATE. This can occur in a consultative transfer before answer scenario.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that *Support Identity In UPDATE and Re-INVITE* is checked.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Assign the following BroadWorks device type to the DUT for this test case: *Generic SIP Phone – Connected Identity*.

2) Browse to the *Profile* page for BroadWorks Users A and B and verify the *First Name* and *Last Name*.

Originate a call from the DUT to BroadWorks User A. Answer the call after a few rings. Initiate a call from BroadWorks User A to User B. Do not answer the call. Transfer the

DUT to BroadWorks user B (before answer). Answer the call. Disconnect the call from the DUT.

Verify the following:

- DUT dials the extension of BroadWorks User A.

    - BroadWorks User A is alerted.

    - DUT receives audible ringback.

    - DUT phone display updates with BroadWorks User A's name and number.

- BroadWorks User A answers the call.

    - Two-way voice path is established.

- BroadWorks User A dials the extension of BroadWorks User B.

    - BroadWorks User B is alerted.

- BroadWorks User A transfers the DUT to BroadWorks User B.

    - DUT receives audible ringback.

    - DUT phone display updates with BroadWorks User B's name and number.

- BroadWorks User B answers the call.

    - Two-way voice path is established.

- DUT hangs up.

    - The call is released.

- Verify the SIP signaling to the DUT.

    - The 18x message from BroadWorks for User A to the DUT contains a *P-Asserted-Identity* header with the called party's name and number. This name and number is then displayed on the DUT phone. The 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none".

    - When BroadWorks User B is ringing, BroadWorks sends an UPDATE message to the DUT. The UPDATE contains a *P-Asserted-Identity* header with User B's name and number. This name and number is then displayed on the DUT phone. The UPDATE message from BroadWorks to the DUT contains a *Privacy* header set to "none".

67. SERVICE – Connected Line Presentation on Re-INVITE (P2)

This test case demonstrates the ability for the DUT to update the caller ID display based on called party information received in a Re-INVITE message. This can occur in a consultative transfer after answer scenario.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that *Support Identity In UPDATE and Re-INVITE* is checked.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Assign the following BroadWorks device type to the DUT for this test case: *Generic SIP Phone – Connected Identity*.

2) Browse to the *Profile* page for BroadWorks Users A and B and verify the *First Name* and *Last Name*.

Originate a call from the DUT to BroadWorks User A. Answer the call after a few rings. Initiate a call from BroadWorks User A to User B. Answer the call. Transfer the DUT to BroadWorks user B. Disconnect the call from the DUT.

Verify the following:

- DUT dials the extension of BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

  - DUT phone display updates with BroadWorks User A's name and number.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- BroadWorks User A dials the extension of BroadWorks User B.

  - BroadWorks User B is alerted.

- BroadWorks User B answers the call.

  - Two-way voice path is established.

- BroadWorks User A transfers the DUT to BroadWorks User B.

  - DUT phone display updates with BroadWorks User B's name and number.

  - Two-way voice path is established.

- DUT hangs up.

  - The call is released.

- Verify the SIP signaling to the DUT.

  - The 18x message from BroadWorks for User A to the DUT contains a *P-Asserted-Identity* header with the called party's name and number. This name and number is then displayed on the DUT phone. The 18x message from BroadWorks to the DUT contains a *Privacy* header set to "none".

  - After the transfer, BroadWorks sends a Re-INVITE message to the DUT. The Re-INVITE contains a *P-Asserted-Identity* header with User B's name and number. This name and number is then displayed on the DUT phone. The re-INVITE message from BroadWorks to the DUT contains a *Privacy* header set to "none".

7.5   BroadWorks Services – Diversion and History-Info

This section tests the DUT's interoperabilit*y with BroadWorks fo*r receiving redirected call information via *Diversion* and *History-Info* headers. Tests are included for the following:

- *Diversion* header

- *History-Info* header

*Br*oadWorks supports sending/receiving redirected call information by use of either the *Diversion* header, per *draft-levy-sip- diversion-08*, or the *History-Info* header, per *RFC 4244*. It is not required for the DUT to support both implementations. If one of the implementations is not supported, the relevant test cases should be identified as "Not Supported".

68. SERVICE – *Diversion* Header (P1)

This test case verifies that the DUT's interoperability with BroadWorks for handling an INVITE with a *Diversion* header.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that *Use History Info* header is not checked.

2) Configure the Call Forward Always service for BroadWorks User B to forward to the DUT.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Typically, the device type assigned when the accounts are created does not have the *Use History Info* header parameter checked. However, if this test case is executed and BroadWorks sends *History-Info* rather than *Diversion*, change the device type assigned to the DUT to *Generic SIP Phone*.

Originate a call from BroadWorks User A to BroadWorks User B. The DUT should be alerted. DUT answers the call. DUT releases the call.

Verify the following:

- BroadWorks User A dials BroadWorks User B.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

- DUT answers the call.

  - Two-way voice path is established between BroadWorks User A and the DUT.

- Verify the SIP signaling to the DUT.

  - BroadWorks sends an INVITE to the DUT with a *Diversion* header.

    Example:

    ```
    Diversion:"Bob
    Cleary"<sip:5551231015@as.broadworks.net;user=phone>;reason=unco
    nditional;counter=1
    ```

69. SERVICE – Diversion Header: Multiple Redirects (P1)

This test case verifies that the DUT's interoperability with BroadWorks for handling multiple comma-separated redirects in a single *Diversion* header as allowed by *RFC 3261*.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that *Use History Info* header is not checked.

2) Configure the Call Forward Always service for BroadWorks User B to forward to BroadWorks User C.

3) Configure the Call Forward Always service for BroadWorks User C to forward to the DUT.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Typically, the device type assigned when the accounts are created does not have the *Use History Info* header parameter checked. However, if this test case is executed and BroadWorks sends *History-Info* rather than *Diversion*, change the device type assigned to the DUT to *Generic SIP Phone*.

Originate a call from BroadWorks User A to BroadWorks User B. The DUT should be alerted. DUT answers the call. DUT releases the call.

Verify the following:

- BroadWorks User A dials BroadWorks User B.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT answers the call.

  – Two-way voice path is established between BroadWorks User A and the DUT.

- Verify the SIP signaling to the DUT.

  – BroadWorks sends an INVITE to the DUT with a *Diversion* header that contains two comma-separated diversion entries.

    Example:

```
Diversion:"Bob
Cleary"<sip:5551231015@as.broadworks.net;user=phone>;reason=unco
nditional;counter=1,"Beverly
Sauder"<sip:5551231019@as.broadworks.net;user=phone>;reason=unco
nditional;counter=1
```

70. **SERVICE – History-Info Header (P1)**

This test case verifies that the DUT's interoperability with BroadWorks for handling an INVITE with a *History-Info* header.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. The following parameters must be selected:

   – Standard Options: *Use History Info*

   – Advanced Options: *Support Cause Parameter*

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS**: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Assign the following BroadWorks device type to the DUT for this test case: *Generic SIP Phone – History Info*.

2) Log in to the BroadWorks Application Server CLI and set the following.

```
AS_CLI/Interface/SIP> set enableRFC6044 true
```

3) Configure the Call Forward Always service for BroadWorks User B to forward to the DUT.

Originate a call from BroadWorks User A to BroadWorks User B. The DUT should be alerted. DUT answers the call. DUT releases the call.

Verify the following:

- BroadWorks User A dials BroadWorks User B.

    - DUT is alerted.

    - BroadWorks User A receives audible ringback.

- DUT answers the call.

    - Two-way voice path is established between BroadWorks User A and the DUT.

- Verify the SIP signaling to the DUT.

    - The INVITE from BroadWorks to the DUT contains the *cause* parameter in the Request-URI.

        Example:

        ```
        INVITE sip:2403646224@10.16.129.20:5060;user=phone;cause=302
        SIP/2.0
        ```

    - The INVITE from BroadWorks to the DUT contains a *History-Info* header.

        Example:

        ```
        History-Info:"Bob
        Smith"<sip:2403646224@as.iop1.broadworks.net;user=phone?
        Reason=SIP%3btext%3d%22Moved%20Temporarily%22%3bcause%3d302%2cDi
        version%3btext%3d%22unconditional%22>;index=1,<sip:2403646223@64
        .215.212.89;cause=302>;index=1.1
        ```

71. SERVICE – *History-Info* Header: Multiple Redirects (P1)

This test case verifies that the DUT's interoperability with BroadWorks for handling a *History-Info* header with multiple redirects.

Test setup:

1) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. The following parameters must be selected:

    - Standard Options: *Use History Info*

    - Advanced Options: *Support Cause Parameter*

2) Log in to the BroadWorks Application Server CLI and set the following.

```
AS_CLI/Interface/SIP> set enableRFC6044 true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted. The Public Interoperability System is preconfigured with *enableRFC6044* set to "true".

3) Configure the Call Forward Always service for BroadWorks User B to forward to BroadWorks User C.

4) Configure the Call Forward Always service for BroadWorks User C to forward to the DUT.

Originate a call from BroadWorks User A to BroadWorks User B. The DUT should be alerted. DUT answers the call. DUT releases the call.

Verify the following:

- BroadWorks User A dials BroadWorks User B.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

- DUT answers the call.

  - Two-way voice path is established between BroadWorks User A and the DUT.

- Verify the SIP signaling to the DUT.

  - The INVITE from BroadWorks to the DUT contains the *cause* parameter in the Request-URI.

    Example:

    ```
    INVITE sip:2403646225@10.16.129.20:5060;user=phone;cause=302
    SIP/2.0
    ```

  - The INVITE from BroadWorks to the DUT contains a *History-Info* header that contains comma-separated entries.

    Example:

    ```
    History-Info:"Carlos
    Bonilla"<sip:2403646225@as.iop1.broadworks.net;user=phone?
    Reason=SIP%3btext%3d%22Moved%20Temporarily%22%3bcause%3d302%2cDi
    version%3btext%3d%22unconditional%22>;index=1,"Bob
    Smith"<sip:2403646224@as.iop1.broadworks.net;user=phone;cause=30
    2?Reason=SIP%3btext%3d%22Moved%20Temporarily%22%3bcause%3d302%2c
    Diversion%3btext%3d%22unconditional%22>;index=1.1,<sip:240364622
    3@64.215.212.89;cause=302>;index=1.1.1
    ```

7.6 BroadWorks Services – Advice of Charge

This section tests the DUT's interoperability with BroadWorks for Advice of Charge (AoC) functionality. The Advice of Charge feature enables BroadWorks to send information to the access device during and/or at the end of a call regarding the current charge for the call. BroadWorks implements the 3GPP specification for sending AoC information to the access device in the form of XML embedded within an SIP message.

BroadWorks supports AoC-D (during a call) and AoC-E (end of call) functionality.

AoC-D

BroadWorks sends a SIP INFO message containing an XML body with current charge information periodically during the call. At the end of the call, BroadWorks sends a final XML body with total charge information in the BYE or *200 OK*, depending on which end generates the BYE.

AoC-E

At the end of the call, BroadWorks sends a final XML body with total charge information in the BYE or *200 OK*, depending on which end generates the BYE.

It is the responsibility of the access device to decode and process the resulting AoC body (included in the SIP messages container) and then present the information to the user.

Test section setup:

The BroadWorks Application Server must be configured to obtain tariff information from the BroadWorks Rating Function (RFN) application or a third-party Online Charging System (OCS). For administrators performing this configuration, see *BroadWorks Diameter, Rf, Ro, and Sh Interfaces Configuration Guide* [9] and *BroadWorks Rf/Ro Interface Specification* [8].

The following steps provide the basic Application Server settings required. The RFN application configuration is not provided here.

1) Log in to the BroadWorks Application Server CLI and traverse the menu to the following:

```
AS_CLI/Interface/Diameter/Peers>
```

2) Add the BroadWorks RFN as a billing server peer.

```
AS_CLI/Interface/Diameter/Peers> add <instance> <identity>
<port> <enabled> ipAddress <ipAddress>
```

- *instance*: The BroadWorks process (xs or ps) for which the realm routing table is displayed.

- *identity*: Diameter identity of the peer. This is the value that the peer uses to populate the Origin-Host AVP. Set to the FQDN for the BroadWorks XSP running the RFN application.

- *port*: The TCP port on which the peer is listening for Diameter connections.

- *enabled*: indicates if connection the peer will be established.

- *ipAddress*: IP address of the peer. This is optional. If not specified, DNS is used on the *identity* to obtain the IP address. Set it to the XSP IP address.

Example:

```
AS_CLI/Interface/Diameter/Peers> add xs
xsp1.iop1.broadworks.net 3868 true ipAddress 199.19.193.16
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted. The Public Interoperability System is preconfigured with the BroadWorks Rating Function as a Diameter peer.

3) Traverse the menu to:

```
AS_CLI/Service/AdviceOfCharge>
```

4) Configure Advice of Charge parameters as follows.

- *delayBetweenNotificationsInSeconds*: Set to "60" seconds. This controls how frequently the endpoint receives notifications.

- *incomingAocHandling*: Set to "ignore" to enable BroadWorks to ignore tariff information sent in a SIP INFO message.

- *useOCSEnquiry*: Set to "true" to enable OCS enquiry for Advice of Charge tariff information.

- *OCSEnquiryType*:

  - Set to "Service Price" if using the BroadWorks Rating Function (RFN) application as the cost information source.

  - Set to "AoC" if using an Online Charging System (OCS) as the cost information source.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted. The Public Interoperability System Advice of Charge settings are preconfigured.

5) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that *Advice of Charge Capable* is checked.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Assign the following BroadWorks device type to the DUT for this test case: *Generic SIP Phone – Advice of Charge*.

6) Assign the Advice of Charge feature to the DUT.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Advice of Charge feature is pre-assigned to the preconfigured users provided in the initial account setup.

7) As group administrator, browse *Call Control → Advice of Charge* for the DUT. Set the parameters as follows, and then click **OK** to save.

- Advice of Charge: On

- Type: The required setting is specified in each test case.

8) As group administrator, browse to *Services → Advice of Charge* for the group. Set the parameters as follows and then click **OK** to save.

- Use Service Provider Settings: Selected

  or

- Use Group Settings: Selected

– Delay between AoC-D notifications: 60

72. **SERVICE – AoC-D Currency (P2)**

This test case verifies the DUT's interoperability with BroadWorks for Advice of Charge during the call (AoC-D) for a charged call.

Test setup:

1) Make sure BroadWorks User C is not in the same group as the DUT.

2) As group administrator, browse to the *Call Control → Advice of Charge* page for the DUT. Set the *Type* to *During Call*, and then click **OK** to save.

Originate a local call from the DUT to BroadWorks User C. Leave the call up for four minutes. Hang up the call from the DUT phone.

Verify the following:

■ DUT dials BroadWorks User C.

– BroadWorks User C is alerted.

– DUT hears ringback.

■ BroadWorks User C answers the call.

– There is two-way voice path.

– DUT displays the charge information to the user, updating every 60 seconds.

■ DUT hangs up the call after four minutes.

– DUT displays final charge information to the user.

– The call is cleared.

■ Verify the signaling to the DUT.

– BroadWorks sends an INFO message with XML body containing charge information every 60 seconds. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
  <aoc-d>
    <charging-info>subtotal</charging-info>
    <recorded-charges>
      <recorded-currency-units>
        <currency-id>EUR</currency-id>
        <currency-amount>1.0</currency-amount>
      </recorded-currency-units>
    </recorded-charges>
<billing-id>normal-charging</billing-id>
  </aoc-d>
</aoc>
```

– BroadWorks sends the final charge information in the *200 OK* to the BYE request from the DUT. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
  <aoc-d>
    <charging-info>total</charging-info>
    <recorded-charges>
      <recorded-currency-units>
        <currency-id>EUR</currency-id>
```

```
        <currency-amount>4.1</currency-amount>
      </recorded-currency-units>
    </recorded-charges>
<billing-id>normal-charging</billing-id>
  </aoc-d>
</aoc>
```

73.   SERVICE – AoC-D Free (P2)

This test case verifies the DUT's interoperability with BroadWorks for Advice of Charge during the call (AoC-D) for a free call.

Test setup:

1) Make sure BroadWorks User A is in the same group as the DUT.

2) As group administrator, browse to the *Call Control → Advice of Charge* page for the DUT. Set the *Type* to *During Call*, and then click **OK** to save.

Originate a local call from the DUT to BroadWorks User A. Leave the call up for two minutes. Hang up the call from BroadWorks User A phone.

Verify the following:

- ■ DUT dials BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT hears ringback.

- ■ BroadWorks User A answers the call.

  – There is two-way voice path.

  – DUT displays the charge information to the user.

- ■ BroadWorks User A hangs up the call after two minutes.

  – DUT displays final charge information to the user.

  – The call is cleared.

- ■ Verify the signaling to the DUT.

  – BroadWorks sends an INFO message with XML body containing charge information after 60 seconds. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
 <aoc-d>
  <charging-info>subtotal</charging-info>
  <recorded-charges>
   <recorded-currency-units>
    <currency-id>EUR</currency-id>
    <currency-amount>0.0</currency-amount>
   </recorded-currency-units>
  </recorded-charges>
  <billing-id>normal-charging</billing-id>
 </aoc-d>
</aoc>
```

  – BroadWorks sends the final charge information in the BYE request to the DUT. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
 <aoc-d>
  <charging-info>total</charging-info>
  <recorded-charges>
   <recorded-currency-units>
    <currency-id>EUR</currency-id>
    <currency-amount>0.0</currency-amount>
   </recorded-currency-units>
  </recorded-charges>
  <billing-id>normal-charging</billing-id>
 </aoc-d>
</aoc>
```

74. **SERVICE – AoC-E Currency (P2)**

This test case verifies the DUT's interoperability with BroadWorks for Advice of Charge at the end of the call (AoC-E) for a charged call.

Test setup:

1) Make sure BroadWorks User C is not in the same group as the DUT.

2) As group administrator, browse to the *Call Control → Advice of Charge* page for the DUT. Set the *Type* to *End of Call*, and then click **OK** to save.

Originate a local call from the DUT to BroadWorks User C. Leave the call up for four minutes. Hang up the call from the DUT phone.

Verify the following:

■ DUT dials BroadWorks User C.

  – BroadWorks User C is alerted.

  – DUT hears ringback.

■ BroadWorks User C answers the call.

  – There is two-way voice path.

■ DUT hangs up the call after four minutes.

  – DUT displays final charge information to the user.

  – The call is cleared.

■ Verify the signaling to the DUT.

  – BroadWorks sends the final charge information in the *200 OK* to the BYE request from the DUT. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
  <aoc-e>
    <recorded-charges>
      <recorded-currency-units>
        <currency-id>EUR</currency-id>
        <currency-amount>4.1</currency-amount>
      </recorded-currency-units>
    </recorded-charges>
    <billing-id>normal-charging</billing-id>
  </aoc-e>
</aoc>
```

75. SERVICE – AoC-E Free (P2)

This test case verifies the DUT's interoperability with BroadWorks for Advice of Charge at the end of the call (AoC-E) for a free call.

Test setup:

1) Make sure BroadWorks User A is in the same group as the DUT.

2) As group administrator, browse to the *Call Control → Advice of Charge* page for the DUT. Set the *Type* to *End of Call*, and then click **OK** to save.

Originate a local call from the DUT to BroadWorks User A. Leave the call up for two minutes. Hang up the call from BroadWorks User A phone.

Verify the following:

- DUT dials BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT hears ringback.

- BroadWorks User A answers the call.

  – There is two-way voice path.

  – DUT displays the charge information to the user.

- BroadWorks User A hangs up the call after two minutes.

  – DUT displays final charge information to the user.

  – The call is cleared.

- Verify the signaling to the DUT.

  – BroadWorks sends the final charge information in the BYE request to the DUT. Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<aoc xmlns="http://uri.etsi.org/ngn/params/xml/simservs/aoc">
 <aoc-e>
  <recorded-charges>
   <recorded-currency-units>
    <currency-id>EUR</currency-id>
    <currency-amount>0.0</currency-amount>
   </recorded-currency-units>
  </recorded-charges>
  <billing-id>normal-charging</billing-id>
 </aoc-e>
</aoc>
```

7.7 BroadWorks Services – Meet-Me Conferencing

This section tests the DUT's interoperability with BroadWorks Meet-Me audio conferencing including the following:

- Meet-Me Conference
- Meet-Me Conference – G722
- Meet-Me Conference – AMR-WB
- Meet-Me Conference – Opus

Test section setup:

1) Assign the Meet Me Conferencing feature to the DUT's BroadWorks group.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Meet Me Conferencing feature is pre-assigned to the preconfigured groups provided in the initial account setup.

2) Configure the BroadWorks group with a *Meet-Me Conference Bridge*. As group administrator, browse to *Meet-Me Conferencing → Meet-Me Conference Bridges*. Select **Add** to add a new bridge. Set the following:

   – Conference Bridge ID: example: Bridge1

   – Name: example: AccountingBridge

   – Calling Line ID Last Name: example: Accounting

   – Calling Line ID First Name: example: Bridge

   – Allocated Ports To This Bridge: at least 4

   – Conference Hosts: add the DUT user as a conference host

3) Activate the bridge. Browse to *Meet-Me Conferencing → Meet-Me Conference Bridges*. Select the bridge created in the previous step. Browse to Addresses and supply a *phone number* and *extension* for the bridge. Click **Apply**. Browse to *Meet-Me Conferencing → Meet-Me Conference Bridges* and make sure that the bridge *Active* flag is checked.

4) Browse to *Group → Users*. Select the DUT BroadWorks user. Browse to *Meet-Me Conferencing* for the DUT. (*Meet Me Conferencing* does not appear if no bridges have been created with the DUT as a host.) Select *Conferences*. Then select **Add** to add a new conference. Set the following:

   – Title: Example: MyConference

   – Type: Reservationless

   – Schedule Start Date: Select today's date

   – Schedule End Date: Never

Select **OK** to create the conference. After the conference is created, select the conference and note the *Conference ID* number.

76. SERVICE – Meet-Me Conference (P0)

This test case verifies the DUT's interoperability with BroadWorks for Meet-Me Conference using G711.

Test setup:

1) Make sure the DUT's G711 codec is enabled as the preferred codec. Disable the DUT's G722 and AMR-WB codecs.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the G711 codec enabled as the preferred codec. Disable each phone's G722 and AMR-WB codecs.

3) Make sure the BroadWorks Media Server G711 codec is enabled.

```
MS_CLI/Applications/MediaStreaming/Services/Conferencing
/Codecs> get
   Codecs
=========
     ulaw
     g722
     alaw
  g726-32
   amr-wb
     opus
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The G711 codec is pre-enabled on the interoperability system BroadWorks Media Servers.

Originate a call from the DUT to the group's Meet-Me conference bridge number. Enter the conference ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference. From the DUT enter *1 to mute and then *1 to unmute.

Verify the following:

- DUT dials the group's Meet-Me conference bridge number.

    – DUT provides the conference ID number when requested.

    – DUT is joined to the conference.

- Repeat for BroadWorks Users A, B, and C.

    – All parties are in conference and can hear each other.

- From the DUT, enter *1 to mute.

    – DUT cannot be heard by other parties.

- From the DUT, enter *1 to unmute.

    – DUT can be heard by other parties.

- DUT hangs up.

- BroadWorks Users A, B, and C hang up.

- Verify the signaling to the DUT.

    – Make sure the G711 codec is negotiated for the DUT.

77. SERVICE – Meet-Me Conference – G722 (P1)

This test case verifies the DUT's interoperability with BroadWorks for Meet-Me Conference using the G722 codec. This test case applies only if the DUT supports the G722 codec.

Test setup:

1) Make sure the DUT's G722 codec is enabled as the preferred codec. Disable the DUT's AMR-WB codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the G722 codec enabled as the preferred codec. Disable each phone's AMR-WB codec.

3) Make sure the BroadWorks Media Server G722 codec is enabled.

```
MS_CLI/Applications/MediaStreaming/Services/Conferencing
/Codecs> get
    Codecs
  =========
      ulaw
      g722
      alaw
   g726-32
    amr-wb
      opus
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The G722 codec is pre-enabled on the interoperability system BroadWorks Media Servers.

Originate a call from the DUT to the group's Meet-Me conference bridge number. Enter the conference ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference. From the DUT, enter *1 to mute, then *1 to unmute.

Verify the following:

■ DUT dials the group's Meet-Me conference bridge number.

   – DUT provides the conference ID number when requested.

   – DUT is joined to the conference.

■ Repeat for BroadWorks Users A, B, and C.

   – All parties are in conference and can hear each other.

■ From the DUT, enter *1 to mute.

   – DUT cannot be heard by other parties.

■ From the DUT, enter *1 to unmute.

   – DUT can be heard by other parties.

■ DUT hangs up.

■ BroadWorks Users A, B, and C hang up.

■ Verify the signaling to the DUT.

   – Make sure the G722 codec is negotiated for the DUT.

78. SERVICE – Meet-Me Conference – AMR-WB (P1)

This test case verifies the DUT's interoperability with BroadWorks for Meet-Me Conference using the AMR-WB codec. This test case applies only if the DUT supports the AMR-WB codec. Note that this codec is also known as G722.2.

Test setup:

1) Make sure the DUT's AMR-WB codec is enabled as the preferred codec. Disable the DUT's G722 codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the AMR-WB codec enabled as the preferred codec. Disable each phone's G722 codec.

3) Make sure the BroadWorks Media Server AMR-WB codec is enabled.

```
MS_CLI/Applications/MediaStreaming/Services/Conferencing
/Codecs> get
   Codecs
=========
    ulaw
    g722
    alaw
  g726-32
  amr-wb
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The AMR-WB codec is pre-enabled on the interoperability system BroadWorks Media Servers.

Originate a call from the DUT to the group's Meet-Me conference bridge number. Enter the conference ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference. From the DUT, enter *1 to mute and then *1 to unmute.

Verify the following:

- DUT dials the group's Meet-Me conference bridge number.

  - DUT provides the conference ID number when requested.

  - DUT is joined to the conference.

- Repeat for BroadWorks Users A, B, and C.

  - All parties are in conference and can hear each other.

- From the DUT, enter *1 to mute.

  - DUT cannot be heard by other parties.

- From the DUT, enter *1 to unmute.

  - DUT can be heard by other parties.

- DUT hangs up.

- BroadWorks Users A, B, and C hang up.

- Verify the signaling to the DUT.

  - Make sure the AMR-WB codec is negotiated for the DUT.

79. SERVICE – Meet-Me Conference – Opus (P1)

This test case verifies the DUT's interoperability with BroadWorks for Meet-Me Conference using the Opus codec.

Test setup:

1) Make sure the DUT's Opus codec is enabled as the preferred codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the Opus codec enabled as the preferred codec. Disable each phone's AMR-WB codec.

3) Make sure the BroadWorks Media Server Opus codec is enabled.

```
MS_CLI/Applications/MediaStreaming/Services/Conferencing
/Codecs> get
   Codecs
=========
     ulaw
     g722
     alaw
  g726-32
   amr-wb
     opus
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Opus codec is pre-enabled on the interoperability system BroadWorks Media Servers.

Originate a call from the DUT to the group's Meet-Me conference bridge number. Enter the conference ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference. From the DUT, enter *1 to mute, then *1 to unmute.

Verify the following:

■ DUT dials the group's Meet-Me conference bridge number.

– DUT provides the conference ID number when requested.

– DUT is joined to the conference.

■ Repeat for BroadWorks Users A, B, and C.

– All parties are in conference and can hear each other.

■ From the DUT, enter *1 to mute.

– DUT cannot be heard by other parties.

■ From the DUT, enter *1 to unmute.

– DUT can be heard by other parties.

■ DUT hangs up.

■ BroadWorks Users A, B, and C hang up.

■ Verify the signaling to the DUT.

– Make sure the Opus codec is negotiated for the DUT.

7.8 BroadWorks Services – Collaborate – Audio

This section tests the DUT's interoperability with BroadWorks Collaborate audio conferencing. Collaborate is similar to Meet-Me Conferencing. However, it involves media interaction with the BroadWorks Video Server (UVS) rather than the BroadWorks Media Server. The following scenarios are covered:

- Collaborate – Audio

- Collaborate – Audio – G722

- Collaborate – Audio – Opus

Test section setup:

1) Assign the Collaborate – Audio feature to the BroadWorks user associated with the DUT.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The Collaborate – Audio feature is pre-assigned to the preconfigured users provided in the initial account setup.

2) Configure the BroadWorks group default collaborate bridge. As group administrator, browse to *Services → Collaborate Bridges*. Select the *BroadSoft-Default* bridge to edit. Browse to *Addresses* and supply a *phone number* and *extension* for the bridge. Click **Apply**.

3) Browse to *Group → Users*. Select the DUT BroadWorks user. Browse to *Services → Collaborate → Collaborate Rooms* for the DUT user. Set the following:

    – Play Tone: Selected

    – Room ID: Take note of the room ID for use when dialing in to the conference.

    Click **Apply** to save the changes.

80. SERVICE – Collaborate – Audio (P0)

This test case verifies the DUT's interoperability with BroadWorks for Collaborate – Audio using G711.

Test setup:

1) Make sure the DUT's G711 codec is enabled as the preferred codec. Disable the DUT's G722 codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the G711 codec enabled. Disable each endpoint's G722 codec.

3) Make sure the BroadWorks Video Server G711 codec is enabled.

```
UVS_CLI/Applications/VideoStreaming/Interfaces/CFW/Audio
Codecs> get
    Type
=========
    ulaw
    g722
    alaw
    g729
    opus
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The G711 codec is pre-enabled on the interoperability system BroadWorks Video Server.

Originate a call from the DUT to the collaborate bridge number. Enter the room ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference.

Verify the following:

- DUT dials the collaborate bridge number.
    - DUT provides the room ID number when requested.
    - DUT is joined to the conference.
- Repeat for BroadWorks Users A, B, and C.
    - All parties are in conference and can hear each other.
- DUT hangs up.
- BroadWorks Users A, B, and C hang up.
- Verify the signaling to the DUT.
    - Make sure the G711 codec is negotiated for the DUT.

81. **SERVICE – Collaborate – Audio – G722 (P1)**

This test case verifies the DUT's interoperability with BroadWorks for Collaborate – Audio using the G722 codec. This test case applies only if the DUT supports the G722 codec.

Test setup:

1) Make sure the DUT's G722 codec is enabled as the preferred codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the G722 codec enabled as the preferred codec.

3) Make sure the BroadWorks Video Server G722 codec is enabled.

```
UVS_CLI/Applications/VideoStreaming/Interfaces/CFW/Audio
Codecs> get
    Type
=========
    ulaw
    g722
    alaw
    g729
    opus
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The G722 codec is pre-enabled on the interoperability system BroadWorks Video Server.

Originate a call from the DUT to the collaborate bridge number. Enter the room ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference.

Verify the following:

- DUT dials the collaborate bridge number.

- DUT provides the room ID number when requested.
- DUT is joined to the conference.
- Repeat for BroadWorks Users A, B, and C.
  - All parties are in conference and can hear each other.
- DUT hangs up.
- BroadWorks Users A, B, and C hang up.
- Verify the signaling to the DUT.
  - Make sure the G722 codec is negotiated for the DUT.

82. **SERVICE – Collaborate – Audio – Opus (P1)**

This test case verifies the DUT's interoperability with BroadWorks for Collaborate – Audio using the Opus codec. This test case applies only if the DUT supports the Opus codec.

Test setup:

1) Make sure the DUT's Opus codec is enabled as the preferred codec.

2) Make sure the endpoints for BroadWorks Users A, B, and C have the Opus codec enabled as the preferred codec.

3) Make sure the BroadWorks Video Server Opus codec is enabled.

```
UVS_CLI/Applications/VideoStreaming/Interfaces/CFW/Audio
Codecs> get
     Type
=========
     ulaw
     g722
     alaw
     g729
     opus
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Opus codec is pre-enabled on the interoperability system BroadWorks Video Server.

Originate a call from the DUT to the collaborate bridge number. Enter the room ID number when it is requested. Repeat for BroadWorks Users A, B, and C to join the conference.

Verify the following:

- DUT dials the collaborate bridge number.
  - DUT provides the room ID number when requested.
  - DUT is joined to the conference.
- Repeat for BroadWorks Users A, B, and C.
  - All parties are in conference and can hear each other.
- DUT hangs up.
- BroadWorks Users A, B, and C hang up.
- Verify the signaling to the DUT.
  - Make sure the Opus codec is negotiated for the DUT.

8 DUT Services Package

The DUT Services Package verifies the interoperability of DUT-provided features with BroadWorks including the following. DUT services are features implemented, configured, and controlled on the DUT.

- Call Control Services

- Registration and Authentication

- Fax

- Emergency Call

- Miscellaneous

8.1 DUT Services – Call Control Services

The test cases in this section verify DUT call control interoperability with BroadWorks. DUT call control is defined here as call control features exercised via the DUT as opposed to a third-party client.

The following DUT Call Control services are verified in this test section:

- Call Waiting

- Call Hold

- Blind Transfer

- Attended Transfer

- Three-Way Call

- Network-Based Conference

Test cases for Call Control services not supported by the DUT should be skipped and identified as not supported.

DUT call control is accomplished in one of the following ways, depending on the device call control implementation.

1) Intelligent Device Call Control: If the DUT provides "device-controlled" call control, the DUT performs the actual call control itself (re-INVITE, REFER, and so on) in response to flash hooks. DUTs of this type are identified as *Intelligent Devices* and require an intelligent device profile on BroadWorks.

2) Non-Intelligent Device Call Control: If the DUT provides "flash-based" call control, the DUT communicates flash hook events to BroadWorks using INFO messages and BroadWorks performs the call control (see *BroadWorks SIP Access Interface Interworking Guide* [2]). This implementation primarily applies to SIP IADs, Embedded Media Terminal Adapters (EMTAs), and similar device types. Flash-based call control is sometimes implemented due to customer request or to quickly add call-control capability to a device that has not implemented "device-controlled" call control. DUTs of this type are identified as *Non-intelligent Devices* and require a non-intelligent device profile on BroadWorks.

The call flows for the test cases in this section differ based on whether the DUT is intelligent or non-intelligent. The differences are identified in the SIP signaling verification step for each test case.

8.1.1 Call Waiting

This section verifies the DUT's interoperability with BroadWorks for Call Waiting performed by the DUT.

83. DUTS – Call Waiting (P1)

This test case verifies the DUT's interoperability with BroadWorks for call waiting performed by the DUT.

Test setup:

■ Make sure the DUT has the BroadWorks Call Waiting service assigned and enabled.

Originate a call from BroadWorks User A to the DUT. Answer the call. Originate a second call from BroadWorks User B to the DUT. Answer the second call from the DUT by selecting the appropriate button or flash hook as required by the DUT. Toggle between the calls.

Verify the following:

■ BroadWorks User A dials the DUT.

   – DUT is alerted.

   – BroadWorks User A receives audible ringback.

■ DUT answers the call.

   – Two-way voice path is established.

■ BroadWorks User B dials the DUT.

   – DUT receives a call waiting tone/indication.

   – BroadWorks User B receives audible ringback.

■ DUT answers the second call by pressing a button or flash hook.

   – Two-way voice path is established between the DUT and BroadWorks User B.

   – The first call is on hold (no voice path in either direction).

■ DUT is able to switch back to the original call.

   – Two-way voice path is established between the DUT and BroadWorks User A.

   – The second call is on hold (no voice path in either direction).

■ DUT hangs up.

   – Call is cleared.

■ Verify the SIP signaling to and from the DUT.

   – Intelligent Device:

      – BroadWorks sends an INVITE with OFFER SDP for the second call to the DUT.

      – DUT sends re-INVITE/UPDATE with HOLD SDP to the BroadWorks for the first call.

      – DUT sends *200 OK* with ANSWER SDP for the second call.

- Non-intelligent Device:

    - BroadWorks sends an INFO message with an application/BroadSoft message body containing *play tone CallWaitingTone1* and Calling Name information.

    - DUT sends an INFO message with a message body of event *flash hook.*

    - BroadWorks sends a re-INVITE to the DUT with OFFER SDP for the second call.

8.1.2 Call Hold

This section verifies the DUT's interoperability with BroadWorks for Call Hold performed by the DUT.

It is expected that the implementations for SIP devices supporting call hold conform to *RFC 3264*. The following test setup and test cases describe verification of hold in this context.

Test setup:

1) Make sure the *RFC 3264* Hold implementation is enabled on BroadWorks.

```
AS_CLI/Interface/SIP> set enableHoldNormalization true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The system is provisioned with the *enableHoldNormalization* attribute set to "true".

2) Make sure *Hold Normalization* is set to "RFC3264" for the BroadWorks Identity/Device profile configured for the DUT.

NOTE: If the DUT does not support call hold per *RFC 3264*, *Hold Normalization* must be set to "Unspecified Address".

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Hold Normalization* setting is a system level configuration item. Use the following device identity/profile depending on the DUT device type and support for *RFC 3264*.

Generic SIP Phone: Intelligent Device; *RFC 3264* supported
Generic SIP Smart (Proxy Addr): Intelligent Device; *RFC 3264* not supported
Generic SIP Non-Int Proxy Domain GW: Non-intelligent Device; *RFC 3264* supported
Generic SIP Std (Proxy Addr): Non-intelligent Device; *RFC 3264* not supported

3) Make sure Music On Hold (MOH) is disabled for the BroadWorks user/group.

Use the following methods to put the call on hold, depending on the device type:

■ Intelligent device: Click the **Hold** button or flash on the DUT.

■ Non-intelligent device: Flash the phone once to obtain dial tone. Dial *22 to place the call on hold. Flash and dial *22 again to retrieve the call.

84.   DUTS – Call Hold: DUT Terminator (P1)

This test case verifies the DUT's interoperability with BroadWorks for call hold performed by the DUT in which BroadWorks originates the call to the DUT.

Originate a call from a BroadWorks User A to the DUT. Hold the call from the DUT. Retrieve the held call.

Verify the following:

- BroadWorks User A dials the DUT.

    - DUT is alerted.

    - BroadWorks User A receives audible ringback.

- DUT answers the call.

    - Two-way voice path is established.

- DUT holds the call.

    - Call is on hold (no voice path in either direction).

- DUT retrieves the call.

    - Two-way voice path is re-established between the DUT and BroadWorks User A.

- Repeat the hold/retrieve process.

- DUT hangs up.

    - Call is cleared.

- Verify the SIP signaling.

    - Intelligent Device:

        - DUT sends a re-INVITE/UPDATE with HOLD SDP to BroadWorks.

            - *RFC 3264* HOLD SDP: Contains *(a): sendonly* or *(a): inactive*.

            - Deprecated HOLD SDP: Contains connection address (c line) of 0.0.0.0.

        - BroadWorks sends a *200 OK* with HELD SDP.

    - Non-intelligent Device:

        - DUT sends an INFO message with a message body of event flash hook.

        - BroadWorks sends a re-INVITE with Media Server SDP to the DUT and the DUT hears stutter dial tone.

        - After *22 is dialed,

            - DUT hears a confirmation dial tone.

            - BroadWorks sends a re-INVITE with HOLD SDP to the remote party.

                - *RFC 3264* HOLD SDP: Contains *(a): sendonly* or *(a): inactive*.

                - Deprecated HOLD SDP: Contains connection address (c line) of 0.0.0.0.

85. DUTS – Call Hold: DUT Originator (P1)

This test case verifies the DUT's interoperability with BroadWorks for call hold performed by the DUT in which the DUT originates the call.

Originate a call from the DUT to BroadWorks User A. Hold the call from the DUT. Retrieve the held call.

Verify the following:

- DUT dials BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- DUT holds the call.

  - Call is on hold (no voice path in either direction).

- DUT retrieves the call.

  - Two-way voice path is re-established between the DUT and BroadWorks User A.

- Repeat the hold/retrieve process.

- DUT hangs up.

  - Call is cleared.

- Verify the SIP signaling.

  - Intelligent Device:

    - DUT sends a re-INVITE/UPDATE with HOLD SDP to BroadWorks.

      - *RFC 3264* HOLD SDP: Contains *(a): sendonly* or *(a): inactive*.

      - Deprecated HOLD SDP: Contains connection address (c line) of 0.0.0.0.

    - BroadWorks sends a *200 OK* with HELD SDP.

  - Non-intelligent Device:

    - DUT sends an INFO message with a message body of event flash hook.

    - BroadWorks sends a re-INVITE with Media Server SDP to the DUT and the DUT hears stutter dial tone.

    - After *22 is dialed,

      - DUT hears a confirmation dial tone.

      - BroadWorks sends a re-INVITE with HOLD SDP to the remote party.

        - *RFC 3264* HOLD SDP: Contains *(a): sendonly* or *(a): inactive*.

        - Deprecated HOLD SDP: contains connection address (c line) of 0.0.0.0.

8.1.3 Call Transfer

This section verifies the DUT's interoperability with BroadWorks for Call Transfer performed by the DUT. There are three types of transfer verified in this section:

■ Blind Transfer: For Blind Transfer, there is no dialog between the DUT and the transfer-to party before the transfer. Blind Transfer is implemented by a simple REFER method without Replaces in the *Refer-To* header.

> **NOTE**: Blind transfer is **not** applicable to non-intelligent devices.

■ Attended Transfer After Answer: For Attended Transfer After Answer, there is a confirmed dialog between the DUT and the transfer-to party before the transfer. Attended Transfer After Answer is implemented by a REFER method with *Replaces* in the *Refer-To* header.

■ Attended Transfer Before Answer: For Attended Transfer Before Answer, the transfer-to party has been called by the DUT, but the transfer-to party has not answered yet. This is also called "attended transfer while ringing". Attended Transfer Before Answer is implemented by a REFER method with *Replaces* in the *Refer-To* header.

BroadWorks supports *RFCs 3515, 3891,* and *3892* for the SIP REFER method implementation.

> **NOTE**: As of BroadWorks Release 18.0, per *RFC 3515*, BroadWorks supports sending a NOTIFY to suppress the implicit subscription created by the REFER method on the dialog.
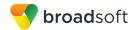
Test setup for test in this section:

1) Set the *suppressImplicitReferSubscription* via the BroadWorks Application Server CLI to "perRFC3515" as shown in the following example. This setting enables BroadWorks to send a NOTIFY to suppress the implicit subscription created by the REFER method on the dialog.

```
AS_CLI/Interface/SIP> set suppressimplicitReferSubscription
perRFC3515
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The system is currently configured with *suppressImplicitReferSubscription* set to "perRFC3515".

2) Make sure the BroadWorks Call Transfer service is assigned to the DUT.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Call Transfer* service is assigned to the preconfigured users, in the initial account setup.

86. DUTS – Blind Transfer (P1)

This test case verifies the DUT's interoperability with BroadWorks for blind call transfer performed by the DUT.

Originate a call from a BroadWorks User A to the DUT. Answer the call. From the DUT, transfer the call to BroadWorks User B by selecting the blind transfer button on the phone or otherwise invoking blind transfer on the DUT.

> **NOTE**: This test case is not applicable to non-intelligent devices.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- The DUT initiates a blind transfer to BroadWorks User B.
    - DUT is released.
    - BroadWorks User B is alerted.
    - BroadWorks User A receives audible ringback.
- BroadWorks User B answers the call.
    - Two-way voice path is established between BroadWorks User A and BroadWorks User B.
- Verify the SIP signaling from the DUT.
    - DUT sends a REFER without *Replaces* in the *Refer-To* header.
    - BroadWorks responds with 202 Accepted followed by a NOTIFY to suppress the implicit REFER subscription.

87. DUTS – Attended Transfer After Answer (P1)

This test case verifies the DUT's interoperability with BroadWorks for attended call transfer performed by the DUT after the second call is answered.

Originate a call from BroadWorks User A to the DUT. Answer the call. Place a second call from the DUT to BroadWorks User B. Answer the call. From the DUT, transfer BroadWorks User B to BroadWorks User A.

> **NOTE**: For non-intelligent devices, the transfer is accomplished by flash hook to initiate the second call and then hanging up after BroadWorks User B has answered. Intelligent device procedure depends on the DUT's implementation.

Verify the following:

- BroadWorks User A dials the DUT.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

- DUT answers the call.

  - Two-way voice path is established.

- DUT initiates attended transfer.

  - BroadWorks User A is held (no voice path in either direction).

- DUT dials BroadWorks User B.

  - BroadWorks User B is alerted.

  - DUT receives audible ringback.

- BroadWorks User B answers the call.

  - Two-way voice path is established between the DUT and BroadWorks User B.

- DUT completes the transfer.

  - DUT is released from both calls.

  - Two-way voice path is established between BroadWorks User A and BroadWorks User B.

- Verify the SIP signaling from the DUT.

  - Intelligent Device:

    - DUT sends a REFER with *Replaces* in the *Refer-To* header.

    - BroadWorks responds with 202 Accepted followed by a NOTIFY to suppress the implicit REFER subscription.

  - Non-intelligent Device:

    - DUT sends INFO for flash hook to initiate the second call.

    - DUT sends BYE to transfer the call.

88. DUTS – Attended Transfer Before Answer (P1)

This test case verifies the DUT's interoperability with BroadWorks for attended call transfer performed by the DUT before the second call is answered.

Originate a call from the DUT to BroadWorks User A. Answer the call. Place a second call from the DUT to BroadWorks User B. Do not answer the call. From the DUT, transfer BroadWorks User B to BroadWorks User A.

> **NOTE**: For non-intelligent devices, the transfer is accomplished by flash hook to initiate the second call and then hanging up after BroadWorks User B has answered. Intelligent device procedure depends on the DUT's implementation.

Verify the following:

- DUT dials BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- DUT initiates attended transfer.

  - BroadWorks User A is held (no voice path in either direction).

- DUT dials BroadWorks User B.

  - BroadWorks User B is alerted.

  - DUT receives audible ringback.

- DUT completes the transfer.

  - DUT is released from both calls.

  - Two-way voice path is established between BroadWorks User A and BroadWorks User B.

- Verify the SIP signaling from the DUT.

  - Intelligent Device:

    - DUT sends a REFER with *Replaces* in the *Refer-To* header.

    - BroadWorks responds with 202 Accepted followed by a NOTIFY to suppress the implicit REFER subscription.

  - Non-intelligent Device:

    - DUT sends INFO for flash hook to initiate the second call.

    - DUT sends BYE to transfer the call.

8.1.4 Three-Way Call

This section verifies the DUT's interoperability with BroadWorks for Three-Way Call mixed by the DUT.

Test setup for test in this section:

- Make sure the BroadWorks Three-Way Call service is assigned to the DUT.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Three-Way Call service is assigned to the preconfigured users in the initial account setup.

Use the following methods to affect the Three-Way Call (depending on the device type):

- Intelligent Device: Depends on the DUT's implementation.

- Non-Intelligent Device: Flash the phone once to get the phone to play dial tone. Dial the second call. Flash again to initiate the conference either before or after the second party answers, depending upon the test case.

89.   DUTS – Three-Way Call After Answer (P1)

This test case verifies the DUT's interoperability with BroadWorks for Three-Way Call performed by the DUT after the second call is answered.

Originate a call from BroadWorks User A to the DUT. Answer the call. From the DUT, place a second call to BroadWorks User B. Answer the call. From the DUT, conference all parties together. Disconnect the call from the DUT.

Verify the following:

■ BroadWorks User A dials the DUT.

– DUT is alerted.

– BroadWorks User A receives audible ringback.

■ DUT answers the call.

– Two-way voice path is established.

■ DUT initiates a Conference/Three-Way Call.

– BroadWorks User A is held (no voice path in either direction).

■ DUT dials BroadWorks User B.

– BroadWorks User B is alerted.

– DUT receives audible ringback.

■ BroadWorks User B answers the call.

– Two-way voice path is established between the DUT and BroadWorks User B.

■ DUT conferences all parties.

– Each of the three parties can hear the other two parties in the conference.

■ The DUT hangs up.

– All calls are released.

  Or

– Users A and B are transferred together.

90.   DUTS – Three-Way Call Before Answer (P1)

This test case verifies the DUT's interoperability with BroadWorks for Three-Way Call performed by the DUT before the second call is answered.

Originate a call from the DUT to BroadWorks User A. Answer the call. From the DUT, place a second call to BroadWorks User B. Do not answer the call. From the DUT, conference all parties together. Answer the call to BroadWorks User B. Disconnect the call from the DUT.

Verify the following:

■ DUT dials BroadWorks User A.

– BroadWorks User A is alerted.

– DUT receives audible ringback.

■ BroadWorks User A answers the call.

– Two-way voice path is established.

■ DUT initiates a Conference/Three-Way Call.

  – BroadWorks User A is held (no voice path in either direction).

■ DUT dials BroadWorks User B.

  – BroadWorks User B is alerted.

  – DUT receives audible ringback.

■ DUT conferences all parties.

  – BroadWorks User B continues to be alerted.

  – BroadWorks User A hears ringback.

  – DUT continues to hear ringback.

  – Two-way voice path is established between DUT and BroadWorks User A.

■ BroadWorks User B answers the call.

  – Each of the three parties can hear the other two parties in the conference.

■ The DUT hangs up.

  – All calls are released.

    Or

  – Users A and B are transferred together.

8.1.5 Network-based Conference

This section verifies the DUT's interoperability with BroadWorks for Three-Way and N-Way calls mixed on the network by BroadWorks.

BroadWorks supports the ad hoc conferencing methods defined in section *5.4* of *RFC 4579*. A SIP device establishes a dialog with a conference bridge. Then the device refers existing dialogs to the conference bridge, which then automatically mixes the parties as they are added to the bridge. BroadWorks does not currently support *RFC 4575*.

> **NOTE**: The test cases in this section are not applicable to non-intelligent devices.

BroadWorks supports two implementations for the REFER request:

■ REFER request to the user: The conference creator sends the REFER request inside the dialog associated with the creator's call with the user. The *Refer-To* header must have the conference ID as its URI. The conference ID is supplied in the *Contact* header of the *200 OK* to the INVITE to the conference URI.

Example:

```
REFER sip:as.iop1.broadworks.net SIP/2.0
Via: SIP/2.0/UDP 219.117.226.252:5060;branch=z9hG4bKa394d2bf
Max-Forwards: 70
Call-ID: 1ec77a27-c09d6f18dc20a2fae3830080f0808080@bw-test
From: <sip:2413333902@as.iop1.broadworks.net>;tag=545682591
To: <sip:2413333901@as.iop1.broadworks.net>;tag=1708067467-
1416456539772
CSeq: 3 REFER
Allow:
INVITE,ACK,CANCEL,BYE,PRACK,INFO,UPDATE,OPTIONS,MESSAGE,NOTIFY,REF
ER
```

```
Contact: <sip:2413333902@219.117.226.252:5060>
Refer-To: <sip:focus@as.iop1.broadworks.net>
Referred-By: <sip:2413333902@as.iop1.broadworks.net>
Content-Length: 0
```

■ REFER request to the conference focus: The conference creator sends the REFER request inside the dialog associated with the creator's call to the conference focus. The REFER request has a *Refer-To* URI that identifies the user to add. The *Refer-To* URI also has an embedded *Replaces* header that identifies the conference creator's dialog with the participant.

Example:

```
REFER sip:as.iop1.broadworks.net SIP/2.0
Via: SIP/2.0/UDP
219.117.226.252:5060;branch=z9hG4bKa394d2bf
Max-Forwards: 70
Call-ID: 1ec77a27-c09d6f18dc20a2fae3830080f0808080@bw-test
From:
<sip:2413333902@as.iop1.broadworks.net>;tag=545682591
To: <sip:focus@as.iop1.broadworks.net>;tag=1708067467-
1416456539772
CSeq: 3 REFER
Allow:
INVITE,ACK,CANCEL,BYE,PRACK,INFO,UPDATE,OPTIONS,MESSAGE,NO
TIFY,REFER
Contact: <sip:2413333902@219.117.226.252:5060>
Refer-To:
<sip:2413333905@as.iop1.broadworks.net?Replaces=4920859543
%3Bfromtag%
3D5441092957%3Bto-tag%3D1484611295-1380833043509>
Referred-By: <sip:2413333902@as.iop1.broadworks.net>
Content-Length: 0
```

Test setup for tests in this section:

1) Configure the system *conferenceURI* and *maxConferenceParties* settings on BroadWorks via the Application Server CLI as shown in the following example.

```
AS_CLI/SubscriberMgmt/Policy/CallProcessing/Conferencing> set
conferenceURI conference@as.iop1.broadworks.net
AS_CLI/SubscriberMgmt/Policy/CallProcessing/Conferencing> set
maxConferenceParties 10
```

The *conferenceURI* can also be set via the GUI for a service provider on the *System → <service provider> → Profile → Call Processing Policies* page. Configure the service provider to use the system *conferenceURI* or provision one for the service provider.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The IOP1and IOP2 Public Interoperability Systems are configured with network-based conference URI conference@as.iop1.broadworks.net and conference@as.iop2.broadworks.net respectively. The DUT must send the conference URI in the Request-URI to BroadWorks for Three-Way and N-Way network-based conference.
>
> The Public Interoperability System is configured with *Maximum Parties in an N-Way Call* set to "10".

2) Make sure the BroadWorks Three-Way Call service is assigned to the DUT.

3) Make sure the BroadWorks N-Way Cal/ service is assigned to the DUT.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The Three-Way Call and N-Way Call services are assigned to the preconfigured users in the initial account setup.

4) Configure the DUT to enable network conference and configure the DUT with the conference URI identified in step 1.

91.   DUTS – Network-based Three-Way Call (P2)

This test case verifies the DUT's interoperability with BroadWorks for Network-based Three-Way Call.

Originate a call from BroadWorks User A to the DUT. Answer the call. From the DUT, initiate a second call to BroadWorks User B. Answer the call. Initiate a conference/join from the DUT to create a Three-Way Call. Release the calls.

Verify the following. (Note that these are not the precise steps since each phone implements this feature differently.)

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- DUT dials BroadWorks User B.
    - BroadWorks User B is alerted.
    - DUT receives audible ringback.
- BroadWorks User B answers the call.
    - Two-way voice path is established between the DUT and BroadWorks User B.
- DUT conferences/joins all parties.
    - Each of the three parties can hear the other two parties in the conference.
- The DUT hangs up.
    - All calls are released.

- Verify the SIP signaling from the DUT.

  – DUT sends an INVITE request to the Conference-URI provisioned on BroadWorks.

  – DUT REFERs both parties to the conference using one of the methods described in the section introduction.

92. **DUTS – Network-based N-Way Call (P2)**

This test case verifies the DUT's interoperability with BroadWorks for Network-Based N-Way Call.

Originate a call from BroadWorks User A to the DUT. Answer the call. From the DUT, initiate a second call to BroadWorks User B. Answer the call. Initiate a conference/join from the DUT to create a Three-Way Call. Add three BroadWorks Users to the conference to create a six-way conference. Release the calls.

Verify the following. (Note that these are not the precise steps since most phones implement this feature differently.)

- BroadWorks User A dials the DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT answers the call.

  – Two-way voice path is established.

- DUT dials BroadWorks User B.

  – BroadWorks User B is alerted.

  – DUT receives audible ringback.

- BroadWorks User B answers the call.

  – Two-way voice path is established between the DUT and BroadWorks User B.

- DUT conferences/joins all parties.

  – Each of the three parties can hear the other two parties in the conference.

- DUT repeats steps to add three more BroadWorks Users to the conference.

  – All parties can hear each other.

- The DUT hangs up.

  – All calls are released.

- Verify the SIP signaling from the DUT.

  – DUT sends an INVITE request to the Conference-URI provisioned on BroadWorks.

  – DUT REFERs all parties to the conference using one of the methods described in the section introduction.

8.2 DUT Services – Registration and Authentication

This section verifies the DUT's interoperability with BroadWorks for registration and authentication scenarios.

BroadWorks supports initiating digest authentication challenges in addition to responding to challenges from the DUT. BroadWorks supports sending and receiving SIP digest MD5 authentication challenges only.

The following Registration and Authentication scenarios are verified in this test section:

- REGISTER Authentication
- Maximum Registration Time
- Minimum Registration Time
- INVITE Authentication
- Re-INVITE/UPDATE Authentication
- REFER Authentication
- DUT Authenticating BroadWorks

93. DUTS – REGISTER Authentication (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for authenticating REGISTER requests. This scenario does not apply to devices that do not register.

Test setup:

1) Assign the BroadWorks Authentication service to the DUT.

2) Configure the BroadWorks Authentication service with authentication *user name* and *password*.

3) Configure the DUT with matching authentication *user name* and *password*.

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart.

Wait for register expiration and observe the next registration.

Verify the following:

- A REGISTER request is sent from the DUT to BroadWorks.

    - BroadWorks challenges the DUT for authentication (SIP 401).

    - DUT resends the REGISTER request with authentication credentials.

    - BroadWorks responds with *200 OK*.

- A second REGISTER request is sent from the DUT to BroadWorks before the first registration expires. Verify the messaging according to the device implementation.

    - Implementation A:

        - DUT REGISTER request reuses previous authentication credentials.

        - BroadWorks responds with *200 OK*.

> **NOTE**: If the DUT is using Quality of Protection (QoP) in the authentication parameters, it MUST increment the nonce counter (nc) in each re-registration. Otherwise, it is identified as a "replay" and rejected by BroadWorks.

– Implementation B:

  – DUT sends next REGISTER request without authentication credentials.

  – BroadWorks challenges DUT for authentication (SIP 401).

  – DUT resends the REGISTER request with authentication credentials.

  – BroadWorks responds with *200 OK*.

94. DUTS – Maximum Registration Time (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for honoring a maximum registration time shorter than the DUT's requested expiration. This scenario does not apply to devices that do not register.

Test setup:

1) Configure the *maximum registration time* via the BroadWorks Application Server CLI as "3600" seconds as shown in the following example.

```
AS_CLI/System/Registration> set maxRegistrationTimeInSeconds
3600
```

2) Configure the registration time on the DUT to *7200 seconds*.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The system is currently configured with *maxRegistrationTimeInSeconds* set to "3600" seconds.

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart. Wait for the device to reregister after the first successful registration.

Verify the following:

■ A REGISTER request is sent from the DUT to BroadWorks.

  – The REGISTER request from the DUT contains *expires=7200*.

  – BroadWorks responds with *200 OK* with *expires=3600* (or less).

■ The next REGISTER request is sent from the DUT to BroadWorks.

  – The next REGISTER request is sent before the expiration period of *3600 seconds* ends.

  – The next REGISTER request contains the same requested expiration (*expires=7200*) as the first. The DUT must not dynamically change the requested expiration.

95. DUTS – Minimum Registration Time (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for honoring a minimum registration time longer than the DUT's requested expiration. This is signaled by a *423* response to the REGISTER request. This scenario does not apply to devices that do not register.

> **NOTE**: When *minRegistrationTimeInSeconds* is provisioned to be a value greater than one hour (3600 seconds), then a 423 response is not issued by BroadWorks unless the expiration interval (requested expiration) is less than one hour.

Test setup:

1) Enable enforcement of *minimum registration time* via the BroadWorks Application Server CLI as shown in the following example.

```
AS_CLI/System/Registration> set enforceMinRegistrationTime
true
```

2) Configure the *minimum registration time* via the BroadWorks Application Server CLI to *1200 seconds* as shown in the following example.

```
AS_CLI/System/Registration> set minRegistrationTimeInSeconds
1200
```

3) Configure the registration time on the DUT to "60" seconds.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The system is currently configured with *minRegistrationTimeInSeconds* set to "1200" seconds and *enforceMinRegistrationTime* set to "true".

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart.

Verify the following:

■ A REGISTER request is sent from the DUT to BroadWorks.

  – The REGISTER request from the DUT contains *expires=60*.

  – BroadWorks responds with a 423 response (Interval too Brief) and a *Min-Expires* header of *1200*.

■ Another SIP REGISTER request is sent from the DUT to BroadWorks.

  – The REGISTER request from the DUT contains *expires=1200* or greater.

  – BroadWorks responds with *200 OK* with *expires=1200*.

96.   DUTS – INVITE Authentication (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for authenticating initial INVITE requests.

Test setup:

1) Assign the BroadWorks Authentication service to the DUT.

2) Configure the BroadWorks Authentication service with authentication *user name* and *password*.

3) Configure the DUT with matching authentication *user name* and *password*.

4) Configure the BroadWorks *inviteAuthenticationRatio* via the CLI as follows to enable initial INVITE challenges. BroadWorks challenges one out of every *X* initial INVITE requests, where *X* is the *inviteAuthenticationRatio*. Setting the ratio to "1" as follows enables BroadWorks to challenge every initial INVITE request.

```
AS_CLI/Interface/SIP> set inviteAuthenticationRatio 1
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is configured with *inviteAuthenticationRatio* set to "1".

Originate a call from the DUT to BroadWorks User A.

Verify the following:

- DUT dials BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- DUT hangs up.
  - Call is released.
- Verify the SIP signaling to and from the DUT.
  - DUT sends INVITE request to BroadWorks.
  - BroadWorks challenges the INVITE for authentication with *SIP 401 Unauthorized* response.
  - DUT resends the SIP INVITE request with authentication credentials.

97. DUTS – Re-INVITE/UPDATE Authentication (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for authenticating re-INVITE or UPDATE requests, whichever the DUT uses for modifying a session. This scenario does not apply to devices that do not send re-INVITE or UPDATE.

Test setup:

1) Assign the BroadWorks Authentication service to the DUT.
2) Configure the BroadWorks Authentication service with authentication *user name* and *password*.
3) Configure the DUT with matching authentication *user name* and *password*.
4) Enable *reInviteAuthentication* via the BroadWorks Application Server CLI as follows.

```
AS_CLI/Interface/SIP> set reInviteAuthentication true
```

Originate a call from BroadWorks User A to the DUT. Place the call on hold from the DUT device (or otherwise trigger the DUT to generate re-INVITE/UPDATE).

Verify the following:

- BroadWorks User A dials the DUT.

    - DUT is alerted.

    - BroadWorks User A receives audible ringback.

- DUT answers the call.

    - Two-way voice path is established.

- DUT places the call on hold from the device.

    - Call is on hold. There is no voice path in either direction.

- Verify SIP signaling to from the DUT.

    - DUT sends a re-INVITE or UPDATE request to place the call on hold.

    - BroadWorks challenges the INVITE for authentication with *SIP 401 Unauthorized* response.

    - DUT resends the re-INVITE/UDPATE request with authentication credentials.

    - BroadWorks responds with *200 OK*.

98.   DUTS – REFER Authentication (P1)

This test scenario verifies the DUT's interoperability with BroadWorks for authenticating REFER requests. This scenario does not apply to devices that do not send REFER requests.

Test setup:

1) Assign the BroadWorks Authentication service to the DUT.

2) Configure the BroadWorks Authentication service with authentication *user name* and *password*.

3) Configure the DUT with matching authentication *user name* and *password*.

4) Make sure the *Authenticate REFER* option is selected on the device identity/profile for the BroadWorks device type assigned to the DUT.

Originate a call from BroadWorks User A to the DUT. From the DUT, transfer the call to BroadWorks User B.

Verify the following:

- BroadWorks User A dials the DUT.

    – DUT is alerted.

    – BroadWorks User A receives audible ringback.

- DUT answers the call.

    – Two-way voice path is established.

- DUT initiates attended transfer.

    – BroadWorks User A is held (no voice path in either direction).

- DUT dials BroadWorks User B.

    – BroadWorks User B is alerted.

    – DUT receives audible ringback.

- BroadWorks User B answers the call.

    – Two-way voice path is established between the DUT and BroadWorks User B.

- DUT completes the transfer.

    – DUT is released from both calls.

    – Two-way voice path is established between BroadWorks User A and BroadWorks User B.

- Verify the SIP signaling from the DUT.

    – DUT sends a REFER request to transfer the call.

    – BroadWorks challenges the REFER for authentication with *SIP 401 Unauthorized* response.

    – DUT resends the REFER request with authentication credentials.

    – BroadWorks responds with 202 Accepted followed by a NOTIFY to suppress the implicit REFER subscription.

99. DUTS – DUT Authenticating BroadWorks INVITE (P2)

This test scenario verifies the DUT's interoperability with BroadWorks for when the DUT is configured to challenge INVITE requests from BroadWorks. This capability is not required of the DUT, but if supported must be verified to ensure interoperability.

Test setup:

1) Assign the BroadWorks Authentication service to the DUT.

2) Configure the BroadWorks Authentication service with authentication *user name* and *password*.

3) Configure the DUT with matching authentication *user name* and *password*.

4) Set the authentication realm on the DUT to the BroadWorks DUT user's domain name.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** If using the IOP1 Public Interoperability System, set the DUT realm to "as.iop1.broadworks.net". If using the IOP2 Public Interoperability System, set the DUT realm to "as.iop2.broadworks.net".

Originate a call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials the DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT answers the call.

  – Two-way voice path is established.

- Verify the SIP signaling to and from the DUT.

  – BroadWorks sends INVITE request to DUT.

  – DUT challenges the INVITE for authentication with *SIP 401 Unauthorized* response.

  – BroadWorks resends the SIP INVITE request with authentication credentials.

8.3   DUT Services – Fax

This section verifies the DUT's interoperability with BroadWorks for fax scenarios. The following fax scenarios are covered in this test section.

- G711 Fax Passthrough
- G711 Fax Fallback
- T38 Fax
- T38 Fax Messaging

Test setup for tests in this section:

1) <u>G711 and T38 Fax scenarios</u>: These scenarios require peer-to-peer fax testing. Another BroadWorks user must be configured with another device that supports the fax capability being tested. Suggested devices include AudioCodes, Cisco, Grandstream, and Obihai. If other devices are not available, it is acceptable to use DUT endpoints for both peers.

2) <u>T38 Fax Messaging scenarios</u>: The T38 Fax messaging scenarios require testing against the BroadWorks Fax Messaging service. With this setup, T38 faxes are sent to and received from the BroadWorks Media Server, not another endpoint. Follow the test case instructions carefully to make sure the T38 Fax messaging test cases are run correctly.

8.3.1   G711 Fax Passthrough

This section verifies G711 fax passthrough scenarios. Fax passthrough occurs if G711 is negotiated as the codec on the initial INVITE sequence.

Test setup:

1) Enable fax passthrough on the DUT and make sure G711 is configured as the preferred codec on the DUT.

2) Plug a fax machine into the DUT's FXS port.

3) Configure BroadWorks User A with another device supporting fax passthrough (see examples above). Enable fax passthrough on BroadWorks User A's device and make sure G711 is configured as the preferred codec.

4) Plug a fax machine into the BroadWorks User A's device FXS port.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** If another device is not available to test against, use a DUT device on both ends of the fax call, for example, configure BroadWorks User A with another DUT device or another port on the same DUT device.

100. DUTS – G711 Fax Passthrough: DUT Originator (P1)

This test case verifies the DUT's interoperability with BroadWorks for fax passthrough scenarios in which the call is originated by the DUT.

From the DUT fax machine, dial BroadWorks User A and send a two page fax.

Verify the following:

- DUT fax device dials BroadWorks User A.

  - The two-page fax is sent successfully.

- Verify the signaling to and from the DUT.

  - DUT sends initial INVITE to BroadWorks.

  - G711 is negotiated as the codec in the *200 OK* from BroadWorks.

  - There are no re-INVITEs.

101. DUTS – G711 Fax Passthrough: DUT Terminator (P1)

This test case verifies the DUT's interoperability with BroadWorks for fax passthrough scenarios in which the call is originated by a BroadWorks user to the DUT.

From the BroadWorks User A fax machine, dial the DUT and send a two page fax.

Verify the following:

- BroadWorks User A fax device dials DUT.

  - The two-page fax is sent successfully.

- Verify the signaling to and from the DUT.

  - BroadWorks sends initial INVITE to DUT.

  - G711 is negotiated as the codec in the *200 OK* from the DUT.

  - There are no re-INVITEs.

8.3.2 G711 Fax Fallback

This section verifies G711 fax fallback scenarios. G711 fax fallback occurs if a codec other than G711 is negotiated initially. Fallback to G711 occurs via re-INVITE when fax is detected.

Test setup:

1) Enable fax passthrough on the DUT and make sure G729 (or any codec besides G711) is configured as the preferred codec on the DUT. Make sure G711 is configured as an alternate codec.

2) Plug a fax machine into the DUT's FXS port.

3) Configure BroadWorks User A with another device supporting fax fallback (see examples above). Enable fax passthrough on BroadWorks User A's device and make sure G729 (or any codec besides G711) is configured as the preferred codec. Make sure G711 is configured as an alternate codec.

4) Plug a fax machine into the BroadWorks User A's device FXS port.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If another device is not available to test against, use a DUT device on both ends of the fax call, for example, configure BroadWorks User A with another DUT device or another port on the same DUT device.

102.   DUTS – G711 Fax Fallback: DUT Originator (P1)

This test case verifies the DUT's interoperability with BroadWorks for fax fallback to G711 scenarios in which the call is originated by the DUT.

From the DUT fax machine, dial BroadWorks User A and send a two page fax.

Verify the following:

- DUT fax device dials BroadWorks User A.

    - The two-page fax is sent successfully.

- Verify the signaling to and from the DUT.

    - DUT sends initial INVITE to BroadWorks.

    - G729 (or a codec other than G711) is negotiated as the codec in the *200 OK* from BroadWorks.

    - BroadWorks sends re-INVITE (fallback) with G711 as the codec.

103.   DUTS – G711 Fax Fallback: DUT Terminator (P1)

This test case verifies the DUT's interoperability with BroadWorks for fax fallback to G711 scenarios in which the call is originated by a BroadWorks user to the DUT.

From the BroadWorks User A fax machine, dial the DUT and send a two page fax.

Verify the following:

- BroadWorks User A fax device dials DUT

    - The two-page fax is sent successfully.

- Verify the signaling to and from the DUT.

    - BroadWorks sends initial INVITE to the DUT.

    - G729 (or a codec other than G711) is negotiated as the codec in the *200 OK* from the DUT.

    - DUT sends re-INVITE (fallback) with G711 as the codec.

8.3.3 T38 Fax

This section verifies T38 peer-to-peer fax scenarios.

Test setup:

1) Enable T38 fax on the DUT and make sure G711 is configured as the preferred codec on the DUT.

2) Plug a fax machine into the DUT's FXS port.

3) Configure BroadWorks User A with another device supporting T38 fax. Enable T38 fax on BroadWorks User A's device and make sure G711 is configured as the preferred codec.

4) Plug a fax machine into the BroadWorks User A's device FXS port.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** If another device is not available to test against, use a DUT device on both ends of the fax call, that is, configure BroadWorks User A with another DUT device or another port on the same DUT device.

104. DUTS – T38 Fax: DUT Originator (P1)

This test case verifies the DUT's interoperability with BroadWorks for T38 peer-to-peer fax in which the call is originated by the DUT.

From the DUT fax machine, dial BroadWorks User A and send a two page fax.

Verify the following:

- DUT fax device dials BroadWorks User A.

    – The two page fax is sent successfully.

- Verify the signaling to and from the DUT.

    – DUT sends initial INVITE to BroadWorks.

    – G711 is negotiated initially as the codec in the *200 OK* from BroadWorks.

    – BroadWorks sends re-INVITE with T38 as the fax codec.

105. DUTS – T38 Fax: DUT Terminator (P1)

This test case verifies the DUT's interoperability with BroadWorks for T38 peer-to-peer fax in which the call is terminated by the DUT.

From the BroadWorks User A's fax machine, dial the DUT and send a two page fax.

Verify the following:

- BroadWorks User A fax device dials DUT.

    – The two page fax is sent successfully.

- Verify the signaling to/from the DUT.

    – BroadWorks sends initial INVITE to the DUT.

    – G711 is negotiated initially as the codec in the *200 OK* from the DUT.

    – DUT sends re-INVITE with T38 as the fax codec.

8.3.4 T38 Fax Messaging

This section verifies T38 fax messaging scenarios. The BroadWorks Fax Messaging feature is used for T38 verification, so no other endpoint is used for these test cases. BroadWorks records and saves the inbound T38 fax. The saved T38 fax can then be sent out to the DUT.

Test setup:

1) Enable T38 fax on the DUT.

2) Plug a fax machine into the DUT's FXS port.

3) Assign the BroadWorks *Voice Messaging* and *Fax Messaging* features to BroadWorks User A.

4) Browse to the *Messaging → Fax Messaging* page for BroadWorks User A. Enable Fax Messaging by selecting *On*. Select a *Fax Messaging Phone Number*.

5) Configure BroadWorks User A with a SIP phone or other endpoint capable of displaying Message Waiting Indicator (MWI).

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** The Voice Messaging and Fax Messaging features are pre-assigned to the first user in the group in the initial account setup.

106. DUTS – T38 Fax Messaging: DUT Originator (P1)

This test case verifies the DUT's interoperability with the BroadWorks Fax Messaging feature for fax calls originated by the DUT.

From the DUT fax machine, dial BroadWorks User A's Fax Messaging Phone Number (as configured above) and send a two page fax.

> **NOTE**: Make sure that you dial the Fax Messaging phone number for BroadWorks User A. Do not dial BroadWorks User A's normal number. If the call keeps ringing or goes to treatment, it is likely that you did not dial the correct number.

Verify the following:

■ DUT fax device dials BroadWorks User A's Fax Messaging Phone Number.

 – The two-page fax is sent successfully.

 – BroadWorks User A's phone indicates message waiting (that is, MWI is activated).

■ Verify the signaling to and from the DUT.

 – T.38 is negotiated.

 – The T38 signaling shows successful completion and no protocol errors.

 – BroadWorks sends a NOTIFY for MWI to BroadWorks User A.

107. DUTS – T38 Fax Messaging: DUT Terminator (P1)

This test case verifies the DUT's interoperability with the BroadWorks Fax Messaging feature for fax calls originated from BroadWorks to the DUT.

From the BroadWorks User A's phone, dial the group voice portal number to check messages. Follow the IVR menu instructions to print the fax recorded by the previous test case and enter the DUT number as the destination for the fax.

Verify the following:

■ BroadWorks User A dials the group voice portal number.

– BroadWorks User A hears the voice portal menu via IVR.

■ BroadWorks User A follows the IVR menu instructions to print the fax recorded in the previous test case and supplies the DUT's extension.

– The two-page fax is sent successfully.

■ Verify the signaling to and from the DUT.

– T.38 is negotiated.

– The T38 signaling shows successful completion and no protocol errors.

8.4 DUT Services – Emergency Call

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The test cases in this section require an E911 gateway on the remote end, which is not available on the Public Interoperability System. Therefore, these test cases cannot be executed against the Public Interoperability System.

If the DUT supports this feature, provide signaling traces obtained by other methods. If that is not possible, indicate in the test report what test cases are supported and then provide an explanation.

In North America, emergency calling has distinct functionality allowing the operator to identify and communicate with a calling party making an emergency call. This enables the emulation of the following circuit-switched Emergency Calling services:

■ Network or Bureau Hold – Enables the operator to maintain control of the call and notifies the operator when the calling party disconnects.

■ Operator Ringback – Allows the operator to re-establish communication with the calling party in cases where the calling party has gone on-hook or remains off-hook but has become unresponsive.

■ Forced Disconnect – Allows the operator to disconnect the call.

For the interface requirements for supporting these emergency call scenarios, see the *BroadWorks SIP Access Interface Interworking Guide* [2]. A summary of the requirements is as follows:

■ The DUT must provide dial plan configuration ability to identify an emergency call by the dialed digits.

■ The DUT must support sending one of the following SIP headers in the INVITE for a call identified as an emergency call:

– Resource-Priority: emgr.0

– Priority: emergency

- Upon hang-up, the DUT should support configuration for sending a re-INVITE with *a=inactive* in the SDP rather than a BYE.

- The DUT must ring after receiving a re-INVITE when in the *on-hook* state after sending a re-INVITE with *a=inactive* in the SDP when going on-hook. The DUT should continue to ring until the handset is off-hook or it times out after roughly 45 minutes.

Test setup for tests in this section:

1) Configure the DUT to identify a specific dial pattern as an emergency call. Avoid using 911 in the US to eliminate the possibility of unintentionally making a live emergency call.

2) Configure the DUT to enable sending one of the emergency headers (*Resource-Priority: emgr.0* or *Priority: emergency*) in the emergency call INVITE.

3) Configure the DUT to send a re-INVITE rather than BYE on hanging up an emergency call.

4) Configure BroadWorks to identify the designated dial plan as an emergency call. Add the digit map via the BroadWorks Application Server CLI as shown in the following example.

```
AS_CLI/System/CallP/CallTypes> add 1 311 Emergency
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability Systems. The following digit maps are pre-typed as Emergency: 311, 0311, 1311, 710xxxxxxx.

5) Browse to the *System → Resources → Identity/Device Profile Type Modify* page for the device type assigned to the DUT. Make sure that the *Support Emergency Disconnect Control* option is selected.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Identity/Device Profile Type Modify* web page is not accessible via the group administrator login. Assign the following BroadWorks device type to the DUT for this test case: *Generic SIP Phone – Emergency*.

108. DUTS – Emergency Call; Originator Hang Up (P1)

This test scenario verifies the DUT's ability to:

- Make an emergency call.

- Include one of the emergency headers (*resource-priority: emgr.0* or *priority: emergency*) in the emergency call invite.

- Send re-INVITE with SDP inactive upon hanging up.

Originate an emergency call from the DUT. Hang up the call from the DUT.

Verify the following:

- DUT dials 311 or another dial pattern identified as an emergency call.

    – The call is answered and there is two-way voice path.

- DUT hangs up.

- Operator terminates the call.

- Verify the SIP signaling from the DUT.

    - DUT sends initial INVITE with one of the following headers:

        - *Resource-Priority: emgr.0*

        - *Priority: emergency*

    - DUT sends re-INVITE (upon hang-up) with *a=inactive* in the SDP.

    - DUT does not send BYE upon hang-up.

    - BroadWorks sends BYE to DUT.

109. DUTS – Emergency Call; Originator Hang Up; Ringback Unanswered (P1)

This test scenario verifies the DUT's ability to make an emergency call and ring again after hang-up.

Originate an emergency call from the DUT. Hang up the call from the DUT. From the operator, initiate a ringback to the DUT. Do not answer the call.

Verify the following:

- DUT dials 311 or another dial pattern identified as an emergency call.

    - The call is answered and there is two-way voice path.

- DUT hangs up.

- Operator initiates a call ringback.

    - DUT phone rings.

    - DUT does not answer. The phone should continue to ring until timeout (after roughly 45 minutes).

- Verify the SIP signaling from the DUT.

    - DUT sends initial INVITE with one of the following headers:

        - *Resource-Priority: emgr.0*

        - *Priority: emergency*

    - DUT sends re-INVITE (upon hang-up) with *a=inactive* in the SDP.

    - DUT does not send BYE upon hang-up.

    - BroadWorks sends re-INVITE to DUT.

110. DUTS – Emergency Call; Originator Hang Up; Ringback Answered (P1)

This test scenario verifies the DUT's ability to make an emergency call, ring again after hang-up, and reconnect the call.

Originate an emergency call from the DUT. Hang up the call from the DUT. From the operator, initiate a ringback to the DUT. Answer the call.

Verify the following:

- DUT dials 311 or another dial pattern identified as an emergency call.

    - The call is answered and there is two-way voice path.

- ■ DUT hangs up.
- ■ Operator initiates a call ringback.
  - – DUT phone rings.
- ■ DUT answers the call.
  - – There is two-way voice path.
- ■ Operator terminates the call.
  - – The call is cleared.
- ■ Verify the SIP signaling from the DUT.
  - – DUT sends initial INVITE with one of the following headers:
    - – *Resource-Priority: emgr.0*
    - – *Priority: emergency*
  - – DUT sends re-INVITE (upon hang-up) with *a=inactive* in the SDP.
  - – DUT does not send BYE upon hang-up.
  - – BroadWorks sends re-INVITE to DUT.
  - – DUT responds with *200 OK*.
  - – BroadWorks sends BYE to DUT.

111. DUTS – Emergency Call; Howler Tone (P1)

This test scenario verifies the DUT's ability to make an emergency call and receive the howler tone on an active call.

Originate an emergency call from the DUT. From the operator, initiate a ringback to the DUT on the active call.

Verify the following:

- ■ DUT dials 311 or another dial pattern identified as an emergency call.
  - – The call is answered and there is two-way voice path.
- ■ Operator initiates a call ringback.
  - – DUT phone hears a three-second howler tone.
  - – The operator hears ringback tone.
  - – After the howler tone, two-way voice path is restored.
- ■ Verify the SIP signaling from the DUT.
  - – DUT sends initial INVITE with one of the following headers:
    - – *Resource-Priority: emgr.0*
    - – *Priority: emergency*
  - – BroadWorks sends re-INVITE to DUT for the howler tone.
  - – BroadWorks sends re-INVITE to DUT to reconnect to the operator.

8.5 DUT Services – P-Access-Network-Info Header

This section verifies the DUT's support for providing the *P-Access-Network-Info* (PANI) header, per *RFC 3455*, in REGISTER and INVITE requests.

According to *RFC 3455* [3], the *PANI* header is composed of one *access-net-spec* field. Each *access-net-spec* field can itself contain none, one, or many semi-colon-separated *access-info* fields. To show support for this feature, the DUT must supply one or more *access-info* fields.

BroadWorks uses the PANI header for Session Admission Control (SAC) to determine whether or not an endpoint is roaming. This usage of the PANI header applies primarily to mobile endpoints. There are other possible uses of the PANI header, including by the remote end.

112. DUTS – REGISTER with P-Access-Network-Info Header (P1)

This test scenario verifies the DUT's support for sending the *P-Access-Network-Info* header in a REGISTER request.

Test setup:

1) Configure the DUT to enable sending *P-Access-Network-Info* header.

2) Via the BroadWorks Application Server CLI, configure BroadWorks to capture the *access-info* field from the PANI header as shown in the following example.

```
AS_CLI/System/Registration> set captureAccessInfoInPaniHeader
true
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The system is configured with *captureAccessInfoInPaniHeader* set to "true".

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart.

Verify the following:

- A REGISTER request is sent from the DUT to BroadWorks.
  - BroadWorks responds with *200 OK*.
- Log in to the BroadWorks web portal as group administrator and browse to *<user> → Utilities → Registrations* for the DUT user.
  - Verify that the *access-info* field(s) sent by the DUT is captured in the register content displayed on the web page.
- Verify the SIP signaling from the DUT.
  - The REGISTER request contains a *P-Access-Network-Info* header with one or more *access-info* fields.

    Example:

```
P-Access-Network-Info: IEEE-802.3;eth-location=12345679
```

113. DUTS – INVITE with P-Access-Network-Info Header (P1)

This test scenario verifies the DUT's support for sending the *P-Access-Network-Info* header in an INVITE request.

Test setup:

- Configure the DUT to enable sending *P-Access-Network-Info* header.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from the DUT.

Verify the following:

- DUT dials the number of BroadWorks User A.
    - BroadWorks User A is alerted.
    - DUT receives audible ringback.
- BroadWorks User A answers the call.
    - Two-way voice path is established.
- DUT hangs up.
    - The call is released.
- Verify the SIP signaling to and from the DUT.
    - The INVITE request contains a *P-Access-Network-Info* header with one or more *access-info* fields.

        Example:

        ```
        P-Access-Network-Info: IEEE-802.3;eth-location=12345679
        ```

8.6 DUT Services – Miscellaneous Features

This section tests miscellaneous features provided by the DUT including the following.

- Do Not Disturb
- Call Forward Always
- Call Forward Always Diversion Inhibitor
- Calling Line ID Blocking
- Anonymous Call Rejection
- Remote Restart via SIP NOTIFY

Each of the calling features must be configurable on the DUT itself (typically via GUI) or identified as not supported.

These features are not required for interoperability with BroadWorks. However, if a feature is supported, it must be verified with BroadWorks to ensure interoperability.

114. DUTS – Do Not Disturb (P1)

This test scenario verifies the DUT's Do Not Disturb service for interoperability with BroadWorks.

Test setup:

- Configure the DUT device to enable Do Not Disturb.

Originate a call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials the DUT.
  - BroadWorks User A hears busy tone or busy treatment.
- Verify the SIP signaling from the DUT.
  - DUT sends a SIP 4XX or 6XX response to BroadWorks, such as *486 Busy*, *403 Forbidden*, or *603 Decline*.

115. DUTS – Call Forward Always (P1)

This test scenario verifies the DUT's Call Forward Always service for interoperability with BroadWorks.

Test setup:

- Configure the DUT device to Call Forward Always to BroadWorks User B's extension.

Originate a call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials the DUT.
  - BroadWorks User B is alerted.
  - BroadWorks User A hears audible ringback.
- BroadWorks User B answers the call.
  - Two-way voice path is established.
- Verify the SIP signaling from the DUT.
  - DUT sends a SIP 3XX response to BroadWorks, such as *302 Redirect*.
  - BroadWorks responds with ACK.

116. DUTS – Call Forward Always Diversion Inhibitor (P1)

This test case verifies that the DUT properly handles an INVITE with diversion inhibitor when Call Forward Always is enabled on the device. The DUT must handle the INVITE and ring the phone. It must not respond with a REFER or 302 Redirect.

Test setup:

1) Enable *diversion inhibitor* via the BroadWorks Application Server CLI as shown in the following example.

```
AS_CLI/Interface/SIP> set sendDiversionInhibitor true
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The system is configured with *sendDiversionInhibitor* set to "true".

2) Assign the BroadWorks *Call Center – Standard* feature to the DUT.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The *Call Center – Standard* feature is pre-assigned to the preconfigured users in the initial account setup.

3) Create a BroadWorks *Call Center* for the BroadWorks group the DUT is assigned to. Log in as the group administrator and browse to *Call Center → Call Centers* to add a call center.

4) After creating the call center, go back to *Call Center → Call Centers* and select the *active* check box for the call center.

5) Assign the DUT to the BroadWorks *Call Center*. Browse to the Call Center created in step 3 and select *Agents*, then select *Search* to list the *Available Users.* Add the DUT to the *Assigned Users*.

6) For the DUT user, browse to *Call Control → Call Centers*. Make sure that *ACD State* is *Available* and *Join Call Center* is checked.

From the DUT enable Call Forward Always to BroadWorks User C. Originate a call from BroadWorks User A to the Call Center number.

Verify the following:

■ From the DUT, set *Call Forward Always* to forward to BroadWorks User C.

   – DUT indicates that *Call Forward Always* is *ON*.

■ BroadWorks User A dials the call center number.

   – DUT is alerted.

   – BroadWorks User A hears ringback.

■ DUT answers the call.

   – There is two-way voice path between BroadWorks User A and the DUT.

■ Verify the signaling to the DUT.

   – BroadWorks sends INVITE to the DUT with *Diversion* or *History-Info* header containing parameter "diversion-inhibited".

   – DUT responds to the INVITE with *200 OK*. If the DUT redirects the call, this test case is failed.

117. DUTS – Anonymous Call (P1)

This test scenario verifies the DUT's Anonymous Call service for interoperability with BroadWorks. When the DUT sends anonymous calls to BroadWorks, it must provide an identity header with the DUT's actual address-of-record so BroadWorks can identify the originator and provide the appropriate originating services.

Test setup:

1) Configure the DUT device to enable Anonymous Call.

2) Make sure BroadWorks User C is in a different BroadWorks group than the DUT.

3) This test section requires use of the UC-One Desktop client in call control mode. See section *5.3 Use UC-One Desktop Client for Call Control* for instructions on using the UC-One client for call control.

4) Log in to the UC-One client for both User C and the DUT on separate PCs using the BroadWorks web login credentials.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The initial account setup also provides two groups. Make sure the DUT is in the first group and BroadWorks User C is in the second group.

Originate a call from the DUT device to BroadWorks User C.

Verify the following:

- DUT dials BroadWorks User C.

  - BroadWorks User C is alerted.

  - DUT hears audible ringback.

  - The outgoing call appears on the DUT's UC-One client.

  - User C's UC-One client shows the incoming call as:

    - *private* or *anonymous* if the call is within the same BroadWorks enterprise or if the DUT sends a *Privacy* header in addition to identity header.

    - Otherwise, the *caller name* and *number.*

- BroadWorks User C answers the call.

  - Two-way voice path is established.

- Verify the SIP signaling from the DUT.

  - DUT sends an INVITE to BroadWorks with the following:

    - *From* header contains anonymous uri.

      Example: *From:"Anonymous"<sip:anonymous@anonymous.invalid>*

    - INVITE contains an identity header (*P-Asserted-Identity, P-Preferred-Identity,* and *Remote-Party-Id*) with the DUT's address-of-record.

      Example: *P-Asserted-Identity*: "1005" 1115551005@as.broadworks.net

    - Optional: INVITE contains a privacy header.

      Example: Privacy:user;id;critical

118. DUTS – Anonymous Call Block (P1)

This test scenario verifies the DUT's Anonymous Call Blocking *se*rvice for interoperability with BroadWorks.

Test setup:

1) Configure the DUT device to enable *Anonymous Call Block*.

2) Make sure BroadWorks User C is in a different BroadWorks group than the DUT.

3) Assign the BroadWorks Calling Line ID Blocking service to BroadWorks User C.

4) Enable the Calling Line ID Blockin*g* service by selecting *Block Calling Line ID on Outgoing Calls.*

Originate a call from the BroadWorks User C to the DUT.

Verify the following:

- BroadWorks User C dials the DUT.

  – BroadWorks User C hears treatment such as an announcement or reorder tone.

- Verify the SIP signaling to and from the DUT.

  – BroadWorks sends an INVITE to the DUT with anonymous *From* header. Example: *From:"Anonymous"<sip:anonymous@anonymous.invalid>*.

  – DUT responds with SIP 4XX response such as *403 Forbidden*.

119. DUTS – Remote Restart via Notify (P1)

This test case verifies the DUT's support for a SIP NOTIFY request to restart. In this scenario, BroadWorks sends a SIP NOTIFY with event *check-sync* or *resync*.

The remote restart NOTIFY is used in conjunction with the BroadWorks Device Management capability to auto-configure SIP phones and other SIP endpoints.

Test setup:

1) If the DUT is a device for which a current BroadWorks Device Profile exists and the DUT already supports remote restart, make sure this device profile is used for the DUT. Browse to the *<user> → Profile → Addresses* page and select the *Configure Device/Identity Profile* link to verify the *Identity/Device Profile Type*. Otherwise, use the Cisco 7960 device type for this test case. Create a new device with the Cisco 7960 device type, assign to one of the users in the group, and configure the line/port to match the DUT's register user ID.

2) Browse to the *<user> → Profile → Addresses* page and select the *Configure Device/Identity Profile* link. Select the *Profile* tab and configure an arbitrary MAC address for the DUT.

Browse to the *<user> → Profile → Addresses* page for the DUT and select the *Configure Device/Identity Profile* link. Select the *Configure* tab. Select Reset the Phone(s) link.

Verify the following:

- Restart the DUT: Browse to the *<user> → Profile → Addresses* page for the DUT and select the *Configure Device/Identity Profile* link. Select the *Configure* tab. Select *Reset the Phone(s)* link.

  – DUT restarts.

  – DUT downloads its configuration files.

  – If the DUT is a registering device, it re-registers with BroadWorks.

- Verify the SIP signaling to the DUT.

  – BroadWorks sends a NOTFY event to the DUT with a message body of *check-sync*.

9   Redundancy Package

This section verifies the DUT's interoperability with the BroadWorks redundancy implementation.

The BroadWorks redundancy implementation is defined in *BroadWorks SIP Access Interface Interworking Guide* [2]. This test section provides interoperability verification for the following redundancy scenarios:

- DNS SRV Lookup

- REGISTER Failover/Failback

- INVITE Failover/Failback

- BYE Failover

BroadWorks Application Servers are deployed in redundant pairs, designated as primary and secondary servers. The DUT must always contact the primary server except in failover conditions. The DUT must be able to route to a secondary (or alternate) server in a failure situation.

The *BroadWorks SIP Access Interface Interworking Guide* identifies the preferred DUT mechanism, which requires use of DNS SRV records for resolution of proxy address as specified by *RFC 3263*.

Specifically, the DUT should attempt to route on each route in the order received by the DNS SRV lookup until a successful route is obtained. The DUT should proceed to the next route after receiving ICMP errors or timing out on the current route. The timeout interval should be relatively short to prevent longer than desirable call setup delays in a failure situation.

The tests in this section verify this preferred redundancy implementation. These tests require the DUT to use DNS lookup to resolve the single fully qualified domain name (FQDN) of a BroadWorks Application Server cluster to the ordered IP addresses of the two (primary and secondary) Application Servers.

DNS SRV records are required to ensure the correct ordering of the servers. DNS A records cannot guarantee preferred ordering. However, if the DUT only supports DNS A record lookups, the test cases in this section can still be run, but it must be ensured that the DNS server returns fixed order A records.

INVITE messages should be addressed to the FQDN and sent first to the primary Application Server. If the DUT does not receive any response, then it should failover quickly to the secondary Application Server. The recommended failover time is four to six seconds. However, the failover time should be configurable on the DUT so that it can be tuned as necessary for a service provider's network.

Test setup for Redundancy tests:

1) Make sure the DNS server is configured with the following DNS SRV records with preferred order of addresses as follows, for the IOP1 Public Interoperability System. Substitute *iop2* for *iop1* for the IOP2 Public Interoperability System:

   – BroadWorks Application Server cluster FQDN: primary, secondary

   Example:

   ```
   _sip._udp.as.iop1.broadworks.net.    IN    SRV    1    50    5060
   as1.iop1.broadworks.net.
   _sip._udp.as.iop1.broadworks.net.    IN    SRV    2    50    5060
   as2.iop1.broadworks.net.
   ```

   – BroadWorks reverse Application Server cluster FQDN: secondary, primary

   Example:

   ```
   _sip._udp.revas.iop1.broadworks.net. IN    SRV    1    50    5060
   as2.iop1.broadworks.net.
   _sip._udp.revas.iop1.broadworks.net. IN    SRV    2    50    5060
   as1.iop1.broadworks.net.
   ```

2) Set the SIP proxy address on the DUT to the BroadWorks Application Server Cluster FQDN.

3) Enable DNS SRV lookup on the DUT.

4) If failover times are configurable on the DUT, configure as follows.

   – INVITE failover: Four to six seconds

   – REGISTER failover: Under 30 seconds

   – BYE failover: Four to six seconds

5) Using the primary BroadWorks Application Server CLI, configure the BroadWorks CONTACT as the BroadWorks Application Server cluster FQDN.

   Example:

   ```
   AS_CLI/System/StartupParam> set bw.sip.accessclustercontacthost
   as.iop1.broadworks.net
   ```

6) Using the secondary BroadWorks Application Server CLI, configure the BroadWorks CONTACT as the BroadWorks Reverse Application Server cluster FQDN.

   Example:

   ```
   AS_CLI/System/StartupParam> set bw.sip.accessclustercontacthost
   revas.iop1.broadworks.net
   ```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted. The Public Interoperability System is preconfigured with CONTACT FQDNs. A preconfigured DNS server is also available. For cluster and reverse cluster FQDNs and configure the DUT accordingly, see section *4 Public Interoperability System Information*.

120. REDUN – DNS SRV Lookup: Proxy Address (P1)

This test verifies the DUT's ability to perform DNS SRV lookup on the SIP proxy address.

> **NOTE**: The DUT should perform a DNS SRV lookup and cache the results, rather than doing a DNS lookup on every request. The DUT generally should perform a look up at startup, when Time to Live (TTL) expires, and when there is a new contact address.

Restart the DUT. Originate a call from the DUT to BroadWorks User A.

Verify the following.

- DUT restarts.

- DUT dials BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

- Verify the SIP and DNS signaling to and from the DUT.

  – At startup, DUT performs DNS SRV lookup to obtain the ordered addresses for the BroadWorks Application Server cluster.

  – (REGISTERING DUTS only): DUT sends REGISTER request to the primary Application Server.

  – BroadWorks responds with *200 OK* to the REGISTER.

  – DUT uses cached DNS record (preferred) or performs another DNS SRV lookup on the BroadWorks Application Server cluster FQDN and sends the INVITE to the primary Application Server.

  – BroadWorks responds with *200 OK* to the INVITE.

121. REDUN – DNS SRV Lookup: *Contact* Header (P1)

This test verifies the DUT's ability to perform a DNS SRV lookup on the FQDN in the *Contact* header from BroadWorks.

The DUT must correctly use the FQDN in the *Contact* header for requests within the dialog. If the DUT has not cached the FQDN supplied in the *Contact* header, the DUT must do a DNS SRV lookup on the FQDN before sending a request within the dialog.

Originate a call from BroadWorks User A to the DUT.

Verify the following:

- BroadWorks User A dials DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

- DUT answers the call.

  – Two-way voice path is established.

- The DUT hangs up.

  - Call is released.

- Verify the SIP and DNS signaling to and from the DUT.

  - BroadWorks sends INVITE request to the DUT with FQDN CONTACT containing the *BroadWorks Application Server Cluster FQDN.*

  - DUT responds with *200 OK* to the INVITE.

  - After hanging up, the DUT uses the cached DNS record (preferred) or performs another DNS SRV lookup on the CONTACT address and sends the BYE to the primary Application Server.

122. REDUN – REGISTER Failover (P1)

This test verifies the DUT's ability to failover to an alternate server when there is no response to a REGISTER request.

Test setup:

- Using the CLI, lock the primary Application Server so that it does not respond to SIP requests.

```
AS_CLI/Maintenance/ManagedObjects> lock force
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. To run this test case, the DUT must configure its proxy address to the FQDN that follows.

IOP1 Public Interoperability system: redas.iop1.broadworks.net
IOP2 Public Interoperability system: redas.iop2.broadworks.net

This FQDN simulates the primary Application Server as unreachable as it resolves to a dummy IP address as the preferred address.

Additionally, for the BroadWorks user, the device line/port *domain*, configured on the *<user><Profile><Addresses>* web page, must be changed as follows:

IOP1 Public Interoperability system: redas.iop1.broadworks.net
IOP2 Public Interoperability system: redas.iop2.broadworks.net

Restart the DUT or otherwise trigger it to re-REGISTER.

Verify the following:

- DUT restarts.

- Verify the SIP signaling to and from the DUT.

  - DUT sends REGISTER request to primary (or dummy) Application Server address.

  - DUT retries REGISTER to primary (usually three retries).

  - After no response from the primary Application Server, DUT sends REGISTER request to the secondary Application Server.

- The REGISTER failover, from initial REGISTER request to failover REGISTER request, should occur within 30 seconds (recommended). Failover taking more than 30 seconds should be considered a test case failure.

- BroadWorks secondary Application Server responds with *200 OK* to the REGISTER request.

123. REDUN – REGISTER Failback (P1)

This test verifies the DUT's ability to immediately failback REGISTER requests to the primary server after failing over to the secondary server. The DUT must always follow the preferred server order as specified by the DNS SRV record when sending REGISTER requests to BroadWorks.

Test setup:

1) Make sure the previous test case has just been executed.

2) Using the CLI, unlock the primary Application Server.

```
AS_CLI/Maintenance/ManagedObjects> unlock
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: For public interoperability server testing, the unlock step is not necessary.
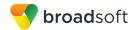
After the previous test case, wait for the DUT's next REGISTER attempt.

Verify the following:

■ Wait until the next REGISTER attempt from the DUT.

■ Verify the SIP signaling to and from the DUT.

- DUT sends next REGISTER request to the primary (or dummy) Application Server address. If the DUT sends the REGISTER request to the secondary Application Server first, then this test has failed.

- The primary Application Server responds with *200 OK* to the REGISTER request.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If the DUT sends the REGISTER request to the dummy Application Server address first, then the test case has passed.

NOTE: When capturing a SIP trace for this test case, the previous test case should be included in the same capture.

124. REDUN – INVITE Failover (P1)

This test verifies the DUT's ability to failover to an alternate server when there is no response to an initial INVITE request.

Test setup:

■   Using the CLI, lock the primary Application Server so that it does not respond to SIP requests.

```
AS_CLI/Maintenance/ManagedObjects> lock force
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. To run this test case, the DUT must configure its proxy address to the FQDN that follows:

IOP1 Public Interoperability system: redas.iop1.broadworks.net
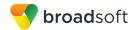IOP2 Public Interoperability system: redas.iop2.broadworks.net

This FQDN simulates the primary Application Server as unreachable as it resolves to a dummy IP address as the preferred address.

Additionally, for the BroadWorks user, the device line/port *domain*, configured on the <*user*><*Profile*><*Addresses*> web page, must be changed as follows:

IOP1 Public Interoperability system: redas.iop1.broadworks.net
IOP2 Public Interoperability system: redas.iop2.broadworks.net

Originate a call from the DUT to BroadWorks User A.

Verify the following:

■   DUT dials BroadWorks User A.

–   BroadWorks User A is alerted.

–   DUT receives audible ringback.

■   BroadWorks User A answers the call.

–   Two-way voice path is established.

■   Verify the SIP signaling to and from the DUT.

–   DUT sends INVITE request to primary (or dummy) Application Server address.

–   DUT retries INVITE to primary (usually three retries).

–   After no response from the primary Application Server, DUT sends INVITE request to the secondary Application Server.

–   The INVITE failover, from initial INVITE to failover INVITE, should occur within four to six seconds (recommended). Failover taking more than six seconds should be considered a test case failure.

–   BroadWorks secondary Application Server responds with *200 OK* to the INVITE request.

125. REDUN – INVITE Failback (P1)

This test verifies the DUT's ability to immediately failback INVITE requests to the primary server after failing over to the secondary server. The DUT must always follow the preferred server order as specified by the DNS SRV record when sending INVITE requests to BroadWorks.

Test setup:

1) Make sure the previous test case has just been executed.

2) Using the CLI, unlock the primary Application Server.

```
AS_CLI/Maintenance/ManagedObjects> unlock
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: For public interoperability server testing, the unlock step is not necessary.

Originate a call from the DUT to BroadWorks User A.

Verify the following:

■ DUT dials BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

■ BroadWorks User A answers the call.

  – Two-way voice path is established.

■ Verify the SIP signaling to and from the DUT.

  – DUT sends next INVITE request to primary (or dummy) Application Server address. If the DUT sends the INVITE request to the secondary Application Server first, then this test has failed.

  – The primary Application Server responds with *200 OK* to the REGISTER request.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If the DUT sends the INVITE request to the dummy Application Server address first, then the test case has passed.

NOTE: When capturing a SIP trace for this test case, the previous test case should be included in the same capture.

126. REDUN – BYE Failover (P1)

This test verifies the DUT's ability to failover to an alternate server when there is no response to a BYE request.

> **NOTE**: The DUT's implementation should allow for failover in the same way for all mid-call requests. However, only BYE requests are verified here. Sending the BYE request to the alternate server allows BroadWorks to generate a closed billing record, which can subsequently be correlated with billing records on the primary server.

Originate a call from the DUT to BroadWorks User A. Answer the call. Lock the primary Application Server or remove the DUT's connectivity to the primary server. Hang up the call.
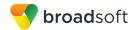
Verify the following:

- DUT dials BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

- Either lock the primary server via the CLI or disconnect the DUT's LAN cable.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. Remove the LAN cable from the DUT or otherwise block the primary server address from the DUT to force it to attempt a failover.

- DUT hangs up the call.

  – The call clears.

- Verify the SIP and DNS signaling to and from the DUT.

  – After hang-up, DUT uses cached DNS record (preferred) or performs another DNS SRV lookup on the CONTACT address and sends the BYE to the primary Application Server.

  – DUT retries BYE to primary (usually three retries).

  – After no response from the primary Application Server, DUT sends BYE request to the secondary Application Server.

  – The BYE failover, from the initial BYE to the failover BYE, should occur within four to six seconds (recommended). Failover taking more than 30 seconds should be considered a test case failure.

  – BroadWorks secondary Application Server responds with *200 OK* to the BYE request.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If the DUT attempts to send the request to the secondary Application Server address on failover, then this test case has passed. Since the LAN connection was removed, no *200 OK* responses to the BYE are expected.

10   SBC/ALG Package

This section verifies the DUT's basic interoperability with BroadWorks when the BroadWorks Application Servers are fronted by a session border controller (SBC) or application layer gateway (ALG) or there is an enterprise SBC or edge gateway. Section coverage includes the following:

- Basic
- Failover/Failback

The DUT must support configurable outbound proxy and symmetric UDP for NAT traversal. Symmetric UDP requires that the UDP send and receive ports are the same. The port used to transmit packets is the same UDP port that is used to receive packets.

For the tests in this section, the DUT must be placed on a private network without direct connectivity to and from the BroadWorks Application Servers.

Test setup for SBC/ALG tests:

1) Make sure the DUT is configured with a private address.
2) Enable the DUT's outbound proxy setting and configure as the SBC address fronting the BroadWorks Application Servers.
3) Make sure the DUT's SIP proxy/domain and SIP registrar settings are still configured with the BroadWorks Application Server domain.
4) Configure the DUT to use symmetric UDP.
5) Assign the BroadWorks Authentication service to the DUT.
6) Configure the BroadWorks Authentication service with the authentication *user name* and *password*.
7) Configure the DUT with the matching authentication *user name* and *password*.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: The Public Interoperability System has two SBC devices available for testing. The SBC addresses are identified in section *4 Public Interoperability System Information*.

Make sure the DUT is on a private address space but is not behind another SBC/ALG or SIP-aware firewall.

10.1   SBC/ALG – Basic

This section covers basic call scenarios in which there is an enterprise or hosted SBC between the DUT and BroadWorks including the following:

- REGISTER
- Outgoing INVITE
- Incoming INVITE

127.   SBC/ALG – REGISTER (P1)

This test case verifies the DUT's ability to REGISTER when behind an SBC.

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart.

Verify the following:

- DUT is restarted.

- Verify the SIP signaling to and from the DUT.

  - DUT sends REGISTER request to the SBC address. The host portion in the *Request-URI, To,* and *From* headers must be the BroadWorks domain.

  - DUT receives challenge for authentication (SIP 401) from the SBC address.

  - DUT resends the REGISTER request with authentication credentials.

  - DUT receives *200 OK*.

128. SBC/ALG – Outgoing INVITE (P1)

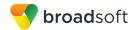This test case verifies the DUT's ability to make an outbound call when behind an SBC.

- Configure the BroadWorks *inviteAuthenticationRatio* via the CLI as follows to enable initial INVITE challenges. BroadWorks challenges one out of every *X* initial INVITE requests, where *X* is the *inviteAuthenticationRatio*. Setting the ratio to "1" as follows enables BroadWorks to challenge every initial INVITE request.

```
AS_CLI/Interface/SIP> set inviteAuthenticationRatio 1
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is configured with *inviteAuthenticationRatio* set to "1".

Originate a call from the DUT to BroadWorks User A. Answer the call. Hang up the call from the DUT.

Verify the following:

- DUT dials BroadWorks User A.

  - BroadWorks User A is alerted.

  - DUT receives audible ringback.

- BroadWorks User A answers the call.

  - Two-way voice path is established.

- DUT hangs up the call.

  - The call is released.

- Verify the SIP signaling to and from the DUT.

  - DUT sends INVITE request to the SBC address. The host portion in the *Request-URI, To*, and *From* headers must be the BroadWorks domain.

  - DUT receives challenge for authentication (SIP 401) from the SBC address.

  - DUT resends the INVITE request with authentication credentials.

  - After answer, DUT receives *200 OK*.

129. SBC/ALG – Incoming INVITE (P1)

This test case verifies the DUT's ability to receive an inbound call when behind an SBC.

Originate a call from BroadWorks User A to the DUT. Answer the call. Hang up the call on the DUT.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- DUT hangs up the call.
    - The call is released.
- Verify the SIP signaling to and from the DUT.
    - DUT receives INVITE request from the SBC address. The host portion in the *To* and *From* headers is the BroadWorks domain.
    - After answer, DUT sends *200 OK*.

10.2 SBC/ALG – Failover/Failback

This section covers failover scenarios in which there is an enterprise or hosted SBC between the DUT and BroadWorks including the following:

- REGISTER Failover/Failback
- INVITE Failover/Failback

There are several implementations possible for multiple SBCs in the network. SBCs may be deployed in pairs or pools. They may be collocated or geographically separated. SBC pairs may or may not share call state.

This section verifies only that the DUT supports timely failover from one SBC address to another for basic SIP requests. To do this, the DUT must support one or both of the following methods to obtain the SBC addresses:

- Static address configuration of two or more outbound proxy addresses, for example, outbound proxy address/port and backup outbound proxy address/port.
- DNS lookup of an SBC FQDN that resolves to two or more addresses. According to *RFC 3263*, DNS SRV lookup should be used.

Test section setup:

1) Configure the DUT with either two static SBC addresses or an FQDN resolving to two SBC addresses.

2) If using an FQDN for the SBC addresses, enable DNS SRV lookup on the DUT. If SRV is not supported, enable DNS A lookup.

3) If failover times are configurable on the DUT, configure as follows:

    - INVITE failover: Four to six seconds
    - REGISTER failover: Under 30 seconds
    - BYE failover: Four to six seconds

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: To run these tests on the Public Interoperability system, do one of the following:

If the DUT uses static addresses for outbound proxy, configure the primary outbound proxy address with a dummy IP address and configure the alternate or backup outbound proxy address with the IOP system SBC address (see section *4 Public Interoperability System Information*).

If the DUT uses an FQDN for outbound proxy, configure the FQDN as follows:

IOP1 Public Interoperability system: sbcfailover.iop1.broadworks.net
IOP2 Public Interoperability system: sbcfailover.iop2.broadworks.net

Using DNS SRV lookup, this FQDN simulates the primary SBC address as unreachable as it resolves to a dummy IP address as the preferred address. The alternate address resolves to the IOP system SBC address.

If these methods are not workable, you may provide your own method for demonstrating support for SBC failover.

130. **SBC/ALG – REGISTER Failover (P1)**

This test verifies the DUT's ability to fail over to an alternate SBC when there is no response to a REGISTER request.

Test setup:

Make the primary SBC address unavailable by taking the SBC offline or removing access to it.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: SBC access control is restricted. To run these tests on the Public Interoperability system, configure the DUT with outbound proxy addresses as recommended in the section introduction.

Restart the DUT or trigger it to re-REGISTER.

Verify the following:

- DUT restarts.

- Verify the SIP signaling to and from the DUT.

  – DUT sends REGISTER request to primary SBC (outbound proxy) address. This is a non-responsive address.

  – There is no response from the primary SBC (outbound proxy) address.

  – DUT retries REGISTER to primary (usually three retries).

  – After no response from the primary SBC address, DUT sends REGISTER request to the alternate SBC (outbound proxy) address.

  – The REGISTER failover, from initial REGISTER request to failover REGISTER request, should occur within 30 seconds (recommended). A failover taking more than 30 seconds should be considered a test case failure.

– Alternate SBC address responds with *200 OK* to the REGISTER request.

131. SBC/ALG – REGISTER Failback (P1)

This test verifies the DUT's support for REGISTER failback to the primary SBC address after failing over to the alternate SBC address.

Test setup:

1) Make sure the previous test case has just been executed.

2) Make the primary SBC address available again.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** For public interoperability server testing, the second step is not applicable.

After the previous test case, wait for the DUT's next REGISTER attempt.

Verify the following:

■ Wait until the next REGISTER attempt from the DUT.

■ Verify the SIP signaling to and from the DUT.

– DUT sends the next REGISTER request to the primary SBC address. If the DUT sends the REGISTER request to the alternate SBC address first, then this test has failed.

– The primary SBC address responds with *200 OK* to the REGISTER request.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** If the DUT sends the REGISTER request to the dummy SBC address first, then the test case has passed.

> **NOTE**: When capturing a SIP trace for this test case, the previous test case should be included in the same capture.

132. SBC/ALG – INVITE Failover (P1)

This test verifies the DUT's ability to fail over to an alternate SBC when there is no response to an INVITE request.

Test setup:

Make the primary SBC address unavailable by taking the SBC offline or removing access to it.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** SBC access control is restricted. To run these tests on the Public Interoperability system, configure the DUT with outbound proxy addresses as recommended in the section introduction.

Originate a call from the DUT to BroadWorks User A.

Verify the following:

- DUT dials BroadWorks User A.

    – BroadWorks User A is alerted.

    – DUT receives audible ringback.

- BroadWorks User A answers the call.

    – Two-way voice path is established.

- Verify the SIP signaling to and from the DUT.

    – DUT sends INVITE request to primary SBC (outbound proxy) address. This is a non-responsive address.

    – There is no response from the primary SBC (outbound proxy) address.

    – DUT retries INVITE to primary (usually three retries).

    – After no response from the primary SBC address, DUT sends INVITE request to the alternate SBC (outbound proxy) address.

    – The INVITE failover, from initial INVITE to failover INVITE, should occur within four to six seconds (recommended). A failover taking more than six seconds should be considered a test case failure.

    – Alternate SBC address responds with *200 OK* to the REGISTER request.

133. SBC/ALG – INVITE Failback (P1)

This test verifies the DUT's support for INVITE failback to the primary SBC address after failing over to the alternate SBC address.

Test setup:

1) Make sure the previous test case has just been executed.

2) Make the primary SBC address available again.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: For public interoperability server testing, the second step is not applicable.

Originate a call from the DUT to BroadWorks User A.

Verify the following:

- DUT dials BroadWorks User A.

    – BroadWorks User A is alerted.

    – DUT receives audible ringback.

- BroadWorks User A answers the call.

    – Two-way voice path is established.

- Verify the SIP signaling to and from the DUT.

    – DUT sends next INVITE request to primary SBC address. If the DUT sends the INVITE request to the alternate SBC address first, then this test has failed.

    – The primary SBC address responds with *200 OK* to the REGISTER request.

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: If the DUT sends the INVITE request to the dummy Application Server address first, then the test case has passed.

NOTE: When capturing a SIP trace for this test case, the previous test case should be included in the same capture.

11 TCP Package

This section verifies the DUT's interoperability with BroadWorks for basic call scenarios when using TCP transport for SIP messages.

Test setup for video tests:

1) Configure the DUT to use TCP as the transport for SIP messages. The DUT must use TCP transport to send messages and must supply a TCP contact.

2) Enable TCP via the BroadWorks Application Server CLI as follows:

```
AS_CLI/Interface/SIP> set supportTCP true
```

3) If the DUT does not register, browse to the BroadWorks *<group> → Resources → Identity/Device Profiles* page, select the DUT device, and from the *Identity/Device Profile Modify* page, set the *Transport* to "TCP".

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The system is preconfigured with the *supportTCP* variable set to "true".

134. TCP – DUT REGISTER (P1)

This test case verifies the DUT's ability to REGISTER over TCP transport.

Force the DUT to register its location with BroadWorks. Some devices allow this via the device menus; others require a restart.

Wait for register expiration and observe the next registration.

Verify the following:

- A REGISTER request is sent from the DUT to BroadWorks.
  - BroadWorks responds with *200 OK*.
- Verify the SIP signaling to and from the DUT.
  - All SIP messages (requests and responses) are via TCP transport.

135. TCP – DUT to BroadWorks; DUT Hangs Up Before Answer (P1)

This test case verifies the DUT's ability to originate and cancel a call over TCP transport.

Originate a local call from the DUT to BroadWorks User A. Do not answer the call. Disconnect the call from the DUT before BroadWorks User A answers.

Verify the following:

- DUT dials the number of the BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT receives audible ringback.
- DUT hangs up before answer.
  - The call is released.

■ Verify the SIP signaling to and from the DUT.

  – All SIP messages (requests and responses) are via TCP transport.

136. TCP – DUT to BroadWorks; DUT Hangs Up After Answer (P1)

This test case verifies the DUT's ability to originate a call over TCP transport.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from the DUT.

Verify the following:

■ DUT dials the number of BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

■ BroadWorks User A answers the call.

  – Two-way voice path is established.

■ DUT hangs up.

  – The call is released.

■ Verify the SIP signaling to and from the DUT.

  – All SIP messages (requests and responses) are via TCP transport.

137. TCP – BroadWorks to DUT; BroadWorks Hangs Up Before Answer (P1)

This test case verifies the DUT's ability to receive a call that is cancelled over TCP transport.

Originate a call from BroadWorks User A to the DUT. Do not answer the call. Disconnect the call from BroadWorks User A before the DUT answers.

Verify the following:

■ BroadWorks User A dials the DUT.

  – DUT is alerted.

  – BroadWorks User A receives audible ringback.

■ BroadWorks User A hangs up.

  – The call is released upon disconnect.

■ Verify the SIP signaling to and from the DUT.

  – All SIP messages (requests and responses) are via TCP transport.

138. TCP – BroadWorks to DUT; BroadWorks Hangs Up After Answer (P1)

This test case verifies the DUT's ability to receive a call over TCP transport.

Originate a call from BroadWorks User A to the DUT. Answer the call. Disconnect the call from BroadWorks User A.

Verify the following:

- BroadWorks User A dials the DUT.
    - DUT is alerted.
    - BroadWorks User A receives audible ringback.
- DUT answers the call.
    - Two-way voice path is established.
- BroadWorks User A hangs up.
    - The call is released upon disconnect.
- Verify the SIP signaling to and from the DUT.
    - All SIP messages (requests and responses) are via TCP transport.

12 IPV6 Package

This section verifies the DUT's interoperability with BroadWorks for a sampling of call scenarios on an IPV6 network.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** See section *4 Public Interoperability System Information* for the system IPV6 addresses.

Test setup for IPV6 tests:

1) IPV6 testing requires a BroadWorks system enabled with IPV6 for SIP. BroadWorks supports dual-stack (IPV4 and IPV6).

```
AS_CLI/Interface/SIP> set sipIpVersion both
```

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured for dual-stack.

2) Configure the DUT with an IPV6 address.

12.1 IPV6 – Basic – Call Origination

139. IPV6 – DUT to BroadWorks; DUT Hangs Up After Answer (P1)

Follow instructions for test case *1*.

140. IPV6 – DUT to BroadWorks; DUT Hangs Up Before Answer (P1)

Follow instructions for test case *2*.

12.2 IPV6 – Basic – Call Termination

141. IPV6 – BroadWorks to DUT; BroadWorks Hangs Up After Answer (P1)

Follow instructions for test case *4*.

142. IPV6 – BroadWorks to DUT; BroadWorks Hangs Up Before Answer (P1)

Follow instructions for test case *5*.

12.3 IPV6 – Basic – Session Audit

143. IPV6 – BroadWorks to DUT; Wait for Session Audit (P1)

Follow instructions for test case *7*.

144. IPV6 – DUT to BroadWorks; Wait for Session Audit (P1)

Follow instructions for test case *9*.

12.4 IPV6 – Basic – Ringback

145. IPV6 – DUT Receives Remote Ringback (P1)

Follow instructions for test case *17*.

12.5 IPV6 – Basic – Codec Negotiation/Renegotiation

146. IPV6 – Codec Negotiation: Initial Answer with HOLD SDP (P1)

Follow instructions for test case *37*.

147. IPV6 – Codec Renegotiation: Attended Transfer (P1)

Follow instructions for test case *39*.

12.6 IPV6 – BroadWorks Services – Voice Message Deposit/Retrieval

148. IPV6 – Voice Message Deposit (P1)

Follow instructions for test case *45*.

149. IPV6 –Voice Message Retrieval (P1)

Follow instructions for test case *46*.

12.7 IPV6 – DUT Services – Call Control Services

150. IPV6 – Call Hold: DUT Terminator (P1)

Follow instructions for test case *84*.

151. IPV6 – Attended Transfer After Answer (P1)

Follow instructions for test case *87*.

152. IPV6 – Three-Way Call After Answer (P1)

Follow instructions for test case *89*.

153. IPV6 – Network-based Three-Way Call (P1)

Follow instructions for test case *91*.

12.8 IPV6 – DUT Services – Registration and Authentication

154. IPV6 – REGISTER Authentication (P1)

Follow instructions for test case *93*.

12.9 IPV6 – DUT Services – Fax

155. IPV6 – T38 Fax Messaging: DUT Originator (P1)

Follow instructions for test case *106*.

156. IPV6 – T38 Fax Messaging: DUT Terminator (P1)

Follow instructions for test case *107*.

12.10 IPV6 – Redundancy

157. IPV6 – REGISTER Failover (P1)

Follow instructions for test case *122*.

158. IPV6 – INVITE Failover (P1)

Follow instructions for test case *124*.

12.11 IPV6 – SBC

159. IPV6 – REGISTER (P1)

Follow instructions for test case *127*.

160. IPV6 – Outgoing INVITE (P1)

Follow instructions for test case *128*.

161. IPV6 – Incoming INVITE (P1)

Follow instructions for test case *129*.

12.12 IPV6 – Dual Stack with Alternate Connectivity

This section applies to devices that support SDP offer/answer methods using the alternate connectivity (ALTC) attribute to support dual-stack (IPv4 and IPv6).

The ALTC attribute provides a backwards compatible syntax for indicating multiple media connection addresses and ports in an SDP offer, which can immediately be selected from and used in the SDP answer.

This section verifies the DUT's interoperability with BroadWorks for supporting ALTC.

Test setup:

1) Enable ALTC on the BroadWorks Application Server.

```
AS_CLI/Interface/SIP> set reportAltcSupported true
```

2) Enable ALTC on the BroadWorks Media Server.

```
MS_CLI/Applications/MediaStreaming/GeneralSettings> set
OfferSdpIpAddressType altcIpv4Legacy
```

PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS: CLI access is restricted on the Public Interoperability System. The Public Interoperability System is preconfigured to support ALTC.

3) Configure the DUT to enable dual-stack with ALTC.

162. IPV6 – DUT Call Origination with ALTC; IPv4 Negotiated (P1)

This test case verifies call origination by a DUT supporting dual-stack, with IPv4 negotiated as the address type. The DUT must supply an IPv4 default connection and ALTC lines for IPv6 and IPv4.

Test setup:

Make sure BroadWorks User A is configured with a SIP device that supports IPv4 only.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from the DUT.

Verify the following:

- DUT dials the number of BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

- DUT hangs up.

  – The call is released.

- Verify the SIP signaling to and from the DUT.

  – Make sure the DUT sends an offer SDP with a default connection to IPv4 and both IPv6 and IPv4 in the alternate connectivity lines. Example:

```
v=0
o=user1 53655765 2353687637 IN IP4 192.168.8.94
s=-
c=IN IP4 192.168.8.94
t=0 0
m=audio 6000 RTP/AVP 0
a=altc:1 IP6 2001:db8::1 6000
a=altc:2 IP4 192.168.8.94 6000
a=rtpmap:0 PCMU/8000
```

  – Make sure the call is established using the negotiated IPv4 address.

163. IPV6 – DUT Call Origination with ALTC; IPv6 Negotiated (P1)

This test case verifies call origination by a DUT supporting dual-stack, with IPv6 negotiated as the address type. The DUT must supply an IPv4 default connection and ALTC lines for IPv6 and IPv4.

Test setup:

Make sure BroadWorks User A is configured with a SIP device that supports ALTC.

Originate a call from the DUT to BroadWorks User A. Answer the call. Disconnect the call from the DUT.

Verify the following:

- DUT dials the number of BroadWorks User A.

  – BroadWorks User A is alerted.

  – DUT receives audible ringback.

- BroadWorks User A answers the call.

  – Two-way voice path is established.

- DUT hangs up.

  – The call is released.

- Verify the SIP signaling to and from the DUT.

  - Make sure the DUT sends an offer SDP with a default connection to IPv4 and both IPv6 and IPv4 in the alternate connectivity lines. Example:

```
v=0
o=user1 53655765 2353687637 IN IP4 192.168.8.94
s=-
c=IN IP4 192.168.8.94
t=0 0
m=audio 6000 RTP/AVP 0
a=altc:1 IP6 2001:db8::1 6000
a=altc:2 IP4 192.168.8.94 6000
a=rtpmap:0 PCMU/8000
```

  - Make sure the call is established using the negotiated IPv6 address.

164. IPV6 – DUT Call Termination with ALTC; IPv4 Negotiated (P1)

This test case verifies call termination by a DUT supporting dual-stack, with IPv4 negotiated as the address type.

Test setup:

Make sure BroadWorks User A is configured with a SIP device that supports IPv4 only.

Originate a call from the BroadWorks User A to the DUT. Answer the call. Disconnect the call from BroadWorks User A.

Verify the following:

- BroadWorks User A dials the number for the DUT.

  - DUT is alerted.

  - BroadWorks User A receives audible ringback.

- DUT answers the call.

  - Two-way voice path is established.

- BroadWorks User A hangs up.

  - The call is released.

- Verify the SIP signaling to and from the DUT.

  - BroadWorks sends INVITE to DUT with an offer SDP that has a default connection to IPv4 and no alternate connectivity lines.

  - Make sure DUT responds with an answer SDP that has an IPv4 address as a default connection.

  - Make sure the call is established using the negotiated IPv4 address.

165. IPV6 – DUT Call Termination with ALTC; IPv6 Negotiated (P1)

This test case verifies call termination by a DUT supporting dual-stack, with IPv6 negotiated as the address type.

Test setup:

Make sure BroadWorks User A is configured with a SIP device that supports ALTC.

Originate a call from the BroadWorks User A to the DUT. Answer the call. Disconnect the call from BroadWorks User A.

Verify the following:

- BroadWorks User A dials the number for the DUT.
  - DUT is alerted.
  - BroadWorks User A receives audible ringback.
- DUT answers the call.
  - Two-way voice path is established.
- BroadWorks User A hangs up.
  - The call is released.
- Verify the SIP signaling to and from the DUT.
  - BroadWorks sends INVITE to DUT with an offer SDP that has a default connection to IPv4 and both IPv6 and IPv4 in the alternate connectivity lines. Example:

```
v=0
o=user1 53655765 2353687637 IN IP4 192.168.8.94
s=-
c=IN IP4 192.168.8.94
t=0 0
m=audio 6000 RTP/AVP 0
a=altc:1 IP6 2001:db8::1 6000
a=altc:2 IP4 192.168.8.94 6000
a=rtpmap:0 PCMU/8000
```

  - Make sure DUT responds with an SDP that has an IPv6 address in the connection line.
  - Make sure the call is established using the negotiated IPv6 address.

166. IPV6 – DUT Call Origination with ALTC to BroadWorks Auto Attendant (P1)

This test case verifies call origination by the DUT to the BroadWorks Auto Attendant, negotiating IPv6 with the BroadWorks Media Server using ALTC.

Test setup:

1) Assign and configure a BroadWorks Auto Attendant for the BroadWorks group.

> **PUBLIC INTEROPERABILITY SYSTEM INSTRUCTIONS:** If you are using the Public Interoperability Server for testing, an Auto Attendant was preconfigured for you when your accounts were created. See your account setup information.

2) Make sure BroadWorks User A is configured with a SIP device that supports IPv4 only.

Originate a call from the DUT to the Auto Attendant. Follow the IVR instructions to transfer the call to BroadWorks User A.

Verify the following:

- DUT dials the Auto Attendant.
  - DUT hears a greeting and a prompt provided by the Auto Attendant.

- DUT responds to the Auto Attendant prompts and supplies the necessary digits to transfer the call to BroadWorks User A.
  - BroadWorks User A is alerted.
  - DUT hears audible ringback.
- BroadWorks User A answers the call.
  - Two-way voice path is established.
- BroadWorks User A hangs up.
  - The call is released.
- Verify the SIP signaling to and from the DUT.
  - Make sure the DUT offer SDP indicates its default connection in the "c=" (IPv4) and its preferred connection in the first "a=altc:1" line (IPv6). Example:

```
v=0
o=user1 53655765 2353687637 IN IP4 192.168.8.94
s=-
c=IN IP4 192.168.8.94
t=0 0
m=audio 6000 RTP/AVP 0
a=altc:1 IP6 2001:db8::1 6000
a=altc:2 IP4 192.168.8.94 6000
a=rtpmap:0 PCMU/8000
```

  - The Media Server answer SDP indicates the connection type is IPv6.
  - Make sure the call between the DUT and the Auto Attendant (Media Server) is established using the negotiated IPv6 address.
  - Make sure that during the transfer, the DUT responds to re-INVITE without SDP with full offer SDP including ALTC lines for IPv4 and IPv6.
  - Make sure that the call between the DUT and BroadWorks User A is established using the negotiated IPv4 address.

Acronyms and Abbreviations

This section lists the acronyms and abbreviations found in this document. The acronyms and abbreviations are listed in alphabetical order along with their meanings.

ACR	Accounting Request
Admin	Administrator
ALG	Application Layer Gateway
ALTC	Alternative Connectivity
AMR-WB	Adaptive Multi-Rate Wideband
AoC	Advice of Charge
AoR	Address of Record
AS	Application Server
AS TAS	Application Server Telephony Application Server
ATA	Analog Telephone Adapters
AUCX	Audit Connection
BFCP	Binary Floor Control Protocol
BLF	Busy Lamp Field
BW	BroadWorks
CC	Country Code
CCR	Call Center Reporting
CDF	Charging Data Function
CDR	Call Detail Record
CDS	Call Detail Server
CF	Call Forward
CFA	Call Forwarding Always
CFB	Call Forwarding Busy
CFNA	Call Forwarding No Answer
CFNRc	Call Forwarding Not Reachable
CLI	Command Line Interface
CLID	Calling Line ID
CRS	Call Recording Server
CS	Conferencing Server
CSCF	Call Session Control Function
CT	Call Transfer
DBMS	Database Management System
DBS	Database Server

DID	Direct Inward Dialing
DLCX	Delete Connection
DM	Device Management
DMS	Device Management System
DN	Directory Number
DND	Do Not Disturb
DNS	Domain Name System
DTG	Destination Trunk Group
DTMF	Dual-Tone Multi-Frequency
DUT	Device Under Test
EA	Equal Access
EM	Emergency
EMS	Element Management System
EMTA	Embedded Multimedia Terminal Adaptors
EOCP	Enhanced Outgoing Calling Plan
E-SBC	Enterprise Session Border Controller
FAC	Feature Access Code
FQDN	Fully Qualified Domain Name
FTP	File Transfer Protocol
FXS	Foreign eXchange Subscriber
GA	Generally Available
GB	Gigabyte
GIN	Generate Implicit Numbers
GUI	Graphical User Interface
GW	Gateway
HD	High Definition
HSS	Home Subscriber Server
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure Sockets
IAD	Integrated Access Device
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IF	Interface
IFC	Initial Filter Criteria
IM	Instant Messaging

IM	IP Multimedia
IM&P	Instant Messaging and Presence
IMS	IP Multimedia Subsystem
IN	Intelligent Network
IO	Input Output
IOP	Interoperability
IOT	Interoperability Testing
IP	Internet Protocol
IPC	Interprocess Communication
IP-PBX	Internet Protocol-Private Branch Exchange
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
IS	Interim Standard
ISC	IMS Service Control
ISR	Integrated Services Router
ITU	International Telecommunications Union
IVR	Interactive Voice Response
IXC	Inter Exchange Carrier
KB	Kilobyte
Kbps	Kilobits per Second
KTS	Key Telephone System
LAN	Local Area Network
LCA	Local Calling Area
LDAP	Lightweight Directory Access Protocol
LI	Lawful Intercept
MAC	Media Access Control
MB	Megabyte
Mb	Megabit
MBps	Megabytes per Second
Mbps	Megabits per Second
MDCX	Modify Connection
MGCP	Media Gateway Control Protocol
MHz	Megahertz
MOH	Music On Hold
MRF	Media Resource Function
MS	Media Server

MS	Milliseconds
MWI	Message Waiting Indicator or Indication
NA	Not Applicable
NADP	North American Dial Plan
NAPTR	Naming Authority Pointer
NAT	Network Address Translation
NCS	Network Call Signaling
NDC	National Destination Code
NE	Network Element
NNACL	NPA-NXX Active Code List
NPA	Numbering Plan Area
NPDB	Number Portability Database
NS	Network Server
NS	Not Supported
NT	Not Tested
NWC	N-Way Calling
OAMP	Operations, Administration, Maintenance, and Provisioning
OCF	Online Charging Function
OCI	Open Client Interface
OCI-C	Open Client Interface-Call Control
OCI-P	Open Client Interface-Provisioning
OCI-R	Open Client Interface-Reporting
OCS	Online Charging System
OCS	Open Client Server
OOTB	Out-of-the-Blue
OS	Operating System
OSI	Open Systems Interconnect
OSS	Operations Support System
OTG	Originating Trunk Group
PAI	P-Asserted-Identity
PBX	Private Branch Exchange
PC	Personal Computer
PDF	Portable Document Format
PM	Performance Measurement
POTS	Plain Old Telephone Service
PS	Packet Switch

PS	Profile Server	
PSTN	Public Switched Telephone Network	
PTT	Push To Talk	
PUI	Public User Identity	
QA	Quality Assurance	
QoS	Quality of Service	
RAM	Random Access Memory	
RCC	Remote Call Control	
RCS	Rich Communications Suite	
RDB	Reporting Database	
RFC	Request for Comments	
RO	Remote Office	
RTCP	Real-Time Control Protocol	
RTF	Rich Text Format	
RTMP	Real Time Messaging Protocol	
RTP	Real-Time Transport Protocol	
RTSP	Real-Time Streaming Protocol	
RSIP	Realm-specific Internet Protocol	
SBC	Session Border Controller	
SCA	Selective Call Acceptance	
SCA	Shared Call Appearance	
SCC	Service Centralization and Continuity	
SCF	Selective Call Forwarding	
SCF	Service Control Function	
SCP	Service Control Point	
SCR	Selective Call Rejection	
S-CSCF	Serving – Call Session Control Function	
SCTP	Stream Control Transmission Protocol	
SCTP/IP	Stream Control Transmission Protocol/Internet Protocol	
SDP	Session Definition Protocol	
SDP	Session Description Protocol	
SGML	Standard Generalized Markup Language	
SIP	Session Initiation Protocol	
SMS	Short Message Service	
SMTP	Simple Mail Transfer Protocol	
SNMP	Simple Network Management Protocol	

SOAP	Simple Object Access Protocol
SRTP	Secure Real-time Transport Protocol
SRV	Service Locator
SS7	Signaling System 7
SSH	Secure Shell
SSL	Secure Sockets Layer
SW	Software
TAS	Telephony Application Server
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TDM	Time Division Multiplexing
TFTP	Trivial File Transfer Protocol
TGRP	Trunk Group
TLS	Transport Layer Security
TSD	Two-Stage Dialing
TZ	Timezone
UC	Unified Communications
UDP	User Datagram Protocol
UI	User Interface
UM	Unified Messaging
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
VM	Voice Mail
VM	Voice Messaging
VoIP	Voice over Internet Protocol
VP	Voice Portal
VPN	Virtual Private Network
WAN	Wide Area Network
WS	Web Server
WWW	World Wide Web
XML	eXtensible Markup Language
XMPP	Extensible Messaging and Presence Protocol
XS	Execution Server
Xsi	Xtended Services Interface
Xsp	Xtended Services Platform

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