Audio Stream Control Service (ASCS)

***Bluetooth*® Test Suite**

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Contents

1 Scope

This Bluetooth document contains the Test Suite Structure (TSS) and test cases to test the implementation of the Bluetooth Audio Stream Control Service specification with the objective to provide a high probability of air interface interoperability between the tested implementation and other manufacturers' Bluetooth devices.

2 References, definitions, and abbreviations

2.1 References

This document incorporates provisions from other publications by dated or undated reference. These references are cited at the appropriate places in the text, and the publications are listed hereinafter. Additional definitions and abbreviations can be found in [1] and [2].

[1] Bluetooth Core Specification, Version 5.2 or later

[2] Test Strategy and Terminology Overview

[3] Audio Stream Control Service, Version 1.0

[4] Audio Stream Control Service Implementation Conformance Statement (ASCS.ICS)

[5] Audio Stream Control Service Implementation eXtra Information for Test (ASCS.IXIT)

[6] Characteristic and Descriptor descriptions are accessible via the Bluetooth SIG Assigned Numbers

[7] GATT Test Suite, GATT.TS

2.2 Definitions

In this Bluetooth document, the definitions from [1] and [2] apply.

2.3 Acronyms and abbreviations

In this Bluetooth document, the definitions, acronyms, and abbreviations from [1] and [2] apply.

3 Test Suite Structure (TSS)

3.1 Test strategy

The Audio Stream Control Service allows a Client to configure and manage Audio Stream Endpoints (ASEs).

The Audio Stream Control Service requires the presence of GAP, SM (when used over LE transport), SDP (when used over BR/EDR transport), L2CAP, and GATT over ATT. EATT can optionally be used. This is illustrated in Figure 3.1.

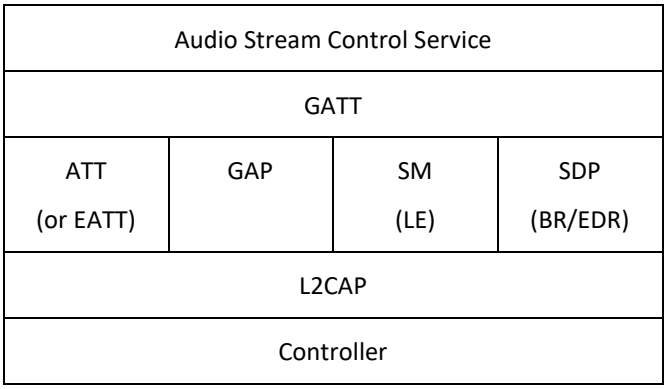

Figure 3.1: Audio Stream Control Service test model

The test objectives are to verify the functionality of the Audio Stream Control Service within a Bluetooth Host and enable interoperability between Bluetooth Hosts on different devices. The testing approach covers mandatory and optional requirements in the specification and matches these to the support of the IUT as described in the ICS. Any defined test herein is applicable to the IUT if the ICS logical expression defined in the Test Case Mapping Table (TCMT) evaluates to true.

The test equipment provides an implementation of the Radio Controller and the parts of the Host needed to perform the test cases defined in this Test Suite. A Lower Tester acts as the IUT's peer device and interacts with the IUT over-the-air interface. The configuration, including the IUT, needs to implement similar capabilities to communicate with the test equipment. For some test cases, it is necessary to stimulate the IUT from an Upper Tester. In practice, this could be implemented as a special test interface, a Man-Machine Interface (MMI), or another interface supported by the IUT.

This Test Suite contains Valid Behavior (BV) tests complemented with Invalid Behavior (BI) tests where required. The test coverage mirrored in the Test Suite Structure is the result of a process that started with cataloged specification requirements that were logically grouped and assessed for testability enabling coverage in defined test purposes.

The interface between the IUT and the Upper Tester may be:

- A man-machine interface
- Provided by the IUT manufacturer

The Test Suite supports the IUT in the Server role and the Lower Tester in the Client role.

3.2 Test groups

The following test groups have been defined:

- Generic GATT Integrated Tests
- Additional Service Requirements
- ASE Control Point procedures
- Multiple Stream Control
- Service Procedures – Error Handling

4 Test cases (TC)

4.1 Introduction

4.1.1 Test case identification conventions

Test cases are assigned unique identifiers per the conventions in [2]. The convention used here is:
<spec abbreviation>/<IUT role>/<class>/**<feat>**/<func>/<subfunc>**/**<cap>**/<xx>-<nn>-<y>**.

Additionally, testing of this specification includes tests from the GATT Test Suite [7] referred to as Generic GATT Integrated Tests (GGIT); when used, the test cases in GGIT are referred to through a TCID string using the following convention:
<spec abbreviation>/<IUT role>/<GGIT test group>/< GGIT class >/<xx>-<nn>-<y>.

Identifier Abbreviation	**Spec Identifier <spec abbreviation>**
ASCS	Audio Stream Control Service
Identifier Abbreviation	**Role Identifier <IUT role>**
SR	Server
Identifier Abbreviation	**Feature Identifier <GGIT test group>**
SGGIT	Server Generic GATT Integrated Tests
Identifier Abbreviation	**Feature Identifier <GGIT class>**
CHA	Characteristic
SDP	SDP Record
SER	Service
Identifier Abbreviation	**Feature Identifier <feat>**
ACP	ASE Control Point Procedures
ASR	Additional Service Requirements
SPE	Service Procedure Error Handling

Table 4.1: ASCS TC feature naming convention

4.1.2 Conformance

When conformance is claimed for a particular specification, all capabilities are to be supported in the specified manner. The mandated tests from this Test Suite depend on the capabilities to which conformance is claimed.

The Bluetooth Qualification Program may employ tests to verify implementation robustness. The level of implementation robustness that is verified varies from one specification to another and may be revised for cause based on interoperability issues found in the market.

Such tests may verify:

- That claimed capabilities may be used in any order and any number of repetitions that is not excluded by the specification
- That capabilities enabled by the implementations are sustained over durations expected by the use case
- That the implementation gracefully handles any quantity of data expected by the use case

- That in cases where more than one valid interpretation of the specification exists, the implementation complies with at least one interpretation and gracefully handles other interpretations
- That the implementation is immune to attempted security exploits

A single execution of each of the required tests is required in order to constitute a Pass verdict. However, it is noted that to provide a foundation for interoperability, it is necessary that a qualified implementation consistently and repeatedly pass any of the applicable tests.

In any case, where a member finds an issue with the test plan generated by the Bluetooth SIG qualification tool, with the test case as described in the Test Suite, or with the test system utilized, the member is required to notify the responsible party via an erratum request such that the issue may be addressed.

4.1.3 Pass/Fail verdict conventions

Each test case has an Expected Outcome section. The IUT is granted the Pass verdict when all the detailed pass criteria conditions within the Expected Outcome section are met.

The convention in this Test Suite is that, unless there is a specific set of fail conditions outlined in the test case, the IUT fails the test case as soon as one of the pass criteria conditions cannot be met. If this occurs, the outcome of the test is a Fail verdict.

4.2 Setup preambles

4.2.1 ATT Bearer on LE Transport

- Preamble Procedure

1. Establish an LE transport connection between the IUT and the Lower Tester.
2. Establish an L2CAP channel 0x0004 between the IUT and the Lower Tester over that LE transport.

4.2.2 ATT Bearer on BR/EDR Transport

- Preamble Procedure

1. Establish a BR/EDR transport connection between the IUT and the Lower Tester.
2. Establish an L2CAP channel (PSM 0x001F) between the IUT and the Lower Tester over that BR/EDR transport.

4.2.3 EATT Bearer on LE Transport

- Preamble Procedure

1. Establish an LE transport connection between the IUT and the Lower Tester.
2. Establish an L2CAP channel 0x0005 for signaling and one or more L2CAP channels (for ATT bearers) with EATT PSM (as defined in Assigned Numbers) between the IUT and the Lower Tester over that LE transport.

4.2.4 EATT Bearer on BR/EDR Transport

- Preamble Procedure

1. Establish a BR/EDR transport connection between the IUT and the Lower Tester.
2. Establish an L2CAP channel 0x0001 for signaling and one or more L2CAP channels (for ATT bearers) with EATT PSM (as defined in Assigned Numbers) between the IUT and the Lower Tester over that BR/EDR transport.

4.2.5 Transition ASE to the Idle State

- Preamble Purpose

  This procedure specifies the steps necessary to transition an ASE (either a Sink ASE or a Source ASE) on the IUT to the Idle state.

- Reference

  [3] 3

- Preamble Procedure

  1. The Lower Tester has cached the ASCS service and characteristics handles (e.g., by running the procedures in Section 4.3).
  2. The Lower Tester randomly selects one ASE characteristic of the specified ASE type (Sink ASE or Source ASE) and reads the characteristic value by executing the GATT Read Characteristic Value sub-procedure. The Lower Tester caches the ASE_ID field value as Test_ASE_ID.
  3. The Lower Tester enables notifications by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the CCCD of the specified ASE type.
  4. If the ASE_State field of the characteristic value read in Step 3 is different than 0x00 (Idle), the Upper Tester commands the IUT to reset the ASE_State to Idle.
  5. The Lower Tester enables notifications by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the ASE Control Point CCCD.

4.2.6 Transition ASE to the Codec Configured State

- Preamble Purpose

  This procedure specifies the steps necessary to transition an ASE (either a Sink ASE or a Source ASE) on the IUT to the Codec Configured state.

- Reference

  [3] 5.1

- Preamble Procedure

  1. The Lower Tester retrieves the ASE_State value of an ASE characteristic of the specified ASE type (Sink ASE or Source ASE) on the IUT by executing the GATT Read Characteristic Value sub-procedure. The Lower Tester caches the ASE_ID field value as Test_ASE_ID.
  2. If the ASE_State is 0x03 (Enabling) or 0x04 (Streaming):

     a. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x05 (Disable) and:

        - Number_of_ASEs set to 1
        - ASE_ID[0] set to Test_ASE_ID

     b. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

     c. The IUT sends a GATT Characteristic Value Notification for the specified ASE characteristic type, with ASE_ID set to Test_ASE_ID.

3. If the ASE_State is 0x06 (Releasing), the IUT does one of these two actions depending on which action it supports:

    a. If the IUT supports transitioning to Codec Configured state, the IUT is induced to perform the Released operation by writing a value of 0x01 (Codec Configured) to the ASE_State field.

    d. If the IUT supports transitioning to Idle state, the IUT is induced to perform the Released operation by writing a value of 0x00 (Idle) to the ASE_State field.

4. If the ASE_State is 0x00 (Idle) or 0x02 (QoS Configured):

    a. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x01 (Config Codec) and:

        - Number_of_ASEs set to 1
        - ASE_ID[0] set to Test_ASE_ID
        - Target_Latency[0], Target_PHY[0], Codec_ID[0], Codec_Specific_Configuration_Length[0], and Codec_Specific_Configuration[0] set to values supported by the IUT (e.g., known to the Lower Tester from the TSPX_SUPPORTED_CODEC_CONFIGURATIONS IXIT item).

    e. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

    f. The IUT sends a GATT Characteristic Value Notification for the specified ASE characteristic type, with ASE_ID set to Test_ASE_ID.

5. When the ASE_State is 0x01 (Codec Configured), this preamble is successfully completed.

4.2.7 Transition ASE to the QoS Configured State

- Preamble Purpose

  This procedure specifies the steps necessary to transition an ASE (either a Sink ASE or a Source ASE) on the IUT to the QoS Configured state.

- Reference

  [3] 5.2

- Preamble Procedure

1. The Lower Tester retrieves the ASE_State value of an ASE of the specified ASE type (Sink ASE or Source ASE) on the IUT by executing the GATT Read Characteristic Value sub-procedure.
2. If the ASE_State is 0x02 (QoS Configured), the preamble is successfully completed.
3. The Lower Tester executes the procedure in Section 4.2.6.

4. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x02 (Config QoS) and:
    - Number_of_ASEs set to 1
    - ASE_ID[0] set to Test_ASE_ID
    - Random valid values for CIG_ID[0] and CIS_ID[0]
    - The remaining QoS parameters set to values acceptable for the IUT based on the preferred values exposed through the Additional_ASE_Parameters field of the codec configured ASE (e.g., after running Step 1)
5. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
6. The IUT sends a GATT Characteristic Value Notification for the specified ASE characteristic type identified by Test_ASE_ID. The value of the ASE_State field is 0x02 (QoS Configured).

4.2.8 Transition Sink ASE to the Enabling State

- Preamble Purpose

  This procedure specifies the steps necessary to transition a Sink ASE characteristic to the Enabling state on an Audio Sink IUT.

- Reference

  [3] 5.3

- Preamble Procedure

1. The Lower Tester selects and sets one Sink ASE on the IUT to the QoS Configured state by running Preamble 4.2.7.
2. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x03 (Enable) and:
    - Number_of_ASEs set to 1
    - ASE_ID[0] set to Test_ASE_ID
    - Metadata_Length[0] set to the length of the value in Metadata[0]
    - Metadata[0] set to the TSPX_Metadata IXIT entry
3. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
4. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic identified by Test_ASE_ID. The value of the ASE_State field is 0x03 (Enabling).

4.2.9 Transition Source ASE to the Enabling State

- Preamble Purpose

  This procedure specifies the steps necessary to transition a Source ASE characteristic to the Enabling state on an Audio Source IUT.

- Reference

  [3] 5.3

- Preamble Procedure

  1. The Lower Tester selects and sets one Source ASE on the IUT to the QoS Configured state by running Preamble 4.2.7.
  2. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x03 (Enable) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
     - Metadata_Length[0] set to the length of the Metadata[0]
     - Metadata[0] set to the TSPX_Metadata IXIT entry
  3. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  4. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic identified by Test_ASE_ID. The value of the ASE_State field is 0x03 (Enabling).

4.2.10 Transition Source ASE to the Disabling State

- Preamble Purpose

  This procedure specifies the steps necessary to transition a Source ASE to the Disabling state on the IUT.

- Reference

  [3] 5.5

- Preamble Procedure

  1. The Lower Tester selects and sets one Source ASE on the IUT to the Enabling state by running Preamble 4.2.8.
  2. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing either the GATT Write Without Response or Write Characteristic Value sub-procedure with the opcode set to 0x05 (Disable) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
  3. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  4. The IUT sends a GATT Characteristic Value Notification for the Source ASE characteristic with ASE_ID equal to Test_ASE_ID. The value of the ASE_State field is 0x05 (Disabling).

4.3 Generic GATT Integrated Tests

Execute the Generic GATT Integrated Tests defined in GATT.TS [7] Section 6.3, Server test procedures (SGGIT) using Table 4.2 below as input:

TCID	Service / Characteristic / Descriptor	Reference	Properties	Value Length	Type
ASCS/SR/SGGIT/SER/BV-01-C [Service GGIT – Audio Stream Control Service]	Audio Stream Control Service	[3] 2	-	-	Primary Service,Unique
ASCS/SR/SGGIT/CHA/BV-01-C [Characteristic GGIT – Sink ASE]	Sink ASE	[3] 4.1	0x12 (Read, Notify)	Skip	
ASCS/SR/SGGIT/CHA/BV-02-C [Characteristic GGIT – Source ASE]	Source ASE	[3] 4.1	0x12 (Read, Notify)	Skip	
ASCS/SR/SGGIT/CHA/BV-03-C [Characteristic GGIT – ASE Control Point]	ASE Control Point	[3] 4.2	0x1C (Write, WriteWithoutResponse, Notify)	Skip	Unique
ASCS/SR/SGGIT/SDP/BV-01-C [SDP Record]	Audio Stream Control Service	[3] 2	-	-	

Table 4.2: SGGIT input table

4.4 Additional Service Requirements

ASCS/SR/ASR/BV-01-C [Service and Characteristic Support Requirements]

- Test Purpose

  Verify that the Server IUT supports a single instance of the Audio Stream Control Service and follows the requirements for the supported characteristics of the service when multiple ASEs are present.

- Reference

  [3] 2.1, 4

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the ASCS service and characteristic handles (e.g., by running the test procedure in Section 4.3).

- Test Procedure

  1. For each ASE characteristic discovered on the IUT, the Lower Tester executes the GATT Read Characteristic Value sub-procedure.

- Expected Outcome

  Pass verdict

  In Step 1, the ASE_ID field of each ASE characteristic value is unique and non-zero.

4.5 ASE Control Point Procedures

4.5.1 Config Codec

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when codec parameters are being configured by the Client.

- Reference

  [3] 5.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester configures a characteristic of the type specified in Table 4.3 by executing the specified Preamble. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Case Configuration

TCID	Preamble	Characteristic
ASCS/SR/ACP/BV-01-C [Config Codec in Idle State – Server is Audio Sink]	4.2.5 Transition ASE to the Idle State	Sink ASE
ASCS/SR/ACP/BV-02-C [Config Codec in Idle State – Server is Audio Source]	4.2.5 Transition ASE to the Idle State	Source ASE
ASCS/SR/ACP/BV-03-C [Config Codec in Codec Configured State – Server is Audio Sink]	4.2.6 Transition ASE to the Codec Configured State	Sink ASE
ASCS/SR/ACP/BV-04-C [Config Codec in Codec Configured State – Server is Audio Source]	4.2.6 Transition ASE to the Codec Configured State	Source ASE
ASCS/SR/ACP/BV-05-C [Config Codec in QoS Configured State – Server is Audio Sink]	4.2.7 Transition ASE to the QoS Configured State	Sink ASE
ASCS/SR/ACP/BV-06-C [Config Codec in QoS Configured State – Server is Audio Source]	4.2.7 Transition ASE to the QoS Configured State	Source ASE

Table 4.3: Config Codec test cases

- Test Procedure

1. The Lower Tester writes to the ASE Control Point on the IUT by executing the GATT Write Without Response Sub-procedure with the opcode set to 0x01 (Config Codec) and:
    - Number_of_ASEs set to 1
    - ASE_ID[0] set to Test_ASE_ID
    - Target_Latency[0], Target_PHY[0], Codec_ID[0], Codec_Specific_Configuration_Length[0], and Codec_Specific_Configuration[0] set to values supported by the IUT (e.g., known to the Lower Tester from the TSPX_SUPPORTED_CODEC_CONFIGURATIONS IXIT entry in [5])
2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
3. The IUT sends a GATT Characteristic Value Notification for the characteristic specified in Table 4.3.

- Expected Outcome

Pass verdict

The IUT sends a notification of the ASE Control Point characteristic with Response_Code set to Success (0x00) for the requested ASE_ID and opcode.

The IUT sends a notification of the Characteristic in Table 4.3. The notified characteristic value is correctly formatted: the ASE_State field is set to 0x01 (Codec Configured), the ASE_ID field is set to Test_ASE_ID, and the Additional_ASE_Parameters field contains the values requested in Step 1 and valid values for Server preferred QoS parameters.

ASCS/SR/ACP/BV-07-C [Config Codec – Server-Initiated]

- Test Purpose

Verify the behavior of the Server IUT when it autonomously configures codec parameters. Verify that the ASE transitions to the correct ASE state and that the IUT does not send a notification of the ASE Control Point characteristic value after the Config Codec operation.

- Reference

  [3] 5.1

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester has discovered and cached the ASCS service and characteristic handles (e.g., by running the test procedure in Section 4.3).
  - For each ASE characteristic, the Lower Tester has enabled notification by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the CCCD.
  - The ASE_State field of the ASE selected for a Codec Config operation is set to 0x00 (Idle), 0x01 (Codec Configured), or 0x02 (QoS Configured).

- Test Procedure

  1. The Upper Tester commands the IUT to configure the codec parameters on one of the ASEs.
  2. The IUT sends a GATT Characteristic Value Notification for an ASE characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends a notification for the ASE characteristic specified in Step 1. The notified ASE characteristic value is correctly formatted, has the ASE_State field set to 0x01 (Codec Configured) and the ASE_ID field set to a valid value, and the Additional_ASE_Parameters contains valid values for the Codec Configured state. The IUT does not send a notification of the ASE Control Point characteristic value.

4.5.2 Config QoS

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when QoS parameters are being configured by the Client.

- Reference

  [3] 5.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The IUT has at least one instantiation of the Characteristic specified in Table 4.4.
  - The Lower Tester configures a characteristic of the type specified in Table 4.4 by executing the specified Preamble. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Case Configuration

TCID	Preamble	Characteristic
ASCS/SR/ACP/BV-08-C [Config QoS in Codec Configured State – Server is Audio Sink]	4.2.6 Transition ASE to the Codec Configured State	Sink ASE
ASCS/SR/ACP/BV-09-C [Config QoS in Codec Configured State – Server is Audio Source]	4.2.6 Transition ASE to the Codec Configured State	Source ASE
ASCS/SR/ACP/BV-10-C [Config QoS in QoS Configured State – Server is Audio Sink]	4.2.7 Transition ASE to the QoS Configured State	Sink ASE
ASCS/SR/ACP/BV-11-C [Config QoS in QoS Configured State – Server is Audio Source]	4.2.7 Transition ASE to the QoS Configured State	Source ASE

Table 4.4: Config QoS test cases

- Test Procedure

  1. The Lower Tester executes the GATT Write Without Response sub-procedure specified in Table 4.4 with the opcode set to 0x02 (Config QoS) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
     - Random valid values for CIG_ID[0] and CIS_ID[0]
     - The remaining QoS parameters set to values acceptable for the IUT based on the preferred values exposed through the Additional_ASE_Parameters field of the ASE in the Codec Configured state
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a notification of the ASE Control Point characteristic with Response_Code set to Success (0x00) for the requested ASE_ID and opcode.

  In Step 3, the notified ASE characteristic value is correctly formatted:
  - ASE_ID field set to Test_ASE_ID
  - ASE_State field set to 0x02 (QoS Configured)
  - Additional_ASE_Parameters field containing the CIG_ID, CIS_ID, and QoS configuration values requested in Step 1

ASCS/SR/ACP/BV-12-C [Client Initiates Receiver Stop Ready – Server is Audio Source]

- Test Purpose

  Verify the behavior of the Server Audio Source IUT when the Client signals that it is ready to stop receiving audio data.

- Reference

  [3] 5.6

- Initial Condition
  - The Lower Tester configures one Source ASE characteristic on the IUT by running Preamble 4.2.10 Transition Source ASE to the Disabling State. The ASE_ID of the configured ASE is stored as Test_ASE_ID.
- Test Procedure
  1. The Lower Tester executes the GATT Write Without Response sub-procedure with the opcode set to 0x06 (Receiver Stop Ready) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.
- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a notification of the ASE Control Point characteristic with Response_Code set to Success (0x00) for the requested ASE_ID and opcode.

  In Step 3, the notified ASE characteristic value is correctly formatted, has the ASE_ID field set to Test_ASE_ID and the ASE_State field set to 0x02 (QoS Configured), and has the Additional_ASE_Parameters field formatted according to the ASE state.

4.5.3 Client Initiates Disable Operation

- Test Purpose

  Verify the behavior of the Server IUT when a Client initiates the Disable operation.
- Reference

  [3] 5.5
- Initial Condition
  - The Lower Tester configures one ASE on the IUT by executing the Preamble specified in Table 4.5. The ASE_ID of the configured ASE is stored as Test_ASE_ID.
- Test Case Configuration

TCID	Preamble	ASE_State
ASCS/SR/ACP/BV-13-C [Client Initiates Disable – Server is Audio Sink]	4.2.8 Transition Sink ASE to the Enabling State	0x02 (QoS Configured)
ASCS/SR/ACP/BV-14-C [Client Initiates Disable – Server is Audio Source]	4.2.9 Transition Source ASE to the Enabling State	0x05 (Disabling)

Table 4.5: Client Initiates Disable Operation test cases

- Test Procedure

  1. The Lower Tester writes to the ASE Control Point characteristic on the IUT using the GATT Write Without Response sub-procedure with the opcode set to 0x05 (Disable) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a notification of the ASE Control Point characteristic with Response_Code set to 0x00 (Success) for the requested ASE_ID and opcode.

  In Step 3, the notified ASE characteristic value is correctly formatted, has the ASE_ID field set to Test_ASE_ID and the ASE_State field set to the value in Table 4.5, and has the Additional_ASE_Parameters field exposing ASE information based on ASE state.

4.5.4 Server Initiates Disable Operation

- Test Purpose

  Verify the behavior of the Server IUT when it autonomously initiates the Disable operation. Verify that the ASE transitions to the correct ASE state and that the IUT does not send a notification of the ASE Control Point characteristic value after the Disable operation.

- Reference

  [3] 5, 5.5

- Initial Condition

  - The Lower Tester configures one ASE on the IUT by executing the Preamble in Table 4.6. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Case Configuration

TCID	Preamble	ASE_State
ASCS/SR/ACP/BV-15-C [Server as Audio Sink Initiates Disable]	4.2.8 Transition Sink ASE to the Enabling State	0x02 (QoS Configured)
ASCS/SR/ACP/BV-16-C [Server as Audio Source Initiates Disable]	4.2.9 Transition Source ASE to the Enabling State	0x05 (Disabling)

Table 4.6: Client Initiates Disable Operation test cases

- Test Procedure

  1. The Upper Tester commands the IUT to disable the ASE identified by Test_ASE_ID.
  2. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.

- Expected Outcome

  Pass verdict

  The IUT initiates the Disable operation and transitions to the ASE state expected in Table 4.6.

In Step 2, the notified ASE characteristic value is correctly formatted, has the ASE_ID field set to Test_ASE_ID and the ASE_State field set to the value in Table 4.6, and has the Additional_ASE_Parameters field exposing ASE information based on the ASE state.

The IUT does not send a notification of the ASE Control Point characteristic.

4.5.5 Client Initiates Release Operation

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when the Client initiates the Release operation.

- Reference

  [3] 5.8, 5.9

- Initial Condition

  - The Lower Tester selects and configures one ASE of the ASE Type specified in Table 4.7 on the IUT by executing the Preamble specified in the Initial Condition column in Table 4.7. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Case Configuration

Test Case	ASE Type	Initial Condition
ASCS/SR/ACP/BV-17-C [Client Initiates Release in Codec Configured State – Server is Sink]	Sink ASE	4.2.6 Transition ASE to the Codec Configured State
ASCS/SR/ACP/BV-18-C [Client Initiates Release in Codec Configured State – Server is Source]	Source ASE	4.2.6 Transition ASE to the Codec Configured State
ASCS/SR/ACP/BV-19-C [Client Initiates Release in QoS Configured State – Server is Sink]	Sink ASE	4.2.7 Transition ASE to the QoS Configured State
ASCS/SR/ACP/BV-20-C [Client Initiates Release in QoS Configured State – Server is Source]	Source ASE	4.2.7 Transition ASE to the QoS Configured State
ASCS/SR/ACP/BV-21-C [Client Initiates Release in Enabling State – Server is Sink]	Sink ASE	4.2.8 Transition Sink ASE to the Enabling State
ASCS/SR/ACP/BV-22-C [Client Initiates Release in Enabling State – Server is Source]	Source ASE	4.2.9 Transition Source ASE to the Enabling State
ASCS/SR/ACP/BV-23-C [Client Initiates Release in Disabling State – Server is Source]	Source ASE	4.2.10 Transition Source ASE to the Disabling State

Table 4.7: Client Initiates Release Operation test cases

- Test Procedure

  1. The Lower Tester writes to the ASE Control Point characteristic on the IUT using the GATT Write Without Response sub-procedure with the opcode set to 0x08 (Release) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends a notification of the ASE Control Point characteristic with Response_Code set to 0x00 (Success) for the requested ASE_ID and opcode.

  In Step 3, the IUT sends a notification of the specified ASE characteristic. The notified ASE characteristic value is correctly formatted, has the ASE_ID field set to Test_ASE_ID, and has the ASE_State field set to 0x06 (Releasing).

4.5.6 Server Initiates Released Operation

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when it autonomously initiates the Released operation. Verify that the ASE transitions to the correct ASE state and that the IUT does not send a notification of the ASE Control Point characteristic value after the Released operation.

- Reference

  [3] 5.8, 5.9

- Initial Condition

  - The Lower Tester selects and configures one ASE characteristic on the IUT of the type specified in Table 4.8 by executing the Preamble specified in Table 4.8. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Case Configuration

TCID	ASE Type	Preamble
ASCS/SR/ACP/BV-24-C [Server Sink Initiates Release in Codec Configured state]	Sink ASE	4.2.6 Transition ASE to the Codec Configured State
ASCS/SR/ACP/BV-25-C [Server Source Initiates Release in Codec Configured state]	Source ASE	4.2.6 Transition ASE to the Codec Configured State
ASCS/SR/ACP/BV-26-C [Server Sink Initiates Release in QoS Configured state]	Sink ASE	4.2.7 Transition ASE to the QoS Configured State
ASCS/SR/ACP/BV-27-C [Server Source Initiates Release in QoS Configured state]	Source ASE	4.2.7 Transition ASE to the QoS Configured State
ASCS/SR/ACP/BV-28-C [Server Sink Initiates Release in Enabling state]	Sink ASE	4.2.8 Transition Sink ASE to the Enabling State
ASCS/SR/ACP/BV-29-C [Server Source Initiates Release in Enabling state]	Source ASE	4.2.9 Transition Source ASE to the Enabling State
ASCS/SR/ACP/BV-30-C [Server Source Initiates Release in Disabling state]	Source ASE	4.2.10 Transition Source ASE to the Disabling State as Audio Source

Table 4.8: Server Initiates Released Operation test cases

- Test Procedure

  1. The Upper Tester commands the IUT to release the ASE identified by Test_ASE_ID.
  2. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.

- Expected Outcome

  Pass verdict

  In Step 1, the IUT automatically initiates the Release operation and transitions the ASE to the state specified in the Additional initial conditions to 0x06 (Releasing).

  In Step 2, the notified ASE characteristic value is correctly formatted, has the ASE_ID field set to Test_ASE_ID and the ASE_State field set to 0x06 (Releasing), and has the Additional_ASE_Parameters field set to the same value received by the Lower Tester in the initial configuration.

  In Step 3, the IUT sends a notification of the same ASE characteristic that was notified in Step 2, with the ASE_ID field set to Test_ASE_ID and the ASE_State field set to either 0x00 (Idle) or 0x01 (Codec Configured).

  The IUT does not send a notification of the ASE Control Point characteristic value.

ASCS/SR/ACP/BV-31-C [Server Initiates Released Operation from dropped LE-ACL]

- Test Purpose

  Verify the behavior of the Server IUT when it autonomously initiates the Released operation due to link loss of a Low Energy-Asynchronous connection-oriented link (LE-ACL).

- Reference

  [3] 3.2, 5.9

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.3 if using EATT over an LE transport.
  - The Lower Tester selects and configures one ASE on the IUT by executing Preamble 4.2.8 Transition Sink ASE to the Enabling State. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Procedure

  1. The Lower Tester tears down the LE ACL connection with the IUT.
  2. The IUT begins transmitting connectable extended advertising packets.
  3. The Lower Tester reestablishes connection to the Upper Tester.
  4. The Lower Tester reads the characteristic value of the ASE characteristic previously selected in the Initial Condition by executing the GATT Read Characteristic Value sub-procedure.

- Expected Outcome

  Pass verdict

  In Step 4, the value of the ASE_State field is either 0x00 (Idle) or 0x01 (Codec Configured).

4.6 Service Procedure – Error Handling

ASCS/SR/SPE/BI-01-C [Invalid Opcode]

- Test Purpose

  Verify the behavior of the Server IUT when the Client attempts a Control Point procedure using an invalid opcode.

- Reference

  [3] 4.2

- Initial Condition

  - Establish a bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester has cached the ASCS service and characteristics handles (e.g., by running the procedures in Section 4.3).
  - The Lower Tester enables notifications by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the ASE Control Point CCCD.

- Test Procedure

  1. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing the GATT Write Characteristic Value sub-procedure with an opcode set to an RFU value and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to a valid ASE ID
     - Target_Latency[0], Target_PHY[0], Codec_ID[0], Codec_Specific_Configuration_Length[0], and Codec_Specific_Configuration[0] are set to values supported by the IUT (e.g., known to the Lower Tester from the TSPX_SUPPORTED_CODEC_CONFIGURATIONS IXIT entry)
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

- Expected Outcome

  Pass verdict

  The IUT sends an ASE Control Point notification and:
  - Number_of_ASEs is set to 0xFF
  - ASE_ID[0] is set to 0x00
  - The Response_Code[0] field is set to Unsupported Opcode (0x01)
  - Reason[0] is set to 0x00

4.6.1 Common Control Point errors

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when the Client initiates control point operations with invalid ASE identifiers and Control Point commands of invalid length.

- Reference

  [3] 5

- Initial Condition

  - The Lower Tester executes the Initial Condition specified in Table 4.9.

- Test Case Configuration

Test Case	Initial Condition	Opcode
ASCS/SR/SPE/BI-02-C [Config Codec – Common Errors]	4.2.5 Transition ASE to the Idle State	0x01 (Config Codec)
ASCS/SR/SPE/BI-03-C [Config QoS – Common Errors]	4.2.6 Transition ASE to the Codec Configured State	0x02 (Config QoS)
ASCS/SR/SPE/BI-04-C [Enable – Common Errors]	4.2.7 Transition ASE to the QoS Configured State	0x03 (Enable)

Table 4.9: Common Control Point errors test cases

- Test Procedure

  Repeat Steps 1–2 for each round in Table 4.10.

  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ASE Control Point on the IUT with the opcode specified in Table 4.9 and the Parameters specified in Table 4.10.
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

Round	Parameters	Response_Code	Number_of_ASEs
1	Number_of_ASEs set to 1, ASE_ID[0] set to 0x00, and appropriate parameters for the opcode	0x03 (Invalid ASE_ID)	0x01
2	Number_of_ASEs set to 1, ASE_ID[0] set to Test_ASE_ID, and parameters of invalid length for the opcode	0x02 (Invalid Length)	0xFF
3	Number_of_ASEs set to 0, ASE_ID[0] set to Test_ASE_ID, and appropriate parameters for the opcode	0x02 (Invalid Length)	0xFF

Table 4.10: Rounds for Common Control Point errors

- Expected Outcome

  Pass verdict

  For each round, the IUT sends an ASE Control Point notification and:
  - The Reason field is set to 0x00
  - The Response_Code field is set to the value of the Response_Code specified in Table 4.10
  - Number_of_ASEs is set to the value of the Number_of_ASEs specified in Table 4.10

  The IUT does not send any ASE characteristic notifications.

4.6.2 Invalid ASE_ID Errors

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when the Client initiates control point operations with invalid ASE identifiers.

- Reference

  [3] 5

- Initial Condition
  - The Lower Tester executes the Initial Condition specified in Table 4.11.
- Test Case Configuration

Test Case	Initial Condition	Opcode
ASCS/SR/SPE/BI-05-C [Receiver Start Ready – Common Errors]	4.2.9 Transition Source ASE to the Enabling State	0x04 (Receiver Start Ready)
ASCS/SR/SPE/BI-06-C [Receiver Stop Ready – Common Errors]	4.2.10 Transition Source ASE to the Disabling State	0x06 (Receiver Stop Ready)

Table 4.11: Invalid ASE_ID Errors test cases

- Test Procedure
  1. The Lower Tester executes the GATT Write Characteristic Value sub-procedure for the ASE Control Point on the IUT with the opcode specified in Table 4.11 and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to invalid ASE_ID
     - Valid values for the remaining parameters for the specified opcode
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
- Expected Outcome

  Pass verdict

  For each round, the IUT sends an ASE Control Point notification and:
     - The Reason field is set to 0x00
     - The Response_Code field is set to 0x03 (Invalid ASE_ID)
     - Number_of_ASEs is set to 0x01

  The IUT does not send any ASE characteristic notifications.

ASCS/SR/SPE/BI-07-C [Config Codec – Unsupported Parameters]

- Test Purpose

  Verify the behavior of the Server IUT when the Client attempts codec configuration using unsupported configuration parameter parameters.
- Reference

  [3] 5.1
- Initial Condition
  - Establish a bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester has cached the ASCS service and characteristics handles (e.g., by running the procedures in Section 4.3).

- The Lower Tester randomly selects one ASE characteristic and reads the characteristic value by executing the GATT Read Characteristic Value sub-procedure. The Lower Tester caches the ASE_ID field value as Test_ASE_ID.
- The Lower Tester enables notifications by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the ASE Control Point CCCD.

- Test Procedure

  Repeat Steps 1–2 for each round in Table 4.12.

  1. The Lower Tester writes to the ASE Control Point on the IUT by executing the GATT Write Characteristic Value sub-procedure with the opcode set to 0x01 (Config Codec) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
     - Unsupported value for the Parameter as specified in Table 4.12
     - The other fields set to valid values
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

Round	Parameters	Reason
1	Codec_ID	Codec_ID (0x01)
2	Codec_Specific_Configuration	Codec_Specific_Configuration (0x02)

Table 4.12: Rounds for Config Codec – Unsupported Parameters

- Expected Outcome

  Pass verdict

  The IUT sends an ASE Control Point notification with the Response_Code field set to one of the following values:
  - Unsupported Configuration Parameter Value (0x07)
  - Rejected Configuration Parameter Value (0x08)
  - Invalid Configuration Parameter Value (0x09)

  and the Reason field as specified in Table 4.12.

  The IUT does not send any ASE characteristic notifications.

ASCS/SR/SPE/BI-08-C [Config QoS – Invalid Parameters]

- Test Purpose

  Verify the behavior of the Server IUT when the Client attempts QoS configuration using parameter values that the Server rejects as Unsupported, Rejected, or Invalid.

- Reference

  [3] 5.2

- Initial Condition
  - Establish a bearer connection between the Lower Tester and the IUT as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The Lower Tester has cached the ASCS service and characteristics handles (e.g., by running the procedures in Section 4.3).
  - The Lower Tester enables notifications by writing the value 0x0001 using the GATT Write Characteristic Descriptor sub-procedure for the ASE Control Point CCCD.
  - The Lower Tester selects and configures one ASE on the IUT into the Codec Configured state by running Preamble 4.2.6 Transition ASE to the Codec Configured State.
- Test Procedure

  Repeat Steps 1–2 for each round in Table 4.13.

  1. The Lower Tester writes to the ASE Control Point on the IUT by executing the GATT Write Characteristic Value sub-procedure with the opcode set to 0x02 (Config QoS) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
     - An RFU value for the Parameter specified in Table 4.13
     - Other fields set to valid values
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

Round	Parameters	Reason
1	SDU_Interval	SDU_Interval (0x03)
2	Framing	Framing (0x04)
3	PHY	PHY (0x05)
4	Max_SDU	Maximum_SDU_Size (0x06)
5	Max_Transport_Latency	Max_Transport_Latency (0x08)
6	Presentation Delay	Presentation Delay (0x09)

Table 4.13: Rounds for Config QoS – Invalid Parameters

- Expected Outcome

  Pass verdict

  The IUT sends an ASE Control Point notification with the Error Reason field set to the value specified in Table 4.13 and the Response_Code field set to one of the following values:
  - Unsupported Configuration Parameter Value (0x07) (not valid when Error Reason=0x04)
  - Rejected Configuration Parameter Value (0x08)
  - Invalid Configuration Parameter Value (0x09)

  The IUT does not send any ASE characteristic notifications.

ASCS/SR/SPE/BI-09-C [Update Metadata – Invalid Parameters]

- Test Purpose

  Verify the behavior of the Server IUT when the Client initiates the Update Metadata operation with invalid parameters.

- Reference

  [3] 5.7

- Initial Condition

  - The Lower Tester selects and configures one ASE on the IUT into the Enabling state by executing the procedure in the Preamble specified in 4.2.8 Transition Sink ASE to the Enabling State.

- Test Procedure

  Repeat Steps 1–2 for each round in Table 4.14.

  1. The Lower Tester writes to the ASE Control Point characteristic on the IUT by executing the GATT Write Characteristic Value sub-procedure with the opcode set to 0x07 (Update Metadata) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
     - Metadata_Length[0] set to the length of the Metadata parameter
     - Metadata[0] configured as specified in Table 4.14
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

Round	Metadata	Response Code
1	Includes Metadata Type unsupported by server	Unsupported Metadata (0x0A) or Rejected Metadata (0x0B)
2	Metadata includes LTV-structure with an RFU value	Rejected Metadata (0x0B) or Invalid Metadata (0x0C)

Table 4.14: Rounds for Update Metadata – Invalid Parameters

- Expected Outcome

  Pass verdict

  The IUT sends an ASE Control Point notification with the Response_Code field set to one of the values specified in Table 4.14 and the Reason field set to the value of the Metadata Type field in error.

4.6.3 ASE Management – Invalid State Transition

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when the Client initiates control point operations that are not allowed when an ASE is in a specific state.

- Reference

  [3] 3, 5

- Initial Condition
  - The Lower Tester executes the Preamble specified in the Initial Condition column in Table 4.15 for the specified ASE Type.
- Test Case Configuration

Test Case	ASE Type	Initial Condition	Rounds
ASCS/SR/SPE/BI-10-C [Invalid State Transition – Source ASE in Idle state]	Source ASE	4.2.5 Transition ASE to the Idle State	2 3 4 5 6 7 8
ASCS/SR/SPE/BI-18-C [Invalid State Transition – Sink ASE in Idle state]	Sink ASE	4.2.5 Transition ASE to the Idle State	2 3 5 7 8
ASCS/SR/SPE/BI-11-C [Invalid State Transition – Source ASE in Codec Configured state]	Source ASE	4.2.6 Transition ASE to the Codec Configured State	3 4 5 6 7
ASCS/SR/SPE/BI-19-C [Invalid State Transition – Sink ASE in Codec Configured state]	Sink ASE	4.2.6 Transition ASE to the Codec Configured State	3 5 7
ASCS/SR/SPE/BI-12-C [Invalid State Transition – Source ASE in QoS Configured state]	Source ASE	4.2.7 Transition ASE to the QoS Configured State	4 5 6 7
ASCS/SR/SPE/BI-20-C [Invalid State Transition – Source ASE in QoS Configured state]	Sink ASE	4.2.7 Transition ASE to the QoS Configured State	5 7
ASCS/SR/SPE/BI-13-C [Invalid State Transition – Sink ASE in Enabling state]	Sink ASE	4.2.8 Transition Sink ASE to the Enabling State	1 2 3
ASCS/SR/SPE/BI-14-C [Invalid State Transition – Source ASE in Disabling state]	Source ASE	4.2.10 Transition Source ASE to the Disabling State	1 2 3 4 5 7

Table 4.15: ASE Management – Invalid State Transition test cases

- Test Procedure

  1. The Lower Tester executes each Round specified in Table 4.16 as specified in the Rounds column in Table 4.15.
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

Round	Step
1	The Lower Tester executes the GATT Write Without Response sub-procedure with the Config Codec (0x01) opcode with Number_of_ASEs set to 1; ASE_ID[0] set to the Test_ASE_ID; and Codec_ID[0], Codec_Specific_Configuration_Length[0], and Codec_Specific_Configuration[0] set to values supported by the IUT (e.g., known to the Lower Tester from the TSPX_SUPPORTED_CODEC_CONFIGURATIONS IXIT entry).
2	The Lower Tester executes the GATT Write Without Response sub-procedure with the Config QoS (0x02) opcode with Number_of_ASEs set to 1; ASE_ID[0] set to Test_ASE_ID; random valid values for CIG_ID[0] and CIS_ID[0]; and the remaining QoS parameters set to values acceptable for the IUT based on the preferred values exposed through the Additional_ASE_Parameters field of the codec configured ASE.
3	The Lower Tester executes the GATT Write Without Response sub-procedure with the Enable (0x03) opcode with Number_of_ASEs set to 1, ASE_ID[0] set to Test_ASE_ID, and Metadata_Length[0] and Metadata[0] set to the TSPX_Metadata IXIT entry.
4	The Lower Tester executes the GATT Write Without Response sub-procedure with the Receiver Start Ready (0x04) opcode with Number_of_ASEs set to 1 and ASE_ID[0] set to Test_ASE_ID.
5	The Lower Tester executes the GATT Write Without Response sub-procedure with the Disable (0x05) opcode with Number_of_ASEs set to 1 and ASE_ID[0] set to Test_ASE_ID.
6	The Lower Tester executes the GATT Write Without Response sub-procedure with the Receiver Stop Ready (0x06) opcode with Number_of_ASEs set to 1 and ASE_ID[0] set to Test_ASE_ID.
7	The Lower Tester executes the GATT Write Without Response sub-procedure with the Update Metadata (0x07) opcode with Number_of_ASEs set to 1, ASE_ID[0] set to Test_ASE_ID, and Metadata[0] set to a valid value using the TSPX_Metadata IXIT entry.
8	The Lower Tester executes the GATT Write Without Response sub-procedure with the Release (0x08) opcode with Number_of_ASEs set to 1 and ASE_ID[0] set to Test_ASE_ID.

Table 4.16: Rounds for ASE Management – Invalid State Transitions

- Expected Outcome

  Pass verdict

  The IUT sends an ASE Control Point notification with the Response_Code field set to 0x04 (Invalid ASE State Machine Transition).

4.6.4 Config QoS with Different ASE with Same Direction, CIG, and CIS

- Test Purpose

  This test group contains test cases to verify the behavior of the Server IUT when QoS parameters are being configured by the Client.

- Reference

  [3] 5.2

- Initial Condition

  - A bearer connection between the Lower Tester and the IUT is established as described in Section 4.2.1, if using ATT over an LE transport, or 4.2.2 if using ATT over a BR/EDR transport, or 4.2.3 if using EATT over an LE transport, or 4.2.4 if using EATT over a BR/EDR transport.
  - The IUT has at least two ASEs.
  - The Lower Tester configures two ASEs on the IUT by executing the Preamble specified in the Initial Condition column in Table 4.17 for each ASE. The ASEs are identified by Test_ASE_ID1 and Test_ASE_ID2.

- Test Case Configuration

TCID	Initial Condition
ASCS/SR/SPE/BI-15-C [Config QoS Multiple ASE – Same Direction, CIG, CIS – Codec Configured State]	4.2.6 Transition ASE to the Codec Configured State
ASCS/SR/SPE/BI-16-C [Config QoS Multiple ASE – Same Direction, CIG, CIS – QoS Configured State]	4.2.7 Transition ASE to the QoS Configured State

Table 4.17: Config QoS with Different ASE with Same Direction, CIG, and CIS test cases

- Test Procedure

  1. The Lower Tester executes the GATT Write Without Response sub-procedure with the opcode set to 0x02 (Config QoS) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID1
     - Valid values for CIG_ID[0] and CIS_ID[0]
     - The remaining QoS parameters set to values acceptable for the IUT based on the preferred values exposed through the Additional_ASE_Parameters field of the ASE in the Codec Configured state
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.
  3. The IUT sends a GATT Characteristic Value Notification for the ASE characteristic.
  4. The Lower Tester executes the GATT Write Without Response sub-procedure with the opcode set to 0x02 (Config QoS) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID2
     - CIG_ID[0] and CIS_ID[0] set to the values used in Step 1
     - The remaining QoS parameters set to the values used in Step 1
  5. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

- Expected Outcome

  Pass verdict

  In Step 5, the IUT sends an ASE Control Point notification with the Error Reason field set to 0x0A (Invalid_ASE_CIS_Mapping) and the Response_Code field set to 0x09 (Invalid Configuration Parameter Value).

ASCS/SR/SPE/BI-17-C [Client Initiates Receiver Stop Ready – Server is Audio Sink]

- Test Purpose

  Verify that a Server Audio Sink IUT returns the correct error code when a Client sends a Receiver Stop Ready operation.

- Reference

  [3] 5.6

- Initial Condition

  - The Lower Tester configures one Sink ASE characteristic on the IUT by running Preamble 4.2.8 Transition Sink ASE to the Enabling State. The ASE_ID of the configured ASE is stored as Test_ASE_ID.

- Test Procedure

  1. The Lower Tester executes the GATT Write Without Response sub-procedure with the opcode set to 0x06 (Receiver Stop Ready) and:
     - Number_of_ASEs set to 1
     - ASE_ID[0] set to Test_ASE_ID
  2. The IUT sends a GATT Characteristic Value Notification for the ASE Control Point characteristic.

- Expected Outcome

  Pass verdict

  In Step 2, the IUT sends an ASE Control Point notification with the Response_Code field set to 0x05 (Invalid ASE direction) or 0x04 (Invalid ASE State Machine Transition) and the Error Reason field set to 0x00.

5 Test case mapping

The Test Case Mapping Table (TCMT) maps test cases to specific requirements in the ICS. The IUT will be tested in all roles for which support is declared in the ICS document.

The columns for the TCMT are defined as follows:

Item: Contains a logical expression based on specific entries from the associated ICS document. Contains a logical expression (using the operators AND, OR, NOT as needed) based on specific entries from the applicable ICS document(s). The entries are in the form of y/x references, where y corresponds to the table number and x corresponds to the feature number as defined in the ICS document for Audio Stream Control Service (ASCS) [5].

If a test case is mandatory within the respective layer, then the y/x reference is omitted.

Feature: A brief, informal description of the feature being tested.

Test Case(s): The applicable test case identifiers required for Bluetooth Qualification if the corresponding y/x references defined in the Item column are supported. Further details about the function of the TCMT are elaborated in [2].

For the purpose and structure of the ICS/IXIT, refer to [2].

Item	Feature	Test Case(s)
ASCS 2/1 OR ASCS 2/2	Audio Stream Control Service	ASCS/SR/SGGIT/SER/BV-01-C
ASCS 5/1 AND ASCS 9/4 AND ASCS 9/5	Sink ASE characteristic	ASCS/SR/SGGIT/CHA/BV-01-C
ASCS 5/2 AND ASCS 9/4 AND ASCS 9/5	Source ASE characteristic	ASCS/SR/SGGIT/CHA/BV-02-C
ASCS 5/3 AND ASCS 9/1 AND ASCS 9/2 AND ASCS 9/4	ASE Control Point	ASCS/SR/SGGIT/CHA/BV-03-C
ASCS 2/1 AND ASCS 10/1	ASCS SDP Record	ASCS/SR/SGGIT/SDP/BV-01-C
ASCS 4/1 AND ASCS 6/3	Service and Characteristic Support Requirements	ASCS/SR/ASR/BV-01-C
ASCS 3/1 AND ASCS 5/1 AND ASCS 5/3 AND ASCS 6/1 AND ASCS 8/2	Config Codec – Server is Audio Sink – Write Characteristic Value	ASCS/SR/ACP/BV-01-C ASCS/SR/ACP/BV-03-C ASCS/SR/ACP/BV-05-C
ASCS 3/1 AND ASCS 5/2 AND ASCS 5/3 AND ASCS 6/1 AND ASCS 8/2	Config Codec – Server is Audio Source – Write Characteristic Value	ASCS/SR/ACP/BV-02-C ASCS/SR/ACP/BV-04-C ASCS/SR/ACP/BV-06-C
ASCS 3/1 AND ASCS 5/1 AND ASCS 5/3 AND ASCS 6/1	Config Codec – Client-Initiated	ASCS/SR/SPE/BI-02-C ASCS/SR/SPE/BI-07-C

Item	Feature	Test Case(s)
ASCS 3/1 AND ASCS 5/1 AND ASCS 5/3 AND ASCS 7/1	Config Codec – Server-Initiated	ASCS/SR/ACP/BV-07-C
ASCS 3/1 AND ASCS 5/1 AND ASCS 5/3 AND ASCS 6/2	Config QoS – Server is Audio Sink	ASCS/SR/ACP/BV-08-C ASCS/SR/ACP/BV-10-C
ASCS 3/1 AND ASCS 5/2 AND ASCS 5/3 AND ASCS 6/2	Config QoS – Server is Audio Source	ASCS/SR/ACP/BV-09-C ASCS/SR/ACP/BV-11-C
ASCS 3/1 AND (ASCS 5/1 OR ASCS 5/2) AND ASCS 5/1 AND ASCS 5/3 AND ASCS 6/2	Config QoS – Client-initiated	ASCS/SR/SPE/BI-03-C ASCS/SR/SPE/BI-08-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 6/6	Receiver Stop Ready when Server is Source – ASE in Disabling state	ASCS/SR/ACP/BV-12-C
ASCS 5/1 AND ASCS 5/3 AND ASCS 6/5	Client Initiates Disable – Server is Audio Sink	ASCS/SR/ACP/BV-13-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 6/5	Client Initiates Disable – Server is Audio Source	ASCS/SR/ACP/BV-14-C
ASCS 5/1 AND ASCS 5/3 AND ASCS 7/3	Automatically Disable Sink ASE in Enabling state	ASCS/SR/ACP/BV-15-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 7/3	Automatically Disable Source ASE in Enabling state	ASCS/SR/ACP/BV-16-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 6/8	Release ASE in Codec Configured state – Write Characteristic Value	ASCS/SR/ACP/BV-17-C ASCS/SR/ACP/BV-18-C ASCS/SR/ACP/BV-19-C ASCS/SR/ACP/BV-20-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 5/2 AND ASCS 7/5	Automatically Release ASE in Codec Configured state	ASCS/SR/ACP/BV-21-C ASCS/SR/ACP/BV-22-C ASCS/SR/ACP/BV-23-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 6/9 AND (ASCS 8/1 OR ASCS 8/2) AND ASCS 7/5	Server initiates Released operation autonomously	ASCS/SR/ACP/BV-24-C ASCS/SR/ACP/BV-25-C ASCS/SR/ACP/BV-26-C ASCS/SR/ACP/BV-27-C ASCS/SR/ACP/BV-28-C ASCS/SR/ACP/BV-29-C ASCS/SR/ACP/BV-30-C

Item	Feature	Test Case(s)
ASCS 2/2 AND (ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 6/9 AND (ASCS 8/1 OR ASCS 8/2)	Server Initiates Released Operation from dropped LE-ACL	ASCS/SR/ACP/BV-31-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3	Invalid Opcode	ASCS/SR/SPE/BI-01-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 6/3	Enable – Common Errors	ASCS/SR/SPE/BI-04-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 6/4	Receiver Start Ready – Common Errors	ASCS/SR/SPE/BI-05-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 6/5	Receiver Stop Ready – Common Errors	ASCS/SR/SPE/BI-06-C
(ASCS 5/1 OR ASCS 5/2) AND ASCS 5/3 AND ASCS 6/7	Update Metadata – Invalid Parameters – ASE in Enabling state	ASCS/SR/SPE/BI-09-C
ASCS 5/2 AND ASCS 5/3 AND ASCS 6/1 AND ASCS 6/2 AND ASCS 6/3 AND ASCS 6/4 AND ASCS 6/5 AND ASCS 6/6 AND ASCS 6/7 AND ASCS 6/8	Invalid State Transitions – Source ASE	ASCS/SR/SPE/BI-10-C ASCS/SR/SPE/BI-11-C ASCS/SR/SPE/BI-12-C ASCS/SR/SPE/BI-14-C ASCS/SR/SPE/BI-20-C
ASCS 5/1 AND ASCS 5/3 AND ASCS 6/1 AND ASCS 6/2 AND ASCS 6/3 AND ASCS 6/4 AND ASCS 6/5 AND ASCS 6/7 AND ASCS 6/8	Invalid State Transition – Sink ASE	ASCS/SR/SPE/BI-13-C ASCS/SR/SPE/BI-18-C ASCS/SR/SPE/BI-19-C
ASCS 5/1	Invalid Receiver Stop Ready operation	ASCS/SR/SPE/BI-17-C
ASCS 4/2 OR ASCS 4/3 AND ASCS 6/2	Invalid ASE CIS Mapping	ASCS/SR/SPE/BI-15-C ASCS/SR/SPE/BI-16-C

Table 5.1: Test case mapping

6 Revision history and acknowledgments

Revision History

Publication Number	Revision Number	Date	Comments
0	p0	2021-09-21	Approved by BTI on 2021-08-19. Audio Stream Control Service (ASCS) v1.0 adopted by the BoD on 2021-09-14. Prepared for initial publication.
	p1r00	2024-10-21	TSE 25916 (rating 2): Updated items for ASCS/SR/SPE/BI-15-C and -16-C in the TCMT. TSE 25940 (rating 2): Updated an item for ASCS/SR/ACP/BV-24-C – -30-C in the TCMT.
1	p1	2025-02-18	Approved by BTI on 2025-02-09. Prepared for TCRL 2025-1 publication.

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